Scientific Journal
Warsaw University of Life Sciences – SGGW

PROBLEMS OF WORLD AGRICULTURE

Volume 15 (XXX) 2015
Number 4

PROBLEMS OF WORLD AGRICULTURE VOLUME 15 (XXX) 2015 Number 4

2081 6960

Scientific Journal
Warsaw University of Life Sciences – SGGW

PROBLEMS OF WORLD AGRICULTURE

Volume 15 (XXX)
Number 4

Warsaw University of Life Sciences Press
Warsaw 2015

Print version is the original version

Indexing in databases:
Index Copernicus, Baza Agro, BazEkon, Information System Food Economy, Arianta Polish Scientific and Professional Electronic Journals, AgEcon search, POL-index.

ISSN 2081-6960

Warsaw University of Life Sciences Press
166 Nowoursynowska St., 02-787 Warsaw
Phone (+48 22) 593 55 20, fax (+48 22) 593 55 21
e-mail: wydawnictwo@sggw.pl
home page: www.wydawnictwosggw.pl

Printed by Polimax s.c.

TABLE OF CONTENTS

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 5–16

Tetiana Ivanivna Balanovska[1]
Department of Management, named after Prof. Zavads'kyi,
National University of Life and Environmental Sciences of Ukraine
Oksana Mykolayivna Gavrysh[2]
Department of Exchange Activity,
National University of Life and Environmental Sciences of Ukraine
Jakub Kraciuk[3]
Faculty of Economic Sciences
Warsaw University of Life Sciences – SGGW

Marketing Strategies as a Part of Crisis Management of Enterprises

Abstract. The paper considers aspects of marketing strategy formation as a component of crisis management by an enterprise. It constructs a tree of objectives for the formation of a strategic set for crisis management by the enterprise. The algorithm of choice for marketing strategies for agricultural enterprises is developed. Finally, a methodical approach to determine efficiency of a marketing strategic set and calculate the extent of its performance for the purpose of defining measures for crisis management by the enterprise is offered.

Key words: crisis management of enterprise, marketing strategy, effectiveness, marketing strategic set, objectives tree, general purpose, indicator «the performance of marketing strategic set», the absolute market share, the relative market share, price, goods, market, demand

Introduction

Today, most enterprises have concluded that in current circumstances it is better to take measures to prevent a crisis than to deal with its consequences. One element of crisis management is the proper use of the tools of marketing. Marketing strategies are flexible and provide for the search of new effective ways of dealing with a crisis, even if there are minor financial costs. Therefore, the formation of the marketing strategy has important significance to further the process of its implementation, since even the most effective and most successfully chosen marketing strategy does not always have the expected result, especially if, at the time of its implementation, certain difficulties arise. In this case, the enterprise has to timely detect shortcomings in implementation as part of the marketing strategy, and strategic set, and to establish the necessity of their adjustments, i.e.: either partial change of a marketing strategy, or detecting the need for the formation of a new strategic set. It is possible to determine the calculating indicators of the effectiveness of marketing strategies and to identify the degree of performance for a marketing strategic set. This has determined the relevance of the study.

[1]Professor, e-mail: balanovskaya@nubip.edu.ua
[2] PhD, e-mail: Ksuha-810@mail.ru
[3] Doctor habilitated, associate professor, e-mail: jakub_kraciuk@sggw.pl

Analysis of recent research and publications

In scientific literature considerable attention is given to the issue of crisis management, in particular the formation of marketing strategies and evaluation of their effectiveness. The results of these studies are reflected in the writings of such Ukrainian and foreign scholars as: Albert M., Ansoff I., Armstrong G., Assel G., Bagiev G., Dei D., Garkavenko S., Hedouri F., Hotho S., Kotler F., Kudenko N., Lamben J., Lydovska O., Mcdonald M., Meskon M, Mitroff I., Pauchant C., Pollard D., Porter M., Saunders J., Shershneva Z., Tanase D., Wong V., etc.

At the same time, individual questions of formation and implementation of marketing strategies, methodical and organizational approaches to the development of indicators for the effectiveness of marketing strategies and the establishment of the need for adjustments under the conditions of crisis management for an enterprise require further study and improvement.

The purpose: Consider aspects of marketing strategy formation as part of crisis management of an enterprise and offer methodological approaches to determine its effectiveness.

Results: In every country, in any society, agriculture is a vital sector of the national economy, since it affects the needs of almost everyone. Today more than 80 % of consumption is formed at the expense of agriculture production. Therefore, it is the primary condition for the existence of mankind.

However, agriculture in Ukraine is particularly important because it is one of the largest sectors of the country's economy. This is evidenced by a number of important macroeconomic parameters. The most important among them is the share of agriculture in gross domestic product of the state (8% as of 2014). In addition, it is worth noting that many agricultural enterprises of Ukraine are unprofitable (Fig. 1).

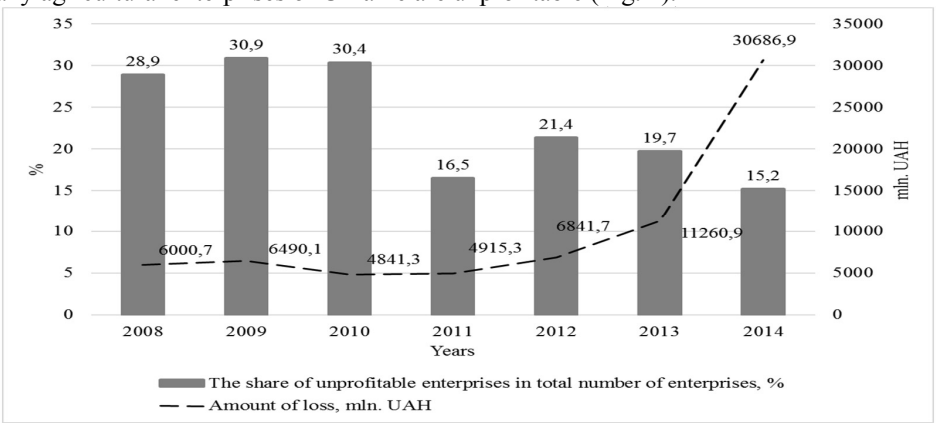


Fig. 1. The dynamics of the number of unprofitable enterprises in agriculture of Ukraine and the amount of their damages

Source: built according to the State statistics service of Ukraine.

According to the data of Fig. 1, the share of unprofitable enterprises in the total number of enterprises in 2014 significantly decreased compared to 2008 and amounted to 15,2 %. However, the amount of losses in recent years in agricultural enterprises has

increased significantly: from 6000,7 mln. UAH in 2008 to 30686,9 mln. UAH in 2014. Ukraine's agricultural enterprises will require immediate crisis measures to prevent their bankruptcy.

In-depth studies were conducted in the field of vegetable growing, as it has always been and remains an important branch of agriculture, in which a significant role is played by greenhouses because they can provide the population with vitamins throughout the year. According to the results of the study, as of 2014 Ukraine had 4,5 thsd. ha of greenhouses, in which gross vegetables amounted to 491,1 thsd. tons, which is much less than in other countries. For example, the area of greenhouses in China is 36,5 thsd. ha, Turkey – 10 thsd. ha, Russia – 7,1 thsd. ha; in Western Europe, almost 300 thsd. ha: including in Spain – 18,5 thsd. ha, Italy – 17 thsd. ha, Netherlands – 10,4 thsd. ha, France – 7,3 thsd. ha [Magazine "Plantator" 2012].

The study found that in Ukraine, more than half of the total number of greenhouses are located on farms which have three times lower crop capacity than agricultural enterprises. Figure 2 shows the dynamics of the production, realization and consumption for vegetables grown in greenhouses of Ukraine from 1990 to 2014.

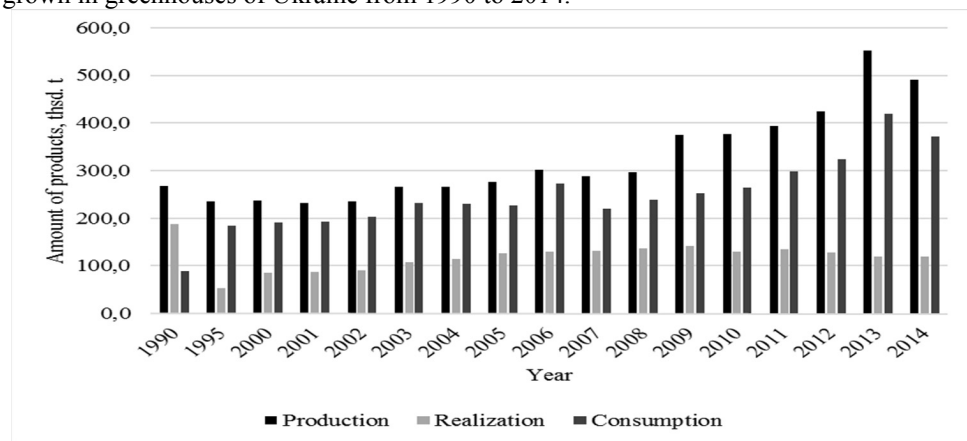


Fig. 2. The dynamics of production, realization of vegetables grown in greenhouses and their consumption by Ukrainians

Source: built according to the State statistics service of Ukraine.

As the data in Figure 2 show, the realization of vegetables from 1990 to 2014 is considerably lower than their production. However, this not evidence of damage to a significant share of the production, but is due to the presence of a large number of self-processing plants in large greenhouses. Fig. 2 was drawn from materials taken from the State statistics service of Ukraine, so, perhaps, inauspicious data on realization of the vegetables grown in greenhouses, is the result of indicators of realization processing appearing in statistical reporting as the realization of products of industrial production.

It also draws attention to the fact that the consumption of vegetables grown in greenhouses from 1990 to 2014 is greater than their realization. This is due to the presence of a large number of greenhouses in local households which manufactured products for their own needs, as well consuming imported vegetables. If such vegetables have a lower cost than domestic products, they are more competitive, which strengthens the position of

foreign enterprises in the Ukrainian agrarian market. In turn, the lack of full-fledged marketing strategies in agricultural enterprises makes it difficult to counteract this influence, to differentiate realization channels and get maximum profits from their business activities.

However, the production of vegetables grown in greenhouses by Ukrainian enterprises is unable to fully satisfy the needs of consumers. Therefore, the shortage of vegetables grown in greenhouses in the off-season exists primarily due to imports. It should be noted that for six years, imports such as tomatoes and cucumbers in Ukraine significantly increased. This is due to the fact that the prices of imported vegetables are substantially lower than the prices of domestic products, as well as the fact that Ukrainian greenhouses do not produce enough to satisfy domestic demand. This once again confirms the need for an increase in the cultivation of tomatoes and cucumbers Ukrainian enterprises.

In a study using economic-statistical methods, the expected level of factors that affect the prices of greenhouse production was calculated. This helped forecast the prices of vegetable grown in greenhouses on the Ukrainian and world markets until 2018 (Fig. 3).

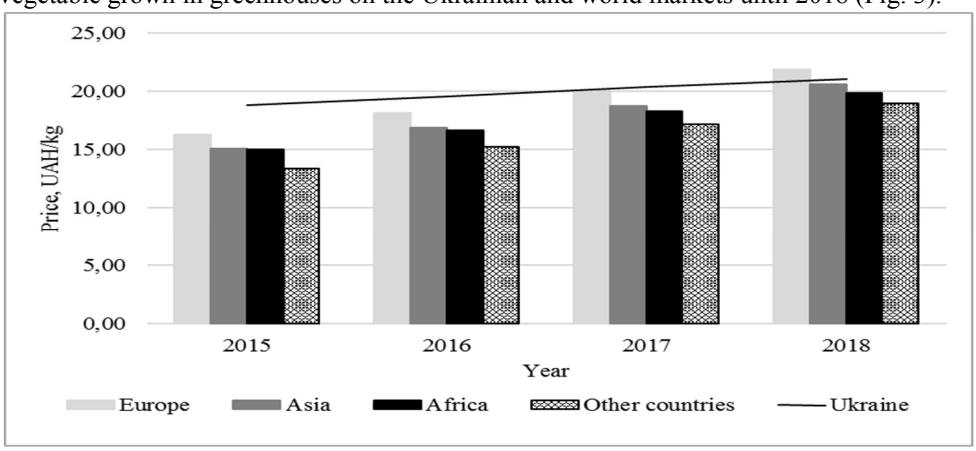


Fig. 3. A comparison of the forecast import price on tomatoes with the price on the Ukrainian market

Source: authors' research.

As can be seen from Fig. 3, the forecasted realization prices for tomatoes, both globally and in Ukraine, will grow annually. The lowest purchase price for tomatoes throughout the forecast period is expected to come from other countries. Prices will be slightly higher in Asia and Africa. Moreover, the price in these countries on the import of tomatoes over the four forecasted years is almost on the same level. High value realization price will be reached in Europe. However, it should be noted that the highest purchase price for tomatoes during the whole forecast period will remain in Ukraine, and only in 2017 will European prices be comparable with Ukraine's, and in 2018 will be slightly lower (21,06 UAH/kg realization price in Ukraine, 21,84 UAH/kg in European countries).

A similar situation is observed on comparing forecast import prices of cucumbers with prices in Ukraine. The lowest purchase price for cucumbers throughout the test period will be in the countries of Africa. Moreover, it decreases annually. Somewhat higher realization price for imported cucumbers is observed in European countries with annual growth, and high purchase price will be in Asia. The highest forecast price realization of cucumbers, as

with tomatoes, during the investigated period will remain in Ukraine, which will increase from 18,51 UAH/kg in 2015 to 22,09 UAH/kg in 2018.

Thus, the forecast prices of imported tomatoes and cucumbers are much lower than the price of Ukrainian domestic producers. Due to the fact that Ukrainian greenhouses grow not enough products to meet the needs of the population in winter, Ukraine is forced to buy imported vegetables. Since the price for them is lower, then the implementation of such products allows domestic sellers get bigger profits. If such a trend is expected in the future, then the Ukrainian market would be flooded with vegetables from Turkey, Spain, Poland and Egypt, and domestic greenhouses in general risk disappearing. To prevent this situation, Ukraine build its own production of vegetable grown in greenhouses and implement legislative restrictions on the import of such products. In addition, as practice has shown, an effective method would be the use of a variety of import taxes and duties, which would serve to equalize Ukrainian and import prices on the market, and could also help replenish the state budget.

According to the research, Ukrainian state-owned greenhouses are unprofitable. In addition, the level of losses every year increases. Unlike state-run enterprises, private enterprises are profitable. However, in recent years, the profits in these enterprises decrease every year. In order to prevent a crisis situation, and possible bankruptcy, greenhouses, especially state-owned ones, need to have a timely and rational system of crisis measures for balancing their financial and economic situation and reducing the impact of imported goods on domestic markets.

