OPTIMUM Studia ekonomiczne

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RESEARCH AND THESES

Arkadiusz ŻABIŃSKI1

FISCAL DEFICIT AND ECONOMIC GROWTH IN EASTERN EUROPEAN TRANSITION COUNTRIES. IS THERE A LINK?

Summary

The countries of Central and Eastern Europe, despite similarities in their routes towards market economy and the EU membership, often differed in their choices regarding fiscal policy and the fiscal instruments to be applied while trying to attain their social and economic goals. At the same time, the social and economic effects of the fiscal measures applied sometimes deviated from the intended ones. Some of the new postcommunist members of the European Union have already joined - and others aspire to join - the European whose stability depends on compliance with the adopted fiscal criteria. All those developments give rise to questions about the most efficient fiscal solutions available to the national economies in the process of attaining the assumed economic goals. Another question well worth considering is whether in the perspective of further economic integration the nations of the former Eastern Block are capable of continuously meeting the fiscal criteria of such an integration. The recent developments in Greece have demonstrated that even the "old" EU members may have some problems there, and that such problems affect other members of the European Community. The analysis has demonstrated the risks related to unsound selection of fiscal policy instruments that are run by the countries of Central and Eastern Europe. The core objective of fiscal policy is attaining a high rate of sustainable economic growth. However, the emerging economies are often tempted to achieve the short-term social objectives. The budget deficit may be utilised to achieve such objectives e.g. to maintain a political consensus. Still, a frequent side effect is an increased public debt.

Key words: Public Economics, Fiscal Policies, National Budget, Deficit, and Debt.

1. Introduction

The fiscal policy, construed as the strategic choices referring both to the sources and methods of public revenue collection and to the directions and rules of public spending in view of reaching the social and economic goals defined by competent public authorities, is of primary importance in the process of creating sustainable economic growth. The efficacy of fiscal policy heavily depends on the selection of adequate fiscal instruments. Such a selection is determined, among other things, by the social and economic characteristics of any given country.

The countries of Central and Eastern Europe, despite similarities in their routes towards market economy and the EU membership, often differed in their choices regarding fiscal policy and the fiscal instruments to be applied while trying to attain

¹ Arkadiusz Żabiński, Ph.D. – Faculty of Economics, Management and Tourism in Jelenia Góra, Wrocław University of Economics, e-mail: azabiz@gazeta.pl

their social and economic goals. At the same time, the social and economic effects of the fiscal measures applied sometimes deviated from the intended ones. Some of the new post-communist members of the European Union have already joined – and others aspire to join – the Eurozone, whose stability depends on compliance with the adopted fiscal criteria. All those developments give rise to questions about the most efficient fiscal solutions available to the national economies in the process of attaining the assumed economic goals. Another question well worth considering is whether in the perspective of further economic integration the nations of the former Eastern Block are capable of continuously meeting the fiscal criteria of such an integration. The recent developments in Greece have demonstrated that even the "old" EU members may have some problems there, and that such problems affect other members of the European Community.

The aim of this paper is to analyse of the choice and efficiency of the fiscal instruments applied in the Central and Eastern Europe countries in reaching the primary objective of any fiscal policy, which is to facilitate sustainable economic growth. The analysis also covers selected components of individual fiscal strategies and their capacity to secure unfailing compliance with the fiscal criteria of Eurozone admission. In terms of time, the analysis covers the 2001-2013 period, while in terms of geographical scope – the economies of Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The survey made use of descriptive and statistical methods. The selection of national economies was based on geographical and historical criteria. All the analysed countries underwent the transition to market economy at about the same time and they brought similar historical experiences into the European Union. In all of them the economic transformation entailed similar social tensions that the fiscal policy was expected to ease. Article is an adaptation of the concept of fiscal, appearing in the literature, the fiscal policy pursued by the countries examined.

2. Fiscal relations in the EU countries

An indispensable element of any discussion on the efficiency of fiscal policy is setting the objectives which they should foster. Zdzisław Fedorowicz [1998] writes about "specific social and economic objectives", while Danuta Hübner [1992] explicitly defines the objective of fiscal policy as "creation of aggregated demand". Other frequently mentioned fiscal policy objectives are price stabilisation, ensuring full employment, balance of trade, or satisfactory levels of economic growth [Neumark, Fritz, 1997]. For Abba Lerner [Domaszewicz, 1991], the primary objective of fiscal policy was to ensure full employment and prevent inflation through managing the sum total of domestic spending (both public and private).

The fiscal policy objectives are often defined in very broad terms. Article 98 of the Maastricht Treaty states that the EU member states should conduct their economic policies with a view to contributing to the achievement of the objectives of the Community, as defined in Article 2, those including e.g. sustainable and non-inflationary growth, a high level of employment, the raising of the standard of living and the economic and social cohesion. They should also act in accordance with the principle

of an open market economy with free competition, favouring an efficient allocation of resources, and in compliance with the principles set out in Article 4, i.e. free competition, open market economy, stable prices, sound public finances and monetary conditions and a sustainable balance of payments [Czernielewska-Rutkowska, 2003]. However, such a broad definition of fiscal policy objectives quickly acquires a more specific shape in various financial plans and programmes that reach parliaments as budget-related bills. What is of crucial importance there is preserving the compliance of the objectives of economic policy, fiscal policy and individual economic programmes and regulations.

Implication which affects the fiscal choices of the EU member countries in Central and Eastern Europe is the potential impact of national fiscal policy on the situation of other EU members. The external effects of economic policies are not limited to the monetary union member countries only - they are felt to a greater or lesser extent in any situation of two or more countries linked by economic relations. It should be noted, however, that the EMU is a special case here. Firstly, because the direct macroeconomic effects are stronger due to stronger ties between the monetary union members. Secondly, as Antonio Fatas and Ilian Mihov [2003] point out, there is a specific type of external effects which occur solely in monetary unions and are related to the credibility of common monetary policy and the risk that a country with unsound fiscal policy may require support from other member countries or from the common central bank. A similar point is made by Michael Artis and Bernhard Winkler [1999], who argue that the newly established European Central Bank may lack on the established reputation, credibility and general public support enjoyed by the central banks with a long history of effectively preventing inflation behind them. Potentially, this might increase the risk of the central bank yielding to the pressures from fiscal policies. Thirdly, in a monetary union the politicians may be more inclined to run an unsound fiscal policy since the benefits of such a policy would stay with them, while the costs resulting from rising the interest rates would be spread evenly among all the union members [Beetsma, Uhlig, 1999]. This is related to the diluted disciplining effect of financial markets, as in a monetary union there is no exchange rate risk. Even if (like in the EMU) there are legal barriers to member countries' offering a bail-out to their peer exposed to an insolvency hazard, the listed price of the bonds issued by such a country is unlikely to reflect the insolvency hazard in accordance with the arm's length principle [ECB, 2004].

With regard to the above, members of a monetary union may show an inclination for an unsound fiscal policy just because its cost would be split among the union member countries. On the other hand, in such a situation the member countries are vitally interested in none of their number running such an unsound policy. Those relations provide a motivation to introduce within a monetary union such fiscal rules as would prevent the member countries from incurring an excessive debt.

Quite a few authors [e.g. Wyplosz, 2002; Buiter et al., 1993] also argue that the potential for external effects arising from the fiscal policies run by countries belonging to an economic or monetary union enforces international coordination. However, this concept also has its opponents [e.g. Alesina et al., 2001] who claim that an active coordination is unnecessary as long as the economic policy meets its objectives. Another argument against active coordination may be the results obtained by Beetsma et al. [2001], who

demonstrated that within a monetary union a fiscal policy coordination is most needed in the situation of a strong asymmetric shock, i.e. precisely when such a coordination is hardest to implement in practice.

To sum up, it can be stated that for the new EU member countries of Central and Eastern Europe their membership in the economic and monetary union may result in a strong dependence of their own fiscal policies on those of other member countries. However, the same can work in the opposite direction – an unsound fiscal policy from one of the new member countries would significantly affect the economic situation of other members. The example of Greece shows how strong an impact of a member's erroneous fiscal policy on the other monetary union members can be.

The source of unsound fiscal policy are the phenomena lying within the scope of political economy and related to a "deficit bias" [Alesina, Perotti, 1994]. The bias results from discretionary actions of the authorities and asymmetry of feedback between the decision-makers and the electorate. The first phenomenon to be taken into account is the so-called "fiscal illusion". This illusion affects the electorates who cannot predict the future burdens to arise from the liberal fiscal policy of the present decision-makers. This phenomenon gets intensified when the financing of the currently liberal fiscal policy is spread across many social groups [Buchanan, Wagner, 1977]. Due to the universal nature of "fiscal illusion", the fiscal policy measures implemented to stabilize the business cycle stop being symmetrical – no budget surplus is generated during an economic upturn. Another significant outcome of the "fiscal illusion" is a political business cycle [Nordhaus, 1975], arising from the instrumental use of fiscal policy in political disputes. As the politicians try to win as many votes as possible, more often than not the fiscal policy run just before the elections has an expansionary bias. The budget spending gets increased or the tax burdens cut. This stimulates the economy, but at the same time accumulates the budget deficit, which at the end of the government's term of office is higher than at the beginning.

The bias towards budget deficit and consequently towards public debt is also related to the "common resource pool" [von Hagen, 2005]. Individual stakeholder groups involved in budget-related decision-making try to get as many resources transferred to them as possible, at the expense of other stakeholders. This tendency is generally believed to be stronger in multi-party coalition governments [Alesina, Tabellini, 1990] or where the political landscape is polarised and the ruling coalitions change frequently [Buti, van den Noord, 2003]. Any tightening of fiscal policy requires taking a decision on reducing the flow of budget funds towards some social groups. An announcement of such intentions may lead to contention between individual groups to keep their former privileges, i.e. the so-called "war of attrition". As a result, the actions for tightening the fiscal policy usually get postponed.

It is worth noticing here that the governments who are politically weaker tend to postpone the adjustment measures and to accumulate debt [Alesina and Perotti, 1994]. Other political factors which cause persistent budget deficit and public debt accumulation include reiterating the former declarations on tightening the fiscal policy on the grounds of 'unforeseen developments'' [Kydland, Prescott, 1977]. Another important factor is the pressure for increasing the public administration spending, especially when the

efficiency, rate and methods of utilizing the resources allocated to the operation of governmental agencies are not sufficiently monitored.

The factors leading to unsound fiscal policy also enhance its pro-cyclical impact on economy. As already mentioned above, during an economic upturn the "fiscal illusion" gives rise to a bias towards either increased spending or tax cuts. A good budget position is considered by the electorate a favourable time for the government to implement their pre-election promises, e.g. tax burden cuts.

An interest in using the surplus budget resources during an upturn leads to the socalled "voracity effect" [Tornell, Lane, 1999], resulting in a rate of public spending that outpaces revenue inflows.

In some situations, a pro-cyclical fiscal policy bias may also be related to the application of numerical fiscal rules [Buiter, Corsetti, Roubini, 1993]. Such a situation may occur where the value of the indicator on which the numerical rule is hooked is not business cycle-adjusted, or where no downturn-related exemptions from the rule have been provided for. If an economic decline brings a danger of breaking the numerical limits, the government may feel forced to apply a pro-cyclical tightening of fiscal policy, thus reducing the symmetry of automatic stabilizers.

It must be emphasized here that the specifics of socio-economic situation in the new EU member countries undergoing transformation puts them at the risk of committing more fiscal errors and omissions than the stable market economies. However, if those countries intend to actively participate in the European integration, they will have to rapidly adjust their fiscal policies to those of the Eurozone. If they do not, their fiscal policies are likely to have a negative impact on the sustainability of economic growth which is the primary objective of both the new and the old EU member countries.

3. Fiscal policy assessment criteria

In order to assess the fiscal policy of any country, it is necessary to select proper criteria first. The definition of acceptable levels of budget deficit and public debt was a subject of European institutions' surveys and analyses for many years. In an attempt to protect the common currency from the negative impacts of unsound fiscal policies, some threshold values generally recognised as safe for long-term economic growth were adopted as convergence criteria.

In the Maastricht Treaty [1992], whose provisions were intended to enforce fiscal discipline within the prospective economic and monetary union so as to ensure a "safety margin" in case of a shock or recession, there was a provision requiring the national debt not to exceed 60% GDP while the public sector deficit should not reach 3% GDP. Moreover, neither the member countries not the European Communities are responsible for the debt of other members. Exceeding the threshold values adopted as fiscal criteria triggers the excessive deficit procedure. Under the procedure, the government must implement measures to reduce the deficit and any country failing to do so may expect sanctions imposed, e.g. an obligation to make a non-interest bearing deposit. Assessment of compliance with the Maastricht criteria is done on the *ex post* basis.

In 1997 those regulations were complemented with the Stability and Growth Pact. One of the core objectives of the Pact was further strengthening and sustaining of the necessary fiscal discipline upon creation of the European Monetary Union. While the fiscal criteria of the Maastricht Treaty were being introduced, there were fears that the fixed maximum allowable deficit level (3% of GDP) may produce a pro-cyclical effect through enforcing the tightening of fiscal policies. Therefore, the fiscal policy patterns proposed in the Stability and Growth Pact were intended to ensure sustained compliance with the Maastricht criteria through a commitment to achieve mid-term budget positions close to balance or in surplus. Thanks to that, a free operation of automatic stabilisers should not present a risk of exceeding the reference value of public sector deficit.

In 2002 it was decided that countries not meeting the Maastricht criteria should take remedial measures to achieve an annual reduction of their deficit by at least 0.5% of GDP. The post-2001 economic downturn demonstrated that the EU fiscal rules then in force did not fully rise to expectations. The downgrading of budget positions in member countries revealed the defects of the existing sanction mechanism. There were numerous objections to the decision waiving additional measures under the excessive deficit procedure against France and Germany despite a notice from the European Commission stating that the countries do not fulfil their commitments for deficit reduction. The decision was finally rescinded by the European Court of Justice in Luxembourg. However, the whole situation was considered a glaring example of the sanction mechanism dependence on political decisions.

This led to commencing the work on changes to the Stability and Growth Pact, which were finally adopted in 2005. It was decided that the values of fiscal policy indicators would be set separately for every country, with regard to their different economic and fiscal situation and the varied scale of potential threat to public finance stability. The lower limit for medium-term budgetary objectives (MTO) for the EMU and ERM II countries was defined as a structural deficit amounting to 1% of GDP. The structural debt and deficit levels were to be set so as to prevent the nominal deficit exceeding the reference value as well as to ensure that the public finances are quickly brought to a position securing their long-term stability. The first condition is met by making the fiscal indicators dependent on the budget sensitivity to business cycle. Meanwhile, the long--term stability assessment should take account of all the overt and hidden commitments of public finances, including in particular the future liabilities towards the ageing society. Since meeting this requirement is a highly complicated task, for the initial stage a simplified method of ensuring long-term stability in setting MTOs was adopted. The method consisted in defining an MTO in relation to the current level of public debt and to the potential GDP growth rate.

During the discussion on applying the fiscal indicators for assessment of the economic condition of individual countries, an increased attention was paid to the public finance stability and to the criterion of public debt-to-GDP ratio. This was because research [Pisani-Ferry, 2002] had demonstrated that a stability assessment should be performed on the basis of just that criterion rather than the reference value which relied on the public finance balance. Using the deficit size as a primary measure may obstruct the necessary

structural reforms and constrain public investment [Balassone, Franco, 2000]. This is because this type of spending, important from the point of view of economic development, is easier to reduce than e.g. social transfers. There was also a change made to the provision defining the situation where a deficit exceeding the reference value is still not considered excessive.

It took several years for the European institutions to specify the fiscal policy criteria for sustainable economic development. During that time, the criteria were subject to numerous analyses, debates, critique and modifications. Even though the adopted criteria were generally accepted, there were also some critical opinions expressed. It was pointed out that public debt levels in the new EU member countries of Central and Eastern Europe were much lower than those of the "old" EU countries, while their GDP dynamics was much higher [Buiter, Grafe, 2002]. At the same time, it was noted that their fiscal policies will face heavy challenges, related e.g. to the underdeveloped public infrastructure. Those arguments imply that it would be reasonable for the new EU members to be temporarily allowed deficits exceeding the reference value of 3% of GDP.

To sum up, it can be stated that all the aforementioned criteria for assessing the condition of a national economy are meant to serve the primary objective of fiscal policy, which is securing a rapid and sustainable economic growth. It is just the level of meeting this objective that will be the ultimate criterion in assessing the efficiency of fiscal policies in the countries in question.

4. Fiscal instruments in creating economic growth in the countries of Central and Eastern Europe

The analysed economies demonstrated diverse rates of economic growth. The average geometric rate of GDP increase during the 2001-2013 period was 2.29%. It should be stressed here that during that time the annual average economic growth in the ten countries in question was much faster than the EU average of a mere 0.53%.

Both the highest and the lowest annual growth rates were recorded in Latvia – +11% in 2006 and -17.7% in 2008. However, the lowest overall average growth rate for the period was 1.6%, recorded by Hungary. Conversely, the highest overall harmonic average growth rate for the period was recorded by Lithuania and amounted to 4.36%. Slovakia was not much worse with the average growth rate of 4.13%. The average rates of annual economic growth recorded by other countries amounted respectively to: for Latvia – 3.97%, Estonia – 3.88%, Romania – 3.68%, Poland – 3.61%, Bulgaria – 3.38%, Czech Republic – 2.54% and Slovenia – 1.82%. The above data justify the statement that within the analysed group there were huge differences in the rate of economic growth.

TABLE 1.

0.9

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|-----------|------|------|------|------|------|------|------|------|-------|------|------|------|------|
| Bulgaria | 4.1 | 4.7 | 5.5 | 6.7 | 6.4 | 6.5 | 6.4 | 6.2 | -5.5 | 0.4 | 1.8 | 0.6 | 0.9 |
| Czech Re. | 2.5 | 2.1 | 3.8 | 4.7 | 6.8 | 7.0 | 5.7 | 3.1 | -4.5 | 2.5 | 1.8 | -1.0 | -0.9 |
| Estonia | 7.5 | 6.6 | 7.8 | 6.3 | 8.9 | 10.1 | 7.5 | -4.2 | -14.1 | 2.6 | 9.6 | 3.9 | 0.8 |
| Latvia | 8.0 | 7.1 | 7.7 | 8.8 | 10.1 | 11.0 | 10.0 | -2.8 | -17.7 | -1.3 | 5.3 | 5.2 | 4.1 |
| Lithuania | 6.7 | 6.8 | 10.3 | 7.4 | 7.8 | 7.8 | 9.8 | 2.9 | -14.8 | 1.6 | 6.0 | 3.7 | 3.3 |
| Hungary | 4.1 | 4.5 | 3.9 | 4.8 | 4.0 | 3.9 | 0.1 | 0.9 | -6.8 | 1.1 | 1.6 | -1.7 | 1.1 |
| Poland | 1.2 | 1.4 | 3.9 | 5.3 | 3.6 | 6.2 | 6.8 | 5.1 | 1.6 | 3.9 | 4.5 | 2.0 | 1.6 |
| Romania | 5.7 | 5.1 | 5.2 | 8.5 | 4.2 | 7.9 | 6.3 | 7.3 | -6.6 | -1.1 | 2.3 | 0.6 | 3.5 |
| Slovenia | 2.8 | 3.8 | 2.9 | 4.4 | 4.0 | 5.8 | 7.0 | 3.4 | -7.9 | 1.3 | 0.7 | -2.5 | -1.1 |

Growth rate of GDP volume - percentage change on previous year

Source: [*Eurostat*, http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/, date of access: 6.06.2014].

5.1 6.7 8.3 10.5 5.8 -4.9 4.4 3.0 1.8

For the ten economies analysed, the average rate of public spending during the 2001--2013 period was 40.97% of GDP. This is a lower ratio than the EU-27 average, which reached 46.59% of GDP.

 TABLE 2.

 Total general government expenditure - General government (% of GDP)

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Bulgaria | 40.3 | 39.6 | 39.1 | 38.6 | 37.3 | 34.4 | 39.2 | 38.4 | 41.4 | 37.4 | 35.6 | 35.8 | 38.7 |
| Czech Rep. | 44.4 | 50.0 | 43.3 | 43.0 | 42.0 | 41.0 | 41.1 | 41.2 | 44.7 | 43.7 | 43.2 | 44.5 | 42.3 |
| Estonia | 34.8 | 35.8 | 34.8 | 34.0 | 33.6 | 33.6 | 34.0 | 39.7 | 44.7 | 40.5 | 37.6 | 39.5 | 38.3 |
| Latvia | 34.6 | 36.0 | 34.9 | 35.9 | 35.8 | 38.3 | 36.0 | 39.1 | 43.6 | 43.4 | 38.4 | 36.5 | 36.1 |
| Lithuania | 36.8 | 35.4 | 33.8 | 34.0 | 34.0 | 34.2 | 35.3 | 37.9 | 44.9 | 42.3 | 38.7 | 36.1 | 34.5 |
| Hungary | 47.3 | 51.5 | 49.7 | 49.1 | 50.1 | 52.2 | 50.7 | 49.2 | 51.4 | 50.0 | 50.0 | 48.7 | 50.0 |
| Poland | 43.8 | 44.2 | 44.7 | 42.6 | 43.4 | 43.9 | 42.2 | 43.2 | 44.6 | 45.4 | 43.4 | 42.2 | 41.9 |
| Romania | 36.0 | 35.0 | 33.5 | 33.6 | 33.5 | 35.3 | 38.2 | 39.3 | 41.1 | 40.1 | 39.4 | 36.7 | 35.0 |
| Slovenia | 47.6 | 46.3 | 46.2 | 45.6 | 45.2 | 44.5 | 42.4 | 44.2 | 48.7 | 49.5 | 49.9 | 48.4 | 59.4 |
| Slovakia | 44.5 | 45.1 | 40.1 | 37.6 | 38.0 | 36.9 | 34.4 | 34.8 | 41.6 | 39.8 | 38.9 | 38.2 | 38.7 |

Source: [*Eurostat*, http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/, date of access: 6.06.2014].

Among the economies analysed, the rate of public spending was kept lowest by Lithuania – at 34.64% of GDP. The highest spending-to-GDP ratio occurred in Hungary, where it amounted to 49.99% on average. During the same period, low values of public spending-to-GDP ratio were also maintained by: Romania – 35.15%, Estonia – 35.21%, Latvia – 36.16%, Slovakia – 38.91% and Bulgaria – 39.4%. Even the economies with highest spending rates in the group, namely Poland with 43.5% of GDP, Czech Republic with 44.65% of GDP and Slovenia with 45.3% of GDP, did not reach the EU average. The post-communist economies which accessed the European Union generally keep their public expenditures low. The countries with the lowest spending-to-GDP ratios at the

3.5

4.6

4.8

Slovakia

same time present the highest rate of economic growth. On the other side, the Hungarian economy with the highest spending-to-GDP ratio in the group at the same time presents the lowest rate of economic growth. The same refers to Poland and the Czech Republic.

TABLE 3.

Net borrowing/lending of consolidated general government sector as a percentage of GDP

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Bulgaria | 0.6 | -1.2 | -0.4 | 1.9 | 1.0 | 1.9 | 1.2 | 1.7 | -4.3 | -3.1 | -2.0 | -0.8 | -1.5 |
| Czech Rep. | -5.6 | -6.5 | -6.7 | -2.8 | -3.2 | -2.4 | -0.7 | -2.2 | -5.8 | -4.7 | -3.2 | -4.2 | -1.5 |
| Estonia | -0.1 | 0.3 | 1.7 | 1.6 | 1.6 | 2.5 | 2.4 | -3.0 | -2.0 | 0.2 | 1.1 | -0.2 | -0.2 |
| Latvia | -2.1 | -2.3 | -1.6 | -1.0 | -0.4 | -0.5 | -0.7 | -4.4 | -9.2 | -8.2 | -3.5 | -1.3 | -1.0 |
| Lithuania | -3.6 | -1.9 | -1.3 | -1.5 | -0.5 | -0.4 | -1.0 | -3.3 | -9.4 | -7.2 | -5.5 | -3.2 | -2.2 |
| Hungary | -4.0 | -9.0 | -7.2 | -6.4 | -7.9 | -9.3 | -5.1 | -3.7 | -4.6 | -4.3 | 4.3 | -2.1 | -2.2 |
| Poland | -5.1 | -5.0 | -6.3 | -5.7 | -4.1 | -3.6 | -1.9 | -3.7 | -7.5 | -7.8 | -5.1 | -3.9 | -4.3 |
| Romania | -3.5 | -2.0 | -1.5 | -1.2 | -1.2 | -2.2 | -2.9 | -5.7 | -9.0 | -6.8 | -5.5 | -3.0 | -2.3 |
| Slovenia | -4.0 | -2.5 | -2.7 | -2.2 | -1.4 | -1.3 | 0.0 | -1.9 | -6.3 | -5.9 | -6.4 | -4.0 | -14.7 |
| Slovakia | -6.5 | -8.2 | -2.8 | -2.4 | -2.8 | -3.5 | -1.8 | -2.1 | -8.0 | -7.5 | -4.8 | -4.5 | -2.8 |

Source: [*Eurostat*, http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/, date access: 6.06. 2014].

During the 2001-2013 period, for the countries in question the average rate of budget deficit as compared to GDP was 3.14%. This value exceeds the EU-27 average deficit of 2.7%. This relationship seems to confirm the hypothesis of the new EU members having deficits naturally exceeding the European average. On the other hand, an analysis of individual years within the period shows that some countries at times exceeded this reference value The highest annual budget surplus (2.5%) was reported by Estonia in 2006. With reference to the average value of budget deficit-to-GDP ratio throughout the period analysed, again the country having the highest average deficit was Hungary with its ratio of 4.73%. Also in Poland the average deficit was high, at 4.68%. The average rates of budget deficits reported by other countries amounted respectively to: for Slovakia - 4.4%, Slovenia - 4.1%, Czech Republic - 3.8%, Romania -3.6%, Lithuania -3.1%, Latvia -2.7% and Bulgaria -0.38%. The only country who managed to average a positive budget balance throughout the period analysed was Estonia (0.45%). The rise Pearsons correlative relationship between GDP and the budget deficit is strongest in Latvia (0,88), Lithuania (0,84) and Estonia (0,82). Strong relationship also occurs in the Bulgaria (0,79), Romania (0,74), Slovenia (0,6) and Slovakia (0,55). Only in Poland and Hungary the correlation is weak. The above values allow the conclusion of an adverse impact of a high budget deficit on economic growth. The countries who had low budget deficit or even a surplus registered a higher rate of economic growth than those with high budget deficit levels. This is contrary to the claim that the new EU member countries use their high budget deficit levels to improve their capacities for EU funding absorption and increase the rates of economic growth. It seems that the high budget deficit levels are rather symptomatic of delays in economy transformations

and public finance reforms. This hypothesis finds its confirmation in the data referring to the public debt-to-GDP ratio.

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Bulgaria | 67.3 | 53.6 | 45.9 | 37.0 | 29.2 | 22.7 | 17.2 | 13.7 | 14.6 | 16.2 | 16.3 | 18.4 | 18.9 |
| Czech Rep. | 24.9 | 28.2 | 29.8 | 30.1 | 29.7 | 29.4 | 27.9 | 28.7 | 34.6 | 38.4 | 41.4 | 46.2 | 46.0 |
| Estonia | 4.8 | 5.7 | 5.6 | 5.0 | 4.6 | 4.5 | 3.7 | 4.5 | 7.1 | 6.7 | 6.1 | 9.8 | 10.0 |
| Latvia | 14.0 | 13.5 | 14.6 | 14.9 | 12.4 | 10.7 | 9.0 | 19.8 | 36.9 | 44.5 | 42.0 | 40.8 | 38.1 |
| Lithuania | 23.1 | 22.3 | 21.1 | 19.4 | 18.4 | 18.0 | 16.9 | 15.5 | 29.3 | 37.8 | 38.3 | 40.5 | 39.4 |
| Hungary | 52.0 | 55.6 | 58.4 | 59.1 | 61.8 | 65.6 | 65.9 | 73.0 | 79.8 | 82.2 | 82.1 | 79.8 | 79.2 |
| Poland | 37.6 | 42.2 | 47.1 | 45.7 | 47.1 | 47.7 | 45.0 | 47.1 | 50.9 | 54.9 | 56.2 | 55.6 | 57.0 |
| Romania | 25.7 | 24.9 | 21.5 | 18.7 | 15.8 | 12.4 | 12.6 | 13.6 | 23.6 | 30.5 | 34.7 | 38.0 | 38.4 |
| Slovenia | 26.8 | 28.0 | 27.5 | 27.2 | 27.0 | 26.7 | 23.3 | 22.0 | 35.2 | 38.7 | 47.1 | 54.4 | 71.7 |
| Slovakia | 48.9 | 43.4 | 42.4 | 41.5 | 34.2 | 30.5 | 29.3 | 27.9 | 35.6 | 41.0 | 43.6 | 52.7 | 55.4 |

General government consolidated gross debt as a percentage of GDP

TABLE 4.

Source: [*Eurostat*, http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/, date access: 6.06.2014].

Throughout the period analysed, only two of the countries in question ever exceeded the 60% cap on the proportion of public debt to GDP: Bulgaria, Slovenia (for one year) and Hungary (for nine consecutive years). The situation of Hungary is the more dangerous that during the 2001-2013 period its public debt grew steadily from 52% to 79.2%. And the debt kept growing despite the fact that since 2006 Hungary has been gradually reducing its budget deficit. During the 2001-2013 period, the average value of debt-to-GDP ratio for the economies in question was 33.6%, which is definitely lower than the EU-27 average of 61.2% for the same period. However, the differences in public debt levels between individual countries were large indeed. Half of the countries: Bulgaria, Estonia, Latvia, Lithuania and Romania surveyed had a average public debt of less than 30,1% GDP. At the same time, those countries obtaining the highest economic growth rates.

5. Conclusions

Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia are all countries in Central and Eastern Europe who had similar experiences on their way to economic and political transformation. All of them had to reform their economies as a consequence of the economic and political transformation. Their transition from the centralised to free-market economy entailed various social tensions and economic costs. However, they did not choose the same fiscal solutions to attain their economic goals. Each of the countries decided to apply its specific set of fiscal instruments to arrive at economic growth.

The analysis of fiscal policies run by the Central and Eastern Europe countries in question demonstrates a significant divergence in their approach to individual aggregates,

but also many regularities which all of them share. It can be observed that all those countries are subject to a competitive pressure with respect to the fiscal burdens imposed within their economies. While competing for investment capital, the Central and Eastern Europe countries reduce the fiscal burdens and that results – for all of them – in the public revenue-to-GDP ratios below the European average. Therefore it may be assumed that in this way those economics have been trying to acquire the capital necessary to finance their long-term economic growth. However, while the decisions to put their public sector revenues low are relatively easy, the decision to curb public expenditure is not necessarily so. In this context, the position of Hungary seems particularly dangerous as its public spending level has exceeded the European average and is coming close to that of Scandinavian countries.

A very different approach to their budgets was adopted by Lithuania, Latvia and Estonia. Those countries adjusted their public spending to low public revenues and run a small-budget policy. In order to maintain the adopted fiscal standards, those countries had to enforce unpopular reforms which allowed to keep spending low. Obviously, it could be argued that The Hungarian policy might be devised for a long-term success. The high public spending levels might favour the absorption of EU funds. However, this concept should be bringing high rate of economic growth, while the situation in Hungary is just the opposite.

The objective of the adopted approach to fiscal policy is attaining a high rate of sustainable economic growth. The decisions related to public revenues and spending, budget deficit and public debt are to foster this primary objective notwithstanding the criteria set forth in the European treaties. However, compliance with the fiscal criteria allows reaching a rate of economic growth that is definitely higher than the one obtained while exceeding the deficit and/or debt reference values. The example of the EU member countries of Central and Eastern Europe clearly demonstrates the relationship between the high fiscal standards and the rate of economic growth. The public revenue levels, budgeted below the European average due to competing for investment capital, have enforced other measures related to public spending, budget balance and - consequently - public debt. Running a prudent fiscal policy required the countries of Central and Eastern Europe to follow the socially controversial path of system transformation. However, this brought about a high rate of economic growth. Therefore, it may be concluded that maintaining the low levels of public revenues and spending as well as budget deficit and public debt ensure not only meeting the convergence criteria but also a higher rate of economic growth than that attained by the non-compliant countries.

The analysis has demonstrated the risks related to unsound selection of fiscal policy instruments that are run by the countries of Central and Eastern Europe. The core objective of fiscal policy is attaining a high rate of sustainable economic growth. However, the emerging economies are often tempted to achieve the short-term social objectives. The budget deficit may be utilised to achieve such objectives e.g. to maintain a political consensus. Still, a frequent side effect is an increased public debt. The Hungarian economy makes an example of the adverse impact of unsound selection of fiscal instruments to reach short-term objectives. The sluggish GDP is just an outcome of such policies. Consequently, the next objective of the Hungarian government must be restoring the balance of public finances. It seems that the Hungarian government suffers from a deficit – first voluntary and then imposed – of instruments to create a long-term, sustainable economic growth. It seems that the fiscal solutions applied by the Baltic states or Romania are best-suited to the specifics of the emerging economies of Central and Eastern Europe. Maintaining the discipline of public finances, low budget deficit and consequently low public debt translate into high rates of economic growth. In this case, the primary objective of fiscal policy prevails over the short-term goals. Moreover, in an economy maintaining the discipline of public finances, the fiscal instruments are easier to apply in a situation of such a global economic downturn as the one we saw in the second half of 2008. An analysis of the processes arising from the fiscal policies adopted by Hungary or other countries discussed here seems to be an exercise recommendable for Poland, which still runs the risk of applying the fiscal instruments to short-term goals at the expense of long-term economic growth.

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Agnieszka PIEKUTOWSKA, Tomasz DUBOWSKI¹

FROM RIVALRY TOWARD COOPERATION. INTEGRATION WITHIN EUROPEAN ECONOMIC AREA

Summary

The path of European economic integration these days seems to be dominated by the European Union – its functioning and current challenges. It is however worth emphasizing, that the process of European integration together with commercial and trade aspects thereof, includes also elements which remain beyond the mainstream of Union–oriented debate and involve countries not being EU Member States. European Economic Area (EEA) is a good example of that. The supranational model of integration combined with inclinations towards more traditional, intergovernmental, concept of cooperation resulted in a very interesting form of economic integration grouping. The motives for establishing EEA, the mosaic of interests represented by states engaged, the economic conditionings in that respect and – finally – the character of EEA and the peculiar instruments of decision-making are then worth a closer analysis. No less important are perspectives of EEA further development. Those problems are the main elements of considerations presented in this contribution.

Key words: European Economic Area, European Union, EFTA, european integration

1. Introduction

The permanent development of the European Union, both in the aspect of constitutional reforms and in the economic dimension, regardless of conclusions formulated in this matter, necessarily results in the most common perspective of the evaluation of the European economic integration becoming just the Union (Community) perspective. The accomplishments of the Lisbon Treaty, the eurozone crisis and the fiscal pact, discussions on the EU extension and its external relations: these issues seem currently to dominate. Simultaneously, it is a truism to state that the Union does not function in an economic or political vacuum. It is important to note the EU and the remaining countries of the continent are connected by a network of incredibly interesting links and relations resulting from a peculiar evolution of integration processes in Europe.

This paper is dedicated to the problem of the European Economic Area (EEA), remaining a particular example of integration of member states of the Communities

¹ Agnieszka Piekutowska, PhD – Faculty of Law, University of Bialystok, e-mail: piekutowska@ uwb.edu.pl; Tomasz Dubowski, PhD – Faculty of Law, University of Bialystok, e-mail: t.dubowski@ uwb.edu.pl.

(now the Union) and member states of the other European cooperation group: the EFTA. The following considerations concentrate on three basic issues: the assessment of the genesis and the process of forming the EEA, the assessment of the formal effects of the aforesaid process in the form of the Agreement on EEA and the decision-making system created thereby; conclusions referring to the future of the EEA and potential challenges in this matter. The selected issues provide an opportunity for a broader analysis of extremely interesting threads. Which motives and interests of the European states determined the EFTA-EEC relations evolving from rivalry, a specific competition towards cooperation and one-direction moves in the membership of both groups? What is, in the treaty dimension, an actual shape of the cooperation model of the member states of both formations and how does it correspond with their needs and expectations? Finally, what are the perspectives of the further development of the EEA in view of current experiences and positions of its members. The following analyses make an attempt at answering the questions signaled.

2. Genesis, motives, interests

2.1 Primary conditions of EC- EFTA coexistence

The European Free Trade Association originated as a response to integration processes of the 6 countries making in the 1950s the European Economic Community. A part of European countries potentially interested in participation in the EEC were not inclined to accept all the conditions of membership in this organization. Denmark, Norway and Portugal were critical towards the rules of free competition of industrial products. Austria, Finland, Sweden and Switzerland, on the other hand, were against forming an supranational institutions which would reduce their neutrality. Great Britain, in turn, wanted to preserve its developed trade relations with the Commonwealth countries. Consequently, based on assumptions different from those of the EEC, an integration group appeared in Western Europe, which was a competitive offer in relation to the membership in the Communities. The then map of the European integration processes was defined as the "Europe of the Six" versus the "Europe of the Seven" [Langenhove, 2011, p. 105], and the formula of mutual relations and potential cooperation became a serious challenge.

What is remarkable, in various periods of these groupings functioning, in their particular member states, a vivid discussion juxtaposing two alternative solutions: cooperation (which actually in the 1990s was institutionalized in the form of EEA) or full membership (of the interested EFTA states in EC/EU) was provoked. Taking into consideration the starting point, there occurred here a sort of paradoxical situation. The conditions of membership in EEC which were unacceptable for European countries set foundations for building EFTA. Cooperation between EFTA and EEC was natural and necessary but the rules of this cooperation turned out so little satisfactory for some EFTA states that they decided to apply for their full membership in EC. Thus, it turned out that the practice of EFTA functioning led to a verification of primary concepts of

some European countries referring to the desired integration formula and made them change the assumptions in this matter directing them towards supranational cooperation. This process is worth close scrutinizing.

The first withdrawals from EFTA, those of Britain and Denmark, and their accession to the Communities meant the diminishing of the former organization and, simultaneously, made an inducement to sum up the effects of its work. The achievements of integration within the framework of EFTA was evaluated positively, which was demonstrated by, for example, the growing volume of trade exchange. An analysis of the trade directions of EFTA countries proved far-reaching trade connections with the EC. For instance, in 1978 intra-EFTA trade (measured in exports) constituted 15.1% of the total trade of the group, whereas the export to the EC as much as 48.8% of the total [Conseil de l'Europe, 1980, p. 613]. It was one of the main reasons for intensifying EFTA countries' actions towards improving the position of the goods from them on the EC market. As early as the beginning of the 1970s individual agreements with the Communities were signed, e.g. the Agreement between the European Economic Community and the Republic of Iceland of 1972 [The Agreement..., 1972], or the Agreement between the European Economic Community and the Kingdom of Norway of 1973 [The Agreement..., 1973] providing for building zones of free trade in industrial products. These agreements, however, were regarded as obsolete and inadequate to face new challenges resulting from the acceleration of integration within the EU [Berg, 2009, p. 20].

At that time EFTA countries expressed their will to deepen their cooperation with EC but the Community party faced new internal and external challenges: i.e. the accession of Greece. Relations with EFTA countries remained of secondary importance [Dupont, 1998, p. 124].

The early 1980s were characterized by further interest on the part of EFTA members in cooperation with EC. The incentive was the growth in importance of EC in terms of trade. Between 1972 and 1986 intra-EFTA import fell as a percentage of total EFTA imports from 15.9 to 13.3%. The fall in export between EFTA states was, on the other hand, 3.8 percentage points (from 18.3 to 14.5%). Simultaneously, EFTA's imports from the EC increased from 59.4 to 61.1% and export to the EC increased from 51.8 to 53.7% [Laursen, 1995, p. 188]. Commercial dependencies were not unilateral. EFTA states made up the largest market of the EC, taking over 23% of its exports, much as goes to the United States [Commission of the European Communities, 1985]. However, reasons for deepening cooperation of the Western European countries did not reach the ground fertile enough on the part of the EC, which focused its efforts on internal actions directed to re-launch the internal dynamics [Dupont, 1998, p. 124].

2.2 A breakthrough in EC - EFTA relations

A factor of fundamental importance for the intensification of EFTA countries' efforts towards closer cooperation with the EC was the beginning of building a single market on the territory of the Communities. The EFTA states saw a threat in this process, for example in the form of relative deterioration of competitive position of their goods. In the late 1980s the five EFTA countries were heavily dependent on the EC market, which is demonstrated by the fact that on average 53% of their exports went to the EC. Whereas in the late 1980s the share of export in GDP made up 35%, thus, roughly 18% of their income was generated directly from sales to the EC [Schiff, Winters, 2003, p. 220]. Between 1986 (the year the Single Market program started) and 1990, EC's importance in EFTA total inward foreign investment fell from 47 to 36%. At the same time the EC share of EFTA's outward foreign direct investment grew from 30 to 63%. Inasmuch as many other factors shape the scale and the direction of direct foreign investment flow, these changes suggest that the EFTA countries' fears were justified [Baldwin, 1992, p. 7].

The factor affecting the EC concept of deepening the cooperation with the EFTA states became political changes in East European countries. Most of the states in this region from the very beginning of transformation aimed at integration with the then EC. Economically, there were emerging demands for new trade arrangements (signed i.a. in 1988 with Hungary, signed in 1989 with Czechoslovakia and Poland). There was clearly a fear that more far-reaching demands would emerge. At that time the Community party wanted to eschew communicating that in the nearest future the accession to the EC was possible by having to accept new members coming from EFTA [Dupont, 1998, p. 124].

The breakthrough in the process of building the EEA was J. Delors speech in the European Parliament in 1989. His words "There is a queue of applicants at the door seeking membership or closer cooperation, even as we are assessing how much remains to be done" [Delors, 1989, p. 2] expressed the anxieties described above. In response to vivid membership aspirations, Delors proposes developing 'flexible proximity policies'.

On the part of EFTA, which made every possible effort to preserve unanimity during the negotiations there emerged positions against the process of building EEA (among those interested in full membership) or doubts if building an institutional and legal bridge between EU and EFTA was possible. Thus, it was necessary to develop a completely new solution [Brundtland, 2009, p. 14]. Advocates of full integration saw a "sidetrack" in the process of EEA building, which would not allow to achieve the goal in the form of membership.

The negotiations brought about significant changes of positions: some EFTA member states, those which even in March 1989 during the meeting of heads of EFTA Governments had defied a customs union with the EC decided to apply for membership in the EC "before the ink was dry on the draft EEA agreement" [Berg, 2009, p. 21]. It is worth noting that until now all the EFTA member states (except Liechtenstein) have applied for EC/EU membership. For instance, Austria formally applied to join the EC on 17 July 1989, which is before the negotiations on EEA began and Sweden formally applied to join the European Communities on 1st July 1991, which is during the negotiations of the EEC Agreement. This leads to reflection and provokes a number of questions. Did EEA not satisfy the needs of EFTA member states referring to either institutional or sector solutions? Were other available solutions better for EFTA states? Perhaps the negotiations on EEA facilitated the process of application for

full EC membership? The EFTA countries faced a dilemma: cooperation with the EC or full membership.

The offer of cooperation within the framework of EEA includes several economic profits for EFTA states. Because both EC import and EFTA import came in 67% and 73%, respectively, from the area which was to embrace the EEA, and, additionally, the EEA Agreement imposed on EFTA states no obligation of adopting a joint customs tariff, it was expected that the trade diversion effect would be low [Baldwin, 1992, p. 3]. As to the creation effect, in the almost duty-free situation and trade based on the previous bilateral agreements, it would result from the removal of resource-wasting trade barriers. Lifting these barriers provides a more beneficial effect on the prosperity of the cooperating states than in the case of lifting duties. Some estimations demonstrated that EFTA states joining the single EC market would bring profits on the part of EFTA on the level of 3% of its GDP, while the losses, if the EFTA states had not decided to cooperate, would have been on the level of 0.5% of GDP [Schiff, Winters, 2003 p. 220].

On the other hand, an essential drawback of the EEA Agreement from the EFTA countries' point of view was an institutional aspect: the influence of the EFTA states on EC law in the scope embraced with the agreement.

Consequences of EFTA states' cooperation with the EC for the latter was not a mirror reflection of the consequences the former could have expected. The cooperation within the framework of EEA brought for the Community party slight economic benefits, which suggests that it was political stimuli that dominated. Liberalization of trade within the framework of cooperation of a large region and a small region entails higher benefits for the smaller region, which is within EEA for EFTA. Haaland-Norman estimated that EFTA states joining the single market would increase the Communities' GDP by 0.02%, whereas the influence on the part of EFTA would be 40 times higher. In 1990 EC export to EFTA countries constituted only 2.4 of its GDP, whereas EFTA export to EC 15.2% of EFTA's GDP [Baldwin, 1992, p. 14]. Among political reasons encouraging the Community party to cooperate with EFTA states it is important to underscore the above-mentioned anxieties of the vivid membership aspirations of European countries. Simultaneously, the Community party was threatened with blaming for being a closed, inaccessible club. Extension would be a strong counter-argument in this debate, whereas extension by the EFTA states would be less expensive than extension by Eastern and Central European countries. Moreover, it is noted that regional integration agreements enabled the main powers on the international stage to strengthen their position in future multilateral negotiations [Schiff, Winters, 2003, p. 260].

EC membership meant for EFTA countries full representation in the decision-making process of the EC but extra economic benefits for this organization (in comparison with cooperation within the framework of EEA) were insignificant. The membership was connected, *inter alia*, with the obligation of participating in the EC budget. From the Community party's point of view, among the benefits resulting from the full membership of EFTA states in the EC may be counted not only payments to the EC budget but also extension of the market area for the existent agricultural surplus of the Community

[Baldwin, 1992, p. 15]. At the same time, it was expected that EFTA states would not benefit from the support of the regional policy. The most cautious estimations indicated that they would be net payers.

Summing up, the EEA brought considerable economic benefits to EFTA states with a considerably limited influence on law created in the Communities. The Community party could not expect far-reaching economic benefits from cooperation in the framework of EEA: the political motives were of the primary importance.

The EFTA countries' membership in the EC, on the other hand, brought them slight extra economic benefits but a significant change in the participation in the decisionmaking process of the EC. The Community party, in turn, could expect (mainly due to the anticipated high contributions of EFTA states to the EC budget) high economic benefits.

A considerable growth in intra-community trade together with significant fall in mutual export between the EC and EFTA [Schiff, Winters, 2003, p. 43] made the negotiating position of EFTA states weaker. The Community party was a regional hegemon, while EFTA acted as a *demandeur*. Consequently, EFTA had to pay a high price for the privilege of access to the single EC market and the EC over-priced the EEA product [Dupont, 1998, p. 124].

3. The EEA Agreement and institutional aspects

The text of the agreement was signed in October 1991. However, the Court of Justice of the EU regarded the legal control system determined in the agreement as against the Treaty of Rome. The text of the EEA Agreement which took into consideration the Court's observations was signed on 2 May 1992 in Porto, Portugal. The Agreement provided for coming into force, after the requisite ratification, at the beginning of 1993. The ratification process was considerably prolonged [Makać, 2011, p. 73]. One of the reasons was the negative result of a referendum in Switzerland of 6 December 1992, as a result of which Switzerland withdrew from the agreement (interesting enough, the decision was taken by the majority of only 50.3% of voters, whereas fewer than 24 thousand votes would be sufficient to make a decision on Switzerland entering EEA) [Kużelewska, 2003, p. 99]. The Agreement taking this change into consideration came into force on 1 January 1994.

Association of the EC/EU with 3 EFTA countries, as Article 1 of the Agreement on the EEA [*Agreement on the European Economic Area*, 1994] maintains, set as a goal supporting trade and economic cooperation between the parties. This goal is to be achieved through for instance free movement of goods, persons, services, capital.

The literature on the subject underscores the special nature of the European Economic Area in relation to the classical classification of economic integration stages. A. Makać considers EEA as a "kind of single market" [Makać, 2011, p. 80]. The EEA market is not identical with the internal market as it is in the EU. It is worth emphasizing that in goods exchange it constitutes a free trade zone and not a customs union. Moreover, agricultural and fish products are excluded from the free movement

of goods and an significant difference is the lack of joint economic policy [Bijak-Kaszuba, 2004 p. 162]. Another reason why the integration processes in the framework of EEA cannot be treated as a single market is the fact that the trade between the EU and the three EFTA countries is limited by such barriers as differences in VAT and different standards [Sporek, 2004, p. 203].

An aspect of great importance for the EC and EFTA member states on the stage of developing the EEA Agreement was the institutional aspect, including the decisionmaking procedure. This area touches upon an issue, neuralgic for every country, which is sovereignty manifesting itself, for example, in the ability of legislation. It is important to note that the specificity of the EEA Agreement assumes the EFTA states joining the joint market and not shaping this market on the basis of bilaterally determined rules. Thus, it also required adopting specific, exceptional institutional solutions.

The dilemma of EFTA countries, naturally enlivened at the stage of negotiations of the EEA Agreement: cooperation with the EC within the EEA or full membership in the EU, inevitably implied comparisons within the area of law making. It is worth highlighting then, which solutions in the field of policy-making was provided for by the alternative option: membership in the EC/EU.

The decision-making process in EEA is shaped in another way and consists in the functioning of common organs establishing EFTA-EEA and EU/EC-EEA representation. It begins on the part of the EC/EU. A draft act is prepared by the European Commission. The EEA Agreement provides for a contribution of EFTA-EEA states at the proposal stage. In accordance with Article 99.1 of the Agreement at the stage of preparing the draft of a new act the European Commission "seek advice from experts of the EFTA States in the same way as it seeks advice from experts of the EC Member States".

During the crucial stage – the adoption stage of new legislation – EFTA-EEA states are not entitled to participate in decision-making. According to Article 99.3 of the Agreement: "during the phase preceding the decision of the Council of the European Communities, in a continuous information and consultation process, the Contracting Parties consult each other again in the EEA Joint Committee at the significant moments at the request of one of them." Thus determined participation of EFTA-EEA states in the process of adopting internal market *acquis* against the background of the solutions binding for EU full members demonstrates clearly lesser influence of the EFTA-EEA countries.

In order to secure the homogeneity of the single market, the legislation on the part of the EU has to be applied by all EEA states, including the EFTA-EEA countries. The adoption of an EEA- relevant legal act by EU institutions launches the decisionmaking process on the part of EEA. The EEA Agreement provides for the incorporation of new EU internal market *acquis* into the EEA Agreement through changes in annexes and protocols (in accordance with Article 102 of the Agreement, "the EEA Joint Committee shall take a decision concerning an amendment of an Annex to this Agreement"). As the EEA is a dynamic area, the process of adjustment of the EEA Agreement is permanent: only in the year 2011 the EEA Joint Committee (which, according to Article 93.1 is accountable for the successful implementation and operation of the Agreement) adopted 164 decisions incorporating 373 legal acts [EEA Joint Committee, 2012, p. 1]. Since the EEA Agreement came into force, over seven thousand EU legal acts have been incorporated into the agreement [European Commission, 2012a, p. 6].

It is worth underscoring that although the incorporation of the internal market *acquis* is carried out through a decision of the joint institution of EEA which includes representatives of both groups (according to Article 93.1 the EEA Joint Committee consists of representatives of the Contracting Parties), the incorporated legislation is the law made on the part of the Union, on the form of which the EFTA-EEA states did not have a far-reaching influence. Hence, critics of so built decision-making system within the framework of the EEA regarded it as "intrusive legislation". [Emerson, Vahl, Woolcock, 2002, p. iv]. In some European leaders' opinion, this meant adoption of the decision-making process "governed by fax"².

From the lack of this far-reaching influence of EFTA-EEA states on the legislative process in the institutional system of the EEA, an essential consequence may result for the entities acting within the EEA. The EEA regime leaves a certain dose of political uncertainty, which diminishes the investment attractiveness of EEA-EFTA states, which do not make this law [Emerson, Vahl, Woolcock, 2002, p. iv].

4. Implementation of the Agreement on the EEA

Evaluation of the functioning of the EEA may be carried out according to different perspectives. The consequences of the functioning of the Agreement felt by the EU will not be identical with the consequences felt on the part of the EFTA-EEA countries. Also the position of the grouping on the international arena requires explanation.

4.1 Economic aspects of Agreement's implementation

As a starting point of the initial analysis of the consequences resulting from the implementation of the EEA Agreement we may assume one of the main aims of the group, which was reflected in Article 1 of the Agreement: "*The aim of this Agreement of association is to promote a continuous and balanced strengthening of trade* (...)". In this light, it is worth noting that in 2010 export of goods within EEA amounted to \$ 3,519,827 million, which made 68.7% of the total export of the group [The World Bank, 2012, p. 352]. From the point of view of the trade exchange of EFTA-EEA states, with one exception of the import of Iceland in 2011, the EU, since 1995, has remained the main trade partner. In the scope of goods exchange, in the case of Iceland, between 1995 and 2007 import and export with the EU tripled. In the case of goods exchange of Norway between 1995 and 2011 import from the EU doubled and export grew by over 3.5 times [Eurostat, 2013a].

² Prime Minister David Cameron's expression [Cameron, 2012].

It is obvious, which was expressed at the stage of preparing and negotiating the Agreement, that economic benefits on the part of the EU-EEA are less measurable than on the part of EFTA-EEA. It is connected with the size of markets. Along with the accession of new states to the EU, the differences between these markets exacerbated. The EEA provides the EFTA-EEA states with access to the market of the population of over 500 million while the EU-EEA states gain access to the market almost 100 times smaller of the population on the level of 5.3 million [Eurostat 2013b]. Hence, an asymmetry of exchange dependencies can be observed. Exemplifying, Norway in 2011 occupied, respectively, the 4th and the 7th place in the ranking of the most important import-export partners of the EU. In turn, the EU27, whose participation in the goods exchange of Norway is on the level of 74.7% is, both in the case of import and export, in first place among main trading partners of Norway [European Commission, 2012c, p. 4]. In the case of Iceland, the inequality turns out even more noticeable. Whereas the share of this country in the EU trade exchange (which in 2011 was 0.1%) situates it in the 60th place of the EU trade partners, the EU27, with its share in the Iceland's trade on the level of 63.7%, is the main trade partner of this country [European Commission, 2012b, p. 4].

It is important to emphasize the financial contribution on the part of the EFTA-EEA states towards reducing economic and social differences between the EU regions. This financial assistance is provided within the framework of Norwegian Financial Mechanism and the European Economic Area Financial Mechanism, i.e. Norway Grants and EEA Grants. It is estimated that within 20 years, i.e. from 1994 to 2014 the EFTA-EEA states will have allotted €3.7 billion. This contribution grew considerably: from €500 million during the period 1994-98 up to €1.79 billion in the current perspective for the period 2009-2014 [European Commission, 2012a, p. 13].

Assuming that the effectiveness of a regional group's functioning manifest itself in fulfilling the assumptions adopted, it is worth referring also to the concept, raised at the stage of originating the EEA, of strengthening the position of European states on the international arena. In trade, whereas the EU export in 2010 constituted 32.7% of the world export, the EEA export made up 33.6% of the world export [The World Bank, 2012, p. 352].

4.2 Legal and institutional aspect of EEA functioning

It is also worth considering the legal aspect of functioning the EEA. It is subject to parallel assessment by the EU and the particular EFTA-EEA countries.

The axis of reflections upon this matter will be, resulting from the specificity of the EEA Agreement, the implementation process of the legislation made on the part of the Union on the level of EEA. In the context of the assumption of the necessity for single law on the whole territory of the EEA, what can be observed is a quite considerable time shift between the adoption of an act by the EU and its implementation on the part of EEA-EFTA. It is partly a natural phenomenon resulting from the necessity of taking a decision by the Joint Committee. However, this shift is excessive in certain cases. For

instance, environmental directives are transposed by the EFTA-EEA states 341 days later than by the EU-EEA [European Commission, 2012a p. 8]. At the same time, as to the transposition of directives, the EFTA-EEA states note a slightly higher transposition deficit than EU countries [EFTA Surveillance Authority, 2013, p. 5].

Sources and consequences of the lack of homogeneity of law on the part of EU-EEA and EFTA-EEA are essential. The reasons may be connected with the existent institutional solutions as well as political stimuli. It is demonstrated, for example, that the delays are for the EFTA-EEA states a buffer, by which they reduce a political tension in the case of controversial legal acts. Moreover, the sources of delays may be found in the decision-making system. Within the framework of it particular EFTA states before taking a decision by the Joint Committee, not always by the deadline provided for by the Agreement, notify meeting their constitutional requirements. Sporadically a source of delay is the lack of agreement on the scope of the matter which is to be considered as "EEA-relevance" [European Commission, 2012a, p. 5].

The lack of homogeneity of law on the whole territory of the EEA results in farreaching consequences: the entities of the single market in the EEA may face various requirements and rules on the part of the EU-EEA and EFTA-EEA. In certain circumstances this may create conditions for improving their competitive position. This phenomenon is not conducive to preserving the certainty of law.

Although both the EU-EEA party and the EFTA-EEA party indicate numerous drawbacks at the stage of law incorporation to the EEA Agreement, so far ultimate mechanisms, provided for in Article 102 or Article 111 of the Agreement (providing for, respectively, a procedure of temporary suspension of the part of the Agreement directly affected by new legislation or a procedure of conflict-solving), have not been applied. This fact, however, cannot be recognized as a confirmation of the proper functioning of the institutional dimension of implementing the Agreement. In view of the irregularities adduced before, the fact of not reaching for the ultimate instruments suggests that their nature is too preventive (coercive). This results in a necessity of the revision of the ETA-EEA.

Moreover, the need for changes in the EEA Agreement results from the evolutions to which the integration within the EU inevitably and incessantly is subject. Along with the development of the EU single market there also emerged the so-called policies accompanying the functioning of entities on this market (such as the issue of copyright and patent protection). The EEA Agreement establishing a single market with important exemptions (such as agricultural policy or tax harmonization) seems to be subject to further asymmetry. This is a justification of the revision of the EEA Agreement.

What is more, the development of the EU provides grounds for considering a possibility of extending the EEA Agreement onto the areas, which were not considered while signing the Agreement. Were they included therein, they would offer the EFTA-EEA states a status alternative to the EU membership "*an la carte basis*" [European Commission, 2012a, p. 4].

The above remarks lead to one more conclusion. Legal and institutional aspects of cooperation in framework of EEA confirm that we deal here with an internationally

eye-catching model of integration binding two separate groupings. Especially the peculiarity of the EU legal order and links between this legal system and the one of the EFTA are worth underlining. They (accompanied by relevant institutional and decision--making aspects) make EEA a very interesting integration structure also from international law perspective.

5. Conclusion – The future of the EEA

The accession of Iceland to the EU will not change the membership of the EEA but will change its structure, i.e. will cause a depletion of the number of states entering the group on the part of EFTA-EEA. The number of EFTA-EEA states, reduced in such circumstances to two, raises a natural question on the future of the group. The financial and logistic aspects of the EEC functioning by no means undermine the sense of its further existence. On the contrary. Cooperation with the EC and now the EU in form of EEA has proved its worth and brought measurable positive results. Consequently it may become a formula on which the cooperation of EU with other states searching for opportunities of tightening economic relations with it may be based³.

Moreover, this formula of cooperation with the EU is also considered by some of EU member states. References to this form of cooperation [McKenna, 2012] appeared in the discussion on a potential leaving the EU by Great Britain and potential formulas of cooperation with the EU in the future.

It is important to underscore, however, that the EEA – access to the EU single market is not an offer which may satisfy the states seeking even deeper integration with/within the EU – for example, in the form of a monetary-economic union. As long as the EU generally rejects a possibility of adopting the euro by non-member states as national currency, the euro will constitute a factor encouraging the accession (for the countries searching for a deeper form of cooperation than a single market).

It is the possibility of adopting a single European currency, a possibility that is not available in the case of cooperation with the EU in the form of EEA, and which is possible only in the case of membership in the EU that has become the factor which made attractive the other option considered by Iceland. This country experiences strong consequences of the economic crisis. An abrupt depreciation of the Icelandic crown during the recent economic crisis resulted in the increase in the accumulated foreign debt (in crowns). There appeared numerous voices among national politicians

³ In Europe we know cases where the further existence of agreements was questionable in connection with leasing them by many member states, including those founding. When CEFTA was left by all the founding states (in connection with the accession to the EU) the membership of this group amounted to 3 countries: Romania, Bulgaria and Croatia, which by 2004 also applied for membership in the EU. This form of integration, however, raised interest among many Balkan countries. On 19 December 2006 Albania, Bosnia and Herzegovina, Croatia, Macedonia, Moldova, Montenegro, Serbia and Kosovo/UNMIK sing an Agreement on accession to CEFTA, simultaneously amending it. The Agreement is known as CEFTA 2006 [*Consolidated Version of the Central European Free Trade Agreement...*, art 40-41].

that if the currency of Iceland had been the euro, the burden of paying off the debt in euro would not have risen so rapidly. An unexpected solution became an opportunity of membership in the EU [Bjarnason, 2010, p. 53].

Over nearly twenty years of the EEA several changes in the membership have taken place. It is important to underscore that these changes are not symmetric: the number of member states constituting a EU-EEA pillar in the EEA expanded (through admission of new member states or a transfer of EFTA-EEA states to the EU so to the EU-EEA). The membership in the EFTA-EEA was subject to reduction only. It is also important to signal here that the increase in the EEA membership on the side of the EU through accession of new states, which essentially changed the territorial range of the EEA Agreement was a process independent from EFTA-EEA states. Whereas the accession of new states to the EU brings consequences also to the EFTA-EEA states, it may be expected that the process of subsequent extensions (e.g. by such countries as Turkey) will become a subject of attention and discussion of the largest EFTA-EEA country: Norway.

A necessary prerequisite of EEA functioning is maintenance of its bipolarity. EEA, whose idea was cooperation of two different groupings, will last as long as the two groupings. Theoretically, the EEA would ceased to exist in the situation of all the EFTA-EEA states' transfer to the EU. Adopting as a perspective of these considerations the geographical or territorial aspect of the Agreement, the shrinking membership of the EFTA-EEA states becomes crucial for the further functioning of the Agreement. Hence, not assuming any probability we can assume three scenarios of the EEA functioning in the future: debilitation (through subsequent countries transferring from the EFTA-EEA to the EU-EEA pillar), no changes in the EFTA-EEA membership, or expansion (EEA as a formula on which the EU's cooperation with other third states will be based).

There is no certainty which scenario will come true. However, regardless the direction of the further EEA evolution, even in the face of no changes in its membership, in view of the opinion of the European Commission and some other member states, certain modifications of the Agreement itself seem inevitable.

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Hanna G. ADAMKIEWICZ, Stanislaw M. KOT¹

HOW DOES INTERNATIONAL COMPETITIVENESS AFFECT ECONOMIC DEVELOPMENT? A TWO-PHASE HYPOTHESIS

Summary

This paper analyses the impact of international competitiveness on economic development, based on the *World Economic Forum Global Competitiveness Index (GCI)* and *GDP/capita* of 125 countries during the period 2007-2010. The results reveal two phases of the evolution of competitiveness. When GCI < 4.5 (on 1-7 scale), any improvement of a country's competitiveness affects current development more than future development. When a country's *GCI* rises above 4.5, further improvements of competitiveness will affect future development more than current development. The 4.5 competitiveness threshold is remarkably stable throughout analyzed period.

Key words: international competitiveness, development, logistic function

1. Introduction

The aim of this paper is examine how international competitiveness affects current and future economic development. Let x_t be the index of international competitiveness at time *t*, and ε_t be the *GDP/capita* elasticity of x_t . We hypothesize the existence of a threshold c_0 of x_t which discriminates the following impact patterns of international competitiveness on development:

- 1. When $x_t < c_0$, then $\varepsilon_t > \varepsilon_{t+1} > \varepsilon_{t+2} > \varepsilon_{t+3} > ...$;
- 2. When $x_t = c_0$ then $\varepsilon_t = \varepsilon_{t+1} = \varepsilon_{t+2} = \varepsilon_{t+3} = ...$;
- 3. When $x_t > c_0$, then $\mathcal{E}_t < \mathcal{E}_{t+1} < \mathcal{E}_{t+2} < \mathcal{E}_{t+3} < \dots$.

In other words, when a country's competitiveness level is below the threshold c_0 , an improvement of competitiveness will affect current development more than future development. On the other hand, if a country has a level of competitiveness above this threshold, further improvements of competitiveness will affect future economic development more than current development.

Salvatore [2010] follows the commonly accepted definition of international competitiveness as the ability of a country or company to generate more wealth for its people than its competitors in world markets. According to him, international

¹ Dr hab. Hanna G. Adamkiewicz – Faculty of Management and Economics, Gdansk University of Technology, e-mail: had@zie.pg.gda.pl; Prof. dr hab. Stanislaw Maciej Kot – Faculty of Management and Economics, Gdansk University of Technology, e-mail: skot@zie.pg.gda.pl.

competitiveness is the "growth potential", because it describes the nations' ability and prospects for future growth.

Salvatore's concept of growth potential is the reason for our research. The question is whether international competitiveness affects only the future economic development, or also the current development. Our two-phase hypothesis provides the answer to this question. Countries in the first phase of competitiveness development, i.e. with $x_t < c_{tb}$ may expect a descending pattern of economic development in current and future years while improving their competitiveness. If countries have achieved the second phase of competitiveness development, i.e. when $x_t > c_0$, they may expect an ascending pattern of economic development in the current and future years while improving their competitiveness. Finally, if a countries' competitiveness equals the threshold c_0 , any improvement of competitiveness will provide the same economic development in all years.

This paper is organized as follows. Section 2 presents statistical data and the method of modeling the impact of international competitiveness on development. Section 3 shows empirical results. Section 4 provides conclusions and suggests the directions of further research.

2. Data and methods

2.1. Statistical data

We measure economic development by *GDP/capita*. The *GDP/capita* data are for the years 2007-2010 come from *WDI* (2010) and given in international US dollars (2005 constant prices). We measure international competitiveness according to the *World Economic Forum Global Competitiveness Index* (*GCI*). *GCI*, ranging from 1 to 7, is a weighted average of several different components, each measuring a different aspect of competitiveness [Schwab, Porter, 2008]. In this paper, we use *GCI* data for 125 countries in the years 2007-2009.

Luxemburg and Qatar seem to be outliers when analyzing *GDP/capita*. Table 1. includes the Grubbs [1969] test for the initial sample and a sample without these two outliers.

TABLE 1.

| Variable | Initia | al sample | The sample without LUX &QAT | | | | |
|----------|-----------|-----------|-----------------------------|---------|--|--|--|
| | Statistic | p-value | Statistic | p-value | | | |
| GDP 2007 | 3.81485 | 0.01047 | 2.62185 | 0.95880 | | | |
| GDP 2008 | 4.10349 | 0.00260 | 2.64767 | 0.87676 | | | |
| GDP 2009 | 4.09105 | 0.00273 | 2.73085 | 0.66719 | | | |
| GDP 2010 | 4.31720 | 0.00072 | 3.19973 | 0.11744 | | | |

The Grubbs test for outliers in GDP/capita, all cases

Source: Own calculations using [WDI, 2010] data.

Table 1. shows that the sample becomes homogeneous when Luxemburg and Qatar are excluded.

Table 2. presents basic descriptive statistics of selected variables in the sample without the outliers.

| Variable | Valid N | Mean | Minimum | Maximum | Std. Dev. |
|----------|---------|----------|---------|----------|-----------|
| GCI 2007 | 124 | 4.19 | 2.50 | 5.81 | 0.80 |
| GCI 2008 | 123 | 4.18 | 2.85 | 5.74 | 0.67 |
| GCI 2009 | 131 | 4.16 | 2.58 | 5.60 | 0.66 |
| GDP 2007 | 121 | 14196.88 | 354.65 | 49876.95 | 13608.74 |
| GDP 2008 | 120 | 14001.57 | 359.61 | 48557.30 | 13051.39 |
| GDP 2009 | 119 | 13351.27 | 361.84 | 47264.07 | 12418.39 |
| GDP 2010 | 110 | 12682.49 | 366.44 | 51969.47 | 12278.22 |

Descriptive statistics of Global Competitiveness Index (GCI) and GDP/capita (data without outliers: Luxembourg and Qatar)

Source: Own calculations using data from: [Schwab, Porter, 2008; WDI, 2010].

2.2. The method

Our aim is to detect the exclusive effect of international competitiveness on development. Therefore we build econometric models with GDP/capita as dependent variable *y*, and *GCI* as the single independent variable *x*. Initial analysis of statistical data shows that the relationship between GDP/capita and GCI is nonlinear. The following logistic function seems to fit the data the best in the light of R^2 criterion:

$$y = \frac{a}{1 + \exp\{-(b + cx)\}}, a, c > 0,$$
 (1)

where *a*, *b*, and *c* are the parameters.

Logistic function (1) is the solution to the following differential equation:

$$\frac{dy}{dx} = \frac{c}{a} y(a - y). \tag{2}$$

TABLE 2.

Eq. (2) shows that the reaction of development to an increase of competitiveness is proportional to the already achieved level y and to the distance a - y from the saturation level a.

The *GDP*/*capita* elasticity ε of international competitiveness is the following function of *x*:

$$\mathcal{E}(x) = \frac{cx}{1 + \exp\{b + c \cdot x\}}.$$
(3)

We estimate the parameters of nine logistic models using the STATISTICA package non-linear least squares method. Each of these models describes the impact of *GCI* in the year *t* on *GDP/capita* in the year *t*+*k*, where k = 0,1,2,3, t = 2007, 2008 and 2009. Thus

we estimate four models for t = 2007, three models for t = 2008, and two models for t = 2009 - because *WDI*(2010) offers *GDP/capita* data up to 2010.

3. Results

Table 3. summarizes the estimation results of four logistic models (1) with GDP/capita as a dependent variable for the years 2007, 2008, 2009, and 2010, where the GCI_{2007} is a single independent variable of each of these four models.

TABLE 3.

| Model No. | GDP/capita | a | b | с | Proportion of |
|-----------|------------|--------------|-----------|-----------|---|
| | | | | | variance accounted for (\mathbf{R}^2) |
| 1 | 2007 | 39991.53708 | -9.83312 | 2.14977 | 0.76769 |
| | | (3614.45950) | (1.38602) | (0.35035) | |
| 2 | 2008 | 41742.06318 | -9.20974 | 1.97624 | 0.81569 |
| | | (3943.17191) | (1.10663) | (0.28582) | |
| 3 | 2009 | 40782.72888 | -8.93714 | 1.90074 | 0.81802 |
| | | (4190.37683) | (1.05714) | (0.27644) | |
| 4 | 2010 | 47551.55456 | -8.28560 | 1.67540 | 0.84363 |
| | | (7156.03567) | (0.89150) | (0.24864) | |

The estimated logistic models (1) of *GDP/capita* against *GCI* 2007 (standard errors in parentheses)

Source: Own calculations using data from [The Global Competitiveness Report..., 2007-2008; WDI, 2010].

Similarly, Table 4. presents the estimation results of three logistic models (1) with GDP/capita as a dependent variable for the years 2008, 2009, and 2010, with GCI_{2008} as the single independent variable of each of these three models.

TABLE 4.

The estimated logistic models (1) of *GDP/capita* against *GCI* 2008 (standard errors in parentheses)

| Model | GDP/capita | a | b | с | Proportion of |
|-------|------------|--------------|------------|----------|---------------------------------|
| No. | | | | | accounted for (R ²) |
| 5 | 2008 | 42246.494791 | -10.381609 | 2.258279 | 0.76483 |
| | | (4081.695) | (1.318) | (0.335) | |
| 6 | 2009 | 41013.104058 | -10.096100 | 2.185260 | 0.76454 |
| | | (4221.165) | (1.281) | (0.328) | |
| 7 | 2010 | 49760.433369 | -9.018812 | 1.838223 | 0.81507 |
| | | (7727.094) | (0.967) | (0.266) | |

Source: Own calculations using data from [The Global Competitiveness Report..., 2008-2009; WDI, 2010].

Finally, Table 5. shows the estimation results of two logistic models (1) with GDP/ capita as a dependent variable for the years 2009 and 2010 and GCI_{2009} as the single independent variable of each of these two models.

The estimated logistic models (1) of *GDP/capita* against *GCI* 2009 (standard errors in parentheses)

TABLE 5.

| Model | GDP/capita | a | b | с | Proportion of |
|-------|------------|--------------|-----------|-----------|---------------------------------|
| No. | | | | | variance |
| | | | | | accounted for (R ²) |
| 8 | 2009 | 41496.83483 | -10.33433 | 2.25141 | 0.77801 |
| | | (4148.65130) | (1.25382) | (0.32261) | |
| 9 | 2010 | 49272.55165 | -9.20171 | 1.90328 | 0.81115 |
| | | (7322.10303) | (1.00668) | (0.27579) | |

Source: Own calculations using data from [The Global Competitiveness Report..., 2009-2010; WDI, 2010].

Tables 3.-5. show that all the parameters are statistically significant (at a 0.05 level of significance). The goodness of fit of the logistic function is surprisingly high bearing in mind that *GDP/capita* is explained by a single variable only. This means that the *Global Competitiveness Index* seems to cover most of the factors which influence economic development.

We have also experimented with other functions, e.g. linear, exponential, polynomials, etc. while approximating the relationship between *GDP/capita* and *GCI*. However, none of these functions fits the data better than logistic function (1). We have discarded linear functions also because they predict negative *GDP* for low levels of *GCI*.

Figure 1. shows the elasticity functions (3) of the logistic models presented in Table 3.

Figure 1. shows that all elasticity functions are positive. This means that an improvement of international competitiveness enhances economic development and that elasticity functions intersect approximately at competitiveness level 4.5. When GCI < 4.5, the improvement of a county's competitiveness affects current development more than future development. On the other hand, the improvement of a country's competitiveness affects future development more than current development when GCI > 4.5.

In Figure 2. and Figure 3. one can observe exactly the same pattern of the impact of international competitiveness on development. It is remarkable that in all the above figures elasticity functions intersect almost at the same point, 4.5. This confirms our two-phase hypothesis.



GDP/capita elasticity of international competitiveness 2007

Source: Own calculations using data from Table3-5.

FIGURE 2.





Source: Own calculations using data from Tables 3-5.

FIGURE 1.

FIGURE 3.



GDP/capita elasticity of international competitiveness 2009

Source: Own calculations using data from Tables 3-5.

4. Conclusions

Three general conclusions may be drawn from our research. First, international competitiveness enhances economic development. The logistic form of the relationship between *GDP/capita* and *GCI*, among other things, means that the impact of competitiveness on development varies according to a country's level of competitiveness.

Second, there is an optimal level of international competitiveness (3.5, 4.0) that provides a maximal *GDP/capita* elasticity.

Third, countries with low competitiveness may enjoy immediate effects of economic development while improving their competitiveness. On the other hand, when highly competitive countries invest in further improvement of their competitiveness they may expect a greater economic development in the future rather than the present.

Obviously, alternative approaches are possible when modeling the impact of international competitiveness on development. For example, *GDP/apita* may be regressed on present and past *GCI* values. Dynamic panel data models can be used for this purpose. Also individual pillars of competitiveness can be used instead of the *GCI* in such models. These are the approaches we plan to adopt in further research.

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Ewa ROLLNIK-SADOWSKA1

TRANSFORMATION OF EUROPEAN LABOUR MARKET POLICY MODELS – EXEMPLIFIED BY DENMARK, GERMANY AND THE UNITED KINGDOM

Summary

Nowadays changes in the field of conditionings of European labour market policy as ageing society and crisis of welfare state, impose new objectives for the process of cohesion creation. The European Union countries, representing different labour market policy models (Scandinavian, corporate, liberal), have implemented labour market reforms allowing for effective usage of labour resources.

The author in the article presents the assumptions of labour market policy models and indicates the main directions of its transformation in the current social and economic conditionings. That transformation mainly regards to concentration on active labour market policies and increasing its efficiency. The analysis was based on the example of three countries - Denmark, Germany and the United Kingdom. They represent three different labour market models and are characterized by the activity in the field of carried out reforms of labour market (mainly active labour market policy). Those countries, thanks to the implemented changes, improved the employability of labour force and (in spite of the economic crisis from 2008) maintained stable situation on the labour market.

Key words: models of labour market policy, welfare state, Denmark, Germany, United Kingdom.

1. Introduction

Nowadays the main challenge of the European labour market policy is to assure appropriate level of labour force², which allows maintaining stable output and demand. As Europe has been facing demographic problems it is crucial to run reasonable management of labour resources to use fully their potential by decreasing structural and long-term unemployment as well as professional inactivity.

At the same time, as one of results of economic crisis, there is shortage of funds for activation policy. The European welfare states have had growing difficulties balancing their budgets. The increasing level of deficits point to problems of system integration which cannot, however, be attributed to the growth of the welfare state. In today's world of budget crises and austerity, the welfare state is often discussed in practical terms:

¹ Ewa Rollnik-Sadowska, PhD – Faculty of Management, Białystok University of Technology, e-mail: e.rollnik@pb.edu.pl

² According to International Labour Organisation methodology, there can be included, in the labour force, those who are employed or unemployed but actively looking for work and are available to take up work.

affordability, tax and benefit adjustment, efficiency, etc.. That is why, many European countries, have conducted reforms, which concentrate on rationalization of public spending.

Due to the low effectiveness of macroeconomic policies in the reduction of unemployment and essential difficulties in implementation of structural reforms in the labour market, researchers and practitioners of labour market policy focus on aspects of the implementation of effective policy on the micro level, directed toward labour supply [compare: Kwiatkowski, 2002, pp. 300-301]. Specialists of labour market policy attach increasing importance to the analysis of programs aimed at active labour market policy (ALMP). Such policy does not create new long-term jobs with competitive nature. Active labour market policy³ is mainly aimed to prepare the unemployed to reintegration into the labour market as well as to maintain the employment of groups of people remaining in the special situation on the labour market.

Its main functions may include [Kwiatkowski, 2002, pp. 301-302]:

- professional activation of the unemployed;
- reduction of the structural mismatch on the labour market;
- improving the productivity of labour;
- the impact on employment and unemployment;
- verification the readiness of the unemployed to work.

Efficient⁴ labour market policy, leading to a better utilization of the existing labour force, in the face of the current economic and demographic conditionings, is one of the priorities of the European Union's cohesion policy.

There are determined, in the literature, four different models of labour market policy – Scandinavian, corporate, liberal and Mediterranean⁵. The rules gathered in those regimes assume different attitude toward the scope of the welfare state, the degree of commercialization of labour market services, rules for the granting of benefits, as well as the role of trade unions. Countries, representing different models, which have

³ The concept of active labour market policy is imprecise, since two approaches operate in the literature. The narrow approach to this issue reduces the role of ALMP to support of the unemployed. The wide recognition determines the role of ALMP in the activation measures directed towards the labour force (the unemployed, the employed, people threatened with redundancy), but also the inactive population [Nagel, Smandek, 2010, p. 44].

⁴ The author of the article distinguishes between the concept of efficiency and effectiveness of active labour market policy. The efficient active labour market policy can be the one that brings the desired results. These results may relate both to reduce unemployment, improve the structural adjustments in the labour market, increase effective labour supply and labour productivity as well as improve competition on the labour market.

On the other hand, the effectiveness of ALMP provides financial surplus generated in the outcome (comparing the expenditure). If, however, it is possible to specify the expenses incurred for the implementation of ALMP, it is difficult to assess the level of financial outcomes as a direct result of employment. It is also difficult to measure indirect effects. In addition, there is a question whether the profit and loss account, in the assessment of the effectiveness of ALMPs should be made on the level of the group covered by the program of ALMP, or at the level of the whole stock of labour supply (in this case, determination of the benefits will be affected by the occurrence of displacement, substitution, idle gear and tax distortion effects)?

⁵ The Mediterranean model is represented by Italy, Spain, Portugal, Greece, which are countries characterized by unstable situation on the labour market. Due to the fact that the article's objective is to present some tendencies and good practices in area of labour market policy, the Mediterranean model is not included in the deepen analysis.

been successfully actively implementing labour market reforms and creating the patterns for the European employment policy, are Denmark, Germany and the United Kingdom.

The publication objective is introduction and analysis of labour market policy models as well as the main trends and structural changes implemented in the countries representing the Scandinavian, corporate and liberal models.

The article was based on the desk-research of secondary data as well as the results of primary research conducted in 2011 in London, 2012 in Aarhus and 2013 in Flensburg. The qualitative research in the form of individual in-depth interviews – IDI was realised among representatives of public and private labour market institutions in the United Kingdom, Denmark and Germany.

2. The selected social and economic conditionings influencing European labour market policy

The main phenomenon influencing European labour market situation is aging of the population, which contributes to the reduction of labour force and changes in their structure. The forecasts of Eurostat show that the share of the age group 0-14 years in all population of the EU-27 is dropping from 15.6% in 2011 to 14.2% in 2060. Moreover, there is a prognosis of a significant decrease of people at working age from 66.9% to 56.2%. At the same time, the share of the elderly (65 years and more) is going to reach 29.5% in 2060 (as it was 17.5% in 2011) [Electronic document: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Population_struct ure_and_ageing, date of access: 29.11.2013].

Simultaneously, individual countries have continued to suffer from the consequences of the economic crisis that affects labour markets' situation. As a result of lower output, there has been noticed remarkable deterioration of labour market indicators. In 2012 the lowest employment rates out of EU-27 was in Spain (59.3%) and Greece (55.3%) [Electronic document: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table& language=en&pcode=tsdec420&tableSelection=3&footnotes=yes&labeling=labels &plugin=1, date of access: 27.12.13]. Those two countries also reached the highest unemployment rates.

On the other hand, the highest employment rates in the European Union in 2012 were in Sweden (76.8%), Denmark (72.2%), Finland (72.5%), the Netherlands (71.9%), Germany (71.5%), Austria (70.3%) and the United Kingdom (68.4%). That indicator for Poland reached 57.5% [Electronic document: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tsdec420&tableSelection=3&footno tes=yes&labeling=labels&plugin=1, date of access: 27.12.13].

Decreasing labour demand creates lower access to workplaces, mainly for the ones with lack of working-experience and lower qualifications or people less flexible on the labour market because of their health conditions or family situation, which makes even worse the situation of fragile groups (like the youths, people at immobile age, long-term unemployed, handicapped, lonely parents). The deterioration of labour market indicators affects mainly the economic situation of young people⁶ and as a result further increasing the old-age dependency ratio⁷. Data of Eurostat show that the indicator increased from 23% in 1999 to 26.7% in 2012. In the EU-27 countries, the highest rise was noticed in Germany (7.9 percentage points), Lithuania (6.4 percentage points), Portugal (6.2 percentage points) and Malta (6.1 percentage points) [Electronic document: http://epp.eurostat.ec.europa.eu/tgm/ table.do?tab=table&init=1&plugin=1&language=en&pcode=tsdde510 (27.12.13)].

Moreover, the systems of social security in the European countries often exacerbate professional inactivity. The solutions, which assure access to social financing while staying without job, frequently make people unmotivated to activation in area of jobsearch.

Abundance of labour market institutions, implementing active employment programs, do not get satisfactory results understood as professional activation of people included in the support. One of the reasons of inefficiency of labour market institutions is the system of social security financing mentioned above. Moreover, offered programs, are often not adjusted to the target groups of beneficiaries.

The challenge for European social policy is also adapting education and training systems to labour market needs. The mismatch between employer's needs and the knowledge and qualifications of graduates is one of the main reasons of structural unemployment.

As a result of the above mentioned phenomena, a significant part of the labour force is not fully used, there is a substantial rate of long-term and structural unemployment.

However, not all European countries, even in the times of economic crisis, are characterized by unstable situation on the labour market. At the level of the European Union, the countries with sustainable indicators that meet demands of the European Employment Strategy, where the dynamic of employment rates is stable and the indicator reaches about 70%, are Austria, Denmark, Finland, the Netherlands, Germany, Sweden, the United Kingdom⁸.

Those countries represent different models of social policy, including labour market policy, and so far they have implemented different principles of the welfare state systems.

3. Models of labour market policy - previous approach

There can be found, in the theory of social policy, the division on four different models of labour market policy [Nagel, Smandek, 2010, pp. 38-40]:

⁶ An increasing problem in Europe is the phenomenon of the lack of professional and educational activities among young people, who are the so-called NEET (Not in Education, Employment or Training).

⁷ This indicator is the ratio between the total number of elderly persons of an age when they are generally economically inactive (aged 65 and over) and the number of persons of working age (from 15 to 64) (Eurostat definition).

⁸ In this case there were taken into account only the EU-15 countries, due to the fact that the further course of discussion will be based on the theory of labour market policy models, where the countries that joined the EU after 2004 have not been analyzed.

- the Scandinavian model (Nordic),
- the corporate model (continental),
- the liberal model (Anglo-Saxon),
- the Mediterranean model (Latin).

Some social policy researchers, such as Esping-Andersen [Esping-Andersen, 1990, pp. 18-32], would also argue that different welfare state regimes and models of industrial relations are interconnected and clustered together with numerous institutional path dependencies, concerning labour market regulations, systems of social insurance and management of unemployment, among others.

The first, from the above mentioned models, is the Scandinavian or Nordic model, which provides a high degree of self-regulation for bargaining parties. The role of the state is more limited. Traditionally, bargaining parties have been given the right to make their own rules for governing the labour market. Hence, legislation provides only a framework for regulations and rules arbitrated by collective agreements. However, since the 1970s, there have been exceptions to this pattern. Collective agreements are now legally binding for organizations and their members. Employers are also legally obligated to apply the provisions of collective bargaining agreements to non-member employees [Karlson, Lindberg, 2012, p. 14].

In this model, unions and employers' associations play an important role by signing and upholding collective agreements. Moreover, unions protect their employees' rights to co-determination and employment protection. Therefore, this model relies on a high level of participatory membership in both unions and employers' associations.

The second model of the labour market policy is the continental model, which is the dominant scheme for explaining labour market relationships in continental Europe. In this model, the state plays a large role, and legislation is the most prominent regulatory instrument. However, bargaining between the parties and collective agreements are still important features. Thus, a distinctive feature of the continental model is that social partners and the state govern industrial relations together.

The continental model's emphasis on regulation is based on a view that labour differs fundamentally from other commodities. This view has descended from Romano-Germanic legal systems and also puts forth a moral basis on which the relationship between employer and employee should rest. Legislation is thus predominantly aimed at protecting employees from market forces.

In that labour market model, according to law, collective agreements are binding for the bargaining parties (unions and employers organizations) and can be enforced as such. The system often includes extension mechanisms, whereby collective agreements can be extended to non-members of both bargaining party sides by government decree. Through this mechanism, the level of coverage of collective agreements is very high.

Countries with this model also have high levels of employment protection legislation (EPL) and co-determination. These rights are predominantly based on the rights of the individual employee, which are enforced legally by public authorities or work councils, but not by unions.

The group of countries included in the continental model has a high level of industrial regulation, including strict rules for job protection and the provision of generous unemployment benefits [Karlson, Lindberg, 2012, p. 13].

The next model is the liberal (Anglo-Saxon) model, which presents a more marketbased view of the labour market. This model is based on a classical liberal philosophy of small government and applies less comprehensive welfare policies than those in northern and continental Europe. There are low levels of labour force coverage under collective agreements, just as there are low levels of membership in unions and employers' organizations. Moreover, this model is founded on common law rather than legislation, and the notion of a flexible labour market ruled by price mechanisms, along with a small amount of regulation. Greater freedom is provided to individual employers to hire and fire personnel, to set pay and define terms of employment and to determine working conditions, which allows for higher business efficiency and higher productivity.

The Mediterranean (or Latin) model is also based on Romano-Germanic legal systems and emphasizes that labour is different from a normal commodity. In that model, as in the continental model, the state plays an important role, perhaps even more so due to the fact that the bargaining parties have less coverage and are more divided. In these countries, commonplace features of relations between bargaining include high levels of industrial conflict and highly politicized, internally divided labour unions. Bargaining agreement coverage is upheld by employers' associations as well as legal extensions of collective agreements to non-union workers and firms. Labour market policies in these countries are distinguished by rigid EPLs and frequent efforts to reduce unemployment through early retirement policies [Karlson, Lindberg, 2012, p. 14].

The labour markets, representing that model, generally have low levels of flexibility, and social protection mechanisms are not as strong as employment protection provisions. These welfare systems are not aimed at labour force participation for all workers, but instead emphasize as it was written early retirement as well as non-participation for women.

As the effect, the countries representing Mediterranean model are characterised by low level of employment and a high risk of poverty. It is the reason that the example of the country representing Latin model was not taken into account in the further analysis.

4. Creating new labour market models – examples of Denmark, Germany and United Kingdom

Among the above-mentioned EU countries, characterized by stable measures of the labour market, Finland, Denmark, the Netherlands and Sweden represent the Nordic model, Germany and Austria - the corporate model, and the United Kingdom – liberal model.

The analysis of labour market policy reforms conducted by these countries, the search for the causes of their success in this area should be the subjects of scientific research.

In the article, the analysis covers the representatives of the different models of labour market policy (Denmark, Germany, and the United Kingdom). They are countries characterized by the activity in the field of carried out reforms of labour market (mainly active labour market policy). Those countries, thanks to the implemented changes, improved the employability⁹ of labour force and (in spite of the economic crisis) maintained stable situation on the labour market.

Denmark belongs to the Nordic labour market model with a high level of both union membership and collective bargaining coverage. Employment conditions and wages have largely been settled by the use of collective agreements. There are comparatively few formal legislative rules regulating the labour market.

Denmark's labour market has been characterized by cooperation between employers and employees organizations. The basis for this cooperation is, according to Andresen and Mailand [2005, pp. 8-9] best described that as an agreement between the parties: "the trade unions recognize the employers' management prerogative, i.e. the right to manage and allocate work, while respecting currently valid collective agreements and the spirit of co-operation, and that the employers accept the right of employees to organize and to establish collective representation".

Denmark was the initiator of flexicurity policy in the 90s of the 20th century, which consists of three components – a flexible labour market (external numerical flexibility), active labour market policy and generous social security system. This model has been adopted by the Nordic countries and the Netherlands. Nowadays it is recommended to be implemented by other countries of the European Union under "the Agenda for New Skills and Jobs", which is part of the Europe 2020 strategy for smart, sustainable and inclusive growth of the society.

The main features of the modern welfare state system in Denmark include [Rollnik-Sadowska, 2013, pp. 20-21]:

- dominance of the principle of compromise and cooperation in setting social policy objectives,
- significant state interference in the sphere of social policy, while conducting active programs in this area,
- social programs cover all major types of social risks, which are addressed to the general public,
- solidarity financing of the welfare state, high taxes burden of society, which are important financial backing for the Danish welfare state,
- membership of the vast majority of workers and employers to organizations representing their interests,
- regulation of the labour market by its participants,
- minimum interference of the state in regulating the wages,
- determination of the collective regulation of wages and employment,
- concluding collective agreements between the employer and the employee representatives.

⁹ Employability refers to a person's capability for gaining and maintaining employment [Hillage, Pollard, 1998].

It is worth mentioning that there is developed, in the Danish system, the code of rights and duties. The set of the citizens' rights is financed not only from the public sources but also from private insurance (which is much more popular than for instance in Germany). A good example of rights and duties system is private unemployment insurance, where the beneficiaries, after the job loss, to maintain the benefits, have to actively look for a job (according to the rules created by insurance company).

Moreover, Danish labour market institution put attention on education system as a part of active labour market policy adjusted to the needs of labour demand as well as the requirements of different groups of the youths.

Germany, as an example of corporate model, has been effectively reducing structural unemployment by a dual system of education adapted to the needs of the labour market. One of the main objectives of German social policy is improving the employability of the youths and overcoming the NEET problems by creation of educational system adjusted to labour market demands¹⁰. It is mainly organised by dual education system with strong orientation on combining theoretical knowledge and practical one (obtained in companies during apprenticeships). Similarly, like in Denmark, there is in Germany developed network of cooperation among private business (with CSR consciousness), labour market institutions and educational institutions.

Furthermore, through the implementation of the Hartz reforms package in 2003-2005, German public employment services were modernized, the system of activation of the unemployed was changed by applying the principle of rights and responsibilities, the demand for labour was developed by the partial deregulation of the labour market.

The main objective of the Hartz reforms was to improve the performance of placement services and policy programmes mostly by introducing market mechanisms to the realm of placement services and by streamlining public employment services. Furthermore, cost-effectiveness in the specific context of each regional labour market is targeted to be the key criteria when choosing programme contents and participants [Jacobi, Kluve, 2006, p. 8].

As an effect of the reform, the former employment offices were converted into costumer-orientated one-stop-centres. The results of research indicate positive impact of one-stop-centres on the integration into regular employment [Jacobi, Kluve, 2006, p. 15].

The second aspect of Hartz reforms in area of organisational structure was introduction of market forces to labour market services. The authors of the reform created, for instance, voucher systems for placement services and training measures. Each individual, whom the public employment service was unable to place after six weeks of unemployment, can choose an alternative private placement service. The private service receives a lump sum payment after having placed the jobseeker successfully. Providers of training measures also can be chosen freely by the client and paid for with a voucher.

¹⁰ In 2011 compared 2008, Luxembourg, Germany, Austria and Sweden were the only EU countries, where there was noticed the drop of NEET population (in Luxembourg by 28.3%, in Germany by 11.8%, 4.7% in Austria and 2.5% in Sweden) [*Not in Education, Employment or Training: Europe's lost NEET generation detailed*, electronic document: http://www.theguardian.com/news/datablog/2012/oct/22/not-in-education-employment-training-europe-neet#, date of access: 27.12.13].

Moreover, the public employment institutions can choose to outsource services fully or partly, most importantly placement services. For example local employment office either may contract a private temporary work agency or, if no provider is available, may run a PSA by itself [Jacobi, Kluve, 2006, pp. 8-9].

The Hartz reforms also shifts priority towards active measures that require proactive behaviour of the unemployed and promote their direct integration into regular employment. To this end, the reform re-designed integration subsidies, introduced new forms of wage subsidies, start-up subsidies and jobs with reduced social security contributions. Many active policy measures were re-designed in terms of their target population. Thanks to the unemployed profiling (also popular in Denmark and the United Kingdom), specific active labour market programs have been offered for those with the highest probability of finding a job after the measure.

Active measures, which are the best representation of the new German activation strategy, are start-up subsidies¹¹. The unemployed can get the grant for own company creation, after acceptation of business plan by the representative of the chamber of commerce. The reform introduced also an alternative subsidy, the so-called *Ich-AG*, which is independent of prior social security contributions.

Moreover, there were implemented by the Hartz reforms the so-called "Minijobs" and "Midijobs". A person holding a Minijob (income below 450 EUR per month or the employee only working a maximum of 50 days per year) is exempted from social security contributions, which effectively increases net wages. People who practice Midijobs (with incomes between 450.01 and 850 EUR) are allowed to get social security subsidies, which are paid at a decreasing rate, depending on the income.

Furthermore, the core element of the Hartz reforms is the principle of rights and duties. It means that the access to benefits and active labour market participation is strictly conditional on a person's ability to work (which is at least 15 hours per week [Jacobi, Kluve, 2006, p. 10]).

The reform also introduced sanction elements, which are connected with monitoring of search activities of the unemployed and their personal efforts to re-integrate into the labour market¹².

What's more, the reform also assumes the support of the unemployed, who come back to professional activity, and presumably represent lower productivity, by several forms of wage subsidies which are paid to employers when hiring a certain type of hardto-place worker.

The last area of the Hartz reforms was deregulation of labour market institutions, which took place regarding temporary work agencies (the restrictions were abolished), dismissal protection and the regulation of fixed-term contracts.

A new important rule was introduced in the activity of temporary work agencies requiring that such an agency must either guarantee equal pay and equal treatment of

¹¹ The evaluation results proved that start-up subsidies had a significant positive effect at an aggregate level. [Räisänen, Alatalo, Krüger Henriksen, Israelsson, Klinger, 2012, p. 28].

¹² For example the jobseeker is obliged to accept any offer of suitable work, which also means to move to different city under certain circumstances.

temporary workers and regular workers or join a collective bargaining agreement between trade unions and employers [Jacobi, Kluve, 2006, p. 13].

At the same time, in Germany, the wage setting process, has remained highly centralised (the minimum wages are often set by collective bargaining agreement in the separate sectors of the economy and separate lands).

The fundamental reforms made in Germany to the labour market in recent years have created flexible working models which correspond with the requirements of the modern marketplace.

Thanks to implemented reforms of labour market (as well as high level of production, export's possibilities and stable labour demand) Germany reaches high level of employment and the lowest youth unemployment rate in Europe (the indicator of youth unemployment rate reached 7.9% in the fourth quarter of 2012, when the average for EU-27 was 23.2% [electronic document: http://epp.eurostat. ec.europa.eu/statistics_explained/index.php/Unemployment_statistics, date of access: 27.12.13]).

The last chosen to the analysis country - the United Kingdom is an example of the liberal labour market model, which used to differ in important aspects from both the Nordic and the corporate models. The industrial relations system was deregulated and liberalized by the conservative Thatcher government in the 1980s and early 1990s through a combination of labour law reforms and a major restructuring and privatization of public services.

Important turning point for British labour market policy was a programme of active labour market policies introduced in the United Kingdom by the Labour government in 1998 called the New Deal. The aim of that initiative was to help those who found it difficult to compete actively in the labour market, and to address various labour market inefficiencies. The New Deal has been designed by the government to target specific groups of the unemployed who are considered to be especially prone to inefficiencies in the labour market. The main part of the New Deal was assistance to young unemployed people (NDYP), but the programme also covered long-term unemployed people aged over 25 (ND 25+) and unemployed aged over 50 (ND 50+).

Nowadays, the United Kingdom has been still developing a welfare state system based on the work (under the motto Welfare for Work) and is currently undertaking the reform of social security - Universal Credit, which objective is higher efficiency and effectiveness of social policy.

There can be determined three rules of conducted policy [Rollnik-Sadowska, 2014, p. 159]:

- 1. Flexibility and diversity:
 - meeting employer demands and employee lifestyle needs,
 - move towards localism and more engaged partnerships,
 - more personalised approach to support (impact on individual professional counselling).
- 2. Making work pay:
 - minimum wage,
 - tax credits,

- introduction of the Universal Credit dynamic benefit system,
- modernising the Public Employment Service,
- creation of Jobcentre Plus delivering employment and welfare services under one roof,
- innovative approach towards customer self-service and digitalisation.
- 3. Active Labour Market Policies:
 - conditionality rights & responsibilities,
 - work first focus on active job search, with 'in-work' skills improvement,
 extending work opportunities to 'inactive' customers.

British government, realising changes in social policy, includes five key reform principles:

- a stronger framework of rights and responsibilities to move benefit claimants from being passive recipients to being active jobseekers,
- a personalised, responsive and effective approach to local and individual needs,
- local partnerships between public, private and voluntary sectors,
- targeting areas of high worklessness by devolving and empowering communities, and
- not just jobs, but jobs that pay well, offer opportunities for progression and continue to develop our customers' skills.

A Universal Credit, which has been implementing since April 2013, represents a new approach to supporting working-age households. It is a move towards a system that brings together existing income-related out-of-work benefits and tax credits into a simpler, integrated system that supports people in and out of work. This builds on recommendations for a number of organizations from across the social policy field.

Universal Credit will improve financial work incentives by ensuring that support is reduced at a consistent and managed rate as people return to work and increase their working hours and earnings. People will generally keep more of their earnings for themselves and their families than in the previous system. Universal Credit will also ensure that all amounts of work will be more financially rewarding than inactivity and remove the current barriers to small amounts of work¹³ [Smith, 2010, p. 3].

The other elements of structural reform of British welfare system are aimed on:

- the scope to strengthen the conditionality regime and ensure that it is aligned with any reforms to the system,
- the scope for having a more tailored, personalized system in which the conditionality regime for people within certain groups could be extended,
- the role of localism in delivering the welfare system, and
- having a system which supports the government's aim of moving everyone who can work into work and to maximize the percentage of a person's income that comes from their earnings.

The assumptions of social policy in the presented above three countries - Denmark, Germany and the United Kingdom, which represent different labour market models

¹³ Before implementation of the Universal Credit, Working Tax Credits were awarded to those working at least 16 hours a week. [Electronic document: *The tax credit system changes from April 2012,* access mode: http://www.bbc.co.uk/news/business-17126987, date of access: 28.12.13].

seem to prove that those countries adjust the changes of conducted labour market policy to the new economic and social conditionings. They have been trying to solve the employment problems in the time of crisis in Europe and follow the concept of transitional labour markets. The transitional labour markets are defined as institutionalised arrangements which allow or support the change of the employment status or the combination of labour market work with other socially (and to some extent even economically) useful activities. Important elements of such a strategy are the combination of working time reduction with life-long learning, the use of explicit wage subsidies for lower income groups or hard-to-place people, and legally or contractually bargained entitlements to transitional employment. Such transitional labour markets would also serve as a flexible buffer which expands in periods of recession and contract during booms [Schmid, 1998, p. 3].

5. Conclusions

Denmark, Germany and the United Kingdom, not only represent different labour market models but they are the countries with dissimilar social and economics conditionings, which are also connected with their culture, history and respected values in the societies. Although those differences, the reforms carried out in the analysed countries indicate at seizure of the division of rules previously existing in the labour market policy in the distinguished above models and at development of common objectives for each of the welfare state systems in the current socio-economic conditionings. These similar rules are designed to improve the effectiveness of labour market policy (mainly ALMP). Such principles, amongst others, include:

- multi-sectoral labour market policy (engaging both private and public labour market institutions, NGOs, educational units, business sector),
- the growing importance of active labour market policies with clear objectives for higher employability of people participating in the active labour market programs,
- implementation of the workfare state based on the system of rights and duties,
- deregulation of the labour market,
- promoting flexible forms of employment,
- creation of networking among labour market institution and business as a base for active labour market programs.

Moreover, trade unions have been weakened both by declining membership and by their decreasing role in facilitating collective bargaining. Collective bargaining coverage has eroded, while more regulatory rights and legal powers have been transferred to firms. Where collective bargaining exists, it takes place at a more decentralized level, closer to the firm or workplace [Karlson, Lindberg, 2011, pp. 11-26].

The analysis of the introduced changes in the countries implementing labour market reforms allows for benchmarking of the good practices, which could be suitable for Polish social and economic conditionings. Although, the Danish flexicurity model is promoted for implementation among the European Union members (including Poland), it could not be the best solution for the countries with substantial budget deficit as well as high public debt (which in Poland has reached the constitutional limit). That is why the flexicurity model (consisting with three elements) cannot be fulfilled in countries with serious instability of public finances as the generous welfare state is the condition of financing of active labour market policy. ALMP allows for, so crucial in the model, security during popularisation of elasticity. The reason of failure of the Danish model in Polish conditionings could also be different social mentality determined by historical process [compare: Rollnik-Sadowska, 2013, p. 19].

More rational for Poland would be the British model, as its main objective is promoting of professional activity by encouraging benefits system. Polish social security system as well as inefficiency of public labour market institutions, boost inactivity of labour force. That is why the development of motivating system of rights and duties together with effective jobcentres and cooperation with private providers could solve the problem of abusing of social aid and unused social capital.

The German labour market policy element worth for implementation in Poland is the system of dual learning, which could decrease the structural unemployment, improve the youth's situation on the labour market and reduce external migration as the labour force structure would be better adjusted toward labour demand needs.

The above assumptions need further research process, but they can be treated as the general guidelines for labour market policy improvement in Poland.

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Agnieszka MALAREWICZ-JAKUBÓW, Paweł KUŁAK¹

CRITICAL ANALYSIS OF SELECTED PROVISIONS OF THE EU LEGISLATIVE PACKAGE IN RESPECT OF THE CAPITAL REQUIREMENTS FOR THE BANKING SECTOR

Summary

The main aim of this article is to provide a critical analysis of selected provisions of the Directive and Regulation in respect of the capital requirements for banking and finance sector in the European Union. It focuses on the analysis of the following aspects: (i) proposed regimes, mechanisms and legal structures creating the European framework on the capital requirements; (ii) implications of the new legislation for the banking sector and for the national regulatory authorities; (iii) certain similarities between the Third Basel Accord prepared by the Basel Committee on the Banking Supervision and the proposed EU capital requirements package; and (iv) implications of the legislation for the Polish banking and finance sector.

As the global financial crisis reshaped the approach to the banking institutions throughout the world, the authorities started to be more concerned about the safety and creation of certain mechanisms preventing the sudden issues of the banks and financial institutions, which were in consequence resolved by the taxpayers. The cooperation between EU authorities and the Basel Committee on Banking Supervision resulted in the creation of the new framework on the capital requirements for the European Banking sector. To a certain extent, the EU proposal is a part of global, legal framework setting out harmonized rules ensuring the general stabilization in the banking and finance sector. It also constitutes a continuation of the EU policy on ensuring the safety of the European banking and finance sector.

Key words: Capital requirements, banking law, banking sector, financial sector, European Union, Basel Committee, financial stability, financial crisis, financial stability mechanisms.

1. Introduction

As a consequence of the financial crisis which triggered certain negative implications for the European banking sector, the European Union (the "EU") authorities proposed to increase the stability and further precautionary measurements to mitigate any potential risks of instability in the European banking and finance sector. In consequence, the EU Parliament, together with the EU Council, proposed new laws on, amongst other things, banking capital requirements and liquidity, namely the Capital Requirements Directive IV and the Capital Requirements Regulation (jointly referred to as the "Capital Re-

¹ dr hab. Agnieszka Malarewicz-Jakubów, prof. UwB – Faculty of Law, University of Bialystok, e-mail: malarewicz@uwb.edu.pl; Paweł Kułak, Ph.D. – Faculty of Law, University of Bialystok, e-mail: paweł.kułak@gmail.com.

quirements Package"). The proposed date of the full implementation of the Capital Requirements Package is on 1 January 2019².

To a certain extent, the Capital Requirements Package is reflecting the new global regulatory framework agreement regarding the capital and liquidity requirements for the international banking and finance sector, prepared and proposed by the Basel Committee on the Banking Supervision (so called the "Basel IIIP" or The Third Basel Accord) [The impact assessment..., 2010, p. 3].

Notwithstanding the continuation of implementing further stability mechanisms under the capital requirements regime³, the new legislation included in the Capital Requirements Package, is considered controversial from many perspectives, as it may have significant impact on the increase of costs associated with the functioning of the banking sector and the financings in general.

The purpose of this article is to perform a brief, critical analysis of the selected provisions of the new legislation regarding *inter alia* the capital requirements and relating to maintaining the stability in the European banking sector and to indicate certain risks associated with implementation of that new legislation. The selection of the provisions which are subject to the analysis provided hereunder was made on the basis of analysis of the financial crises that took place in the past and factors directly or indirectly causing them. These enhanced new mechanisms being the subject of the analysis provided hereunder, may – in authors' opinion - have a positive impact on maintaining the long-term stability in the European banking sector.

2. Sanctioning regimes in the banking and finance sector

As an aftermath of certain difficulties with the safety of funds kept by European banks and the lack of effective supervisory powers sanctioning infringement in the European banking sector, the European Commission decided to begin consultations regarding the efficient enforcement of the mechanisms ensuring the stability in the banking and finance sector [*Communication from the Commission* ..., 2013, p. 2]. As a result, the Commission issued a communication paper addressed to Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions, in which the sanctioning regimes in the banking and finance sector, were assessed. The communication paper addresses certain inconsistencies and weaknesses of the banking and finance sector in the European Union resulting from the assessment of the sanctioning regimes in the EU Member States, carried out by the Commission in cooperation with the Committees of Supervisors [*Communication from the Commission* ..., 2013, p. 6].

According to the key provisions of that communication paper, sanctioning regimes in respect of the banking sector are considered to be the crucial elements in ensuring the financial stability in the sector across the European Union [Communication from the

² Information obtained from CRD IV FAQ.

³ The proposal for the capital requirements Directive IV will replace the current capital requirements directives (2006/48 and 2006/49).

Commission..., 2013, p. 4]. Communication paper considers 'sanctions' as all possible actions and measures which ensure the stability across the banking and finance sector. It therefore constitutes a good starting point for the new mechanisms improving functioning of the European banking and finance sector.

As the outcome of the assessment performed under the communication paper, it was revealed that few aspects of the functioning of the banking and finance sector require certain improvements. These aspects are [*Communication from the Commission...*, 2013, p. 6-9]:

- a) various sanctions for the same infringement of the EU laws regarding the banking and finance sector, and
- b) inconsistent sanctioning mechanisms for the infringement of the EU laws regarding the banking and finance sector in respect of legal and natural persons.

The analysis performed for the purposes of the communication paper shows certain failures in functioning of the sanctioning mechanisms which have an impact on the trust and safety within the banking and finance sector. However, the assessment of issues associated with the sanctioning regimes across the EU, is only a part of a bigger reform aimed at the improvement of the safety mechanisms in the European banking and finance sector. Hence, the European Commission, taking into account the results of the sanctioning regimes assessment and the mechanisms of the Basel III agreement, initiated further steps in order to create more coherent and comprehensive framework regarding the safety in the European banking and finance sector.

3. Analysis of the selected provisions of the Capital Requirements Directive IV

The scope of the Capital Requirements Directive IV, is the Directive of the European Parliament and the Council on the access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms and amending Directive 2002/87/EC of the European Parliament and of the Council on the supplementary supervision of credit institutions, insurance undertakings and investment firms in a financial conglomerate [*Proposal for a Directive...*, 2013], (the so-called the Capital Requirements Directive IV), except for the aforementioned range of various sanctioning mechanisms, covers *inter alia* the following crucial areas [*Proposal for a Directive...*, 2013, p. 2]:

- a) corporate governance,
- b) provisions preventing the overreliance on the credit ratings, and
- c) establishment of the capital buffers (similar to those proposed in the Basel III).

As the Directive is not directly applicable, a number of prudential, directly applicable provisions are included in the Capital Requirements Regulation. However, the Directive includes more flexible and slightly broader provisions, which allow the EU Member States to have certain flexibility while implementing these provisions into their legal systems

3.1. Corporate governance

As mentioned above, The Directive establishes the new legal framework for the prudential corporate governance. The source of main drivers for imposing new rules regarding the corporate governance was the aftermath of the most recent financial crisis of 2008 [*The explanatory memorandum...*, 2011, p. 3].

According to the report prepared by High Level Group on financial supervision in the EU, chaired by Jacquies de Larosiere [*The report of the high level group*..., 2009], one of the factors which caused the credit crunch was the legislation which did not prevent promotion of the policy concerning short term profits aligned with the high compensation incentive system for bankers, without consideration of the long-term consequences [*The report of the high level group*..., 2009, pp. 30-31]. This factor, described in the report as the corporate governance failure [*The report of the high level group*..., 2009, p. 31], should be addressed in the set of new rules which amongst other things, would allign the compensation schemes for the bankers with long term profits and amongst ther things, the supervision of the compensation schemes in the financial sector [*The report of the high level group*..., 2009, p. 31]. The Directive addresses issues pointed out in the *de Larosiere* report by emphasising the role and standing of the senior management of credit institutions and investment firms, the increased role of the risk management and mentioned above, sophisticated sanctioning mechanisms [*The explanatory memorandum*..., 2011, p. 11].

Pursuant to the provisions of the Directive, EU Member States shall ensure that the management of the credit institution implements and oversees the appropriate risk strategy, strategic objectives and controls the senior management of such institution [*Directive*..., 2011, Art. 88]. Additionally, the Directive points out that (*unless its justified*), the chairman of the management board of the credit institution cannot simultaneusly hold the position of the chief executive officer of such institution [*Directive*..., 2011, Art. 88]. Furthermore, the Directive includes set of professional requirements (such as skills, knowledge, experience) that the management of the credit institution and investment firm should comply with. The key provision is, that the competent public authority is entitled to monitor and and assess the institution's compliance with the corporate governance requirements set out in the Directive [*Directive*..., 2011, Art. 88]. As regards other corporate governance provisions, the Directive indicated rules for the remuneration of the management which should be aligned with (among other things) efficient risk management (which should not encourage the excess risk), long term interest of the institution, subject to extensive reviews.

Additionally, remuneration policies and management rules are subject to review as to their compliance with the Directive. The supervisory function regarding the compliance with these provisions is imposed on the competent institution of the EU Member State, which is obliged to request credit institutions and investment firms to take necessary measures and address (at the early stage) potential risk of not meeting the requirements of the Directive and any potential breach of rules imposed by the Directive [*Directive...*, 2013, Art. 102].

3.2 Overreliance on the credit ratings

The experience of the financial crisis, during which rating agencies (usually indemnified from the responsibility by the way of their cautiously drafted disclaimers) prepared many ratings highly above the real credibility of the borrower, has led the European legislators to the idea of establishing mechanisms preventing such practices. The overreliance on the credit ratings may have a significant effect on the destabilisation of the whole sector, especially when the ratings of the major rating agencies are similar [The explanatory memorandum..., 2011, p. 3]. In order to mitigate the risks associated with external credit ratings which do not reflect the actual financial standing, the EU emphasized the internal risk assessment of each institution in order to obtain a wider, more objective financial perspective on an entity. The Directive, imposes the obligation on the EU Member States, to ensure that the credit institutions develop and evaluate the internal rating-based assessment mechanisms [Directive..., 2013, Article 77]. This would complete the results of the external rating agencies assessments. In consequence, the bank making decision regarding the transaction, would be able to take the holistic view on the entity, its assets and obligations, considering external and internal ratings. Firstly, the implementation of such a mechanism will motivate independent rating agencies to perform their assessments more carefully. Secondly, the risk that the credit institution was taking while relying on the external ratings only, would be mitigated by relying also on solid, internal risk rating assessment mechanisms, that will be subject to supervision and potentially sanctions by the competent public authorities monitoring the compliance with the Directive provisions. Such protection mechanism shall lower the risk of failure in respect of financial assessment of and in consequence, shall lower the risk of non-performing loans and potentially risky exposure of the credit institution's capital.

3.3. The establishment of capital buffers

The concept of countercyclical capital buffers has been first introduced under the Third Basel Accord [*A global regulatory framework*..., 2011, p. 5]. The aim of imposing regulations regarding the capital buffers is to prevent excessive leverage and stabilise the bank's capital, despite the current cycle of the economy [*The explanatory memorandum*..., 2011, p. 3].

The Directive, sets out two types of the capital buffers [*Directive...*, 2013, Articles 128-129]:

- a) capital conservation buffer, and
- b) countercyclical capital buffer.

Capital conservation buffer

The Directive imposes on the EU Member States the obligation to require from the credit institutions to maintain (in addition to the common equity tier 1 capital) the specific conservation buffer of the common equity tier 1 capital, equivalent to 2.5% of

the total capital exposure of such credit institution calculated in accordance with the Capital Requirements Regulation [*Directive*..., 2013, Art. 129]. In other words, the capital conservation buffer is a buffer would be based on the tier 1 assets (best quality) to ensure that the capital behind such buffer is available at all times. Such buffer should be built up in the prosperous, market high years. The aim of such buffer is to absorb losses and enable the credit institution to resist market downgrade for several years [*The explanatory memorandum*..., 2011, p. 12].

Countercyclical capital buffer

In addition to the capital conservation buffer, the Directive imposes on the EU Member States the obligation to require from the credit institutions, the countercyclical buffer, which shall consist of the weighted average of the countercyclical buffer rates that apply in the jurisdictions where the relevant credit exposures of the institution are located [*Directive...*, 2013, Article 140]. In other words, the countercyclical capital buffer is aimed at providing stability for the credit institution during the market destabilisation resulting from systemic changes (i.e. liberalisation or de-liberalisation of the credit policies and any structural changes). As regards the amount of the countercyclical buffer, it will be set up by the EU Member States national authorities in relation to the loans provided in favour of the legal and natural persons. The amounts of the countercyclical capital buffer are between 0 and 2.5% of the risk weighted assets and can be set by the national authorities even beyond 2.5% (*if justified*) [*The explanatory memorandum...*, 2011, pp. 12-13]. Funds for such buffer are collected during the market growth.

Buffers proposed under the Directive are aimed at the stabilisation of the financial sector and balancing the capital floating within such sector during the market variations. However, the funds which are gathered for the purposes of the capital buffers may increase the costs of financing. Although, it mainly depends on the way in which the Directive will be implemented, most probably funds collected for the purposes of the buffers will be compensated by the banks from the customers.

The above-analysed mechanisms included in the Directive, create numerous additional obligations on EU Member States and credit institutions/investment firms. All of them are aimed at enhancing organization and improving the supervision in the banking and finance sector. To a certain extent, the obligations imposed on Member States may imply the development of certain units within the financial supervision authorities, which will manage solely the sector's compliance and implementation of the new mechanisms. Furthermore, considering the number of regulations, the banks within their compliance departments may need to establish special units which would manage the effective implementation and monitoring the compliance with the new rules.

4. Analysis of the Capital Requirements Regulation

The Regulation of the European Parliament and the Council on prudential requirements for the credit institutions and investment firms (the "**Regulation**") is a complimentary element of the Capital Requirements Package aimed at providing further stabilization in the European banking sector. As it is directly applicable in the EU Member States, its provisions need to be clear, coherent and possible to apply in the diverse banking sectors of all EU Member States. The Regulation more than the Directive, creates so called "*The Single Rule Book*", which is aimed at creating organized, harmonized, including sanctions and relevant supervision mechanisms, legal framework [*The executive summary...*, 2011, pp. 4-5].

Amongst other things, the Regulation covers the following areas [The executive summary..., 2011, p. 5]:

- a) Liquidity;
- b) Leverage;
- c) Regulatory capital, and
- d) Counterparty credit risk.

4.1 Liquidity

The nationalisation of the British Northern Rock Bank is considered as the commencement of the European banking sector's liquidity crisis [*The nationalisation of Northern Rock...*, 2009, p. 3]. The default of the Northern Rock has started the period of issues with raising funds by banks. In consequence, such issues were partially resolved by the taxpayers under several big nationalisations, such as Nothern Rock or The Royal Bank of Scotland. In addition to the extreme cases of nationalisation, liquidity issues were being resolved *ad hoc*, also by interbank funding. According to the EU Commission, in few months at the end of 2008, the European Central Bank loans granted in favour of the credit institutions within the Euro Zone, have increased by 70% [*The executive summary...*, 2011, p. 2]. In practice, the shortage of funds as a result of liquidity issues, is usually caused by not synchronised inflows and outflows of the funds [*The executive summary...*, 2011, p. 8]. The experience of past years and the requirement to enhance the management of liquidity led European authorities to prepare set of rules and mechanisms aimed at ensuring the stable liquidity in the banking and finance sector.

The capital requirements regulation addresses liquidity issues by way of setting up the two following key mechanisms adopted from the Third Basel Accord:

- a) Liquidity coverage ratio, and
- b) Net stable funding ratio.

Liquidity coverage ratio (the "LCR"), is a measure introduced to ensure the stable liquidity of the financial institutions in a short term liquidity shortage (up to 30 days) resulting from the systemic shock and particular institution issues [*The explanatory memorandum...*, 2011, point 2.2.1]. The source of capital required to ensure the short term coverage would be based on the high quality (tier 1) liquid assets (such as for example cash, central bank reserves, high quality sovereign debt and potentially high quality corporate bonds and/or covered bonds) [*Annex IV...*, 2011]. The liquidity coverage ratio should be implemented in 2015 and it is expected to bring gains of the EU

GDP in the range of 0.1% to 0.5%, (in consequence of the reduction of the systemic shocks) [*The executive summary*..., 2011, p. 4].

It appears that the liquidity coverage ratio as the measure ensuring the short term liquidity upon unexpected downturn should be backed up not by liquid securities (such as bonds) but rather by reserves in cash. However, this would create the impression that the LCR is rather a reserve fund/buffer, than a ration which in general should be a instrument separate from the buffers (also introduced by the Capital Requirements Package). It is worth mentioning that the proposed scope of the liquid "assets" backing up the LCR, should be rather flexible (construed in a form of a open catalogue) in order to leave the flexibility of choosing the asset which should be liquified for the purposes of covering the LCR, depending on the current market situation.

Net stable funding ratio (the "NSFR") is a measure introduced to ensure liquidity during downturn in profitability or stress scenario for a period of 1 year [*The impact assessment*, 2011, p. 26]. According to public consultations which took place in 2010, the source of funds for the net stable funding ratio, should be [*Annex V*...]:

- a) own funds eligible instruments and other liabilities > 1 year residual term 100%;
- b) stable deposits of retail and small business customers (non-maturity or residual maturity < 1year);
- c) less stable deposits of retail and small business customers (non-maturity or residual maturity < 1year);
- d) wholesale funding provided by non-financial corporate customers (nonmaturity or residual maturity < 1year) 50%;
- e) all other liabilities and equity not included above.

The Commission intends to impose the measurements of the NSFR from 2018 [*The explanatory memorandum...*, 2011, p. 14] and up until then, observations of the banks practices will be procured. Considering that the NSFR is intended to provide the long term liquidity backup, the "assets" backing up funds for these purposes are required to ensure the adequate, stable return. The results of public consultations suggest that mainly deposits and own funds should be the source for NSFR. In addition to these key elements, the return on mid-term investment grade corporate loans may be considered as the stable basis for the stable return and profits for the credit institutions.

4.2 Leverage

The level of credit institutions' leverage is closely related with the risk of the bank. In practice, the leverage is the percentage that represents the degree of the bank's exposure exceeding its capital [*The explanatory memorandum*..., 2011, p. 57]. In other words, it is considered as the amount of exposed capital of the bank versus its own capital/assets.

According to the provisions of the Regulation, the so called "exposure" is defined as "assets, off-balance sheet obligations and contingent obligations to pay or to deliver or to provide collateral, including obligations from received funding, made commitments, derivates or repurchase agreements, but excluding obligations which can only be enforced during the liquidation of an institution'' [*Regulation*..., 2013 Art. 4].

Although the Regulation does not currently contain provisions setting out the standarised degree of the leverage ratio, it:

- a) establishes mechanisms on the monitoring and supervisory of the level of the leverage within the European credit institutions and investment firms [*The executive summary...*, 2011, p. 5], and
- b) contains provisions on method under which the degree of leverage should be calculated [*Regulation...*, 2013, Art. 429].

In order to ensure the stabilization in the European banking sector, the Capital Requirements Package should also contain binding provisions on the degree of leverage, which would allow banking institutions to have some flexibility. Hence, the degree of leverage should rather not be set at the certain level but rather as a range of percentage.

Notwithstanding the non-binding nature of current leverage ratio, it is possible that it will become binding in 2018 after its period of observation elapses [*The executive summary*..., 2013, p. 5]. However, it is not clear whether the imposed ratio will take the form of a threshold or a percentage range.

4.3 Regulatory capital

The Regulation introduces new criteria for categorizing the quality of the regulatory capital. Such new criteria built up the definition of the regulatory capital, which appears in the new regulation as Capital Tier 1 and Equity Tier 1 [*The explanatory memo-randum...*, 2011, p. 6]. Improving the quality and harmonisation of the funds held by credit institutions and investment firms resulting from the experience of large-scale losses in the banking sector was one of the main drivers to introduce new rules regarding the quality of the capital [*Regulation...*, 2013, Point 53 of the preamble]. The overall crisis in the banking sector indicated weak financial instruments, such as hybrid capital instruments based on the structures containing debt and equity instruments [*The executive summary...*, 2011, p. 2]. Such hybrid instruments, amongst other characteristics, have an insufficient degree of loss absorption and in consequently lower the degree of trust in the markets.

In order to strengthen and harmonise corporate structures of credit institutions and investment firms, the Regulation includes provisions regarding the minimum requirements in respect of the quality and the quantity of the regulatory capital. Under the Regulation, the capital should consist of the following items [*Regulation...*, 2013 Article 25 and Article 62 and further]:

- a) Common Equity Tier 1 capital;
- b) Additional Tier 1 capital, and
- c) Tier 2 capital that is equal to or less than 25 % of own funds.

Pursuant to the provisions of the Regulation,

- 1. Common Equity Tier 1 capital should include the following items [*Regulation...*, 2013, Art. 25]:
 - a) capital instruments, provided the conditions laid down in Article 27 and 28 (*Amongst other things: the instruments are issued directly by the institution with the prior approval of the owners of the institution or, where permitted under applicable national law, the management body of the institution.*) are met;
 - b) share premium accounts related to the instruments referred to in point (a),
 - c) retained earnings,
 - d) accumulated other comprehensive income,
 - e) other reserves,
 - f) funds for general banking risk.
- 2. Additional Tier 1 capital should include the following items [*Regulation...*, 2013, Art. 51]:
 - a) capital instruments, where the conditions laid down in Article 52(1) (Amongst other things: the instruments are issued and paid up, the purchase of the instruments is not funded directly or indirectly by the institution) are met,
 - b) share premium accounts related to the instruments referred to in point (a).
- 3. Tier 2 capital should include (among other things) the following items [Regulation..., 2013, Art. 62].
 - a) capital instruments, where the conditions laid down in Article 63 (*Amongst* other things: the instruments are issued and paid up, the purchase of the instruments is not funded directly or indirectly by the institution) are met,
 - b) the share premium accounts related to the instruments referred to in point (a).

Considering the aforementioned features, the proposed new capital requirements regime creates a quite strictly regulated framework. On the one hand, strengthening and stabilizing capital structures within the banking sector will help to avoid financial, institution-specific variations caused by the market turbulences. On the other hand, strict requirements regarding own capital and the imposed "savings" policy may have a negative impact on the potential investment activities of credit institutions and investment firms in the EU. In consequence, European credit institutions having funds limited by the capital requirements framework may be less competitive in the investment sector, in comparison with banks registered outside the EU⁴.

The new framework concerning the regulatory capital will not be fully implemented from the beginning. It will be monitored and gradually implemented in order to ensure that the new requirements would not destabilize the banking and finance industry and financial markets in the EU [*The explanatory memorandum...*, 2011, p. 6].

4.4. Counterparty credit risk

The global financial crisis has indicated that the regulations in respect of certain types of securities (such as so called ,,over-the-counter" derivatives) are not sufficient to

⁴ And not binded by the Basel III requirements.

keep the risk associated with such transactions at a relatively low level [*The executive summary*..., 2011, p. 3]. The difference between the bank's exposure resulting from the loan in comparison to the exposure resulting from the counterparty credit risk, is that the transaction failure has an impact on at least two parties involved therein, rather than a singular impact on the bank granting a loan [*The impact assessment*..., 2011, p. 56]. Therefore, a series of failed transactions on derivatives (by both parties, *i.e.* the party whose risk was hedged and the hedging counterparty) may have a systemic impact on the market circumstances (*both for the party whose risk was hedged and the hedging counterparty*).

In order to impose further regulations regarding the counterparty hedging risk, the Capital Requirements Package would impose additional capital charge for possible losses associated with the failure of the counterparty [*The explanatory memorandum...*, 2011, p. 6].

This capital charge – on the longer term, would enable hedged parties to retain the funds that might have been lost if the hedging counterparty has defaulted. Implementing in the Regulation the stabilisation and safety mechanisms in respect of derivatives, is an element of a bigger policy on building up the safe European derivatives market. In this respect, the Regulation is complementary with the Regulation on over-the-counter derivatives, central counterparties and trade repositories [*The explanatory memo-randum...*, 2011, p. 26], of 15 September 2010 [*Regulation (EU) No 648/2012...*, 2013]. Establishment of the additional charge on the banks potentially will increase the costs of hedging transactions and in consequence the transactions in general. However, from the perspective of systemically important financial institutions, the establishment of such charge may secure the interest of parties involved in the transaction.

In addition to the provisions described above, the Regulation establishes new, harmonised supervisory legal framework [*The explanatory memorandum*..., 2011, p. 6]. Considering, that a number of crucial provisions has been included in the Regulation (which is directly applicable), it may have a positive impact on the harmonisation and interpretation of certain rules in all EU Member States. The aim of EU legislators drafting the Regulation was to create a comprehensive source of main rules, which are clear, coherent and easy to read and interpret. However, bearing in mind that capital requirements and other related areas are quite specific matters, at first the Regulation may appear as an encyclopaedia rather than a book. It is also worth mentioning that the purpose of creating a single rule book was to avoid situations in which national authorities would interpret certain provisions differently (in line with its own intentions, understanding), which may be deeded as promoting, the so-called "gold plating"⁵ of the Regulation's provisions.

⁵ Intentional exceeding the terms of the EU legislation by the national authorities of the EU Member States.

5. Presumable positive and negative implications of the new EU legislation

Criticism of independent observers and bankers relates mainly to the standarised rules for all the banks in the European banking and finance sector, despite the differences in their size and the lack of the minimum, risk limiting, binding leverage ratio [Lannoo, 2012]. The proportionality issue has been pointed out by the Parliament of the EU as one of the most important matter in the context of the "too big to fail" issue and proportionate adjustment of the regulations to the type of business, level of risk, size and the business model [*European Parliament Resolution...*, 2011] of the financial institution being subject to the Capital Requirements Package provisions.

As the European banking sector is rather diverse, construed as in Poland of: numerous cooperatives, commercial banks and banks being members of larger, international corporate structures, Capital Requirements Package's provisions should be applicable proportionately to the scale of risk that the banks are exposed to. On the other hand, the control mechanisms are playing quite important role in shaping the level of proportionality concept [Stępkowski, 2010, p. 230] while applying the Capital Requirements Package in the banking sector. However, at this stage the pragmatism of the supervision and control in respect of applying the new mechanisms to be implemented under the Capital Requirements Package is difficult to assess, as these provisions have not been yet exercised in practice. Notwithstanding the lack of practical assessment of the mechanisms, it should be pointed out that the Capital Requirements Package includes numerous new mechanisms which would allow the banks and the regulators to proportionately apply them for the relevant addressees.

Imposing heavy regulations, in general does not have a good impact on the development of any firm or institution as it may cause an administrative burden. However, in this particular case, the purpose of this legislation is not to ensure the free float of funds and freedom of transacting but rather to ensure the safety, control and prevention of the banking and finance sector from major stresses.

In fact all the new legal concepts introduced by the Capital Requirements Package can be analysed, among others, from four main perspectives:

- a) commercial,
- b) legal,
- c) short-term,
- d) long-term.

Many of the legal mechanisms introduced under the Capital Requirements Package (such as the capital buffers or the counterparty risk charge) impose additional costs on the banking sector and in consequence may have a short-term negative commercial impact on the number of transactions, as banks may try to transmit these costs on to the borrowers and other business parties.

However, from the long term commercial perspective, additional costs resulting from the establishment of *inter alia* capital buffers, may mitigate the risk of a systemic shock and a default of the credit institution, which at the end would prevent more significant losses of the business parties' capital. As regards the legal short term perspective, the establishment of a significant number of new rules and mechanisms may cause major challenges for national supervisory authorities in the EU Member States, the European Banking Authority and the internal compliance departments of the banks. On the other hand, for the banks performing cross-border activity within the EU, having a single rule book would help to standarise the compliance mechanisms in all EU Member States.

Despite the short term organizational challenges for the banks and supervisory authorities, the new legislation is expected to have a positive impact on the harmonization of laws regarding the safety in the European banking and finance sector. Additionally, broad supervisory prerogatives introduced by the Capital Requirements Package, would potentially prevent mismanagement and malpractices in the sector.

6. Potential impact on the Polish banking and finance sector

Keeping in mind the structure of the Polish banking sector (66 % of all banks assets belong to foreign, mostly EU financial, institutions) [Nier, Nedelescu, Knight, Lindgren, 2012] the impact of the new legislation in Poland, would be to a certain extent, similar to the impact of such regulations in the other EU Member States (such as: Germany, France and other EU countries whose banks have their subsidiaries in Poland).

The scale of the potential impact of the Capital Requirements Package may depend on the transition period of the new rules [*The impact assessment...*, 2011, p. 49]. In case the adequate timeframe is adopted, changes may be smoothly implemented. However, if the new rules are adopted within reasonably short time, then certain increase in cost of financing or immediate cuts on the shareholders dividend payments may be applicable.

One of the factors pointed out in the International Monetary Fund's report in the light of Capital Requirements Package from the Polish perspective, was the concern as to which authority, either the Financial Supervision Authority or the Systemic Risk Board, should decide on the percentage of the capital buffers under the Directive provisions [Nier, Nedelescu, Knight, Lindgren, 2012, p. 34]. This is rather a technical matter but it emphasizes that in practice, in Poland and other EU Member States some interpretation controversies may appear in relation to the delegation of some crucial assessment prerogatives.

Furthermore, as pointed out in the Impact Assessment, the implementation and enforcement of the Capital Requirements Package provisions will increase the so-called "administrative costs" [*The impact assessment...*, 2011, p. 48]. On one hand, administrative costs of the implementation may be regarded as costs of financing and other services resulting from cautious saving policies.

From the perspective of emerging economy such as Polish, the short-term implications of the new regulatory framework may be at first considered as a bit tough and limiting the growth of the country's Gross Domestic Product (the "GDP"). According to the analysis prepared by the Basel Committee on the Banking Supervision, ensuring long term stability may reduce the probability of crisis which and in consequence may even have an impact on the growth of GDP (for example, reduction of the probability of financial crisis by 1 and may even generate a growth in GDP of 0.2 per year and in case the financial crisis have long lasting implications, gains may be larger, even between 0.6% and 1.6% of GDP p.a. [*Basel Committee on the Banking Supervision...*, 2010, p. 13].

In order to have a complementary view on the Polish legislation on the prudential mechanisms for the banking sector, it needs to be emphasized that Polish authorities as a consequence of the implementation of a financial stability framework, set up a banks resolution fund [*Ustawa o zmianie ustawy o Bankonym Funduszu Gwarancyjnym...*, 2013]. The idea of the banking resolution funds was mentioned in 2010, by the Cross Border Bank Resolution Group associated with the Basel Committee on the Banking Supervision which prepared a consultative document called "The Report and Recommendations of the Cross-border Bank Resolution Group" [*Basel Committee on Banking Supervision, Report and Recommendations...*, 2010, p. 6]. This report has first addressed the risks relating to the crises and potential insolvency in the banking and finance sector, which may have a negative impact on the economy of the country, region and financial situation of interconnected institutions and companies. Polish banks resolution fund was set up in order to finance the banks which are facing financial difficulties. This initiative, together with the potential implications of the Capital Requirements Package, may be considered as restrictive regulator's reply to the potential financial crises.