Crisis management takes into account two essential features of the crisis, namely the effects of physical and symbolic focus, not only on the reaction, but also on prevention and training [Tanase 2012]. It can be concluded that just as with individuals, some organizations, be they economic, social, political, military or otherwise, including their «top management» are subject to or can be the subject of crises more than others. In the literature these organizations, their managers and management organizations were called «port crisis» [Pauchant, Mitroff 1995]. Similarly, to «the talisman model» these port managers by their management activities are causing crises, disasters. There are of course organizations that have taken all measures to avoid being affected by major crises that are able to manage and administrate those crises that occur despite preventive means, such organizations and managers being called preventive managers [McDonald 2009]. Moreover, Pollard and Hotho suggested that scenario planning should be included as a part of crisis management plan. Scenario planning is essential when developing a Strategic Crisis Management Plan and an Executable Crisis Management Action Plan. It is important to integrate crisis management into the strategic management of organizations because both depend on innovative and intuitive strategies which are also required in order for organizations to survive and flourish [Pollard, Hotho 2006].

To ensure the effective activity of any enterprise, especially in the conditions of a crisis situation, it is necessary to clearly define the purpose of its functioning. To achieve this purpose, it is appropriate to develop a number of objectives and under-objectives, that is, to build the so-called "tree of objectives". The “tree of objectives” is a visual graphic image showing affiliation and relationship objectives, demonstrating the distribution of the overall (general) purpose or mission in under-objectives tasks and individual action. "The tree of objectives" can be defined as the target framework of an organization, phenomena or activity [Shershneva 2004]. By this tree, a company has the ability to more efficiently and quickly achieve its main purpose while considering all opportunities and threats.

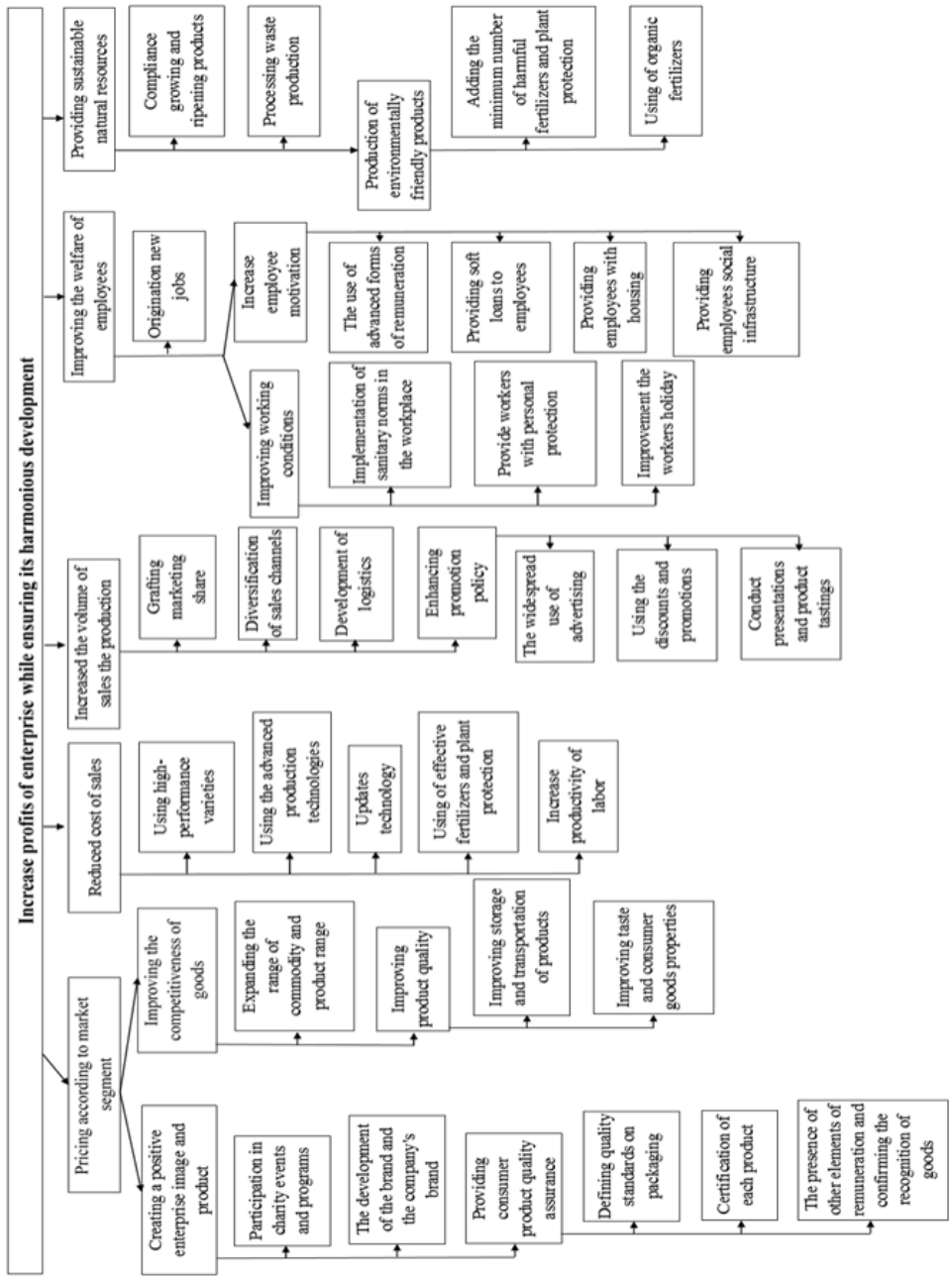


Fig. 4. The structure of "the tree of objectives" for creating a marketing strategic set for greenhouses

Source: authors' research.

The course of research was conducted on the basis of study materials for greenhouses (in-depth research was conducted on materials from State Enterprise "Scientific-Research Agrocomplex "Pushcha-Vodytsia", PJSC "Complex "Teplychnyi" and PRAE "Uman Hothouse Complex") within the crisis management proposed objectives tree to further the formation of marketing strategic set (Fig. 4). The general purpose is chosen to increase profits of enterprises while ensuring their harmonious development. The objectives of the first level include: increasing revenue and reducing the costs. The implementation of the objectives of the first level is ensured by the implementation of the objectives of the second level, namely increasing the incomes of greenhouses is made possible by raising the prices of production and increasing sales volume growth. The main objective of reducing the cost is to lower the cost per unit of production. In accordance with the objectives of the second level may be due to the realization of the objectives of the third level.

It should be noted that in many writings on the theory of marketing, much attention is paid to the choice of marketing strategy. Today, the following approaches are used the most widely:

- the approach is based on the matrix and I. Ansoffa "product–market" [Ansoff 1989];
- the matrix "Boston Consulting Group" [Kudenko 1998];
- the matrix "Mc Kinsey – General Electric" [Lamben 1996];
- the program is built on the impact of market strategy for profit (PIMS) [Assel 1999];
- the strategic Porter's model [Porter 1980];
- the matrix of balance the life cycles of strategic business units [Mescon, Albert, Hedouri 2000].

However, the above approaches were developed by Western scientists and, as revealed by the research, cannot be used as effectively by Ukrainian enterprises. Therefore, on this basis, we have developed the algorithm for choosing marketing strategies, which, in our opinion, are more adapted to the Ukrainian conditions (Fig. 5).

The essence of this algorithm lies in choosing the strategy depending on the impact of one or another factor. Factors of influence on the marketing strategies were merged into three large groups, which directly affect the enterprise: goods, consumer and demand. Other factors influence it indirectly. Marketing strategies were taken by the classification of S. Garkavenko [Garkavenko 2004], as this classification is the most common in Ukraine.

In our view, the choice of one or another marketing strategy should begin with a definition of what the enterprise produces, or will produce, i.e. with the goods (Fig. 5).

According to the proposed algorithm for mono-product production, and depending on the group of consumer oriented goods, there is emitted the strategy of trading specialization and one-segment concentration. For the strategy of trading specialization, it is typical manufacturing by enterprise for one of the products for different groups of consumers, while the one-segment concentration provides orientation on one, rather narrow group of consumers.

These strategies are generally branded mono-product strategies, which, in turn, based on the impact of a factor are more specific. So, depending on whether the selected product is new on the market or not, and also targeting it to a new group of consumers, or on an existing group, they are divided into strategies of conglomerate (pure) diversification, product development, maintenance the market positions and market development.

As evidenced by Fig. 5, strategy of conglomerate (pure) diversification is aimed at production of absolutely new goods for an entirely new group of consumers. According to the proposed algorithm of choosing the marketing strategy, the presence of seasonal demand for

the product is characterized by the application of strategies of maintaining the market positions and market development. The strategy of synchro-marketing helps overcome any lack.

The result of the application of this strategy (as well as supportive marketing) is achieved by using a no-trading differentiation, which is divided into service and image.

It should be noted that the service differentiation provides a higher level of service than in the firms-competitors, while image is aimed at ensuring the commitment of consumers through the creation of a positive image of the manufacturer (stability of the enterprise, participation in charity events, etc.). Therefore, the proposed algorithm of choosing the marketing strategy, in our opinion, is the best when choosing one or another set of marketing strategies for agricultural enterprises in the conditions of crisis management, because, on the one hand, it takes into account the main factors which affect their marketing activities, and on the another – it is fairly simple to use.

Table 1. Indicators of the effectiveness of marketing strategic set

Type of the strategies	Indicator of the effectiveness	The formula
Basic	The average annual rate of change in the absolute market share of enterprise	$\overline{MS} = \sqrt[n-1]{\frac{MS_n}{MS_0}}$, (1) where $\overline{MS}$ – the average annual rate of change in the absolute market share; MS_n – final level dynamics of the absolute market share, %; MS_0 – entry-level dynamics of the absolute market share, %; n – number of dynamic levels, years.
Competitive	The average annual rate of change in the relative market share of enterprise	$\overline{RMS} = \sqrt[n-1]{\frac{RMS_n}{RMS_0}}$, (2) where $\overline{RMS}$ – the average annual rate of change in the relative market share; RMS_n – final level dynamics of the relative market share, %; RMS_0 – entry-level dynamics of the relative market share, %; n – number of dynamic levels, years.
Price	The average annual rate of change in the price of the implementation per unit	$\overline{P} = \sqrt[n-1]{\frac{P_n}{P_0}}$, (3) where $\overline{P}$ – the average annual rate of change in the price of the implementation; P_n – final level dynamics of the price of the implementation per unit, UAH/kg; P_o – entry-level dynamics of the price of the implementation per unit, UAH/kg; n – number of dynamic levels, years.
Commodity	The average annual rate of change in the volume of sales production	$\overline{Q} = \sqrt[n-1]{\frac{Q_n}{Q_0}}$, (4) where $\overline{Q}$ – the average annual rate of change in the volume of sales; Q_n – final level dynamics in the volume of sales the production, t; Q_o – entry-level dynamics in the volume of sales the production, t; n – number of dynamic levels, years.

Source: authors' research.

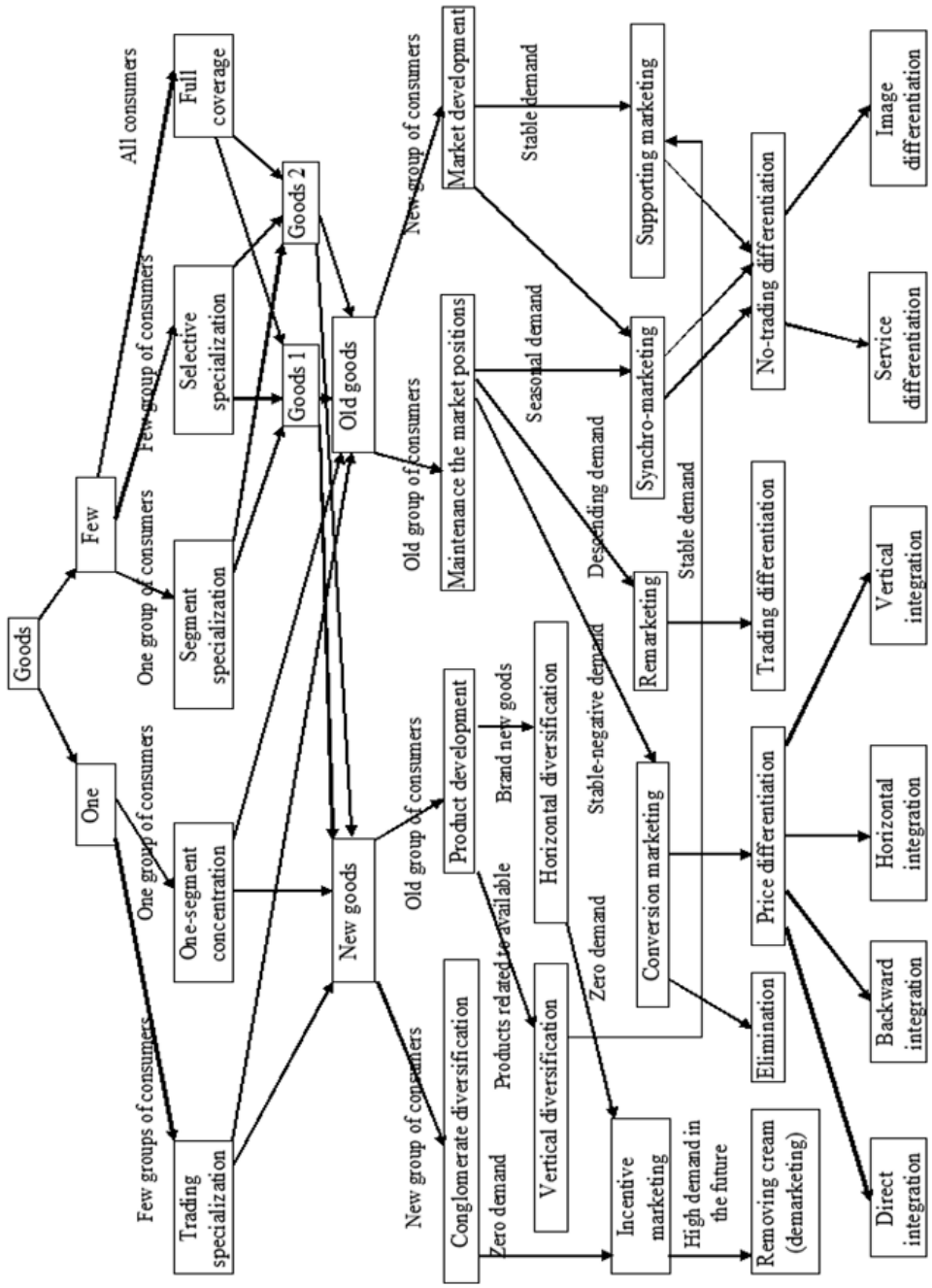


Fig. 5. The algorithm of choosing the marketing strategy

Source: authors' research.

Acceptance and monitoring of the implementation of the decision to change the strategic set under the conditions of crisis management is impossible without measuring the effectiveness of marketing strategies. Since the implementation of a strategic set requires significant financial cost, information on the extent of implementation of the objectives is important.