The Capital Requirements Package, together with Polish initiatives on setting up the resolution fund are aiming at ensuring the liquidity of the banks, understood as the ability to fulfil its financial obligations rather than ensuring the financial liquidity understood as the method to exchange the assets into funds [Uryga, Magielski, 2000, p. 48]. From the practical perspective, the later seems to be more difficult to achieve, as the external factors (such as the current economic situation of the state, amount of funds on the market, demand and supply) have impact on the level of financial liquidity.

7. Conclusions

The EU Capital Requirements Package is considered as well-structured (less precise provisions are included in the Directive which is required to be implemented and crucial, precise provisions are included in the Regulation which is directly applicable), coherent and comprehensive source of important institutions and mechanisms which shall ensure the harmonisation of the banking safety rules within the EU and stabilisation of the European banking. The European initiative to impose new rules on the capital requirements is a part of a bigger global policy on the financial stabilization, initiated by the Basel Committee on the Banking Supervision under the Third Basel Accord and many other international and European initiatives, such as the initiative to establish banks resolution funds. The current version of the European Capital Requirements Package is, to a certain extent, a continuation of the former European policy in respect of the capital adequacy within the European banking sector. Further improvements on the rules were required after the analysis of the financial crisis results. Hence, the cooperation of the EU authorities with the Basel Committee on the Banking Supervision on the global harmonization of the "safety" rules for the banking sector was required.

As presented in the above analysis, the EU Capital Requirements Package brings many changes to the legislation which was in force up until now. Some of the mechanisms and legal institutions are incorporated into the EU legislation from the Third Basel Accord and some of them were created autonomously by the EU authorities.

Under the new rules, the European banking sector will be exposed to an extensive supervision and monitoring regarding the compliance with the new legislation. This may have a positive impact on limiting the negative aspects of the functioning of the banks and financial institutions but, on the other hand, it may create a situation in which the regulators having power in their hands will be exposed to certain risks associated with the improper use of implied powers.

The overview of the new capital requirements legislation creates the impression that from the date on which the new rules are implemented, the European banking sector will be subject to heavy regulations, monitoring and certain limitations. However, the new rules are aimed at improving stabilization and safety of the banking sector and preventing the unexpected falls rather than improving the profitability of the banking and finance sector. In the current market situation, such rules may create a good environment for sustainable development of the European economies instead of rapid growth of the banking sector.

Capital Requirements Package has been passed by the relevant European authorities on 26 June 2013. Regulation is effective upon the entry into force and the provisions of Directive will be gradually implemented into the legal frameworks of the EU Member States.

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Ewa ROSZKOWSKA1

THE MACBETH APPROACH FOR EVALUATION OFFERS IN ILL–STRUCTURE NEGOTIATIONS PROBLEMS²

Summary

This paper described the main idea of the MACBETH approach and M-MACBETH software to multicriteria negotiation analysis. The MACBETH is based on the additive value model and requires only qualitative judgments about differences of attractiveness to help a decision maker quantify the relative value of options or criteria. The main goal of this procedure is to support interactive learning about evaluation problems and to provide the recommendations to select and rankordering options/criteria in decision making processes.

We proposed to use MACBETH methodology as well M-MACBETH software to support ill-structure negotiation problems, i e. evaluation of negotiation offers in an environment with uncertain, subjective and imprecise information and not precisely defined decision makers preferences.

An numerical example showing how M-MACBETH software can be implemented in practice, in order to help a negotiator to define numerical values of options/criteria based on verbal statements and next build a scoring system negotiation offers taking into account different types of issues in negotiation problems is presented. More detail we describe the main key points of M-MACBETH software related to structuring the negotiation model, building value scales for evaluation negotiation packages, weighting negotiation issues and selected elements of sensitivity analyzes.

Key words: MACBETH, M-MACBETH, qualitative judgments, support negotiation, preference analysis, scoring function

1. Introduction

The MACBETH (Measuring Attractiveness by a Category-Based Evaluation Technique) is an interactive approach for multi-criteria value of the attractiveness or value of objects (options/criteria) through a non-numerical pairwise comparison questioning. The judgment is based on seven qualitative categories of difference in attractiveness: "no difference" ("indifference"), or is the difference "very weak", "weak", "moderate", "strong", "very strong", or "extreme". What is important and what differs MACBETH from other multi-criteria techniques, MACBETH uses only qualitative judgments of difference in attractiveness objects (options/weights) in order to generate, by mathematical

¹ Dr hab. Ewa Roszkowska, prof. UwB – Faculty of Economics and Management, University of Bialystok, e-mail: erosz@02.pl

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programming, value scores for options and weights for criteria mode. The MACBETH procedure for generating the ranking of the options consists of the following main steps: structure the problem, followed by entering pairwise comparisons into a judgment matrix, calculating the attractiveness of options/criteria with sufficiently *consistent* matrix (otherwise the user is obliged to revise their judgments), construct value functions an optional make sensitivity and robustness analysis [Bana e Costa et al., 2003, 2005a, 2012; Bana e Costa, Vansnick, 1994, 1995, 1999].

The MACBETH approach and M-MACBETH software have been used to derive verbal preference judgment, construct value functions and scaling constants in various multi-criteria analysis, such as: evaluation of bids, public policy analysis, prioritization of projects, resources allocation and conflict management, credit scoring, strategic town planning, environmental management, portfolio management, airport management, risk management, firms competitiveness, resource allocation, among many others [Bana e Costa et al., 2005a]. Despite the MACBETH approach has already been considered in the literature with many applications there is no research on applying it to the support of the ill-structured negotiation problems.

In this paper we proposed to use MACBETH methodology as well M-MACBETH software in support negotiation. Negotiation is an iterative process of exchanging offers and messages between the interested parties that is conducted until the satisfying both parties agreement is reached [Thompson, 1998, Gimpel, 2007; Raiffa, 1982]. The important part of a negotiation analysis is a pre-negotiation phase where a negotiator evaluates offers, usually in form of negotiation packages, and rankordering them using a *scoring function*. Such function has to take into account the structure of negotiation problem, as well objective and subjective decision-makers' preferences. Multi-Criteria Decision-Making Methods (MCDM) offers a lot of techniques for the evaluation and ranking negotiation packages which can be used by the negotiator adequate to a negotiation situation as well negotiator's profile [see: Salo, Hamalainen, 2010; Figueira, et al, 2005; Brzostowski et al, 2012a, 2012b] Sometimes evaluation of negotiation packages are characterized by several qualitative as well quantitative issues, so the negotiation problem is ill structured.

In the paper a comprehensive MACBETH-based approach to support negotiation is presented, which is an original research contribution to the negotiation analysis. This contribution consists of the formulating the model of the decision problem in ill-structured negotiation, which allows the MACBETH approach to be applied to evaluate the negotiation template and M-MACBETH software to build MACBETH-based scoring system. Let us note, that other approaches to solve ill-structure negotiation problems have also been proposed in literature [Roszkowska, Wachowicz, 2012, 2014; Roszkowska et al, 2014; Wachowicz, Blaszczyk, 2012; Wachowicz et al, 2012].

The paper is structured as follows. Section 2 presents MACBETH methodology of questioning and technical procedure for elicitation value function as well M-MACBETH software. The negotiation model based on MACBETH approach is presented in Section 3. The example using M-MACBETH software is discussed in Section 4. Brief conclusions are drawn in Section 5.

2. The MACBETH Methodology

2.1. Mathematical foundation of MACBETH

The mathematical foundations of MACBETH are described in several papers [Bana e Costa et al., 2003, 2005a, 2012; Bana e Costa, Vansnick, 1994, 1995, 1999] and M-MACBETH software in [M-MACBETH..., 2005; Bana Costa 2005b]. The MACBETH approach has been developed since the early 1990s by Bana e Costa and Vansnick [2003]. Bana e Costa and Vansnick [1995] pointed out 'In Measurement Theory terminology, MACBETH is an interactive approach for mapping into a real scale various degrees of a property of the elements of a finite set A. The originality of MACBETH's questioning procedure is the possibility of establishing a constructive path towards cardinal measurement in both quantitative and substantive meaningful terms, avoiding the operational problems recognised as a weakness of other procedures. The use of the notion of semantic absolute judgments pays a key role here, and the simplicity, interactivity and constructiveness of our approach inserts it in the modern paradigms of decision aid'.

Mathematically, MACBETH method is composed of few sequential PPLs (linear programming problems), which perform the analysis of cardinal consistency, the construction of the cardinal value scale which represents the set of judgments of the decision-maker, reveal sources of inconsistency, i.e. to check the existence of inconsistencies and suggest their solution. The exact formulation of these PPLs can be found in Bana e Costa and Vansnick [1995, 1999], Bana e Costa et al. [2012]. We present here the basic notion of *Measurement Theory* which are implemented in MACBETH procedure [for details see: Bana e Costa, Vansnick, 1995; Bana e Costa et al, 2012]. We define first two main types of scale: the ordinal scale and the cardinal scale.

Ordinal and cardinal value information. Let X be a finite set of elements or different options or performance levels under evaluation. Ordinal measurement of the attractiveness (or desirability) of the elements x of X consists in associating each $x \in X$ with a numerical score a real number v(x) that satisfies the following two ordinal measurement conditions [Bana e Costa, Vansnick, 1995; Bana e Costa et al., 2012]:

the condition of strict preference

$$\forall x, y \in X \quad x P y \Leftrightarrow v(x) > v(y) \quad (x \text{ is more attractive than } y) \tag{1}$$

- the condition of indifference

$$\forall x, y \in X \quad xIy \Leftrightarrow v(x) = v(y) \ (x \text{ is as attractive as } y) \tag{2}$$

A scale v that satisfies the measurement conditions (1)-(2) is an ordinal scale of measurement.

Cardinal measurement of the attractiveness of the elements x of X consists in associating each x with a numerical score -a real number v(x) that satisfy conditions (1), (2) and also the following (3) condition [Bana e Costa and Vansnick 1995; Bana e Costa et al. 2012]: $\forall w, x, y, z \in X$ with x more attractive than y and w more attractive than z the ratio $\frac{v(x) - v(y)}{v(w) - v(z)}$ measures the difference in attractiveness between x and y when the

difference in attractiveness between w and z is taken as the measurement unit. (3) A scale v that satisfies the measurement conditions (1)-(3) is *interval scale* of measurement.

The numerical scale $v: X \to \Re$; $v \to v(x)$ can be constructed by positioning the elements of X on a vertical axis so that [Bana e Costa, Vansnick 1995; Bana e Costa et al., 2012]:

- 1. $\forall x, y \in X : x \text{ is positioned above } y \text{ if and only if } x \text{ is more attractive than } y$ (ordinal value information);
- 2. the relative distances between the elements of *X* on the vertical axis reflect the relative differences in attractiveness between these elements (cardinal value information).

The MACBETH judgment matrix. The MACBETH procedure transform *ordinal* information for *cardinal information* by a non-numerical *painwise comparison* questioning mode in the form of MACBETH judgment matrix. On this judgment is based the interval value scale, which is constructed interactively with the decision maker [Bana e Costa et al., 2012]. However both technique, MACBETH and AHP are based on pairwise comparisons entered by the user, the MACBETH uses an interval scale, whereas AHP adopts a ratio scale [Saaty, 1980].

First, the decision-maker is asked to rank the elements of X by decreasing attractiveness. In situation, where it is difficult to rank directly elements of X he is asked to compare the elements in two steps procedure: is one of the two elements more attractive than the other and if yes, which one? When x is more attractive than

y (*xPy*), the decision-maker is asked for a qualitative judgment about the difference of attractiveness between x and y, by presenting the decision maker with six categories³: C_1 – very weak difference of attractiveness, C_2 – weak difference of attractiveness, C_3 – moderate difference of attractiveness, C_4 – strong difference of attractiveness, C_5 – very strong difference of attractiveness, C_6 – extreme difference of attractiveness.

Judgmental disagreement or hesitation between two or more consecutive categories, except indifference, is also allowed. Some useful techniques were proposed to simplify judgment in MACBETH matrix [Sanchez-Lopez et al., 2012; Bana e Costa, Chagas, 2004; Bana e Costa et al., 2008]. One of the proposition is to enter the qualitative information into this matrix to the right of the matrix's main diagonal starting from the difference between the highest level (i.e. the most attractive) and the lowest level (i.e. the least attractive). Judging the difference of attractiveness between every two consecutive scale the main diagonal of the matrix was first completed. Next, decision-makers judge the difference of attractiveness between the first level and the third, the second level and the fourth and so on, thus completing the second diagonal of the matrix [Sanchez-Lopez et al., 2012]. The other technique was proposed by Bana e Costa and Chagas [2004]. The authors suggested make judgment from top to bottom the last column of the matrix, next to fill from right to left the first row, and finally to complete the main diagonal of the matrix. Bana e Costa et al. [2008] mentioned that both procedures are correct, however others are also possible. It is also worth nothing that it is not necessary to

³ It is worth nothing, that however there is no restriction about the number of semantic categories to be used seven categories usually were used because of human limited perception and difficulties of evaluating simultaneously big numbers of options, when giving absolute value judgments.
perform all of the $\frac{n(n-1)}{2}$ paired comparisons to complete MACBETH matrix. It was shown that *n*-1 is the minimum acceptable number of judgments', which corresponds either to the last column or the first row or the main diagonal of the matrix. However, it is also recommended to perform some additional judgments in order to cross-check consistency [Bana e Costa et al., 2008; Sanchez-Lopez et al., 2012]. In the MACBETH matrix cell containing a "positive" difference of attractiveness means that, for those judgments, the information available is ordinal.

Problem of Consistency in MACBETH Matrix. There are two types of inconsistencies: *semantic*, when the assignment of category of difference of attractiveness to a pair of comparison is not logically acceptable and *cardinal* if the representation of the judgments is not possible through a cardinal scale within the real numbers. In general, for each paired comparison, M-MACBETH verify their consistency with regard to the judgments already available in the matrix uses an algorithm based on linear programming [Bana e Costa et al., 2005, 2012]. Each time that a qualitative judgment is elicited, M-MACBETH tests the consistency of all the judgments made by the decision maker, and their compatibility with cardinal information. A detailed study of the inconsistencies, the formal description of problem of inconsistency, types of inconsistencies as well consistency tests can be found in papers [Bana e Costa et al, 2005; Ishizaka, Nemery 2013].

Determination of MACBETH Scale. In the case of consistent matrix of judgments, the software will calculate the weights and scores of options by linear optimization which minimizes the score of the most attractive option/criterion. The least attractive option/criterion is grounded to 0. The software propose a decision-maker scale which he can accept as the final scale. However, because several solutions may exist, software calculated also (by integer linear programming) "free interval" which can be used to modify scores of options if needed [Bana e Costa, Vansnick, 1995; Bana e Costa et al., 2005; Ishizaka, Nemery, 2013].

The Values Function. Finally, a process was accomplished in order to construct the corresponding *value functions*. The performance of the options on each criterion in the form of value score are transformed for value function. [Bana e Costa, Vansnick, 1995; Bana e Costa et al., 2005; Ishizaka, Nemery, 2013].

The Overall Score Measures. Next, options are evaluated globally using multi-criteria additive aggregation mode by calculating weighted average of the options scores on the criteria. This overall score measures the relative global attractiveness of the options across the entire set of criteria under consideration. Let us note that weights were also assigned to the criteria by a MACBETH weighting process [Bana e Costa, Vansnick, 1995; Bana e Costa et al., 2005; Ishizaka, Nemery, 2013].

2.2. M-MACBETH software

The M-MACBETH Decision Support System is based on the implementation of the MACBETH methodology⁴. **M-MACBETH** *is a multi-criteria decision support software that permits the structuring of value trees, the construction of criteria descriptors, the scoring of options in relation to criteria, the development of value functions, the weighting of criteria, and extensive sensitivity and robustness analysis about the relative and intrinsic value of options* [Bana e Costa et al., 2005b].

The **M-MACBETH** software allows model structuring through a "value tree" which useful and easy visual interface⁵. The questioning procedure is providing by verbal information about the difference of attractiveness of the options/criteria and the software tests the compatibility of the information collected with regard to information. The software gives a warning message about "inconsistent judgments". Then it provides the discussion with the decision-maker presenting, in this time, graphically the source of the problem and giving suggestions to deal with inconsistencies. After solving inconsistency, the software proposes a numerical scale with friendly graphic representation. The numerical scale is automatically transformed into a scoring scale. Criteria weights can be represented in a bar chart of scores. Finally, the M-MACBETH software aggregates the scoring and weighting scales in an overall scale of attractiveness as well proposes a graphic representation in the form of the Overall Thermometer which can be used for discussion and later analysis by decision maker.

The M-MACBETH software proposes also several additional tools which are very helpful for analyzing the obtained results. The tool *Difference profiles* shows graphically the difference between the profiles for any two options. The *XY Map* represents a two-dimensional graph comparing visually options with regards two selected criteria. The tool *Sensitivity analysis by weight* allows to observe the impact of the change on one criterion weight on the overall score, whereas *Robustness analysis* shows the impact ordinal or/and pre-cardinal intra-criteria and inter-criteria information in described model.

3. The negotiation model based on MACBETH approach

The important part of the pre-negotiation phase is evaluation negotiation offers and rankordering them using a *scoring function*. To formalize our model of negotiation we assume that negotiation problem is ill-structured, what means that problem itself as well the negotiation preferences cannot be precisely defined [Roszkowska et al. 2012, 2014]. However, a several multi-criteria decision making techniques can be used to support decision maker in negotiation [see: Salo, Hamalainen, 2010; Brzostowski et al, 2012a, 2012b; Wachowicz, et al, 2012; Wachowicz, Blaszczyk, 2012; Roszkowska et al., 2012, 2014] we propose here an effective application of the MACBETH approach and M-MACBETH software to handle ill-structured negotiation problems. What is one of

⁴ A full tutorial *M-MACBETH* see http://www.m-macbeth.com/en/downloads.html. A free trial version program can be downloaded from http://www.m-macbeth.com/. This version is limited to five criteria and five options.

⁵ For details see: [Bana e Costa at el., 2005b; M-MACBETH..., 2005; Ishizaka, Nemery, 2013].

the advantages proposed approach is that the MACBETH-based negotiation model makes possible to quantify preferences arising from a verbal evaluation of the quality of negotiation issues and building the scoring function for negotiation packages. The MACBETH can be used to analyze the structure of the negotiation problem, to determine the importance weights of the negotiations issues and to obtain the final ranking of the negotiation packages. To formalize our model we start with the following definitions:

- *a negotiation package (option)* is an offer, which negotiator may send to or receive from their opponent,
 - an issue is a criterion negotiator use to evaluate the offers.

We assume that negotiator has to evaluate (or rank) m feasible packages P1, P2,...,Pm taking into consideration the set of n issues $Z = \{Z_1, Z_2, ..., Z_n\}$ and vector of issue weights $w = [w_1, w_2, ..., w_n]$. The process of formalizing negotiation model and preparing the negotiator's *scoring function* is described in a few steps as follows:

Step 1. Negotiation model structuring

1.1. The negotiation template. Negotiator define the negotiation problem, conducts a thorough analysis of the problem, identify of the objectives forthcoming negotiation and transform them into the negotiation issues. These objectives are the evaluation criteria of the potential negotiation contract. Negotiator define also a set of feasible dimensions which bounded by the lowest acceptable target value (reservation level) and an aspiration value (aspiration level), for each issues. These values give the maximum limit of demands as well as the minimum limit of concessions and define the negotiation space [Roszkowska et al., 2014].

Having such defined negotiation template negotiator implemented M-MACBETH software to elicit the preferences and generate the *scoring function* of the negotiation offers. The next steps are strictly based on M-MACBETH software [for details see: *M-MACBETH...*, 2005].

1.2. Negotiation issues. The decision-makers have to structure the goals of negotiation and identify the negotiation issue (criteria) in value tree. In general, M-MACBETH tree is formed by two different types of modes such as "*criteria modes*" and "*non-criteria*" modes. Non-criteria nodes are included in the tree to help with the evaluation of criteria nodes but are not directly influential in the decision (because they act as comments to structure the problem). In evaluation phase, only "*criteria modes*" are used to assign the numerical score to each package.

Next, the decision-makers have to identify the few most relevant sub-levels of a given negotiation issue to describe their performance in the scale from the most attractive to the least. In order to measure the attractiveness of package, it is required to construct a value function for every evaluation criteria in the model. The criterion mode can be entering with direct or indirect bases of comparison. The choice of the evaluation technique: direct and indirect comparison needs to be done by decision-makers when setting the criterion nodes. We have two bases for direct comparison [Bana Consalting, 2005]:

1. "pairwaise comparison packages only among themselves";

2. "pairwise comparison each package to two benchmark references".

The M-MACBETH offers also two indirect bases for comparison:

- 1. "qualitative performance levels"
- 2. "quantitative performance levels".

However, a choice between direct and indirect technique depends on decision- makers, from the perspective of negotiation analysis and application M-MACBET indirect bases for comparison technique seems more adequate and recommended to support ill-structure negotiation⁶. The pairwaise comparisons packages only among themselves might be difficult as well time-consuming in case of many packages. But, if anyway a decision-maker choses direct comparisons, pairwise comparison with regards benchmark references gives him an opportunity to compare packages with two reference points: *ideal package* determined by all aspiration levels and *anti-ideal package* determined by all reservation levels.

The other advantage of indirect comparison is the fact that it is easier to evaluate attractiveness sub-levels of issues and weights and next aggregate them. Such approach allows us also for numerical and visual analyses obtained results by friendly M-MACBETH tools us such as: *Difference profiles*, The XY Map, Sensitivity analysis by weight and Robustness analysis which is very helpful in forthcoming negotiation process.

In the case of indirect comparison, the packages are evaluated by *value function* which converts any level performance on the issue into numerical score. The basic of comparisons with respect to criteria are selected sub-levels for each issue. The aspiration level and reservation level, for each issue, are coded as "*upper reference level*" and "*lover reference level*" in M-MACBETH procedure.

1.3. Negotiation packages. During this phase, decision-makers have to define the negotiation packages to be evaluated as well as their performances. The approach starts with the identification, for each issue, the few most important sub-levels (objects) to be considered in the scale and to decide if those performance sub-levels can be described qualitatively or quantitatively. Next the classification of the selected objects in order of attractiveness from the most to the least attractive is provided where equal rankings or ties are also allowed.

The next step is to assemble all possible combinations of sub-levels of performance identifying possible combinations in the form of negotiation packages regarded as potential negotiation offers. The packages can be obtained by the comparisons of sub-levels between aspiration and reservation level with respect to those criteria. Finally, the negotiator specifies the preliminary set of feasible packages $P = \{P1, P2, ..., Pm\}$ in the form of the *Table of Preferences*. In the case where the bases for comparison of the all criteria are given in the forms of qualitative/quantitative performance levels the conversion of a package's performance into a score will require that the package's performance be enter into the model. After the phase **negotiation model structuring**, three types of scores have to be calculated: *scores of*

⁶ The negotiation model proposed in this paper is based on *indirect bases for comparison*, however the direct bases of comparison is also possible.

options which represent the attractiveness of a package to one specific issue, *weighting* criteria which measure the attractiveness of each issue in relation to the top goal of negotiation, and overall score of options (scoring function) where issue weight and option scores are only intermediate results used to calculate the overall score of package (value of scoring function of the package). While the score of options ranks packages with regard to a single issue, the overall score of packages, i.e. scoring function, ranks them with regard to all issues and consequently to the overall goal of negotiation.

Step 2. Evaluation of packages

2.1. Scoring of packages with respect to each issue. Here, the decision-makers have to evaluate each package attractiveness with regards to each issue in the form of MACBETH judgment matrix. The questioning procedure appears on verbal information about the difference of attractiveness between the pairs of objects (sub-levels) issue at a time with application seven semantic categories: difference of attractiveness. (e.g. "no", "very weak", "weak", "moderate", "strong", "very strong" and "extreme"). The MACBETH can also function with the minimum of n-1 responses (in general the diagonal line of successive pairs), based on the hypothesis that the difference for the other pairs is positive.

For each of the answers about a new pair of objects, the software tests the compatibility of the information collected with regard to cardinal information, verifies its compatibility with the judgment previously inserted in the matrix. In the situation of incompatible judgments, the software gives a message about inconsistent judgments, shows the source of the incompatibility and gives a proposition of solving problem in friendly discussion with a decision-maker.

When judgment is consistent M-MACBETH software can propose a numerical scale (*current scale* column) which is compatible with the verbal expressions provided (i.e. this scale is the results of the conversion of the verbal expressions into numerical values). These scores are based on a scale ranking from zero (the reservation level) to 100 (the aspiration level). The M-MACBETH proposes a representative score and indicates also the *interval* of the compatible values with the verbal evaluations. Thus, the decision maker can use any value from the interval that seems most appropriate for him while remaining consistent with the verbal evaluation. What is useful, the software presents a graphic representation of the proposed *scale* and friendly tools that allow its transformation into a *cardinal scale*. We can see an interval within which the score of a performance level can be changed while keeping fixed the scores of the remaining performance levels and maintaining the compatibility with the matrix judgment.

The software proposed two graphical visualization: a vertical axis in which each proposed scorer is plotted at the same point as the respective quantitative level and the picewise-linear value function's graph where the performance levels are plotted on the horizontal axis and the scores on the vertical axis. What is also worth noting the linear pieces serve to calculate the score of any package where performance with respect to the issue is between consecutive performance levels. **2.2. Weighing the negotiation issues**. The ranking of issues weights is determined by ranking the overall references in terms of their overall attractiveness. Next the weights scale is build from the weighing matrix of judgment. We have also interval within with the weight can be changed while maintaining the compatibility with the weighing matrix of judgment.

Step 3. The creating scoring function (overall scores) and analyses the score results

3.1. The scoring function (overal scores). The M-MACBETH software has a module that aggregates the scoring and weighting scales in an overall scale of attractiveness, so create *scoring function* for evaluation negotiation packages. The overall attractiveness (*scoring function*) of packages is obtained through an additive aggregation model. The software presents the summarized information within a *Table of scores* and proposes a graphic representation in the form of *The Overall Thermometer* which is useful for later discussion and analysis.

3.2. The analysis the scores results. In order to better understanding of the model results the M-MACBETH allow to observe how a *package issue* scores contribute to its *overall package scores*. Each criterion bar in the weighted profile of the option (package) corresponds to the product of criterion weight and the option's (package's) score on the criterion (issue). We can easy specify negative contribution situation where the second of the two selected packages issues outperformed the first one, positive contribution situation, where the first of the two selected packages are indifferent in the issue. *The weighed bar* allows to analyze the possibilities of compensation one options by another. The M-MACBETH offered graphical representation model's results in a two dimensional graph (*XY map*), which enable to compare the option's scores in two criteria or group of criteria. *Sensitivity analysis on criterion weight* gives useful visualization the effects of a change in its weight on the packages scores and *Robustness analysis* allows for discussion about impact ordinal or/and pre-cardinal intra-criteria and inter-criteria information in negotiation model.

4. Numerical example

Let us now consider a buyer-seller negotiation that allows us to show how the proposed MACBETH-based model and M-MACBETH software can support one of the negotiator (Seller) in scoring negotiation offers. Let as assume that Seller and Buyer negotiate the conditions of the potential business contract and three issues are discussed: *price, time of payment* and *returns conditions*.

Step 1. Negotiation model structuring

1.1. The negotiation template. Let as assume that Seller and Buyer negotiate the conditions of the potential business contract. The following three issues are discussed: *price* (Z_1) , *time of payment* (Z_2) and *returns conditions* (Z_3) . The negotiation space for Z_1, Z_2 are defined by numerical values and for Z_3 by linguistic values.

- Price (EUR): $\langle 20, 30 \rangle$ for both parties;
- Payment (days): $\langle 3, 22 \rangle$ for both parties,

- Returns: defined qualitatively taking into account % defects and % penalty. To build the initial set of packages in the pre-negotiation phase Seller defines the salient options for each issue in the following way:

- Price: 30, 25, 23, 20.
- Payment: less than 3 (days), 4-7 (days), 8-14 (days), 15-21 (days), more than 22 (days)
- Returns: 5% defects and 2% penalty, 5% defects and 4% penalty, 7% defects and 4% penalty

Having such defined negotiation template Seller implemented M-Macbeth software to elicit the preferences and generate the scoring system of the negotiation offers. We testify practically all steps of Sellers preference analysis to show usefulness M-Macbeth software in supporting negotiation.

1.2. Negotiation issues (criteria). For simplicity, in our example, all modes are "criteria modes". The value tree for the Seller is presented on the Figure 1.

FIGURE 1.

The "value tree" for the Seller



Source: Own elaboration based on M-MACBET software.

Let us assume that the basic of comparisons with respect to criteria are salient sublevels for each issue. The "*upper reference lever*" and "*lover reference level*" are represented by aspiration level and reservation level. Thus we have the following:

- Price: qualitative performance levels
 Basis for comparison: 25, 20, 23 (EURO).
 References points: Upper reference level: Aspiration level 30 (EURO), Lower reference level: Reservation level 20 (EURO);
- Payment qualitative performance levels
 Basis for comparison: 4–7 (days), 8–14 (days), 14–21 (days);

References points: Upper reference level: Aspiration level – less than 3 (days), Lower reference level: Reservation level – more than 22 (days);

Returns – qualitative performance levels
 Basis for comparison: levA: Aspiration level, lev1: 5% defects and 2% penalty, lev2: 5% defects and 4% penalty, lev3: 7% defects and 4% penalty, levR: Reservation level

References: levA: Aspiration level, levR: Reservation level

1.3. **Negotiation packages**. Let us assume that the preliminary set of feasible packages $P = \{P1, P2, ..., P10\}$ consist of ten packages which are represented in the form of the *Table of Preferences* (see Figure 2).

FIGURE 2.

| 🏭 Tabl | × | | |
|---------|-------|---------------|---------|
| Options | Price | Payment | Returns |
| P1 | 30 | 14-21 (days) | lev2 |
| P2 | 25 | 8-14 (days) | lev1 |
| P3 | 25 | 4-7 (days) | lev3 |
| P4 | 25 | 8 - 14 (days) | lev2 |
| P5 | 25 | 8 - 14 (days) | lev3 |
| P6 | 23 | 14-21 (days) | lev1 |
| P7 | 23 | 4-7 (days) | lev1 |
| P8 | 23 | 4-7 (days) | lev3 |
| P9 | 23 | 8 - 14 (days) | lev2 |
| P10 | 20 | 4-7 (days) | lev1 |

The Table of Preferences for the Seller

Source: Own elaboration based on M-MACBET software.

Step 2. Evaluation of negotiation packages

2.1. Scoring of packages with respect to each issue. Matrix of judgments for performance levels and MACBETH numerical scale of issue "*Price*" are presented on the Figure 3. Let us remember that only n - 1 independent evaluation are required and others can be deduced by transitivity. However, it is better to fill the upper triangle of the matrix using the semantic categories. In the case, where the decision-maker is unsure about the exact category, he can select two or more successive categories as in Figure 3., where the difference between price 30 and 23 is evaluated from *week to strong*.

Matrixes of judgments for performance levels and MACBETH numerical scales of issues "*Time*" and "*Returns*" are presented in the Figures 4 and 5.

It is worth noting that all the scores can to be readjusted, in this same time being compatible with the judgment provided in the matrix. The permissible interval for 4-7 days is shown in red on the left part of the *Scale* on the Figure 4. Decision maker can feel free to use the value from the interval that seems for him most appropriate. In our example, however the score value suggested by M-MACBETH was accepted without modification.

FIGURE 3.



Price: Numerical and graphical display of a precardinal scale

Source: Own elaboration based on M-MACBET software.

Payment: Numerical and graphical display of a precardinal scale

| ^{XI} Payment | | | | | | | X | Payment | |
|---------------------------|-------------|-------------|-------------------|--------------|--------------|---------|-----------|-----------------|----|
| | less than 3 | 4-7 (davs) | 8-14 (davs) | 14-21 (davs) | more than 22 | Current | extreme | o less than 3 | 1. |
| | | | • • • • • • • • • | | | scale | v. strong | <u>0.81</u> | |
| less than 3 | no | weak | moderate | v. strong | strg-extr | 1.00 | strong | 4-7 (days) | 0 |
| 4-7 (days) | | no | weak | moderate | mod-strg | 0.73 | moderate | 0.64 | |
| 8-14 (days) | | | no | moderate | weak-mod | 0.55 | weak | 8-14(days) | U |
| 14-21 (days) | | | | no | weak | 0.18 | very weak | | |
| more than 22 | | | | | no | 0.00 | no | | |
| Consistent | t iudaemen | ts | | | | | | 0 | 0 |
| | - J Joinon | | | | | | | more than 22 | 0. |
| 罵 이 좋 안 있 채 뺀 損 堀 님 읎 원 팀 | | | | | | | | | 0. |
| UKr See 3 | | *** -*• .+= | HBETH COLOR | X (| | | | ■ 1 0.? に下門 ✓ ■ | |

Source: Own elaboration based on M-MACBET software.

FIGURE 5.

FIGURE 4.



| 🕮 Ret | urns | | | | | | X | | Fige F | Returr | ns | | × |
|----------|-----------------------|-----------|-----------|-----------|----------|------------------|-----------|--|--------|--------|------|---|------|
| | levA | lev1 | lev2 | lev3 | levR | Current scale | extreme | | | | | - IevA | 1.00 |
| levA | no | very weak | moderate | strong | extreme | 1.00 | strong | | | | | lev1 | 0.75 |
| lev1 | | no | very weak | weak | strong | 0.75 | moderate | | | | | | |
| lev2 | | | no | very weak | weak-mod | 0.50 | weak | | | | | -lev2 | 0.50 |
| lev3 | | | | no | weak | 0.38 | very weak | | | | | lev3 | 0.38 |
| levR | | | | | no | 0.00 | no | | | | | | |
| Cons | Consistent iudaements | | | | | | | | | | | | |
| œ OK? | | | | | | | | | | 1 0. | 2 #= | - Ieve ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;; | 0.00 |

Source: Own elaboration based on M-MACBET software.

2.2. Weighing the issues. The judgment matrix for issue weights are presented on the Figure 6.



Weights: Numerical and graphical display of a precardinal scale

Source: Own elaboration based on M-MACBET software.

Step 3. The scoring function of packages and analyse the score results

3.1. The scoring function (overal scores). Numerical and graphical display of a scoring points (*overall scores*) for evaluated negotiation packages are presented on the figure 7. The *Table of scores* contains the overall scores for packages and scores with regard to each issue.

FIGURE 7.

FIGURE 6.

| Table of scores | | | | | | | | |
|-----------------|---------|--------|---------|---------|--|--|--|--|
| Options | Overall | Price | Payment | Returns | | | | |
| P1 | 0.70 | 1.00 | 0.18 | 0.50 | | | | |
| P2 | 0.58 | 0.56 | 0.55 | 0.75 | | | | |
| P3 | 0.59 | 0.56 | 0.73 | 0.38 | | | | |
| P4 | 0.55 | 0.56 | 0.55 | 0.50 | | | | |
| P5 | 0.54 | 0.56 | 0.55 | 0.38 | | | | |
| P6 | 0.26 | 0.22 | 0.18 | 0.75 | | | | |
| P7 | 0.43 | 0.22 | 0.73 | 0.75 | | | | |
| P 8 | 0.39 | 0.22 | 0.73 | 0.38 | | | | |
| P9 | 0.35 | 0.22 | 0.55 | 0.50 | | | | |
| P10 | 0.29 | 0.00 | 0.73 | 0.75 | | | | |
| [all upper] | 1.00 | 1.00 | 1.00 | 1.00 | | | | |
| [all lower] | 0.00 | 0.00 | 0.00 | 0.00 | | | | |
| Weig | hts : | 0.6000 | 0.3000 | 0.1000 | | | | |



Table of scores. Numerical and graphical display of a Overall scores

Source: Own elaboration based on M-MACBET software.

Let us assume now that during negotiation process negotiator can search and construct new packages and evaluate it using *scoring function*. The optimal *scoring function* should produce consistent ranking after new packages are added (or removed) and should not provide to rank reversal [García-Cascales, Lamata, 2012; Schenkerman, 1994]. This means that in the case of adding or removing new package the negotiator does not need to reevaluate the previously evaluated packages, as well the score points of all packages are stable.

We can see that the M-MACBETH approach allows, under same conditions, introducing to a set of packages new ones without rescoring other packages. Let us introduce three new prices: 18, 21, 32 to the basic of comparison for criterion *Price*, where price 18 is under reservation level, 32 is over aspiration level, 21 is from negotiation space. We introduce also new sub-level in Returns conditions: Level 4: 3% defects and no penalty.

In the case of quantitative issues *Price* M-MACBETH can estimate score based on the previous scale. In this case, the new judgment matrix is even not necessary if decision maker can agree for the M-MACBETH software approximation. But it is possible make judgment matrix without changing the previous scale. In all cases where the minimal information was used the judgment is consistent as well stable with respect to previous scores. The judgment of differences of attractiveness within a issue "*Price*" is presented on the Figure 8 and judgment within "*Returns*" in Figure 9.

FIGURE 8.



Price: Numerical and graphical display of a precardinal scale.

Source: Own elaboration based on the M-MACBET software.

FIGURE 9.

| Ret 🖁 | urns | | | | | | | X | Returns | × |
|----------|-----------------------|-----------|-----------|-----------|----------|----------|------------------|--|----------------|---|
| | levÅ | lev1 | lev2 | lev3 | lev4 | levR | Current scale | extreme | ↔—_[levA] 1.00 | |
| levA | no | very weak | moderate | strong | positive | extreme | 1.00 | strong | e-lev1 0.75 | |
| lev1 | | no | very weak | weak | positive | strong | 0.75 | moderate | | |
| lev2 | | | no | very weak | positive | weak-mod | 0.50 | weak | 0.50 | |
| lev3 | | | | no | positive | weak | 0.38 | very weak | 0.37 | |
| lev4 | | | | | no | positive | 0.19 | no | | |
| levR | | | | | | no | 0.00 | | lev4 0.19 | |
| Consi | Consistent judgements | | | | | | | | | |
| ₩ 0K? | | | | | | | | 0.01 • • • • • • • • • • • • • • • • • • • | | |

Returns: Numerical and graphical display of a precardinal scale

Source: Own elaboration based on M-MACBET software.

Let us assume that the decision-makers have to take into account five new negotiation packages P11, P12, P13, P14, P15 obtained by using new basic on comparisons with respect to issue *Price* and *Returns*. The new *Table of Preferences* as well *Table of Scores* and *Overall Thermometer* were presented on the Figure 10.

We can see that M-MACBETH allows for evaluation of new packages which are outside negotiation space (over-good or under-bad with regards to some issues), to provide discussion about compensation. Let us observe thethat new package P14 is the most attractive, packages P11, P15 are less attractive and packages P12, P13 are the least attractive.

FIGURE 10.

| Mu Tabl | e of nerf | ormances | × | ÌÎ | H Table of s | scores | | | × | 🖓 Overall ther 🔀 |
|---------|------------|--------------|---------|------|--------------|---------|--------|---------|---------|---------------------|
| | e or perio | Jimanees | | | Options | Overall | Price | Payment | Returns | |
| Options | Price | Payment | Returns | | P1 | 0.70 | 1.00 | 0.18 | 0.50 | [all upper] 1.00 |
| P1 | 30 | 14-21 (davs) | lev2 | [| P2 | 0.58 | 0.56 | 0.55 | 0.75 | P14 0.96 |
| P2 | 25 | 8-14 (days) | lev1 | | P3 | 0.59 | 0.56 | 0.73 | 0.38 | |
| P3 | 25 | 4-7 (days) | lev3 | | P4 | 0.55 | 0.56 | 0.55 | 0.50 | |
| D/ | 25 | 9-14 (dous) | 1003 | I II | P5 | 0.54 | 0.56 | 0.55 | 0.38 | P1 0.70 |
| | 2.5 | 0 14 (days) | 1672 | 11 | P6 | 0.26 | 0.22 | 0.18 | 0.75 | |
| P5 | 25 | 8-14 (days) | IeV3 | 11 | P7 | 0.43 | 0.22 | 0.73 | 0.75 | P3 0.59 |
| P6 | 23 | 14-21 (days) | lev1 | | P 8 | 0.39 | 0.22 | 0.73 | 0.38 | |
| P7 | 23 | 4-7 (days) | lev1 | l li | P9 | 0.35 | 0.22 | 0.55 | 0.50 | P5 0.54 |
| P8 | 23 | 4-7 (days) | lev3 | | P10 | 0.29 | 0.00 | 0.73 | 0.75 | P7 0.43 |
| P9 | 23 | 8-14 (days) | lev2 | | P 11 | 0.38 | 0.07 | 1.00 | 0.38 | P8 0.39 P11 0.38 |
| P10 | 20 | 4-7 (days) | lev1 | | P12 | 0.15 | 0.07 | 0.18 | 0.50 | P15 0.36 |
| P11 | 21 | less than 3 | lev3 | | P13 | 0.21 | -0.15 | 0.73 | 0.75 | P9 0.35 P10 0.29 |
| P12 | 21 | 14-21 (days) | lev2 | | P14 | 0.96 | 1.18 | 0.73 | 0.38 | P6 0.26 |
| P13 | 18 | 4-7 (days) | lev/1 | | P15 | 0.36 | 0.56 | 0.00 | 0.19 | P13 0.21 |
| D14 | 20 | 4.7 (duys) | 1001 | | [all upper] | 1.00 | 1.00 | 1.00 | 1.00 | Fall lower 1 0.00 |
| P14 | 32 | 4-7 (days) | ievs | 11 | [all lower] | 0.00 | 0.00 | 0.00 | 0.00 | |
| P15 | 25 | more than 22 | lev4 | | Weiq | hts : | 0.6000 | 0.3000 | 0.1000 | |

Table of preferences. Table of scores and Overall Thermometer

Source: Own elaboration based on M-MACBET software.

Now, using M-MACBET software selected analysis obtained results will be done graphically from the perspective usability to forthcoming process of extending offer. The difference between the profiles for any two packages can be viewed by *Difference*

profiles. Let us observe that each criterion bar in the weighted profile of the negotiation package corresponds to the product of issues scores and the sub-levels scores on this issue. For example, in Figure 11 the package P1 is compared to the package P5. The package P1 out performed overall the package P5 with 0.17 score points. However, the package P1 out performed in package P5 with regards to the issue *Price* with 0.26 score points as well issue *Returns* with 0.01 score points. On the other hand, package P5 out performed in package P1 in with regards issue *Payment* with 0.26 score points. The weighed bars allows to analyze the extent to which the differences in favor of the one issue compensate, or not, the differences in of the others issues.

FIGURE 11.



Profile differences

Source: Own elaboration based on M-MACBET software.

The M-MACBETH software allows *sensitivity analyses* to be performed. All changes on scores and weights are instantaneously reflected upon all other dependent values and graphics. The sensitivity analysis on weight is presented on the Figure 12. We can see rankordeing ten selected packages in the case of changing weight for issue *Price*.

Sensitivity analysis on the weight

FIGURE 12.



Source: Own elaboration based on M-MACBET software.

We can also analyze the results of *scoring function* graphically by using a two-dimensional graph (*XY Map*), where each axis represents negotiation issue In Figure 13., the packages

are presented according to their attractiveness on the *Price* and *Returns* issues. We can see that the package P13 has a good *Returns* condition but is not attractive on the *Price* issue. On the other hand, the package P15 has an attractive *Price* and a not good *Returns* conditions. On the red line which represent the efficient frontier we can found P1, P2, P14 as dominated packages.

FIGURE 13.



Comparison of scores on two issues: Price and Returns

Source: Own elaboration based on the M-MACBET software.

5. Conclusion

In the paper a framework for the evaluation of negotiation offers based on MACBETH methodology and M-MACBETH software have been proposed. The MACBETH technique were used to structure negotiation problems by defining numerical values based on verbal statements which enables the construction of value functions derived from qualitative judgments about the difference of attractiveness between every two performance levels of the negotiation scale. Such approach allow us to quantify preferences arising from a verbal evaluation of the quality of negotiation option or negotiation issues and calculate the attractiveness (scores) of the negotiation packages in numerical way. It shows how M-MACBETH can be used to construct an additive evaluation model based on qualitative value judgments of difference in attractiveness.

The main key advantages of the MACBETH approach are the following:

- 1. This technique allow for verbal preference elicitation attractiveness of packages with procedure that transform *ordinal* information for *cardinal information* by a non-numerical *pairwise comparison* questioning mode. It is very useful approach especially were problem is poorly defined, in the context of qualitative issues which often appear in negotiation template, as well in the case of imprecise information.
- 2. This same M-MACBETH technique can be used to measure attractiveness of negotiation issues as well weight of sub-levels of issues.

- 3. The computation processes of determining the scoring function take into account the negotiation space of each issue as well the concepts of reservation and aspiration levels.
- 4. The verbal negotiator expressions sometimes could be vague, so the representative score generated by the MACBETH is accompanied by the value of the interval within which it is located. The M-MACBETH software proposed *exact score* however the negotiator can modify *preference scale* using points form interval scale if needed.
- 5. The MACBETH procedure makes possible to expand the negotiation template by introducing new package after the preference elicitation has been conducted (within or outside the actual negotiation space) without modifying ranking preliminary estimated packages. That means that proposed *scoring function* produces consistent ranking after new packages are added (or removed) and does not provide to rank reversal.

The main advantages of the M-MACBETH software are the following: this questioning procedure is straightforward and friendly for decision maker, allow for useful visualizations results, checks the consistency of judgment, proposed solution in the case of inconsistency providing simple discussion with decision maker, allows for useful sensitive analysis, offers a few interesting tools for visualization results evaluation negotiation packages which are very helpful in phase of forthcoming negotiation.

The disadvantages of the MACBETH technique is fact that the MACBETH procedure is time-consuming, so it is practically usable only if the number of criteria and alternatives is sufficiently low, usually not higher than 9.

Our future work will be focused on modifying the M-MACBETH approach to be more useful for evaluation negotiation offers in ill structure negotiation problems. One of the proposition is comparing MACBETH with other verbal technique such as ZAPROS [Górecka et al., 2014]. It could be also powerful, from the perspective negotiation analysis, to combine MACBETH with TOPSIS technique or extend MACBETH in fuzzy environment.

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Marek SZOPA1

HOW QUANTUM PRISONER'S DILEMMA CAN SUPPORT NEGOTIATIONS²

Summary

Decision-making by the two negotiating parties is simulated by a prisoner's dilemma game. The game is formulated in a quantum manner, where players strategies are unitary transformations of qubits built over the basis of opposite decision options. Quantum strategies are correlated through the mechanism of quantum entanglement and the result of the game is obtained by the collapse of the resulting transformed state. The range of strategies allowed for quantum players is richer than in case of a classical game and therefore the result of the game can be better optimized. On the other hand, the quantum game is save against eavesdropping and the players can be assured that this type of quantum arbitration is fair. We show that quantum prisoner's dilemma has more favorable Nash equilibria than its classical analog and they are close to the Pareto optimal solutions. Some economical examples of utilizing quantum game Nash equilibria are proposed.

Key words: game theory; quantum game; prisoner's dilemma; Nash equilibrium; Pareto optimal solutions.

1. Negotiations as a game

Many decisions made by negotiating parties rely on the strategic interaction between them. By this we mean that negotiating parties can choose between different strategies, typically conflict or cooperation between them. They both agree that the mutual cooperation is the most desirable behavior but their choices are made simultaneously without knowing the other party's decision. It yields the temptation to refuse cooperation (defection). This kind of interactions is often described by the classical game theory.

One of the best known games of that type in the Prisoner's Dilemma [PD] game. It was first described by Flood and Dresher [Flood, Dresher, 1952] and popularized by Albert Tucker, whose two-prisoner story was a basis for the current name of the game. The popularity of PD comes from its universal game scheme, which describes a negotiation dilemma very common in everyday life. A typical scenario contains an assumption that two players, Alice and Bob, independently of each other make a choice between cooperation (C) and defection (D). The choice of the two players is a basis for a payoff matrix which is shown in Table 1.

¹ Prof. dr hab. Marek Szopa – Institute of Physics, University of Silesia, e-mail: szopa@us.edu.pl.

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TABLE 1.

The payoff matrix for the Prisoner's Dilemma

| | | Bob | | | | | | |
|-------|---|-------------------------|-------------------------|--|--|--|--|--|
| | | С | D | | | | | |
| Alice | С | (<i>r</i> , <i>r</i>) | (s,t) | | | | | |
| | D | (t,s) | (<i>p</i> , <i>p</i>) | | | | | |

The strategy (*C*) means cooperation and strategy (*D*) - defection. The first number of each pair represents Alice's payoff, while the second number is Bob's payoff. The payoff *r* corresponds to 'reward' for cooperation, *t* is related to 'temptation' of betrayal, *s* is 'sucker's payoff' and *p* stands for 'punishment' for mutual refusal of cooperation. These numbers fulfill an inequality: t > r > p > s and $r > \frac{s+t}{2}$.

Source: [Rapoport, Chammah, 1970].

Analyzing the payoff matrix we can notice that independently of the opponent's move, the dominant strategy of each of the players is the defection strategy. The pair of strategies (**D**, **D**) is here the Nash equilibrium [NE]. Paradoxically, the equilibrium corresponds to mutual punishment (**p**, **p**), which is highly remote from the Pareto optimal result. Mutual cooperation (**C**, **C**) is the best move to get an optimal result. However, a game like this requires mutual trust of the players, as every change of (**C**, **C**) strategy brings each person a reward - a temptation of betrayal **t**, which for the second player means a punishment in form of a sucker's payoff **s**. If the PD is played by two parties without mutual trust, the most frequent outcome is mutual punishment for lack of cooperation. Mutual defection as the only NE of the PD is the natural reservation point for both negotiators. The goal of the present paper is to show, that within the quantum framework, mutual defection can be replaced by another NE, that is much more favorable for negotiators and therefore can be regarded as an alternative reservation point.

A natural extension of the game to a multiplayer PD is possible, in which the dilemma is generally the same as in the two player game. From a practical point of view an important extension of the game is its iterated version [Hamilton, Axelrod, 1981] in which the players' strategies depend on previous games they played. These extensions will not be considered in the present paper.

2. Quantum game definition

Experimental psychology shows that real human decisions in a situation of PD are often incompatible with the classical NE. Some researchers argue [Busemeyer, Wang, Townsend, 2006; Pothos, Busemeyer, 2009], that to explain human decisions making,

more suitable than classical are quantum methods. As the research on quantum information processing was developed, the quantum version of PD has been formulated [Eisert, Wilkens, Lewenstein, 1999; Szopa, 2014]. In its perspective players' strategies are operators in a vector space called the Bloch sphere. This space is a collection of qubits – normalized vectors with complex coefficients spanned on a basis of two elements $\{|C\rangle, |D\rangle\}$, which, up to the phase, can be represented in the form

$$|\psi\rangle = \cos\frac{\theta}{2}|C\rangle + e^{i\phi}\sin\frac{\theta}{2}|D\rangle, \qquad (1)$$

If $\phi \in [-\pi,\pi]$ (cf. Figure 1).

where $\theta \in [0, \pi]$ and $\phi \in [-\pi, \pi]$ (cf. Figure 1)

FIGURE 1.



The Bloch sphere with marked localizations of the qubits, $|C\rangle = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ - cooperation, $|D\rangle = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$ - defection and the qubits localized in the xy plane and intersecting axes.

The qubits $|C\rangle$ and $|D\rangle$, which are quantum pure states, correspond to cooperation and defection. The following description is the same for an arbitrary 2x2 game with $|C\rangle$ and $|D\rangle$ corresponding to any other strategies. The rest of the Bloch sphere qubits are states in a superposition of two quantum states. According to the principles of quantum mechanics, unless we take a measurement we cannot tell in which of the two states, the qubit actually is. The one thing we can say is that as a result of measurement, $|C\rangle$ can occur with probability of $\cos^2 \frac{\theta}{2}$ and $|D\rangle$ with probability of $\sin^2 \frac{\theta}{2}$.

The measurement is followed by a collapse of the wave function, which from state changes to $|C\rangle$ or $|D\rangle$. As an example, all qubits located on the Bloch sphere equator (the circle in the *x-y* plane of Figure 1.) represent quantum states, which after the measurement collapse into state $|C\rangle$ or $|D\rangle$ with probability $\frac{1}{2}$. (The Schrödinger's cat example shows

analogous situation in which states $|C\rangle$ i $|D\rangle$ correspond to the cat being dead or alive.)

In quantum game theory, neither qubits $|C\rangle$ nor $|D\rangle$ corresponds to players' strategies. Here the strategies are unitary operators \hat{U}_A – for Alice and \hat{U}_B – for Bob. The unitary strategies work at certain entangled quantum state $|\psi_0\rangle$, which is known for both players. These transformations, in general, are Bloch sphere rotations $\hat{U}_X \in SU(2)$, defined by unitary matrices

$$\widehat{U}(\theta,\phi,\alpha) = \begin{pmatrix} e^{-i\phi}\cos\frac{\theta}{2} & e^{i\alpha}\sin\frac{\theta}{2} \\ -e^{-i\alpha}\sin\frac{\theta}{2} & e^{i\phi}\cos\frac{\theta}{2} \end{pmatrix},$$
(2)

with $\widehat{U}_X = \widehat{U}(\theta_X, \phi_X, \alpha_X), \theta_X \in [0, \pi]$ and $\alpha_X, \phi_X \in [-\pi, \pi], X = A, B$. In particular, if the rotation is determined only by the angle θ , i.e. $\alpha = \phi = 0$, it may be written as $\widetilde{U}(\theta) = \widehat{U}(\theta, 0, 0) = \cos\frac{\theta}{2}\widehat{C} + \sin\frac{\theta}{2}\widehat{D}$, where the identity matrix $\widehat{C} \equiv \widetilde{U}(0)$ corresponds to the cooperation strategy and the matrix $\widehat{D} \equiv \widetilde{U}(\pi) = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ (altering the qubits $|C\rangle$ and $|D\rangle$) corresponds to the defection strategy. The strategy $\widetilde{U}(\theta)$ is equivalent to the classical mixed strategy, for which the probabilities of both pure strategies C and D are accordingly $\cos^2\frac{\theta}{2}$ and $\sin^2\frac{\theta}{2}$.

The quantum game, being a two-player game, takes place in a space of qubit pairs, one per each player. The qubits are correlated with each other by quantum entanglement (Figure 2).

FIGURE 2.

The setup of a quantum game



Such a game may be physically performed by implementing a quantum computer algorithm dependent on the strategy of players. Such algorithm was realized experimentally [Du, et al., 2002] on a two-qubit, nuclear magnetic resonance quantum computer. Details of its operation, i.e. physical implementation of the quantum algorithm are not essential for the understanding of quantum games, and in this paper will be omitted.

The initial state of the game is represented by a pair of $|CC\rangle$ qubits, the first of them representing Alice's state, the second Bob's state. The basis vectors of the space of pairs of qubits $|CC\rangle$, $|CD\rangle$, $|DC\rangle$, $|DD\rangle$ are pure states. For computational simplicity, we define them as vectors (1, 0, 0, 0), (0, 1, 0, 0), (0, 0, 1, 0), (0, 0, 0, 1) in a fourdimensional space of states. The initial state $|CC\rangle$ is transformed by entangling operator $\hat{f} = \frac{1}{\sqrt{2}}(\hat{I} + i\hat{\sigma}_x \otimes \hat{\sigma}_x)$, where \hat{I} is the 4-dim identity matrix and $\hat{\sigma}_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ is the Pauli matrix. As the result we get the entangled state $|\psi_0\rangle = \hat{f} |CC\rangle = \frac{1}{\sqrt{2}}|CC\rangle + \frac{i}{\sqrt{2}}|DD\rangle$. Then we act by a direct product of operators \hat{U}_A and \hat{U}_B representing quantum strategies of Alice and Bob. Before taking measurement on the final state we act using disentangling operator \hat{f}^{\dagger} . As a result, the final state $|\psi_f\rangle$ is given by

$$\left|\psi_{f}\right\rangle = \hat{f}^{\dagger}(\hat{U}_{A} \otimes \hat{U}_{B})\hat{f}\left|\mathcal{C}\mathcal{C}\right\rangle \tag{3}$$

and usually it is an entangled state:

$$|\psi_f\rangle = p_{CC} |CC\rangle + p_{CD} |CD\rangle + p_{DC} |DC\rangle + p_{DD} |DD\rangle, \tag{4}$$

where $|p_{CC}|^2, ..., |p_{DD}|^2$ are probabilities of the measurement taken on the final state being one of the four possible outcomes.

In the quantum game the expected value of Alice's payoff a is the weighted mean of four classical values r, s, t and p from the payoff matrix (Table 1)

 $\$_{A} = r |p_{CC}|^{2} + s |p_{CD}|^{2} + t |p_{DC}|^{2} + p |p_{DD}|^{2},$ (5)

where weights correspond to quantum probabilities of corresponding pure states, which up to the phase are equal to [Chen, Hogg, 2006]:

$$p_{CC} = \cos\frac{\theta_A}{2}\cos\frac{\theta_B}{2}\cos(\phi_A + \phi_B) - \sin\frac{\theta_A}{2}\sin\frac{\theta_B}{2}\sin(\alpha_A + \alpha_B),$$

$$p_{CD} = \sin\frac{\theta_A}{2}\cos\frac{\theta_B}{2}\cos(\alpha_A - \phi_B) - \cos\frac{\theta_A}{2}\sin\frac{\theta_B}{2}\sin(\phi_A - \alpha_B),$$

$$p_{DC} = \sin\frac{\theta_A}{2}\cos\frac{\theta_B}{2}\sin(\alpha_A - \phi_B) + \cos\frac{\theta_A}{2}\sin\frac{\theta_B}{2}\cos(\phi_A - \alpha_B),$$

$$p_{DD} = \cos\frac{\theta_A}{2}\cos\frac{\theta_B}{2}\sin(\phi_A + \phi_B) + \sin\frac{\theta_A}{2}\sin\frac{\theta_B}{2}\cos(\alpha_A + \alpha_B).$$

Bob's expected payoff is given by formula after the $s \leftrightarrow t$ replacement. Let us notice that the quantum situation can be simulated by a classical experiment, where the coefficients in front of r, s, t and p in can be replaced by 0 or 1 by using a classical device, which draws 1 with probabilities $|p_{CC}|^2, ..., |p_{DD}|^2$ respectively and 0 otherwise. The result shall be the same as an average result after the quantum game is played multiple times. When taking into account a quantum device entangling qubits and performing particular unitary transformations, the game result is given by a measurement taken on the final state. The final state, obtained as a result of the collapse of the wave function, shall give, with proper probabilities, one of four possible states. Using entangled quantum strategies by

the players gives an opportunity to have mutual interaction between them, which has no counterpart in classical games. The main advantage of the quantum game is that the result of the wave function collapse is hidden by Nature. Even if one of the players eavesdrops the other player strategy, he can't be sure about the result of the game, which is given by (3) until the measurement of the final state $|\psi_f\rangle$.

3. Quantum PD in classical limit

The quantum game becomes a classical game when strategies do not include complex phase factors i.e.: $\alpha = \phi = 0$. In fact, entangling operator \hat{f} is commuting with direct product $\widetilde{U}_A \otimes \widetilde{U}_B$ of each pair of classical operators, but $\hat{f}^{\dagger}\hat{f} = \hat{I}$ and therefore $|\psi_f\rangle = (\widetilde{U}_A \otimes \widetilde{U}_B) |CC\rangle$ and consequently Alice's expected payoff is

$$\begin{aligned} \$_A(\theta_A, \theta_B) &= r \, \cos^2 \frac{\theta_A}{2} \cos^2 \frac{\theta_B}{2} + s \, \cos^2 \frac{\theta_A}{2} \sin^2 \frac{\theta_B}{2} + \\ t \, \sin^2 \frac{\theta_A}{2} \cos^2 \frac{\theta_B}{2} + p \, \sin^2 \frac{\theta_A}{2} \sin^2 \frac{\theta_B}{2}, \end{aligned} \tag{6}$$

this gives, a result identical with the classical game, where both players choose mixed strategies (Table 2).

TABLE 2.

The payoff matrix of quantum PD in the classical limit Bob

| | | DOD | |
|------|--|--|--|
| | | $C\left(\cos^2\frac{\theta_B}{2}\right)$ | $D\left(\sin^2\frac{\theta_B}{2}\right)$ |
| lice | $C\left(\cos^2\frac{\theta_A}{2}\right)$ | (<i>r</i> , <i>r</i>) | (<i>s</i> , <i>t</i>) |
| Α | $D\left(\sin^2\frac{\theta_A}{2}\right)$ | (t,s) | (p, p) |

In the classical limit $\alpha_A = \phi_A = \alpha_B = \phi_B = 0$. The payoffs are reproduced by assuming that players use mixed strategies determined by θ_A and θ_B . Their payoffs are to be multiplied by the probability of particular strategy choice (in the parenthesis).

For example if Alice chooses cooperation $\theta_A = 0$ and Bob defection $\theta_B = \pi$, the game result is (s, t), so Bob wins. The only difference between the classical PD and the classical limit of quantum PD is that in the former the player choosing mixed strategy has to take draw by his or her own and eventually choose the option C or D. Between drawing and choosing an option there is a moment in time when the player can change his or her mind (as well as probability distribution) or the opponent can eavesdrop information regarding the planned movement (and respond to it adequately). In quantum PD a player decides only which strategy to use. The strategy is determined by an angle θ and

all the rest is done by the quantum computer. There is no opportunity to eavesdrop quantum information by the opponent, at least in case without the quantum noise. Any such attempt would lead to a collapse of the wave function and ultimately end of the game.

Analyzing (6) it can be easily shown that the NE for the classical PD is the pair of mutual defections (D, D), corresponding to $\theta_A = \theta_B = \pi$. If one of players uses a classical strategy, e.g. $\tilde{U}(\theta)$ and the other quantum strategy $\hat{U}\left(\theta + \pi, 0, -\frac{\pi}{2}\right)$ then the game result shall be (s, t) in favor of the quantum player. This shows the advantage of quantum strategy over classical strategy - independently of the strategy used by the classical player, the quantum player always finds the best answer, which gives him the maximum payoff t and leaving the classical player with the sucker's payoff s.

4. Nash equilibria of quantum PD

The quantum strategies give in fact, a great variety of outcomes, normally not achievable by conventional strategies. Let us assume that Alice chooses arbitrary quantum strategy $\hat{A} = \hat{U}(\theta_A, \phi_A, \alpha_A)$. Bob may answer with strategy $\hat{B} = \hat{U}(\theta_B, \phi_B, \alpha_B) = \hat{U}(\theta_A + \pi, \alpha_A, \phi_A - \frac{\pi}{2})$. Note that regardless of Alice's choice Bob's move gives coefficients $p_{CC} = p_{DC} = p_{DD} = 0$ and $|p_{CD}| = 1$. Transformation used by Bob "cancels" any of Alice's moves and drives to a situation when Alice's final strategy written in $|\psi_f\rangle$ becomes 'cooperation' whereas Bob plays 'defection'. The game results in Bob's maximum reward $(\$_A, \$_B) = (s, t)$. However, the quantum game is symmetrical, so that Alice can respond to Bob's strategy \hat{B} with $\hat{A}' = \hat{U}(\theta'_A, \phi'_A, \alpha'_A) = \hat{U}(\theta_A, \phi_A - \frac{\pi}{2}, \alpha_A - \frac{\pi}{2})$ strategy. Here the only non-zero factor of $|\psi_f\rangle$ is $|p_{DC}| = 1$, which means that now Alice plays 'defection' while Bob plays 'cooperation' and the payoff gets reversed $(\$_A, \$_B) = (t, s)$. The best answer for Alice's strategy \hat{A}' is Bob's $\hat{B}' = \hat{U}(\theta'_B, \phi'_B, \alpha'_B) = \hat{U}(\theta_A + \pi, \alpha_A - \frac{\pi}{2}, \phi_A - \pi)$, because the game's result is again $(\$_A, \$_B) = (s, t)$. Eventually, the best answer to \hat{B}' is Alice's initial strategy, which gives her a winning position again $(\$_A, \$_B) = (t, s)$.

Let us now assume that Alice chooses her meta-strategy which mixes two of her quantum strategies $\cos^2 \frac{\gamma_A}{2} \hat{A} + \sin^2 \frac{\gamma_A}{2} \hat{A}', \gamma_A \in [0, \pi]$. We call it meta-strategy because it is a classical mixture of two quantum strategies. At the same time, Bob takes a similar step by playing his meta-strategy $\cos^2 \frac{\gamma_B}{2} \hat{B} + \sin^2 \frac{\gamma_B}{2} \hat{B}', \gamma_B \in [0, \pi]$. Alice's expected payoff is equal to:

$$\$_{A} = s \left(\cos^{2} \frac{\gamma_{A}}{2} \cos^{2} \frac{\gamma_{B}}{2} + \sin^{2} \frac{\gamma_{A}}{2} \sin^{2} \frac{\gamma_{B}}{2} \right) + t \left(\cos^{2} \frac{\gamma_{A}}{2} \sin^{2} \frac{\gamma_{B}}{2} + \sin^{2} \frac{\gamma_{A}}{2} \cos^{2} \frac{\gamma_{B}}{2} \right).$$
(7)

Note that in this game the sum of Alice's and Bob's payoffs is fixed and equals A + $s_B = s + t$. The game has only one NE for $\gamma_A = \gamma_B = \frac{\pi}{2}$ - at that point the players' payoffs are $A = B_B = \frac{s+t}{2}$ and none of them can increase his or her payoff by unilateral change of strategy (Flitney & Abbott, 2002). In fact, to get an equal reward $\frac{s+t}{2}$ per each player, it is enough that one of them uses strategy $\gamma = \frac{\pi}{2}$.

The game restricted to Alice's \hat{A} , \hat{A}' and Bob's \hat{B} , \hat{B}' strategies is in fact a constant sum game. The quantum PD has infinitely many NEs, each determined by three initial parameters of Alice's strategy $\hat{A} = \hat{U}(\theta_A, \phi_A, \alpha_A)$. Therefore we have shown that an appropriate choice of mixed quantum strategies can provide both players a result only slightly worse than mutual cooperation (remember that $r > \frac{s+t}{2}$ by PD definition). Taking into account that in the classical PD the payoff of the only NE is(p, p), the quantum game gives players a much better equilibrium, not achievable in the classical game.

Note that, in particular, if we set
$$(\theta_A, \phi_A, \alpha_A) = (0, 0, 0)$$
, then
 $\hat{A} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = \hat{I}, \hat{B} = \begin{pmatrix} 0 & -i \\ -i & 0 \end{pmatrix} = -i\hat{\sigma}_x$
(8)

and

$$\widehat{A}' = \begin{pmatrix} i & 0\\ 0 & -i \end{pmatrix} = i\widehat{\sigma}_z, \widehat{B}' = \begin{pmatrix} 0 & -1\\ 1 & 0 \end{pmatrix} = -i\widehat{\sigma}_y.$$
(9)

Strategies \widehat{A} , \widehat{A}' , \widehat{B} , \widehat{B}' , lead, up to a constant, to four matrices (an identity matrix plus three Pauli matrices) from the group of unitary matrices SU(2). The Pauli matrices $\hat{\sigma}_x, \hat{\sigma}_y$ and $\hat{\sigma}_z$ are generators of rotations by the angle π about the x, y and z axes respectively (green, blue and red circles at Figure 1).

5. Is it possible to use PD quantum equilibria?

Figure 3 shows PD utility diagram (for t = 5, r = 3, p = 1 and s = 0) with four classical strategies (C, D), (C, C), (D, C) and (D, D). A series of red lines corresponds to pairs of classical strategies (θ_A, θ_B) with constant θ_A while blue lines correspond to (θ_A, θ_B) with constant θ_B . The arrows point the players' preferences and the only classical NE is at the point (D, D). Black line linking points (C, D) and (D, C), refers to a game of constant sum A + B = s + t = 5 and comprises all payoffs of Alice's metastrategies $\cos^2 \frac{\gamma_A}{2} \hat{A} + \sin^2 \frac{\gamma_A}{2} \hat{A}'$ and Bob's meta-strategies $\cos^2 \frac{\gamma_B}{2} \hat{B} + \sin^2 \frac{\gamma_B}{2} \hat{B}'$.

FIGURE 3.



Prisoner's Dilemma utility diagram

PD utility diagram for t = 5, r = 3, p = 1 and s = 0. Regardless of Alice's mixed strategies (red lines), the best strategy for Bob (arrows) is D. Likewise in case of Bob's mixed strategies (blue lines), the best strategy for Alice is D. The quantum PD has NE for the pair of meta-strategies $\left(\frac{1}{2}(\hat{A} + \hat{A}'), \frac{1}{2}(\hat{B} + \hat{B}')\right)$ which is far more favorable than NE for classical PD strategy (D, D).

As shown in the previous section, the only NE here corresponds to the pair of meta-strategies $\left(\frac{1}{2}(\widehat{A} + \widehat{A'}), \frac{1}{2}(\widehat{B} + \widehat{B'})\right)$. Due to characteristic entanglement of classical strategies (C, D) and (D, C), quantum equilibrium gives the players payoff $\frac{s+t}{2} = 2.5$, which is more favorable than the classical equilibrium and not achievable using classical strategies.

Bringing PD to a constant sum game is only possible in a quantum manner. An analysis of this solution shows that its essence is in specific correlation of the 'cooperation' - 'defection' solutions, in such a way that players are unable to foresee

whether their strategies lead to one or other option. When Alice chooses strategy A or A' she does not know whether Bob responds with \hat{B} or \hat{B}' strategy, so she does not know whether her move is 'cooperation' or 'defection'. The same applies to Bob's strategies. With that kind of strategy selection the quantum PD is then led to the matching pennies - zero sum game. This game has no pure strategy NE and the only NE is in mixed strategies - each player chooses any option with equal probability. If one of the players uses this strategy, then his payoff is at lest $\frac{s+t}{2}$ therefore it is his quantum reservation point which is much better than p, which can only be guaranteed be the classical NE strategy.

Naturally, here appears a question whether the quantum version of PD can be used to resolve negotiations, which may have a nature of the prisoner's dilemma. Examples from different areas indicate that quantum strategies are better than classical in cases such as solving stock and market game issues [Piotrowski, Sładkowski, 2002], as well as auction and competition issues [Piotrowski, Sładkowski, 2008], gambling [Goldenberg, Vaidman, Wiesner, 1999] or artificial intelligence [Miakisz, Piotrowski, Sładkowski, 2006]. As shown in this paper, solving a dilemma using quantum strategies could lead to better outcomes than using classical solutions. Since classical PD inevitably leads negotiators to the only rational solution, which is mutual refusal of cooperation, which leads to punishment for lack of cooperation. Quantum PD has NE yielding much better payoff, which is an average of 'temptation to betrayal' and 'sucker's payoff'. Is it in fact possible to use quantum strategies in everyday life?

One of the market processes regulated by PD is a price equilibrium known as the Nash 'beautiful equilibrium'. Companies which are likely to sell its products with higher prices, de facto decrease their prices in order to optimize profits [Dixit, Nalebuff, 2008]. Here, a PD shows that bilateral (or multilateral) cooperation, which is to maintain the high prices, is in an almost impossible market situation because there will always be a company which wants to sell cheaper ('defection'), compensating for the lower prices by increasing the number of customers and abandoning the more expensive manufacturer (who 'cooperates') without customers. However, in some cases PD mechanism does not work properly, as in the example of price collusion. A good example is an incident known from 1950s which happened on American turbine market [Dixit, Nalebuff, 2008]. Three companies made an agreement that they would use inflated prices. But under condition that, depending on the date of the invitation to tender, one of them would win. The winner in each auction took everything (temptation to betrayal), the others were left with nothing (sucker's payoff). Randomness of announcing tendering periods ensured that all partners earned, each in their time. The most important issue in the whole affair was to correctly correlate the company that should win the tender with the moment of its publication. They had to be correlated in such a way that interested parties had no doubt and nobody else could to predict the algorithm (because price collusion is illegal). If the price-fixing partners used an algorithm based on quantum entanglement, none of external observers could prove them collusion. Nevertheless, the directors of the companies got imprisoned because they used a less sophisticated, easy to uncover correlating system -a winner of the tender was chosen on basis of the lunar calendar – each company won depending on the number of days that had elapsed since the new moon.

Another example of the possible use of quantum solution would be the situation where companies, competing on the same market, come to an agreement to limit the amount of advertisements of their products to the agreed level. Unless any of them will not increase their quota, the number of customers and profits reach certain equilibrium. However, there is always a temptation for a given company to increase the amount of adverts above the agreed level ('defection'). This will lead to the increase of the number of customers and their profits but only temporarily, until other parties do the same. Finally they will reach the same or similar customers' equilibrium but their profits will be smaller ('punishment payoff') as they all spend more money for advertisements. In the quantum game the NE assures that at the same time only one company is exceeding the quota of adverbs while the other keeps the limits, the roles of companies are changing in time in a random manner. Therefore, the quantum setup designed to coordinate the amount of advertisements can lead to more favorable results for competing companies.

6. Summary and discussion

In negotiations there is always a difference in the knowledge level of involved parties. The players often have no interest in disclosing all of their preferences because it may be used against them by others. On the other hand, in integrative negotiations the full knowledge of preferences of both parties can help in finding the optimal possible result. This contradiction is common in negotiations and can only be resolved by mutual disclosure of both parties preferences. Alternatively, they can use the third-party arbiter, who secretly collects information from both parties and then proposes optimal solution that is binding on the parties. In this paper we show that quantum entanglement can play the role of such an arbiter.

We formulate negotiation as a quantum game where the players strategies correspond to unitary transformations of the given initial state in the Hilbert space. Quantum strategies are correlated through the mechanism of quantum entanglement and the result of the game is obtained by the collapse of the resulting transformed state. The range of strategies allowed for quantum players are richer than in a classical case and therefore the result of the game can be optimized. On the other hand, the quantum game is completely save against eavesdropping and the players can be assured that this type of quantum arbitration is fair.

In quantum games an essential element of a game mechanism is entanglement. Does this phenomenon also have its counterpart in the real classical game? Can macroscopic objects that are controlled or observed only by our senses be entangled? These are open questions. Problems with decoherence of the wave function means that even at a level of well-controlled experiments, held in extreme isolation from surroundings, it is difficult to maintain two entangled qubits. Building a quantum computer whose work is based on a register with a number of entangled qubits, transformed by unitary operations of quantum gates, which is capable of solving practical problems, using quantum algorithms, or capable of simulation of quantum games, is a real challenge to modern physics. Over the last decade, these challenges have been successfully undertaken, which led to building of first quantum computers [Vandersypen, Steffen, Breyta, Yannoni, Sherwood, 2001; Haroche, 2012; van der Sar, et al., 2012]. Progress of physics and technology creates opportunities for application of quantum games to real life problems.

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Grzegorz KORONKIEWICZ, Paweł JAMRÓZ¹

COMPARISON OF THE TAILS OF MARKET RETURN DISTRIBUTIONS

Summary

The aim of this study is to analyze the tails of the distributions of stock market returns and to compare the differences between them. It is a well-established fact that the vast majority of stock market return distributions exhibit fat tails (a bigger probability of extreme outcomes then in the case of the normal probability). Apart from that, there seems to be a popular opinion that most market returns are negatively skewed with a fatter left tail. The study utilizes two methods for comparing the tails of a distribution. A simple approached based on the sample kurtosis, with a modification that allows for the calculation of kurtosis separately for the right and the left tail of a single distribution and a more complex approach based on the maximum likelihood fitting of the Generalized Pareto Distribution to both tales of standardized return distributions. The second approach is based on the assumptions of the Extreme Value Theory (EVT) and the Pickands-Balkema-de Haan theorem. Both approaches provide similar conclusions. Results suggest that whether the left or the right tail of the return distribution is bigger varies from market to market. All four major equity indices of the Polish Warsaw Stock Exchange exhibited a fatter left tale. However, in the whole sample it was actually more common for the right tail to be heavier, with 12 indices out of 20 exhibiting a fatter right tail then the left. The sample kurtosis indicated that all stock market return's distributions were heavy tailed, whereas the estimates of Generalized Pareto Distribution parameters did indicate standard or thin tails in two cases. Statistical tests indicate that the differences between the tails of stock market distributions are not statistically significant

Key words: Stock-market returns, fat tails, Extreme Value Theory, Generalized Pareto Distribution

1. Introduction

Financial markets constitute a very important element of the developed economies and can be seen as an important source of information. Information provided by the financial markets is used to evaluate the condition of enterprises and often the condition of the economy as a whole. One moment when the information from the financial markets can have the biggest actual impact on the economy is during rapid unexpected market movements, as in the case of the outbreaks of financial crises. The probability of extreme (and therefore rare) events is captured by the tails of probability distributions. Therefore, the analysis of the tails of stock market return probability distributions is an important issue in the study of the microstructure of financial markets. When a classic investment of purchasing a stock is considered the tails of

¹ Grzegorz Koronkiewicz, MA – Faculty of Economics and Management, University of Białystok, e-mail: g.koronkiewicz@gmail.com; Paweł Jamróz, Ph.D. – Faculty of Economics and Management, University of Białystok, e-mail: p.jamroz@uwb.edu.pl.

stock market returns represent the probabilities of worst and best-case scenarios. The left tail represents the probability of an extreme loss and the right tail represents the probability of an abnormally high gain. This is not always so with more complicated investment strategies which employ short selling and/or derivative instruments. Despite that the tails of financial return distributions are a key element of the investment and market-risk analysis.

Among the scientists and investors alike there exists a set of the so-called stylized facts on the shape of the probability distributions of market returns. For example: daily expected return is approximately equal to zero, the distribution has a negative skew with the highest probability of a daily return slightly above the expected value (mode above zero), both tails of the distribution are heavier than those of the normal distribution [Cont, 2001, p. 224], the left tail of the of the distribution is heavier than the right one [Jondeau, Rockinger, 2003, p. 560; Bali et al., 2013, p. 1]. Some of the above facts are more firmly established then the others. Currently, there seems to be little or no doubt that the probability distribution of stock market returns is leptokurtic (has fatter tails) with respect to the normal distribution. However, when it comes to the skewness and the difference between the left and the right tail, the body of available empirical research cannot be considered conclusive [Jondeau, Rockinger, 2003 p. 560], [Wen, Yang 2009, p. 360]. The observation that busts are more common than the booms is sometimes given as the explanation for the concept that the left tail is fatter than the right. This would mean that in the case of a classic investment it is more probable to incur an extreme loss than an exceptionally abnormal gain. However as short selling and derivative instruments are becoming more common the left tail no longer represents only the probability of a loss.

The aim of this paper is to analyze the tails of the distributions of stock market returns and to compare the differences between them and especially to establish whether it is more common for the left tail to be heavier than the right one. This study tests the hypothesis that one tail of the stock return probability is heavier than the other based on a sample of 20 time series of daily logarithmic stock market returns from the period ranging from 1 January 2004 until 1 April 2014. The following indices were included in this study: WIG, WIG20, mWIG40 and MiS80 indices of the Polish Warsaw Stock Exchange; and S&P 500 (U.S.), Nikkei 225 (Japan), All Ordinaries Index (Australia), Bovespa Index (Brazil), SAX Index (Slovakia), PX Index (Czech Republic), OSE All Share Index (Norway), OMX Vilnius Index (Lithuania), OMX Tallinn Index (Estonia), OMX Riga Index (Latvia), OMX Helsinki Index (Finland), IBEX Index (Spain), FTSE 250 (United Kingdom), DAX Index (Germany), CAC40 (France), and BUX Index (Hungary). The study utilizes two methods for comparing the tails of the distribution. A simple approached based on the sample kurtosis, with a small modification that allows for the calculation of kurtosis separately for both tales of the distribution and a more sophisticated approach based on the maximum likelihood fitting of the Generalized Pareto Distribution to both tales of standardized return distributions. The second approached is based on the assumptions of the Extreme Value Theory (EVT) and the Pickands-Balkema-de Haan theorem [Balkema, de Haan, 1974; Pickands, 1975]. The obtained results suggest that there is no statistically significant difference between the left and the right tail of the distribution.

2. Tails of stock market return distributions

First works that demonstrated that tails of stock market returns are fatter than those of a normal distribution were published by Mandelbrot [Mandelbrot, 1963] and Fama [Fama, 1965]. Fatter tails of stock market returns mean that extreme market movements are more probable than other extreme events that have a Guassian probability distribution. Most investors hold the opinion that the left tail of the distribution is heavier then the right one mostly due to the observation of higher autocorrelation of negative returns during bursting stock-bubbles [Jondeau, Rockinger, 2003 p. 2]. Extreme drops in market asset prices tend to follow one another, whereas during the bull market, the prices rise gradually and extreme jumps happen only occasionally and are usually separated events. There are many more possible explanations on why the left tail should be heavier then the right one. Campbell and Hentschnel [Cambel, Hentschel, 1992] argue that news, whether good or bad tend to come in clusters and hence cause a rise in market volatility which in turn rises the risk premium and has a negative effect on stock prices. This effect has a diminishing influence on positive returns resulting from good news and a stimulating effect on negative returns caused by bad news. A different explanation relies on the arguments of the Prospect Theory of Kahneman and Tversky [Kahneman, Tversky, 1979]. The asymmetry of tails may be a result of differences in treatment of gains and losses by the investors, due to asymmetry in preferences and utility [Bali et al., 2013] p. 1]. In a study by Thurner, Farmer and Geanakoples, the authors demonstrate how leveraged investing by large hedge funds can be responsible for fat tails in general [Thurner et al., 2010]. A recent argument for why left tails can be fatter then the right ones comes as a result of experiences from the recent financial crisis. Many papers study the tail dependencies among different markets, a phenomenon of extreme movements in prices on one market causing extreme movements in other markets. Studies by Jondeau [Jondeau, 2010] and Bollerslev, Todorov and Li [Bollerslev et al., 2011] among other show empirical results for asymmetry of tail dependencies in some markets with extreme negative price changes being more interdependent across different markets. In a an extensive study Jondeau and Rockinger [Jondeau, Rockinger, 2003 p. 577], show that, although the left tail tends to be heavier in empirical data, for many markets the difference between tails of stock market returns is not statistically significant. Some of the above explanations for why the left tail of stock markets returns is heavier than the right one rely on the fact that the left tail is associated with the fact that the left tail generally represents losses and the right tail generally represents gains.

3. Data and research methodology

Data for this study was downloaded from the http://stooq.pl service and consists of daily logarithmic returns for 20 stock market indices from the period ranging from 1 January 2004 until 1 April 2014 what gives the average of 2580 observations per index. Returns were calculated from the daily closing prices. Four of the indices are from the Polish Warsaw Stock Exchange, further twelve indices come from other European markets and the remaining four indices are from the markets outside of Europe. The studied indices are listed in table 1.

TABLE 1.

| Polish | Outside Europe | | European | |
|--------|-------------------------------------|----------------------------------|---------------------------------|------------------------------|
| WIG | S&P 500 - U.S.A | SAX Index - Slovakia | OMX Tallinn Index - Estonia | FTSE 250 – United Kingdom |
| WIG 20 | Nikkei 225 - Japan | PX Index – Czech Republic | OMX Riga Index - Latvia | DAX Index - Germany |
| mWIG40 | All Ordinaries Index - Australia | OSE All Share Index - Norway | OMX Helsinki Index - Finland | CAC 40 - France |
| MiS80 | Bovespa Index - Brazil | OMX Vilnius Index - Lithuania | IBEX Index - Spain | BUX Index - Hungary |

Stock-market indices included in the study

Source: own elaboration

The most popular measure of the thickness of tails of a distribution is the kurtosis:

$$k = \frac{E(x-\mu)^4}{\sigma^4} \tag{1}$$

where: μ is the mean of *x* and σ is the standard deviation of *x*.

The exact kurtosis equation is given in (2):

$$k = \frac{\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^4}{\left(\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2\right)^2}$$
(2)

Being a measure based on the central moments the above expression for kurtosis is burdened with all the drawbacks of such a measures, the most apparent one is the high sensitivity to the extreme observations. There are other measures of kurtosis based on quantiles and percentiles. The most popular of those measures can be found in [Groenevald, Meeden, 1984; Groenevald, 1998]. However, as this study is mostly focused on extreme values and the quantiles based measures of kurtosis are most suited for symmetrical distributions, the classic measure of kurtosis of Pearson (2) will be utilized. The drawback of using kurtosis is that it allows to draw conclusions only jointly for both of the tails of the distribution and is best suited for symmetrical distribution. This is an important issue as this study aims to compare the differences between left and right tails of the distributions. The following adjustment allows for the use of kurtosis for comparison between both tails: For a given data sample we discard all of the observations above the mean, transform all of the remaining observations symmetrically with respect to the mean and create a perfectly symmetrical data sample by combining the non-discarded observations and their symmetrical transformations. We compute the kurtosis for such a data sample obtaining a measure of the thickness of the left tail. An analogous procedure is then applied to the observations above the mean in order to compute the right-sided kurtosis. The kurtosis of a normal distribution is equal to 3 hence, distributions with kurtosis higher than 3 can be considered fat-tailed.

The other approach utilized in this study is based on the Extreme Value Theory (EVT). Elements of EVT are described in section 3.1 of this article. Further in the study statistical tests are utilized to evaluate the obtained results. Most prominently the Jarque-Bera test of normality [Jarque, Bera, 1987] and the Mann-Whitney U test for the differences between two populations [Mann, Whitney, 1947]. The Jarque-Bera test has a null hypothesis that the data comes from a population which is normally distributed². The test statistic is given in (3):

$$JB = \frac{n}{6} \left(A_d^2 + \frac{1}{4} (k-3)^2 \right)$$
(3)

where: k is the sample kurtosis as defined in (2) and A_d is the sample skewness given in (4)

$$A_{d} = \frac{\frac{1}{n} \sum_{i=1}^{n} (x_{i} - \bar{x})^{3}}{\left(\frac{1}{n} \sum_{i=1}^{n} (x_{i} - \bar{x})^{2}\right)^{\frac{3}{2}}}$$
(4)

The test statistic (asymptotically) has a chi-squared distribution with two degrees of freedom.

The Mann-Whitney test is a non-parametric test that utilizes ranks in order to test the null hypothesis that two samples come from the same population against an alternative hypothesis that one population consistently has higher values. In order to utilize the Mann-Whitney test one must first sort observations from both samples jointly in an ascending order and assign a rank to each observation. The test statistic is given in (5)

$$U = n_1 n_2 + n_1 \frac{n_1 + 1}{2} - T_1 \tag{5}$$

where: n_1 and n_2 are sample sizes for the first and second sample and T_1 is the sum of all ranks of the observations from the first sample.

It does not matter which sample is treated as the first one and which as the second one. Critical values for the test can be found in many statistic textbooks e.g. [Kanji, 2006, p. 218-221].

3.1. Elements of Extreme Value Theory

Extreme Value Theory is sometimes described as the equivalent of the Central Limit Theorem that applies to the tails of the distributions (rather than their means). The basis of EVT were formulated by Fisher and Tippet [Fisher, Tippet, 1928] and Gnedenko [Gnedenko, 1943], in what became the Fisher-Tippet-Gnedenko theorem: let $x_1, x_2, x_3, \ldots, x_m$ be a sequence of m independent and identically distributed random variables with an (unknown) distribution F(x) and let M_n be the maximum of the first n < m observations, then for a sequence of pairs of real numbers $a_n > 0$ b_n with $n \rightarrow \infty$ normalized maxima of the form $(M_n-b_n)/a_n$ converge to the Generalized Extreme Value Distribution (GEV) with the following Cumulative Distribution Function (CDF):

$$H_{\beta\xi}(x) = \begin{cases} e^{-\left(1+\xi\frac{x}{\beta}\right)^{\frac{1}{\xi}}} \text{ for } \xi \neq 0\\ e^{-e^{-\frac{x}{\beta}}} \text{ for } \xi = 0 \end{cases}$$
(6)

² More formally that the skewness and kurtosis, have the same values as the normal distribution

where: $\beta > 0$ and ξ are the parameters of the distribution.

This theorem suggests that no matter what is the initial distribution of random variables, their standardized maxima (defined as above) will asymptotically converge to one of the three distributions: Weibull distribution for $\xi < 0$, what corresponds to thin finite tails, Gumbel distribution for $\xi = 0$, what corresponds to exponentially diminishing tails (as in the case of a normal distribution), or the Fréchet distribution for $\xi > 0$, what corresponds to tails that diminish by a power, this can be described as thick tails (see figure 1).

When it comes to financial applications the second theorem in Extreme Value Theory is more useful, as it applies not to standardized maxima but to the values above a certain (high) threshold. For an unknown distribution function F(x) of random variables x, the distribution of the variable x above a threshold s can be defined as:

$$F_{s}(y) = P(x - s \le y | x > s) = \frac{F(y + s) - F(s)}{1 - F(s)}$$
(7)

Pickands-Balkema-de Haan theorem [Balkema, de Haan, 1974; Pickands, 1975] states that for a large class of underlying functions F and for $s \rightarrow \infty$ the distribution F_s is well approximated by the Generalized Pareto Distribution (GPD) with the following CDF:

$$G_{\beta\xi}(x) = \begin{cases} 1 - \left(1 + \xi \frac{x}{\beta}\right)^{-\frac{1}{\xi}} dla \ \xi \neq 0\\ 1 - e^{-\frac{x}{\beta}} dla \ \xi = 0 \end{cases}$$
(8)

where: $\beta > 0$ and ξ are parameters

Similarly, as in the case of GEV distribution the ξ parameter determines the thickness of tails. In general: the higher the ξ parameter, the thicker the tail of the distribution. Figure 1. presents sample distributions with varying thickness of right tails according to the corresponding values of ξ

FIGURE 1.





Source: own elaboration, based on Wolfram Demonstrations Project, electronic document: [http://demonstrations.wolfram.com/, date of access: 12.03.2014].
The GPD parameters can be estimated with the Maximum Likelihood Method, by maximizing the following log-likelihood function:

$$\mathcal{L}\left(\xi\beta\big|k, x_1, \dots, x_n\right) = -k \times \ln(\beta) - \left(1 + \frac{1}{\xi}\right)\sum_{i=1}^k \ln\left(1 + \frac{\xi(x_i - s)}{\beta}\right) \tag{9}$$

where: $\frac{\xi}{\beta}(x_i - s) > -1$, and k is the number of observations exceeding the threshold s.

The parameters can be estimated for both tails of the distribution by using the absolute value of the excess above the threshold $|x_i - s|$.

4. Empirical Results

The return data was normalized with respect to the mean and the standard deviation:

$$z_t = \frac{\mu_t - \overline{\mu}}{\sigma} \tag{10}$$

where: z_t is the standardized return and μ_t is the lognormal return.

For each index the cutoff threshold s was set at the 10th and 90th percentile of the sample data for the left and right tail respectively. The GPD fitting was carried out with the Maximum Likelihood Estimation with the use of Matlab software. The sample kurtosis values were calculated on the unstandardized data according to the equation (2). The following table summarizes the obtained results.

| Index | WIG | WIG20 | mWIG40 | MiS80 | S&P500 | Nikkei225 | Bovespa |
|-----------------|---------|---------|---------|---------|----------|-----------|---------|
| Country | Poland | Poland | Poland | Poland | U.S.A. | Japan | Brazil |
| No of obs. | 2571 | 2571 | 2571 | 2571 | 2578 | 2513 | 2534 |
| GPD ξ[L] | 0.0891 | 0.0723 | 0.1197 | 0.1502 | 0.2104 | 0.2542 | 0.1031 |
| GPD ξ[R] | 0.0127 | 0.0307 | 0.0119 | -0.0425 | 0.2927 | 0.2419 | 0.2545 |
| GPD β[L] | 0.7319 | 0.7068 | 0.8019 | 0.8127 | 0.7075 | 0.5785 | 0.6284 |
| GPD β[R] | 0.6281 | 0.6049 | 0.5973 | 0.5911 | 0.5371 | 0.4169 | 0.4518 |
| min | -0.0829 | -0.0844 | -0.0910 | -0.0801 | -0.0947 | -0.1211 | -0.1209 |
| max | 0.0608 | 0.0815 | 0.0512 | 0.0503 | 0.1096 | 0.1323 | 0.1368 |
| mean | 0.0003 | 0.0002 | 0.0004 | 0.0006 | 0.0002 | 0.0001 | 0.0003 |
| std. dev. | 0.0131 | 0.0155 | 0.0117 | 0.0114 | 0.0128 | 0.0157 | 0.0181 |
| skewness | -0.4826 | -0.2983 | -0.9589 | -1.1671 | -0.3298 | -0.5749 | -0.0713 |
| kurtosis | 6.5055 | 6.0031 | 8.5410 | 8.9674 | 14.1482 | 11.2688 | 8.3368 |
| kurtosis[L] | 7.0889 | 6.3755 | 9.4174 | 9.4473 | 12.1987 | 11.5957 | 7.2997 |
| kurtosis[R] | 5.2053 | 5.3562 | 5.0867 | 4.6844 | 16.1960 | 10.2817 | 9.3655 |
| jbera | 1416.23 | 1004.26 | 3682.95 | 4398.38 | 13396.69 | 7297.63 | 3009.29 |
| p-value (jbera) | ~0 | ~0 | ~0 | ~0 | ~0 | ~0 | ~0 |

Empirical results

TABLE 2.

| Index | AOR | SAX | РХ | OSE | OMX Vilnius | OMX Tallinn | OMX Riga |
|-----------------|-----------|----------|----------|---------|----------------|----------------|-------------|
| Country | Australia | Slovakia | Czech R. | Norway | Lithuania | Estonia | Latvia |
| No of obs. | 2593 | 2524 | 2577 | 2578 | 2620 | 2580 | 2565 |
| GPD ξ[L] | 0.1472 | 0.2531 | 0.2340 | 0.1323 | 0.2156 | 0.1447 | 0.0747 |
| GPD ξ[R] | 0.1973 | 0.0709 | 0.2840 | 0.1411 | 0.2669 | 0.2473 | 0.1627 |
| GPD β[L] | 0.6558 | 0.7316 | 0.6503 | 0.7744 | 0.7527 | 0.7136 | 0.7311 |
| GPD β[R] | 0.5322 | 0.7177 | 0.4854 | 0.5576 | 0.5620 | 0.5726 | 0.6656 |
| min | -0.0855 | -0.1481 | -0.1619 | -0.0971 | -0.1194 | -0.0705 | -0.0786 |
| max | 0.0536 | 0.1188 | 0.1236 | 0.0919 | 0.1100 | 0.1209 | 0.1018 |
| mean | 0.0002 | 0.0001 | 0.0002 | 0.0005 | 0.0004 | 0.0004 | 0.0001 |
| std. dev. | 0.0107 | 0.0115 | 0.0153 | 0.0155 | 0.0116 | 0.0118 | 0.0129 |
| skewness | -0.5594 | -1.3751 | -0.5521 | -0.6485 | -0.3605 | 0.1936 | 0.1551 |
| kurtosis | 8.6984 | 26.2181 | 17.2585 | 9.1263 | 21.1430 | 12.4455 | 9.8399 |
| kurtosis[L] | 9.5687 | 31.0941 | 17.7981 | 8.8295 | 20.7456 | 9.2590 | 8.4888 |
| kurtosis[R] | 6.6419 | 17.3933 | 15.5755 | 8.3714 | 20.8907 | 15.2650 | 11.0339 |
| jbera | 3643.52 | 57488.57 | 21960.76 | 4212.16 | 35991.04 | 9606.91 | 5010.39 |
| p-value (jbera) | ~0 | ~0 | ~0 | ~0 | ~0 | ~0 | ~0 |

| Index | OMX Helsinki | IBEX | FTSE250 | DAX | CAC40 | BUX |
|-----------------|-----------------|---------|---------|---------|---------|---------|
| Country | Finland | Spain | U.K. | Germany | France | Hungary |
| No of obs. | 2579 | 2609 | 2590 | 2612 | 2627 | 2567 |
| GPD ξ[L] | 0.0355 | 0.0263 | -0.0557 | 0.1093 | 0.0643 | 0.1742 |
| GPD ξ[R] | 0.1860 | 0.2253 | 0.0992 | 0.2447 | 0.2732 | 0.1828 |
| GPD β[L] | 0.7380 | 0.7756 | 0.8816 | 0.6882 | 0.7520 | 0.5775 |
| GPD β[R] | 0.5788 | 0.5250 | 0.6029 | 0.5045 | 0.4846 | 0.5380 |
| min | -0.0923 | -0.0959 | -0.0673 | -0.0743 | -0.0947 | -0.1265 |
| max | 0.0885 | 0.1348 | 0.0746 | 0.1080 | 0.1059 | 0.1318 |
| mean | 7.84E-05 | 0.0001 | 0.0004 | 0.0003 | 7.9E-05 | 0.0002 |
| std. dev. | 0.0145 | 0.0150 | 0.0117 | 0.0138 | 0.0143 | 0.0168 |
| skewness | -0.1341 | 0.1185 | -0.3399 | 0.0186 | 0.0418 | -0.0863 |
| kurtosis | 7.3108 | 10.0971 | 6.7275 | 10.0149 | 10.0437 | 9.3842 |
| kurtosis[L] | 6.6818 | 7.1270 | 6.2031 | 7.1391 | 7.7945 | 9.2250 |
| kurtosis[R] | 7.9712 | 13.4992 | 6.9358 | 13.3189 | 12.6234 | 9.4095 |
| jbera | 2004.60 | 5481.73 | 1549.30 | 5355.72 | 5431.32 | 4362.59 |
| p-value (jbera) | ~0 | ~0 | ~0 | ~0 | ~0 | ~0 |

Source: own elaboration

Apart from the GPD parameters and kurtosis, skewness and Jarque-Bera statistic were also calculated. The instances where the ξ parameter or the kurtosis indicates that the left tail is fatter are highlighted with bold font. In most cases both of the used methods indicate that the same tail is the heavier one. This was not true for three indices the Australian AOR, the Czech PX and the Norwegian OSE in which case the ξ parameter

indicated a fatter right tail and the kurtosis a fatter left tail. Based on the GPD fitting criterion there were 14 cases in which the right tail was heavier (S&P 500, Bovespa, AOR, PX, OSE, OMX Vilnius, OMX Tallinn, OMX Riga, OMX Helsinki, IBEX, FTSE 250 DAX, CAC40 and BUX), kurtosis indicated that eleven of the studied indices have a fatter right tail. Those results do not confirm the stylized fact that the left tail of a stock market return distribution is heavier than the right one. In fact both methods indicated the opposite. There were two instances in which the ξ parameter although close to zero was actually negative what can be interpreted as an indication of thin tails. Those were the left tail of the London Stock Exchange FTSE 250 Index and the right tail of the Warsaw Stock Exchange MiS80 index. There were five instances of positive in-sample skewness, those were: OMX Tallinn, OMX Riga, IBEX, DAX, and CAC 40 indices. In all cases the Jarque-Bera test strongly indicates that the data is not normally distributed.

In order to statistically test the difference between the two tails the differences between the left and right tail ξ parameters were calculated for each index:

$$\xi_{\text{dif},i} = \xi_{\text{L},i} - \xi_{\text{R},i} \tag{11}$$

The results of the Jarque-Bera and Student t tests on the series of the differences of the ξ parameters ($\xi_{dif,i}$) and additionally the results of the Mann-Whitney U-test for the comparison between the series of the right sided ($\xi_{R,i}$), and left sided ($\xi_{L,i}$) parameters are summarized in the table 3.

TABLE 3.

| Test | Statistic | p - value | No basis to reject the null hypothesis (90%) |
|----------------|-----------|-----------|---|
| Jarque-Bera | 1.221 | 0.311 | H0 - data normal |
| Student t | -1.587 | 0.129 | H0 - mean difference = 0 |
| Mann-Whitney U | 353 | 0.126 | H0 - both populations equal |

Statistical tests

Source: own elaboration.

The Jarque-Bera test indicates that the difference between the left sided parameter and the right sided parameter is normally distributed and the student t test suggests that the mean of that distribution is equal to zero with no sufficient evidence to reject the null hypothesis at 10% significance level. The Mann-Whitney test also suggests that both populations are equal (again no basis to reject the null hypothesis). This can be interpreted that the difference between the thickness of the right and left tail is a random white-noise-like process without a preference for any of the tails.

5. Conclusions

The obtained results do not confirm the stylized fact that the left tail of the distribution of stock market returns is thicker than the right tail. The statistical tests suggest that it may be equally likely for either of the tails to be thicker. The kurtosis-based measure indicated that the left tail was thicker in more than half of the studied cases and the ξ parameter of the GPD indicated that only 6 out of 20 indices exhibited a fatter left tail. With short selling and other more complex investment strategies becoming more widely used the classic association of the left tail with the probability of an investment loss becomes outdated. In this situation a fatter right tail cannot be interpreted simply as a bigger probability of an extreme gain. It is possible that with time left and right tails of stock market return distributions will become more similar. The lack of statistical significance of the differences between the tails of stock market returns is in line with the study by Jondeau and Rockinger [Jondeau, Rockinger, 2003], however, the results obtained in this paper show even less support for the hypothesis that the left tail is heavier.

The results do not suggest however that the distributions of stock market returns are symmetrical, as the big majority of examined indices (15 out of 20) exhibited negative skewness. The Jarque-Bera tests strongly indicate that daily stock market returns are not normally distributed, and the measures of the thickness of tails show that almost all of them come from thick-tailed distributions with Fréchet–type tails. A further study is needed to test whether or not those characteristics (especially lack of significant differences between tails) change with time and market circumstances. This is problematic as methods based on Extreme Value Theory in general require very long time series.

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Edyta MARCINKIEWICZ¹

SOME ASPECTS OF APPLICATION OF VECM ANALYSIS FOR MODELING CAUSAL RELATIONSHIPS BETWEEN SPOT AND FUTURES PRICES

Summary

The article is devoted to the issue of the application of econometric concept of cointegration and error correction models (VECM) to study the relationship between futures prices and spot prices. The author attempted to identify the determinants of the use of this methodology with respect to the relationship of spot and futures prices. In case of the prices of futures contracts and their underlying instruments causal modeling is associated with the need to deal with the multiple problems resulting from the specific nature of this dependency. These problems affect both the proper preparation of the data, as well as adaptation of the methods to the nature of the investigated phenomena. The article also points out the possible interpretation of the results of the VECM analysis in the context of the theory related to spot and futures prices linkages.

Keywords: VECM, cointegration, spot prices, futures prices

1. Introduction

In recent decades there has been a tremendous rise of derivatives markets reflected on the one hand by a huge variety of instruments offered on these markets, and on the other hand by increasing volume traded. Derivatives offer the ability to manage the risk of changes in prices (of goods, interest rates, exchange rates, etc.) and thus, they are widely used in business practice, especially for manufacturing and trade. On the other hand, there are highly leveraged products, and therefore these instruments themselves are of high risk.

A major category of derivatives are futures contracts today, which are offered on regulated markets, mainly on commodity, currency and stock exchanges. The existence of linkages between futures price and the price of the underlying instrument (spot or cash) appears to be obvious, because it arises from the origins of a contract, which is structured as a derivative of another instrument. The nature and extent of these relationships, however, are widely studied for decades because of the practical importance of this issue. The first significant works on this problem date back to the 30's of the last century. Keynes [1930] and Hicks [1939] developed the concept of *Normal backwardation*, referring to the relationship between futures prices and expected

¹ dr inż. Edyta Marcinkiewicz – Faculty of Organization and Management, Lodz University of Technology, e-mail: edyta.marcinkiewicz@p.lodz.pl.

cash prices. Starting from the 90s, scientific research on the links between cash and futures markets with respect to the causal relationships became a predominant trend. These studies were possible because of the development of a methodology based on vector autoregression models, introduced by Sims [1980]. These methods, which include cointegration analysis, vector autoregression models (VAR) and their transformation – error correction models (VECM), could be a starting point for the analyses allowing for causality inference (in Granger sense) with respect to the spot and futures prices.

The purpose of this article is to consider specific features of application of econometric methods including VECM modeling to analyze the causal relationship in Granger sense between futures prices and their underlying instruments. These reflections are presented in the context of the nature of the futures prices and the underlying spot. Furthermore, in the article a characteristic of this relationship was presented, which distinguishes these linkages and requires a specific approach to the VECM modeling in this area. Basing on a review of the previous empirical studies, the optional solutions for practical applications of this method were analyzed.

2. Long-run relationships investigation in economic phenomena

Econometric concept of cointegration refers to the relationships that occur in nonstationary processes, that time series are realizations of. Wherein non-stationarity in this case should be understood as the absence of a weak (covariance) stationarity, ie. when the conditions for the finite and fixed in time average, variance and covariance of the process are met. Non-stationary variables are cointegrated if there is a long-term relationship between them, which is a process with a lower degree of integration [Charemza, Deadman, 1997]. An example of cointegrated series can be futures quotations and quotations of the underlying instrument (see Figure 1.). This is the case of cointegration CI (1, 1).

According to the definition of Engle and Granger [1987], two processes x_t and y_t are cointegrated of order d, b i.e. x_t , $y_t \sim CI(d, b)$, where $d \ge b > 0$ if:

- 1. both series are integrated in the same degree *d*,
- 2. there is a linear combination of these variables $\beta_1 x_t + \beta_2 y_t$, which is integrated in *d-b* degree, where β_1 , β_2 are elements of the cointegrating vector $[\beta_1, \beta_2]$.

In the literature, there are two most common types of cointegration tests: the Granger procedure and the Johansen procedure. Johansen test is newer than the Granger procedure and it is considered to be more appropriate in view of the fact that it provides more efficient estimators, can also be carried out when the distributions of residuals are not normal and heteroscedastic. Moreover, it does not depend on the ordering of the variables in the regression equation [Kavussanos, Nomikos, 2003]. Johansen procedure is based on the trace test and the maximum eigenvalue test, which are conducted on the foundation of error correction model specified as follows [Kusidel, 2000]:

$$\Delta \mathbf{y}_{t} = \mathbf{\Psi}_{\mathbf{0}} \mathbf{D}_{t} + \mathbf{\Pi} \mathbf{y}_{t-1} + \sum_{i=1}^{p} \mathbf{\Pi}_{i} \Delta \mathbf{y}_{t-i} + \mathbf{\varepsilon}_{t}$$
(1)

where: $\Delta \mathbf{y}_t$ – vector of the first differences of the current values of analyzed processes for *m* dependent variables, $\mathbf{y}_t = [y_{1t}, y_{2t}, ..., y_{mt}]$, \mathbf{D}_t – vector of deterministic components of the equations, such as intercept, time variable, dummy variables, including seasonal variables, Ψ_0 – matrix of parameters standing by variables of vector \mathbf{D}_t , $\mathbf{\Pi}$ – product of cointegrating vectors matrix and adjustment matrix, *p* –maximum lag of endogenous variables, $\mathbf{e}_t \sim N(0, \mathbf{\Omega})$, where $\mathbf{\Omega}$ is covariance matrix of the random component.

FIGURE 1. WIG20 index futures prices (series FW20U12) and WIG20 prices in the period 2012-03-14 – 2012-07-14



Source: Own research based on WSE data [electronic document: http://gpw.com.pl, date of access: 10.01.2014].

In both – the trace test and the maximum eigenvalue test – rank of matrix Π is validated. Johansen [1988] showed that the rank is equal to the number of independent cointegrating vectors. In the case of two variables, if the test results show that rank Π =0, then there is no cointegration relationship and model appropriate for describing the causal relationship (in Granger sense) between the two variables is VAR for first differences. If rank Π =1, then there is only one cointegrating vector, which is a prerequisite for the estimation of VECM model, and if rank Π =2, it can be assumed that the variables of vector \mathbf{y}_t are stationary and model (1) is VAR model for the variables in their levels.

Cointegration analysis preceded by the analysis of stationarity of time series allows therefore to choose the appropriate model (VAR or VECM) to test Granger causality. The definition of Granger causality states that the variable X_t is the cause of the variable Y_t if future values of Y_t can better predicted on the basis of the available set of information than using the information other than X_t [Osińska, 2008]. The Granger representation theorem states that if there is cointegration between the variables, then there is a representation in the form of error correction model. The relationship between such variables can be interpreted in terms of causality, as far as it is justified, for example by economic theory.

The presence of a single cointegrating vector in time series indicates that the better model for the analysis of causal relationships in the studied phenomena is error correction model. It allows distinguishing between long-run and short-run dependence. The ability of two variables to remain in the long-run equilibrium is evaluated on basis of the significance of the parameter standing next to the error correction term in a given VECM equation. One can then specify the variable, due which the correction of the deviation from the long-term equilibrium takes place. On the basis of VECM it is also possible to conduct Granger causality test, which allows for the statistical inference of causality in the short run. The test procedure involves comparing estimated error correction model with a new model VECM with zero restrictions imposed on the coefficients of the variable which causality in the equation is examined. Granger causality test procedure for the VECM model is presented for example in [Osińska, 2008].

3. Relationship between spot and futures prices and causality

Linkages between cash and futures prices arise from the nature of the derivative. They are also reflected in the theoretical models of contract pricing. The most well-known formula for the valuation of futures prices is cost-of-carry model, introduced in the early 80's by Cornell and French [1983]. This model has been developed for the valuation of forward contracts. Under conditions of non-stochastic interest rates, it is assumed however, that futures and forward prices are the same (for instruments characterized by the same parameters), and the formula for cost-of-carry is also used for pricing of futures contracts traded on regulated exchange markets. Depending on the category of the underlying instrument (commodities, currencies, interest rates, equities) formulas used to calculate the fair value of the futures contract in the model cost-of-carry vary. For each of the underlying instruments, there are different costs of storage. For example, cost-of-carry model for stock and index futures contracts, which are the most popular among investors, takes the form:

$$FV_t = S_t e^{(r-q)T} \tag{2}$$

where: FV_t – theoretical futures contract price at the moment *t*, S_t – spot price at the moment *t*, r – risk-free rate, q – dividend yield (the ratio of dividends per share and the market price of shares), T = n/365 – time to maturity of the contract (n – number of days to maturity).

The concept of the cost-of-carry model is a basis for assumption that the current futures price is equal to the price that would be paid for the underlying instrument at the moment and the cost of its storage to a certain moment in the future. This moment is determined by the needs of the investor involved in the contract, and it is defined by the maturity of the contract. Connection between futures price and cash price described by the cost-of-carry model is also often presented in a slightly different way [Stoll, Whaley, 1990]:

$$R_{S,t} = (r - q) + R_{F,t}$$
(3)

where: $R_{5,t}$ – rate of return of the underlying instrument, $R_{F,t}$ – rate of return of futures contract.

There is also another concept of the futures and spot price relation, different form the cost-of-carry. According to that concept the price of a futures contract at a given moment is equal to the sum of the price of the underlying good S_t , expected risk premium $E_t[P(T,t)]$ and expected change in the spot price $E_t[S_T-S_t]$ [Fama, French, 1987]:

$$F_{t} = S_{t} + E_{t}[P(T,t)] + E_{t}[S_{T} - S_{t}]$$
(4)

The implication of both, cost-of-carry model and model the expected risk premium, is the existence of a stable long-term relationship between spot and futures prices [Asche, Guttormsen, 2002]. Also assuming that the conditions underlying the cost-of-carry model are met, i.e. no transaction costs, short sale restrictions, the lack of information asymmetry, etc., then, considering equation (3), it can be concluded that changes in cash prices and futures prices should remain simultaneous, without any delay of one rate of return relative to the other [Lafuente, Novales, 2003]. In most markets, however, causal relationships between spot and futures prices in terms of Granger are observed. Green and Joujon [2000] showed that bi-directional causality (i.e. when the spot price changes are the cause of changes in prices are formed on the basis of cost-of-carry model.

A number of studies carried out on the world exchange markets have been devoted to the issue of Granger causality between prices of futures and underlying instruments. A detailed review of the results of most studies conducted since the 80's to the 90's of the last century was provided by Sutcliffe [2006]. The findings of these studies can be generalized concluding that causality more often runs from futures to spot, therefore futures market more frequently is leading in relation to the underlying instrument market. The reverse situation is much rarer, as the two-way causality. Another regularity disclosed in the studies is the causal relationship in prices depending on the degree of development of markets. In the less developed markets, spot and futures prices are usually less synchronized, so one of the markets clearly follows the other, than it takes place in more mature markets. This could mean, therefore, that the more efficient markets, which are generally mature markets, the weaker (or does not exist at all) leading role of one of the markets in the disclosure of the price. The above considerations apply when both markets are sufficiently liquid, because low market liquidity is a factor reducing the speed of the influx of new information in the prices of listed securities. However, one can distinguish other factors that can delay this process, such as limitations of the trading systems operating in a given stock exchange, the amount of transaction costs, price limits, etc.

4. Specific features of VECM modeling in case of spot and futures prices relationship

In particular, when relationship of two variables such as spot and futures prices is modeled, VECM equations can be written as follows:

$$\Delta f_{t} = a_{F,0} + \sum_{i=1}^{p} a_{F,i} \Delta s_{t-i} + \sum_{i=1}^{p} b_{F,i} \Delta f_{t-i} + \alpha_{F} E C T_{t-1} + \sum_{i=1}^{m} c_{F,i} k_{i,t} + \varepsilon_{F,t}$$
(5)

$$\Delta s_{t} = a_{S,0} + \sum_{i=1}^{p} a_{S,i} \Delta s_{t-i} + \sum_{i=1}^{p} b_{S,i} \Delta f_{t-i} + \alpha_{S} E C T_{t-1} + \sum_{i=1}^{m} c_{S,i} k_{i,t} + \varepsilon_{S,t}$$
(6)

where: Δf_i – logarithmic rate of return of futures contract, Δs_i – logarithmic rate of return of underlying instrument, $a_{S,0}$, $a_{F,0}$ – intercepts, $a_{S,b}$, $b_{S,b}$, $a_{F,b}$, $b_{F,i}$ – short-run coefficients, ECT_{i-1} – error correction term, a_S , a_F – long-run coefficients, k_{bi} – deterministic variables, $c_{S,b}$, $c_{F,i}$ – coefficients standing next to the deterministic variables, p – maximum lag of variables Δf_i and Δs_i . $\varepsilon_{F,b}$, $\varepsilon_{S,i}$ – random components (Gaussian white noise).

Modeling Granger causality in the prices of futures contracts and their underlying instruments is associated with the need to deal with the multiple problems resulting from the specific nature of this relationship. These problems affect both the proper preparation of the data, as well as adjusting methodology, which is expected to correspond to the nature of the phenomena examined.

TABLE 1.

Examples of causal analysis of spot-futures prices of different data frequency

| Data frequency | Examples of empirical research |
|----------------|--|
| daily | [Bohl et al., 2011], [Ozen et al., 2009], [Nieto et al., 1998], [Chen, |
| | Zheng, 2008], [Green, Joujon, 2000]; |
| 1-hour | [Gwilym, Buckle, 2001]; |
| 15-minutes | [Gosh, 1993], [Hodgson et al., 2006], [Cheung, Ng, 1999]; |
| 5-minutes | [Stoll, Whaley, 1990], [Chiang, Fong, 2001], [Frino, West, 1999], |
| | [Abhyankar, 1998]; |
| 1-minute | [Dwyer et al., 1996], [Kawaller et al., 1988], [Pizzi et al., 1998]; |
| tick-by-tick | [Chu et al., 1999], [Fung, Jiang, 1999]; |

Source: own research

The first of the significant problems that causal modeling involves is the choice of frequencies of analyzed transactional data. In this case there are a lot of possibilities – from the data of the highest frequency of observation (tick-by-tick), through intraday observations at regular time intervals (e.g. 5 -, 15 -, 30 -, 60 - minute) to the observations of closing prices (see Table 1.). Analyses carried out on closing prices allow avoiding non-synchronicity problems with the spot and futures transactional prices. Usually there is no need to reject non-overlapping observations over time, which could bias causal modeling results. This problem occurs in the case of intraday data, but in the era of high frequency investments analysis of trading data based on a frequency higher than the daily seem to have more practical value. They allow disclosing causal relationships that are manifested in very short time intervals. In addition, the analysis of high frequency data, also in terms of causal relationships between the prices of different instruments, contributes to the study of market microstructure, which is defined as a set of features and mechanisms of a particular market, which determine how prices are formed, and under what conditions and at what time transactions occur [Doman, 2011]. It should be

noted, however, that in the analysis of high frequency data, especially in the case of intra-day study of phenomena relating to the financial markets, hybrid models are often used. They, in addition to the error-correction mechanism, involve structures allowing for the modeling of irregular variability, typical for financial time series. Such models can take various forms, e.g. VECM-DCC-GARCH [Bohl et al., 2011], VECM-TGARCH [Floros, 2009], VECM-SV [Pajor, 2006].

Another problem emerging in the context of cointegration analysis and causality modeling is the issue of deterministic variables in the VECM equations. In the VECM models (and in general VAR) in a matrix of deterministic variables seasonal variables can appear. However, in the case of futures and spot prices, which tend to be cointegrated, they do not seem to be necessary. If both series have the same linear trend and seasonality, there is no need to take account of seasonal variables as deterministic variables [Gorecki, 2010]. However, deterministic variables are often used to represent lack of continuity in the data set and they are applied to avoid structural breaks in the series, especially in the case of intraday data [Green, Joujon, 2000; Kavussanos, Nomikos, 2003]. Such variable might be the number of days between consecutive sessions, which determines overnight, weekend or holiday break. An additional dummy-variable can also mark the moment of rollover of the series of contracts, because usually tested futures price time series are composed of many combined series.

In the cointegration analysis it is acceptable to adopt *a priori* the form of cointegrating vector [Charemza, Deadman, 1997; Majsterek, 2005]. This assumption is also possible in the case of long-run dependencies between futures prices and cash prices. Then, the natural representation of the cointegrating vector is futures basis b_i . Basis is a primary indicator of the relationship of spot and futures prices for the given moment. The effectiveness of hedging strategies depends on its value and stability. The formula of basis is expressed as the difference between the price of the underlying asset (S_i) and the price of futures contract (F_i):

$$b_t = S_t - F_t \tag{7}$$

Basing on the appropriate statistical tests one can show that time series of the spot and futures prices usually are non-stationary i.e. they are realizations of the process I(1). Thus, they are cointegrated if there is a stationary linear combination of them. This condition in a natural and intuitive way corresponds with the concept of basis. Alexander [1999] and Green and Joujon [2000] pointed out, however, that the basis, which represents cointegration relationship, is expressed in a slightly modified form, as the difference between the logarithms of spot and futures prices:

$$b_t = s_t - f_t \tag{8}$$

where $s_t \equiv \ln S_t$, and $f_t \equiv \ln F_t$.

The theoretical foundation for adaptation of the basis as a cointegrating vector has been presented by Brenner and Kroner [1995], and its empirical verification was carried out by Bohl et al. [2011].

5. Interpretation of the results of VECM modeling

The presence of causal relationships between spot and futures prices can be considered in relation to *Efficient Market Hypothesis* (EMH). The concept of informationally efficient market has been introduced by Fama [1965] in the 60's of the last century. According to the EMH in the efficient market all the information is already reflected in the prices, so it is not possible to predict future price movements and maintaining long-term rate of return higher than the market benchmark. The ability to obtain better forecasts of variables using past values of other variables contradicts the conditions of informationally efficient markets. Therefore, the analysis of Granger causality is also used to verify the EMH on cash and futures markets. The use of VAR and VECM models to verify the efficient market hypothesis is described i.e. in [Maddala, 2006]. An example of the application of this methodology for the analysis of the market efficiency provided Nieto et al. [1998].

However, in the literature of the subject, in regard to cointegration existing between the prices of instruments listed on the exchanges, there are different views on their impact on the efficiency of markets. Kuhl [2007] argued that the presence of cointegration is in contradiction with the existence of a weak form of efficiency. On the other hand, Sweeney [2003] demonstrated that the presence of cointegration is not related to the efficiency of the market, but only under certain conditions. Hakkio and Rush [1989] presented arguments for cointegration determining the existence of the efficiency of the market. Similar conclusions are presented by Mall et al. [2011]. They found the existence of cointegration between the index futures market and the underlying market to be closely related to the informational efficiency.

The results of the cointegration and causality research in the long and short term related to futures and cash prices may also serve as a reference for the consideration of the price discovery process. It is based on the disclosure of information about the future price on one of the markets with the price on the second of the markets. Basing on the previous studies, two concepts of the price discovery can be distinguished. The first one is related to the theory of expectations, i.e. refers to the assumption that the futures price is an estimate of the future value of the underlying instrument. Term *future* relates to the delivery time (physical or cash settlement) of the original asset on expiry date of the contract. Such understanding of the role of price discovery function of the futures market corresponds to the idea of OTC markets, where the trade involves nonstandardized contract, which are forward contracts. The second concept is related to the change in the perception of the price discovery in recent years. It is seen as an opportunity to predict the behavior of the one price in the nearest future basing on the price from another market. In this sense, the process of realization of this function closely refers to the market microstructure. In this regard, the subject of specific study is a way of spreading new information in related spot and futures markets. Due to the fact that the goods offered in both markets are mutually substitutable, it is natural that such information has an impact on the prices of both - derivative and underlying instrument. Price discovery is performed by this market, on which new information is quicker reflected in the change in price. In this approach it is not assumed in advance that the futures market plays price discovery role. On the foundation of VECM model it is possible to estimate the extent to which one market leads the other. The measure *CFW* (ang. *Common Factor Weight*) developed on the basis of the studies of Schwarz and Szakmary [1994], as well as Gonzalo and Granger [1995], can be expressed as [see Bohl et al., 2011; Rittler, 2009]²:

$$CFW^{F} = \frac{|\alpha_{s}|}{|\alpha_{s}| + |\alpha_{F}|}$$
(9)

and

$$CFW^{S} = \frac{|\alpha_{F}|}{|\alpha_{S}| + |\alpha_{F}|}$$
(10)

where CFW^S , CFW^F denote relative price discovery contribution of spot and futures market, and a_S , a_F are the parameters estimates in equations (5) and (6). When CFW^S = 1 (or CFW^F = 1), then the whole price discovery process takes place through spot market (or futures market respectively). Equations (9) and (10) are universal and apply to any normalization adopted to cointegrating vector, since they take into account the absolute values of the parameters α_S , α_F . Basing on the manner the indicators are calculated, described by formulas (9) and (10), it can be stated that the price discovery process is realized in the market, through which slower correcting deviations from the long-term equilibrium between spot and futures prices occur. Wherein, it is acceptable that it is present on both markets, in equal or varying degrees. The process of price discovery is associated with the existence of long-term dependence, but VECM systems also allow for the identification of causal relationships that occur in the short term.

Problems with the economic interpretation of the results appear, however, when the results indicate the existence of bi-directional causality between spot and futures prices. On the basis of the theory it is difficult to explain the mechanism that makes the cash market prices affect prices on the futures market and vice versa. It seems that such a case can be regarded as a prerequisite for analyzes using transactional data of higher frequency, which allows to distinguish cause from effect.

6. Conclusions

Econometric concepts of cointegration and Granger causality are widely used in the studies of economic phenomena. They have found their application in the analysis of the price dependencies that exist between markets of shares, currencies, commodities, natural resources and associated derivatives markets. Their application to the studies of the relationship of cash and futures prices, however, requires an individualized approach taking into account the specific nature of both markets and the links between them. Particular attention should be paid primarily on the proper preparation of data for analysis and consideration of the characteristics of the examined phenomena, with

² The *CFW* indicator can be applied not only to spot and futures time series. Booth et al. [2002] used it to explore the degree of price discovery on both – OTC and regulated markets. Rittler [2009] studied price discovery process using theoretical and actual futures prices. This measure can be also definied in a different manner than given by the formulas (9) and (10) [see: Theissen, 2012; Yan, Zivot, 2010].

a special regard to basis as a primary indicator of the linkage between spot and futures prices.

The results of the cointegration analysis and VECM modeling can be applied both to discussion on the informational efficiency of exchange markets, as well as the consideration of the price discovery function. As shown, however, interpretation of the results of the VECM analysis in this context is not obvious and clear, as there are different views on these issues.

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Władysława ŁUCZKA, Lidia JABŁOŃSKA-PORZUCZEK1

SECONDARY PROFESSIONAL ACTIVITY IN THE LABOUR MARKET PENSIONERS

Summary

A pension is a benefit of cash character, which aim is to secure the material existence in the period, in which an individual, regarding to age is not able to perform work. In order to gain the entitlement, one should meet defined conditions, having met which the choice of the moment of retirement is made by the entitled person. A person at retirement age may fully spend their time resting resigning from professional activity, may also continue work, postponing retirement or combine receiving benefits with professional work. The aim of the paper is to analyse the occurrence of secondary professional activity as well as factors determining the undertaking of employment in the period of receiving benefit. The conducted research shows that the responders relatively earlier exercised their right to a pension and average age of responders' retirement amounted to 59 years. However, gaining entitlement to a pension did not caused responders' withdrawal from the labour market and over half of them combined receiving benefits with professional work. The undertaking of the professional activity was conditioned by responders' financial situation.

Key words: pension, retirement age, secondary professional activity

1. Introduction

In the literature there are different definitions of pension. It is widely recognised that this is a financial benefit, the purpose of which is to secure the existence in the period in which individuals, because of their age, are not able to perform their job. To be eligible for the benefit one has to meet certain conditions which primarily are reaching the retirement age and the corresponding length of participation in the labour market or insurance period. However, after meeting certain statutory conditions, a decision on retirement is made by the entitled person. A person at retirement age has different choices, they may wholly devote their time to relaxing, resigning from the participation in the labour market, and they can also decide to continue work postponing retiring or combine receiving the benefit with professional work. In the case of pensioners, reduction or withdrawal from work causes a change of earnings into non-wage income. This does not lead to a complete lack of income, but may be associated with deterioration of the income level of the elderly. In Poland, the amount of benefit is usually lower than

¹ prof. dr hab. Władysława Łuczka, Lidia Jabłońska-Porzuczek, Ph.D. – Faculty of Economics and Social Sciences, Poznań University of Life Sciences, e-mail: jablonska-porzuczek@up.poznan.pl.

pay. As a result, this contributes to the deterioration of the income level of pensioners, who decide to participate partially in the labour market.

The purpose of the paper is to analyse the phenomenon of secondary professional activity in the labour market of pensioners, as well as the factors determining taking up employment during the retirement period. The work also presents the factors influencing the decision to withdraw from the labour market. It includes empirical data according to selected demographic variable.

2. Materials and research methods

In order to determine the professional activity of people receiving pensions in 2009-2010 in the region of Wielkopolska, a survey on 350 beneficiaries was conducted. The survey was supposed to contribute to the identification of the main causes for a secondary participation in the labour market of pensioners. The aim of the survey was also to verify whether pensioners' opinions vary depending on the selected demographic variable, namely gender. The purposive sampling method was used to select beneficiaries. The study included only persons receiving benefits from the public pension system. Due to the demographic structure of the population, in particular, feminisation in the older age groups of population, women accounted for 60% of the respondents.

Test of independence was applied to analyse empirical data. In each case under consideration, which was subjected to statistical verification, there was adopted the $\alpha = 0.05$ level of significance. All calculations were performed in the R statistical package using a statistical function chisq.test (). The decision to reject the hypothesis of independence of the studied traits in favour of the alternative hypothesis stating that the relation exists, was made on the basis of comparison of the adopted level of significance $\alpha = 0.05$ with the so-called p-value issued by the program. Therefore, in the description of the verified issues, the authors resigned from providing the value of the test statistic, the number of degrees of freedom and the critical value; it is limited to giving the p-values, which unambiguously allows to decide to reject the hypothesis of independence or on the lack of grounds for its rejection.

A research tool used to analyse the data was also the automatic interaction detection method (CHAID – Chi-squared Automatic Interaction Detector), which is a technique allowing to choose from a set of variables the ones that most affect the indicated dependent variable; the variables are assigned according to the strength of this effect. As dependent variables were adopted the variables measured on the qualitative (weak) scales of measurement: the answer to the question: *If you do not work at present, are you willing to start work?* As explanatory variables were adopted: gender, age, place of residence, marital status and education.

3. Research results

Retirement age

The respondents relatively early exercised their right to pension benefits. The average age of the respondent's retirement was 58.6. The results of the survey do not differ significantly from the statistics published by the Social Insurance Institution (SII), according to which in 2010 the average age of a retiring man was 60.2 and women – 59 [Social Insurance Institution, 2012, p. 46]. The report *Deactivation of people approaching retirement age*' shows that nearly 70% of men and 68% of women obtain the benefits for 1-5 years before reaching the retirement age. This means that the majority of population receive benefits allowing the deactivation before the retirement age [Sztanderska, 2008, p. 18]. The study shows that the right to early retirement exercised more than 43% of men and 38% women (figure 1.).



Source: authors' own research.

For many people retiring earlier than the statutory retirement age is a preferred alternative to professional work which is influenced by the fact that in the previous pension system extension of the length of service insignificantly increased the level of benefits. Therefore, in the case of a lower level of pay there is no strong motivation to continue to work in a situation when there is a right to receive pension. The lower the pay, the more the pension replaces the lost income [Wóycicka, Matysiak, 2004, pp. 63-64] (table 1.).

TABLE 1.

| Pension | in relation to pay | (excluding social | security contril | butions) depend- |
|---------|--------------------|-------------------|------------------|------------------|
| | ing on the length | of service and pa | y in the current | t system |

| Length | 60% average pay | 100% average pay | 120% average pay |
|------------|-----------------|---------------------------|------------------|
| of service | | Pension in relation to pa | ay |
| 25 | 82% | 62% | 57% |
| 30 | 88% | 69% | 64% |
| 35 | 95% | 75% | 70% |
| 40 | 101% | 82% | 77% |
| 45 | 108% | 88% | 83% |

Source: [Wóycicka, Matysiak, 2004, p. 63].

Implemented for many years, the labour market policy fostering early withdrawal from the labour market of older people helped to spread among people around the retirement age a tendency to give up their jobs and retire [Klimkiewicz, 2007; Klimkiewicz, 2009, p. 4-10]. The research shows that the main reason for exercising the right to a pension was reaching the retirement age (58 %), which to a large extent also was associated with favourable conditions for retirement (12.5%) and unfavourable pay conditions (5 %), as well as the threat of job loss (8%).

Secondary professional activity in the labour market

Exercising the right to a pension does not need to have a direct impact on professional deactivation. However, it creates a favourable opportunity to combine receiving the benefit with performing professional work. This allows pensioners to feel more financially secure. When receiving the benefit, 197 out of 350 respondents (56%) were economically active, of which the highest percentage, i.e. 69% worked from 2 to 5 years, 22% not more than one year, and 9% from 6 to 10 years. Men demonstrated higher professional activity than women did. About 58% of men and 54% of women connected retirement with work. The data of Social Insurance Institution show that in December 2009 the number of people entitled a pension registered to the pension insurance amounted to 422.6 thousand, and in December 2010 - 404.8 thousand, and registered to health insurance respectively: 586.7 thousand and 582.0 thousand [Social Insurance Institution, 2012]. It can therefore be concluded that about 15% of retirees were economically active². The report published in 2006, *The future of retirement*, prepared by The Hong Kong and Shanghai Banking Corporation (HSBC) in collaboration with Oxford Institute of Ageing, containing the results of surveys conducted in 20 countries around the world, including Poland, shows that after retiring 20% of respondents do not intend to work, and 75% would like to continue employment, out of which 9% full-time and 66% part-time. In Poland, about 7% of the surveyed

 $^{^2}$ The CSO data shows that the number of retirees under the non-agricultural social insurance system in 2009 was 5239 thousand, in 2010 – 5256 thousand. However, there were 1138 thousand pensioners under the agricultural social insurance system in 2009, and in 2010 – 1097 thousand.

want to work full-time and 70% part-time [*The Future of Retirement...*, 2006; Kaluża, Lewandowska-Sweda, 2009, p. 169]. However, the survey conducted in 2011 by the European Commission shows that the majority of the EU citizens would not want to work after reaching the retirement age (54%). About 33 % of the respondents were interested to be further active in the labour market. In Poland, the percentage of people belonging to the first group was slightly lower – 49%, while the latter one – 37% [European Commission, 2012, pp. 74-75]. The data proves that over half of the employed at the age of 45/50+ plan to use the right to a pension as quick as possible. About 30% of the inquired would like to undertake secondary professional activity and 16% was hesitant [*Diagnoza obecnej sytuacji kobiet i meżczyzn...*, 2013, p. 21].

The professionally active pensioners are generally socially active people, higher educated, with higher incomes and living in larger cities, usually employed under a contract in full-time or part-time work. The pensioners mainly occupy managerial positions and other independent ones, and perform basic work requiring low physical load [*Diagnoza obecnej sytuacji kobiet i mężczyzn...*, 2013, p. 21].

The conducted inquiry research proves that over half of the respondents receiving benefits and continuing paid work were employed under a contract of employment, however, most of them part-time (figure 2.).

FIGURE 2.





Source: authors' own research.

The test of independence shows that there is a statistical relationship between working time and gender of respondents. However, no statistically significant relationship was started between the number of working hours (full-time or part-time work and the age, educational background and marital status of those polled (table 2.)³. Respondents working ¹/₂ and ¹/₄ of working time were dominated by women, who respectively accounted for 66% and 54%.

TABLE 2.

| Specification | Gender | Age | Education | Marital status |
|---------------|--------|-------|-----------|-------------------|
| Working time | 0.042 | 0.224 | 0.177 | 0.907 |

Working time – test of independence results

Source: authors' own research.

Every third respondent performed work under commission contracts, and every twelfth conducted non-agricultural business. Over 5 % of the respondents worked under specific task contracts, and 6% without a contract. Out of 350 respondents over 3% combined receiving pension with conducting non-agricultural business activities and working under a contract of employment. People who before being entitled to benefits had conducted non-agricultural economic activities were more likely to take up employment under a contract of employment (47%) than to continue to be selfemployed (14%). If the business is profitable and cannot be conducted by another people, then at the time to retire the beneficiary runs it further. In this case, they decide to take advantage of the right to benefits for fear of a change in legislation in this area. They continue to operate regardless of the level of generated income, which may affect the suspension or reduction of pension. In this case, the deactivation causes deterioration of the financial situation. If the economic activity is unprofitable, then the person decides to terminate it and take up employment, which in combination with receiving pension, improves financial conditions. Over two thirds of respondents did work consistent with their learned profession or the same kind of work as prior to acquiring the right to the retirement benefit. The decision to take up employment under a contract of part-time employment or a commission contract, specific task contract was related to the situation in the labour market. Employers prefer flexible forms of employment, since these are often deprived of the privileges of employees. On the other hand, working pensioners are not interested in such privileges. Flexible forms of employment are also associated with low pay. Due to the extra work almost 70% of pensioners obtain income not exceeding PLN 1000, over 27% - PLN 1001 to 2000, and 3% - over PLN 2000 (figure 3.).