At present, there is no single methodological approach to determine the effectiveness of a marketing strategy. In Ukrainian practice, two methods are used: by the degree of achievement of the stated objectives and the ratio of the effect of marketing activities to the costs of its implementation [Bagiev 2007; Lidovska 2008].

The lack of a universal indicator of extent of the performance of the strategic set, in our view, creates a number of problems for the management of the enterprise, which will provide definitive evaluation of existing strategies, develop amendments to them, if necessary, or to refuse the implementation of realization strategic set while preventing a crisis situation of the enterprise. In Table 1 follow the most relevant, in our view, indicators of the effectiveness of marketing strategies for their groups.

The universal indicator of the extent of the performance of the strategic set is proposed to determine how the ratio, expressed as a percentage, is obtained as the product of the indicators of effectiveness for all group strategies (Formula (5)).

$$E = \sqrt[4]{\overline{MS} \times \overline{RMS} \times \overline{\mathrm{P}} \times \overline{Q}} \times 100\% \tag{5}$$

where E – the extent of performance of the marketing strategic set, %.

While this formula can simplify, since relative market share is determined by taking into account the absolute, and the volume of products – taking into account the price of the implementation (Formula (6) – (7)):

$$\overline{\mathrm{RMS}} = \sqrt[n-1]{\frac{\mathrm{RMS_n}}{\mathrm{RMS_0}}} = \sqrt[n-1]{\frac{\mathrm{MS_n}}{\mathrm{MS_0}}} \times \sqrt[n-1]{\frac{\mathrm{MSC_0}}{\mathrm{MSC_n}}}, \tag{6}$$

$$\overline{Q} = \sqrt[n-1]{\frac{Q_n}{Q_0}} = \sqrt[n-1]{\frac{P_0}{P_n}} \times \sqrt[n-1]{\frac{D_n}{D_0}}, \tag{7}$$

where: MSC_0 – entry-level dynamics of the market share of the nearest competitor, %;
MSC_n – final level dynamics of the market share of the nearest competitor, %;
D_0 – entry-level dynamics of sales revenue, thsd. UAH;
D_n – final level dynamics of sales revenue, thsd. UAH.

The final formula (8) for the calculation of the extent of performance of the marketing strategic set has the next form:

$$\mathrm{E} = \sqrt[4(n-1)]{\frac{\mathrm{MS_n^2 \times MSC_0 \times D_n}}{\mathrm{MS_0^2 \times MSC_n \times D_0}}} \times 100\,\%\,, \tag{8}$$

Thus, to calculate the extent of performance of the marketing strategic set requires only the information about the market share of the enterprise, market share of its nearest

competitor and the value of the sales revenue of products, which makes this method very easy to use.

In the course of study the following scale values were formed of the indicator of the extent of performance of the marketing strategic set (Table 2). If necessary, the partial adjustment of the strategic set is needed in deciding which strategy should be used, and which are acceptable and well implemented. It is easy to identify, then totaling the indicators of the effectiveness (see Table 1) separately for each group of strategies. If the value of the indicator for a certain type of strategy is the smallest, then this strategy will need to be adjusted, and vice versa – in the largest, the strategy does not require adjustment.

Table 2. Scale values to assess the extent of performance of the marketing strategic set

The recommended value of the extent of performance of the strategic set, %	Assessment of the performance of the strategic set
$E \leq 50$	Strategic set is not executed and requires radical revision
$50 < E < 75$	Strategic set performed in part, requires editing of individual groups of strategies
$75 \leq E < 100$	Strategic set selected right, but there are some problems in its implementation stage
$E \geq 100$	Strategic set selected right, its implementation is in full

Source: authors' research.

The technique has been applied in the study of greenhouses. As evidenced by the results of the study, in State Enterprise "Scientific-Research Agrocomplex "Pushcha-Vodytsia" only the pricing strategy was fully implemented (the extent of performance ≥ 100 %), while basic, competitive and commodity strategies need adjustment due to inability their implement in this enterprise. In PJSC "Complex "Teplychnyi" all marketing strategies are fully implemented, PRAE "Uman Hothouse Complex" has the greatest extent of performance of the marketing strategic set, which is indicated by a lack of demand for its correction.

Thus, the proposed mechanism for assessing the extent of performance of the marketing strategic set is quite suitable for application in practice at the enterprises of different specialization and ownership, bringing quite accurate result. It is easy to understand and use, especially in a crisis, and may also contribute to the provision of competitiveness of enterprises.

Conclusions

Modern conditions of the functioning of Ukrainian agricultural enterprises require amendments to the standard management approaches, including making appropriate corrections regarding the use of effective instruments of crisis management, among them the important place that is taken by the development and implementation of marketing strategies. Well-chosen marketing strategies help the enterprise fully exploit to their advantage the opportunities of a changing external environment and minimize the impact of its threat. In addition, the enterprises that have a clearly defined marketing strategy, to a certain extent are immune from the risk of making wrong decisions in the course of their activities. However, as revealed by the research, approaches to the choice of marketing strategies offered by foreign scientists, are fairly complex for application to Ukrainian

enterprises at the time of the formation of strategic set, and some of them are even impossible to use because of the lack of special programs and databases in the agricultural enterprises. Therefore, the proposed algorithm of choosing the marketing strategy is available to be applied in practice for Ukrainian enterprises, especially in the conditions of crisis management, and gives the possibility to form a complete marketing strategy.

No less an important value in crisis management of enterprises is taken by the efficiency of realization of the strategic marketing set. The results of practical application of the methodological approach to determine the extent of performance of the marketing strategic set in the analysis of the effectiveness of the marketing strategies of the investigated greenhouses, the appropriateness of its use, as it allows the combination of a simple calculation of statistically significant results, and identifies the reserves of increased efficiency of the marketing strategic set by using the adjustment of existing or new strategies depending on the value of the indicator. Also, this approach allows us to precisely identify specific shortcomings of strategic set, which enables us to adjust the strategies whose effectiveness are low, and not to reject the strategic set in general.

References

Ansoff I. [1989]: Strategic Management. MacMillan, p. 519.

Assel H. [1999]: Marketing: principles and strategy: textbook. for universities. Thomson S.-W., p. 485.

Bagiev G. [2007]: Economics Marketing. Publishing SPbGYEF, p. 175.

Dei D. [2002]: Strategic Marketing. Publishing house EKSMO-Press, p. 640.

Dragoş Ionuț Tanase. Procedural and Systematic Crisis Approach and Crisis Management Theoretical and Applied Economics Volume XIX (2012), No. 5(570), pp. 177–184.

Garkavenko S. S. [2004]: Marketing. Tutorial. Kyiv, Libra, p. 712.

Kudenko N. V. [1998]: Strategic Marketing: textbook. KNEU, p. 152.

Kotler F. [2000]: Fundamentals of Marketing. Publishing house "Williams", p. 944.

Lambin J.-J. [1996]: Strategic Marketing. A European perspective. SPb. Science, p. 589.

Lidovska O. P. [2008]: Evaluation of the Effectiveness of Marketing and Advertising. Ready Marketing Solutions, Sank-Petersburg: p. 141.

Mac-Donald M. [2000]: Strategic Planning of Marketing. SPb. Peter, p. 276.

Magazine «Plantator». – № 4, November 2012.

McDonald M. [2009]: Marketing accountability: how to measure marketing effectiveness. London and Philadelphia, Kogan Page, p. 294.

Mescon M. [2000]: Fundamentals of Management. Mescon M., Albert M., Hedouri F. – M. Delo, p. 704.

Pauchant C. T., Mitroff I. I. [1995]: La gestion des crises et des paradoxes, Editura Hec/Quebec/Amerique.

Pollard D., Hotho S. [2006]: Crises, Scenarios and the Strategic Management Process. Management Decision, 44 (6): 721–736.

Porter M. [1980]: Competitive Strategy. New York.

Porter M. E. [1990]: Competitive Advantage of Nations, Harvard Business Press.

Shershneva E. [2004]: Strategic management: tutorial. KNEY, p. 699.

Statistical bulletin. Sales agricultural enterprises by 2012. Kyiv, 2013, p. 110.

Statistical bulletin. Sales agricultural enterprises by 2014. Kyiv, 2015, p.110, 112.

Statistical Yearbook 2008. Balances and consumption of basic foods of the Ukrainian population. Kyiv, 2009, p. 54.

Statistical Yearbook 2008. Agriculture in Ukraine. Kyiv, 2009, p. 370.

Statistical Yearbook 2009. Crop production in Ukraine. Kyiv, 2012, p. 124.

Statistical Yearbook 2011. Balances and consumption of basic foods of the Ukrainian population. Kyiv, 2012, p. 54.

Statistical Yearbook 2011. Crop production in Ukraine. Kyiv, 2012, p. 108.

Statistical Yearbook 2011. Agriculture in Ukraine. Kyiv, 2012, p. 386.

Statistical Yearbook 2014. Agriculture in Ukraine. Kyiv, 2015, p. 379.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 17–25

Łukasz Chryniewicz[1]
Department of Agricultural Economics and International Economic Relations,
Warsaw University of Life Sciences – SGGW

Changes in the Value of Exports of Agricultural Products from Selected ACP Countries

Abstract. The process of globalization creates and stimulates the network of mutual economic and trade relations between countries through cooperation within international organizations. Export of agricultural products has a measurable and significant impact on the development of world trade, and therefore it is important to examine the changes that have occurred in exports of selected ACP countries from 2002 to 2013.

Key words: export, ACP, agriculture, food, EU

Introduction

The European Union and African, Caribbean and Pacific (ACP) countries have a special relationship, which was established in the 1960s. The EU relations with Africa date back to colonialism. It is important to understand that for the European Communities it was to preserve their zones of influence in Africa as is shown through the regulation of economic relations with former colonies directly by the Treaty of Rome. Newly established relations with these countries have become the basis for developing cooperation of the Union. In the Caribbean region, there have also been significant results on the path to increasing economic growth and bringing the society out of poverty. In 1995, only 10% of EU trade was made with the ACP countries, of which more than half of the exchange were oil, diamonds, cocoa beans, timber, coffee, copper and fruit. In 2012, exports and imports between the EU and ACP decreased to 5%.

The interesting issue of the formation and evolution of export value with selected ACP countries, may come from possible new approaches with the European Union, which plays a significant role among selected countries and may in fact shape their development in the future. There is still relatively little motion in this arena, especially when it comes to the economic aspect of these relations. Perhaps especially important is the context of a better understanding of the European Union's development policy and the further development of its trade and economic relations in this region of the world. Also, in recent years, one can observe the desire of some EU countries to rebuild a sphere of influence in ACP, as well as a tendency to strengthen the Union's policy in this region of the world. This is largely associated with the growing importance of the Eastern Partnership, whose emergence and development is associated with the last major enlargement of the Union to the countries of Central and Eastern Europe, for which the East is a historic area of interest. There is also increasing interest in the USA toward the ACP countries. Therefore, also for Poland, as a member of the Union, it is important to understand the mechanisms governing the EU's development policy, which are at present connected with trade, so that Poland can actively

[1] MA, e-mail: lukasz_chryniewicz@sggw.pl

participate in and benefit from it. It may focus, as has already been mentioned, primarily on the economic aspects of the EU-ACP relationship, which indeed is the core of the relationship. It is possible to trace the evolution of African, Caribbean and Pacific countries' exports, referring to their economies as well to general theories of development. The starting point for consideration is the already mentioned developing economics. An undoubted advantage would be to show the EU's policy on development cooperation as an expression of support for developing countries and embedding these issues in theory regarding development of emerging economies. Debate by economists on this issue date back to World War II and stemmed from the ongoing dismantling of colonialism, which entailed the creation of new, mostly underdeveloped countries.

The challenge for these countries was to stimulate their own growth and the progressive processes of globalization. Historically, the relationship has not been one of pure interregionalism, as defined by Aggarwal, as the ACP Group is not a region as defined either by geography or by law (in the sense of a WTO-sanctioned regional preferential trade agreement under Article XXIV of the GATT). The ACP Group was a creation of the European Union at the time of the signing of the first Lomé Convention in 1975 and has had little presence outside of the interregional partnership, which is one of the problems for the unwieldy grouping. That the relationship is one of hybrid interregionalism caused increasing problems for the EU with the strengthening of the rules of the global trade regime when the WTO replaced the GATT. The EU has made strong efforts to bring its trade relations with members of the ACP Group back into the nest, that is, to make them compatible with WTO rules, by signing regional preferential trade arrangements with ACP sub-groupings under Lomé's successor, the Cotonou Agreement [Ravenhill 2002].

Deepening division of the world into so-called rich and poor countries led in the 1950s to the emergence of theories of development economics, which not only tries to answer the question of how the less developed countries can enter the path of rapid economic development, but also looks for the sources of their backwardness in their specific problems and conditions. In this context, the author attempts to explain the failure of the European Union in the efforts undertaken to develop these countries. Efforts that, rather than improving the economic situations in these countries, have only deepened the differences between them and the EU.

Statement of main material

One of the most important stages of economic globalization is the expansion of international trade. While some developing countries have performed well in world markets, many have struggled to become fully integrated in the world trading system. The liberalization of world trade through successive rounds of the General Agreement on Tariffs and Trade (GATT) negotiations and the establishment of the World Trade Organization (WTO), however, has created opportunities for developing countries to access developed country markets more easily. In particular, recent efforts to reduce barriers to trade in agricultural and food products, including tariffs, quantitative restrictions and other trade barriers, through the Uruguay Round, provide opportunities for enhanced export performance for both traditional and non-traditional products [Henson Loader 2001]. The selected specific objective would be to assess trends and intensify the analysis of the dynamics of exports of selected ACP countries.

The method used to elaborate the stated issue was analysis of dynamics trend. It examines the distribution of the statistical characteristics over time (here, years). Dynamic series represent the development of phenomena in time – here, export for chosen African, Caribbean and Pacific countries. In general, we can point out that the number of ACP countries is 89. The detailed list is given below. It is worth mentioning that Cuba is treated as an ACP state, by World Trade Organization methodology, but ACP countries do not recognize it as one of their members (Table 1).

Table 1. Member list of the African, Caribbean and Pacific Group of States according to WTO

Angola	Congo, Dem. Rep.	Ghana	Mali	Mozambique	Sudan
Antigua and Barbuda	Cook Islands	Grenada	Marshall Islands	Saint Kitts and Nevis	Suriname
Bahamas	Côte d'Ivoire	Guinea	Mauritania	Saint Lucia	Seychelles
Barbados	Cuba	Guinea-Bissau	Mauritius	Saint Vincent and the Grenadines	Tanzania
Belize	Djibouti	Guyana	Micronesia	Samoa	Timor Leste
Benin	Dominica	Haiti	Mozambique	Sao Tome and Principe	Togo
Botswana	Dominican Republic	Jamaica	Namibia	Senegal	Tonga
Burkina Faso	Equatorial Guinea	Kenya	Nauru	Seychelles	Trinidad and Tobago
Angola	Eritrea	Kiribati	Niger	Sierra Leone	Tuvalu
Cameroon	Cook Islands	Lesotho	Nigeria	Solomon Islands	Uganda
Central African Republic	Fiji	Liberia	Niue	Somalia	Vanuatu
Chad	Gabon	Guinea-Bissau	Palau	South Africa	Zambia
Comoros	Gambia	Malawi	Papua New Guinea	South Sudan	Zimbabwe
Congo					

Source: author's own work.