³ The table presents p-value in chi-square independency test between following variables: working time and gender, age and marital status of a responder. The level of significance α =0,05 was accepted for the test of hypotheses about the independence of the relevant features. The cases, in which the dependency was observed (p≤a) were marked with bold font.



FIGURE 3.

Source: authors' own research.

Men received higher pay than women. This is due to far worse position of women in the labour market, the evidence of which is the ratio of pay of women and men. Women, although on average better educated, are still paid less than men [Kołaczek, 2009, pp. 2-6]. Low income of working pensioners compared with people not receiving benefits results not only from short-time work, but also the low level of pay in the labour market. The level of income of beneficiaries may also result from the fact that the undertaken work is an additional activity, odd job, often on a replacement. Among people performing professional work there is a significant part for whom combining income from work and benefits is an important way to improve their financial situation. With the additional participation in the labour market the pension increased in the case of over half of the respondents, 11% significantly and 46% slightly. Due to the receiving too high pay, 98 % of respondents did not have suspended or reduced benefits. This shows that the pensioners themselves opt for flexible forms of employment in order to generate income from work not causing suspension or reduction of benefits.

Among those who combined old-age pension and professional activity 52% gave up work. The most common reason to cease economic activity, indicated by the respondents, was health (95%) (figure 4.).



Reasons for resignation from work

FIGURE 4.

Source: authors' own research.

Confirmation of the health assessment of the elderly is the Central Statistical Office research, which shows that in 2009 45% of respondents aged 50-59 favourably assessed their health status (very good and good), and 40% as 'so-so, neither good nor bad'. Moreover, 15% claimed they had bad and very bad health. Among people aged 60-69 years old, almost half of the respondents assessed their health status as 'so-so, neither good nor bad', 25% as poor and very poor, and 28% as very good or good. Among people aged 70 years old or more, compared to the previous age group, the share of negative health assessment increased by 18 percentage points, and the number of those who evaluated positively fell by 13 percentage points [CSO, 2011, p. 108]. Over one third of the beneficiaries resigned from work for other reasons, which included among others: age, taking care of family members, lack of need, and lack of job offers. Every third respondent gave family reasons, and every fourth – low pay.

At the time of the study, 73% of the beneficiaries were not economically active, with 69% of respondents expressed no willingness to work, and 31% wanted to start a secondary economic activity. In order to build a profile of a pensioner who is interested in professional activity, the automatic interaction detection method (CHAID) was used. The variables measured on qualitative (weak) scales of measurement were adopted as dependent variables, namely the answer to the question: *If you do not work at present, are you willing to take up employment?* As the explanatory variables were adopted gender (woman, man), age (before reaching retirement age, after reaching retirement age), place of residence (urban areas, rural areas), marital status (married, divorced, widow/widower) and education (primary, vocational, seondary, higher). The division of the branches is related with the value of test probability p in χ^2 independency test. The figure 5. presents information on χ^2 test statistics values, p-value and apropriate number of degrees of freedom (df).

The CHAID model analysis shows that the willingness to take up employment depended primarily on age. Among the respondents who at the time of the survey were not economically active 60% were people who reached the retirement age and 40% were people who did not reach the retirement age (figure 5.). In the first group, those who did not want to take up employment accounted for 77%, while in the latter on -55%.

FIGURE 5. Pensioner's profile according to reaching to undertake professional activity



Source: authors' own research.

Among the respondents in the pre-retirement age an explanatory variable strongly influencing the dependent variable was sex. Men accounted for 32% of the pre-retirement age respondents, and among them 73% expressed a desire to undertake economic activity. However, women accounted for 68% of the pre-retirement age respondents, but 68% were not interested in finding a job. In the group of women another explanatory variable strongly influencing the dependent variable was the place of residence. Urban inhabitants accounted for 55%, and those living in rural areas – 45%. Both groups were dominated by people who did not express a desire to take up employment. Nearly 58% of women living in the city did not want to restart their economic activity. However, among women living in rural areas the proportion was much higher and accounted for over 80%.

Secondary participation in the labour market is not interesting for people who reached the statutory retirement age (65 for men and 60 for women), and women before the age of retirement, living in rural areas. Those interested in taking up employment are primarily men before the retirement age.

Nearly 47% of people expressing a desire to work received benefits below PLN 1000. However, those who did not want to take up employment were dominated by the respondents receiving pension of PLN 1001-2000. The decision to restart the participation in the labour market is connected with the opinion of the respondents on meeting everyday needs. People receiving lower benefits had difficulty meeting current needs, which encouraged them to take up employment. Among the respondents who would like to work over 74% said they had difficulty meeting the needs (table 3.).

TABLE 3.

| If you currently do not work | Is the level of your income sufficient to meet your current | | |
|--|---|---------------|--|
| professionally, are you interested in undertaking such work? | is not sufficient | is sufficient | |
| I am not interested | 55.2% | 44.8% | |
| I am interested | 74.1% | 25.9% | |

Willingness to undertake employment and to meeting current needs

Source: authors' own research.

Although the received pension was not sufficient to meet current needs, 55% of the respondents expressed no desire to restart their professional activity.

Among those who wanted to work, their deactivation was due to various reasons. For 81 people who declared their willingness to work the greatest barrier was the lack of job offers, and health status (figure 6.). These reasons were pointed by every second respondent. The demand for work in this age group depends on the level of education and type of occupation. This is due to the fact that older people should not perform certain kind of jobs. This applies mainly to jobs requiring physical strength, fitness and the use of modern technology, as well as jobs which are connected over the years with a 'burnout', leading to lower efficiency.

Poor health is a major factor impeding undertaking employment by economically inactive people [Kotowska, 2008, pp. 23-26; Kotowska, Abramowska-Kmon, 2008, pp. 47-69]. Employers often do not want to hire older people, because of certain limitations related to age, such as the pace of work, reluctance to acquire new skills and qualifications, lower education level compared to young people, professional burnout. However, it should be noted that as employees, older people have a lot of valuable advantages, namely experience, precision, discipline, concentration. Considering these features, multi-generational groups of workers can be created. Undoubtedly, their important advantage is combining current knowledge and years of experience, diverse skills and abilities, which in turn may contribute to the stabilisation of employment [Golinowska, Szatur-Jaworska, 2004, p. 204].



Reasons for professional inactivity

Source: authors' own research.

4. Conclusions

The research shows that respondents relatively early exercised their right to a pension, and the average age of respondent's retirement was under 59. However, for the surveyed retirees acquiring entitlement to a pension did not contributed to the withdrawal from the labour market, and over half of the respondents combined receiving the benefit with professional work. At the time of the survey almost two thirds of the retirees were economically active or expressed the desire to participate in the labour market again. Retirement is usually associated with deterioration of income, since the benefit provides a constant, though lower than pay income. This is due to the existing rules for determining the amount of benefits, as well as maintaining their real value. Among the respondents participation in the labour market was mainly conditioned by their financial situation (68%). Almost two thirds of respondents combining receiving benefits with work stated that the received pension was not sufficient to meet current needs, which was the main reason to participate in the labour market.

It should be noted that the secondary economic activity of pensioners is of a multidimensional meaning. It affects eliminating socio-economic inequalities. In terms of on personal and individual level, professional work can be regarded in two aspects, namely the material and immaterial one. In terms of the material aspect, it guarantees an income and contributes to improving the quality of life, both during the professional activity and afterwards. Combining work and receiving pension is not just an additional pay, but also an increase of the amount of pensions in the future. In terms of the immaterial aspect, it has many functions very important for every person. Through work the man meets important psychosocial needs, which include self-esteem, usefulness and fulfilment. Work of pensioners also affects the increase in revenue to the pension

FIGURE 6.

system. On the other hand, receiving too high work income helps to reduce its expenses by reducing or suspending the benefits, which has a positive effect on the financial situation of the pension system.

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Anna GRZEŚ¹

TEMPORARY WORK AGENCIES AND UNEMPLOYMENT IN POLAND

Summary

During the last several years most European countries have noted a rapid increase in the share of temporary employment in the total number of employees. Among the forms of temporary employment have dominated: fixed-term employment contracts and temporary work agencies employment. [OECD]. Poland was located among the top of the countries with rapidly growing temporary employment and high unemployment.

In 2003, Poland introduced regulations regarding the employment of temporary workers. There was a sharp increase in demand for the services of temporary work agencies. The number of temporary workers rose from 0.23% of total employment in 2003 to 3.27% in 2012. Using empirical data, the author analyses the impact of temporary work agencies on the number of the unemployed. The results show that with the increase in the number of temporary work agencies, the number of the unemployed fell. Each agency employed an average of 795 unemployed. The largest group of temporary workers were those unemployed for 6 to 24 months.

Key words: temporary work agencies (TWAs), unemployment, Poland, temporary workers, employer -user.

1. Introduction

As business entities remain under constant pressure to improve efficiency, they are forced to seek new ways to reduce the costs of their activity or to achieve greater flexibility, which requires a partial replacement of fixed costs with variable costs, commensurate with the volume of produced goods and services. Among the most significant expenses of firms are costs of labour, which in many companies have undergone considerable modifications, mainly because of increased flexibility of the labour market and the associated changes in the labour law. Traditional contracts are being displaced by new flexible forms of employment, such as temporary contracts, telecommuting, self-employment, job sharing, management contracts, or outsourcing, enabling firms to adjust staff numbers as well as employment structure and rules to their needs, depending on the type and magnitude of performed tasks [*Elastyczne formy zatrudnienia*..., 2003, pp. 122-145]. These forms of employment are to ensure more flexible time and place of work, and alter the employee-employer relationships, as well as pay scales and job descriptions.

¹ Anna Grześ, Ph.D - Faculty of Economics and Management, University of Bialystok, e-mail: agrzes@uwb.edu.pl

Temporary work is a flexible form of employment which is immensely greatly popular with companies in Poland and most European countries. Employment relationship is here established among three parties: temporary work agency (employer), temporary employee, and employer-user (agency's customer). The activities of temporary work agencies has became the subject of discussion among researchers and the public due to the growing interest in this form of employment and its deregulation in many countries. Services provided by the agencies may be perceived as a substitute for regular employment. Typical research questions are concerned with such areas of research as determinants of the using of services of temporary work agencies [Forde, Slater, 2005, pp. 249-277; Vidal, Tigges, 2009, pp. 55-72; Spytek-Bandurska, Szylko-Skoczny, 2008], the productivity of TWAs [Hirsh, Mueller, 2011, pp. 216-235], TWAs as a stepping stone to regular employment [Author, Houseman, 2010, pp. 96-128; Ichino et al., 2008, pp. 305-327]. Also data from the three largest temporary work agencies: Adecco, Work Service and Work Express, indicate that the number of contracts signed by these organisations with companies in need of staff grows along with the rise in unemployment rates [Wesolowska, 2012]. For instance, Adecco Poland report that in the third quarter of 2013, they were employing a record 11,450 temporary workers, 84% more than a year earlier. Similarly, studies conducted by the International Confederation of Private Employment Agencies and Boston Consulting Group on sample data from 46 countries across the world, including Poland, show that work agencies (incl. temporary work agencies) contribute to a reduction of unemployment by providing jobs to growing numbers of persons and help find a balance between supply and demand for labour.

These observations have prompted the author's interest in the link between temporary work agencies and the rate of unemployment in Poland, as expressed by the number of registered unemployed. The purpose of this paper is to analyse the dependence between the activity of temporary work agencies and the changes in the level of unemployment in Poland during the period 2003-2012.

On the basis of the above data, one can formulate a tentative hypothesis that temporary work agencies take care of a large proportion of the unemployed and provide a solution to slow down the rise in unemployment in Poland. To achieve the aim and verificate the hypothesis it will be used the following research methods: dynamics analysis of variables, basic statistical measures, correlation and linear regression model.

2. Legal and economic conditions of TWAs activity

Temporary work agencies are a type of labour market entity, and more precisely a type of employment agency. Under the Polish law, these organisations must function in accordance with the Act on the Promotion of Employment and Labour Market Institutions of April 20th, 2004 [Journal of Laws of 2008, No. 69, item 415 with further amendments], the Act on the Freedom of Business Activity of July 2nd, 2004 [Journal of Laws of 2004, No. 173, item 1807, with further amendments], the Act on the Employment of Temporary Workers of July 9th, 2003 [Journal of Laws of 2003, No. 166, item 1608, with further amendments], and the Regulation of the Minister Economy and Labour of October 13th, 2005 on the registration of entities conducting employment agencies and information submitted by employment agencies [Journal of Laws of 2005, No. 212, item 1770]. Article 18 of the Act on Promotion of Employment and Labour Market Institutions stipulates that work agencies provide employment services, both in Poland and abroad, as well as services regarding HR counselling, job counselling, and temporary work, and are entered in the regulated activity register of the relevant marshal's office. Such an entity can provide services in one, several, or all of the above-mentioned fields, and is obliged to submit annual reports on its activity to the marshal of the relevant voivodeship.

Under the Polish law, temporary work, as a flexible (non-standard) form of employment is also regulated by the Act on the Employment of Temporary Workers. This law rules that the formula of temporary work encompasses three entities: the employee, the employer-user and the temporary work agency (as employer). A temporary employee is taken on by a temporary work agency on the basis of a fixed-term employment contract, a contract for a specified task, or a civil law agreement. The maximum length of time for employment by a single employer is 18 months within 36 consecutive months [Art. 20 of The Act on the Amendment to the Act on the Employment of Temporary Workers, Journal of Laws of 2009 No. 221, item 1737]. This period was extended from 12 to 18 months in 2009. According to the representatives of the Association of Employment Agencies (SAZ), the change was extremely important for maintaining the employment of workers hired for projects whose implementation requires more than one year. The amendment has also benefited employers from smaller towns, since the limit of 12 months made rotation of temporary workers among a small number of companies difficult [Od dziś obowiazują, electronic document: http://www.saz.org.pl/a,662,Od_dzis_obowiazuja_nowe_przepisy_o_pracy_tymcz asowej.html, date of access: 06.11.2013].

The Act on the Employment of Temporary Workers states that a temporary work agency and an employer-user agree on: 1. type of job, 2. expected term of employment, 3. qualification requirements, 4. working time, 5. place of work, 6. scope of information on temporary work necessary to calculate remuneration and working time, 7. duties resulting from health and safety at work regulations, 8. terms regarding holiday entitlement of workers employed by a given employer-user on contracts shorter than six months.

Under the Act on the Employment of Temporary Workers, employer-users are obliged to: 1. provide temporary employees with healthy and safe working conditions which are compliant with health and safety regulations, 2. keep records of working time, 3. permit holiday leaves for workers employed by them for more than six months, 4. provide professional training to workers employed for more than six weeks. The employer-user must not assign tasks other than those specified in the contract signed with a temporary work agency or offer temporary workers working and employment conditions inferior to those given to full time staff.

A legal framework for this form of employment is also provided by the European Parliament and Council Directive of November 19th, 2008 on temporary agency work. The document emphasises that temporary work is a solution to meet the needs of both

entrepreneurs (flexibility) and employees (reconciling family and professional life). It is also noticed that there exist large disparities across EU member states as regards the legal status of temporary employees and their working conditions. The discussed document was designed to ensure the safety of temporary workers and improve the quality of temporary employment by implementing the principle of equal treatment of temporary workers as compared with regular workers in matters of employment and working conditions. According to Article 5, item 1 of the Directive, an employer-user is required to guarantee that temporary workers have at least the same basic working and employment conditions as those that would apply if they had been recruited directly by the employer for the same position. The listed conditions include matters connected with: working time, overtime, breaks, rest periods, night work, holidays and public holidays, as well as the protection of pregnant women and nursing mothers, the protection of children and young people, equal treatment for men and women, the combat of discrimination based on sex, race or ethnic origin, religion, age, etc. They must be compliant with the binding legislative, regulatory or administrative provisions, collective labour agreements and other general provisions that are currently in force [Directive 2008/104/EC..., 2008].

The representatives of Polish HR Forum believe that the market of employment agencies in EU countries used to be extremely varied in terms of legal regulations. For instance, in Great Britain the sector was mainly regulated by free market mechanisms. It was not until the introduction of the analysed Directive, after the 12-week transition period, that temporary and permanent workers were formally declared as equal. In the Netherlands, the work agency sector was regulated by means of collective agreements. Neither of the two countries mentioned above had provisions concerning the maximum duration of employment. In Poland, meanwhile, the relevant regulations were laid down in the Act on the Employment of Temporary Workers, the Polish Labour Code and related acts, and – to a limited extent – by collective agreements. The substantial discrepancies in the applied solutions caused initial difficulties in the implementation of the Directive, which was to become a 'happy medium', i.e. to provide appropriate protection of temporary workers and to restrict the freedom of employment agencies [CIETT, 2013].

Taking into consideration the economic context of the cited legal provisions, it has to be said that for employer-users the profitability of hiring temporary workers in Poland is mainly a result of the increased freedom to employ and dismiss staff. The rules stipulating that: 1. a third fixed-term contract must by right become a permanent employment contract [Art. 25 of the Labour Code] and that 2. the employer must extend a fixed-term or probationary period contract of a pregnant employee until the day she gives birth, provided that the contract would expire after the third month of the pregnancy (Art. 177 of the Labour Code] do not apply to temporary workers. Moreover, employers are not legally compelled by the Group Redundancy Act [Journal of Laws of 2003, No. 90, item 844].

Also the lengthening of employment duration should be seen as advantageous for employer-users, since excessive fluctuation of workers taken on for some tasks, e.g. projects, generally results in a worsening of the final outcome and causes delays in their completion. In addition, this amendment caters for the needs of employers in terms of flexibility of employment and maintaining/lowering labour costs [see also Nunziata, Staffolani, 2007, pp.72-104]. However, Miles [2000 pp. 74-101] and the Author [2003, pp.1-42] present empirical evidence of a positive correlation between employment protection and the development of the market of temporary work agencies in the USA. Also the OECD uses indicators of the strictness of employment protection legislation in temporary agency and regular jobs. The greater the relative difference between these indicators, the more likely it seems that employers will hire temporary workers. This is because with an economic downturn and diminished demand for products and services, it is much faster and cheaper to make redundancies among temporary workers (particularly those on civil law contracts) than among regular employees. Nevertheless, a rise in temporary employment can strongly depend on the extent in which work agencies are influenced by the requirements of employment protection legislation [see Baumann, et al, 2011, pp. 308-329] and may be associated with malpractices as regards certain types of jobs, or with the fact that employer-users choose to conclude civil law agreements rather than fixed-term contracts or contracts for a specific task. OECD data for 2013 on employment protection in Polish business entities reveal that the weakest protection was observed in the case of civil law agreements (0.5 on a 0-6 scale), temporary job contracts (1.8), and individual and collective dismissals (-2.4) [OECD Database Employment, 2013].

What is more, the change in the form of employment helps reduce such fixed costs as marked-up costs of remuneration incurred regardless of revenue levels and results in a rise of those variable costs whose level depends on demand for manufactured goods. Similarly, when a shortage of staff occurs because of a temporary increase in labour demand resulting, e.g., from a larger than usual number of orders, seasonal jobs or absence of regular employees, temporary work is a relatively cost-effective solution. That is why this form of employment is increasingly popular with employer-users. The growing demand for temporary workers has led to a proliferation of temporary work agencies.

This form of employment is relatively frequently used by companies with foreign capital, when the mother company refuses permission to employ more staff despite increased demand for labour in certain periods. Hiring temporary workers, who are not included in the company personnel statistics, provides a convenient solution to the problem. Temporary employment is also useful for firms operating in special economic zones and taking advantage of preferential conditions for business activity. This is because, regardless of their financial results, they are obliged to maintain a predetermined average annual number of full-time equivalent employees over an agreed period of time. Otherwise they have to return public subsidies, which would place them under considerable financial strain.

Among the results of a dynamic development of temporary work agencies in Poland, growing numbers of employer-users and temporary workers, as well as the necessity to adjust Polish legislation to the EU directive, is the fact that 222 entities have already been subjected to inspection by the National Labour Inspectorate. The institution's 2012 report confirmed the fact that employers overused civil law agreements, as 19% of

the surveyed workers were employed on such a basis even though they should have concluded temporary work contracts. An even more frequent transgression committed by temporary work agencies was failure to pay on time of remuneration for work and other labour-related benefits. Such was the case in 46% of the surveyed employees. The inspection also included employer-users. It was found that 18% of the controlled entities had infringed health and safety regulations, while 24.2% of them burdened temporary workers with tasks other than those prescribed by Art. 2, item 3 of the Act on the Employment of Temporary Workers. Other irregularities concerned non-compliance with the obligation to undergo health and safety training before commencement of work [PIP, 2013, p. 158].

As was already mentioned in the introduction, the growing popularity of temporary employment is a relatively widespread phenomenon, inevitable in many economies. The rise in the share of temporary workers in the employment structure is compatible with the concept created by Ch. Handy [1998], who stresses the need for diversification of staff. He compares an organisation to a three-leaved shamrock, as it can be said to encompass three types of workers which differ in their outlooks, are managed by means of different methods, are differently remunerated and vary in terms of internal structure. These three groups are: 1). professional core – key employees who are essential for the very existence of the organisation, and who are sought-after in the labour market because of their professional experience, qualifications, pay, time and cost of recruitment; 2). contractual professionals – important for the rhythm and continuity of the processes taking place in the organisation, relatively easy to find in the labour market; and 3). technical and service staff (self-employed specialists, temporary workers, freelancers), easy to find without the necessity to incur high expenses.

Temporary employment is becoming increasingly common since global economies, having experienced a serious worsening of their situation, have begun to return to the expected level of performance [Luo et al, 2010, pp. 3-16; Cappelli, Keller, 2013, pp. 576-596]. The staffing sector has considerably expanded: as many as 46 million people worked as agency employees in 2011. There are 140,000 private employment agencies providing organisations with temporary, leased, and temp-to-perm workers, who work as many hours as 12.4 million full-time employees. Meanwhile, global total annual sales revenues reached €259 billion. Penetration rate for agency work in Europe was 1.6%, while Poland and Germany took increasing advantage of temporary work to build their economic potentials [CIETT, 2013].

In 2004, when the Temporary Employment Act was passed in Germany, the country saw a steep rise in the number of temporary workers. Using empirical data from the Socio-Economic Panel Study (SOEP) of the German Institute for Economic Research (DIW), M. Garz [2013 pp. 307-326] analyses the impact of the deregulation on employment and pay levels. He observes that no significant changes in overall employment rates have been noted since regular workers started to be replaced by temporary ones. The share of regular employees in total employment (70.1% in 2003) revealed an irregular upward trend until 2009 (when regular employees accounted for slightly over 76% of all the employed). As the percentage of regular workers grew, so did the share of temporary workers in overall employment: from 1.01% before the reform
to 1.73% after the reform, until 2006, and later fell slightly, reaching ca. 1.6% in 2010. The unemployment rate remained at basically the same level of 6.94-6.98%. There was, however, an increase in the gap between the pay levels of regular and temporary workers, which proves that companies resorted to temporary employment to reduce the costs of labour. This was mainly achieved thanks to a greater number of worse-paid temporary workers as opposed to regular employees.

The favourable image of temporary work is slightly marred by the results of research conducted by M. Król [2011, pp. 341-349] into the degree of professional commitment of a sample group of 197 respondents. The study revealed a discrepancy between declared and perceived commitment. Although the respondents claimed to be fairly deeply committed to their jobs, their perceived attitudes did not confirm the existence of such commitment. They usually pointed to stability and length of service as factors which enhanced professional commitment, and which are obviously not guaranteed by temporary employment. The level commitment of temporary workers was also rated as very poor by the surveyed employers. It should be noted that the above factors are contradictory with the very idea of temporary employment and the significant reduction in the number of the unemployed resulting from the growing popularity of this form of flexible work arrangement. The available literature is lacking in analyses of the influence of temporary job agencies on the unemployment rate in Poland. But before this correlation is investigated and presented in the form of an econometric model, this paper will provide a brief history of the development of the agency sector in Poland, a discussion of the rising demand for agency services among employer-users, as well as a review of the changes in the number of unemployed and employed persons in the Polish economy.

3. Development of temporary work agency sector in Poland 2003-2012 in the light of statistical data

The Act on the Employment of Temporary Workers, of July 9th, 2003 and the Act on Promotion of Employment and Labour Market Institutions, of April 20th, 2004 laid the legal foundations for the operation of temporary work agencies in Poland. In view of the above, the presented analysis uses data for the period 2003-2012 and is based on statistics obtained from public labour institutions as well as on annual reports on temporary work agencies published by the Department of Labour Market of the Ministry of Labour and Social Policy (MPiPS) [http://www.psz.praca.gov.pl/main. php?do=ShowPage&nPID=867997&pT=details&sP=CONTENT,objectID,867970, data of access: 10.12.2013]. Similar data concerning the number of the unemployed and the unemployment rates were taken from labour market statistics available on the website of the MPiPS and Local Data Bank of Central Statistical Office of Poland [http://stat.gov.pl/bdl/app/dane_podgrup.dims?p_id=813177&p_token=0.386288 2809673729, date of access: 10.12.2013)]. According to the statistical data, the first temporary work agencies in Poland were registered in 2003 and have since become an inherent part of the labour market as an employer that provides labour services to employer-users via temporary workers who were previously unemployed, or who sought additional employment in order to improve their economic circumstances. Figure 1. illustrates the distribution of the number of temporary work agencies operating on the Polish market and of the employer-users who were their customers in the analysed period.



Temporary work agencies and employer-users in 2003-2012

FIGURE 1.

Source: [Informacja o działalności agencji zatrudnienia..., 2004-2013; Statystyki strukturalne..., 2004-2013; Local Data Bank...].

The aggregate data included in Fig.1 show that in Poland the work agency sector was developing dynamically, though unevenly. In 2003, 56 entities of this type were entered in the Register of Employment Agencies, to reach as many as 1509 agencies at the end of 2012. As the curve depicting the number of agencies clearly demonstrates, a sharp rise in their number took place between 2003 and 2008. The number of employers who used work agency services grew at a roughly similar pace. This confirms the existence of demand for the services offered by the agencies. In 2009, the growing trend was reversed and the number of TWAs dropped by nearly a half, i.e. by 1088. The year 2010 brought a closure of another 68 agencies. The decline of 2009 was a direct result of the previous year's decrease in the number of employer-users in need of employment services from 11,938 to 10,825 (i.e. by 5.1%). Other reasons included: ongoing global economic crisis, the processes of consolidation and specialisation of work agencies, deletion from the commercial register of 20% of the agencies operating in 2009, as they had failed to comply with binding regulations (Agencje zatrudnienia 2009), and a closure of smaller entities which had been unable to compete in the market. To verify the above conclusion, the following indicators were calculated: the number of employees per one

agency and the number of temporary workers per one employer-user. This is illustrated by Figure 2., which shows that the numbers of workers per agency varied widely.



Temporary workers per 1 employer-user and per 1 agency

Source: [Informacja o działalności agencji zatrudnienia..., 2004-2013; Statystyki strukturalne..., 2004-2013; Local Data Bank...].

After the first two years of their functioning in Poland, many new agencies emerged. However, while it was relatively easy to establish such institutions, the falling demand for employment services made it difficult for their owners to continue business operations. Meanwhile, the average number of temporary workers per one employer-user continued to be fairly steady and averaged about 40 persons.

Despite the decrease in the number of agencies in 2009, the number of employer-users rose by 1 unit, reaching 10,826. The demand for agency services among employer-users kept growing until 2011, to fall slightly in the last of the analysed years (by 1pp). This was caused by the relatively dynamic, although less so in 2012, rise in the number of new agencies in the market. The number of agencies in operation at the end of 2012 accounted for nearly 70% of their population of 2008.

A comparison of the sets of employer-users and temporary workers shows that, although the latter's number fell by 20% between years 2008 and 2009, the former remained at the same level. This means that in 2009 some employer-users, in an attempt to safeguard their business against the effects of the crisis, reduced their demand for the services provided by temporary workers. After 2010, having realised that the economic effects of the crisis were not acutely felt, but at the same time being aware of the situation in the labour market and of the economic slowdown, some of the employer-users again started to resort to this flexible form of employment. As a result, as early as in 2011, the number of temporary workers exceeded that recorded in 2007. The growing popularity of temporary work is confirmed by the rise in the number of temporary workers: from 0.23% in 2003 to 3.27% in 2012. This proves that employers tended to eschew

FIGURE 2.

conventional employment contracts in favour of alternative solutions, such as temporary work.

A preliminary analysis of the relationship between the numbers of temporary workers and the unemployed is also performed by the author of the present paper. Its results are presented in Figure 3.

The data included in Figure 3. demonstrate that in 2003, nearly 3,176,000 unemployed persons were registered in Poland. In the years 2003-2008, this figure shrank to 1,474,000. Such a substantial decrease in the number of the unemployed was accompanied by a steep rise (by 442,000) in the number of temporary workers. This means that around 26% of the unemployed joined the temporary workforce who were increasingly sought-after by employer-users wishing to lower their labour expenditures and improve the efficiency of their companies. When the situation of employers had worsened as a result of the economic slowdown, the number of the unemployed soared, which led to, as was mentioned earlier, a short-term decrease in the number of temporary workers. Since 2010, a reverse trend has been noted: the number of the unemployed has continued to grow steadily, though less dynamically, whereas the number of temporary workers is rising quite rapidly, which seems to confirm the predominant tendency of managers to take on temporary workers rather regular employees.

FIGURE 3. Unemployed persons and temporary workers (in thousands) in years 2003-2012



Source: [Informacja o działalności agencji zatrudnienia..., 2004-2013; Statystyki strukturalne..., 2004-2013; Local Data Bank...].

In order to illustrate the dispersion of the above variables by means of basic measures of descriptive statistics, I calculated the arithmetic mean, standard deviation and the coefficients of variation for the selected variables. I chose the classical coefficient of variation because the data used in the study regard all the observations, as illustrated by Table 1. The data in Table 1. reveal that the analysed variables (apart from the number of persons employed in the Polish economy) were characterised by a coefficient of variation higher than 10%. The coefficient of variation illustrates the relative dispersion, dependent on the arithmetic mean, of a given feature of each analysed variable. The above coefficients of variation are in a range between 25-45%. Average dispersion (20-40%) is observed in the case of such features as: the number of unemployed (25.1%), temporary workers on civil law agreements (30.08%), and temporary workers on job contracts (37.55%). The relatively large dispersion occurs variables such as: the number of temporary work agencies (52.8%), the number of employers users (52.3%). Having analysed these data, I propose a preliminary hypothesis that there exists a link between the establishment of TWAs and the changing numbers of the unemployed.

TABLE 1.

| T. | 14 | 0. 1 1 | 0 6 |
|---|----------|-------------|------------------------|
| Item | Mean | Standard | Coefficient |
| | | deviation S | of variation |
| | | | (CV) in % ² |
| Number of employed in economy (in | 14,965.7 | 858.9 | 5.7 |
| thousands) | | | |
| Number of temporary work agencies | 1,164.04 | 615.03 | 52.8 |
| Unemployment rate | 14.3% | 3.5% | 24.6 |
| Total unemployed (in thousands) | 2,244.5 | 562.8 | 25.1 |
| Number of employer-users | 8,330.3 | 4,358.9 | 52.3 |
| Temporary workers on employment | 44.5% | 16.7% | 37.55 |
| contracts | | | |
| Temporary workers on civil law agreements | 55.5% | 16.7% | 30.08 |
| in persons | | | |
| Number of temporary workers | 347.7 | 166.1 | 47.8 |
| Share of temporary workers in total | 2.3% | 1.0% | 45.3 |
| employment | | | |
| Number of temporary workers per one | 349.7 | 128.0 | 36.6 |
| work agency | | | |
| Number of temporary workers per one | 46.3 | 21.9 | 47.3 |
| employer-user | | | |

Basic measures of variables; years 2003-2012

Source: Author's calculations.

4. Empirical analysis of the relationship between the number of unemployed persons and the number of temporary work agencies

In view of the aim of the paper, and taking into account available literature on the subject as well as the above considerations of the changes occurring in the years 2003-2012, I ventured to perform an analysis of the relationship between the number of

² If the coefficient of variation does not exceed 10%, the dispersion of characteristics is a statistically insignificant [Zeliaś, 2000].

temporary work agencies and the number of unemployed persons registered in Polish job centres, using the Pearson product-moment correlation coefficient for 10 consecutive years, i.e. N=10 observations, and then by means of a descriptive econometric model. Analysis of the correlations among the variables will make it possible to determine their degree of interdependence and to verify the rationale for the selection of exogenous variables for the econometric model.

After correlation analysis, the values of the variables are as follows:

TABLE 2.

| Item | Number of agencies (X) | Total number of unemployed (Y) |
|--------------------------------|------------------------|--------------------------------|
| Number of agencies (X) | 1 | -0.8804 |
| Total number of unemployed (Y) | -0.8804 | 1 |

Correlation coefficients of potential variables X and Y

Source: Own accounts.

It stems from the above that the correlation coefficient between the number of agencies and the number of unemployed persons is around -0.8804. This indicates a strong negative dependence: a rise in the number of agencies leads to a drop in the number of the unemployed.

The next step of the analysis was to investigate the dependence between the number of agencies and the number of the unemployed in the years 2003-2012. Taking the number of agencies as the exogenous variable X and the number of the unemployed as the endogenous variable Y, I constructed a scatter plot with a trendline (Fig.4) in order to identify an appropriate regression function and express it in the form of a mathematical function.

I made a preliminary assumption that the regression function takes the form of a simple linear regression with using the method of least squares:

$$Y = \alpha_0 + \alpha_1 X + \varepsilon, \tag{1}$$

where: Y is a dependent variable, X – independent variable, α_0 , α_1 – unknown model parameters estimated from the data, ε – the error term. Also α_1 denotes the slope of regression line, α_0 – the Y-intercept.

Analysis of the scatter plot showed that linear regression does yield the best fit for the coefficient of determination R^2 and so the above linear model (1) can be used to describe the relationship. The coefficient R^2 best explains the percentage of variance for the variable Y which can be ascribed to the influence of the variable X.

In order to assess the regression model for the number of the unemployed (Y) and the number of temporary work agencies (X), parameters α_0 , α_1 were calculated using the function of regression. The studied model takes the form of the following equation:

$$Y = 3\,165\,999.08 - 794.61 \mathrm{X}.$$



FIGURE 4. Scatter plot for relationship between variable Y and variable X

Source: Own accounts.

Next, I checked the significance of the structural parameters of the model so as to find out whether the exogenous variable X has a significant influence on the endogenous variable Y. To achieve this, I verified the zero hypothesis.

temporary agencies

H₀: $[\alpha_1 = 0]$ against the alternative hypothesis H₁: $[\alpha_1 \neq 0]$.

Table 3. contains statistics calculated for this function.

TABLE 3.

Estimation model of simple linear regression with using the method of least squares for equation (2), N=10 and α =0,05; dependent variable(Y) = number of unemployed

| Item | Coefficients | Standard error. | t-Studenta | p-value |
|----------------|--------------|-----------------|------------|-----------|
| const | 3,165,999.08 | 196971 | 16.0734 | < 0.00001 |
| Number of TWAs | -794,611 | 151,298 | -5.2520 | 0.00077 |

| R-squared | 0.775175 | Multiple of B | 0 747071 |
|-----------------------------|----------|-------------------------------|----------|
| The sum of squared | 6.41e+11 | Standard error | 283042.5 |
| residuals | | | |
| F(1, 8) | 27.58318 | Value p for test F | 0.000772 |
| LM-test for nonlinearity | 0.278517 | Value p for nonlinearity test | 0.597675 |
| Value p for test chi-square | 0.87777 | Value p for test White | 0.086411 |

Source: Own accounts.

From the data in Tab. 3 it can be inferred that the total variation of the number of the unemployed is in 77.52% explicable by the number of TWAs, which means that the fit of model to the data is good. The standard error of 283,042.521 denotes an arithmetic mean deviation of 12.60%. Also the Fisher-Snedecor statistics value, with the assumed level of significance at 0.05 and df=1;8, demonstrates that the significance coefficient F amounts to $0.000772 \le 0.05$, while its value $F_{estim} = 27.58 \ge F_{crit} = 5.8$, which means that the test is statistically significant. Therefore, we must reject the hypothesis of the lack of influence of the exogenous variable X. To determine the significance of the relationship between the variables, the 'R' coefficient was tested with the aid of the t-Student test, by comparing t_{crit} with t_{estim} . Assuming the level of significance to be p=0.05, with 8 degrees of freedom, the t_{crit} equals 2.306. Thus $t_{estim} = 16.073 > t_{crit} = 2.306$. Likewise, the t-Student distribution shows that the variable X has a significant impact on the endogenous variable Y. Also testing hypotesisis of the linear regression model with using LM-test, test White, chi-squere test proves corect their assumptions. The linear regression coefficient reflects the strength of interdependence between the variables under study. It can be concluded that there is a 95-percent likelihood that each newlyestablished temporary work agency led to a decrease in the number of the unemployed by nearly 795 persons on average.

The set of the unemployed is varied in terms of the length of the unemployment period. According to official statistics, the structure of the registered unemployed was as follows (Table 4.).

| Year | Unemployed | | | | | | | | |
|------|----------------------|------------------|------------------|-------------------|--------------------|-------------------|--|--|--|
| | Less than 1 month | 1 to 3 months | 4 to 6 months | 7 to 12 months | 13 to 24 months | over 24 months | | | |
| 2003 | 6.6 | 12.9 | 12.4 | 15.5 | 18.8 | 33.7 | | | |
| 2004 | 6.8 | 13.2 | 12.2 | 15.5 | 17.0 | 35.1 | | | |
| 2005 | 7.1 | 14.8 | 13.3 | 14.6 | 15.5 | 34.7 | | | |
| 2006 | 7.1 | 15.6 | 13.3 | 14.5 | 15.4 | 33.9 | | | |
| 2007 | 9.2 | 17.9 | 14.0 | 13.8 | 13.9 | 31.1 | | | |
| 2008 | 12.4 | 23.3 | 15.8 | 14.2 | 12.2 | 21.7 | | | |
| 2009 | 10.4 | 23.9 | 19.7 | 20.1 | 12.8 | 13.0 | | | |
| 2010 | 11.2 | 22.9 | 18.3 | 18.4 | 17.1 | 11.9 | | | |
| 2011 | 9.4 | 19.5 | 17.5 | 18.9 | 19.2 | 15.3 | | | |
| 2012 | 9.6 | 19.6 | 17.2 | 18.0 | 17.6 | 17.8 | | | |

Structure of unemployed by duration of unemployment (in %)

TABLE 4.

Source: Own accounts.

It is evident from the data included in Tab. 4 that in the analysed period, the shares of particular groups of unemployed persons went through several changes. The slimmest of the groups comprises those who remained out of work up to 1 month, whereas the

members of the largest group were unemployed for over 24 months. The latter, however, shrank almost 3-fold between years 2003 and 2010, only to expand again in 2012, reaching 17.8%, i.e. a level comparable with the other groups. A similar trend can be observed among the unemployed who were out of work for more than 12 but fewer than 24 months. After 2007, the increase in all the above categories was a result of the economic slowdown caused by the global crisis, and the consequent wariness of entrepreneurs fearing further downturn in their situation. Observation of the economic practice of Polish business entities shows that the rise in unemployment could also have been brought about by increased use of technologies replacing human work and further modifications of the organisation of labour. However, to verify this, additional analyses that are beyond the scope of the present paper are required.

Obviously, the consequences of the global crisis were first, in 2007 and 2008, observable among the unemployed who had been out of work up to 6 months. A growth in the number of people out of work for more than 24 months occurred after two years. One might believe that some of the persons affected by the economic slump found it difficult to cope in the labour market and joined the ranks of the long-term unemployed. A question arises here: Which of the groups became of particular interest to temporary work agencies? To answer it, I gauged the interdependence of the compared charakteristics using a correlation coefficient of variables, i.e. the number of the unemployed according to the duration of unemployment and the number of temporary work agencies. The values for the coefficients are presented in Table 5.

TABLE 5.

| Item | Number of | Unemployed by duration of unemployment (in months) | | | | | | |
|----------------|-----------------|---|---------------------------|---------------------------|--------------------------|----------------------------|------------------------------|--|
| | agencies (Y) | Less than 1 (X ₁) | 1 -3 (X ₂) | 4- 6 (X ₃) | 7-12 (X ₄₎ | 13-24 (X ₅) | over 24 (X ₆) | |
| Y | 1.0 | -0.6069 | -0.5187 | -0.7971 | -0.9274 | -0.8743 | -0.6493 | |
| \mathbf{X}_1 | -0.6069 | 1.0 | 0.8356 | 0.7524 | 0.6625 | 0.4906 | 0.0365 | |
| X_2 | -0.5187 | 0.8356 | 1.0 | 0.8526 | 0.6453 | 0.3103 | -0.1317 | |
| X_3 | -0.7971 | 0.7524 | 0.8526 | 1.0 | 0.9335 | 0.7190 | 0.2920 | |
| X_4 | -0.9274 | 0.6625 | 0.6453 | 0.9335 | 1.0 | 0.8974 | 0.5684 | |
| X_5 | -0.8743 | 0.4906 | 0.3103 | 0.7190 | 0.8974 | 1.0 | 0.7693 | |
| X_6 | -0.6493 | 0.0365 | -0.1317 | 0.2920 | 0.5684 | 0.7693 | 1.0 | |

Correlation coefficients of TWAs and unemployed by duration of unemployment

Source: Own accounts.

When analysing the data in Tab. 5, it should be noted that there is a negative linear correlation between the number of agencies and the number of the unemployed according to length of unemployment. This means that a rise in the number of agencies will lead to a decrease in the average number of unemployed persons across the groups. This decrease varies from one group to another. A strong interdependence is observed between the

number of agencies and the number of those unemployed for 7-12 and 13-24 months: $r_{YX4} = -0.9274$ and $r_{YX5} = -0.8743$ respectively. A slightly less strong, although relatively high, correlation is found for persons without work for 4-6 months: $r_{YX3} = -0.7971$. In the other two groups the correlation is of average magnitude. In these two groups greater interest in searching for work is associated with satisfying of the basic needs (as defined by Maslow), such as physiological needs and safety needs, possible thanks to received remuneration.

5. Conclusion

In this study, I pose the following questions: How do temporary work agencies affect the level of unemployment? What decided about an increase in demand for the services of temporary work agencies, especially in the legal and economic context?

Using data from the Public Employment Services and Local Data Bank of the Central Statistical Office of Poland for the period 2003-2012, as well as the current legislation, I attempt to answer the above questions. After the legislation concerning TWAs came into force in 2003, the Polish sector of temporary employment started to expand dynamically. The growing demand for temporary employees, created employer-users and newly established agencies, led to a rise in the number of temporary workers from 0.23% of total employment in 2003 to 3.27% in 2012. It must be added that according to OECD 2011 data, temporary employment in Poland accounted for almost 27% of dependent employment, whereas in Germany, this proportion stood at 17.2% (Database Employment OECD). Analysis of the binding regulations on employing temporary workers reveals that the rising demand for this form of employment results from more liberal legislation, allowing employers to dismiss workers faster than is prescribed by the labour code or the mass redundancy act. Lower pay cost, reduced by the amount equal to social security seems to be another factor that explains this popularity. Observation of the business practice in Poland confirms that this form of employment has been used to decrease or maintain, despite the growing costs of business activity, the level of funds for remuneration, and to transfer some of the obligations associated with the employment process onto temporary work agencies.

Still another reason for choosing temporary employment is the shift in operational activity costs which consists in reducing the costs of pay (fixed costs) in favour of variable costs in the form of outsourced services. Reports of the National Labour Inspectorate confirm that temporary job contracts are overused as employers conclude them in disregard of the nature of contracted services and the period and form of employment. More than a half of the temporary workers were employed on civil law agreements, which do not guarantee any workers' privileges or job security. Short-term (4-6 months) contracts prevailed, which temporary workers concluded with their employers, i.e. temporary work agencies.

The presented statistical data for the period 2003-2012 demonstrate that the number of TWAs grew dynamically from 56 in 2003 to 2166 in 2008. In 2009, a suddenly decrease in the number of agencies took place, and in 2010, their number began to

grow once again, reaching nearly 70% of the state from 2007. There were several reasons for the drop in the number of agencies in 2008: weaker demand among employer-users caused by their apprehension of the global crisis, the diminishing profitability of agency activity (expressed as the number of workers per agency), deletion from the commercial register of 20% of the agencies which had failed to comply with the regulations, the processes of consolidation and specialisation of work agencies, and a rise in unemployment resulting from the restrictions in the numbers of full-time workers employed for economic, technical and organisational reasons.

In 2003, almost 3,176,000 unemployed persons were registered in Poland. In 2003-2008, this figure went down to 1,474,000 – a drop by 53.6%. Such a sharp decrease in the number of the unemployed was accompanied by a rise in the number of temporary workers by 443,000. This means that ca. 26% of the registered unemployed joined the ranks of temporary workers, who were increasingly sought after by employer-users interested in lowering labour costs and improving or maintaining efficiency. When the situation of employers had worsened as a result of the economic slowdown, the number of the unemployed soared, which led to, as was mentioned earlier, a short-term decrease in the number of temporary workers and an even steeper decrease in the number of TWAs. Since 2010, a reverse trend has been noted: the number of the unemployed has continued to grow steadily, though less dynamically, whereas the number of temporary workers is rising fairly rapidly, which seems to confirm the predominant tendency of managers to hire temporary workers rather regular employees taken on by TWAs, whose number has been gradually growing since 2011.

The analysis of the dependence between the number of temporary work agencies and the number of the unemployed registered in Polish labour offices, conducted by means of the Pearson product-moment correlation coefficient for 10 consecutive years of observation of two variables, yields a strong negative correlation (r = -0.8804), i.e. the number of the unemployed decreases along with the rising numbers of TWAs. The model of regression of the number of unemployed (Y) against the number of TWAs (X) proves that one work agency helped reduce the number of the unemployed by an average of 795 persons. Further study of the structure of the unemployed divided according to duration of unemployment demonstrated that TWAs were interested in jobless persons who had been out of work for 7-24 months, while the smallest proportion consisted of persons who had been unemployed less to one month or over 24 months. It should be concluded, therefore, that temporary work agencies are not very popular with people who have just lost a job or who are new to the labour market and are searching for other than temporary work. Also the long-term unemployed are not very interested in temporary work, since they have little motivation to undertake relatively poorly-paid employment, which will not last long, or for which they are insufficiently qualified. Further, more in-depth research is required to explain why job agencies show relatively weak interest in these groups of workers, and vice versa.

It should also be noted that TWAs are one of the employers that hire most frequently unemployed. For the part of temporary workers this form of employment that allows to find a permanent job and move from unemployment to employment. Can not be excluded that there are other reasons for the decrease in unemployment, for example: an increase in wages, an increase in unemployment benefits, an increase in the demand for labor and a higher propensity to employ on a fixed term employment contract, their previous experience of employers users and the like. Therefore, the obtained results indicate that relationship between number of TWAs and number of unemployed. Some of these factors are more difficult to verify and may be subject to further studies that investigate the changes in the number of unemployed.

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Maria MAJEWSKA, Eliza BUSZKOWSKA¹

THE CHANGES IN THE POSITION OF POLAND ON ITS INVESTMENT DEVELOPMENT PATH: THE RESULTS OF THE EMPIRICAL ANALYSIS

Summary

The aim of this paper was to indicate on which stage of an economic development path is probably Poland. The subject of this paper was one of the economic development paths, named usually the investment development path, which model has been shaped mainly by J. H. Dunning and R. Narula. This model is also similar to the model of the economic development path proposed by M. Porter. Therefore, were discussed the changes in the main elements of this model, which took place in the Polish economy in 1995-2012. Those elements were the trade structure diveded by the degree of technological sophistication, direct investment and indicators of economic performance. In order to verify if in the case of Poland have been occurred economic dependences assumed by the representatives of this model also was carried out correlation and regression analysis. The results of the study suggest that Poland shifted to the third stage of analyzed economic development path where more emphasis is placed on innovations as the country moves toward producing more technology intensive products.

Key words: economic development path, Poland

1. Introduction – the theoretical contributions

As presents the United Nations Development Group structural transformation for most developing countries means a transition from production and export of mineral and agricultural commodities toward more diversified and productive activities with higher value added. In emerging economies, to which Poland is still classified for instance, emphasis might be placed on increasing domestic demand, strengthening social protection, addressing inequalities and promoting innovations. Most low income countries may need to continue relying on export-led growth, as they simply do not have sufficient domestic demand, which also unfortunately occurs in Poland, inter alia, due to later underlined poverty among working. As countries attain higher development levels, the United Nations Development Group stresses the need of another kind of structural transformation – shifting toward more energy-efficient and less carbon-emitting sectors [United Nations Development Group, 2013].

¹ Dr hab. Maria Majewska – Faculty of Law and Administration, Adam Mickiewicz University, e-mail: mmajewska0@op.pl; Eliza Buszkowska, PhD – Faculty of Law and Administration, Adam Mickiewicz University, e-mail: eliza_b2@o2.pl.

The subject of this paper is one of the economic development paths, named the Investment Development Path, which model has been shaped systematically by different authors, e.g. T. Ozawa, J. H. Dunning, R. Narula and M. Porter. Porter in his model of an economic development path, which based on the theory of competitive advantage, distinguished four basic stages: manufacturing-led, investment-led, innovation-led and prosperity. Ozawa, Dunning and Narula in their works introduced to the M. Porter's framework the additional factor – inward and outward direct investment [Porter, 1985; Porter, 1990a; Porter, 1990b, pp. 73-93; Porter, 2000, pp. 15-35].

In this theoretical approach the inward and outward investment position of a country is tied with its economic development. At the beginning a country is a net inward receiver of foreign direct investment (FDI) and with an increasing economic development a country becomes a net outward investor. As a country develops, structural changes occur in the conditions faced by domestic and foreign companies, affecting direct investment inflows and outflows, which, in turn, change the country's economic structure. Therefore, in this approach are analyzed the dynamic relationships among levels of economic development, competitiveness and structural changes and the influence on these of inward and outward investment and foreign trade, with both export and direct investment of created asset-intensive products increasing their significance relative to national incomes of countries. Dunning and Narula point out, like in the endogenous growth theory, that FDI activity per se plays no role in development. The most significant contribution of multinational enterprises (MNEs) to the growth of productive capacity is indirect: where inward MNEs activity results in positive externalities, and when domestic firms have the capacity to internalize these externalities usefully, and if the non-firm sector supports domestic capacity building, there will be industrial development [Narula, Dunning, 2010, pp. 263-287].

According to J. Dunning, countries follow a path that consists of five stages, which are briefly described below. At stage 1 a less developed economy neither attracts, nor generates FDI. A country has the majority of its advantages in natural resources and its export sector consists mostly of labour-intensive manufacturing, such as textiles and agricultural and primary goods. Internal institutions and infrastructure are generally simple and underdeveloped.

At stage 2 industrializing developing economies attract FDI through their improved location advantages and perhaps generate minimum domestic direct investment (DDI), leading to a negative net investment position. A country still draws the majority of its advantages from natural resources, but starts to shift toward capital-intensive sectors and slightly more sophisticated and knowledge-intensive goods such as electrical products, clothing, or processed foods. Greater attention is paid to the infrastructure as well as the educational system.

At stage 3 there occurs a shift toward an industrialized economy. Governments modify policies in attempts to make their markets more competitive and open to the rest of the world. Governments also spend more on tertiary education institutions and still on infrastructure. More emphasis is placed on innovations as opposed to investment-driven growth as the country moves toward producing more sophisticated products that require relatively skilled labour. With the improvement of the country's technological capabilities and the expansion of enterprises to foreign markets, the country attracts significant FDI and generates DDI based also on its innovation activity. However, the net investment position remains negative.

At stage 4, local advantages of companies are more and more dependent on their endogenous assets as they begin to become more competitive with firms from other developed nations. A country should spend heavily on R&D as they seek to develop new products and innovative production methods. The role of government becomes more of one helping companies to cope with market imperfections as opposed to enhancing their markets. The net investment position becomes positive.

The last 5. stage, known in the literature as the knowledge-based economy, is characterized by comparative advantage in technology-intensive products. Additionally, research shows that certain emerging economies have leapfrogged along the development path, omitting the subsequent stages, as in the linear stages theory of economic development advanced by A. Gerschenkron [Ozawa, 1992, pp. 27-54; Narula, Dunning, 2000, pp. 141-167; Dunning, Kim, Lin, 2001, pp. 145-154; Majewska, Grala, 2002, pp. 69-85; Majewska, Grala, 2004, pp. 243-258; Fonseca, 2008, pp. 1-24; Ferencikova, Ferencikova, 2012, pp. 85-111; Stoian, 2013, pp. 615-637].

The main aim of this paper is to indicate on which stage of analyzed economic development path is probably Poland. Therefore, the changes will be presented in main elements of this model, which took place in the Polish economy. Those elements are the trade structure divided by the degree of technological sophistication, direct investment and indicators of economic performance. In order to verify if in the case of Poland have been occurred economic dependences assumed by the representatives of this model also will be carried out correlation and regression analysis.

The period between 1995 and 2012 was under our consideration. The data came mainly from the statistics of the United Nations Conference on Trade and Development (UNCTAD), as the organization gives access to the broad statistic of international trade structure, foreign and domestic direct investment as well as national accounts. Only data on R&D expenditures were taken from the statistics of the United Nations Educational, Scientific and Cultural Organization (UNESCO). All included in correlation and regression analysis variables were transformed into natural logarithms, except for percentages of particular groups of export, because in this case the use of logarithms is redundant. The correlation and regression analysis also was accounted for the time delays.

2. The analyzed economic development path: evidence from Poland

In view of the nature of the development path of a country presented in our paper as a segmentation criterion of trade structure was chosen the degree of technological sophistication. However, due to the marginal share of exports and imports of coin, which reached in almost all years the value 0, this group will be omitted in our analysis. Therefore, using the UNCTAD data in the study taken into account the following groups of products:

- 1. Exports and imports of primary commodities, precious stones and nonmonetary gold (EXPPC, IMPPC).
- 2. Exports and imports of manufactured goods by degree of manufacturing:
 - Labour-intensive and resource-intensive manufactures (EXPLRM, IMPLRM).
 - Low-skill and technology-intensive manufactures (EXPLSM, IMPLSM).
 - Medium-skill and technology-intensive manufactures (EXPMSM, IMPMSM).

- High-skill and technology-intensive manufactures (EXPHSM, IMPHSM).

In the literature it is widely assumed that with increasing technological sophistication of economy production, thus its exports, should grow productivity and hence welfare. For this reason one of the main conditions for passing a country on the analyzed path of economic development is to increase the share of industries with higher added value, and thus technological sophistication. Table 1 illustrates the structural changes in terms of technological sophistication in the Polish industry in 1995-2012 using the proxy of import and export structures. In 2012 which moved from third place in 1995. It exhibited an upward trend in 1996-2012 and after dropped by 4.4%. This was the biggest increase in the share of Polish exports - that is 15.5%. Compared with 1995 labour-intensive and resource-intensive exports moved from second to fourth place in terms of percentage of total exports and this was the biggest drop (12,85%) in 1995-2012. After 1999 one can see a downward trade. In 1995 exports of primary commodities, precious stones and non-monetary gold had the biggest share of Polish exports. In 2012 it dropped one position. Low-skill and technology-intensive exports gradually shrank with slight fluctuations. At the beginning of the period the share of high-skill and technologyintensive exports was the smallest and reached third place in 2012, with the increase by 7.34% in 1995-2012.

Poland's import structure was characterized by much lower fluctuation than exports regarding changes in terms of percentage. During the period considered, the share of medium-skill and high-skill technology-intensive imports maintained above 50%, and the share of labour-intensive and resource-intensive imports fell to the highest extent by 5%. This may indicate that there are still relatively large development needs of Polish industry and it takes place the implementation of technological progress by learning from the rest of the world. In the present competitive world technological progress does not depend only on own stock of the knowledge, as results of R&D activities, but also on absorption abilities of foreign knowledge. New theories of economic growth and international trade underline that the available stock of knowledge for the country is greater from produced, so Poland has the chance to accelerate its economic development in spite of too small investments in R&D activities. Consequently, this should lead to positive structural changes in production factor endowments, which indeed is reflected in the above-described changes in Polish export structure [Majewska-Bator, Jantoń-Drozdowska, 2007, pp. 115-127].

TABLE 1.

| Changes in | trade | structures | of Poland | in | %, | 1995-2012 |
|------------|-------|------------|-----------|----|----|-----------|
| | | | | | | |

| Year | Primary commodities, precious stones, non-monetary gold | | Labor resor inter | Labour and Lo resource- te intensive | | Low-skill and technology- intensive | | m-skill nd ology- nsive | High-s techn inter | kill and ology- nsive |
|------|---|-------|-------------------------|--|-------|---|-------|----------------------------------|--------------------------|-----------------------------|
| | EXP | IMP | EXP | IMP | EXP | IMP | EXP | IMP | EXP | IMP |
| 1995 | 28.74 | 25.31 | 27.20 | 15.95 | 16.12 | 7.42 | 16.80 | 26.38 | 11.13 | 24.94 |
| 1996 | 25.78 | 24.77 | 27.73 | 14.88 | 15.72 | 7.37 | 18.78 | 28.75 | 11.99 | 24.23 |
| 1997 | 27.12 | 22.34 | 27.19 | 14.41 | 12.40 | 7.39 | 19.97 | 30.94 | 13.31 | 24.93 |
| 1998 | 22.77 | 18.88 | 26.95 | 14.83 | 15.22 | 8.11 | 22.44 | 32.90 | 12.62 | 25.28 |
| 1999 | 21.30 | 18.65 | 27.56 | 14.48 | 14.32 | 7.91 | 24.81 | 32.02 | 11.99 | 26.93 |
| 2000 | 19.87 | 21.97 | 24.73 | 13.22 | 13.56 | 8.14 | 29.10 | 28.80 | 12.75 | 27.88 |
| 2001 | 19.22 | 21.27 | 24.07 | 13.73 | 15.25 | 9.39 | 29.05 | 28.49 | 12.43 | 27.13 |
| 2002 | 18.05 | 19.88 | 23.39 | 13.78 | 15.34 | 10.68 | 30.45 | 29.15 | 12.78 | 26.51 |
| 2003 | 17.61 | 19.35 | 22.74 | 13.23 | 14.69 | 11.59 | 32.08 | 30.52 | 12.88 | 25.32 |
| 2004 | 19.28 | 20.05 | 19.73 | 12.17 | 14.53 | 12.59 | 34.16 | 30.30 | 12.30 | 24.89 |
| 2005 | 20.18 | 22.78 | 18.25 | 11.31 | 13.24 | 11.64 | 35.39 | 28.87 | 12.93 | 25.40 |
| 2006 | 20.36 | 22.60 | 16.51 | 10.72 | 12.73 | 11.80 | 36.15 | 29.45 | 14.24 | 25.43 |
| 2007 | 19.04 | 22.43 | 16.01 | 10.38 | 13.24 | 12.51 | 36.72 | 29.87 | 14.98 | 24.80 |
| 2008 | 18.99 | 23.83 | 14.83 | 9.83 | 13.33 | 11.81 | 35.93 | 29.15 | 16.91 | 25.37 |
| 2009 | 19.12 | 22.53 | 15.22 | 10.92 | 10.89 | 10.28 | 35.27 | 28.02 | 19.49 | 28.24 |
| 2010 | 20.86 | 24.17 | 14.69 | 10.24 | 10.33 | 10.64 | 33.70 | 26.41 | 20.42 | 28.54 |
| 2011 | 22.04 | 26.85 | 14.57 | 10.06 | 11.75 | 11.06 | 33.57 | 26.26 | 18.07 | 25.77 |
| 2012 | 23.47 | 28.16 | 14.40 | 9.59 | 11.33 | 10.88 | 32.32 | 25.22 | 18.47 | 26.15 |

Source: own calculations, based on [UNCTADstat, International Trade in goods and services, Trade Structure by partner, product or service category, http://unctadstat.unctad.org/ReportFolders/report Folders.aspx., access data: 16.05.2014].

The changes in the nature of Poland's economic development path also can show merchandise trade specialization index calculated by the UNCTAD secretariat. Thus, table 2 presents the values of merchandise trade specialization index (TSI) which is used to measure the degree of specialization in the production/consumption of goods through trade. It compares the net flow of goods (exports minus imports) to the total flow of goods (exports plus imports). This is also known as normalized trade balance by product. The formula of this index is as follows: $TSI_{ji} = X_{ij} - M_{ij} / X_{ij} + M_{ij}$, where *i* is product or product groups, *j* economy, X_{ij} economy's *j* exports of goods *i*.

The range of values is between -1 and 1, the positive value indicates that an economy has net exports (hence it specializes on the production of that specific product) and negative values means that an economy imports more than it exports (net consumption). This index removes bias of high exports values due to significant re-exports activities, thus it is more suitable to identify real producers than traders [UNCTADstat, http://unctadstat.unctad.org/TableViewer/summary.aspx., date of access: 16.05.2014].

| Year | Primary commodities, precious stones, non- monetary gold manufactures | Labour and resource- intensive manufactures | Low-skill and technology- intensive manufactures | Medium-skill and technology- intensive manufactures | High-skill and technology- intensive Manufactures |
|------|--|--|---|---|--|
| 1995 | -0.054 | 0.148 | 0.264 | -0.331 | -0.479 |
| 1996 | -0.186 | 0.103 | 0.169 | -0.398 | -0.508 |
| 1997 | -0.150 | 0.070 | 0.011 | -0.435 | -0.509 |
| 1998 | -0.156 | 0.048 | 0.064 | -0.416 | -0.536 |
| 1999 | -0.192 | 0.061 | 0.036 | -0.370 | -0.582 |
| 2000 | -0.264 | 0.093 | 0.035 | -0.212 | -0.545 |
| 2001 | -0.214 | 0.113 | 0.075 | -0.156 | -0.506 |
| 2002 | -0.195 | 0.115 | 0.032 | -0.126 | -0.473 |
| 2003 | -0.166 | 0.150 | -0.002 | -0.095 | -0.429 |
| 2004 | -0.108 | 0.151 | -0.017 | -0.029 | -0.415 |
| 2005 | -0.123 | 0.174 | 0.001 | 0.039 | -0.380 |
| 2006 | -0.107 | 0.159 | -0.017 | 0.047 | -0.332 |
| 2007 | -0.152 | 0.145 | -0.043 | 0.032 | -0.312 |
| 2008 | -0.198 | 0.117 | -0.027 | 0.017 | -0.283 |
| 2009 | -0.115 | 0.132 | -0.004 | 0.082 | -0.215 |
| 2010 | -0.114 | 0.139 | -0.055 | 0.081 | -0.205 |
| 2011 | -0.139 | 0.143 | -0.011 | 0.081 | -0.215 |
| 2012 | -0.108 | 0.184 | 0.003 | 0.106 | -0.189 |

| Merchandise trade s | pecialization | indexes t | for Poland, | 1995-2012 |
|---------------------|---------------|-----------|-------------|-----------|
| | | | | |

TABLE 2.

Source: [UNCTADstat, International Trade in goods and services, Trade indicators: http://unctadstat. unctad.org/ReportFolders/reportFolders.aspx., date of access: 16.05.2014].

The values of merchandise trade specialization indexes show that the large increase in medium-skill and technology-intensive exports led to the emergence of specialization in this type of products in 2005. Additionally, the negative values of trade specialization indexes for high-skill and technology-intensive manufactures gradually decreased compared with 1995. Despite the above described positive changes in the structure of Polish foreign trade, the highest degree of specialization remains in labour-intensive and resource-intensive manufactures. But this does not imply that in comparison to other economies Poland is competitive in this regard, since its cost advantage is gradually decreasing when compared to countries with more resources of cheap labour and less developed. Maintaining by force the cost advantage by companies in Poland and not to make the reallocation of resources towards innovative activity and limit investment in human-capital formation, is therefore a bad strategy. Moreover, from the perspective of a long period it will have a strong regressive impact on national income, which is already observable.

This problem is stressed, for example, by specialists working for the Organisation for Economic Co-operation and Development (OECD) in report titled *OECD Economic Surveys: Poland 2014.* According to this report labour-cost pressures have been moderate, with real wages having risen less than labour productivity by a cumulated 20% since 2002.

Since 2002, wage increases have not matched the pace of labour productivity gains in any year except 2008, thereby improving cost competitiveness. Thus, the labour share of national income has fallen steadily, leading to one of the lowest levels in the OECD. This situation contributes to a further increase of working-poor in Poland, resulting in maintaining income gap between Poland and the rest of the world [OECD, 2014].

In order to see how different groups of trade distinguished by their technological content, impact on the productivity growth of Polish economy, passing Poland closer or away from the next stage of economic development, the analysis with Pearson linear correlation was performed (Table 3.). Therefore, the study covered the following indicators of Poland's economic performance: export *per capita*, which was calculated by divided Poland's export by its total population (EXP*pc*), GDP *per capita* (GDP*pc*), nominal gross national income *per capita* (GNI*pc*), gross domestic expenditure on R&D in purchasing power parity *per capita* (GERD*pc*), and value added *per capita* of total economic activity (TVE*pc*).

TABLE 3.

Correlation coefficients for relationship between groups of Polish exports in % and indicators of Poland's economic performance in USD in current prices *per capita*, 1995-2012

| | EXPPC t0 | EXPLRM _{t0} | EXPLSM _{t0} | EXPMSM t0 | EXPHSM _{t0} |
|----------------------|----------|----------------------|----------------------|-----------|----------------------|
| EXPpc _{t0} | -0.431 | -0.993* | -0.688* | 0.867* | 0.795* |
| EXPpc _{t+2} | -0.733* | -0.969* | -0.584* | 0.955* | 0.688* |
| | EXPPC t0 | EXPLRM _{t0} | EXPLSM _{t0} | EXPMSM t0 | EXPHSM _{t0} |
| GDPpc _{t0} | -0.378 | -0.978* | -0.703* | 0.815* | 0.837* |
| GDPpc _{t+2} | -0.655* | -0.978* | -0.637* | 0.925* | 0.715* |
| | EXPPC t0 | EXPLRM _{t0} | EXPLSM _{t0} | EXPMSM t0 | EXPHSM _{t0} |
| GNIpc _{t0} | -0.381 | -0.977* | -0.700* | 0.815* | 0.837* |
| GNIpc _{t+2} | -0.654* | -0.977* | -0.641* | 0.925* | 0.716* |
| | EXPPC t0 | EXPLRM _{t0} | EXPLSM _{t0} | EXPMSM t0 | EXPHSM _{t0} |
| GERD <i>pc</i> t0 | -0.267 | -0.807* | -0.807* | 0.664* | 0.928* |
| GERD <i>pc</i> t+2 | -0.505 | -0.934* | -0.745* | 0.781* | 0.912* |
| | EXPPC t0 | EXPLRM _{t0} | EXPLSM _{t0} | EXPMSM t0 | EXPHSM _{t0} |
| TVEpc _{t0} | -0.382 | -0.979* | -0.705* | 0.817* | 0.840* |
| TVEpc _{t+2} | -0.658* | -0.978* | -0.636* | 0.926* | 0.717* |

Note: *statistically significant coefficient at the level 0.05.

Source: own calculations, based on [UNCTADstat, International Trade in goods and services, National accounts, Population and labour force, http://unctadstat.unctad.org/ReportFolders/report Folders.aspx; http://www.uis.unesco.org/ScienceTechnology/Pages/research-and-development-statistics.aspx., date of access: 16.05.2014].

According to the earlier presented assumptions of the considered country's economic development path, also in the case of Poland in the relevant period occurred positive and statistically significant correlation of medium-skill and high skills technology-intensive exports with each indicator of economic performance. In contrast, labour-intensive and resource-intensive exports had the strongest negative and statistically significant correlation with each indicator of economic performance. There was also a statistically significant and negative relationship between all indicators of economic performance and low-skill and technology-intensive exports. All these relationships maintained statistically significant over time.

Another prerequisite for the achievement by a developing country the next stage of economic development is not so much the scale of inward direct investment but its positive influence on structural changes leading to a reallocation of production factors towards the sectors with higher added value that depends too on stressed above knowledge absorptive ability. In the analyzed model of economic development the authors also assume that the scale of domestic direct investment is positively correlated with an increase in technological progress of a given country and in cumulated experience of enterprises, which expand to foreign markets through exports [Drozdowska-Janton, Majewska, 2013, pp. 281-292].

Consequently, it was decided to perform Pearson's linear correlation to verify these assumptions for Poland (table 4). There was also carried out a linear regression analysis to check if it is a two-way dependence, and in which direction is stronger (Tables 5. and 6.). The country's net outward investment position is usually defined as the difference between outward direct investment stock (STDDI) and inward direct investment stock (STFDI) and therefore we have chosen these variables in our study.

TABLE 4.

| 1995-2012 | EXPPC t0 | EXPLRM t0 | EXPLSM t0 | EXPMSM t0 | EXPHSM t0 |
|-------------------------|-----------|------------|------------|------------|------------|
| STFDIpc t0 | -0.612* | -0.964* | -0.739* | 0.930* | 0.796* |
| STDDIpc t0 | -0.348 | -0.974* | -0.807* | 0.785* | 0.893* |
| 1995-2012 | EXPPC t0 | EXPLRM t0 | EXPLSM t0 | EXPMSM t0 | EXPHSM t0 |
| STFDI _{pc t+2} | -0.774* | -0.949* | -0.645* | 0.971* | 0.695* |
| STDDI _{pe t+2} | -0.605* | -0.988* | -0.696* | 0.898* | 0.773* |
| 1993-2012 | EXPPC t+2 | EXPLRM t+2 | EXPLSM t+2 | EXPMSM t+2 | EXPHSM t+2 |
| STFDIpc t0 | -0.631* | -0.939* | -0.761* | 0.920* | 0.807* |
| STFDIpc t0 | -0.354 | -0.930* | -0.841* | 0.739* | 0.942* |

Correlation coefficients for relationship between foreign direct investment stocks pc (STFDI_{pc}) and domestic direct investment stocks pc (STDDI_{pc}) in USD and groups of Polish exports in %, current prices, 1993-2012

Note: *statistically significant coefficient at the level 0.05.

Source: own calculations.

The result of the correlation analysis is a statistically significant relationship of STDDI *pc* and STFDI *pc* with all distinguished export groups except primary commodities, precious stones and non-monetary gold. The correlative relationship between STDDI *pc* and STFDI *pc* and labour-intensive and resource-intensive exports and low-skill and technology-intensive exports is negative. Thus, one can make the assumption, for example, as the volume of outward and inward direct investment grew, the share of these export groups decreased. In the case of medium-skill and high skills technology-intensive

exports the correlative relationship is positive. If the STDDI *pc* and STFDI *pc* increased, so did the shares of these export groups became bigger in the relevant period and vice versa. The strongest correlation occurred for labour-intensive and resource-intensive manufactures.

TABLE 5.

| Dependent variables | Regression coefficien | nt | Constant | R^2 | p-value | |
|-------------------------|------------------------|------------------------|------------------------|---------|---------|--|
| | Independent variables | | | | | |
| variables | I | EXPPC t0 | | | | |
| STFDI _{pc t0} | -0.212* | | 11.904* | | | |
| | S | STFDI _{pc t0} | | 0.374 | 0.007 | |
| EXPPC _{t0} | -1.766* | | 34.361* | | | |
| | E | XPLRM t0 | | | - | |
| STFDI _{pc t0} | -0.198* | | 11.511* | | | |
| | 5 | STFDI _{be t0} | | 0.930 | 0.000 | |
| EXPLRM t0 | -4.705* | | 55.609* | - | | |
| OTEDI | E | XPLSM t0 | 40.745* | | | |
| SIFDI _{pc t0} | -0.46 /* | | 13./15* | | | |
| EVDLOM | 1 1714 | SIFDI _{pc t0} | 22 100* | 0.547 | 0.000 | |
| EXPLSM t0 | -1.1/1* | VDMCM | 22.199* | | | |
| CTEDI | E. | APIM5IM t0 | 2 70.9* | | | |
| SIFDI _{pc t0} | 0.15/* | TEDL | 2.708* | 0.866 | 0.000 | |
| EVDMSM | 5 521* | STFD1 _{pc} t0 | 10.048* | - 0.800 | | |
| EAF WISTVI t0 | 5.521° | VDUSM . | -10.940 | | | |
| STEDL | 0.200* | AF1151VI t0 | 3.065* | | | |
| 511 D1pc to | 0.299 | STEDL | 3.005 | 0.634 | 0.000 | |
| EXPHSM.0 | 2 118* | $OIIDI_{\mathcal{H}}$ | -1 210 | | 0.000 | |
| 1.221 110101 (0 | EXPPC | | | | | |
| STEDI | -0.213* | | 12 11 3* | 0.600 | 0.000 | |
| 511 D1pt t+2 | -0.215 | | STEDI . | 0.000 | 0.000 | |
| EVDDC | 1 457* | | 21 207* | 0.200 | 0.005 | |
| EAPPC t+2 | -1.45/** | EXPLOY | 51.38/* | 0.398 | 0.005 | |
| EXPLRM to | | | | | | |
| STFDI _{pc t+2} | -0.169* | | 11.2/0* | 0.901 | 0.000 | |
| | | | STFDI _{pc t0} | | | |
| EXPLRM t+2 | -3.667* | | 46.203* | 0.882 | 0.000 | |
| | | | EXPLSM t0 | | | |
| STFDI _{pc t+2} | -0.351* | | 12.463* | 0.416 | 0.007 | |
| | STFDI _{6c t0} | | | | | |
| EXPLSM _{t+2} | -0.964* | | 20.212* | 0.579 | 0.000 | |
| FXDMSM | | | | | | |
| STEDI2 | 0.130* | | 3.806* | 0.942 | 0.000 | |
| 511 D1pt t+2 | 0.150 | | STEDI | 0.742 | 0.000 | |
| EVDMCM | 4 260* | | 0.262 | 0.946 | 0.000 | |
| EAPINISINI t+2 | 4.309** | | -0.303 | 0.840 | 0.000 | |
| CTEDI | 0.000* | | EAPHSM t0 | 0.402 | 0.002 | |
| SIFDI _{pc t+2} | 0.252* | | 4.5/9* | 0.483 | 0.003 | |
| | | | STFDIpc t0 | | • | |
| EXPHSM t+2 | 1.717* | | 2.567 | 0.651 | 0.000 | |

Results of linear regression analysis for relationship between STFDI_{pc} in USD and groups of Polish exports in %, current prices, 1995-2012

*statistically significant coefficient and constant at the level 0.05.

Source: own calculations.

One can also to note that statistically significant relationship between the export groups and stocks per capita of outward and inward direct investment is maintained over time and is two-way directional. The bidirectional relationship between the observed variables has been also confirmed by statistical significant regression coefficients calculated for the models where the independent variable in year t_0 , is the cause of the emergence of the phenomenon being explained in year t_{+2} . Regression models of the dependence of the export groups on STFDI pc and STDDI pc on export groups show, inter alia, that according to the theory the scale of domestic direct investment is related to technological progress taking place in the Polish economy, and that FDI stimulate positive changes in Poland's export structure. Additionally, the impact of FDI on the changes in export structure is stronger than the effect of changes in export structure on FDI. The same situation occurs in the case of outward direct investment.

TABLE 6.

| Dependent variables | Regression coefficient | Constant | R^2 | p-value | | |
|--------------------------------------|---------------------------------|------------------------|-------|---------|--|--|
| | Independent variables | | | | | |
| | EXPLRM | 0 | | | | |
| STDDI _{te t0} | -0.311* | 0.949 | 0.000 | | | |
| | STDDI _{pc} to | | | | | |
| EXPLRM t0 | -3.055* | 35.470* | | | | |
| | EXPLSM t | | | | | |
| STDDI _{pc t0} | -0.793* | 0.651 | 0.000 | | | |
| | STDDIpet | | | | | |
| EXPLSM t0 | -0.821* | 17.478* | | | | |
| | EXPMSM | | | | | |
| STDDI _{by t0} | 0.206* | -1.357 | | | | |
| | STDDIpe to | 0.616 | 0.000 | | | |
| EXPMSM t0 | 2.993* | 15.516* | | | | |
| | EXPHSM | 10 | | | | |
| STDDI _{fec t0} EXPHSM t0 | 0.522* | 0.797 | 0.000 | | | |
| | STDDI _{pc} | | | | | |
| | 1.527* | | | | | |
| | | EXPPC t0 | | | | |
| STDDI _{pr t+2} | -0.300* | 11.372* | 0.366 | 0.013 | | |
| | | EXPLRM t0 | | | | |
| STDDI _{tx t+2} | -0.317* | 11.895* | 0.976 | 0.000 | | |
| | | | | | | |
| EXPLRM t+2 | -3.011* | 33.530* | 0.866 | 0.000 | | |
| | $\mathrm{EXPLSM}_{\mathrm{t0}}$ | | | | | |
| STDDI _{pc t+2} | -0.684* | 14.473* | 0.484 | 0.003 | | |
| | | STDDI _{pc t0} | | | | |
| EXPLSM t+2 | -0.884* | 17.268* | 0.707 | 0.000 | | |
| | | | | | | |
| STDDI _{tx t+2} | 0.217* | -1.350 | 0.807 | 0.000 | | |
| | | STDDI _{pc t0} | | | | |
| EXPMSM t+2 | 2.911* | 17.586* | 0.546 | 0.000 | | |
| | EXPHSM t0 | | | | | |
| STDDI _{pc t+2} | 0.467* | -1.490 | 0.598 | 0.000 | | |
| | | STDDI _{pr t0} | | | | |
| EXPHSM t+2 | 1.662* | 7.443* | 0.886 | 0.000 | | |

Results of linear regression analysis for relationship between $STDDI_{pc}$ in USD and groups of Polish exports in %, current prices, 1995-2012

*statistically significant coefficient and constant at the level 0.05.

Source: own calculations.

3. Conclusions

The results of previous study carried out for the period of 1991-2002 suggested that Poland was at the beginning of the second - investment-led - stage of development according to the country's development path of M. Porter that corresponds to the second stage of the model proposed by J. Dunning and his collaborators, which was described above [Majewska, Grala, 2004, pp. 243-258]. The findings of research performed by M. Gorynia, J. Nowak and R. Wolniak for the similar period 1990-2003 also indicated that Poland was at the end of stage 2, which it entered in the mid-1990s. They argued that this is mainly due to the pull of the large internal market, the still weak competitiveness of domestic firms in international markets, and government reluctance to adopt more active, firm-specific ownership advantage stimulating policies toward outward FDI [Gorynia, Nowak, Wolniak, 2007, pp. 52-74].

The results of the present study suggest that Poland after further 10 years of economic transformation shifted to the third stage of analyzed country's development path. For this stage of development is characteristic that as a country improves its endogenous comparative advantages to adjust to the needs of foreign market, what is reflected in the changes in its export structure, outward direct investment starts to grow faster like in Poland. Additionally Poland's locational advantages began to base in a broader extent on created assets in more capital- and technology-intensive manufactures. In the case of inward foreign investment is observed a slowdown what is connected with the erosion of Poland's comparative advantages in labour-intensive and materials-intensive industries compared to the countries located at lower stages of development. The results of the study also indicate that Poland has begun to attract FDI into more skill- and technology-intensive manufactures and that FDI is related to the reallocation of labour-intensive processes to more technology-intensive production.

Thus, Poland is slowly passing on the next stage of economic development. However, whether Poland reaches this stage depends mainly on its own efforts to continue various types of structural changes, which is called the endogenous process of specialization. Moreover, the results of our study on the impact of export groups on the economic performance of Poland confirm the conclusions of the OECD report cited above, because the authors of this report believe that in the case of Poland structural reforms are prerequisites for climbing the technological ladder, developing knowledge-based capital and becoming a more innovation-based economy. In their opinion with slow implementation of reforms, there is always a risk that the full potential of the economy will not realised, and in the case of Poland that risk is compounded by the general distrust in key public institutions [OECD, 2014].

We also agree with the views of the United Nations Development Group that the role of the State should not be confined to doing the basic minimum. Thus, the Polish government should ensure an enabling environment for enterprises, provide public goods, such as reliable infrastructure and social services, redistribute gains from inequitable growth and be more proactive in providing incentives to accelerate a process of developing successful and innovative economic activities – in other words promote

technological upgrading, skills formation, innovativeness and job creation [United Nations Development Group, 2013].

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Irena SOBOL, Dariusz KACPRZAK, Witold KOSIŃSKI¹

OPTIMIZING OF A COMPANY'S COST UNDER FUZZY DATA AND OPTIMAL ORDERS UNDER DYNAMIC CONDITIONS²

Summary

The purpose of this article is to suggest tools of inventory management which would determine economically optimal order quantities. One of them is based on the so-called fixed order quantity model which takes into account several elements of inventory cost, such as ordering cost, transportation and storing cost, frozen capital cost, as well as extra discounts. The tool is based on fuzzy concepts represented by Ordered Fuzzy Numbers. The second tool takes into account the dynamics and works on the basis of replenishment system. This tool can be treated as a kind of controller. Examples of using this tools are presented.

Key words: Ordered Fuzzy Numbers, defuzzification, Economic Order Quantity Model, optimal order quantity

1. Introduction

The main objective of a good inventory management system is to keep the inventory cost at the minimum level. There are several elements of inventory cost, such as ordering cost, transportation cost, frozen capital cost, cost of loss (i.e. aging), cost of lost sales due to inventory shortages, and others. Several inventory models have been built based on the above. There are two most commonly used inventory models: fixed order quantity system and replenishment system.

In the first system, the quantity to be ordered is fixed and re-orders are made once the stock reaches a certain pre-determined level called safety stock. It means that the next order is typically fixed and based on the average consumption during the lead time plus some safety stock. Often in calculation the buffer stock is the one-day inventory consumption.

Under the second system, the quantity to be ordered is not fixed, the next order is decided based on the lead time of the material, maximum stock level, i.e. the ordered level changes with time.

¹ Irena Sobol, Department of Computer Science, Polish-Japanese Institute of Information Technology, e-mail: s8531@pjwstk.edu.pl; Dariusz Kacprzak, PhD, Faculty of Computer Science, Bialystok University of Technology, e-mail: d.kacprzak@pb.edu.pl.

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In this paper we propose two tools of inventory management. The first one is based on the fixed order quantity model which takes into account several elements of inventory cost. The tool based on fuzzy concepts represented by Ordered Fuzzy Numbers. The second tool takes into account the dynamics, and works on the basis of replenishment system. This tool can be treated as a kind of controller.

When dealing with the first tool the fuzzy optimization problem for the total cost function is formulated within a space, where all variables of the model are fuzzy. After choosing of a particular defuzzification functional, an appropriate theorem is formulated and gives a solution to the fuzzy optimization problem.

When developing the second tool, the authors faced a situation where material demand is irregular during the production process. This results in no equal ordered levels as well as in different elapse times between orders.

The organization of the paper is as follows. In Section 2, within the economic order quantity model the problem of supply management is considered, in which the optimal size of a delivery from outside is determined; this minimizes total costs, when crisp unit costs of purchase, transportation and storage are given. Then in Section 3, a fuzzy optimization problem is formulated together with its solution and a numerical example. In Section 4, a problem of management of supply and determining an optimal size of a delivery from outside is considered while the material demand depends on time. Then a solution algorithm is described. The final results of this section is a kind of a controller together with a numerical example. In Section 5, conclusions are formulated. Appendix refers to the model of Ordered Fuzzy Numbers.

2. Economic order quantity model

Inventory management within an enterprise is an integral part of its operating activities, as it influences its competitive advantage and its financial liquidity. The purpose of inventory management is to have the stock at a high enough level and operate smoothly, while incurring the lowest possible operating costs. The presented formulation is within the general framework of the model of economic order quantity (EOQ).

We consider an abstract inventory item. To estimate the cost of inventory management we formulate the main assumptions in the EOQ model:

- 1. the abstract inventory item is split into units;
- 2. we refer a defined time frame, say one year;
- 3. demand is constant in time;
- 4. sales is uniform in time and known;

5. the next delivery arrives when the stock is for one day only.

Let us start with deterministic formulation in which the following objects appears:

- D annual inventory demand, measured in number of units;
- D/360- daily demand for supply (assuming that a year has 360 days);
- Q order quantity, measured in number of units;
- Q_0 daily consumption of inventory;
- D/Q frequency of deliveries;

- C_p – unit price of purchase;

- c_t – transportation cost of a single delivery;

- c_s – unit inventory cost per day;

- r(Q) – discount function on purchase;

- s(Q) – discount function on stored inventory;

- K(Q) – total cost;

- K_p – purchase cost;

- K_f – frozen capital cost;

- K_t – transportation (delivery) cost;

- K_s storage cost;
- R banking interest rate, used to calculate the cost of frozen capital.

We can write the general expression of the total cost K(Q), as the sum of the purchase cost K_p , the frozen capital cost K_f , the transportation (delivery) cost K_t and the storage cost K_s , i.e.

$$K(Q) = K_p + K_f + K_t + K_s.$$
 (1)

Suppose that we get the discount r(Q) on purchase and the discount s(Q) on stored inventory depending on the amount of Q, both as step functions:

$$r(Q) = \begin{cases} r_0 = 0 & \text{if } 0 < Q < Q_1^r \\ r_1 & \text{if } Q_1^r \le Q < Q_2^r \\ r_2 & \text{if } Q_2^r \le Q \le D \end{cases}$$
(2)

and

$$s(Q) = \begin{cases} s_0 = 0 & \text{if } 0 < Q < Q_1^s \\ s_1 & \text{if } Q_1^s \le Q < Q_2^s \\ s_2 & \text{if } Q_2^s \le Q \le D \end{cases}$$
(3)

where Q_1^r , Q_2^r , Q_1^s and Q_2^s are fixed quantities (here 3 steps have been assumed, however, more steps can also be considered). The purchase cost K_p depends on the quantity of the single delivery Q, the frequency of deliveries D/Q, the discount r(Q) and the unit price c_p , and is given by

$$K_p = c_p \cdot \left(1 - r(Q)\right) \cdot Q \cdot \frac{D}{Q} = c_p \cdot \left(1 - r(Q)\right) \cdot D.$$
(4)

The cost of frozen capital depends on the number of deliveries D/Q, the money spent on a single delivery, the banking interest rate R, and on the single delivery Q. The form of the purchase cost K_p gives the following cost K_f of frozen capital:

$$K_f = c_p \cdot \left(1 - r(Q)\right) \cdot Q \cdot \frac{D}{Q} \cdot \frac{R}{\frac{D}{Q}} = c_p \cdot \left(1 - r(Q)\right) \cdot Q \cdot R.$$
(5)

We can see that the expression K_f represents a step function, which is piecewise linear. The cost of the transportation (delivery) K_t depends on the annual frequency of deliveries D/Q and the transportation cost of a single delivery c_t , i.e.

$$K_t = c_t \cdot \frac{D}{Q}.$$
 (6)

According to the assumptions 3 to 5, the storage cost K_s depends on the annual frequency of deliveries D/Q, the discount s(Q), the unit inventory cost c_s and the level of inventory between successive deliveries. The level of inventory is given by

$$\int_0^{t_0} \left(-\frac{Q}{t_0} \cdot t + Q + Q_0 \right) dt = \left(\frac{Q}{2} + Q_0 \right) \cdot t_0, \tag{7}$$

and the storage cost by

$$K_{s} = \frac{D}{Q} \cdot c_{s} \cdot \left(1 - s(Q)\right) \cdot \left(\frac{Q}{2} + Q_{0}\right) \cdot t_{0} = \frac{D}{Q} \cdot c_{s} \cdot \left(1 - s(Q)\right) \cdot \left(\frac{Q}{2} + Q_{0}\right) \cdot \frac{360}{\frac{D}{Q}} =$$
$$= 180 \cdot c_{s} \cdot \left(1 - s(Q)\right) \cdot \left(Q + 2 \cdot Q_{0}\right). \tag{8}$$

Hence the function describing the total cost K(Q) in (1) has summed up to $K(Q) = c_p \cdot (1 - r(Q)) \cdot (D + Q \cdot R) + c_t \cdot \frac{D}{Q} + 180 \cdot c_s \cdot (1 - s(Q)) \cdot (Q + 2 \cdot Q_0).$ (9)

FIGURE 1.

Graphical representation of discount functions and subintervals L_k , k = 0, 1, 2, 3, 4.



Source: own work.

The optimization problem of inventory management requires us to find the minimum of the cost function K(Q). The argument which gives the minimum is the optimal value of the order quantity. Please note that in K(Q) the first and the last component both depend on Q in a piecewise way. Suppose that

$$0 < Q_1^r < Q_1^s < Q_2^r < Q_2^s < D.$$
(10)

The search for the optimal value should be performed in a piecewise way, i.e. considering each subinterval (Fig. 1.).

 $L_0 = (0, Q_1^r), L_1 = [Q_1^r, Q_1^s), L_2 = [Q_1^s, Q_2^r), L_3 = [Q_2^r, Q_2^s), L_4 = [Q_2^s, D].$ (11) Thus the global optimum is the quantity which gives the minimal cost over these five values calculated from each subinterval. Since

$$\frac{\partial K(Q)}{\partial Q} = c_p \cdot \left(1 - r(Q)\right) \cdot R - c_t \cdot \frac{D}{Q^2} + 180 \cdot c_s \cdot \left(1 - s(Q)\right) \tag{12}$$

and

$$\frac{\partial K(Q)}{\partial Q} = 0 \iff Q^* = \sqrt{\frac{c_t \cdot D}{c_p \cdot (1 - r(Q)) \cdot R + 180 \cdot c_s \cdot (1 - s(Q))}} \tag{13}$$

in each of these subintervals L_k , k = 0,1,2,3,4 the local extreme is attained at

$$Q_k^* = \sqrt{\frac{c_t \cdot D}{c_p \cdot (1 - r_i) \cdot R + 180 \cdot c_s \cdot (1 - s_j)}},\tag{14}$$

where the following identification has been assumed between these sets of indexes:

$$0 = k \leftrightarrow [ij] = [00], 1 = k \leftrightarrow [ij] = [10], 2 = k \leftrightarrow [ij] = [11], 3 = k \leftrightarrow [ij] = [21], 4 = k \leftrightarrow [ij] = [22].$$
(15)

If $Q_k^* \in L_k$, then the optimal value can appear in one of these subintervals or at their borders, i.e. it is attained at the argument given by

 $Q_{opt} = \arg \min \{\{K(Q_k^*), k = 0, 1, 2, 3, 4\}, K(Q_1^r), K(Q_2^r), K(Q_2^r), K(Q_2^s), K(D)\}\}$. (16) In the model (9) all components such as prices, discounts, total demand, have been assumed to be constant and known in advance. But in reality, many factors that influence economic decisions are not exactly known, and there is a margin of uncertainty. There are several options to handle this, like stochastic modelling, interval methods and, last but not least, the fuzzy approach sketched in this paper.

3. Fuzzy optimization problem

The present formulation is within the framework of the model of the Economic Order Quantity (EOQ) and similar to the one proposed in the set of Convex Fuzzy Numbers (CFN) by [Vuješević et al., 1996] and repeated by [Kuchta, 2001]. In the OFN's framework problems in economics and administrative accounting were formulated in [Chwastyk, Kosiński, 2013; Kosiński et al., 2013]. Our aim is to give a general solution to the optimization problem with the cost function given by (9) when D, c_p , c_t and c_s are fuzzy and represented by Ordered Fuzzy Numbers. It will be easy to see that the arithmetic of OFN manifests its superiority over the arithmetic of Convex Fuzzy Numbers, and the complex calculations performed by authors of [Kuchta, 2001; Vuješević et al., 1996] can be avoided. The only thing we need to do is choose the defuzzification functional which suits the decision maker the most. For more details on OFN we refer to in the Appendix.

Let $\Phi(\cdot)$ be the defuzzification functional chosen by the decision maker. Then the problem of minimizing the fuzzy cost K(Q) gives us the economic order quantity. Writting it explicitly

find
$$\arg\{\min\Phi(K(Q)): Q \in \mathcal{R}\}.$$
 (17)

The new question arises: how can we find the minimum of this functional? The answer is rather obvious and comes from physics, and is formulated according to the stationary action principle: the minimum of the functional appears at the argument Q where its first variation (the Gâteaux derivative) vanishes. Calculating the first variation of $\Phi(K(Q))$ with respect to Q under given D, c_p , c_t and c_s , we get

$$\delta\Phi(K(Q)) = \partial_K \Phi(K) \partial_Q K(Q) \delta Q.$$
⁽¹⁸⁾

The condition $\delta \Phi(K(Q)) = 0$ implies that

$$\partial_K \Phi(K) \partial_Q K(Q) \delta Q = 0, \tag{19}$$

for any variation δQ , where $\partial_K \Phi(K)$ and $\partial_Q K(Q)$ denote functional derivatives, and the argument Q^* , at which the product of these derivatives vanishes, gives us the solution to our optimization problem.

To illustrate this, let us consider a class of linear functionals given by (36). Let us denote the branches of the fuzzy number K(Q) by (f_K, g_K) , and for the remaining quantities we will adapt the previous notation by using the appropriate subscripts, i.e.

 $D = (f_D, g_D), Q = (f_Q, g_Q), c_p = (f_p, g_p), c_t = (f_t, g_t), c_s = (f_s, g_s).$ (20) We keep similar assumption on the discount functions r(Q) and s(Q) as two step functions with the steps represented by relationships (2) and (3), where r_i and s_j are here crisp³, while the border values $Q_i^r, Q_j^s, i = 1, 2, j = 1, 2$, are Ordered Fuzzy Numbers, which satisfy the inequalities (10). Hence we can define 5 subinterval (11). The linear functional superposed on the fuzzy cost K(Q) has the form of:

 $\Phi(K(Q)) = \Phi(f_K, g_K) = \int_0^1 f_K(s) dh_1(s) + \int_0^1 g_K(s) dh_2(s), \quad (21)$ where, due to (9) and the step functions r(Q) and s(Q), the pair of functions f_K, g_K represents 6 pairs, namely

$$f_{K_{ij}}(s) =$$

$$= f_p(s)(1 - r_i) \left(f_D(s) + Rf_Q(s) \right) + f_t(s) \frac{f_D(s)}{f_Q(s)} + 180 f_s(s) (1 - s_j) (f_Q(s) + 2Q_0) \quad (22)$$

$$g_{K_{ij}}(s) =$$

$$= g_p(s)(1 - r_i) \left(g_D(s) + Rg_Q(s) \right) + g_t(s) \frac{g_D(s)}{g_Q(s)} + 180g_s(s) \left(1 - s_j \right) \left(g_Q(s) + 2Q_0 \right)$$
(23)

where i, j = 0,1,2. Like in Section 2 we can introduce new index k = 0,1,2,3,4 and use the same identification as in (15) to decrease the number of pairs of functions $(f_{K_{ij}}, g_{K_{ij}})$. Now, we take variation in (16) where the functional is given by (21), to

$$\delta\Phi(K(Q)) = \int_0^1 \left[f_p(s)(1-r_i)R - f_t(s)\frac{f_D(s)}{f_Q^2(s)} + 180f_s(s)(1-s_j) \right] \delta f_Q(s)dh_1(s) + \\ + \int_0^1 \left[g_p(s)(1-r_i)R - g_t(s)\frac{g_D(s)}{g_Q^2(s)} + 180g_s(s)(1-s_j) \right] \delta g_Q(s)dh_2(s)$$
(24)

with i, j = 0, 1, 2. We could consider two cases:

Case A: The functions h_1 and h_2 are absolutely continuous, and

Case B: The functions h_1 and h_2 are singular, i.e. the derivatives $h'_1(s)$ and $h'_2(s)$ equal zero almost everywhere.

It is interesting to notice that in the first cases particular forms of h_1 and h_2 in (21) do not affect the optimal value of Q, it does affect, however, the optimal value of the crisp $\cot \Phi(K(Q))$. Hence we formulate remark concerning the first case.

Theorem 1. If the total inventory cost K(Q) arising from fuzzy unit costs of delivery c_t , of inventory c_s , of the annual demand D, of the discount functions r(Q) and s(Q), and of the banking interest rate R, are given by (9) and the decision maker chooses the

³ If there are also fuzzy numbers from \mathcal{R} , then final results will be of the same type with 4 extra pairs of functions appearing in a multiplicative way in the expressions for $f_{M_k}(s)$ and $g_{M_k}(s)$ from (26).

defuzzification functional Φ in (21), then in Case A the economic order quantity is given by two phase optimization procedure:

- **Phase 1.** On each subinterval L_0 , L_1 , L_2 , L_3 , L_4 the optimal values are found $q_k^* = \Phi(Q_k^*)$, with $Q_k^* = (f_{Q_k^*}, g_{Q_k^*})$, (25)

where

$$f_{Q_k^*} = \sqrt{\frac{f_t(s)f_D(s)}{f_{M_k}(s)}}, \ g_{Q_k^*} = \sqrt{\frac{g_t(s)g_D(s)}{g_{M_k}(s)}}, s \in [0,1],$$
(26)

with $f_{M_k}(s) = f_p(s)(1 - r_i)R + 180f_s(s)(1 - s_j)$, and expression for $g_{M_k}(s)$ is analogous. The notation and the identification between the indexes k and [ij] are coming from (15).

- **Phase 2.** From these five values $\Phi(Q_k^*)$, k = 0,1,2,3,4 and the values of the boundary numbers: Q_1^r , Q_1^s , Q_2^r , Q_2^s , D, the optimal value is calculated according to

 $Q^{opt} = \arg \min \{ \Phi(K(Q_k^*)), \Phi(K(Q_1^r)), \Phi(K(Q_1^s)), \Phi(K(Q_2^r)), \Phi(K(Q_2^s)), \Phi(K(D)) \}.$ (27) In [Chwastyk, Kosiński, 2013] the authors have discussed a less complex case. On Fig. 4 the graph of the cost function (9) without any discount on storage inventory and the cost of frozen capital for different values of Q is plotted. In the next subsection a numerical example will be presented.

3.1. Numerical example

In [Kuchta, 2001] the author considered the problem of minimizing the value of the fuzzy cost K(Q) of a company in which

$$K(Q) = D \cdot c + c_t \cdot \frac{D}{Q} + c_s \cdot \frac{Q}{2}.$$
(28)

It corresponds to our problem by neglecting the cost of frozen capital, discount of purchase cost, discount stored inventory cost as well as the influence of safety stock related to daily consumption of inventory. Then the storage cost equals $K_s = c_s \cdot \frac{Q}{2}$ instead of (8). It corresponds to the case formulated as the optimization problem from Section 2.

Kuchta in her paper [Kuchta, 2001] considered first the crisp (deterministic) case with the following data: D = 1000, c = 10, $K_t = 8$ and $K_s = 7$. In her calculation the final economic order quantity Q_k was 46 and the total cost $K(Q_k)$ corresponding to this order value was 10329. In our calculation we get $Q_k = 47.8$ and the cost value $K(Q_k) = 10334.7$. These values are different from those of Kuchta in (Kuchta, 2001).

Then she considered the fuzzy case with the same crisp values of D and c, but with the fuzzy transportation cost \tilde{K}_t represented by the triangular membership function (7,8,9) and the fuzzy storage cost \tilde{K}_s represented by the triangular membership function (1.5,7,15). Determination of the economic order quantity in that fuzzy case is not unique, and is based on some estimation to be done by the decision maker if he/she is supplied with a set of fuzzy cost value determined with the help of

(28) in which the fuzzy values \tilde{K}_t and \tilde{K}_s appear, together with 2M + 1 crisp values of Q from the vicinity of Q_k , where M is a natural number determined by the decision maker (in Kuchta's paper it was 50). Then the decision maker has to choose from those 2M + 1 fuzzy cost values the one most suitable for him/her.

The same example will be considered here for OFN. Adapting our general solution formula (26) with vanishing discount functions we obtain

$$f_{Q^*}(s) = \sqrt{\frac{2 \cdot f_t(s) \cdot f_D(s)}{f_s(s)}}$$
 and $g_{Q^*}(s) = \sqrt{\frac{2 \cdot g_t(s) \cdot g_D(s)}{g_s(s)}}$

In contrast to Kuchta's approach, if we apply our method and the linear defuzzification functional (24), then from the Theorem for the Case A (absolutely continuous h_1 and h_2 in (21)), we get the explicit expression of the fuzzy EOQ

$$f_{K^*}(s) = f_D(s) \cdot c + f_t(s) \cdot \frac{f_D(s)}{f_{Q^*}(s)} + f_s(s) \cdot \frac{f_{Q^*}(s)}{2}$$

and

$$g_{K^*}(s) = g_D(s) \cdot c + g_t(s) \cdot \frac{g_D(s)}{g_{Q^*}(s)} + g_s(s) \cdot \frac{g_{Q^*}(s)}{2}$$

To this end let us choose the representation of two convex triangular fuzzy numbers \tilde{K}_t and \tilde{K}_s as Ordered Fuzzy Numbers. We know that to each CFN there are two corresponding OFNs, and they differ by orientation. Hence for \tilde{K}_t we have (9 - s, 7 + s) and (7 + s, 9 - s), with $s \in [0,1]$ (Fig.2). On the other hand for \tilde{K}_s we have (15 - 8s, 1.5 + 5.5s) and (1.5 + 5.5s, 15 - 8s) (Fig.3). For \tilde{K}_t , if we take the first OFN, which has the so-called negative orientation, it means that our estimation of future transportation cost is rather optimistic, the cost is at most around 8; on the other hand if we take the second OFN, namely (9 - s, 7 + s), then we are rather pessimistic: the transportation cost is at least around 8.

For further calculation we assume the optimistic viewpoint and take for $f_t(s) = 9 - s$ and $g_t(s) = 7 + s$, while for $f_s(s) = 15 - 8s$ and $g_s(s) = 1.5 + 5.5s$. Please note that we could assume 3 different cases and, consequently, 3 different solutions for fuzzy EOQ could arise.

Applying the formula appearing in Remark⁴, with $f_D(s) = 1000$, $f_M(s) = f_s(s)/2$ and $g_D(s) = 1000$, $g_M(s) = g_s(s)/2$ we obtain the fuzzy EOQ as the Ordered Fuzzy Number

$$f_{Q^*}(s) = \sqrt{\frac{2000 \cdot (9-s)}{15-8s}}, \ g_{Q^*}(s) = \sqrt{\frac{2000 \cdot (7+s)}{1.5+5.5s}}, \ s \in [0,1].$$

⁴ Notice that in our example D is crisp and is represented by the pair of constant functions (1000, 1000)



From the last expression we could easily calculate the fuzzy minimal inventory $\cot K(Q^*)$. Please note that neither Q^* nor $K(Q^*)$ can be represented in the form of CFN with triangular membership function. We could draw figures for them by substituting values of s from [0,1] interval. By applying a particular defuzzification functional we could calculate the crisp values corresponding to Q^* and $K(Q^*)$. At the end of this section we point out the characteristic values of Q^* , namely

 $f_{Q^*}(0) = 34.6, \ f_{Q^*}(1) = g_{Q^*}(1) = 47.8, g_{Q^*}(0) = 96.6.$

Please note that by applying of the defuzzification functional $\phi = \phi_{MOM}$ to Q^* we obtain the crisp EOQ $\phi_{MOM}(Q^*) = f_{Q^*}(1) = 47.8$, which is equal to Q_k from the deterministic case. Corresponding to those values, the characteristic values of the cost are:

$$\begin{aligned} f_{K^*}(0) &= 10000 + f_t(0) \cdot \frac{1000}{f_{Q^*}(0)} + f_s(0) \cdot \frac{f_{Q^*}(0)}{2} = 10519.6, \\ f_K^*(1) &= g_K^*(1) = 10000 + f_t(1) \cdot \frac{1000}{f_{Q^*}(1)} + f_s(1) \cdot \frac{f_{Q^*}(1)}{2} = 10334.6, \\ g_K^*(0) &= 10000 + g_t(0) \cdot \frac{1000}{g_{Q^*}(0)} + g_s(0) \cdot \frac{g_{Q^*}(0)}{2} = 10144.9. \end{aligned}$$

If we look at the fuzzy cost values in [Kuchta, 2001], we can see in Table 7.1 on page 112 that domains of triangular membership functions of those values vary from 10138 to 10513. Moreover, fuzzy values of cost are related to the range of order quantities from 91 to 36. In our calculation this range is 34.6 to 96.6.
4. Optimal orders under dynamic conditions

In the next subsection we file a solution to the deterministic optimization problem with the help of a controller. In any company material demand from warehouse during the production processes is often irregular. It is related to uneven production or technical problems. Thus, the inventory optimization problem becomes more complicated in relation to the order quantity and the frequency of orders, as well as transportation costs. The algorithm described here solves that problem in a relatively easy way by some simple algebraic operations. The final result is a *controller*.

In order to always provide a proper state of inventory quantity in a warehouse, one has to provide appropriate supplies. Each supply requires us to determine an optimal order quantity which should be calculated for a given time period t taking into account the actual status of warehouse inventory while minimizing the costs of purchase, transportation and maintaining items in the warehouse.

In our solution we keep the previous notations, adding some new variables. Moreover, some new assumptions are also made.

- 1. Demands are not constant in time and depend on the length of time period for which the order is made.
- 2. Sales is not uniform and hence actual status of the warehouse is different in time.
- 3. The next delivery arrives after a known period of time that may change by $\pm \delta t$.
- 4. The safety stock depends on the length of period of time for which the order is made.
- 5. Cost of transportation depends on the order quantity.
- 6. There is a discount on purchase.
- 7. The partitioning of domains of variables does not have to be regular.

For presenting the solution we use the following additional variables (cf. Section 2):

- *M* actual inventory status in the warehouse;
- q possible order quantity used for calculations;
- ΔQ a value by which Q (or q) might be increased or decreased;
- t time period for which particular order is made, its value may be changed by some rules of our controller;
- Δt time period by which t may be increased or decreased, or by its multiplicity;
- D(t) inventory demand for period t, (with safety stock included);
- $\theta(t)$ safety stock;
- r(q) discount function on purchase;
- $K_t(q)$ transportation cost function, in general nonlinear, e.g. a step function;
- P a set of possible order quantities located on discontinuities of K(q) function, related to the step characteristics of the discount function r(q) and the transportation cost functions $K_t(q)$.

4.1. Total cost evaluation

If q represents a possible order quantity, then the total cost is

$$K(q) = K_p(q) + K_t(q) + K_s(q).$$
(29)

Assuming that the discount function on purchase r(q) depending on the amount of q is a step functions, and its form is similar to that r(q) from section 2, with the small change of Q_1^r , Q_2^r into q_1^r , q_2^r , respectively. The cost of transportation (delivery) forms a step function, as well:

$$K_t(q) = \begin{cases} K_0 = 0 & \text{if} \quad 0 < q < q_1^t \\ K_1 & \text{if} \quad q_1^t \le q < q_2^t \\ K_2 & \text{if} \quad q_2^t \le q \le D \end{cases}$$
(30)

where q_1^r , q_2^r , q_1^t and q_2^t are fixed amounts of the item's quantity (here 3 steps have been assumed, however, more or fewer steps can be also considered). The purchase cost $K_p(q)$ depends on the discount r(q) and the unit price c_p as below:

$$K_p(q) = c_p \cdot \left(1 - r(q)\right) \cdot q. \tag{31}$$

Due to discontinuity of both functions r(q) and $K_t(q)$ as well as the quantized nature of q in deliveries⁵ the order quantity Q cannot be an arbitrary number: it needs to be adjusted even if the economic order quantity Q^* has been calculated by solving an appropriate optimization problem. Hence deliveries can be partitioned by ΔQ and the other relevant functions: $\theta(t)$ and D(t). Please note that arguments at which the function r(q) is discontinuoued may be different from those of the function $K_t(q)$. Hence we formulate two rules which form the basis rule of our controller.

- 1. **IF** t_{old} is the time period for which inventory demand is made **THEN** the new time t_{new} is equal to $t \Delta t$ if the state M is lower than the safety stock $\theta(t)$, or is equal to $t + \Delta t$, providing that the state M is higher than the demand D(t), otherwise $t_{new} = t_{old}$.
- 2. IF *P* is the set of discontinuity arguments of both functions r(q) and $K_t(q)$ **THEN** the final order quantity *Q* is the smallest element of *P* that with the current amount in the warehouse would suffice for the next period of time with the minimal cost. IF such an element of *P* does not exist, **THEN** the final order quantity should be equal to the smallest multiple of ΔQ , that with the current amount in the warehouse would suffice for the next period of time.

The above rules need explicit relationships to be applied in practice. We assume further that $K_s(q)$ is constant. Hence for the first rule

$$t_{new}(t_{old}, M) = \begin{cases} t_{old} - \Delta t & \text{if} & M < \theta(t_{old}) \\ t_{old} & \text{if} & \theta(t_{old}) < M < D(t_{old}). \\ t_{old} + \Delta t & \text{if} & D(t_{old}) < M \end{cases}$$
(32)

⁵ If the item to be ordered is coal, it is impossible to buy a fraction of tones; in practice coal is bought in full tons or in full boxcars.

For the second rule we will use the notation $[\cdot]$ and $[\cdot]$ in order to keep the quantized nature of q. Hence the optimal order quantity Q^* is the function of M and $D(t_{new})$ and is equal to q^* if such q^* exists which is equal to

 $\underset{K(q): [D(t_{new}) - [M]] \leq q \land q \in P \land K(q) \leq K([D(t_{new}) - [M]]) }{ and otherwise }$ (33)

$$Q^* = [D(t_{new}) - M].$$
(34)

In the next subsection a numerical example will be presented.

4.2. Numerical example

Let us consider an example of an item measured in number of units, with 8000 unit as the base quantity, and with the following data: $c_p = 10$, $c_s = 7$, M = 0, $\Delta Q = 5000$, $D(t) = t \cdot 8000 \cdot 110\%$, $\Delta t = 1$ week, $\theta(t) = D(t) \cdot 10\% / 110\%$, $K_t(q) =$ 7000 and

$$r(q) = \begin{cases} 0\% & \text{if} \quad 0 < q < 5000\\ 5\% & \text{if} \quad 5000 \le q < 10000\\ 10\% & \text{if} \quad 10000 \le q < 20000\\ 15\% & \text{if} \quad q \ge 20000 \end{cases}$$

In general, the graph K(q) on Fig.4 does not have to be linear between border values that are not multiples of ΔQ . However, those values are not achievable as an order quantity, hence there is no need to consider them. The circled areas are interesting because of the optimization possibility. Those values of q belong to the set P. In the interval (4000;4999] the cost K(q) is in (61000;74486,5], measured in PLN. But in the next interval with the bigger order, the value K(5000) = 71987 PLN appears, which is smaller than the upper limit of the previous interval. It means that ordering bigger amount means that cost will be the same or lower. So it is better to buy more, in this case 5000 units. Thus, the knowledge base can be changed in those particular places.

In Table 1, the results for q are presented. If t is changed, we have to order our item not for the old value of t but for the new one, according to (31). This is presented in Table 2 together with the final results of the controller for Q.

FIGURE 4.



Source: own work.

TABLE 1.

| q | | | <u>t</u> | | | | | |
|---|-------------|-------|----------|-------|-------|--|--|--|
| | | 1 | 2 | 3 | 4 | | | |
| | 0-799 | 10000 | 20000 | 30000 | 40000 | | | |
| М | 800-1599 | 10000 | 20000 | 30000 | 35000 | | | |
| | 1600-2399 | 10000 | 20000 | 25000 | 35000 | | | |
| | 2400-8799 | 10000 | 20000 | 25000 | 35000 | | | |
| | 8800-17599 | 0 | 10000 | 20000 | 30000 | | | |
| | 17600-26399 | 0 | 0 | 10000 | 20000 | | | |
| | 26400 | 0 | 0 | 0 | 10000 | | | |

Partitioning of q based on different factors together with the rules for q

Source: own work.

TABLE 2.

The knowledge base for changing t together with the final results of the controller

| t _{new} | | t_{old} | | | | | |
|------------------|-------------|----------------------|----------------------|----------------------|----------------------|--|--|
| | | 1 | 2 | 3 | 4 | | |
| | 0-799 | t_{old} | $t_{old} - \Delta t$ | $t_{old} - \Delta t$ | $t_{old} - \Delta t$ | | |
| | 800-1599 | t_{old} | $t_{old} - \Delta t$ | $t_{old} - \Delta t$ | $t_{old} - \Delta t$ | | |
| | 1600-2399 | t _{old} | t _{old} | $t_{old} - \Delta t$ | $t_{old} - \Delta t$ | | |
| М | 2400-8799 | t _{old} | t _{old} | t _{old} | $t_{old} - \Delta t$ | | |
| | 8800-17599 | $t_{old} + \Delta t$ | t _{old} | t _{old} | t_{old} | | |
| | 17600-26399 | $t_{old} + \Delta t$ | $t_{old} + \Delta t$ | t _{old} | t _{old} | | |
| | 26400 | $t_{old} + \Delta t$ | $t_{old} + \Delta t$ | $t_{old} + \Delta t$ | t _{old} | | |

| Q | | t | | | | | |
|---|-------------|-------|-------|-------|-------|--|--|
| | | 1 | 2 | 3 | 4 | | |
| | 0-799 | 10000 | 10000 | 20000 | 40000 | | |
| М | 800-1599 | 10000 | 10000 | 20000 | 30000 | | |
| | 1600-2399 | 10000 | 10000 | 20000 | 25000 | | |
| | 2400-8799 | 10000 | 10000 | 25000 | 25000 | | |
| | 8800-17599 | 10000 | 10000 | 20000 | 30000 | | |
| | 17600-26399 | 0 | 10000 | 10000 | 20000 | | |
| | 26400 | 0 | 0 | 10000 | 10000 | | |

Source: own work.

Let us start with M = 0, $t_{old} = 4$. We need 30000 items and have to decrease t by a week i.e. $t_{new} = 3$. After 3 weeks we are left with 3600 units in the warehouse, so the next order should consist of 25000 pieces and t = 3. Now we are left with 2200 units in

the warehouse, and consequently, the next order should consist of 20000 pieces, and t = 2. After 2 weeks we are left with 4600 units and the next order should consist of 20000 and t = 2, and so on. If there are no bigger fluctuations in demand, the controller should give each time the same or similar results throughout the whole year.

5. Conclusions

We have solved a problem originating from management of inventory, using the setup of Ordered Fuzzy Numbers (OFN), and demonstrated its applicability in modelling of the influence of imprecise quantities and preferences of a decision maker. Thanks to welldefined arithmetic of OFN one can construct an efficient decision support tool when data are imprecise. In Section 2 we introduced economic order quantity model and in the next section its fuzzy solution. In Section 4 of the paper we have introduced some dynamics in management of inventory and showed that in a simplest case a rule based controller can play a role of an optimizing tool. The future work can be connected to the extension of the economic order quantity model and reflect its reality.

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Appendix

Proposed recently by Kosiński and his two co-workers Prokopowicz and Ślęzak [Kosiński et al., 2002, Kosiński et al., 2003, Kosiński, 2006] an extended model of Convex Fuzzy Numbers (CFN) [Nguyen, 1978], called Ordered Fuzzy Numbers (OFN), does not require any existence of membership functions. In this model we can see an extension of CFN – model, when one takes a parametric representation of fuzzy numbers know since 1986, [Goetschel, Voxman, 1986] of convex fuzzy numbers.

Definition 1. By an Ordered Fuzzy Number we understand a pair of functions (f, g) defined on the unit interval [0,1], which are continuous functions (or of bounded variations) [Kosiński et al., 2002; Kosiński et al., 2003, Kosiński, 2006].

On OFN, denoted by \mathcal{R} (or \mathcal{R}_{BV}), four algebraic operations have been proposed between fuzzy numbers and crisp (real) numbers, in which component wise operations are present. In particular

$$f_C(y) = f_A(y) * f_B(y), \quad g_C(y) = g_A(y) * g_B(y),$$
 (35)
where " * " works for" + ", " - ", " · " and " ÷ ", respectively, and where $A \div B$ is
defined, if the functions $|f_A|$ and $|f_B|$ are bounded from below. Hence any fuzzy algebraic

A relation of partial ordering in the space of all OFN, can be introduced by defining the subset of 'positive' Ordered Fuzzy Numbers: a number A = (f, g) is not less than zero, and by writing

equation A + X = C with A and C as OFN possesses a solution.

$$A \ge 0 \quad \text{iff} \quad f \ge 0, g \ge 0. \tag{36}$$

In this way the set \mathcal{R} (or \mathcal{R}_{BV}) becomes a partially ordered ring. Note, that for each two fuzzy numbers $A = (f_A, g_A)$, $B = (f_B, g_B)$ as above, we may define $A \wedge B =: F$ and $A \vee B =: G$, both from \mathcal{R} , by the relations: $F = (f_F, g_F)$, if $f_F = \inf(f_A, f_B)$, $g_F = \inf(g_A, g_B)$. Similarly, we define $G = A \vee B$ and we get the next structure on \mathcal{R} , namely a *lattice*. Its sublattice will be a chain of real numbers. If $A \leq B$, then the set $[A, B] = \{C \in \mathcal{R}: A \leq C \leq B\}$ will be a sublattice of the lattice (\mathcal{R}, \leq) .

In dealing with applications of fuzzy numbers we need set of functionals that map each fuzzy number into real, and in a way that is consistent with operations on reals. Those operations are called defuzzifications. To be more strict we introduce.

Definition 2. A map Φ from the space \mathcal{R} (or \mathcal{R}_{BV}) of all OFN's to reals is called a defuzzification functional if is satisfies:

- $\Phi(c^*) = c,$
- $\Phi(A + c^*) = \Phi(A) + c,$
- $\Phi(cA) = c\Phi(A) \text{ for any } c \in R \text{ and } A \in \mathcal{R},$
- $\quad \Phi(A) \ge 0 \text{ if } A \ge 0$

where $c^*(s) = (c', c')$, where c'(s) = c for any $s \in [0,1]$, represents crisp number (a real) $c \in R$

The linear functionals, as MOM (*middle of maximum*), FOM (*first of maximum*), LOM (*last of maximum*) are given by specification of h_1 and h_2

$$\Phi(f_A, g_A) = \int_0^1 f_A(s) dh_1(s) + \int_0^1 g_A(s) dh_2(s), \tag{37}$$

where h_1 , h_2 are nonnegative functions of bounded variation and

$$\int_0^1 dh_1(s) + \int_0^1 dh_2(s) = 1.$$
(38)

If we substitute $h_1(s)$ and $h_2(s)$ by $\lambda H(s)$ and $(1 - \lambda)H(s)$, respectively, where $0 \le \lambda \le 1$, and H(s) is the step Heaviside function (with the step at s = 1), we may obtain all the classical linear defuzzification functionals known for the fuzzy numbers of Zadeh, namely: MOM (*middle of maxima*), FOM (*first of maximum*), LOM (*last of maximum*) and RCOM (*random choice of maximum*), depending on the choice of λ ; for example if for $h_1(s)$ and $h_2(s)$ we substitute $\frac{1}{2}H(s)$, then we get MOM.

Adam ZAREMBA, Przemysław KONIECZKA¹

THE RELATIONS BETWEEN MOMENTUM, VALUE, SIZE, AND LIQUIDITY FACTORS AND STOCK RETURNS ON THE POLISH MARKET

Summary

The paper examines the relations between selected company characteristics and common stock returns. In the paper, we concentrate on four well-recognized fundamental factors determining stock returns: momentum, value, size and liquidity. First, we review the existing literature in the field. Second, we investigate the relationship between fundamental factors and stock returns on the Polish market. Our computations are based on all companies on the Warsaw Stock Exchange listed in the period 2000-12. Our research provides fresh out-of-sample evidence for momentum, value, size and liquidity premium from the Polish market.

Key words: value, size, momentum, cross-section of stock returns, Polish market, Warsaw Stock Exchange.

1. Introduction

The paper examines the relations between selected company fundamentals and common stock returns. Taking into account long finance literature, firm characteristics such as market capitalization, the ratio of book equity to market equity, the short-term history of past returns and daily turnover are important determinants of stock returns.

In the paper, we concentrate on four well-recognized fundamental factors determining stock returns: momentum, value, size and liquidity. First, we review the existing literature in the field. Second, we investigate the relationship between fundamental factors and stock returns on the Polish market. Our computations are based on all companies on the Warsaw Stock Exchange listed in the period 2000-12².

2. Theoretical basis

The relations between an asset's return and varied factors have been the most studied capital market phenomena over the past century. The capital asset pricing model

¹ Adam Zaremba, PhD – Department of Investment and Capital Markets, Poznan University of Economics, e-mail: adam.zaremba@ue.poznan.pl; Przemysław Konieczka, MA, Warsaw School of Economics, e-mail: przemysław.konieczka@gmail.com.

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presented and developed by Sharpe [1964], Lintner [1965] and Black [1972] has shaped for long time in what way scientists and financiers understand the relationship between an average return and risk. However, the growing empirical evidence demonstrated the inefficiency of market factor suggested in fully explaining security prices, as suggested by CAPM. As a consequence, researchers attempted to identify company characteristics which explain differences in common stock returns. Amongst these firm attributes the most prominent ones are: capitalization (size of company), the ratio of book equity to market equity (value of company), the short-term history of past returns [momentum] and daily turnover (liquidity of company stocks). Fama and French [1993] introduced to CAPM model value and size factors, based on individual stock characteristics. Following Fama and French [1993], other factors have been proposed in the literature and introduced to asset pricing models (most notably the momentum factor or liquidity factor) to examined these occurrence in stock returns.

In this part, we provided a brief overview of the momentum, value, size and liquidity factors and summarized the evidence for all of these.

2.1. Momentum factor

The momentum factor is based on the observation by Jagadeesh and Titman [1993] that stocks with a high past performance (winners) outperforms stocks with a low past performance (losers) in the short-term horizon. The momentum strategy relay on buying the winner portfolio and shorting the loser portfolio.

The initial study of this patterns in stock returns was the work of DeBondt and Thaler [1985]. They found strong evidence that recent good performing stocks become poor performers over 3-year and 5-year holdings. Jagadeesh and Titman [1993, 2001] performed an analysis similar to DeBondt and Thaler [1985] but with focus on a short-term investment horizon.

The evidence of momentum factor in returns of stocks in the international markets was proved by Asness [1994], Fama and French [1998, 2011], Rouwenhorst [1998], Liew and Vassalou [2000], Griffin, Ji, and Martin [2003], Grinblatt and Moskowitz [2004], Chui, Wei, and Titman [2010], Vu [2012], Groot et al. [2012], and Asness, Moskowitz, and Pedersen [2013].

2.2. Value factor

The value factor derived from the research on the so-called value effect. The value effect is tendency of value stocks (stocks with low prices relative to their fundamentals) to outperform growth stocks (stocks with high prices relative to their fundamentals). Alternative value measures used in the literatures are:

- B/M the book value of equity divided by the market value of equity;
- E/P the earnings after taxes divided by the market value of company's shares;
- past sales growth the compounded growth rate in net sale for three years prior to portfolio formation.

Formal statistical evidence of the value effect were presented by Stattman [1980] and Rosenberg [1985]. They used the book to market ratio as a value indicator. Davis et al. [1994] confirmed the value effect in US stock markets. Chan et al. [1991] and Capaul et al. [1993] confirmed the value effect, but in outside the US markets.

The value effect was observed in stocks returns by Chan, Hamao and Lakonishok [1991], Fama and French [1998, 2011], Rouwenhorst [1999], Lam [2002], Ghargohori [2009], Chui, Titman, and Wei [2010], Asness, Moskowitz, and Pedersen [2013]. Lischewski and Voronkova [2012], Kowerski [2006], Kowerski [2008], Żarnowski [2007], Czapkiewicz and Skalna [2010], and Borys and Zamcik [2011], confirmed the value effect on the Polish equity market.

2.3. Size factor

The size factor is related to the size effect, which was firstly documented by Banz [1981]. Banz found that the smallest 20 per cent of firms earn an annual return that is 5 per cent higher than the return on other firms. In the other words, he showed that stocks with lower capitalization (small stocks) tend to have higher average returns. Banz carried out the research into return premium on small stocks during the 1936 – 1975 period for the stocks quoted on the NYSE.

In the literature are a variety of ways in which one can measure company size:

- market capitalization the market price of the company's share multiplied by number of shares outstanding;
- total asset the book value of total asset;
- enterprise value the market value of equity plus book value of net debt;
- net sales the difference between gross sales and sales returns.

Reinganum [1981] and Cook and Roseff [1982] confirmed the evidence of the size effect by using a broader sample and decile portfolios. The size effect was later confirmed by Blume and Stambaugh [1983] and Brown et al. [1983]. In particular, the size effect was detected in US markets and several international markets by a variety of researchers (Herrera and Lockwood [1994], Heston at al. [1999], Rouwenhorst [1999], Horowitz et al. 2000a, Fama and French [2008], Michou et al. [2010]).

However, Fama and French [2011] did not find the size premium in any of four global regions after examining returns over a 20-year horizon starting in 1990. Dimson et al. [2011] observed that higher returns of smaller companies did not exist for long periods of time.

Lischewski and Voronkova [2012] estimated the impact of size effect on returns in Polish equity market. They found that size factor plays an significant role in explaining returns from Polish stocks. The effect was also confirmed by Borys and Zemcik [2011].

2.4. Liquidity factor

The paper of Amihud and Mendelson [1986] broke ground to various studies showing that liquidity may be the relevant factor that explains stock returns. The rationale behind is that illiquidity can be measured as costs of immediate execution and an investor willing to transact at a favorable price faces a trade-off.

A large part of existing literature confirms the presence of a liquidity effect on the US stock market (Amihud and Mendelson [1986], Brennan and Subrahmanyam [1996], Haugen and Baker [1996], Chalmers and Kadlec [1998], Datar et al. [1998], Brennan et al. [1998], Chordia et al. [2001] and Garleanu [2009]). The evidence for liquidity effect in international market was confirmed by Amihud et al. [1997], Hu [1997], Chan and Fa [2005]. The issue of liquidity factor in the Polish market was examined by Lischewski and Voronkowa [2012] and Waszczuk [2013].

3. Data and research design

We investigated the issue of returns to momentum, value, liquidity and size factors in the Polish market based on all stocks listed on the Warsaw Stock Exchange 30.11.2000 and 30.11.2012. The data came from Bloomberg. We used both listed and delisted stocks in order to avoid the survivorship bias.

We divided the stocks into three separate equal-sized groups classes on their fundamental characteristics:

- B/M value factor (book to market ratio);
- S size factor (market capitalization);
 - -M momentum factor (past year rate of return);
- L liquidity factor (average daily turnover).

We used only these stocks, which had all four computable characteristics in a given year. The number of stocks in the sample grew along with the development of Polish capital market from 36 at the beginning of the research period to 423 at the end.

Based on these characteristics, we constructed equal-weighted portfolios, which were reconstructed once a year on the 30th of November. The date was chosen intentionally in order to avoid look-ahead bias.

Next, we constructed long/short portfolios for each characteristic compounded of a long position in the highest-class portfolio and a short position in the lowest-class portfolios. For example, the B/M long/short portfolio was 100% long in the highest book-to-market ratio and 100% short in the lowest book-to-market ratio.

Finally, the performance of long/short portfolios were tested against two models: market model and CAPM [Cambell, Lo, MacKinlay 1997; Cochrane 2005]. The first one was the classical market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it},$$

$$E[\varepsilon_{it0}] = 0, \quad var[\varepsilon_{it0}] = \sigma_{\varepsilon}^2$$

where R_{it} and R_{mt} are the period-*t* returns on security and the market portfolio, ε_{it} is the zero mean disturbance term and $a_b \beta_i$ and σ_{ε^2} are the parameters of the market model. We employed average cross-sectional returns of all stocks in the sample as the proxy for market portfolio. We took such approach in order to be consistent with the portfolios' equal weighting methodology.

The other model we employed was Capital Asset Pricing Model. The long/short portfolios excess returns were regressed on market portfolio excess returns, accordingly to CAPM equation:

$$R_{pt} - R_{ft} = \alpha_i + \beta_i [R_{mt} - R_{ft}] + \varepsilon_{pt},$$

where R_{pb} , R_{mt} and R_{fl} are annual long/short portfolio, market portfolio and risk-free returns, and a_i and β_i are regression parameters. We used 1-year WIBID rates to represent the risk-free rate. The a_i intercept measures the average annual abnormal return [so called Jensen-alpha]. In both models, our zero hypothesis is that the alpha intercept is not statistically different from zero, and the alternative hypothesis states that it is actually different from zero. We found the equation parameters using OLS and tested them in both parametric and non-parametric (bootstrap) way.

4. Results and interpretation

The Table 1 shows descriptive characteristics of the portfolios constructed based on fundamental characteristics.

TABLE 1.

| Factor | Average annual rate of return | | Stan | dard devia | ation | | Beta* | | |
|--------|----------------------------------|--------|---------|------------|--------|---------|--------|--------|---------|
| | Lowest | Middle | Highest | Lowest | Middle | Highest | Lowest | Middle | Highest |
| V | 8.90% | 14.26% | 19.45% | 47.13% | 47.46% | 58.82% | 0.91 | 0.90 | 1.15 |
| М | 6.80% | 16.21% | 19.84% | 54.45% | 49.43% | 51.52% | 1.05 | 0.97 | 1.00 |
| S | 18.15% | 16.21% | 19.84% | 63.40% | 49.43% | 51.52% | 1.21 | 0.97 | 1.00 |
| L | 21.43% | 11.99% | 9.22% | 57.90% | 52.84% | 43.44% | 1.11 | 1.02 | 0.82 |

Descriptive statistics of class portfolios, 2000-2012

* Calculated against average return of all stocks

Source: own elaboration.

The value, momentum and liquidity portfolios behaved similarly to patterns observed on the developed markets. High book-to-market ratio, high momentum and low liquidity stocks noted higher returns than other stock classes. The exception was the size factor. In this case smaller stocks did not perform better than larger ones.

The next table (Table 2.) presents the analysis of long/short factor portfolios.

TABLE 2.

| Long/short portfolios | V | Μ | S | L | | | |
|-------------------------------------|----------|-------|---------|---------|--|--|--|
| Descriptive statistics | | | | | | | |
| Average annual rate of return | 16.4% | 9.7% | 2.8% | 15.6% | | | |
| Standard deviation | 24.3% | 28.2% | 32.5% | 39.3% | | | |
| Correlation with market returns**** | 0.90 | 0.27 | 0.76 | 0.87 | | | |
| Mark | et model | | | | | | |
| β | 0.52 | 0.10 | 0.48 | 0.91 | | | |
| z-stat _{par} | 4.36*** | 0.63 | 2.58*** | 2.97*** | | | |
| α | 0.13 | 0.12 | 0.01 | 0.13 | | | |
| <i>z-stat</i> par | 2.07** | 1.44 | 0.16 | 0.86 | | | |
| ζ-stat non par | 1.66* | 1.65* | 0.02 | 0.53 | | | |
| CA | 4PM | | | | | | |
| β | 0.53 | 0.11 | 0.49 | 0.90 | | | |
| <i>z-stat</i> par | 4.47*** | 0.69 | 2.66*** | 3.00 | | | |
| α | 0.10 | 0.07 | -0.02 | 0.13 | | | |
| <i>z-stat</i> par | 1.63 | 0.85 | -0.18 | 0.85 | | | |
| ₹-stat non par | 1.38 | 0.88 | -0.45 | 0.52 | | | |

The long/short factor portfolios, 2000-2012

* Significantly different from 0 at 10% level.

** Significantly different from 0 at 5% level.

*** Significantly different from 0 at 1% level.

**** We employed stock universe equal-weighted return as the market proxy.

Source: own elaboration.

All the long/short portfolios showed single- or double digit average annual returns: the highest in case of value factor and the lowest in case of size factor. However, in most cases (with the exception of B/M market model), the excess returns were not statistically significant. We suppose, that it may be due to high factor volatility and relatively short time series available.

Summing up, our computations showed that historically in Poland it was possible to build factor-based portfolios which outperformed the broad market portfolio. Nonetheless, the Polish market seems too young to derive some significant statistical interferences.

5. Conclusions

In the paper, we investigated whether the relations between four well-recognized factors: value, growth, momentum and liquidity – is present on the Polish market. We performed a long/short portfolio analysis based on all stocks listed on the Warsaw Stock Exchange between 2000 and 2012. We observed, that portfolios formed based on all the four factors delivered positive stock returns. However, only in case of value factor the abnormal returns were significantly positive.

The findings in this paper have a few implications for three distinct areas: investment practice, portfolio performance measurement and cost of capital calculation. First, they may be important for international investors who pursue factor strategies with regional focus. Second, the regional versions of factor models may be implemented to testing portfolio performance. Third, is seems reasonable to use the additional factors in investment and budgeting corporate decision, they appear to be valid determinants of cross-sectional variation in stock returns.

The further research should concentrate on four main issues. First, it should be tested, whether the factor based strategies withstand the application of transaction costs and liquidity constraints. Second, the sources of value, size, momentum and micro premiums in the CEE market could be examined. Third, it could focus on finding the reasons of anomalous reversed micro-cap momentum in the CEE market, which contradict the observations in the developed markets. Finally, it would be interesting, to explore further asset pricing anomalies, like for example the gross profitability effect by Novy-Marx [2014].

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Anna MILIAN¹

ON SOME RISK-REDUCING DERIVATIVES

Summary

In this paper, we propose some derivative designed for small stock investors. Using the Black-Scholes model we derive an explicit formula for the price of the derivative, computing its discounted expected payoff. The payoff is modelled on the payoff of the catastrophe bonds, random occurrence of a natural disaster is replaced by a random stock price falling. Different variants of the proposed derivative are obtained by introducing a parameter to the payoff of the derivative. By Monte Carlo method, to reduce the risk of large losses associated with the investment, indicated the variant of this instrument, appropriate to selected typical values of volatility of considered stock .