The source of the data for analyses is the official WTO Statistics Database. The time frame for the research is data chosen from 2000 to 2013. Trade relations with ACP countries is regulated by the *Cotonou Partnership Agreement*, signed in 2000. However, more recent studies of the effects of liberalization of customs duties on agricultural products from the WTO point of view, come from 2011. So we can say, that there is a lack of recent studies on agricultural goods exports from ACP countries. Furthermore, agricultural trade plays an important role as an aspect of the global trade, in the holistic approach on this issue in relation to export goods group. The quantity of examined countries will be set as nine countries, which has selection method of purposeful selection: The countries which will be examined: Angola, Barbados, Belize, Benin, Dominican Republic, Fiji, Haiti, Jamaica, Mauritius.

First, it is important to select export commodities - agricultural products. Agricultural products according to the AOA (WTO Agreement on Agriculture) definition refer to HS chapters 1 to 24 (excluding fish and fish products) and a number of manufactured agricultural products. A detailed list of the agricultural products is listed below.

Table 2. WTO agricultural products classification

01	Live animals
02	Meat and edible meat offal
03	Fish and crustaceans, molluscs and other aquatic invertebrates [EXCLUDED]
04	Dairy produce; bird eggs; natural honey; edible products of animal origin, not elsewhere specified or included
05	Products of animal origin, not elsewhere specified or included
06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage
07	Edible vegetables and certain roots and tubers
08	Edible fruit and nuts; peel of citrus fruit or melons
09	Coffee, tea, mate and spices
10	Cereals
11	Products of the milling industry; malt; starches; inulin; wheat gluten
12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder
13	Lac; gums, resins and other vegetable saps and extracts
14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes
16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates
17	Sugars and sugar confectionery
18	Cocoa and cocoa preparations
19	Preparations of cereals, flour, starch or milk; pastry cook products
20	Preparations of vegetables, fruit, nuts or other parts of plants
21	Miscellaneous edible preparations
22	Beverages, spirits and vinegar
23	Residues and waste from the food industries; prepared animal fodder
24	Tobacco and manufactured tobacco substitutes

Source: author's own work.

After selecting which countries to analyze, we can start to construct a dynamic series for each country. The dynamics of the studied phenomenon are called the changes - increases or decreases in the phenomenon over the distinguished unit of time. For the presentation level of the phenomenon observed in subsequent periods (moments) are the ranks of dynamic. A number of dynamic is a sequence of the observed levels of a given phenomenon (X) ordered by a unit of time [Parlińska 2001]. Marking periods (moments) next numbers 1, 2, n .. n (where n is total number of periods - moments) and by xt – levels observed the phenomenon, we get a series of dynamic tabular form. Below is the example for Mauritius

Table 3. Dynamic series for Mauritius

Years	Export of agricultural products in USD	Individual indexes	
		Leaner 2000=100	chain
2000	282628135	1	*
2001	389294642	1,377	1,377
2002	475840180	1,684	1,222
2003	485175786	1,717	1,02
2004	550297928	1,947	1,134
2005	582962670	2,063	1,059
2006	656646770	2,323	1,126
2007	650240766	2,301	0,99
2008	688570440	2,436	1,059
2009	619025457	2,19	0,899
2010	704090589	2,491	1,137
2011	776310413	2,747	1,103
2012	829871600	2,936	1,069
2013	934420767	3,306	1,126

Source: own calculations.

To study the dynamics of Mauritius we use the statistical indexes. They are metrics that allow the evaluation of the changes that occur at the level of the phenomenon studied, in the analyzed periods (moments) compared with the level of phenomena in time adopted as the basis of the study. Depending on whether it is calculated for a single collective entity or entities for the team collectivises the share index of individual (straight) and aggregate (team) [Parlińska and Parliński 2011]. Example of calculations for Mauritius in Table 3.

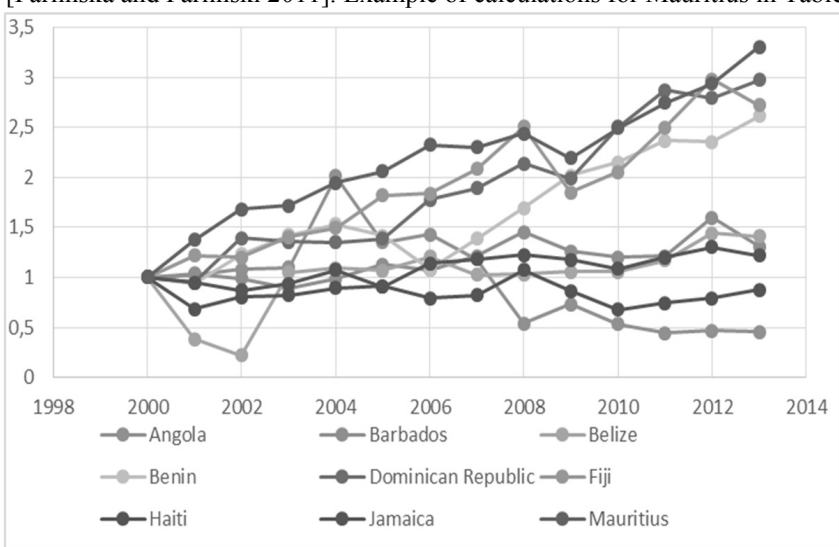


Fig.1. Changes in export of selected ACP countries Expressed by Means of Statistical Indices

Source: author's own calculations.

A string indexes chain (like a string of relative increments chain) informs us about the changing dynamics in time of observed phenomena. Then we have an important question, how to calculate the average level of change in the period considered. The proper mean here is the geometric mean G which is the root of the nth degree of product *n* observations [Parlińska and Parliński 2011].

After completing all individual indices, we are able to see how export value has changed during the time. Thus, we can point out that from simple research we are able to distinguish two groups. First, is the group associated with states that have constant rising export. By which we can recognize: Mauritius, Dominican Republic, Fiji, Benin. Second, we can describe export stagnation or downward trend. The countries describe are: Belize, Barbados, Jamaica, Haiti, Angola.

The average level of the interesting changes taking place during the relevant period (the average size of the chain index) is expressed in the formula:

$$G_n = \sqrt[n]{a_1 * a_2 * \ldots * a_n} \quad g_n = a_1 \cdot a_2 \cdot \ldots \cdot a_n \text{----------} \sqrt{n} \tag{1}$$

Therefore, we are calculating the geometric mean G for each of selected ACP countries. The Figure 2 gives a better graphical understanding of the received result.

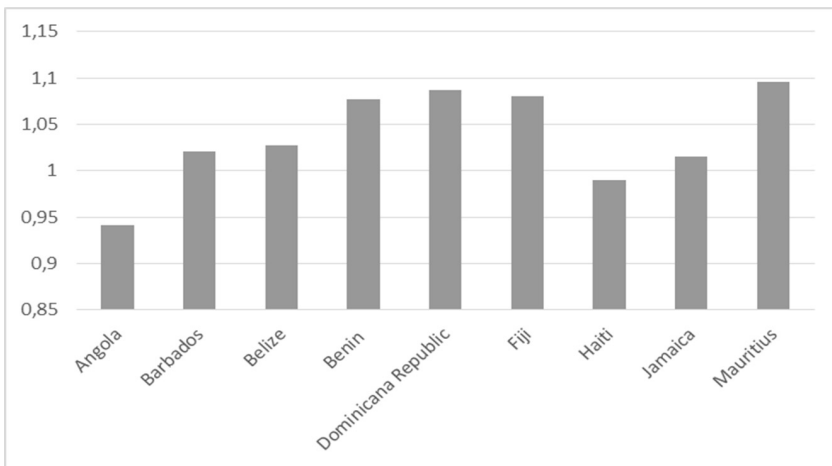


Figure 2. Comparison of the Geometric Mean for selected ACP countries

Source: author's own work.

After comparing the average rate of change in exports for selected ACP countries, we can divide them into three groups by which they have been examined.

Table 4. Grouped selected ACP countries according to the geometric mean

Group I	High dynamics trend	Mauritius, Benin, Fiji, Dominican Republic
Group II	Average dynamics trend	Barbados, Jamaica, Belize
Group III	Low dynamics trend	Angola, Haiti

Source: author's own work.

An interesting issue occurs after comparing research results when we compare the collate indices and the Geometric Mean for selected ACP countries. In the first, we can observe two groups of countries and in the second, there are three other groups. This gives us interesting feedback, with more detailed outcome.

Thus we can make a statement that Mauritius has the highest growth rate trend. If we would scope how it is possible, we would need to focus on several issues. The basis of the economy of Mauritius is the plantation cultivation of sugar cane, tea, bananas and tobacco. Mauritius accounts for 27% of the non-traditional exports identified in this study and in that sense cannot be regarded as a "typical" ACP country. However, this success is of very recent origin and until the mid-1970s, Mauritius was almost wholly dependent on sugar for its merchandise exports [McQueen 1990].

Unlike Mauritius, Benin is one of the poorest countries in the world. The economy is based on agriculture. The structure of land: arable land accounted for 21% of the country, grasslands (mostly pasture) - 4%, plantations 4%. Grown: cotton, cocoa, coffee, palm oil and coconut, corn, cassava, sorghum, millet, yam, beans and jam. Raising sheep, cattle, and goats developed mainly in the north due to the presence of the tsetse fly in the south.

Fiji is a country where the agricultural sector plays a dominant role. Agriculture is primarily focused on the production of sugar cane. Sugar is the most serious item in the balance of exports of the country. To meet the internal needs there is grown mainly rice, tobacco and coconut palm, bananas, lemons, coffee, cocoa, rubber. In animal production pig breeding is vital. Of great importance for the economy is the exploitation of valuable trees in humid equatorial forests, which cover up to 65% of the country. Fishing is also a substantial addition to the national food balance sheet. Canned fish is produced largely for export.

The Dominican Republic belongs to the group of countries less advanced in economic development. Agriculture is an important sector of the economy, and is the main source of livelihood for over one fifth of the population. The most important crops grown to meet the internal needs include corn, rice, cassava, cotton, peanuts, bananas, legumes, cocoa and coffee. The main industrial crop, grown mainly for export, is sugar cane. Animal breeding consists mostly of cattle, and to a lesser extent, pigs. Fishing also plays an important role in the national food balance.

The lowest growth rate trend is found in Angola. If we analyze land use structure, farmland occupy 2.6% of the country. Grown: coffee, sugar cane, palm oil, corn, cassava, jam, sweet potatoes, bananas, millet, cotton. Breeding is done with cattle, pigs, sheep (mostly Caracul), goats. Fishing is mainly mackerel and sardines.

The structure of land: arable land accounted for 77% of the country, grassland, mainly pastures - 9%. Sugarcane is cultivated in 80% of the area, citrus fruit, cotton, cassava, sweet potato, wheat, corn is also grown. Breeding consists of cattle, pigs, goats, donkeys and sheep. It should be remembered that islands suffer from isolation, remoteness and small size (even in the case of archipelagos), which gives these countries' economies a greater fragility [Garcia et lege 2010]. In the example of Jamaica, traditionally an important element of its economic system is agriculture, which employs almost a quarter of the economically active population. The most important crop is sugarcane and coconut palms, bananas, coffee, cocoa, citrus trees. Livestock plays a decidedly secondary role.

Belize's economy is based on agriculture and forestry. Farmland accounts for 4% of arable land, and grassland 2%. Grown: sugarcane, citrus crops (oranges, grapefruit), bananas. corn, rice, beans, yams, tobacco and marijuana illegally. There is some small

breeding of cattle, pigs, horses, and exploitation of forests (mahogany, chicle - the raw material for the production of chewing gum).

It is interesting that 66% of the population in Haiti depend on farming, supplying 30% of national income. Haitian villages are characterized by massive overcrowding and archaic methods of land cultivation. In order to meet the internal needs they cultivate yams, cassava, rice, millet, corn, beans and peas. The main crops grown in farm commodities are sugar cane, coffee, cocoa, sisal, mangoes. In vast areas of the country cultivation is possible thanks to artificial irrigation.

Conclusions

We can observe from previous elaboration that there is variation in average export growth. In examining the effects of exports on economic growth in countries which have established an industrial base, we test the hypothesis that export-oriented policies lead to better growth performance than policies favouring import substitution. This result is said to obtain because export-oriented policies, which provide similar incentives to sales in domestic and in foreign markets, lead to resource allocation according to comparative advantage, allow for greater capacity utilization, permit the exploitation of economies of scale, generate technological improvements in response to competition abroad and, in labor-surplus countries, contribute to increased employment [Balassa 1978].

Policies to promote trade, including lower tariff barriers, market-determined exchange rates, and deregulation of international trade, have created opportunities for developing countries to export agricultural commodities, both to high-income countries and to other developing countries. The lowering of import barriers in developed countries has probably facilitated the growth of high-value exports such as fish and seafood products. But perhaps more important is the fact that developing countries themselves have reduced import tariffs and moved toward market-oriented exchange rates, which increase the incentives to export. Since high-value agricultural commodities and processed foods represent a larger share of the food budget of high-income consumers, it is natural that, as farmers in developing countries shift from meeting domestic demand to meeting international demand, they also shift production from staple crops toward high-value agricultural commodities [Gulati 2005].

The rights formulated and tested by the theory of international economic relations are part of a universal nature. Common to all disciplines dealing with the economy, and partly specific to the discipline of science. The universal character is primarily classical economic theory and related principles advantage absolute and relative (comparative) determining the directions of international specialization of production. The common denominator for both of these principles is the principle of free trade considered today (with minor changes) by many economists as a basis for the development of international trade. The universal character they also have a right of determining the impact of foreign trade on national income, including the theory of the export multiplier, as well as many others depending still current, despite changing external and internal conditions.

Future changes in average rate of change can be stimulated by the program Aid for Trade. Aid for Trade (AfT) is assistance provided to support partner countries' efforts to develop and expand their trade as leverage for growth and poverty reduction. This can include support for building new transport, energy or telecommunications infrastructure,

investments in agriculture, fisheries and services, as well as assistance in managing any balance of payments shortfalls due to changes in the world trading environment. The contribution of trade for achieving inclusive growth and sustainable development is also emphasized in the EU development policy [European Commission 2015].

Literature

Balassa, B. [1978]: Exports and economic growth. Future evidence. Journal of Development Economnics 5, 181-189. North-Holland Publishing Company.

European Commision, Aid for Trade [Available at:] http://ec.europa.eu/trade/policy/countries-and-regions/development/aid-for-trade/ [Access: November 2015].