Keywords: Black-Scholes model, risk-reducing derivatives, Monte Carlo method, risk transfer

1. Introduction

Derivative is a financial instrument whose value is derived from an underlying asset. In this paper we use the Black-Scholes model with one risk-free asset and one risky asset. The risky instrument - a stock - is regarded as the underlying. We consider the simplest case of the model which is based on the following assumptions: security trading is continuous, there are no riskless arbitrage opportunities, there are no transaction costs and no dividends during the life of a derivative, the risk-free rate of interest and the volatility of an underlying asset are constant. Volatility, essential in the Black-Scholes model, can be computed as the standard deviation of the returns of an underlying asset for a period of one year (the annualized volatility). Assuming that there are 250 trading days in any given year, we obtain the annualized volatility, multiplying the standard deviation of the daily returns of a stock by $\sqrt{250}$ [Tarczyński, Zwolankowski, 1999, p. 280]. An estimate of future volatility of an underlying asset can be obtained by assuming that the recent realized level of volatility will continue in the future [Weron, Weron, 1998, p. 183]. Estimating volatility is a broad subject [Wiklund, 2012, p. 2] and goes beyond the scope of this work. The annualized volatility of stock, from now on called briefly volatility, is typically between 15% and 60% [Wiklund, 2012, p. 2]. The higher volatility, the greater risk of investing in stock. In the case of high volatility, to protect a holder of a stock against a large loss, we propose a financial instrument, paying an agreed amount

¹ Anna Milian, PhD – Institute of Mathematics, Cracow University of Technology, e-mail: amilian@ pk.edu.pl.

of money when the value of the stock falls below a specified level. The issuer of this instrument could be an investor having large financial resources, willing to take more risk. An investor investing in risky stocks would be a buyer of this instrument. When the stock price falls below a specified level, determined in the prospectus of the derivative, the holder of the financial instrument exercises his right to sell the instrument at the agreed price. The issuer of this instrument is obliged to redeem the instrument for an amount of money, fixed in a contract. In this paper we obtain an analytical closed form formula to price the proposed derivative instrument. Using Monte Carlo simulations we consider the derivative in a few variants. Different variants of the derivative are obtained by introducing different parameter values to the function of the payoff of the instrument. Depending on volatility of a stock price, we indicate a proper variant of a derivative instrument for reducing risk of large losses associated with investing in a stock. The idea of this financial instrument is based on the idea of catastrophe bonds [Romaniuk, Ermolieva, 2004, p. 115].

2. Definition and pricing a risk-reducing derivative

Let *r* be the risk-free interest rate and $\sigma > 0$ be a stock price volatility. We assume the price *S* of the stock follows a geometric Brownian motion

$$S_t = S_0 \exp\left(\left(r - \frac{1}{2}\sigma^2\right)t + \sigma W_t\right), t \in [0, T],\tag{1}$$

where $W = \{W_t, t \in [0, T]\}$ is a standard Brownian motion under the risk-neutral probability P, the stock price at time 0 is S_0 and T is the expiry date. Let us denote by E^P the expectation operator under the P – measure and by $\{\mathcal{F}_t\}$ a filtration for Brownian motion W. Let us consider a financial derivative instrument dependent on parameter a > 0, with the following payoff function

$$f(S_T) = \begin{cases} S_T & \text{if } S_T \leq aS_0, \\ 0 & \text{if } S_T > aS_0. \end{cases}$$
(2)

If someone invests an amount S_0 in a risky stock at time 0, he obtains S_T at time T. If the investor is additionally the holder of the proposed derivative and value S_T of his investment falls below aS_0 at time T, he receives compensation equal to S_T , as the payoff of the instrument. If S_T exceeds the level of aS_0 , he does not receive a compensation. Thus the instrument provides some protection against the collapse of the value of the stock and can be considered as an obligation transferring the risk from a holder of the derivative - an individual investor investing in stocks, to an issuer. The method of pricing the instrument for selected values of a. Since $f(S_T)$ is positive, \mathcal{F}_T – measurable and square-integrable with respect to measure P, the arbitrage price of the proposed instrument expresses as the expected value of its discounted payouts. This expectation is taken with respect to the risk-neutral measure P [Jakubowski et al., 2003, p. 180]. Then today's price of the instrument is

$$c = E^P \left(e^{-rT} f(S_T) \right). \tag{3}$$

By (2) and (3) we have:

 $c = e^{-rT} E^P (S_T \mathbb{1}_{(S_T \le aS_0)}) = e^{-rT} \int_{\Omega} S_T \mathbb{1}_{(S_T \le aS_0)} dP = e^{-rT} \int_{\Omega} S_T \mathbb{1}_{(0 \le S_T \le aS_0)} dP.$ With the change of variables, denoting by g the probability density function of S_T ,

With the change of variables, denoting by g the probability density function of S_T , we have

$$c = e^{-rT} \int_0^{aS_0} xg(x) dx.$$

Let *f* denote probability density function of $X = \left(r - \frac{1}{2}\sigma^2\right)T + \sigma W_T$.

Since $S_T = S_0 e^X$, it follows that the probability density function g of S_T is expressed as

$$g(x) = \frac{1}{x} f\left(\ln \frac{x}{s_0}\right) \text{ for } x > 0 \text{ and } g(x) = 0 \text{ for } x \le 0$$

and consequently we have

$$c = e^{-rT} \int_0^{aS_0} f\left(\ln\left(\frac{x}{S_0}\right)\right) dx.$$

Substituting $\ln\left(\frac{x}{s_0}\right) = u$ in last integral and taking into account that

$$f(x) = \frac{1}{\sigma\sqrt{2\pi T}} \exp\left(-\frac{\left[x - \left(r - \frac{1}{2}\sigma^2\right)T\right]^2}{2\sigma^2 T}\right)$$

we have

$$c = \frac{S_0 e^{-rT}}{\sigma \sqrt{2\pi T}} \int_{-\infty}^{\ln a} \exp\left\{u - \frac{\left[u - \left(r - \frac{1}{2}\sigma^2\right)T\right]^2}{2\sigma^2 T}\right\} du.$$

But

$$\begin{split} u - \frac{\left[u - \left(r - \frac{1}{2}\sigma^2\right)T\right]^2}{2\sigma^2 T} &= \frac{2\sigma^2 T u - \left[u - \left(r - \frac{1}{2}\sigma^2\right)T\right]^2}{2\sigma^2 T} = \\ &- \frac{-u^2 + 2uT\left(r + \frac{1}{2}\sigma^2\right) - T^2(r - \frac{1}{2}\sigma^2)^2}{2\sigma^2 T} = \\ &= -\left(\frac{u^2 - 2uT\left(r + \frac{1}{2}\sigma^2\right) + T^2(r + \frac{1}{2}\sigma^2)^2 + T^2(r - \frac{1}{2}\sigma^2)^2 - T^2(r + \frac{1}{2}\sigma^2)^2}{2\sigma^2 T}\right) \\ &= \frac{-[u - \left(r + \frac{1}{2}\sigma^2\right)T]^2 + 2r\sigma^2 T^2}{2\sigma^2 T}. \end{split}$$

Hence

$$c = \frac{S_0 e^{-rT}}{\sigma \sqrt{2\pi T}} \int_{-\infty}^{\ln a} exp\left(\frac{-\left[u - \left(r + \frac{1}{2}\sigma^2\right)T\right]^2 + 2r\sigma^2 T^2}{2\sigma^2 T}\right) du = S_0 H(\ln a)$$

where *H* is cumulative distribution function of normal distribution with mean $\left(r + \frac{1}{2}\sigma^2\right)T$ and standard deviation $\sigma\sqrt{T}$.

Finally, we obtain the price of considered derivative

$$c = S_0 N \left(\frac{\ln a - \left(r + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}} \right)$$
(4)

where N is the cumulative probability distribution function for a standardized normal distribution.

From (4) it follows that for every fixed σ the price of the considered derivative is an increasing function of the coefficient a and does not exceed S_0 . Our purpose is to propose a variant of the derivative (i.e. to propose value of a) with a payoff given by (2) according to the volatility of the stock. To this end, let us examine more closely how the price c varies according to parameters a and σ . Since the instrument is designed to protect against a decline in the stock price i.e. against the event $S_T \leq aS_0$, we consider parameter a in the interval [0,1].

Example. Let $S_0 = 1, T = 1, r = 5$ %. Figures 1 and 2 plot today's price *c* against the coefficient *a*.

FIGURE 1.

The price *c* as a function of *a*, for fixed σ =15%



Source: own study.

FIGURE 2.



The price *c* as a function of *a*, for fixed $\sigma = 60\%$

Source: own study.

A growth rate of the price depends on the volatility of the stock price. When the volatility increases, the price of the proposed instrument is positive for smaller and smaller values of parameter a. It can be explained by the fact that the greater volatility implies greater probability of a large decline in the stock price and consequently greater probability of payoff from the derivative.

In Figure 3 we present dependence of the price c on the volatility σ changing in the range [10%, 100%], with three fixed values of a.

One can see the derivative price not always increases with stock price volatility. The graphs are significantly different, it can be assumed that the choice of the parameter a will have significantly different consequences for the investor. The above cursory analysis of the derivative price does not yet provide decision-making rule which variant of the considered derivative to choose (from an investor point of view). The graphs motivate the need for further analysis of the problem. We proceed with the study of the problem in the next section.



Plots of c against σ , for different but fixed values of a

Source: own study.

3. Return on investment

To examine the usefulness of proposed derivative instrument, let us compare two investment portfolios:

1. The portfolio is composed of one stock with value S_0 at time 0. The discounted profit from the portfolio at time T equals

$$S_T e^{-rT} - S_0.$$

We will simulate related, discounted profit from the portfolio, expressed in percentage

FIGURE 3.

$$U = \frac{S_T e^{-rT} - S_0}{S_0} * 100\%$$
 (5)

2. An investor decides to buy one stock with value S_0 at time 0 and additionally one risk reducing derivative at price c. The portfolio consists of one stock and the purchased derivative. The discounted gain from the portfolio is

$$(S_T + f(S_T))e^{-rT} - (S_0 + c).$$

related, discounted percentage of profit from the portfolio equals
$$V = \frac{(S_T + f(S_T))e^{-rT} - (S_0 + c))}{S_0 + c} * 100\%.$$
 (6)

We will compare the two portfolios, computing U and V. We use formula (4) to calculate c and Monte Carlo method to calculate random variables occurring in formulas (5) and (6). Namely, we simulate a sample $s_1, ..., s_n$ of $n = 10^5$ values of random variable S_T . Then we calculate, substituting s_i in place of S_T :

$$\begin{aligned} f_i &= f(s_i), i = 1, \dots, n \ \text{by (2)}, \\ U_i &= U(s_i), i = 1, \dots, n \ \text{by (5)}, \\ V_i &= V(s_i), , i = 1, \dots, n \ \text{by (6)}. \end{aligned}$$

Let q(U) denote quantile of order 0.05 of the sample U_i , i = 1, ..., n and let q(V) be the same order quantile of the sample V_i , i = 1, ..., n. Hence $P(U \le q(U)) = P(V \le q(V)) = 0.05$ and each of the quantiles indicates the potential loss of the respective portfolio, expressed in percentage over time horizon T for a given confidence level 0.95. Let us denote by Q(U) and Q(V) quantile of order 0.95 of the samples of U_i , i = 1, ..., n and V_i , i = 1, ..., n respectively. Then P(U > Q(U)) = P(V > Q(V)) = 0.05. The gain of the portfolio I, expressed in percentage, over time horizon T, does not exceed Q(U) with probability 0.95. The analogous gain of the portfolio II, impassable with probability 0.95, is equal to Q(V).

The results of our calculations for T = 1, r = 5%, $S_0 = 1$, $\sigma = 0.1 * k, k = 1, ..., 10$ and $a \in \left\{\frac{1}{2}, \frac{3}{4}, 1\right\}$ are presented below:

TABLE 1.

| σ | q (U) | Q(U) | q(V) | Q(V) |
|-----|-----------------------|--------|--------|--------|
| 0.1 | -15.57 | 17.18 | -15.57 | 17.18 |
| 0.2 | -29.52 | 36.00 | -29.5 | 35.99 |
| 0.3 | -41.60 | 56.57 | -40.30 | 55.90 |
| 0.4 | -52.19 | 78.30 | -46.12 | 74.83 |
| 0.5 | -61.22 | 101.19 | -49.46 | 93.21 |
| 0.6 | -68.87 | 125.78 | -52.41 | 112.61 |
| 0.7 | -75.20 | 147.22 | -55.46 | 129.11 |
| 0.8 | -80.48 | 172.28 | -64.24 | 149.35 |
| 0.9 | -84.90 | 191.81 | -72.58 | 165.03 |
| 1 | -88.35 | 214.87 | -78.95 | 184.46 |

Quantiles of order 0.05 and 0.95 of U and V, for a = 1/2

Source: own study.

The

As one can see, for a=1/2 and volatility 0.1, the quantiles q(U) and q(V) are equal, for volatility 0.2 and 0.3 the difference between the quantiles q(U) and q(V) is not significant. The biggest difference, about 20%, is observed for volatility 0.7.

| σ | q(U) | Q(U) | q(V) | Q(V) |
|-----|--------|--------|--------|--------|
| 0.1 | -15.64 | 17.34 | -15.64 | 17.36 |
| 0.2 | -29.42 | 36.52 | -26.33 | 34.75 |
| 0.3 | -41.75 | 56.38 | -31.61 | 42.02 |
| 0.4 | -52.20 | 78.34 | -34.94 | 55.32 |
| 0.5 | -60.93 | 100.96 | -38.31 | 70.68 |
| 0.6 | -68.83 | 126.43 | -47.80 | 89.62 |
| 0.7 | -75.33 | 146.70 | -58.97 | 105.14 |
| 0.8 | -80.46 | 169.74 | -67.58 | 123.75 |
| 0.9 | -84.73 | 196.49 | -74.65 | 146.12 |
| 1 | -88.21 | 211.41 | -80.38 | 159.27 |

Quantiles of order 0.05 and 0.95 of U and V, for a = 3/4

Source: own study.

When a = 3/4 and volatility equals 0.1 quantiles q(U) and q(V) are equal, for volatility 0.2 the difference is about 3% only. The biggest difference between q(U) and q(V), over 20%, is observed for volatility 0.5 and 0.6.

TABLE 3.

| σ | q(U) | Q(U) | q(V) | Q(V) |
|-----|--------|--------|--------|--------|
| 0.1 | -15.46 | 17.23 | -25.33 | 45.16 |
| 0.2 | -29.69 | 35.87 | -28.46 | 36.04 |
| 0.3 | -41.71 | 56.33 | -28.92 | 34.55 |
| 0.4 | -52.13 | 78.11 | -30.60 | 36.84 |
| 0.5 | -61.21 | 100.33 | -43.09 | 46.96 |
| 0.6 | -68.93 | 123.77 | -54.00 | 65.66 |
| 0.7 | -75.25 | 147.70 | -62.97 | 85.30 |
| 0.8 | -80.68 | 171.17 | -70.77 | 105.15 |
| 0.9 | -84.92 | 189.79 | -76.92 | 121.79 |
| 1 | -88.30 | 212.98 | -81.87 | 142.40 |

Quantiles of order 0.05 and 0.95 of U and V, for a = 1

Source: own study.

In case when a =1, if volatility is 0.1, q(U) and q(V) differ by about 10%. For volatility 0.2, the difference between the quantiles q(U) and q(V) is not significant. The difference is significant, over 20%, for volatility 0.4. Knowing the value of the parameter σ (calculated on the base of observations of market prices of stock) an investor can choose the optimum value of the parameter a to minimize the risk of the investment in

TABLE 2.

the stock. Namely, for each of the typical value of the volatility we indicate for an investor the parameter and consequently the derivative which reduces the risk of a large loss by more than 10% on confidence level 95%. Precisely, if $\sigma = 0.3$ then choosing the derivative with parameter a = 1, an investor obtains reduction of the potential loss of his portfolio from 41.71% to 28.92%, for confidence level 0.95. This means that probability that loss of portfolio U exceeds 41.71% (gain is less than -41.71%) equals 5% while for portfolio V, probability of 5% refers to the loss greater than 28.92% only. If $\sigma = 0.4$ and a = 1, potential loss, on 0.95 confidence level, decreases from 52.13% to 30.6%. If $\sigma = 0.5$ or $\sigma = 0.6$, an investor gets the largest reduction of the potential loss, over 20%, at a confidence level of 0.95, for the derivative with parameter a = 3/4. If $\sigma = 0.7$, taking into account reduction of potential loss of his portfolio, the most preferred purchase of the derivative corresponds to the value of the parameter a = 1/2. If the stock price volatility σ does not exceed 0.2 the proposed derivative has no effect on the potential loss of a portfolio. As one can see, generally q(U) < q(V) which means that the proposed derivative instrument reduces the risk associated with investing in stocks.

4. Conclusions

To summarize, we propose a risk reducing derivative designed for small stock investors. We obtain an analytical closed form formula to price the proposed derivative instrument. To analyze the applicability of the proposed instrument, we compare the two investment portfolios, one composed of a stock with the other composed of a stock and the proposed risk reducing derivative. Using Monte Carlo simulation we compute and compare discounted profit and corresponding quantiles of various order for both portfolios. The obtained results demonstrate that generally, the portfolio including our proposed derivative has associated greater quantile indicating potential loss and consequently smaller risk.

The payment of the proposed derivative depends on a parameter. The derivative is precisely determined by fixing the parameter value. Using Monte Carlo, for each of the typical value of the volatility we indicate for investors the parameter and consequently the derivative which reduces the risk of a large loss by more than 10% on confidence level 95%. To conclude, our proposed derivative instrument reduces the risk of large losses associated with investing in stocks. Reducing the risk of ruin can be important for small investors. Note that the lower risk of a large loss goes hand in hand with limited chance for a big profit. On the other hand, the possibility of large profits, even fraught with greater risk, may be attractive for large market players, holders of the proposed instrument.

In future work, a more general Black-Scholes model could be used to investigate the proposed derivative.

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Dorota KOZIOŁ-KACZOREK1

THE USE OF COMBINED MULTICRITERIA METHOD FOR THE VALUATION OF REAL ESTATE

Summary

A considered problem is a valuation of real estate. It is important to specify their exact market value, which is the result of several factors. Valuation of property is made on the basis of information and transactions on the local market. Moreover, the valuation always is based on the data of the similar properties. A comprehensive set of data is needed for these reasons. It is quite confusing because the number of transactions on the local market often is not sufficient. The purpose of this paper is to present a method for multicriteria valuation of real estate. This procedure is based on the Analytic Hierarchy Process (AHP) and the Goal Programming (GP). It was designed especially for valuation in situation in which information are limited. The proposed method was used for the valuation of the real estate located on Warsaw.

Key words: real estate, value of real estate, AHP, GP, multicriteria agricultural valuation

1. Introduction

The considered problem is valuation of real estate as a subject of ownership. The study is limited only to the valuation of the market value of the property. In the paper are used definitions of a valuation and the market value of the real estate which are regulated by Real Estate Management Act [Act of 21.08.1997] and Council of Ministers On the Valuation of Property and Preparing the Appraisal [Act of 21.08.2004]. These definitions are based on recommendations of The International Valuation Standards, European Valuation Standards and EU directives [Maczyńska 2009; Trojanek, 2010, p. 66-75]. The valuation is defined as the process of estimating e.g. market value of property. The market value is defined as the price of a property that is available for purchase. This price is most likely to be concluded by buyers and sellers of the property [Maczyńska 2009; Trojanek, 2010, p. 66-75]. The correct valuation of real estate requires the fulfillment of certain conditions. Firstly, the correct valuation is based on comprehensive set of information and transactions from local real estate market. It means, that it is based on information of properties which were traded on the local market in the last two years. Therefore, all characteristics of real estate have a local nature. Secondly, the correct valuation is based on information of properties which are similar

¹ Dorota Koziol-Kaczorek, Ph.D. – Faculty of Economic Sciences, Warsaw University of Life Sciences, e-mail: dorota_koziol@sggw.pl.

to the valued one. The similar property means, that it is comparable due to the type, location, legal status, purpose, method of use and other characteristics that affect its value. Also, in the valuation process is required the determining weights for the characteristics of properties which are compared [Maczyńska 2009; Trojanek, 2010, p. 66-75].

Unfortunately, on the local market often is not sufficient number of transactions that can be used for valuation. Moreover, values of characteristics of property mostly are intangible. Solution of this problem can be a method of valuation of real estate which does not need an extensive set of information to obtain reliable results.

The purpose of this paper is to present a combined multicriteria valuation method (CMVM). This procedure is based on a combination of two multicriteria decision-making methods i.e. the Analytic Hierarchy Process (AHP) and Goal Programming (GP). The mixed AHP and GP procedure for multicriteria real estate valuation has been designed especially for valuation in situation in which information are limited [*Mixed valuation methods...*, 2011, p. 221-238; Koziol-Kaczorek, 2012, p. 236-239; Koziol-Kaczorek, 2013, p. 87-93]. Originators of CMVM are J. Aznar, F. Guijarro and J.M. Moreno-Jimenez. They created this procedure during a research project of the Spanish Ministry of Education and Science. The application of the proposed methodology was illustrated by the example of the valuation of a peach plantation in the La Riberta district in Valencia in Spain.

The main aim of the CMVM is to extract the knowledge from specific characteristics of real estate during the valuation process. This technique can be used with both intangible and scarce information. The Analytic Hierarchy Process allows for the incorporate tangible and intangible aspects by means of using paired comparisons in the valuation procedure. The Goal Programming (GP) allows for the incorporate both the scarce information available (objective) and the individual appraiser's attitude with regards to the valuation process (subjective) [*Mixed valuation methods...*, 2011, p. 221-238; Koziol-Kaczorek, 2012, p. 236-239; Koziol-Kaczorek, 2013, p. 87-93]. The proposed method will be used for the valuation of the real estate located in Warsaw.

2. The Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) was developed by T. L. Saaty. It is discrete multicriteria method which combines a decisions theory and mathematics. AHP is used to making optimal choices for the multicriteria decisions problems by reducing them to a series of pairwise comparisons. These pairwise comparisons are carried out by experts and allow to designate a numerical measure of a validity of analysed variants. Other words, the optimal choice is made on the basis of weights of criteria and features determined by using AHP. These criteria and characteristics can be in the form of both metric or nonmetric (ordinal). AHP algorithm consists of few steps: definition of a problem, construction of a hierarchical model, pairwise comparison of the validity of analysed variants on each level of a hierarchy, construction of a vector of priorities

for analysed decisions elements, verification of a consistency of comparisons at each level of the hierarchy, analysis of results [Saaty 1980, Saaty 2001, Wysocki 2010]².

Stage I. This stage contains general definition of the problem being solved. It contains a determination of an overarching objective, a determination of main and partial criteria and also a determination of analysed variants of these criteria [Saaty, 1980; Saaty, 2001; Wysocki, 2010].

In the case of property valuation, the overarching objective is prioritization of those characteristics of property that affect its market value. It consists in assigning weights for each of characteristic. The main criterion are real estate, which have been the subject of a transaction on an analysed local market, along with the prices for 1 m². Partial criteria are characteristics of real estate and their values. The set of characteristics depends primarily on the type of property (undeveloped or developed property, premises realty etc.) and on the specificity of the local market. And so, the set of the characteristics of e.g. premises realty may consist position and location, the neighbourhood and the environment, surface, place, location of the premises in the building, the condition of the building, the standard finish of premises, etc. [Dydenko 2006]. Variants of partial criteria are values of the selected characteristics. Those values are determinants of both partial and the main criteria.

Stage II. This stage contains construction of a multicriteria hierarchical tree. The main criterion is always on the top of this structure. There are also below partial criteria. The rule indicates that in the tree structure cannot be less than two partial criteria but not more than seven. This rule is based on the psychological fact that human brain can compare, with no mistake, no more than 7 ± 2 objects [Saaty, 1980; Saaty, 2001; Wysocki, 2010].

In the case of property valuation, the form of the hierarchical model is depend on the type of real estate (undeveloped or developed property, premises realty etc.), as well as the peculiarities of the local market. The main criteria may include the following: the property with the lowest price (A), the property with the price somewhat below average (B), the property with the price slightly above average (C), the property with the highest price (D). Partial criteria are discussed above.

Stage III. The third stage involves the evaluation of all components of the hierarchical tree by comparing them in pairs on a "peer". Those comparisons are made on the basis of expert knowledge. Compared pair of elements of some level of hierarchical model is evaluated in terms of relative importance in relation to the criterion level located above (their weights are determined). For this purpose, a matrix of comparisons $\mathbf{A} = [a_{ij}]_{nrn}$ is created, where

- a_{ii} are values of Saaty's fundamental scale;

- if
$$a_{ij} > 0$$
, then $a_{ij} = \frac{1}{a_{ij}}$

² See also: [Zmienne decydujące..., 2011; Kozioł-Kaczorek, 2012; Kozioł-Kaczorek, 2013].

- if i = j, then $a_{ij} = 1$ i $a_{ji} = 1$.

The Saaty's fundamental scale contains degrees of preference for the comparison of pairs of elements of decision-making. The scale of values and their descriptions are shown in table 1.

TABLE 1.

| Numerical scale | Verbal scale |
|-----------------|--|
| 1 | Same importance |
| 3 | One item moderately more important than another |
| 5 | One item significantly more important than another |
| 7 | One item much more important than another |
| 9 | One item very much more important than another |
| 2, 4, 6, 8 | Intermediate situations |

Saaty's fundamental scale

Source: own study based on literature [Saaty 1980, Saaty 2001]

In the case of real estate, this stage involve construction of five matrices of comparisons:

- the matrix of comparisons of real estate due to prices,
- the matrix of comparisons of characteristics of property with the lowest price,
- the matrix of comparisons of characteristics of property with the price somewhat below average,
- the matrix of comparisons of characteristics of property with the price slight-ly above average,
- the matrix of comparisons of characteristics of property with the highest price [*Zmienne decydujące...*, 2011; Kozioł-Kaczorek, 2012].

Stage IV. The fourth stage is the construction of the vector

$$\mathbf{W} = \mathbf{C}\overline{\mathbf{w}},$$

which is a vector of the priorities of the analysed objects. This vector is also called a vector of acceptable solutions. It expressed the weight of analysed criteria and alternatives due to the overarching objective. Columns in the matrix **C** are vectors of priorities (scale) designated for the corresponding partial criteria. Vector $\overline{\boldsymbol{w}}$ is a vector of the scale fixed for the main criterion. The priorities vector is obtained by calculating the weights

$$w_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}},$$

and then by calculating elements of this vector

$$\overline{w}_i = \frac{\sum_{j=1}^n w_{ij}}{n}, i, j = 1, 2, ..., n.$$

Elements of hierarchical model are arranged according to the size of elements of the priorities vector \mathbf{W} , in order of their importance. A higher value means more the significance of the item [Saaty 1980, Wysocki 2010].

In the case of real estate, the vector of priorities includes weights of the individual characteristics of the property. This stage involve construction of five vectors of priorities:

- the vector of priorities for four chosen real estate;
- the vector of priorities for property with the lowest price;
- the vector of priorities for property with the price somewhat below average;
- the vector of priorities for property with the price slightly above average;
- the vector of priorities for property with the highest price [Zmienne decydujace..., 2011; Koziol-Kaczorek 2012].

Stage V. The fifth step involves checking compliance of comparisons for the whole hierarchical structure. To this end, is calculated the indicator of inconsistencies

$$CI=\frac{(\lambda_{max}-n)}{(n-1)},$$

where

$$\lambda_{max} = \frac{1}{n} \left(\sum_{i=1}^{n} \frac{(\mathbf{A}\overline{\mathbf{w}})_i}{\overline{w}_i} \right), \lambda_{max} \ge n$$

is a maximal eigenvalue of the matrix **A**. The value λ_{max} inform about the consistency of the results. The more closely related to the size of the *n* including the results of comparisons of pairs show greater compliance. When comparing pairs do not contain any incompatibilities $\lambda_{max} = n$. Similarly, if the value of the indicator CI = 0 and $\lambda_{max} = n$ it means that evaluations are completely consistent [Saaty, 1980; Saaty, 2001; Trzaskalik, 2006; Wysocki, 2010].

A coefficient of inconsistencies can be also computed by the formula

$$CR = \frac{CI}{RI}$$

where RI is a random index, which is dependent on the matrix order. If the value of the coefficient of inconsistencies $CR \leq 0.1$, then it can be concluded that comparisons are consistent. If the value of the coefficient of inconsistencies CR = 0, then it can be concluded that comparisons are completely consistent. When CR > 0.1 it is necessary to repeat (all or some) comparisons in pairs to remove the discrepancy [Saaty, 1980; Saaty, 2001; Trzaskalik, 2006; Wysocki, 2010].

3. The Goal Programming (GP)

The Goal Programming (GP) is an extension of linear programming. However, it is not focused on optimisation like linear programming. The Goal Programming is focused on satisfaction and searching of a number objectives at the same time. It is mathematical nonlinear programming but it can be easy linearized. Objectives are formulated by specifying the desired values of the analyzed criteria. The main task of goal programming is to find the best solution in which all the conditions are satisfied. A lot of variants of GP exist in literature. In this paper two of them are applied: Weighted Goal Programming and MinMax. The form of the basic model for WGP is:

$$\min_{x} z_{[i1]} = \sum_{j=1}^{r} \lambda_j (d_j^- + d_j^+)$$

$$z_j(x) + d_j^- - d_j^+ = \hat{z}_{j,j} = 1, \dots, r$$

$$g_i(x) \le 0, i = 1, \dots, m$$

$$x \ge 0, d_j^- \ge 0, d_j^+ \ge 0,$$

where d_j^- is the negative deviation and d_j^+ is positive deviations with respect to the *j*-th goal (\hat{z}_j) . Moreover, λ_j denotes a normalisation factor. Note that, since the values are already normalised in the distribution mode, there is no need for normalisation factor, so $\lambda_j = 1$ is taken [*Mixed valuation methods...*, 2011 pp. 221-238]. In the model occurs *m* strong constrains. Their determine feasible region i.e. $g_i(x), i = 1, ..., m$. There are also *r* weak constrains for the goals considered $(\hat{z}_j, j = 1, ..., r)$.

The goal vector $\hat{z} = (\hat{z}_1, ..., \hat{z}_r)$ contains prices of each real estate comparable to the subject one during the valuation of real estate. The valuation function is on the form:

$$z(x^{j}) = a_{0} + \sum_{l=1}^{n} a_{l} x_{l}^{j}, j = 1, ..., r,$$

where x_l^j is the relative value in the l -th criterion of the j -th real estate, and $a_l > 0$ are estimated parameters of the model [*Mixed valuation methods...*, 2011, p. 221-238]. The basic model for MinMax (symbols are the same as in WGP) is:

$$\begin{split} \min_{x} z_{[\infty 1]} &= d_{max} = \max_{j} \left(d_{j}^{-} + d_{j}^{+} \right) \\ z_{j}(x) + d_{j}^{-} - d_{j}^{+} &= \hat{z}_{j}, j = 1, \dots, r \\ d_{j}^{-} + d_{j}^{+} &\leq d_{max}, j = 1, \dots, r \\ g_{i}(x) &\leq 0, i = 1, \dots, m \\ x \geq 0, d_{j}^{-} \geq 0, d_{j}^{+} \geq 0. \end{split}$$

Note that, this model uses L_{∞} – metric to obtain the best solution [*Mixed valuation methods...*, 2011, p. 221-238; Kozioł-Kaczorek, 2013].

4. The combined multicriteria valuation method (CMVM)

As it was written before, the combined multicriteria method (CMVM) is a combination of the Analytic Hierarchy Process (AHP) and Goal Programming (GP). The algorithm of CMVM contains three stages. The first stage is the use of AHP to quantify the subjective information about the elements being compared. The second stage is the use of GP for estimating the parameters of regression model $z(x^j)$ to obtain the market value of real estate. The GP is used in two different ways, according to a Manhattan norm L_1 and a Tchebychef norm L_{∞} . The Manhattan norm L_1 introduces scarce information available into the model. The Tchebychef norm L_{∞} captures the subjective attitude with respect to the valuation process (i.e. the greater distance between the compared elements contribute to the greater subjectivity of the assessment). Furthermore, this norm allows consideration of the proximity of the subject asset to one of the comparable sets of assets that does not follow common or majority behaviour. These norms are used to determine the objective function to be optimised [Mixed valuation methods..., 2011, p. 221-238; Koziol-Kaczorek, 2013].

The third stage is the final valuation of the real estate. The final market value of real estate is a result of a convex combination of values obtained in stage two. The formula of the market value is:

 $CMM(X) = (1 - \alpha)V_1(X) + \alpha V_{\infty}(X), \alpha \in [0, 1]$

where $V_1(X)$ and $V_{\infty}(X)$ are the L_1 and L_{∞} values. The level of α depends on the expert knowledge. The level $\alpha = 1$ means that the valued property is very similar to comparable properties. On the other hand, level $\alpha = 0$ means that the valued properties is significant different from comparable properties [*Mixed valuation methods...*, 2011, p. 221-238; Koziol--Kaczorek, 2013].

5. The valuation of real estate

The above-described methodology was applied to the valuation of premises realty located on Mokotów district in Warsaw. Therefore, the set of data also comes from the real estate market in the Mokotów district in Warsaw. It was collected by the property appraisers of Institute of Property Consultancy.

The first step of the CMVM is the use of AHP to determine the weights of characteristics of real estate. The overarching objective was the assigning weights for characteristics of valued premises realty. Main criteria were properties with the lowest price (A), the price somewhat below average (B), the price slightly above average (C), the highest price (D).

Partial criteria were characteristics of premises realty i.e.: the position and location, the neighbourhood and the environment, the surface, the location of the premises in the building, the condition of the building, the standard of finish of premises. Values of the selected characteristics of premises realty i.e.: very good, good, sufficient, bad were variants of partial criteria. The hierarchical model were then on the form presented in above table 2.

Hierarchical model

TABLE 2.

| Main criterion | Partial criteria | Variants of partial criteria |
|----------------|--|------------------------------|
| | the position and location | good |
| | the neighbourhood and the environment | bad |
| The property A | the surface | sufficient |
| The property A | the location of the premises in the building | bad |
| | the condition of the building | sufficient |
| | the standard of finish of premises | bad |
| | the position and location | good |
| | the neighbourhood and the environment | good |
| The property B | the surface | very good |
| The property D | the location of the premises in the building | good |
| | the condition of the building | good |
| | the standard of finish of premises | sufficient |
| | the position and location | good |
| | the neighbourhood and the environment | good |
| The property C | the surface | very good |
| The property C | the location of the premises in the building | good |
| | the condition of the building | good |
| | the standard of finish of premises | sufficient |
| | the position and location | very good |
| | the neighbourhood and the environment | very good |
| The property D | the surface | good |
| The property D | the location of the premises in the building | very good |
| | the condition of the building | very good |
| | the standard of finish of premises | very good |

Source: own study based on literature [Zmienne decydujące o wartości..., 2011; Kozioł-Kaczorek, 2012].

The property A (the lowest price) is premises realty located on 11th floor in eleven storey building. The total area of the apartment is about 65 m². Requires overhaul of apartment. The building also needs global renovation due to its technical condition. The price of 1 m² of the property was PLN 4 443.

The property B (the price somewhat below average) is premises realty located on 5th floor in ten storey building. The total area of the apartment is about 37 m². Requires renovation of apartment. The building is in good technical condition. The price of 1 m² of the property was PLN 8 706.

The property C (the price slightly above average) is premises realty located on 5th floor in ten storey building. The total area of the apartment is about 31 m². Requires

renovation of a partment. The building is in good technical condition. The price of $1\ m^2$ of the property was PLN 8 710.

The property D (the highest price) is premises realty located on 3rd floor in fife storey building. The total area of the apartment is about 45 m². The apartment was completely renovated, and the standard of it is very high. The building is new and in very good technical condition. The price of 1 m² of the property was PLN 13 283.

Presented in table 2 hierarchical tree was established by analysis of the local market and the appraiser's knowledge. Then it was constructed five matrices of comparisons:

- the matrix of comparisons of real estate due to prices;
- the matrix of comparisons of characteristics of property with the lowest price;
- the matrix of comparisons of characteristics of property with the price somewhat below average;
- the matrix of comparisons of characteristics of property with the price slightly above average;

- the matrix of comparisons of characteristics of property with the highest price; and also five vectors of priorities:

- the vector of priorities for four chosen real estate;
- the vector of priorities for property with the lowest price;
- the vector of priorities for property with the price somewhat below average;
- the vector of priorities for property with the price slightly above average;
- the vector of priorities for property with the highest price [*Zmienne decydujące*..., 2011; Koziol-Kaczorek, 2012].

The another step involved checking compliance of comparisons for the whole hierarchical structure. For this reason the coefficients of inconsistencies were computed:

- for comparisons of real estate due to prices (CR = 0.08);
- for comparisons of characteristics of property with the lowest price ($CR_A = 0.01$);
- for comparisons of characteristics of property with the price somewhat below average ($CR_B = 0.01$);
- for comparisons of characteristics of property with the price slightly above average ($CR_C = 0.01$);
- for comparisons of characteristics of property with the highest price ($CR_D = 0.01$).

The obtained values of the coefficients of inconsistencies indicate that every comparison was consistent and compatible. A detailed description of the analysis and detailed results are on Koziol-Kaczorek [2012]. Weights obtained as a result of the analysis are presented in the Table 3.

Letter V denotes the valued property. It is premises realty located on 2nd floor in fife storey building. The total area of the apartment is about 39 m². The apartment was completely renovated, and the standard of it is very high. The building is in very good technical condition.
TABLE 3.

| Characteristic | Properties | | | | |
|-------------------------------------|------------|--------|--------|--------|--------|
| | Α | В | С | D | V |
| the position and location | 0.3324 | 0.1425 | 0.2520 | 0.3615 | 0.3037 |
| the neighbourhood and the | 0.1525 | 0.3675 | 0.2520 | 0.0740 | 0.1588 |
| environment | | | | | |
| the surface | 0.0609 | 0.0563 | 0.0471 | 0.1316 | 0.1007 |
| the location of the premises in the | 0.3324 | 0.0563 | 0.2520 | 0.0740 | 0.1146 |
| building | | | | | |
| the condition of the building | 0.0609 | 0.1425 | 0.0471 | 0.1316 | 0.1154 |
| the standard of finish of premises | 0.0609 | 0.2349 | 0.1498 | 0.2272 | 0.2068 |

Weights of characteristics of premises realty

Source: own study based on literature [Zmienne decydujące..., 2011; Kozioł-Kaczorek, 2012].

The second stage of the CMVM contains the GP application. The GP was used in two different ways (the Manhattan norm L_1 and the Tchebychef norm L_{∞}) for estimating the regression parameter. In this paper the mentioned regression model was on the form

 $z(x^j) = a_0 + a_1x_1^j + a_2x_2^j + a_3x_3^j + a_4x_4^j + a_5x_5^j + a_6x_6^j$, j = 1,2,3,4where x^j denotes weight of one of six characteristics of j -th premises realty and $z(x^j)$ denotes their prices. Obtained parameters were used to calculate the values of valued property by:

- WGP: $V_1(X) = 10564 \text{ PLN/m}^2$;
- MinMax: $V_{\infty}(X) = 11.861$ PLN/m².

The obtained market value of the valued premises realty (V) is within the range (10 564; 11 862) PLN/m². This market value is considerably in excess of the average price of 1 m² of premises realty on this local real estate market. This is due to the fact, that the valued premises realty (V) was more similar to the property with the highest price than to those with the average price.

6. Conclusions

The use of usual valuation method often is not possible because of the common problem with insufficient number of transactions on local real estate market. Described in the paper method of valuation (CMVM) can be solution of this problem. It is the combination of two multicriteria methodologies i.e. Analytic Hierarchy Process (AHP) and Goal Programming (GP). The AHP enables to quantify qualitative variables and include the weight of the importance of preferences. The GP captures the information from the limited information and the attitude of the appraiser in the valuation process. The calculated value range enables the expert to define the final market value. This method was primarily created for valuation of agricultural real estate. In this study, however, showed that it is appropriate solution also for situations with a lack of information and a limited number of transactions in other real estate markets. In present paper it was adapted to premises realty market. The obtained market value of the valued premises realty is within the range (10 564; 11 862) PLN/m². It is higher price from average price but the valued property is much more similar to the property with the highest price not to the property with average price.

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Leanid DAVYDZENKA1

РАЦИОНАЛИЗАЦИЯ ЛЬГОТ В ОБЩЕСТВЕННОМ СЕКТОРЕ

Аннотация

В статье систематизированы принципы социальной защиты населения в разных странах. В мировой практике существуют различные модели социальной защиты, которые отличаются источниками финансирования, способами поддержки и защиты населения. Феноменология льгот отражает их историческую когерентность (соотнесение) таким социальным мотивам, как альтруизм, помощь, сотрудничество.

Ключевые слова: альтруизм, адресная социальная помощь, феноменология льгот, социальная занцита, общественное сотрудничество.

Summary

The article provides systematized principles of welfare services aimed at societies in different countries. In the world, various models of welfare services are in operation; they differ in the sources of funds and ways of assistace and protection of the country's population. The phenomenology of concessions reflects their historical coherence or correlation with such social motives as altruism, assistance, cooperation.

Keywords: altruism, addressed welfare services, phenomenology of concessions, social security, social cooperation

1. Введение

Социальная защита населения является первоочередной задачей для большинства стран мира. В мировой практике насчитывается большое количество моделей социальной защиты, которые отличаются друг от друга источниками финансирования, способами поддержки и защиты населения, масштабами применения.

Главная цель социальной политики в рыночной экономике – это создание для каждого трудоспособного гражданина условий, позволяющих ему своим трудом и предприимчивостью обеспечивать собственное благосостояние и благосостояние семьи при усилении адресности социальной поддержки со стороны государства слабо защищенных групп населения.

Государственная политика в сфере общественного благосостояния связана, в первую очередь, с системой социальной защиты населения. Цель социальной за-

¹ Проф. др габ. Леонид Давыденко – Университет у Белостоке.

щиты – обеспечить жизнедеятельность человека в обществе во всем многообразии отношений, факторов, обуславливающих его социальное положение.

2. Основные направления социальной защиты

В широком значении социальная защита населения – это совокупность связей и отношений, обусловленных необходимостью защиты социального положения от воздействия социальных рисков. Она охватывает все население. Ее стержнем являются отношения законодательно закрепленных социальных гарантий и прав в сфере человеческой жизнедеятельности.

В узком значении социальную защиту можно определить как комплексную систему социально-экономических и правовых отношений, предназначенную для обеспечения государственных гарантий в области уровня жизни, а также поддержки социально уязвимых слоев населения в связи с трудной жизненной ситуацией.

В системе социальной защиты можно выделить основные направления деятельности, разработанные Международной организацией труда (МОТ).

В качестве субъектов управления в системе социальной защиты выступают, прежде всего, службы и организации Министерства труда и социальной защиты Республики Беларусь различных уровней. Вопросы социальной защиты населения (в широком смысле этого понятия) решают также органы образования, культуры и искусства, здравоохранения, туризма, физкультуры и спорта, жилищных и коммунальных хозяйств и др. Социальное обслуживание населения осуществляют также общественные организации, благотворительные и другие негосударственные структуры, роль и количество которых заметно выросло.

К субъектам социальной работы на контактном уровне относятся социальные работники, оказывающие помощь определенным группам нуждающихся, или специализирующиеся по определенным направлениям социальной работы. К субъектам можно отнести также членов семьи и группы людей, оказывающих помощь нуждающимся своим непосредственным общением, моральной поддержкой и т. д.

В качестве объекта управления в системе социальной защиты (в узком смысле) выступает, прежде всего, человек, личность или группа людей, оказавшихся в затруднительном положении. К ним можно отнести такие категории людей, как инвалиды, безработные, одинокие пожилые люди; беженцы и вынужденные переселенцы; лица, подвергшиеся радиационному воздействию вследствие аварии на Чернобыльской АЭС и др.

Это и различные проблемные семьи: с детьми-инвалидами, имеющие низкий уровень доходов, многодетные и др. В последнее время все больше в социальной защите нуждаются женщины, дети и подростки.

Одним из главных вопросов развития любого государства является создание эффективной и действенной системы социальной защиты населения. Для Республики Беларусь имеет большое значение изучение опыта других стран по решению социальных задач, адаптация его к национальным принципам социальной политики.

ТАБЛИЦА 1.

Классификация основных направлений деятельности системы социальной защиты

| Элементы | Функции | Механизмы | Инструменты | Основные направле- |
|----------------------|---|---|--|--|
| системы | | | | ния деятельности |
| | | | | в соответствии с Кон- |
| | | | | венцией МОТ № 102 |
| Социальная защита | обеспечение равных условий для интегра- | Нормативно-правовая ба- за, регламентирующая | социальная политика; | Реализация международ- ных документов |
| | ции и реинтеграции | функционирование | пенсионное | в соответствии с нор- |
| | в рынок труда; | институтов социальнои | обеспечение; | мами, разработанными |
| | обеспечение гарантий | защиты | социальное | Международнои орга- |
| | достойного уровня жи- | | страхование; | низациеи труда |
| | зни нетрудоспособно- | | социальная | |
| | го населения, адекват- | | помощь | |
| | ного уровню эконо- | | | |
| C | мического развития | 14 | TT | <u></u> |
| Социальная | разработка стратегии | Институты государствен- | Нормативно-пра- | Соответствие социаль- |
| политика | развития системы | ной законодательной и | BOBBIC AKTEI | ных нормативов меж- |
| | социальной защиты | исполнительной власти | | дународным нормам |
| | и определение социа- | | | ства в межаународное |
| | лыных норматньов | | | сообщество |
| Пенсионное | минимизация соци- | обязательное пере- | государственный | пенсия по старо- |
| обеспечение | альных рисков сни- | распределение средств; | пенсионный | сти; |
| | жения уровня дохо- | обязательное накоп- | фонд; | пенсия по случаю |
| | дов при утрате тру- | ление средств; | накопительные | потери кормильца |
| | доспособности по | профессиональное | пенсионные фон- | |
| | старости | пенсионное обеспе- | ды и договоры | |
| | | чение; | пенсионного | |
| | | дополнительное пен- | обеспечения; | |
| | | сионное обеспечение | пенсионные | |
| 0 | | | аннуитеты | |
| Социальное | минимизация соци- | обязательное страхо- | – договоры стра- | медицинская по- |
| страхование | альных рисков сни- | вание от несчастных | хования; | мощь; |
| | жения уровня дохо- | случаев на производ- | - страховые | пособие по боле- |
| | дов при уграге тру- | и безработниы: | полисы; | зни; |
| | интеграции в рынок | - обязательное мел. ст- | - пенсионные | пособие по случаю пособие по случаю |
| | труда | рахование граждан: | аннуитсты, | болевания. |
| | 17 | обязательное страхова- | - социальные ан- | нособие по безра- |
| | | ние технологического | нушсты и др. | – пособие по осзра- ботице: |
| | | имущества предприятий | | страховые выплаты |
| | | и предпринимателей; | | в случае уграты иму- |
| | | обязательное страхова- | | щества; |
| | | ние имущества граждан; | | пенсионные аннуи- |
| | | обязательное пенси- | | теты |
| | | онное страхование | | |
| Социальная | минимизация социаль- | разнообразные про- | – институты соц- | пособие по |
| помощь | ных рисков недостат- | граммы социальной | иальной работы; | беременности |
| | ка доходов при отсуг- | помощи и социального | благотворитель- | и родам; |
| | ствии трудоспособнос- | оослуживания; | ные организации | пособие по инва- |
| | ти или снижения уро- | стимулирование бла- | и акции; | лидности; |
| | вня доходов при ут- | готворительности | - социальные | семейные пособия |
| | сти а также миними- | | аннуитеты | |
| | зация рисков реинтег- | | | |
| | рации в рынок труда | | | |

Источник: разработка автора.

Понятие социальной защиты по-разному рассматривается в разных странах и международных организациях. В одних случаях в данное понятие включается все, что затрачивает социальные условия жизни человека (например, благоприятную экологическую среду, заботу о детях, решение жилищных проблем). В других случаях данное понятие ограничивается вопросами пенсионного обеспечения и помощи безработным.

По уровню гарантий, предоставленных населению, все системы социальной защиты, существующие в разных странах мира, можно разделить на 2 группы: немецкая (Бисмарк) и английская (Беверидж).

Первая система устанавливает связь между уровнем социальной защиты и успешностью профессиональной деятельности. Социальные права обуславливаются теми выплатами, которые выплачиваются на протяжении всей активной жизни. Таким образом, социальные выплаты принимают форму отложенных доходов государства, которые можно отнести к данной системе (Германия, Франция), главной политической задачей считают охрану доходов.

Вторая система исходит из того, что любой человек имеет право на минимальную защиту от болезней, старости и других причин снижения своих трудовых способностей. В тех странах, которые выбрали эту модель, действует система общественного страхования по болезням, а пенсионные системы обеспечивают минимальный доход всем пожилым, независимо от уровня выплат из заработной платы. Такие системы социальной защиты финансируются за счет налогов из государственного бюджета (Англия, Ирландия). Главное, за что несет ответственность государство – охрана минимальных доходов.

Названные модели имеют разные варианты. Наиболее распространены в мировой практике либеральная, социал-демократическая и консервативная модели.

Общими для всех моделей социальной защиты являются принципы социальной справедливости (равные для всех граждан возможности получения социальной помощи) и принципы компромисса между государственным управлением и рыночным механизмом.

Формирование и развитие системы социальной защиты в Республике Беларусь основывается на следующих подходах и принципах:

- праве граждан республики на социальную защиту от объективно установленных рисков (болезни, старости, безработицы и др.);
- адресности социальной помощи;
- разнообразии форм и видов социальной помощи;
- предоставлении трудоспособному населению возможности получения достаточного дохода через зарплату;
- реформировании пенсионной системы;
- реформировании гибкой системы программ по поддержке малообеспеченных и многодетных семей, одиноких граждан, детей и т. д.

3. Социальная защита населения в Беларуси

Система социальной защиты населения Беларуси до начала 2000-х гг. сохраняла большинство черт, унаследованных от советской системы социальной защиты. В ее рамках средние и крупные предприятия держали на своих балансах социальные объекты – детские сады, спортивные объекты, учебные заведения, клубы, поликлиники, санатории и др., в которых предоставляли услуги по льготным ценам своим сотрудникам. Однако с начала 2000-х гг. начался процесс снижения социальной нагрузки на предприятиях и увеличения коммерциализации предоставляемых услуг, в особенности медицинских и образовательных.

Одновременно с этим население имело возможность пользоваться огромным числом различных льгот. Всего около 65% населения имело права на льготы, включая льготы на проезд, приобретение лекарств, оплату услуг ЖКХ, стоматологию. Всего более 50 категорий населения могло воспользоваться льготами, которых насчитывалось более 100 типов.

Данная система была реформирована в сторону резкого сокращения в 2007 г. с одновременным увеличением масштаба адресной социальной поддержки, которая выдается исходя из критериев нуждаемости.

Система социальной защиты Беларуси является значительно замкнутой на поддержке официально утвержденных уязвимых групп. К ним относятся одинокие пенсионеры, люди с ограниченными возможностями, многодетные семьи, ветераны войны, что частично совпадает с социально уязвимыми группами. Так, одинокие пенсионеры, как и люди с ограниченными возможностями, неполные семьи и многодетные семьи, имеют право на услуги социальной помощи. Соответствующие центры социальной поддержки функционируют во всех районных центрах Беларуси. Они предоставляют услуги сиделок, по ведению хозяйства, транспорт, дают правовые консультации, курсы повышения квалификации, оказывают психологическую поддержку и ведут работу по увеличению социальной вовлеченности пенсионеров и людей с ограниченными способностями.

ТАБЛИЦА 2.

| Виды пособий | Размеры пособий |
|----------------------|---|
| Пособие по временной | В соответствии с п. 27 Положения о порядке обеспечения пособиями по вре- |
| нетрудоспособности | менной нетрудоспособности и по беременности и родам, утв. постановлени- |
| | ем СМ РБ от 30.09.1997 № 1290 (далее – Положение) пособие по временной |
| | нетрудоспособности назначается в размере 80 процентов среднедневного |
| | (среднечасового) заработка за рабочие дни (часы) по графику работы работ- |
| | ника, приходящиеся на первые 6 календарных дней нетрудоспособности, |
| | и в размере 100 процентов среднедневного (среднечасового) заработка за пос- |
| | ледующие рабочие дни (часы) непрерывной временной нетрудоспособности, |
| | но за каждый календарный месяц не более трехкратной величины средней за- |
| | работной платы рабочих и служащих в республике в месяце, предшествую- |
| | щем каждому месяцу временной нетрудоспособности. |
| | Лицам, указанным в п. 28 Положения (участникам ликвидации последствий |
| | катастрофы на Чернобыльской АЭС; лицам, имеющим на иждивении троих |
| | и более детей в возрасте до 16 лет (учащихся - до 18 лет); донорам; лицам, осу- |
| | ществлявшим уход за больным ребенком и др.), пособие по временной нетру- |

Виды и размеры пособий в Республике Беларусь

| | доспособности назначается с первого дня утраты трудоспособности в размере 100 |
|----------------------------|--|
| | процентов среднедневного (среднечасового) заработка за рабочие дни (часы) по |
| | графику работы работника, но за каждый календарный месяц не более тре- |
| | хкратной величины средней заработной платы рабочих и служащих в республи- |
| | ке в месяце, предшествующем каждому месяцу временной нетрудоспособности. |
| | Пособие по временной нетрудоспособности назначается в размере 50 процен- |
| | тов от исчисленного пособия в случаях: |
| | временной нетрудоспособности в связи с заболеванием или травмой, |
| | причиной которых явилось употребление алкоголя, наркотических |
| | или токсических веществ; |
| | нарушения режима, установленного врачом или комиссией по назна- |
| | чению государственных пособий семьям воспитывающим детей и по- |
| | собий по временной нетрулоспособности (лалее – комиссия) – со лня |
| | его нарушения на срок. устанавливаемый комиссией: |
| | наступления временной нетрулоспособности в период прогуда без ува- |
| | жительной причины |
| Пособие но беременности | Пособне по беременности и розам назначается в размере 100 процентов сред |
| н ролам | нособие по беременности и родам назначается в размере тоо процентов сред- |
| иродам | подповного (среднечасового) заработка за рабочие дни (часы) по графику ра- |
| | облы работницы, но за каждын календарнын месяц не более трехкратной ве- |
| | личины средней заработной платы рабочих и служащих в республике в ме- |
| | сице, предпествующем каждому месяцу отпуска по беременности и родам, |
| | Перебно в свери с рожнопист обрание наринателя и виналивается онино. |
| пособие в связи с рожде- | пособоне в связи с рождением ребенка назначается и выплачивается едино- |
| нием реоенка | временно. |
| | при рождении первого реоенка - в размере пятикратнои наиоольшеи |
| | величины оюджета прожиточного минимума в среднем на душу на- |
| | селения (далее – оюджет прожиточного минимума) перед датои рож- |
| | дения реоенка; |
| | - при рождении второго и последующих детей - в размере семикрат- |
| | нои наиоольшеи величины оюджета прожиточного минимума перед |
| | датой рождения ребенка. |
| | В случае рождения, усыновления (удочерения) двух и более детен, установле- |
| | ния опеки над двумя и более детьми пособие назначается и выплачивается на |
| | каждого ребенка. |
| Пособие женщинам, став- | Пособие назначается и выплачивается единовременно в размере наибольшей |
| шим на учет в государст- | величины оюджета прожиточного минимума перед датой рождения ребенка |
| венных организациях здра- | |
| воохранения до 12-недель- | |
| ного срока беременно | |
| Пособие по уходу за ребен- | Пособие по уходу за ребенком в возрасте до 3 лет назначается в размере 100 |
| ком в возрасте до 3-х лет | процентов наибольшей величины бюджета прожиточного минимума. |
| | Пособие по уходу за ребенком в возрасте до 3 лет в размере 50 процентов от |
| | установленного пособия назначается (выплачивается): |
| | лицам, вышедшим на работу на условиях, предусматривающих их |
| | занятость на протяжении более половины месячной нормы рабочего |
| | времени; |
| | - оформлении ребенка в учреждение, обеспечивающее получение до- |
| | школьного образования. |
| Пособие на погребение | Пособие на погребение выплачивается в размере средней заработной платы |
| | рабочих и служащих в республике за позапрошлый месяц относительно ме- |
| | сяца наступления смерти. |
| | Размер пособия (материальной помощи) на погребение определяется на день |
| | смерти, а в случаях, когда по причине длительного розыска умершего погре- |
| | бение производилось позднее установленного дня смерти - на день погребения. |

Источник: официальный сайт Фонда социальной защиты населения Республики Беларусь.

Семья в случае рождения ребенка может рассчитывать на одноразовое пособие в размере 500% от прожиточного минимума (700% для второго и последующих

детей). В дальнейшем на каждого ребенка в возрасте до 3 лет предоставляется пособие в размере 100% от прожиточного минимума. Если располагаемый доход на члена семьи не превышает 60% от данного минимума, то пособие продлевается до достижения ребенком 16 лет. Дополнительные выплаты определяются исходя из критериев нуждаемости, и выплачиваются на детей, рожденных вне брака, до достижения ими 18 лет.

Помимо этого существует система льгот и адресная социальная помощь, направленная непосредственно на решение проблемы бедности. Система адресной социальной помощи была создана в 2001 г., но ее активное применение сдерживалось очень низким уровнем доходов, при котором полагалась социальная помощь.

Изначально критерием предоставления ежемесячной помощи был располагаемый доход ниже 50% от прожиточного минимума (60% с октября 2001 г.). С отменой же большинства социальных льгот критерий нуждаемости для предоставления ежемесячной адресной социальной помощи был поднят до 100% от бюджета прожиточного минимума. Также был повышен критерий нуждаемости и для единовременного социального пособия с 60 до 120% от бюджета прожиточного минимума. В итоге в 2008 г. помощь была оказана 277 тыс. человек, а средний размер пособий составил 57400 руб. и 124500 руб. на человека для ежемесячного и единовременного социального пособия соответственно. В дальнейшем число получателей данных пособий начало снижаться, что потребовало определенного реформирования системы. С 2010 г. добавилось еще одно пособие - на оплату технических средств социальной реабилитации; критерий нуждаемости при единовременном пособии увеличен до 150% от бюджета прожиточного минимума; а максимальный срок предоставления ежемесячного пособия продлен с 3 до 6 месяцев. Однако это способствовало лишь незначительному увеличению числа людей, охваченных социальной помощью. Так за 9 месяцев 2010 г. адресная помощь была оказана 142.7 тыс. человек (из них 12.6 тыс. получили пособие на оплату технических средств социальной реабилитации), а размер пособий составил 50400 руб. и 164400 руб. на человека для ежемесячного и единовременного социального пособия соответственно. В 2009 г. за этот период помощь была оказана 135.8 тыс. человек при среднем размере пособий 63700 руб. и 1793005 руб. Такая динамика числа людей, получающих адресную социальную помощь, и размеров пособий свидетельствует как о снижении глубины бедности в Беларуси, так и о слишком низкой черте бедности и критерии нуждаемости соответственно.

Большинство расходов по финансированию системы социальной защиты населения лежит на соответствующем Фонде социальной защиты населения. Его расходы в последние годы (2009 и 2010 гг.) имеют растущую динамику, что во многом объясняется увеличением расходов на выплату пенсий. Тем не менее, финансирование ряда социальных платежей также увеличилось. Это относится к различным пособиям на детей. За 2007–2009 гг. общий объем пособий на детей увеличился с 0.79% от ВВП до 0.95% от ВВП. Большая часть этих расходов приходится на пособия на детей в возрасте до 3 лет, масштабы выплат которых из ФЗН постоянно увеличиваются. Это связано с постепенным увеличением размера пособия: с 65 до 80% от бюджета прожиточного минимума в 2008 г. и до 100% в 2010 г. Также в 2008 г. было увеличение размера единовременного пособия при рождении ребенка с 2 до 5 бюджетов прожиточного минимума для первого ребенка и с 3 до 7 для последующих. Однако существенно влияния на размеры расходов ФСЗН это не оказало. Важной статьей расходов ФСЗН являются пособия по временной нетрудоспособности, чей размер (0.84% от ВВП за первое полугодие 2010 г.) существенно превышает все остальные пособия. К примеру, расходы на финансирование мероприятий по защите от безработицы и обеспечению занятости составили всего 0.07% от ВВП, что меньше расходов на оздоровление населения.

Социальные расходы бюджета сформированы в основном выплатой пенсий, в том числе по инвалидности и потере кормильца, пособиями на детей, пособиями по временной нетрудоспособности. Значительно в меньшей степени расходы идут на социальную защиту, и на поддержку безработных в особенности. Оценка эффективности данных расходов может быть проведена путем сравнения существующего уровня бедности и гипотетического уровня, который был бы в случае, если бы отсутствовали социальные трансферты. Исключаются при этом такие доходы, как пособия на детей, другие государственные дотации и пособия, стипендии и пособия по безработице. При таком сценарии уровень абсолютной бедности был бы в 2009 г. 7.1% вместо 5.4%, а относительной – 14.2 и 14.6% вместо 11.8 и 12.4% в зависимости от шкалы эквивалентности.

Существующая система социальной поддержки достаточно эффективна в поддержке населения из официально признанных групп риска. В первую очередь, это пенсионеры и дети. Система пенсионного обеспечения практически исключает случаи абсолютной бедности среди пенсионеров. Система пособий на детей существенно снижает уровень детской бедности. Однако решение данных проблем идет на уровне абсолютной бедности, в то время, как относительно среднего дохода и дети, и пенсионеры остаются бедными. Это требует пересмотра официальной черты бедности в сторону ее увеличения и соответствующего роста социальных гарантий, в особенности пособий на детей. Существует значительный потенциал увеличения единовременного пособия при рождении ребенка, расходы на выплаты которого остаются достаточно низкими, несмотря на увеличение пособия в 2.5 раза в 2008 г.

В случае пенсионной системы встает проблема ее устойчивости демографическим вызовам. В ближайшие десятилетия Беларусь ожидает увеличение числа пенсионеров при снижении числа молодежи, что в 2030 г. приведет к выравниванию числа людей в пенсионном возрасте и официально занятых в экономике, а дефицит пенсионной системы ожидается уже к 2015г. Обеспечить финансирование пенсионной системы в существующем формате будет невозможно, что ставит перед правительством вызов реформирования пенсионной системы. Иначе большой пласт населения может оказаться за чертой абсолютной бедности, учитывая, что и на данный момент существенная доля пенсионеров относительно бедна. Начать реформы необходимо в ближайшие годы, так как любая их форма будет сопровождаться дополнительными издержками, финансирование которых на данный момент еще возможно за счет профицита фонда социальной защиты населения.

В целом комплекс мер социальной политики, включающая пособия на детей, адресную социальную помощь и ряд других пособий, позволяет снизить абсолютную бедность на 1.7 процентного пункта. Иными словами в условии их отсутствия уровень бедности был бы на треть выше, что подтверждает в целом их эффективность. Также значительно возросла эффективность системы льгот. После отмены большинства из них в 2007 г. доля льгот в располагаемых доходах населения существенно упала до 0.9%. Однако этот незначительный объем социальной помощи от государства позволяет снизить уровень абсолютной бедности на 0.5 процентного пункта, что говорит о высокой адресности льгот.

Регион Численность в том числе: получателей ежемесячное соц. единовременное соц. пособие (чел.) пособие соц. пособие на оплату техн. (руб.) (pyő.) средств соц. реабилитации 10 186 8014 1 0 5 1 1 1 2 1 Брестская Витебская 8 6 5 3 6 5 2 1 1 4 3 3 699 13 830 9 4 4 8 2661 1 721 Гомельская 725 7 482 5 821 936 Гродненская 6 6 3 6 Минская 8 6 4 0 848 1 1 5 6 13 572 9 760 2762 $1\ 050$ Могилевская г. Минск 4875 1 4 2 7 677 2771ВСЕГО 67 238 47 627 10 157 9 4 5 4

Сведения о назначении государственной адресной социальной помощи в 1 полугодии 2011 года

Источник: данные Министерства труда и социальной защиты Республики Беларусь.

Однако адресность, как системы льгот, так и всей системы социальной поддержки, имеет обратную сторону. В таких условиях достаточно широкий пласт социально уязвимых групп остается без социальной поддержки. В первую очередь, это относится к безработным, среди которых высок как уровень абсолютной, так и относительной бедности. На июнь 2009 г. пособие по безработице составило 45,000 руб., т.е. 17.6% от прожиточного минимума, или 4.1% от средней заработной платы. Более того, для его получения необходимо отработать определенное время на общественных работах. Важной проблемой является создание системы социальной защиты безработных. На данный момент данное бремя лежит на реальном секторе в форме избыточной занятости, что с одной стороны увеличивает государственные расходы на поддержку реального сектора, а с другой – значительно снижает эффективность функционирования рынка труда. Таким образом, увеличение пособия по безработице до уровня бюджета прожиточного минимума помогло бы увеличить гибкость рынка труда, уменьшить потребность в господдержке реального сектора и обеспечить социальную защи-

ТАБЛИЦА 3.

щенность безработным. Негативным моментом помимо роста расходов на выплату пособий, в таком случае станет рост безработицы из-за увеличения привлекательности статуса безработного, особенно в сельской местности и малых городах, где уровень зарплат невысок.

Актуальной является проблема привлекательности статуса безработного, особенно в сельской местности и малых городах, где уровень зарплат невысок. Нерешенной остается проблема бедности на селе, несмотря на активную государственную поддержку сельского хозяйства и программы развития села (расходы консолидированного бюджета на сельское хозяйство в 2009 г. составили 3.9% от ВВП). Одним из выходов является увеличение предпринимательской активности в сельской местности, что создаст дополнительный источник доходов для населения. В 2009 г. доходы от предпринимательской деятельности для жителей сельской местности составили всего 1.2% от располагаемых доходов в то время как в целом по населению этот показатель немного выше – 2.5%.

4. Оптимизация льготирования

В теории и практике социальной политики категория льгот занимает особое место. Исторически она зародилась на первых этапах социогенеза – в форме неинституционализированной, полуинстинктивной заботы о детях и стариках, поддержки и взаимовыручки. В этом нашли свое выражение социабельная природа неоантропов, аффилиативные мотивы, а главное – первые проблески человеческого нравственного чувства и разума, способного к рефлексии. Со временем льготы превратились в общесоциальный институт, призванный поддерживать стабильность общества за счет частичного перераспределения доходов, компенсировать эпифеномены неоправданного неравенства, стимулировать посильное участие каждого в самообеспечении, поддерживать социально уязвимые категории, повышать шансы молодежи из малообеспеченных семей в приобретении профессии и самореализации и т. д.

Под **льготой** понимается любое облегчение открывающее для субъекта новые возможности достижения цели, улучшения материального положения, доступа к тем или иным благам. В современном мире льготы существуют во всех странах, хотя бы на межличностном и межгрупповом уровне, но их набор и процедуры льготирования существенно различаются. В некоторых странах лыготы материализуются и включаются в заработную плату, социальную страховку или денежные пособия. Так, в Японии – это автоматическое повышение зарплаты с увеличением стажа работы и возраста, в США – надбавки к зарплате тем категориям, которые могли бы рассчитывать на транспортные, медицинские, коммунальные и иные льготы (военнослужащие, полицейские, судьи и др.), в Германии – бесплатное высшее образование, в Китае – гибкая система стимулирования семейного бизнеса и т. п. На первый взгляд может показаться, что такого рода мероприятия не имеют отношения к социальной политике в области льгот, однако при ближайшем рас-

смотрении становится ясным, что они возможны только благодаря узаконенному механизму перераспределения и составляют его суть.