Garcia, E. [2010]: The Features of Development in the Pacific Countries of the African, Caribbean and Pacific Group Springer Science+Business Media B.V.

Gulati A. [2005]: Growth in high-value agriculture in Asia and the emergence of vertical links with farmers [Available at:] http://siteresources.worldbank.org/INTRANETTRADE/Resources/Topics/Standards/paper_minot.pdf [Access: November 2015].

Henson S., Loader R. [2001]: Barriers to Agricultural Exports from Developing Countries: The Role of Sanitary and Phytosanitary Requirements, World Development Vol. 29, No. 1, pp. 85-102, 2001.

McQueen M. [1990]: ACP Export Diversification: The Case of Mauritius, ODI Working Papers 41, London.

Parlińska M., Parliński J., [2011]: Statystyczna Analiza danych z Excelem, Wydawnictwo SGGW.

Ravenhill J. [2002]: Back to the Nest? Europe's Relations with the African, Caribbean and Pacific Group of Countries, Working Paper PEIF-9, December 1, 2002.

WTO Statistics Database, [Available at:]: http://stat.wto.org/Home/WSDBHome.aspx?Language= [Access: November 2015].

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 26–32

Anatolii Dibrova[1], Larysa Dibrova[2], Oleksandr Labenko[3]
National University of Life and Environmental Sciences of Ukraine
Kyiv, Ukraine

State Financial Support of Agriculture in Ukraine

Abstract. In recent years, Ukraine has allocated considerable financial resources for agricultural support according to their demands on the budget. However, the increase of domestic support has not substantially influenced the effectiveness indices of agricultural yields. This demonstrates the imperfect nature of the internal support mechanisms for Ukrainian agriculture. As a result, domestic support has not become an effective stimulus for increases in production quality or stock/breeding production. In 2013, Ukraine gathered its biggest grain harvest. This increase in production did not, however, improve the financial results for agriculture and did not produce stable and dynamic branch development due to the negative influence of the global financial crisis. An unbalanced supply and demand of agricultural production, low buying ability of inhabitants, and the lack of an effective mechanism of domestic support caused several problems with price in the domestic food market.

Key words: state support, agrarian policy, agriculture, Ukraine

Introduction

Global economic practice considers state budgetary policy to be one of the most important instruments of state regulation for the redistribution of national income as a means of solving urgent tasks of the agricultural sector.

Budgetary financing of the agricultural sector has its own specific requirements, such as the financing of programs to support livestock, crop production, compensation of expenses for resources, programs of preferential lending, etc. Each agricultural support program is defined by its own goals and methods of implementation. However, the special approaches which should be used to estimate the effectiveness of budget expenditures are not really used in Ukraine.

Therefore, it is obvious that the state has the task of finding the most effective usage of budget funds, especially under conditions that limit such funds [Galushko 2006].

Material and methods

The given research is based on general scientific methodology. The research process utilized such methods of scientific research as: system analysis and synthesis, monographic, abstract, logical, economically-mathematic, computational and balance methods.

In order to evaluate the effectiveness of agricultural policy and the level of domestic support for agriculture, we used the methodology which is applied to member-countries of the OECD. The methodology of quantitative estimation of state support has been

[1] DrSc, professor, Dean of Faculty of Economics, e-mail: anatoliy_dibrova@ukr.net
[2] PhD, associate professor, e-mail: dibrova@wm.nauu.kiev.ua
[3] PhD, associate professor, e-mail: labenko@nubip.edu.ua

substantiated in the works of such known scientists as Josling [1973], I. Tsakok [1990], A.J. Webb [1990], M. Lopes [1990], R. Penn [1990].

Results

At the initial stage of the transformation of the economy, the policy regarding budgetary support for agricultural production was very conservative. It was closed to outside participation by other interested parties, and did not come under control of any of the public professional organizations that were established by agrarian enterprises. It did not become compulsory for budget administrators to report on annual expenditures until the Resolution of the Cabinet of Ministers of Ukraine of October 15, 2014, № 1378. This resolution approved the procedure for conducting public consultations on the formation and implementation of state policy.

From 2000 to 2011, funding for agriculture from the state budget increased more than 900%, from 1.2 to 10.5 billion UAH. The share of budget allocations as a percentage of total state budgetary expenditures for agriculture decreased from 3.5 to 2.8 %, while GDP increased from 0.7 to 0.8% during this period.

However, the significant growth in budgetary support during this period did not significantly affect the efficiency and competitiveness of agricultural producers, nor did it help the agricultural sector of Ukraine become a more attractive investment for domestic and foreign capital.

The agricultural sector received its largest allocation of government support (13 billion UAH) in 2008. Since that time, the government has been forced to cut expenditures on agriculture (about 9-10 billion UAH) due to a generally difficult economic situation and rigid budget cuts. In the last three years, funds were insufficient to meet the planned agricultural budget. In particular, the gap between planned expenditures and actual expenditures was about 26% and 27% in 2011 and 2012, respectively. The gap reduced to 21% in 2012, but it still remained too large to provide a favorable investment climate in the sector. In addition, there is a positive trend of gradual restructuring of state support towards "measures that stimulate growth" – that is, measures that do not distort trade or that cause minimal distortion (for example, research and training on agricultural subjects, programs for environmental protection and regional development, etc.), as opposed to measures that "slow growth" (production subsidies, price regulation tools). The total volume of production subsidies over the past seven years decreased by 70%, while the share of subsidies that "stimulate growth" in the total agricultural budget increased from 55% in 2007 to 84% in 2013 [Ogarenko 2013].

The two key sources of support for agricultural producers are: a) preferred treatment for Value Added Tax (VAT) payment, and b) Fixed Agricultural Tax (FAT). The FAT in particular, exempts agricultural enterprises from payming income tax. In nominal terms, the volume of these benefits rose from 1,5 billion UAH in 2001 to 18 billion UAH in 2012. At the same time, during 2001-2012, changes in the tax system were implemented which actually reduced significantly the real tax benefits for the entire sector.

The reduction in real tax benefits stems primarily from the failure to return VAT that was added onto the export of grains and oilseeds. According to estimates, failure to return VAT in exports has led to lower purchase prices of more than 9 million UAH: this means that the balance of tax benefits (including exemption from VAT and FAT) was only about

8,5 billion USD in 2012, since the return of VAT on export was not restored (partially) until 2014 [Sabluk, Saperovich 2014].

It can be seen, therefore, that any reform of the preferential taxation system that aims to reduce benefits and increase public revenues should be planned and implemented very carefully. It should consider the interests of various interested parties, thereby avoiding uncertainty for producers and traders. The first step in this direction was made in March, 2014. In particular, the base of FAT was extended, and this led to an increase of FAT from 6 to 19,2 UAH per hectare in average. Also the minimum rent for the land was increased [Ogarenko 2013].

At present, the acting structure of VAT collection is very important for agricultural producers, because its effect can be considered as twofold: on the one hand, there is no outflow of revenue from sales which can be aimed at current production needs; on the other hand, part of the revenues come back in the form of grants and are obtained through budgetary compensation [Shindyruk 2006].

The analysis suggests that the amount of support to agricultural producers has decreased in general, but there is a tendency to reduce direct budget subsidies and increase the amount of support through mechanisms of a special VAT structure for agricultural producers (Figure 1).

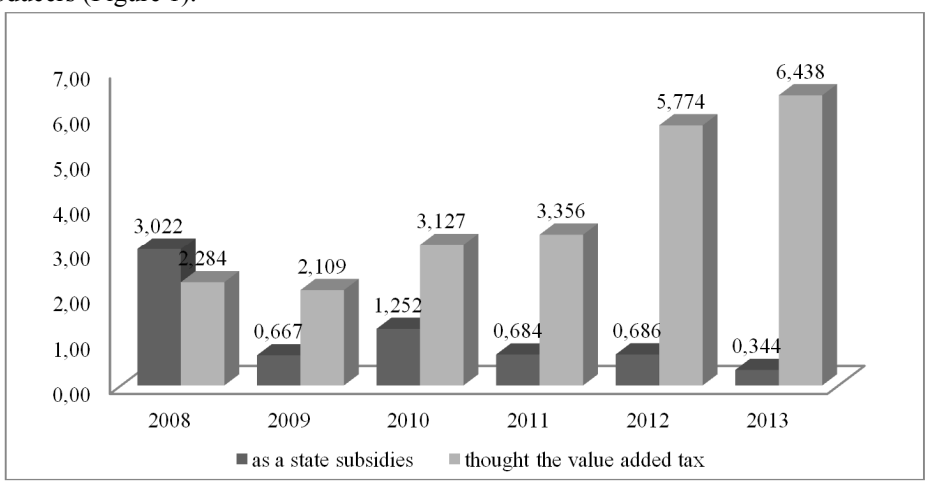


Fig. 1. The amount of state financial support for agricultural producers, billion UAH

Source: own edition according to the data State statistic service of Ukraine: www.ukrstat.gov.ua.

During the analyzed period, the amount of subsidies for agricultural producers decreased from 3 billion UAH in 2008 to 300 million UAH in 2013. At the same time, the amount of support through special VAT structures increased from ,,2 billion in 2008 to 6,5 billion UAH in 2013.

The structure of state support to agricultural producers changed significantly during the analyzed period. Thus, budget subsidies accounted for 55 % of budget support in 2008, and their share was less than 5% in 2013. The majority of state support consisted of money that came to agricultural producers through the special VAT structure.

The above-mentioned comparison does not take into account the financial support given through the application of a special tax system for agricultural producers. This

amount is difficult to calculate given the fact that the amount of support should be compared with the amount of corporate income tax, the calculation of which is very complex and cannot be applied equally to all farmers.

In terms of percentage of state support to agricultural enterprises, Ukrainian crop production received about 60 % or 4034.4 million UAH, and livestock products received 40% or 2685.5 million UAH (Figure 2).

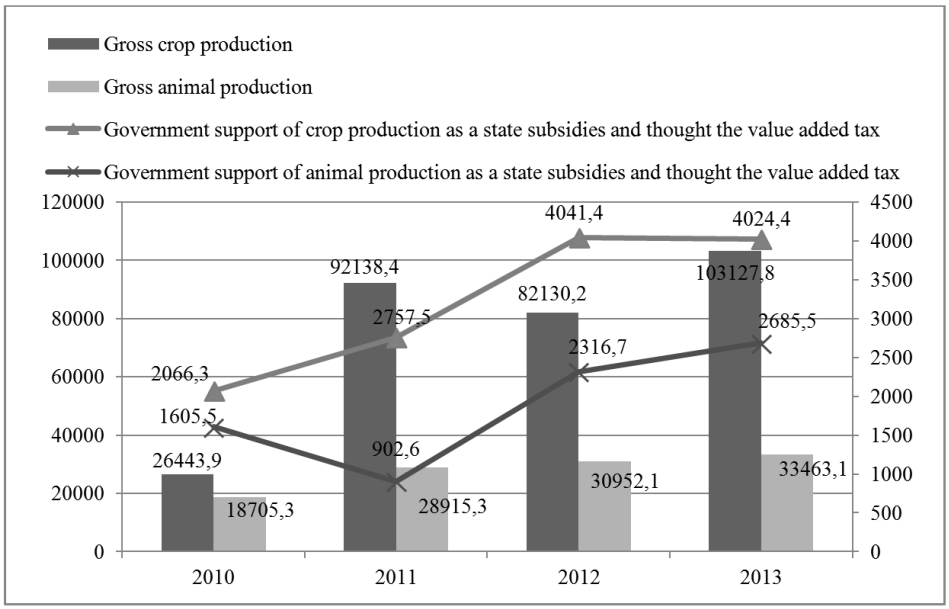


Fig. 2. Gross output of crop and livestock production in Ukranian agricultural enterprises (in comparative prices) and state support through budget subsidies and special structure of VAT collection, in million UAH

Source: constructed according to the data State statistic service of Ukraine: www.ukrstat.gov.ua.

The analysis shows that the increase in government funding for agricultural production in 2013 compared to 2011 did not affect the level of gross output significantly, especially for livestock products. Through subsidies to processing enterprises from VAT for sold milk and meat in live weight, agricultural enterprises received 2462.9 million UAH in 2013; this was two times more than in 2012 (Table 1).

Table 1. State support of livestock production in agricultural enterprises of Ukraine in terms of budget subsidies and special structure of VAT collection, million UAH

Products	2010 р.		2011 р.		2012 р.		2013 р.	
	1*	2*	1*	2*	1*	2*	1*	2*
Total, including:	169	1436,5	91,5	811,1	427,1	1889,6	222,6	2462,9
Milk	60,7	712,4	1,8	120,1	227,7	689,7	92,3	1104,6
Beef	47,4	115,7	33,9	47,2	71,9	137,0	52,9	207,8
Pork	47,7	117	4,5	128,9	114,5	175,1	21,6	288,4
Poultry	13,3	491,4	4,3	442,2	0,1	816,2	0,1	777,0

1* – budget subsidies; 2* – subsidies through special structure of VAT collection

Source: own edition according to the data State statistic service of Ukraine: www.ukrstat.gov.ua.

The analysis indicates that per 1c of products, state support increased 1.29 times with an increase of milk purchase price of 1.28 times, on average, and an increase of the total cost of 1.33 in 2013 compared to 2010. (Table 2)

Average prices for beef increased by 1.18 times, the total cost – 1.33 times, and the amount of governmental support – 1.62 times per 1 c of products during the analyzed period. Average prices for pork increased by 1.27, the total cost – 1.17 times, and governmental support – 1,43 times. Average prices for poultry increased by 1.07 times, the total cost – 1.14, and governmental support increased by 1.56 times.

In conclusion, increments of the governmental support for all major types of livestock products outpaced the growth rate of purchase prices and total cost.

Table 2 The effectiveness of major types of livestock production in Ukraine

Products	The average selling price of 1 c, UAH	Total cost of 1 c, UAH	Profit (loss) from sales of 1 c, UAH	Subsidies from VAT and budgetary supplements per 1 c, UAH	Including:		The level of profitability (loss ratio) without subsidies, %	The level of profitability (loss ratio) with subsidies, %
					Subsidies from VAT, UAH	Budgetary supplement, UAH		
2010								
Milk	269,8	228,9	40,9	40,8	37,6	3,2	17,9	35,7
Beef	896,1	1397,2	-501,1	85,0	60,3	24,7	-35,9	-29,8
Pork	1220,4	1323,7	-103,3	52,8	37,5	15,3	-7,8	-3,8
Poultry	989,3	1034,4	-45,1	464,9	452,6	12,3	-4,4	40,6
2011								
Milk	313,1	264,3	48,8	6,2	6,1	0,1	18,5	20,8
Beef	1196,7	1590,9	-393,2	55,4	27,7	27,7	-24,7	-21,2
Pork	1364,8	1417,6	-52,8	35,8	34,6	1,2	-3,7	-1,2
Poultry	1038,0	1247,1	-209,1	635,2	629,1	6,1	-16,8	34,2
2012								
Milk	272,7	266,5	6,2	41,6	31,3	10,3	2,3	18,0
Beef	1236,9	1754,9	-517,9	125,3	82,2	43,2	-29,5	-22,4
Pork	1594,1	1562,6	31,5	81,7	49,4	32,3	2,0	7,2
Poultry	1121,0	1207,9	-87,0	762,1	762,0	0,1	-7,2	55,9
2013								
Milk	345,8	304,3	41,5	52,5	48,5	4,1	13,6	30,9
Beef	1053,7	1857,6	-803,9	138,1	110,1	28,0	-43,3	-35,8
Pork	1552,6	1549,7	2,8	75,7	70,4	5,3	0,2	5,1
Poultry	1057,7	1174,6	-116,9	725,6	725,5	0,1	-10,0	51,8

Source: Own edition according to the data State statistic service of Ukraine: www.ukrstat.gov.ua.

According to the data (Table 2), due to an increase of governmental support, the efficiency of livestock production managed to increase slightly. However, beef production is unprofitable in Ukraine.

The analysis shows that the government spends more money in supporting poultry production than beef and pork production. Per 1 kg of poultry governmental support of agricultural enterprises through special structure of VAT collection increased almost 1,6 times from 2010 to 2013. (Figure 3)

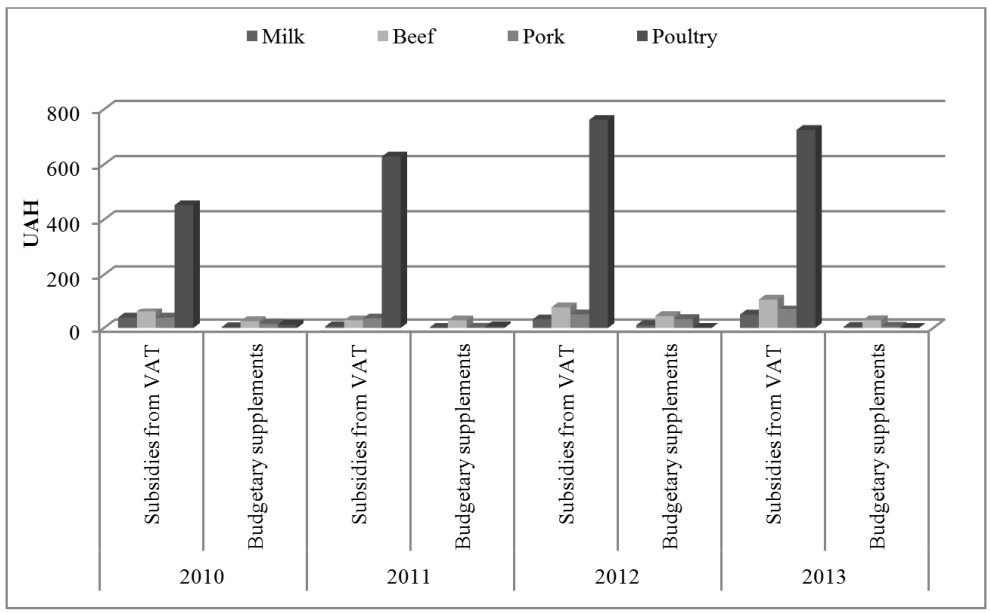


Fig. 3. Governmental support for major types of livestock production in agricultural enterprises of Ukraine through budget subsidies and special structure of VAT collection per 1 c, UAH

Source: own edition according to the data State statistic service of Ukraine: www.ukrstat.gov.ua.

However, poultry production in agricultural enterprises would remain unprofitable without governmental support. Despite the increase of governmental support poultry production has remainied unprofitable since 2007.

Conclusion

Our analysis shows that state subsidies to agricultural producers were increased significantly from 3 billion in 2008 to 6.5 billion in 2013 during years 2008-2013. The mentioned increase in governmental support for agricultural producers allowed them to significantly increase profitability, and as a result, contributed to the dynamic development of agricultural production.

There were significant changes in the structure of financial support for agricultural producers. Thus, if the state financial support in 2008 was carried out mainly by direct payments from the budget in favor of agricultural producers (about 60% of total support), in 2013 the situation was radically different. More than 90% of the total support was implemented through the mechanism of VAT. Thus, the volume of direct budget payments to agricultural producers was almost neutralized, and the role of financial support through the VAT mechanism became dominant. It should be noted that financial support through the mechanism of VAT is available for tax payers of VAT and consequently small farmers, which are not registered as VAT payers, were deprived of any financial support in most cases.

Dynamic development of agricultural production in Ukraine occurred mainly due to increases in crop volume, while there was a decrease in livestock animals. The main livestock products were produced by small farms and family farms; this is a characteristic feature of the livestock industry. Small and family farms are not able to receive assistance through the mechanism of VAT, as they are not subject to the VAT tax, thereby reducing the direct financial support.

In addition, the number of budget programs for financial support for agricultural producers saw a targeted decrease during the years 2008-2013.

Thus, there was a transition from targeted financial support for agricultural producers to total overall support without industry-specific recipients, which contributed to a substantial increase in crop production.

This should draw attention of those who allocate public financial support for agricultural producers to those who really need such support, because there is a situation where those producers who are already operating profitably get more financial support through the mechanism of VAT, and small farmers and family farmers end up with a lack of governmental financial support.

Literature

Josling T.E. [1973]: Agricultural Protection: Policy and International Trade. – Rome: FAO, P.82.

Ogarenko Y. [2013]: Reforming government support of agricultural sector in Ukraine - Kyiv: German-Ukrainian Agricultural Policy Dialogue (APD), p. 4. – http://www.apd-ukraine.de/ua/publikatsiji/oglyad-agrarnoji-politiki

Tsakok I. [1990]: Agricultural Price Policy: A Practitioner's Guide to Partial–Equilibrium Analysis".

Webb A.J., Lopes M., Penn R. [1990]: Estimates of Producer and Consumer Subsidy Equivalents. Government Intervention in Agriculture".

Галушко В.П. [2006]: Методологічні та практичні аспекти оцінки рівня державної підтримки сільськогосподарських товаровиробників в Україні /В.П. Галушко, А.Д. Діброва, Л.В. Діброва //Економка АПК. №3. – С. 3–11.

Саблук В.П., Сеперович Н.В. та ін. Пропозиції Міністерства аграрної політики та продовольства України до проекту Плану відновлення України на 2014-2017 рр.

Шиндирук І.П. [2006]: Організація фінансування підприємств методами податкової підтримки / І.П. Шиндирук //Облік і фінанси АПК., №7, С. 85.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 33–40

Hanna Dudek[1], Monika Krawiec[2], Grzegorz Koszela[3]
Department of Econometrics and Statistics,
Warsaw University of Life Sciences – SGGW

Are Changes in Food Consumption in the European Union Environmentally Friendly?

Abstract. Food production and consumption have significant impacts on the environment. Changes in consumption patterns typically entail changes in related production systems. Consumers through their consumption behavior, market demand for food, and choices between animal and vegetal products indirectly influence the environment. The paper is aimed at assessing changes in food consumption in the European Union with regard to their environmental impact. The empirical analysis covering the period from 2004 to 2011 is based on the most recent FAO data on calorie supply per capita and its split between animal and vegetal products. The investigation uses econometric models for panel data. Results obtained reveal a significant increase in supply from animal products in "new" EU members and a significant decrease in "old" EU members. In both groups, there is no significant change in supply from vegetal products, although they are not homogenous with regard to the food supply.

Key words: food consumption, animal and vegetal products, environment, panel data models

Introduction

Since the release of the Brundtland Report [UNWCED 1987], the relationship between economic growth and the environment has been an issue of growing interest. Both production and consumption activities can generate negative effects on the environment. Duarte et al. [2015] cite several studies that point to the damages caused to the natural environment by the long-term process of economic growth. Recognition of the problem results in an increasing tendency to create an economic growth that goes along with natural resource preservation under the concept of sustainable development. Its integral parts are sustainable production and sustainable consumption. Putting sustainable consumption into practice is a challenge that requires, among others, the effort to change consumption patterns.

In general, changes in consumption patterns typically entail changes in related production systems through shifting consumption within a product group to less environmentally harmful products in the same product category; through shifting consumption from one product category to another; through reducing the consumption of certain product categories or commodities such as energy, water, meat, or petrol; through reducing overall consumption [Wolff and Schönherr 2011]. Consumers have a major role in determining the type of production. Through their consumption behavior and market demand for goods and services they indirectly influence the environment.

According to Westhoek et al. [2014], the consumption of meat, dairy, and eggs is increasing worldwide, and this will aggravate the environmental impact related to livestock production. Agriculture and livestock farming are great direct water consumers and direct

[1] doctor habilitated, associate professor, e-mail: hanna_dudek@sggw.pl
[2] PhD, e-mail: monika_krawiec@sggw.pl
[3] PhD, e-mail: grzegorz_koszela@sggw.pl

pollutants. They are the highest in Nitrogen and Phosphorus, and also with water activity in biochemical oxygen demand, and solid suspension. In atmosphere emissions, livestock farming is the activity that represents the biggest amount of methane, and agriculture – of nitrous oxide [Flores-Garcia and Mainar 2009]. Agriculture also accounts for 70% of all water use. Both primary food production and food processing are critically dependent upon reliable water supply and water quality. The production of food also requires vast amounts of land. Of the global soil surface, 31% is suitable for growing crops, while an additional 33% is suitable for grassland. However, agricultural land is becoming a scarce resource as a result of ongoing industrialization, urbanization, infrastructural development, land degradation, and desertification [Gerbens-Leenes and Nonhebel 2002].

Concerns about animal welfare, reactive nitrogen, greenhouse gas emissions, and also global warming have stimulated public debate in Europe about eating less meat and dairy products. However, consumer choices of foods and diet are determined by a complex set of personal values, social norms, habits, and aspirations. Foods with positive sustainability characteristics are often more costly than conventional foods due to higher costs of compliance with environmental standards and/or lower productivity of resource use. While it may not be a problem for consumers in the middle and higher categories of income, limited affordability is often a drawback for adoption of sustainable consumption among poorer households [de Haen and Requillart 2014].

The general aim of the paper is to assess changes in consumption with regard to their environmental impact. More precisely, the intention is to determine trends in food supply regarding the division into animal and vegetal products and to answer the question of whether observed changes are environmentally friendly. Moreover, the study verifies the significance of the influence of population income on the level of food supply. Empirical analysis is based on the most recent FAO data for European Union countries, covering the period from 2004 to 2011 (up to now, FAO hasn't published any new data on this subject). The data is available at www.fao.org. The examination is carried out for two groups of countries: the so-called "old" EU members and the so-called "new" EU members. In order to study the issues, econometric methods for panel data analysis are applied.

Methods

Panel data involve regularly repeated observations on the same individuals. Because they have both cross-sectional and time series dimensions, the application of regression models to fit econometric models are more complex than those for simple cross-sectional data sets. The standard linear panel model can be written as:

$$y_{it} = \alpha + \mathbf{x}_{it}\boldsymbol{\beta} + u_i + \varepsilon_{it} \tag{1}$$

where y_{it} is an outcome (dependent variable) for the i-th country at time t,
$\mathbf{x}_{it}$ – a row vector of observations on k explanatory factors for the i-th country at time t.
α – intercept,
β – a column vector of slope parameters,
u_i – an individual country-specific effect, $u_i \sim IID(0, \sigma_u)$, i=1, 2,…,N,

ε_{it} – error term, $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon)$, $i=1, 2,\ldots,N$, $t=1, 2,\ldots,T$.

The error term ε_{it} is assumed to be uncorrelated with the explanatory variables and with the individual country-specific effect. The assumptions on u_i help to determine the type of model that should be estimated. In the absence of the individual effect, pooled OLS estimator can be applied[4], otherwise random or fixed effects models (shortly named RE and FE respectively) are usually estimated. The key consideration in choosing between these approaches is whether u_i and $\mathbf{x}_{it}$ are uncorrelated, which is an assumption of the RE model [Wooldridge 2002]. The choice between fixed or random effects relies on the comparison of these two estimators by Hausman test[5]. Here, the null hypothesis is that the preferred model is the random effects model vs. the alternative of the fixed effects model.

Data

The study uses daily calorie supply per capita in European Union countries. This data is based on the food balance sheets available at FAOSTAT data sources. They show the per capita supply of total calories and the split between calories from animal and vegetal products. However, it is important to note that the data does not reflect exact consumption itself, as it includes losses through distribution and food preparation. The food balance sheets show the availability of food for human consumption. The total quantity of all foodstuffs produced in a country added to the total quantity imported and adjusted to any change in stocks that may have occurred since the beginning of the reference period, gives the supply available during that period.

In order to explain daily calorie supply per capita, the median of equivalized[6] net income in PPS (Purchasing Power Standard) was used (from Eurostat database). Such data gives information on the average wealth of people living in a given country.

Results and discussion

In the period under consideration, there was observed significant differentiation in consumption of vegetal and animal products within the European Union (Figures 1 and 2). On the base of Figure 1, one may state that in 2004 the least caloric meals were consumed by Cyprians, Bulgarians, Slovaks and Croats (on average less than 3000 kcal per day). On the other side, the most caloric meals were consumed by Belgians and Greeks (on average more than 3700 kcal per day). However, in most countries there was observed average consumption of 3000 – 3500 kcal.

When analyzing the consumption structure, one can notice that in 2004 in the European Union, the average share of animal products in general consumption reached

[4] Pooled OLS is compared with FE by the *F* test and RE – by the Breusch and Pagan test. If the null hypothesis is not rejected in either test, the pooled OLS regression is favoured.

[5] It should be noted that the differences in the estimates of fixed effects and random effects models in finite samples can originate from different sources, therefore results of Hausman test should be interpreted with caution. For example, FE estimator may also be inconsistent due to dependence of time-varying explanatory variables and idiosyncratic error term (see for example [Ahn and Low 1996]).

[6] 50/30 equivalence scale was applied, which states that the first adult receives a weight of one, subsequent adults receive a weight of 0.5, and children of 0.3.

29%, whereas the smallest shares (less than 25%) were observed in Bulgaria, Greece, Croatia, Romania, and Slovakia. The largest shares (more than 35%) were observed in Luxembourg, France, and Finland. When comparing caloric intake from animal products, there is a clearly visible division into "old" and "new" European Union members. Intake of less than 1000 calories from animal products was observed in all "new" members and in Greece, Spain, and Italy. Intake of more than 1000 calories from animal products was observed in all other countries under consideration. The smallest intake of calories from animal products (600 kcal) was observed in Bulgaria, whereas in France and Luxembourg it was twice as much.