При всей несомненной социальной значимости системы льгот советского периода, она не была свободна от ряда методологических погрешностей, которые особенно усилились в 1970-е годы. Выделим некоторые из них:

- Существовал простой для расчета, но социально неоправданный и неэффективный принцип «категорийности», согласно которому льготы назначались не адресно и персонифицировано, а всей группе лиц, имеющих формально общий признак льготирования, независимо от материального положения, нуждаемости, квалификации, уровня исполнения трудовых обязанностей и пр.;
- 2. Расходы по финансированию льгот относились на ведомства и местные органы управления и тем самым растворялись в их бюджетах, создавая видимость «бесплатности»;
- 3. Лыготы гасили недостатки оплаты труда: легче было предоставить тому же сельскому учителю жилищную льготу, чем повысить заработную плату;
- Льготы позволяли отнести решение назревших социальных проблем на будущее;
- 5. Льготы смешивались с привилегиями, придавая последним форму узаконенных преимуществ.

Постсоциалистические страны в начале 1990-х годов продемонстрировали три модели социальной политики, в том числе и в области льгот. Первая модель (страны ЦВЕ, отчасти Прибалтики): стремление рационализировать социальные расходы, упорядочить унаследованную систему льгот, сохраняя сравнительно высокие налоги – выше, чем в странах с сопоставимым уровнем экономического развития. Вторая модель – прямо противоположная первой (страны Закавказья и Средней Азии): лишение бюджетного финансирования целых отраслей социальной сферы и их полная зависимость от негосударственных источников в силу резкого снижения налоговых поступлений. Прежние льготы формально не отменялись, но они отмирали.

Третья модель – промежуточная (Россия и Беларусь, отчасти Украина и Молдова): попытки государства сохранить консервативную преемственность в данной сфере, что потребовало значительного увеличения числа льгот для амортизации снижения уровня жизни и вместе с тем вызвало и растущее превышение социальных обязательств государства над возможностями их финансирования. В конце 1990-х годов стало очевидным, что «простым увеличением ассигнований без смены механизмов и направлений расходования средств проблемы социальной сферы решены быть не могут».

Подавляющее большинство катаклизмов – общественных, коллективных, личностных – происходит там и тогда, где и когда люди не могут или не хотят трезво оценить существующее положение дел. Популярная формула конца 1980-х годов: «Так жить нельзя!» (С. Говорухин), достаточно абстрактна и неконструктивна. Однако она отражала назревшие противоречия и тем самым подталкивала к поиску их решения, то есть была диагностичной, что, как известно, в любом деле больше половины успеха.

Проблемная ситуация в области льготирования состоит в том, что существующая система льгот перестала быть адекватной как с точки зрения своего предназначения и социальных функций, так и относительно изменившихся условий и общественных потребностей. Она не удовлетворяет ни получателей льгот - реципиентов, ни государство и те органы, которые от его имени выступают в качестве бонифициариев (от лат. bonus – добрый, хороший), – тех, кто предоставляет льготы населению. Первые считают, что многие льготы обесцениваются и уже не позволяют решать какие-либо жизненные проблемы; что в число льготников попало много лиц, которые их не заслуживают, а часто и не нуждаются в этом; что существующая система запутана и непрозрачна и пр. Вторые – ссылаются на то, что больше половины населения имеет какие-то льготы, в силу чего при возрастающих затратах на эти цели размеры льгот снижаются и т. д. Реальные средние размеры льготных выплат остаются низкими, в то же время, как показывают социологические исследования, многие льготы распределяются таким образом, что их большая часть приходится на средне- и высокообеспеченные группы по сравнению с малообеспеченными (по транспортным льготам разница в 4 раза, коммунальным – в 2 раза в пользу обеспеченных и лишь льготы по оплате лекарств в группе малообеспеченных в 1,3 раза больше). Это значит, что пусть и со значительным опозданием, но достигнуто понимание того, что положение дел в данной области необходимо изменить.

Что касается конструктивного знания, то его пока не хватает. Начиная реформы, необходимо прежде всего определить, чего мы хотим: сократить расходы, изменить схему финансирования, перестроить функции льгот или отделить льготы от других средств компенсации, а также от преимуществ вознаградительного и стимулирующего плана. Еще сложнее сказать, какие льготы можно изъять безболезненно, какие заменить и чем, как на это отреагируют те или иные категории нынешних и особенно потенциальных льготников, – на такие вопросы четких ответов нет.

Второй этап – комплексный междисциплинарный научный анализ проблемы с теоретическим моделированием разных вариантов – на сегодняшний день пропущен. А тем временем очевиден недостаток и эмпирической информации. Например, по данным российских ученых, до 30% работников, имеющих право на пенсионные льготы, трудятся в нормальных (а не вредных) условиях. Судя по всему, подобные сдвиги произошли и в Беларуси, но достоверных количественных показателей нет. Нужно учитывать, что льготы, по справедливому утверждению доктора юридических наук А.В. Малько, «...не только правовое средство. Они весьма тесно «вплетены» и в политику, и в мораль, и в обычаи. Это общесоциальный регулятивный институт, олицетворяющий собой исключения из определенных правил» [Малько, 1999].

Россия раньше начала реформу и пошла по пути «монетизации льгот», смысл которой – в замене «натуральных облегчений» (помощи) для определенных категорий населения (бесплатный проезд, лекарственное обеспечение, скидки на оплату коммунальных услуг и пр.) денежными выплатами или компенсациями. Рациональное зерно такого подхода видится в том, что появляется возможность более строгого учета льгот, а значит, предотвращения злоупотреблений, приписок и т. п. Существенно и то, что те, кто не может воспользоваться положенными им льготами (например, сельские пенсионеры – бесплатным проездом), получают некоторое возмещение, равно как и то, что со временем может быть создана более справедливая оценка вклада и эффективная система стимулирования деловой активности. Основная трудность заключается в том, как и во сколько в денежном выражении оценить пакеты льгот с учетом индивидуальных различий, прежде всего в отношении лекарств, но также и транспортных, коммунальных, образовательных и других услуг. С этой трудностью не сразу удалось справиться, ощущается она и сегодня. По словам председателя Госдумы России Б. Грызлова, «половина льготников предпочла получать деньги вместо бесплатных лекарств». Принята программа ДЛО – дополнительно лекарственного обеспечения, охватывающая около семи миллионов человек, в том числе триста тысяч нуждающихся в дорогостоящих препаратах.

Многие льготы в России заменены денежными выплатами, однако наступивний экономический кризис 2008г. нарушил ход реформы. Не во всех регионах отменен льготный проезд. Также были отменены натуральные льготы, которые заменили денежные компенсации на федеральном и региональном уровнях. Репены вопросы по введению надбавок за сложность, напряженность и специальный режим службы для военнослужащих и сотрудников органов внутренних дел в части компенсации отмененных натуральных льгот этих категорий граждан.

При проведении реформы был выявлен ряд проблем:

- российским гражданам предоставляется социальная поддержка в разных объемах в зависимости от финансовой обеспеченности субъектов Федерации. Это приводит к нарушению равенства прав граждан на социальное обеспечение и разрушает единое социальное пространство страны;
- не решены в полной мере вопросы об отнесении на федеральный уровень расходных обязательств по осуществлению мер социальной поддержки реабилитированных лиц, лиц, признанных пострадавшими от политических репрессий, тружеников тыла и граждан, награжденных нагрудным знаком «Почетный донор СССР» и «Почетный донор России»;
- передача образовательных учреждений начального и среднего профессионального образования в ведение субъектов РФ организационно оказалась недостаточно подготовленной и не была обеспечена необходимыми финансовыми ресурсами. В результате в ряде регионов указанные образовательные учреждения не финансируются в необходимом объеме;
- в ряде субъектов Федерации остаются проблемы в части обеспечения бесплатными лекарственными средствами некоторых категорий граждан. Это относится, например, к Астраханской, Брянской, Курганской, Сахалинской и ряду других областей;
- необходимо решить вопросы, связанные с льготами по оплате жилищно-коммунальных услуг. В соответствии с законом меры социальной под-

держки в этой сфере отнесены к расходным обязательствам субъектов Федерации. Во многих регионах льготы по оплате ЖКУ заменены денежной компенсацией, размер которой не покрывает реальных потребностей на оплату данных услуг;

с проведением реформы в стране усилилась дифференциация в уровне поддержки граждан, имеющих детей, в зависимости от региона проживания. В некоторых субъектах РФ ежемесячное пособие на ребенка попрежнему выплачивается в размере 70 рублей. При этом в отдельных регионах размер такого пособия составляет 300-340 рублей [Давыденко, 2012, с. 246].

В целом, преодолевая некоторые первоначальные просчеты, реформа по типу «монетизации льгот» совершенствуется и входит в жизнь.

Беларусь избрала, можно сказать, «нулевой вариант». Его суть раскрыл Президент Беларуси, отвечая на пресс-конференции для СМИ регионов России на вопрос журналиста из Смоленска: «Не планируете ли Вы в Беларуси монетизацию льгот по примеру России?» Приведем основные положения его ответа, по возможности, близко к тексту.

- «Мы отменили все льготы и сейчас вводим их Указом Президента для тех, кто ими должен пользоваться. Прежде всего, это инвалиды. Вовторых, многодетные семьи.
- 2. По лекарствам: четко определили 37 болезней, «но от головной боли анальгин или цитрамон покупаешь сам».
- 3. Мы отдаем деньги вузам: разберитесь, кто будет ездить бесплатно.
- 4. Не монетизация, а повышение пенсий: «Вот тебе деньги, хочешь ехать плати, не хочешь платить иди пешком».
- Все эти льготные деньги направляются детям (имеется в виду бесплатное питание в школах, оздоровление, минимальная плата за детский сад и пр.), [Давыденко, 2012, с. 246].

Нужно учесть, что Постановлением Совмина Беларуси № 526 от 25 апреля 2007 года отменен категорийный подход и введена адресная социальная помощь (АСП) для семей с доходом до 80% бюджета прожиточного минимума. Сравнивая процессы реформирования в России и Беларуси, важно отметить, что при общности целей имеются некоторые различия в механизмах их реализации. В декабре 2009г. был принят закон «О льготах и социальной помощи гражданам». В соответствии с которым отменены многие социальные льготы для пенсионеров, студентов и других категорий граждан. Они заменены адресной социальной помощью в виде единовременного и ежемесячного пособий. Льготы, в частности бесплатный проезд на общественном транспорте, сохранят только инвалиды первой и второй групп, несовершеннолетние, проживающие в зонах радиоактивного загрязнения, пострадавшие от чернобыльской катастрофы, а также Герои Беларуси, Советского Союза, Социалистического Труда, Славы, Трудовой Славы, награжденные орденом Отечества трех степеней. Продолжат пользоваться льготами и участники и инвалиды войн и родители военнослужащих погибших при исполнении служебного долга [Давыденко. 2012, с. 247].

кие основания льготирования, в частности, отличие льгот от иных категорий вознаградительного поощрительного характера. По такой причине в России на первом этапе оказались ущемленными права ряда категорий заслуженных работников – героев страны, орденоносцев, лауреатов, народных артистов и др. В Беларуси, учитывая опыт России, почетные доноры сохранили практически все льготы. Учитывая, что оптимизация льгот в РБ и РФ будет продолжаться не один год, целесообразно еще раз обратиться к анализу методологических аспектов и юридических категорий этой важной для социальной политики проблемы.

Феноменология льгот отражает их историческую когерентность (соотнесение) таким просоциальным мотивам, как аффилиация (поддержание социальных связей, общности), альтруизм и помощь. Известный американский психолог Г. Мюррей описывал феномен помощи следующим образом: «выказывать сочувствие и удовлетворять потребности беспомощного другого – ребенка или любого другого, который слаб, покалечен, устал, неопытен, немощен, унижен, одинок, отвержен, болен, который потерпел поражение или испытывает душевное смятение» [Мюррей]. Бескорыстная помощь, вместе с моральной поддержкой, была исторически первой формой социального льготирования (в отличие от родительской заботливости и кровнородственных обязанностей). Зародившаяся в первобытной общине, она предоставлялась в первую очередь уязвимым категориям - детям, старикам, инвалидам и другим, как не имеющим достаточных средств для самозащиты и выживания, а также тем, кто попадал в затруднительное положение, особенно при чрезвычайных обстоятельствах (пожары, наводнения и т. п.). Наряду с материальными пожертвованиями в форме дарения (орудий труда, скота, топлива и пр.) пострадавшие могли освобождаться от исполнения некоторых общих обязанностей и, что особенно важно, получать трудовую помощь со стороны соплеменников, имеющую не только потребительную ценность, но и высокий морально-психологический эффект. Традиция непосредственного трудового участия сохранялась многие века. В русской деревне эта форма носила название «помочи». В Беларуси она известна как «толока».

Анализируя феномен человека, П. Тейяр де Шарден проницательно заметил, что всякое эгоистическое решение жизни движимо мотивами одновременно рвения и бессилия. Эгоизм прав, поднимаясь вверх и развивая до предела собственное, уникальное и непередаваемое содержание. Однако он допускает трагическую опшобку, суть которой в смешивании индивидуальности и личностности. «Стремясь как можно больше отделиться от других элементов, он индивидуализируется, но, индивидуализируясь, он падает опять и стремится увлечь мир назад, к множеству, к материи. В действительности он уменьшается и теряется. Чтобы быть полностью самими собой, нам надо идти в обратном направлении – в направлении конвергенции со всем остальным, к другому. Вершина нас самих, венец нашей оригинальности – не наша индивидуальность, а наша личность, а эту последнюю мы можем найти лишь объединяясь между собой. Нет духа без синтеза. Все тот же самый закон, сверху донизу. Настоящее Едо возрастает обратно пропорционально «эготизму». Было бы опшобкой интерпретировать эти слова в духе

морализаторства, осуждения психологии эгоизма или даже призыва к единению. Это вывод как о феномене человека, так и о феномене социальности, то есть «коллективной гоминизации – гоминизации всего вида» [Тейяр де Шарден, 1987].

5. Заключение

Современная наука обладает достаточными сведениями, чтобы утверждать, что процесс антропосоциогенеза был бы невозможен без альтруизма, поддержки, сотрудничества и пр., то есть тех социабельных черт индивида и социальных связей, скрепляющих человеческое сообщество. Неандертальцы, у которых «уже явно обнаруживается психическая ступень (первые захоронения)... и наличие пламени настоящего разума», тем не менее, оказались тупиковой вствью эволюции. Поведение неандертальцев «характеризовалось резкой возбудимостью, часто приводившей, по-видимому, к кровавым столкновениям в неандертальском коллективе». О столкновениях судят по числу проломов на скелетах неандертальского человека, обнаруженных в пещерах и иных местах захоронения. Они свидетельствуют о том, что социальная ткань сообщества еще не сформировалась, зоологические инстинкты (половой, пищевой) удовлетворялись силой. Повышенная агрессивность мешала также приручению животных, требующему терпения и ласки. «Поверх неандертальца оказывается, по словам Тейяр де Шардена, Homo Sapiens, coвершивший внезапное нашествие, подгоняемый действием климата или душевным беспокойством» [Тейяр де Шарден, 1987]. Отметим, что механический перенос на общество основных категорий эволюционной теории, таких как борьба за существование, естественный отбор, выживание наиболее приспособленных, ведет к социальному дарвинизму, в том числе и к его наиболее реакционной форме – расизму. Как писал А. Маслоу, «Дарвин был настолько убежден в дурной природе инстинктов, что основными факторами эволюции животного мира счел борьбу, соревнование, и совершенно не заметил проявлений сотрудничества, кооперации, которые, однако, легко сумел разглядеть Кропоткин» [Давыденко, 2012, c. 250].

Социальные связи, благодаря которым существует человеческое сообщество (от семьи до государства и человечества), при всей их сложности и противоречивости не могут быть тотально враждебными. Люди не могли бы жить вместе – ни в естественном, ни в гражданском состоянии, если бы придерживались принципа Homo homini lupus est («Человек человеку волк»). Но и в одиночку, неким «робинзоном», человек выжить не может; совместность, которую русские религиозные философы называли соборностью, – судьба индивида и естественный закон жизни. Христианская мораль неэгоизма, любви к ближнему не изобретает, а лишь закрепляет и рационализирует холистическую природу социума. Императив целостности – попечение о слабых, ибо никто не знает, не понадобится ли ему самому помощь других. Таким образом, феноменология льгот возвышается до метафизики – смысло-содержательных опор бытия, находя свое выражение, с одной стороны, в общечеловеческих моральных принципах, с другой – в политической стратегии «разумного» государства.

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Ewa GRUSZEWSKA

RECENZJA

książki pt.: Ład gospodarczy a współczesna ekonomia, pod red. Piotra Pysza, Anny Grabskiej, Michała Moszyńskiego, Wydawnictwo Naukowe PWN, Warszawa 2014, ss. 283

Książka zawiera rozważania dotyczące koncepcji ładu gospodarczego oraz praktycznych aspektów dążenia do jego osiągnięcia, autorstwa siedemnastu naukowców reprezentujących kilka ośrodków badawczych w Polsce, na Białorusi i w Niemczech.

Zagadnienie ładu gospodarczego pojawia się w rozważaniach ekonomistów jako swoisty stan docelowy i pożądany. Proces kształtowania struktury gospodarczej w kierunku ładu jest sprzężony z rozwojem gospodarczym. W recenzowanej publikacji skoncentrowano się przede wszystkim na koncepcji ładu gospodarczego, głoszonej przez ordoliberalizm, choć w kolejnych częściach występuje odniesienie do tej tematyki na gruncie austriackiej szkoły ekonomii bądź też nowej ekonomii instytucjonalnej.

W piśmiennictwie polskim dyskusja nad porządkiem ekonomicznym, politycznym czy instytucjonalnym toczy się od długiego czasu. W latach osiemdziesiątych XX wieku dysputowano o reformie gospodarki ("Ile państwa, ile rynku"). W latach dziewięćdziesiątych głównym punktem rozważań stała się transformacja systemowa, jej dynamika i kierunki. Obecnie w publikacjach naukowych pojawiają się oceny podsumowujące osiągnięcia 25 lat przekształceń ustrojowych w Polsce i innych krajach Europy Środkowo-Wschodniej. Problematyka ładu *versus* nieładu gospodarczego jest podejmowana w publikacjach naukowych z coraz większą intensywnością, również w związku z kryzysem gospodarczym i jego następstwami. Załamanie koniunktury w krajach wysoko rozwiniętych ujawniło ogólny nieład, którego istotą była naruszona równowaga między rozwojem sektora finansowego a realnego.

Ordoliberalizm nie jest wyjątkowo spopularyzowanym nurtem myśli ekonomicznej. Należy zatem docenić wysiłek badawczy P. Pysza, który od wielu lat prowadzi prace nad koncepcją społecznej gospodarki rynkowej oraz możliwościami jej wdrażania w Polsce. Wraz ze swoim zespołem badawczym dokonuje szerokich porównań zmian: gospodarczych, politycznych, społecznych w krajach transformujących się, ze szczególnym uwzględnieniem byłej NRD¹. W przypadku recenzowanej publikacji idea tych badań jest szersza, gdyż, jak piszą redaktorzy na wstępie: w celu stworzenia, mających walory aplikacyjne, konceptualnych podstaw dla polityki kształtowania lub też samokształtowania się ładu gospodarczego, trzeba jednocześnie dążyć zarówno do dalszego badania i rozwoju teorii ładu gospodarczego, jak i ich konkretyzacji. (...) Założenia teorii ładu stanowionego (Euckena) i ładu spontanicznego (Hayeka) mogą być dla polityki jedynie czymś w rodzaju drogowskazu. Dając polityce ogólną orientację, nie przesądzają one jednak ani o kształcie jej programów, ani też o realizowanych na ich podstawie działaniach (s. 9).

Recenzowana monografia zawiera siedemnaście artykułów, które ujęto w trzech częściach. Autorzy podjęli w nich analizy problemów rynkowego ładu gospodarczego z perspek-

¹ Efektem tych prac jest kilka publikacji naukowych, np.: *Ordoliberalizm i społeczna gospodarka rynkowa wobec wyzwań współczesności*, E. Mączyńska, P. Pysz (red.), Seria: Biblioteka Myśli Ekonomicznej, Polskie Towarzystwo Ekonomiczne, Warszawa 2013.

tywy ideologicznej i teoretycznej (Część I pt.: *Ideologiczne i teoretyczne problemy rynkowego ładu gospodarczego*). Rozważania dotyczące kształtowania (się) ładu gospodarczego w procesie transformacji systemowej w Polsce i innych krajach, a także wdrażania koncepcji ordoliberalnych w Niemczech stały się główną osią badań przedstawionych w części II pt.: *Ordoliberalizm, ład gospodarczy a transformacja systemowa*. Poza teoretycznymi podstawami ładu gospodarczego, w monografii były analizowane możliwości ich aplikowania w praktyce gospodarczej. Odniesienia do polityki społeczno-gospodarczej, jako zespołu działań wpływających na formowanie ładu, znalazły się w ostatniej części monografii (Część III pt.: *Koncepcje polityki społeczno-gospodarczej*).

Autorzy przeprowadzili wszechstronne analizy koncepcji ładu gospodarczego na poziomie rynków, gospodarek narodowych, a także z perspektywy globalnej. Przyjmowali przy tym różne punkty widzenia wynikające z rozmaitych teorii ekonomicznych, ale również uwzględniające wieloaspektowość badanej kategorii. W efekcie powstał dopełniający obraz procesów stanowienia oraz kształtowania (się) ładu gospodarczego w warunkach transformacji systemowej.

Teoretyczną analizę koncepcji rynkowego ładu gospodarczego rozpoczął artykuł J. Godłów-Legiędź, w którym opisano płaszczyzny sporu toczącego się między przedstawicielami ekonomii liberalnej i keynesistami; sporu, który odżył ze zdwojoną siłą wraz z kryzysem finansowym. Autorka badała przyczyny kryzysu, odnosząc się do stopnia realizacji zasad polityki prowadzonej na podstawie idei liberalnych bądź keynesowskich. Jednocześnie zwróciła uwagę na to, że w ocenie działań państwa nie uwzględniano faktu, iż gospodarka rynkowa uległa zasadniczej transformacji i nie należy już oczekiwać podobnych efektów, jakie tradycyjnie przypisywano mechanizmowi rynkowemu. Sergey Łukin, z kolei, poszukiwał elementów koncepcji liberalnych w myśli chrześcijańskiej. W swojej analizie wnioskował, że np. podstawowa rola państwa, jaką widzą przedstawiciele katolickiej myśli społecznej, jest zbieżna z funkcjami państwa przedstawianymi w pismach Erharda. Ten ordoliberał wyrażał przekonanie, iż *polityka porządku konkurencyjnego jest w stanie rozwiązać najważniejsze bolączki społeczne* (s. 35).

ldeę samoregulującej się gospodarki w koncepcjach ordoliberalnych przybliżyła A. Zabkowicz. Szczególny nacisk położono tu na poglądy Waltera Euckena i Karla Polanyi'ego. W konkluzjach zostało zadane kluczowe pytanie: "Co stoi na przeszkodzie przemian instytucjonalnych, które zbliżyłyby urządzenia społeczeństwa do wizji zawartych w książkach obu myślicieli [W. Euckena i K. Polanyi'ego – *przyp. E.G.*]?"(s. 50). Wydaje się, że jest to zasadnicza kwestia, która powinna być postawiona w badaniach zespołu P. Pysza. Autorka zwróciła uwagę, że państwa, które ulegają grupom nacisku, nie mogą skutecznie zabezpieczać praw własności czy strzec wolności gospodarczej. Niezbędne jest więc wprowadzenie odpowiednich zasad regulacyjnych, które umożliwiłyby nadzór na przykład nad monopolami czy oligopolami. Jednak i to może być niewystarczające, a problem władzy ekonomicznej dominujących grup nie zostanie rozwiązany. Grupy nacisku bowiem doprowadziły do wynaturzenia idei samoregulującej gospodarki rynkowej (s. 51).

W kolejnych artykułach tej części monografii poruszono koncepcje teoretyczne ładu gospodarczego. Przykładowo, A. Chmielak już w tytule zadała pytanie o realność istnienia ładu konkurencyjnego w gospodarce światowej. Podkreślając dysfunkcjonalność procesów globalizacyjnych, wskazała na destrukcję dotychczasowego ładu światowego oraz brak tendencji do kreowania nowego, spójnego i efektywnego ładu. System światowy działa za sprawą logiki wypaczonego rynku, przy wzmacnianiu pozycji korporacji i krajów najbogatszych. W związku z tym, w artykule podjęto próbę przedstawienia warunków nowego, zrekonstruowanego ładu konkurencyjnego. Zatem warto byłoby zadać pytanie, czy istnieje realna szansa, aby warunki te mogły być spełnione?

W następnej pracy W. Giza opisał proces kształtowania ładu na podstawie teorii gier. Ta ostatnia modelowo wyjaśnia korzyści i straty podejmowania indywidualnych decyzji. W wyniku badań Autor wysnuł wniosek, że ordoliberałowie dążą do stworzenia w społeczeństwie takich ram instytucjonalnych, które służą stymulacji bodźców na rzecz zachowań prospołecznych. Chodzi o zwiększenie prawdopodobieństwa kooperacji. Rozwiązania kooperacyjne umożliwiają wzrost korzyści społecznych. Jednak teoria gier nie może być przyjęta jako jedyny wzorzec

zasad działania, gdyż współcześnie problemem nie jest poszukiwanie zerojedynkowej odpowiedzi na pytanie «państwo czy rynek», ale próba harmonijnego połączenia rynku i państwa (s. 89).

Wpływ zmian technologicznych na rynkowy ład gospodarczy był przedmiotem rozważań podjętych przez R. Ciborowskiego. Analizie poddano *twórczą destrukcję* Josepha A. Schumpetera w aspekcie oddziaływania na system gospodarczy i jego strukturę, która głosi, że: *Zmiany innowacyjne od środka burzą strukturę gospodarczą, tworząc nową. (...) Na poziomie mikro-ekonomicznym [odbywa się – przyp. E.G.] (...) tworzenie i destrukcja pewnego porządku produkcyjnego (s. 78). Można zatem przedstawiać zmiany technologiczne jako jeden z przejawów dążenia gospodarki do stanu bardziej pożądanego i doskonalszego.*

W kolejnej części monografii osią rozważań było odniesienie ładu do transformacji systemowej w krajach Europy Środkowej i Wschodniej. Rozważania te rozpoczęła teoretyczna analiza M. Miszewskiego, który zwrócił uwagę na podobieństwa myśli neoinstytucjonalnej (neoinstytucjonalizm postveblenowski) oraz ordoliberalnej. Wskazał on i omówił takie elementy wspólne, jak: płaszczyzna metodologiczna (umiarkowany indywidualizm metodologiczny), wspólne korzenie (niemiecka szkoła historyczna), skupienie się na dobrostanie jednostki (a nie tylko ilościowych efektach procesów gospodarowania) oraz koncentracja na rzeczywistych problemach gospodarczych. W konkluzji Autor zaproponował stworzenie wspólnego podejścia teoretycznego – hybrydy – łączącej neoinstytucjonalizm z dorobkiem szkoły freiburskiej. Taka teoria *może okazać się zdolna do ogarnięcia coraz bardziej burzliwych przemian współczesnego bytu społeczno-gospodarczego* (s.102).

Na ordoliberalizm jako koncepcję, która nabiera coraz większego znaczenia w warunkach nieładu instytucjonalnego, zwróciła uwagę E. Mączyńska. Autorka poddała szerokiej analizie globalny nieład i jego przyczyny. Na wybranych współczesnych przykładach przedstawiła *shorttermizm* (skracanie horyzontu czasowego w decyzjach gospodarczych) oraz powszechną anomię wartości, której przejawem są nasilające się zjawiska nierespektowania prawa i łamania obietnic (umów). Jak pisała autorka: *łamane obietnice można uznać za jeden z najgroźniejszych przejawów nieładu instytucjonalnego* (s.107). Stąd stwierdziła ona, że ordoliberalizm i koncepcja społecznej gospodarki rynkowej może stać się lekarstwem na *hipokryzję instytucjonalną i łamanie obietnic* (s. 118). Zwłaszcza koncepcja roli państwa jako: *kreatora i stróża ładu społeczno-gospodarczego, państwa ani nie za dużego, ani małego, ale optymalnego, skutecznego, zyskuje współcześnie na aktualności* (s.119). Mimo to, niezbędne jest odpowiednie dopasowanie tych teorii do współczesnych uwarunkowań (szczególnie po kryzysie 2007). Czy jednak ordoliberalizm, nurt mało popularny, mógłby urosnąć do takiej rangi? Czy może być *remedium* na nieład współczesnego świata?

Rozwinięciem rozważań stały się wyniki badań P. Pysza, zaprezentowane w kolejnym rozdziale. Dzięki koncepcji ordoliberałów, Autor zbudował schemat analizy porównawczej stanowionych i spontanicznych elementów ładu gospodarczego. Zauważył on, iż koncepcja ładu odgórnie stanowionego przez państwo (W. Eucken) i ładu spontanicznego (F. Hayek) nie wykluczaja sie wzajemnie, a raczej dopełniaja. Dopiero ich połaczenie może w pełniejszy sposób objaśnić mechanizm zmian instytucjonalnych. Sprzeżenie zwrotne, występujące między regułami gry gospodarczej ustanawianymi odgórnie przez władze polityczne a ewolucyjnie samokształtującymi się regułami ładu spontanicznego, wymaga dynamicznego podejścia do analizy procesów rozwoju oraz modernizacji gospodarek. Autor uznał proces transformacji postsocjalistycznych gospodarek Europy Środkowej i Wschodniej jako swego rodzaju pole doświadczalne do badań nad formowaniem się ładu gospodarczego (s.131). Transformacia systemowa musi w początkowej fazie polegać na ustaleniu w sposób stanowiony nowych rynkowych reguł gry gospodarczej. Powinno to zainicjować pożądany proces zmian zachowań gospodarczych, a pośrednio także spontanicznie kształtujących się w dłuższym okresie reguł gry gospodarczej. Zależności te przedstawiono w sposób schematyczny, w ujęciu statycznym i dynamicznym. Schematy te (s. 134-135) mają charakter bardzo ogólny. Można to uznać za zaletę. Model taki pozwala na kompleksowe spojrzenie na procesy zmian instytucjonalnych, dokonujacych się spontanicznie lub w efekcie stanowienia. . Jednak nie ma możliwości przetworzenia przedstawionych relacji w konkretne decyzje, w zmiany, które mogłyby być zastosowane w realnie funkcjonujących gospodarkach. Sam Autor stwierdził, że badania empiryczne, zrealizowane na podstawie abstrakcyjnych teorii W. Euckena i F. Hayeka, umożliwiłyby stworzenie właściwego instrumentarium dla polityki gospodarczej, co byłoby pożądanym rozwinięciem idei ładu (s.137). Wydaje się, że może to być zagadnienie rozwijające rozważania i wnioski zawarte w niniejszej monografii.

Kazimierz Meredyk podjał się weryfikacji hipotezy, że przyczyna niepełnego sukcesu transformacji gospodarki polskiej był brak jednolitej koncepcji zmian, swoistego modelu ładu instytucionalnego. Bez wprowadzenia odpowiedniego, spójnego wewnetrznie zbioru reguł nie jest możliwe stworzenie sprawnego, realnego makrosystemu gospodarczego. Autor stwierdził iż jedną z ciekawszych koncepcji sprawnego funkcjonowania współczesnego społeczeństwa i gospodarki jest koncepcja Wielkiej Triady (The Triple Helix). W jej ramach kluczowymi elementami gospodarki, stanowiacymi filary postępu technicznego, sa: Uniwersytet (sfera B+R), Przedsiebiorstwo (sfera realna) i Państwo. Autor dodał do tego Media – "rumaka" postępu. Aby gospodarka mogła być sprawnie działającym mechanizmem, niezbędne jest sprawne funkcjonowanie wszystkich tych czterech sił (Wielka Kwadryga) oraz wzajemne ich zrównoważenie. Tymczasem badanie tych składowych dla gospodarki polskiej wskazuje na ich silne niezrównoważenie. W artykule przeanalizowano przejawy niesprawności państwa, przedsiębiorstw oraz sfery badawczo-rozwojowej. Ocenie poddano role sektora mediów, a zwłaszcza jego dysfunkcjonalność (bezkarne i legalne wytwarzanie "zatrutych owoców"). W zakończeniu Autor zawarł wniosek, iż ordoliberalizm jest ideą, która może stać się ogólną wskazówką zmian w kierunku nowoczesnej gospodarki, a jego konkretyzacją może być koncepcja Wielkiej Kwadrygi.

Analizę stanowionych i spontanicznych elementów ładu w okresie transformacji w Polsce przedstawiła A. Grabska. W sposób usystematyzowany, odwołując się do koncepcji W. Euckena i F. Hayeka, przeprowadziła obszerne badania stopnia realizacji zasad ładu konkurencyjnego w procesie zmian ustrojowych w Polsce. Były to następujące zasady: elastyczność cen, stabilność pieniądza, liberalizacja rynków, własność prywatna, swoboda zawierania umów, odpowiedzialność materialna za wyniki działalności gospodarczej oraz stałość polityki gospodarczej. W trakcie analizy zwróciła ona uwagę na te elementy ładu, które były wynikiem stanowienia oraz te, które kształtowały się spontanicznie, następnie określiła główne ich słabości. Badanie ujawniło brak pełnej realizacji zasad ładu konkurencyjnego W. Euckena. Autorka podkreśliła niewystarczający zakres takich elementów, jak: elastyczność cen, otwarcie rynków, swoboda zawierania umów, odpowiedzialność materialna za wyniki działalności gospodarczej i stałość polityki gospodarczej. Wymaga to dalszego procesu zmian instytucjonalnych czy wprowadzania i usprawniania reguł ładu konkurencyjnego.

Bliźniacze badanie, dotyczące elementów ładu stanowionego i spontanicznego w odniesieniu do procesu transformacji we wschodnich Niemczech, wykonał M. Moszyński. Punktem wyjścia tych analiz była koncepcyjna zbieżność stanowionego i spontanicznego porządku gospodarczego. W praktyce gospodarczej wyraża się to w zależności między instytucjami formalnymi i nieformalnymi. Przykład transformacji jest dobrym obszarem do analizy tych relacji. Autor zauważył, iż zmiany w byłej NRD przebiegały z większą inercją, zwłaszcza reguł nieformalnych, co stanowiło barierę w adaptacji i tym samym sprawnym działaniu instytucji formalnych. Równocześnie zauważalne było to, że proces budowy reguł stanowionych przebiegał jedynie z niewielkim uwzględnieniem warunków zastanych (normy społeczne i wartości). Najważniejsze było szybkie ujednolicenie instytucji formalnych w Zjednoczonych Niemczech.

Trzecia część monografii zawiera analizę "otoczenia" polityki ładu gospodarczego i dotyczy problematyki polityki społeczno-gospodarczej. Józefa Famielec dokonała oceny możliwości zastosowania koncepcji ordoliberalnych do wsparcia procesów rozwoju, a przede wszystkim rozwoju zrównoważonego. Po przedstawieniu głównych zasad tworzenia (się) ładu gospodarczego, Autorka wykorzystała je do modyfikacji koncepcji rozwoju zrównoważonego, który można traktować jako cel oraz zasadę konkurencyjnego ładu (s. 205). Proces ten wymaga: stabilnej wartości pieniądza, otwartego dostępu do informacji, zmniejszenia nadużyć związanych z inwestowaniem państwa w ochronę środowiska, przestrzegania zasad uczciwej konkurencji

w przetargach, egzekwowania odpowiedzialności za szkody w środowisku, usunięcia konfliktów między celami ekonomicznymi, społecznymi a ekologicznymi w polityce państwa. Jednocześnie jest niezbędne wypracowanie spójnych zasad rozwoju zrównoważonego, komplementarnych z innymi dokumentami strategicznymi. Docenienie ordoliberalnej koncepcji ładu konkurencyjnego umożliwi, według Autorki, usprawnienie procesów rozwoju na poziomie jednostek, a także gospodarek, w tym procesów rozwoju zrównoważonego.

Ekologiczny wymiar rozwoju gospodarczego został podjęty również w artykule B. Fiedora. Autor zwrócił uwagę na konieczność prowadzenia polityki ekologicznej, która powinna być spójna z innymi obszarami aktywności państwa. W efekcie takich działań będzie możliwe realizowanie celów ekonomicznych i społecznych przy zapewnieniu dostępności zasobów i odpowiedniej jakości środowiska. Badania wykazały, iż istnieją wieloprzekrojowe związki między koncepcją trwałego rozwoju a ideą społecznej gospodarki rynkowej. Każdą zasadę ładu konkurencyjnego można powiązać ze zrównoważonym rozwojem, w tym z kształtowaniem warunków korzystania ze środowiska naturalnego. Zdaniem Autora: *Tworzenie «ekologicznego wymiaru» społecznej gospodarki rynkowej, czy też nadawanie jej atrybutów trwałości w rozumieniu koncepcji trwałego rozwoju, może i powinno też być postrzegane w kontekście ordoliberalnie rozumianej Ordnungspolitik, czyli polityki tworzenia ładu instytucjonalnego dla konkurencyjnej gospodarki rynkowej (s. 227).*

Artykuł J. Bokajło obejmuje analizę porównawczą koncepcji ładu społeczno-gospodarczego A. Rüstowa, W. Röpkego i A. Müllera-Armaka. Autorka przedstawiła je jako ujęcia komplementarne. Wspólną "strategią" tych myślicieli była budowa takiego porządku w społeczeństwie, co prowadziłoby nie tylko do dobrobytu materialnego mieszkańców, ale wpływałoby korzystnie na inne aspekty życia, w tym bezpieczeństwo socjalne. Wydaje się, że idee ordoliberalne zyskują na znaczeniu, gdyż jak pisze Autorka: przez brak osadzenia w określonym «porządku» i efektywnego zarządzania, człowiek egzystuje w środowisku: niestabilnym, niezrównoważonym spofecznie, politycznie, ekonomicznie i ekologicznie (...). Najpilniejszą sprawą jest poszukiwanie nie nowej perspektywy cywilizacyjno-kulturowej, ale znalezienie dla niej nowej formuły ordo, pozwalającej uporządkować i zorganizować współczesną dynamikę postępu (s. 230).

Witold Kwaśnicki opisał koncepcję *państwa – minimum*, zastanawiał się przy tym, czy istnieje *optimum* rozmiarów rządu oraz przeciwstawił temu koncepcję *społeczeństwa bez rządu*. Autor wskazał na szereg niesprawności państwa jako regulatora procesów gospodarczych i społecznych. Mimo szczytnych celów (To właśnie dzięki <<silnemu i mądremu rządowi>> ostatecznie miał zapanować spokój społeczny i pokój między narodami – s. 244) dążenia do ich realizacji nie okazały się zwieńczone sukcesem (*Z perspektywy kilkudziesięciu lat rozrostu rządu jako instytucji społecznej widać, że wiara w rząd była w istocie romantycznym marzeniem i próbą ucieczki od odpowiedzialności* – s. 244). Każdy rząd to aparat przymusu, który działa za sprawą wysokich kosztów i nie kieruje się kryterium racjonalności (*Będąc z natury instytucją zaprojektowaną, jest on bardzo nieefektywny w wielu poczynaniach* – s. 245). Czy więc możliwe jest społeczeństwo bez rządu? Autor sam stwierdził, że *jest to postulat zbyt daleko idący* (s. 245). Budowa społeczeństwa opartego na zasadach wolności i swobodnego rozwoju jednostek wymaga zabezpieczenia tych jednostek od agresji innych. Trudno wyobrazić sobie osiągnięcie takiego ładu bez rządu. Jednak rozmiary współczesnych rządów są na tyle duże, że nie można tego uznawać za typowe i akceptować bez sprzeciwu.

Henryk Wnorowski skupił się na jednym z elementów ładu gospodarczego – przedsiębiorczości. Nie bez przyczyny nastąpił wybór tego zjawiska. Przedsiębiorczość ujawnia się w powstawaniu i upadaniu firm. Bez rozwoju przedsiębiorstw nie może dokonywać się rozwój gospodarczy. Natomiast tu uwidacznia się rola państwa, które może pozytywnie oddziaływać na postawy przedsiębiorcze w społeczeństwie. Artykuł zawiera analizę uwarunkowań instytucjonalnoprawnych, tworzących otoczenie przedsiębiorczości. Badanie zostało przeprowadzone głównie na podstawie raportów *Doing Business*. W rezultacie u stworzono swoisty ranking krajów według ich profilów "przychylności biznesowej". Przykładowo, Polska została zaliczona do grupy krajów o profilu nieprzychylnym dla przedsiębiorczości. Wymaga to zatem odpowiednich rozwiązań instytucjonalnych, usuwających bariery na drodze aktywności gospodarczej. Przedstawiona monografia podejmuje istotne problemy z punktu widzenia współczesnych gospodarek, szczególnie, gdy zwróci się uwagę na: dysfunkcjonalność, dysproporcje rozwojowe czy ujawniającą się anomię. W obliczu wielu problemów, z którymi borykają się kraje europejskie, należy zadać pytanie o narastanie ich przyczyn oraz o sposoby, które są możliwe do zastosowania, żeby złagodzić ich występowanie. Warto podkreślić, że tę lukę poznawczą może uzupełniać po części ordoliberalizm i koncepcja społecznej gospodarki rynkowej. Aby powstały koncepcje, jak pisał M.Miszewski: *zdolne do ogarnięcia coraz bardziej burzliwych przemian współczesnego bytu społeczno-gospodarczego* (s. 102), niezbędne jest dokonanie syntezy ordoliberalizmu i neoinstytucjonalizmu. Jednak od idei do realizacji jest długa droga. Brakuje narzędzi (rekomendacji dla polityki gospodarczej), których zastosowanie umożliwiłoby zbudowanie ładu gospodarczego odgórnie stanowionego przez państwo (W. Eucken). Z drugiej strony, czy istnieje sposób na wygenerowanie bodźców dla zmiany spontanicznej, o których pisał F.Hayek ? Czy istnieje realna szansa, by warunki ładu konkurencyjnego, opisane przez ordoliberałów, mogły być spełnione? Myślę, że zespół P. Pysza ma "pełne ręce roboty", aby odpowiedzieć na te i inne pytania, które pojawiły się jako pokłosie niniejszej publikacji.

6TH PODLASIE CONFERENCE ON MATHEMATICS (6PCM)

KONFERENCJA NAUKOWA

POLSKIE TOWARZYSTWO MATEMATYCZNE, ODDZIAŁ BIAŁOSTOCKI WYDZIAŁ EKONOMII I ZARZĄDZANIA UNIWERSYTETU W BIAŁYMSTOKU WYDZIAŁ MATEMATYKI I INFORMATYKI UNIWERSYTETU W BIAŁYMSTOKU WYDZIAŁ INFORMATYKI POLITECHNIKI BIAŁOSTOCKIEJ BIAŁYSTOK, 1-4 LIPCA 2014 R.

W dniach 1-4 lipca 2014 roku w siedzibie Wydziału Ekonomii i Zarządzania Uniwersytetu w Białymstoku przy ul. Warszawskiej 63 odbyła się 6th Podlasie Conference on Mathematics, zorganizowana przez Oddział Białostocki Polskiego Towarzystwa Matematycznego (PTM) wraz z Wydziałem Ekonomii i Zarządzania Uniwersytetu w Białymstoku (UwB), Wydziałem Matematyki i Informatyki Uniwersytetu w Białymstoku oraz Wydziałem Informatyki Politechniki Białostockiej (PB). Konferencja miała charakter międzynarodowy. Wzięli w niej udział pracownicy naukowi, doktoranci i studenci z wielu ośrodków krajowych i zagranicznych. Językiem konferencyjnym był język angielski. Informacje o 6PCM są dostępne na stronie internetowej konferencji: http://katmat.pb.bialystok.pl/pcm14/.

Oprócz instytucji współorganizujących konferencję, konferencję finansowo wsparły: Ministerstwo Nauki i Szkolnictwa Wyższego (główny sponsor), National Science Foundation oraz firmy: Mlekovita, SaMASZ i Enea.

Komitet Organizacyjny składał się z następujących osób: Anna Gomolińska (UwB) – przewodnicząca, Zbigniew Bartosiewicz – wiceprzewodniczący (Prezes Oddziału Białostockiego PTM, Politechnika Białostocka), Czesław Bagiński (PB), Josef Diblik (Czechy), Marzena Filipowicz-Chomko (PB), Ewa Girejko (PB), Adam Grabowski (UwB), Piotr Grzeszczuk (PB), Małgorzata Hryniewicka (UwB), Magdalena Kacprzak (PB), Artur Korniłowicz (UwB), Beata Madras-Kobus (UwB), Ryszard Mazurek (PB), Dorota Mozyrska (PB), Joanna Olbryś (PB), Antoni Pierzchalski (Uniwersytet Łódzki), Anna Poskrobko (PB), Krzysztof Prażmowski (UwB), Ewa Roszkowska (UwB), Miroslava Ružičkova (Słowacja), Ewa Schmeidel (UwB) i Henryk J. Wnorowski (UwB). W skład Komitetu Programowego konferencji, poza wyżej wymienionymi osobami, weszli także organizatorzy zgłoszonych sesji specjalnych, tacy jak: Dariusz Kacprzak (PB) i Tomasz Wachowicz (Uniwersytet Ekonomiczny w Katowicach).

W trakcie uroczystego otwarcia konferencji uczestników powitał Dziekan Wydziału Ekonomii i Zarządzania UwB, prof. dr hab. Henryk J. Wnorowski. Oprócz Dziekana Wydziału Ekonomii i Zarządzania UwB, konferencję również zaszczycił swoją obecnością Dziekan Wydziału Informatyki Politechniki Białostockiej, prof. dr hab. Leon Bobrowski (władze Wydziału Matematyki i Informatyki UwB, w zastępstwie Dziekana, prof. dr. hab. Anatola Odzijewicza, reprezentowała dr hab. Anna Gomolińska, Prodziekan ds. ogólnych tegoż wydziału). Obradowano w sesji plenarnej oraz 12 sesjach specjalnych. Sesja plenarna, adresowana do wszystkich uczestników konferencji, objęła wykłady następujących, zaproszonych wykładowców:

- Marek Jerzy Szopa (Uniwersytet Śląski w Katowicach, Polska), Quantum games and their possible applications in economics;
- Krystyna Kuperberg (Auburn University, Alabama, USA), Algebraic connections between shape theory and dynamical systems;

- 3. Andrzej Szałas (Uniwersytet Warszawski, Polska oraz University of Linköping, Szwecja) *Efficient reasoning over partial and inconsistent belief bases*;
- 4. Josef Diblik (Brno University of Technology, Czechy), New criteria for the existence of positive solutions of advanced differential equations;
- 5. Hans Havlicek (Vienna University of Technology, Austria), *Preserver problems in geometry*;
- 6. Andrzej Skowron (Uniwersytet Warszawski, Polska), Interactive granular computations and cyber-physical systems;
- 7. Ulrich Krähmer (University of Glasgow, Scotland, UK), Comonads, flat connections, and cyclic homology;
- 8. Bent Ørsted (Aarhus University, Dania), Universal principles for Pohozaev identities.

Wszystkie wykłady plenarne zostały starannie przygotowane i wygłoszone przez zaproszonych gości, będących znanymi i cenionymi ekspertami w swoich dziedzinach. Wykłady te, dotyczące aktualnych problemów badawczych z rozmaitych dziedzin matematyki i jej zastosowań, w szczególności w naukach ekonomicznych i informatyce, były naprawdę ciekawe i cieszyły się dużym zainteresowaniem uczestników konferencji. Pierwszy wykład plenarny został wygłoszony przez prof. dr. hab. Marka Jerzego Szopę z Uniwersytetu Śląskiego w Katowicach na temat gier kwantowych i możliwości ich zastosowania w ekonomii (*Quantum games and their possible applications in economics*). Był to bardzo dobry i zajmujący wykład, który stał się przyczynkiem do wielu merytorycznych pytań.

Zorganizowano niniejsze sesje specjalne:

- 1. Algebra (kierowana przez Ryszarda Mazurka);
- 2. Computer Science (kierowana przez Magdalenę Kacprzak);
- Computer-assisted Formalization of Mathematics In Memoriam of Andrzej Trybulec (kierowana przez Artura Korniłowicza);
- 4. *Control Theory and Dynamical Systems* (kierowana przez Zbigniewa Bartosiewicza i Ewę Girejko);
- 5. Decision Support in Negotiation (kierowana przez Ewę Roszkowską i Tomasza Wachowicza);
- 6. Difference and Differential Equations and Their Generalisation on any Time Scales (kierowana przez Ewę Schmeidel i Josefa Diblika);
- 7. Differential Operators: Algebra, Geometry, and Representations (kierowana przez Antoniego Pierzchalskiego);
- Fuzzy Calculus and Its Applications (kierowana przez Dariusza Kacprzaka; głównym inicjatorem i organizatorem tej sesji był śp. Witold Kosiński, który zmarł nagle, zanim konferencja doszła do skutku);
- 9. Mathematics in Biology and Medicine (kierowana przez Annę Poskrobko);
- 10. Quantitative Methods in Economics (kierowana przez Beatę Madras-Kobus);
- 11. Weak Partial Linear and Partial Chain Spaces and Their Geometry (kierowana przez Krzysztofa Prażmowskiego);
- 12. *Student Session* (kierowana przez Marzenę Filipowicz-Chomko, Ewę Girejko i Ryszarda Mazurka).

W ramach sesji specjalnych zostały wygłoszone referaty przedstawione przez uczestników konferencji oraz następujące wykłady na zaproszenie:

- 1. Daniel Franco (Universidad Nacional de Educación a Distancia (UNED), Madrid, Hiszpania), sesja Control Theory and Dynamical Systems: *Getting rid of chaotic population dynamics*;
- 2. Andreas Ruffing (The Technical University of Munich, Niemcy), sesja Control Theory and Dynamical Systems: *Quantum difference-differential equations*;
- 3. Priti Kumar Roy (Jadavpur University, Kolkata, Indie), we współpracy z Shubhankar Saha, Amar Nath Chatterjee i Sonia Chowdhury, sesja Mathematics in Biology and Medicine: *Effect of awareness programs with HAART in controlling the disease HIV/AIDS: A mathematical approach*;

- 4. Daniel Franco (Universidad Nacional de Educación a Distancia (UNED), Madrid, Hiszpania), sesja Mathematics in Biology and Medicine: *Effects of environmental protection in population dynamics*;
- 5. Krzysztof M. Piasecki (Poznań University of Economics, Polska), sesja Quantitative Methods in Economics: *Intuitionistic present value an axiomatic approach*;
- Marek Drużdżel (University of Pittsburgh, USA oraz Białystok University of Technology, Polska), sesja Student Session: *Being an academic researcher: what's it like?* (wygłoszony po polsku, streszczenie w języku angielskim).

Podobnie jak wykłady plenarne, wyżej wymienione wykłady na zaproszenie zostały przygotowane na wysokim poziomie i interesująco zaprezentowane przez znanych i cenionych przedstawicieli swoich dziedzin nauki. Jedynie względy organizacyjne spowodowały, że niektóre wykłady zaproszonych gości zostały zaplanowane jako plenarne, a inne jako właśnie, na zaproszenie (w programie konferencji odpowiednio *plenary lectures* i *keynote lectures*).

Konferencja stanowiła niemałe wyzwanie logistyczne, ze względu na dużą liczbę sesji specjalnych, których obrady z konieczności toczyły się równolegle w różnych salach (zwykle 3-4 jednocześnie). Jednak wysiłek organizacyjny opłacił się, gdyż konferencja spotkała się z ogromnym zainteresowaniem środowiska naukowego Białegostoku, związanego z matematyką i jej zastosowaniami w naukach ekonomicznych, naukach biomedycznych i informatyce, a także przyciągnęła sporą grupę uczestników z innych ośrodków w Polsce i za granicą. Szczególnie cieszy zainteresowanie udziałem w konferencji ze strony studentów i doktorantów, ponieważ daje nadzieję na kontynuację inicjatywy *Podlasie Conference on Mathematics* w następnych latach.

Łącznie z trzynastoma zaproszonymi wykładowcami, konferencja liczyła ponad stu uczestników (część bez referatów), w tym dwadzieścia jeden osób z ośrodków zagranicznych: sześć z USA, po dwie z: Czech, Wielkiej Brytanii, Indii i Japonii, po jednej z: Austrii, Danii, Francji, Hiszpanii, Holandii, Niemiec i Ukrainy.

Streszczenia wszystkich referatów zostały opublikowane w księdze abstraktów, w dalszym ciągu dostępnej na stronie internetowej konferencji. Ponadto, opublikowano następujące dwie e-monografie wieloautorskie, ogólnie dostępne na stronie internetowej konferencji, których rozdziały zostały opracowane przez autorów na podstawie zgłoszonych przez nich referatów konferencyjnych:

- A. Gomolińska, A. Grabowski, M. Hryniewicka, M. Kacprzak, E. Schmeidel (eds.), *Recent Results in Pure and Applied Mathematics Podlasie 2014*, Bialystok University of Technology Publishing Office, Białystok, 2014, ISBN 978-83-62582-57-0;
- A. Gomolińska, A. Grabowski, M. Hryniewicka, M. Kacprzak, E. Schmeidel (eds.), *Trends in Contemporary Computer Science Podlasie 2014*, Bialystok University of Technology Publishing Office, Białystok, 2014, ISBN 978-83-62582-58-7.

Konferencja stanowiła świetną okazję do: wymiany poglądów, dyskusji na tematy związane z wykładami i referatami, zawierania nowych znajomości zawodowych i odświeżenia starych kontaktów. Oprócz obrad, organizatorzy zaplanowali również program socjalny. W dniu 3 lipca 2014 roku, w godzinach popołudniowych odbyła się wycieczka do Tykocina i okolic. Wieczorem tego dnia, w Klubie Profesorskim zlokalizowanym przy Wydziale Ekonomii i Zarządzania UwB, miała także miejsce uroczysta kolacja konferencyjna. W trakcie tego spotkania uczestnicy zostali zaproszeni do wzięcia udziału w kolejnej konferencji *Podlasie Conference on Mathematics*, która zgodnie z planem powinna się odbyć w roku 2016. W czasie wolnym od obrad uczestnicy mieli możliwość samodzielnego zwiedzenia głównych atrakcji turystycznych Białegostoku, np. położonego niedaleko miejsca obrad pałacu Branickich i parku pałacowego. Z okazji konferencji *6PCM* w budynku, w którym odbywały się obrady, została zorganizowana wystawa fotograficzna autorstwa dr. Tomasza Poskrobko (m.in. współtwórcy inicjatywy *Magia Podlasia*, www.facebook.com/magiapodlasia), ukazująca uroki regionu podlaskiego.

WYDZIAŁ EKONOMII I ZARZĄDZANIA UNIWERSYTETU W BIAŁYMSTOKU POLECA PUBLIKACJE NAUKOWE:



Ewa Gruszewska

INSTYTUCJE A PROCES TWORZENIA KAPITAŁU W POLSCE

Białystok 2013, ISBN 978-83-7431-372-8

Grażyna Michalczuk

ZASOBY NIEMATERIALNE JAKO CZYNNIK WARTOŚCI PRZEDSIĘBIORSTWA LUKA INFORMACYJNA sprawozdawycości Hinansowej



Grażyna Michalczuk

ZASOBY NIEMATERIALNE JAKO CZYNNIK WARTOŚCI PRZEDSIĘBIORSTWA. LUKA INFORMACYJNA SPRAWOZDAWCZOŚCI FINANSOWEJ

Białystok 2013, ISBN 978-83-7431-370-4



REGIONALNE SYSTEMY INNOWACJI A KONKURENCYJNOŚĆ WOJEWÓDZTW W POLSCE



Monika Kondratiuk-Nierodzińska

REGIONALNE SYSTEMY INNOWACJI A KONKURENCYJNOŚĆ WOJEWÓDZTW W POLSCE

Białystok 2013, ISBN 978-83-7431-369-8

WYDZIAŁ EKONOMII I ZARZĄDZANIA UNIWERSYTETU W BIAŁYMSTOKU POLECA PUBLIKACJE DYDAKTYCZNE:



Grażyna Michalczuk, Teresa Mikulska, Grażyna Klamecka-Roszkowska, Katarzyna Jamróz

PODSTAWY RACHUNKOWOŚCI FINANSOWEJ

Białystok 2012, ISBN 978-83-7431-299-8



Andrzej H. Jasiński, Robert Ciborowski (red.)

EKONOMIKA I ZARZĄDZANIE INNOWACJAMI W WARUNKACH ZRÓWNOWAŻONEGO ROZWOJU

Białystok 2012, ISBN 978-83-7431-308-7



Nina Siemieniuk, Agnieszka Zalewska-Bochenko

MICROSOFT WORD 2007, MICROSOFT POWERPOINT 2007 ILUSTROWANY PRZEWODNIK DLA STUDENTÓW

Białystok 2012, ISBN 978-83-7431-310-0

PODYPLOMOWE STUDIA RACHUNKOWOŚCI I AUDYTU WEWNĘTRZNEGO W JEDNOSTKACH SEKTORA PUBLICZNEGO

15-062 Białystok ul. Warszawska 63 pok. 208

tel. (085) 7457702, fax (085) 7457702

Kierownik: dr hab. Ryta I. Dziemianowicz, prof. UwB Sekretariat: Grażyna Majewska

CEL STUDIÓW

- zdobycie i poglębienie wiedzy z zakresu organizacji i funkcjonowania sektora finansów publicznych,
- poglębienie wiedzy w zakresie prawa finansów publicznych i administracji publicznej,
- przekazanie sluchaczom wiedzy na temat szczególnych zasad i metod prowadzenia rachunkowości w jednostkach sektora finansów,
- poznanie nowych regulacji dotyczących organizacji i zasad przeprowadzania wewnętrznej kontroli finansowej w jednostkach sektora finansów publicznych,
- zdobycie praktycznych umiejętności w zakresie tworzenia oraz analizy funkcjonowania i oceny komórek kontroli finansowej i audytu wewnętrznego.

STUDIA ADRESOWANE SĄ DO:

- glównych księgowych i kadry kierowniczej w jednostkach sektora finansów publicznych
- pracowników odpowiedzialnych za prowadzenie nowoczesnego systemu audytu wewnętrznego i kontroli finansowej w jednostkach sektora publicznego.

Zasady naboru:

- decyduje kolejność zgłoszeń.

Warunki rekrutacji:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.

PODYPLOMOWE STUDIA FINANSÓW I RACHUNKOWOŚCI PRZEDSIĘBIORSTW

15-062 Białystok ul. Warszawska 63 pok. 208

tel. (085) 7457702, fax (085) 7457702

Kierownik: dr hab. Ryta I. Dziemianowicz, prof. UwB Sekretariat: Grażyna Majewska

Podyplomowe Studia Finansów i Rachunkowości Przedsiębiorstw istnieją od roku akademickiego 1992/1993. Przeznaczone są dla absolwentów szkół wyższych różnej specjalności.

Celem studiów jest przygotowanie kadr dla przedsiębiorstw i instytucji w zakresie finansów i rachunkowości oraz przygotowanie słuchaczy do działalności usługowej w zakresie prowadzenia ksiąg rachunkowych.

Studia trwają dwa semestry, kończą się zaliczeniami lub egzaminami z poszczególnych przedmiotów. Zajęcia odbywają się w formie 7 dwudniowych zjazdów w weekendy w każdym semestrze i obejmują ponad 300 godz. zajęć dydaktycznych. Studia kończą się wydaniem świadectwa ukończenia studiów podyplomowych.

Wykładane są następujące przedmioty:

- rachunkowość finansowa,
- sprawozdawczość finansowa,
- rachunek kosztów,
- system podatkowy,
- papiery wartościowe,
- prawo cywilne, gospodarcze i administracyjne,
- system informatyczny i podstawy informatyki,
- wykłady okolicznościowe.

Zasady naboru:

- decyduje kolejność zgłoszeń.

Warunki rekrutacji:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.

PODYPLOMOWE STUDIA MENEDŻERSKIE

🖃 15-062 Białystok ul. Warszawska 63 pok. 229

★ tel. (0~85) 745 77 25 fax (0~85) 741 46 85

Kieronnik: dr hab. Tadeusz Truskolaski, prof. UwB Sekretariat: Anna Kitlasz

Podyplomowe Studia Menedżerskie istnieją od roku 1992. Przeznaczone jest dla absolwentów szkół wyższych, różnych specjalności.

Wykładowcami są pracownicy naukowi oraz praktycy, dyrektorzy banków i specjaliści z poszczególnych dziedzin. Program i treści nauczania dostosowane są do potrzeb i wymagań rynku. Studium daje szansę nawiązania ciekawych kontaktów oraz konsultacji z wieloma specjalistami z różnych branż.

Zasady naboru: decyduje kolejność zgłoszeń.

Warunki rekrutacji:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.

Studia trwają dwa semestry. Zajęcia odbywają się w formie 2-dniowych zjazdów (w soboty i niedziele) i obejmują 256 godzin zajęć dydaktycznych. Studia kończą się egzaminem i wydaniem świadectwa ukończenia studiów podyplomowych.

Wykładane są następujące przedmioty:

- Organizacja i zarządzanie
- Zarządzanie finansami i rynek kapitałowy
- Marketing
- Zarządzanie zasobami pracy
- Zarządzanie strategiczne
- Biznes plan
- System podatkowy
- Funkcjonowanie gospodarki rynkowej
- Rachunkowość zarządcza
- Negocjacje w biznesie
- Public relations
- Prawo pracy
- Zamówienia publiczne
- Rynek i wycena nieruchomości
- Zajęcia komputerowe
- Seminaria wykłady okolicznościowe

PODYPLOMOWE STUDIA ZARZĄDZANIA PROJEKTAMI UNII EUROPEJSKIEJ

15-062 Białystok, ul. Warszawska 63, pok. 234,
 tel. (085) 7457721, fax (085) 7414685

e-mail: kpeirg@uwb.edu.pl http://www.weiz.uwb.edu.pl/

Kierownik: dr hab. Marek Proniewski, prof. UwB *Sekretariat:* mgr Jolanta Wiszniewska

Cele studiów

Przekazanie praktycznych umiejętności opracowania projektu i jego zarządzania (w tym finansowego) oraz wypełniania wniosków, gwarantujących pozyskanie środków finansowych z Unii Europejskiej.

Adresaci

Wszystkie osoby, które są zobowiązane lub pragną z tytułu potrzeb lub planów zawodowych otrzymać wiedzę dotyczącą pozyskiwania środków finansowych z Unii Europejskiej.

W szczególności program kierowany jest do:

- przedsiębiorców,
- pracowników administracji samorządowej, organizacji pozarządowych,
- nauczycieli
- absolwentów szkół wyższych
- i innych osób zamierzających uzyskać kwalifikacje niezbędne do pozyskiwania środków finansowych z UE

Korzyści

Przygotowanie specjalistów w dziedzinie zarządzania projektami Unii Europejskiej. Studia dają możliwość nawiązania kontaktów z osobami bezpośrednio zaangażowanymi w realizację projektów finansowanych z funduszy strukturalnych

Zasady naboru: decyduje kolejność zgłoszeń.

Należy złożyć następujące dokumenty:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.

PODYPLOMOWE STUDIA WYCENY I GOSPODARKI NIRUCHOMOŚCI

Specjalności: WYCENA NIERUCHOMOŚCI ZARZĄDZANIE NIERUCHOMOŚCIAMI POŚREDNICTWO W OBROCIE NIERUCHOMOŚCIAMI

Kierownik Studiów: dr Dorota Wyszkowska e-mail: d.wyszkowska@uwb.edu.pl

Sekretariat: mgr Jolanta Wiszniewska tel. 085 745 77 21 fax 085 741 46 85 e-mail: kpeirg@uwb.edu.pl

CEL STUDIÓW:

Celem Studiów jest przygotowanie słuchaczy, w zależności od wybranej specjalności, wykonywania zawodu. W przypadku Wyceny nieruchomości celem studiów jest także przygotowanie do ubiegania się, po spelnieniu dodatkowych wymogów (praktyki zawodowe), o uzyskanie uprawnień zawodowych (egzamin państwowy).

Uczestnikami Studiów mogą być absolwenci szkół wyższych.

Studia trwają 2 semestry od października do czerwca w wymiarze godzin określonym w programie studiów. W przypadku specjalności Wycena nieruchomości program zgodny jest z minimum programowym zalecanym przez Ministerstwo Infrastruktury i Rozwoju, zawartym w Rozporządzeniu Ministra Infrastruktury i Rozwoju z dnia 12 czerwca 2014 r. w sprawie minimalnych wymogów programowych dla studiów podyplomowych w zakresie wyceny nieruchomości (Dz. U. z 24 czerwca 2014 r., poz. 826).

Zajęcia odbywają się w 2-dniowych zjazdach (soboty i niedziele) co 2 tygodnie i kończą się egzaminem.

Więcej informacji: http://www.weiz.uwb.edu.pl/studia-podyplomowe/studia-podyplomowe-wyceny-i-gospodarki-nieruchomosciami.html

Zasady naboru:

o przyjęciu decyduje kolejność zgłoszeń

WYMAGANE DOKUMENTY:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.
PODYPLOMOWE STUDIA ZARZĄDZANIA ZASOBAMI LUDZKIMI

15-062 Białystok ul. Warszawska 63, pok. 225 tel. (085) 745-77-19, fax (085) 741-46-85 e-mail: agrzes@ uwb.edu.pl http://www.weiz.uwb.edu.pl

Kierownik: dr Anna Grześ

CEL STUDIÓW:

Przekazanie specjalistycznej wiedzy teoretycznej i praktycznych umiejętności z zakresu zarządzania zasobami ludzkimi niezbędnych do skutecznego funkcjonowania organizacji.

Zakres ten obejmuje m.in.:

- zasady i metody rekrutacji i selekcji,
- system ocen pracowniczych,
- systemy wynagradzania,
- prawo pracy i zbiorowe stosunki pracy,
- negocjacje zbiorowe,
- zarządzanie karierami i rozwojem pracowników, itp.

ORGANIZACJA STUDIÓW:

Studia trwają 2 semestry. Obejmują 188 godzin dydaktycznych. Zajęcia odbywają się w 2-dniowych zjazdach (w soboty i niedziele) co 2 tygodnie i kończą się obroną pracy dyplomowej oraz wydaniem świadectwa ukończenia studiów podyplomowych.

STUDIA ADRESOWANE SĄ DO:

- kadry kierowniczej przedsiębiorstw,
- pracowników działu kadr,
- osób zainteresowanych zdobyciem oraz pogłębieniem wiedzy z zakresu problematyki zarządzania zasobami ludzkimi w nowoczesnych organizacjach.

WYMAGANE DOKUMENTY:

- odpis dyplomu,
- wygenerowane z systemu IRK podanie kandydata,
- kserokopia dowodu osobistego
- potwierdzenie opłaty manipulacyjnej.

Zasady naboru:

decyduje kolejność zgłoszeń.