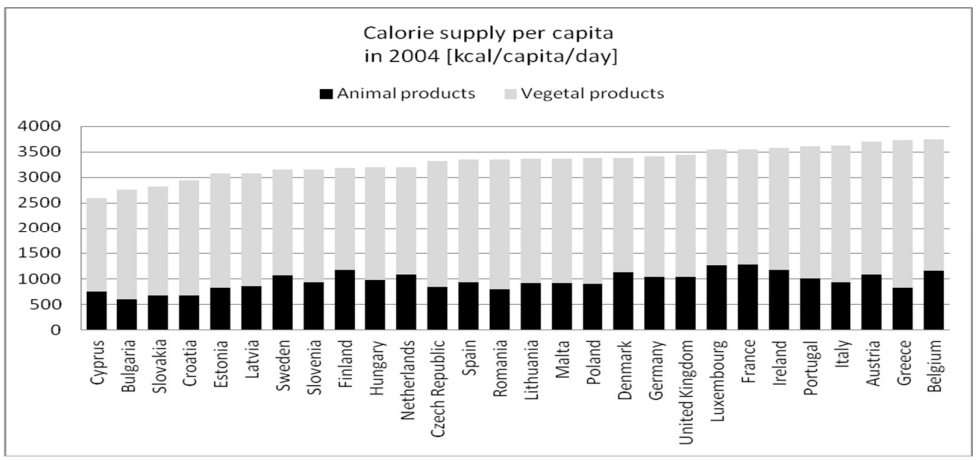


Fig. 1. Calorie supply per capita in 2004

Source: own elaboration on the base of FAO data.

Figure 2, presenting calorie supply per capita in 2011, allows an assessment of possible changes in consumption in the period under consideration. It shows that in 2011 in most countries there was still an observed food supply of 3000-3500 kcal daily per capita. In the European Union, the average share of animal products still equaled 29% of general consumption. However, in the majority of "new" European Union members there was observed an increase in animal product consumption, whereas half of the "old" members demonstrated a significant decrease in animal product consumption.

Table 1. Estimates of trend models

Results	Food origin			
	Animal		Vegetal	
	"old" members	"new" members	"old" members	"new" members
const	1091.21***	829.40***	2285.11***	2293.09***
t	-4.09***	3.30**	1.72	3.12
H	0.0001	0.0001	0.0006	0.0004
B-P	296.23***	296.25***	371.03***	316.44***
F	78.10***	80.06***	133.81***	119.26***

Source: own calculations. Note: * indicates statistical significance at 0.1, ** at 0.05, and *** at 0.01.

Table 1 presents results of trend estimations explaining calorie intakes from animal and vegetal products for "old" and "new" EU members. Test results[7] indicate random effects models, thus we present only their estimates.

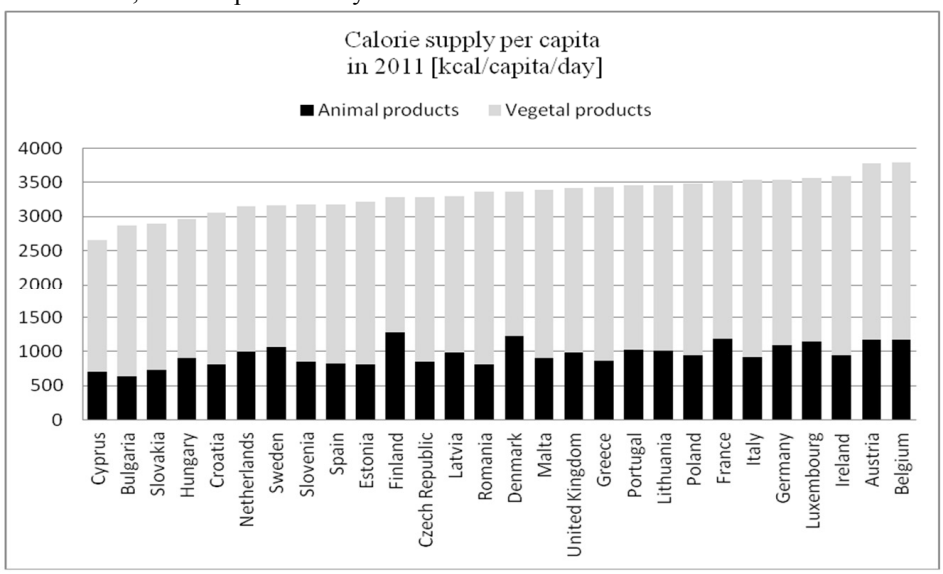


Fig. 2. Calorie supply per capita in 2011

Source: own elaboration on the base of FAO data.

On the basis of results given in Table 1, one can observe a significant increase in supply from animal products in "new" EU members and a significant decrease in "old" EU members. In both groups of countries there was no significant change in supply from vegetal products.

Table 2. Estimates of models explaining food supply by income

Results	Food origin			
	Animal		Vegetal	
	"old" members	"new" members	"old" members	"new" members
const	6.78***	6.11***	7.75***	7.58***
lnIncome	0.02	0.07***	0.003	0.02*
H	1.72	0.42	0.99	2.45
B-P	286.27***	304.31***	358.57***	185.71***
F	57.00***	129.95***	135.62***	79.35***

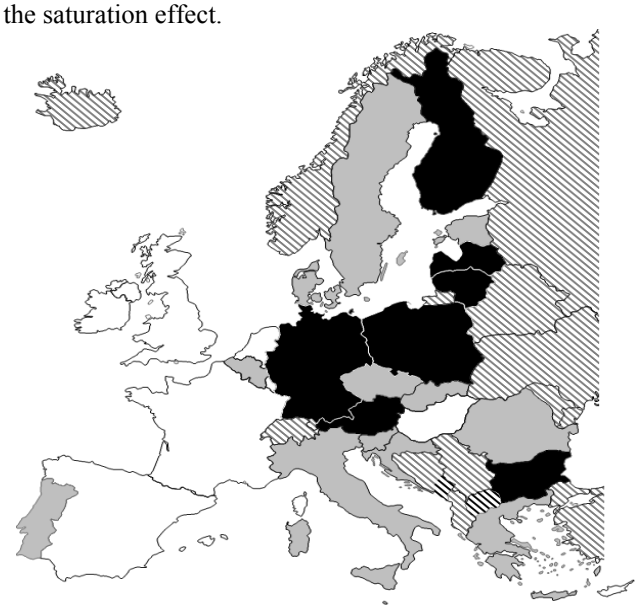
Source: own calculations, Note: * indicates statistical significance at 0.1, ** at 0.05, and *** at 0.01.

In Table 2, there are displayed estimates of models where the dependent variable is a logarithm of calorie intake from animal and vegetal products and the independent variable

[7] In all models the Breusch-Pagan test and F test reject pooled OLS models, the Hausman test statistic indicates RE models.

is a logarithm of equivalized net income. Like in trend models, here again tests indicate random effects models, thus we present solely their estimates.

Results, given in Table 2, may be interpreted as income elasticities due to the fact the models are estimated on the basis of logarithmic values of dependent and independent variables. For example, a 1% income increase in "new" EU members causes an increase in supply from animal products by 0.07% and increase in supply from vegetal products by 0.02%. Our findings are consistent with observations of other researchers that in general, when standards of living are low, increasing incomes will favor more foods of animal origin, while the consumption of grains and carrots will drop [Grigg 1994]. As far back as 1960, Perisse et al. [1969] showed that a rise in income was accompanied by a significant increase in the share of lipids from animal products, by a reduction in the share of carbohydrates as the increase in the consumption of sugar products did not compensate for the reduction in cereal consumption, and by stability of a share of protein calories, with a substitution of plant proteins by animal proteins. Since the 1960s, this trend has been confirmed in developed countries and has gradually spread to emerging countries. For example, Regmi et al. [2008] analyzed the convergence of food diets from 1990 to 2004 among 47 countries grouped by level of income. They revealed that expenditures on major food groups (meats, vegetables, sweets and soft drinks) converged toward the level of high-income countries, although this convergence also included upper middle-income and lower middle-income groups in poor countries. On the other hand, income increase in "old" EU members does not cause any increase in food supply and the probable cause of this phenomenon is the saturation effect.



Note: black - upward trend, white - downward trend, grey – no clear trend, lined – not EU members

Fig. 3. Tendencies in the food supply from animal products in EU countries.

Source: own elaboration.

Our results, displayed in Tables 1 and 2, reflect average trends and relationships in the two groups of countries under consideration, e.g. "new" and "old" members of the

European Union. However, these groups are not completely homogenous with regard to the food supply. Figure 3 presents the map where different colors correspond to different tendencies[8] in the food supply from animal products. Black color denotes an increasing tendency, White denotes a decreasing tendency and Grey denotes no clear tendency (lined countries are not EU members). Six of the "old" EU members represent decreasing food supply from animal products. It is worth mentioning that the group includes countries with high numbers of inhabitants, such as France, the UK, and Spain. Only three of the "old" EU members show increasing tendencies in supply from animal products (Austria, Finland, Germany).

The situation is different in the case of "new" EU members. Only two of them (Hungary and Cyprus) are characterized by downward trends in food supply from animal products, while four of them (Bulgaria, Latvia, Lithuania, and Poland) are characterized by upward trends in food supply from animal products. This is not good from an environmental aspect, as – according to Westhoek et al. [2014], who explored possible consequences of replacing 25-50% of current meat, eggs and dairy consumption in the EU with plant-based foods – reducing livestock production by 50% will lead to large structural changes within the EU agricultural sector, resulting in a reduction in the emission of greenhouse gases (25-40%), and reactive nitrogen (around 40%). Moreover, due to reduced feed demand, the use of imported soybean meal would drop by 75% and the EU would become a large net exporter of basic food commodities. Actually, it is quite optimistic that the population of White-colored countries, representing downward trends in food supply from animal products, constitutes 41% of the total EU-28 population, whereas the population of Black-colored countries, representing upward trends in food supply from animal products, corresponds to 29% only.

Concluding remarks

Agriculture and food consumption are identified as drivers of environmental pressures as there are a number of factors in agricultural food production and consumption that have significant impacts on the environment. These factors are, for example: water use and water pollution, energy use, climate change, chemical usage or desertification. However, in the long-run food production and consumption evolve under the effect of dietary changes that are caused, among others, by increases in income. In the period under consideration (2004-2011), most of the EU countries reported a rise in the income of their populations. However, in the case of "old" EU members, this didn't have a significant effect on changes in consumption of both animal and vegetal products, whilst in the case of "new" EU members it caused an increase in food consumption. Nevertheless, income elasticities of consumption, presented in the paper, have low values, implying weak effects.

Initially, in 2004 "new" EU members were characterized by lower consumption of animal products than the majority of "old" EU members. Then it changed and most of the "new" members started to exhibit an increase in consumption of animal products. This phenomenon is unfavorable, taking into account the negative environmental consequences of livestock farming that are listed in the introduction. Moreover, according to Eurostat, the

[8] At least 50% value of R squared and a trend parameter significant at 0.05 were taken as the evidence for a tendency

food and drink value chain in the EU causes 17% of direct greenhouse gas emissions and 28% of material resource use. Furthermore, animal calorie production is particularly inefficient compared to that of vegetable calories, as large quantities of the calories are fed to livestock in order to maintain living functions and for the production of non-edible body parts, e.g. bones.

In the majority of "old" EU member countries, consumption of animal products has declined. What is more, the number of people living in countries which represent decreasing consumption of animal products is higher than the number of people living in countries which represent increasing consumption of animal products. Both groups of countries do not exhibit any significant changes in consumption of vegetal products.

Hopefully, a growing segment of consumers in the medium- and high-income categories who benefit from income increases will use their potential to contribute to environmentally friendly agriculture by purchasing foods from certified sources and by reducing the share of resource-intensive products, such as meat, in their diets. Possibly, when "new" EU members catch up with the living standards of "old" members, their consumption patterns will converge toward those environmentally friendly diets.

References

Ahn S. C., Low S. [1996]: A reformulation of the Hausman test for regression models with pooled cross-section time-series data, *Journal of Econometrics*, 71, 309-319.

Duarte R., Pinilla V., Serrano A. [2015]: Globalization and natural resources: the expansion of Spanish agrifood trade and its impact on water consumption: 1965-2010. Regional Environmental Change, Springer-Verlag, Berlin Heidelberg.

Flores-Garcia M., Mainar A.J. [2009]: Environmental effects of production and consumption activities within an economy: the Aragon case. *International Advance in Economic Research*, 15, 437-455.

Gerbens-Leenes P.W., Nonhebel S. [2002]: Consumption patterns and their effects on land required for food. Ecological Economics, 42, 185-199.

Grigg D. [1994]: Income, industrialization, and food consumption. *Tijdschrift voor economische en sociale geografie*, 85, 3-14.

de Haen H., Requillart V. [2014]: Linkages between sustainable consumption and sustainable production: some suggestions for foresight work. *Food Sector*, 6, 87-100.

Our common future (Brundtland Report) [1987]: United Nations World Commission on Environment and Development, Oxford University Press, Oxford.

Perisse J., Sizaret F., Francois P. [1969]: Effet du revenue sur la structure de la ration alimentaire. *Bulletin de Nutrification*, FAO, 7 (3), 1-10.

Regmi A., Takeshima H., Unnevehr L.J. [2008]: Convergence in global food demand and deliver. Washington, *USDA Economic Research Report*, 56.

Westhoek H., Lesschen J.P., Rood T., Wagner S., De Marco A., Murphy-Bokern D., Leip A., van Grinsven H., Sutton M.A., Oenema O. [2014]: Food choices, health and environment: effects of cutting Europe's meat and dairy intake. *Global Environmental Change*, 26, 196-205.

Wolff F., Schönherr N. [2011]: The impact evaluation of sustainable consumption policy instruments. *Journal of Consumption Policy*, 34, 43-66.

Wooldridge J. [2002]: Econometric analysis of cross section and panel data, The MIT Press, Massachusetts.

http://ec.europa.eu/eurostat

www.fao.org

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 41–55

Wojciech J. Florkowski[1]
University of Georgia
Grzegorz Łysiak[2]
Poznan University of Life Sciences

Quality Attribute-Price Relationship: Modernization of the Sweet Cherry Sector in Poland

Abstract. This study describes the development of sweet cherry production in Poland in the context of relationship between quality attributes and wholesale prices as well as modernization of orchards creating opportunities for increased exports. Global demand for sweet cherries increases because of their perceived unique health benefits, but the fruit must have the desired quality attributes. The link between quality attributes and prices is illustrated using the wholesale prices collected during the harvest season in years of limited and normal crop in Poland, respectively. Among the discussed varieties is 'Cordia' which dominates in the modern orchards. As the sweet cherry production declines in the region, with the introduction of modern production technology, the increasing yields and volume produced creates opportunities for increased exports also to countries outside the EU.

Keywords: sweet cherries, wholesale price, quality attribute, cultivar, price trend, exports

Introduction

The fresh fruit global market has been expanding due to increasing incomes and changing preferences. The increasing of fruit consumption in response to income has been illustrated in countries of varying economic development [Florkowski et al. 2014]. The observed consumer behavior is consistent with predictions based on Engle's curve, suggesting that the consumed volume of various foods increases in response to increasing incomes. In addition to increasing incomes, the changing preferences of consumers contribute to per capita growth of fruit consumption and alter the composition of the fruit basket. Among fresh fruits that have been experiencing a global growth in production and trade is sweet cherries. Largely unnoticed has been the expansion of fresh cherry production within the Pacific basin, namely between the United States and Canada acting as suppliers and Japan, South Korea, and even China as destination markets [Carew, Florkowski, Doroundian 2012]. The combination of health benefits, breeding, and postharvest handling changed the competitive position of sweet cherries in the market.

Sweet cherries are a common fruit in Europe, including several Central European countries such as Germany and Poland. They are generally well accepted and are one of the earliest fresh fruits of the season. Poland produces a substantial volume of sweet cherries and exports sweet cherries to a number of European countries.

The objective of this study is to describe some of the reasons behind the observed sweet cherry production expansions worldwide, examine the Polish sweet cherry sector

[1] [1] Professor, e-mail: wojciech@uga.edu
[2] [2] PhD, e-mail: glysiak@up.poznan.pl

including cherry exports, and to explore the link between observed market prices and selected sweet cherry attributes for major varieties. The investigation focuses on two years, 2007 and 2011, and applies data collected during the harvest season from the Poznan-Franowo, Poland, a major fruit wholesale market. The analyses of links between prices by variety and major quality attributes reveal that the market appears to send clear price signals to growers and traders in years when the supply of sweet cherries is limited, but not necessarily in years of average crops. Capricious price signals may discourage harvesting, but, more importantly, affect production decisions including planting of new orchards or replacement of old trees. The persistence of inconsistent price signals will result in production decrease, loss of export earnings, and less consumer access to healthy fresh fruit. Results of this study generate knowledge about the importance of specific quality attributes for sweet cherry prices, thus providing insights for choosing varieties for planting or re-planting, and allowing the anticipation of changes in Poland's domestic sweet cherry supply.

Health-promoting sweet cherry properties

Sweet cherries, like many other species from the *Prunus* genus, have a high nutritional value contributing to human health [Yahia 2010]. Besides water, their main components are carbohydrates, responsible for the sweetness, and organic acids, which determine sourness [Bernalte et al. 2003; Esti et al. 2002]. Over 80% of total sugars (110-150 g/kg FW) are glucose and fructose, and around 75% of total acids (29-54 g/kg FW) is malic acid [Hayaloglu and Demir 2015]. Sweet cherries contain both hydrosoluble (C, B) and liposoluble (A, E and K) vitamins and some carotenoids, in particular beta-carotene, and to a lesser extent, lutein and zeaxantine [Ferretti et al. 2010]. Sweet cherries are rich in phenolic compounds, notably anthocyanins [Gao and Mazza 1995; Yahia 2010]. The latter is the main contributor to the high antioxidant activity of sweet cherries, which was found to vary between 216 and 475 mM trolox/100 g FW [Liu et al. 2011].

The total phenolic content in sweet cherries depends on many factors, such as the growing location, cultivar, rootstock, cultivation, weather conditions etc. Several studies [Usenik et al. 2008; Ferretti et al. 2010; Faniadis et al. 2010; Hayaloglu and Demir 2015] have shown that the content of phenolic compounds can vary considerably depending on the growing location, from 44 to 265 mg of gallic acid equiv. 100 g−1 FW. Also, the accumulation of the phenolic compounds is higher in the same cultivars if they are grown on higher elevations or in colder climates [Faniadis et al. 2010]. Still others [Borochov-Neori et al. 2011; Fernandes de Oliveira et al. 2015] have found that the accumulation of anthocyanins in fruit is significantly higher in colder climates. High levels of anthocyanins result in darker cherry fruit which was found to have higher antioxidant activity [Gonzalez-Gomez et al. 2010; Hayaloglu and Demir 2015].

The above findings suggest that sweet cherry cultivars grown in Poland can be expected to be darker and, consequently, have higher content of phenolic compounds than the same cultivars grown in southern locations. Therefore, in Poland, climatic conditions favor production of sweet cherries with high antioxidant content, that is, health promoting qualities. This intrinsic attribute offers opportunities to market sweet

cherries at a premium, even if the cultivars grown in Poland are the same as in southern Europe. It should be noted that the importance of the health benefits of eating fruit including sweet cherries was an explicit national policy objective under the centrally planned economy in much of Central and Eastern Europe [Kramer 1985] although the actual implementation fell short of that goal. Health benefits of eating sweet cherries are a major driving force behind the growing global demand and consequent exports from the United States and Canada to Asian markets.

Sweet cherry sector in Poland

Rather than simply sustaining the production [Ing 2008], Polish crop statistics show the tendency to increase. The growing specialization in sweet cherry production is demonstrated in the decreasing number of farms reporting sweet cherry production, while the area planted remains fairly stable. The agricultural census of 2010 reported 49,539 farms producing sweet cherries [GUS 2014]. The number of sweet cherry producing farms has decreased by 34% since 2002, the year of the previous agricultural census [Uprawy ogrodnicze 2012]. Total area planted with sweet cherries was 11,461 hectares in 2010 and was 40.5% larger than in 2002 [Uprawy ogrodnicze 2012]. More importantly, the share of farms growing sweet cherries on an area of 2 hectares or larger increased noticeably. The share of growers operating sweet cherry orchards with an area of no more than one hectare was 18% in 2010 and shrunk after 2002 indicating a shift away from small operations. Large orchards are likely to be high-density, irrigated operations that plant cherry trees grafted on new rootstock which, given Poland's climatic conditions, better tolerate freezes than old trees. Interestingly, the share of sweet cherry orchards in the total number of fruit tree operations has increased from 3.3% in 2005 to 4.4% in 2012, although the share decreased to 4.0% in 2013 [Uprawy ogrodnicze 2012].

Sweet cherry cultivation in Poland is risky due to climate [Sitarek, Grzyb, Kozinski 2008] causing variable yields. Yields per hectare can change by 1 or 2 tons from one growing season to another and determine profitability of production [Sitarek, Grzyb, Kozinski 2008]. The observed crop growth in recent years, in addition to the expansion of orchard area, has been a result of increasing yields, which have displayed a tendency to increase in recent years reaching 4.37 ton per hectare in 2013 [Agencja Rynku Rolnego 2014]. Growing yields reflect slow structural change in the sweet cherry sector that is induced by production specialization.

Climatic conditions are primarily responsible for regional concentration of sweet cherry production in Poland. Mazowieckie and Wielkopolskie Voivodships are the leading production areas with the share of the total area planted of 33.4% and 18.5%, respectively. In Wielkopolska, 4158 farms represent 8.4% of all sweet cherry producing farms, while 7747 farms or 15.4% of sweet cherry producing farms are located in Mazowieckie Voivodship. That is, 51.9% of the area planted with sweet cherries is operated by 23.8% of farms in the two leading regions. These figures suggest a growing tendency for sweet cherry production concentration and, consequently, the increasing role of wholesale markets in Warsaw and Poznan-Franowo as sweet cherry trading hubs shaping cherry wholesale prices in Poland. Buyers from Russia frequent the Warsaw

wholesale market and import, among others, sweet cherries. The recent embargo on food imports from Poland imposed by Russia on the European Union has curtailed the exports, but is unlikely to completely eliminate it because of the distance of alternative supply sources (for example, Argentina).

Sweet cherry cultivars grown in Poland differ from those in other areas of commercial cherry production (e.g., Bing, grown in the western United States and Canada) [Carew, Florkowski, Doroundian 2012]. Among cultivars planted in Poland, there is a clear domination of varieties developed in Germany, likely because of similar growing conditions and consumer preferences. Cultivar "Bütnera Czerwona" is known among producers under its Polish name "Bitnera." The cultivar originates from Germany and is known there under the name "Büttners Rote Knorpelkirsche" [Hartmann 2003, Braun-Lüllemann and Bannier 2010]. "Hedelfińska" [English name "Hedelfingen" in Westwood 1993] was also devloped in Germany, where it is known as "Hedelfinger Riesenkirsche" [Hartmann 2003, Braun-Lüllemann and Bannier 2010]. Both cultivars are well known and frequently recommended for commercial orchards in Poland [Rozpara 2005, COBORU 2015]. "Sznajder", the Polish common name for cultivar "Schneidera Późna" ("Schneiders Späte Knorpelkirsche" in German) [Rejman 1994, Hartmann 2003, Braun-Lüllemann and Bannier 2010, COBORU 2015], and cultivar "Regina" are among the most popular new varieties [Rozpara 2005]. The latter was developed in Germany in 1957 and introduced in commercial orchards in 1981 [Bundessortenamt 2000]. "Regina" is popular globally due to its late season maturity that allows the extension of crop season, higher yields, and large-sized fruit – all important economic attributes. Cultivar "Van" originated in Canada [Westwood 1993] and is a popular cultivar in Europe, from Italy to Norway [Rozpara 2005]. The wide popularity of cultivars "Hedelfinska", "Schneidera Późna", and "Van" has been reported [Kramer 1985]. In recent years, cultivars "Kordia" and "Regina" are the most popular in Poland [Agencja Rynku Rolnego 2014]. "Regina" has been very favorably accepted by consumers in other countries [Turner et al. 2008] and has been planted in the western United States and Canada.

Kordia is a relatively new, late-maturing variety, good for the fresh market, and developed in the Czech Republic. Fruits tend to be large weighing 8-10g [Rozpara 2005]. Kordia can grow large so the choice of rootstock is essential for a commercial orchard. This variety grafted on *Prunus avium* and *Prunus mahaleb* seedlings with interstocks of 'Northstar' and three types of *Prunus fruticosa* Pall reduced tree size and had positive influence on yield [Rozpara et al. 2011]. Grafting on rootstock that limtis growth did not reduce fruiting or compromises quality [Sitarek et al. 2011, Milatović et al.2013]. Because the variety is susceptible to winter and spring frost it requires a careful site selection [Rozpara 2005; Lech et al. 2012].

Fruit consumption has been increasing in Poland in recent decades [Florkowski et al. 2014] and sweet cherries compete with other fresh fruit. However, because sweet cherries are one of the earliest fruits of the season they are well liked. In addition, because fresh fruit prices are higher than prices for fruit destined for processing, Polish growers prefer to sell their cherry crop as fresh fruit. For example, the share of sweet cherries sold as fresh fruit was 86% in 2007, while the balance was processed. Detailed per capita consumption figures regarding sweet cherry consumption are not available for Poland, but it has been noted that fruit consumption has been increasing in Poland in recent decades [Florkowski et al. 2014]. The changing retail structure is a major factor

driving the changes in consumer fruit choices. Therefore, like many other fruits, sweet cherry consumption is increasingly dependent on sales through supermarket chains. Still, wholesale markets remain a major distribution channel because of fragmented sweet cherry production and less organized producer groups (as compared, for example, to apple growers).

Sweet cherry exports

Kramer [1985] reports that the former CMEA (the Council for Mutual Economic Assistance) member countries produced about 400,000 tons of sweet cherries and between 70% and 80% were destined for consumption as fresh fruit in the early 1980s. For Poland, despite not fulfilling the national goal of fresh fruit consumption, fresh fruit exports were important for the national economy in the 1980s [Kramer 1985]. The expansion of sweet cherry production was anticipated in Eastern Europe, especially areas whose climate is influenced by the Black Sea [Ing 2008]. Sweet cherry production in Russia, Ukraine, and Romania is utilized domestically, while some cherries have been exported from the countries in this region to Russia. Overall, the response of suppliers in the region was weak; for example, the production of sweet cherries in Bulgaria decreased [Borovinova et al. 2008].

In the most recent decade, sweet cherry production averaged around 40,000 tons in Poland. Since Poland has joined the EU, the lowest volume produced was 20,189 tons, was reported in 2007 [FAOSTAT 2015], while the highest crop of 47,600 tons was harvested in 2013 [GUS 2014]. A typical crop can be expected between 38,000 and 40,000 tons, but the crop size has shown a tendency to increase in recent years. Sweet cherry exports from Poland ranged from a low of 3,000 tons in 2009 to a high of 11,000 tons in 2010 in the period 2004-2013. Agencja Rynku Rolnego [2014] estimates that 20-30% of the sweet cherry crop is exported in years when cherry production is normal. However, it is reasonable to expect the steady expansion of production if technological progress can offset production risk arising from spring freezes and diseases [Sitarek, Grzyb, and Kozinski 2008].

Polish sweet cherry growers do not have strong competition within the region. Latvia, which continues to develop new sweet cherry varieties focusing on spring frost tolerance [Ruisa 2008], has a limited area of production and its crop is destined primarily for domestic consumption. In Bulgaria, the sweet cherry production expanded in the 1980s [Kramer 1985] and reached 11,004 hectares in 1990, but has since declined to 6800 hectares in 2002 [Borovinova et al. 2008]. Sweet cherry cultivars grown in Bulgaria include “Bing”, which has been outperformed in consumer tests [Turner et al. 2008], while “Hedelfinska” and “Van” had shares of 14% and 9%, respectively, in the total area planted. However, the sweet cherry sector is unlikely to expand soon in Bulgaria. Bulgaria’s advantage is the early ripening window and, as such, the country competes with Turkey as an international sweet cherry supplier.

Outside Europe, New Zealand has been expanding its small sweet cherry production area [Hewett, Hofma, and Weaver 2008]. The focus of producers is predominantly the export market, primarily Taiwan and the United States, but the list of countries importing sweet cherries from New Zealand exceeds 20. The primary

characteristic of the New Zealand sweet cherry crop is that it is harvested during the winter season in the Northern Hemisphere and the deliveries do not compete with the European crop. The primary challenge for growers at distant supply areas is the organization and optimization of a cold chain to maintain and protect cherry quality.

Another Southern Hemisphere sweet cherry supplier is Argentina. However, this country (like Chile) does not compete with Northern Hemisphere suppliers. Tree fruit production has become an important sector in recent decades in Argentina. Fortunately, Polish sweet cherry growers are not affected by the expanding production. Indeed, the supply of fresh sweet cherries in winter months may sustain demand and increase sales once the harvest begins in Europe because accessibility may have developed a preference for sweet cherries among consumers.

The expansion of sweet cherry production in the western United States and Canada has been driven by the increasing demand in the wealthy East Asian markets of Japan, Taiwan, South Korea, and China. The development of new varieties combined with improved postharvest handling practices has generated returns, encouraging cherry orchard expansion. Polish fruit tree growers have become very competitive in recent decades and the expansion of sweet cherry orchard size proves that they are searching for alternative enterprises. With the competition from the Southern Hemisphere growers not being a factor and the production in surrounding countries declining, Polish growers are poised to fill the vacuum.

Figure 1 shows the volume of fresh sweet cherry exports from Poland in the period 2010-2014. Russia has become an increasingly important destination of Polish sweet cherries in recent years until the imposition of the trade embargo in the summer of 2013. Belarus replaced Russia as the primary export market in 2014. Overall, East European markets have been the primary recipients of sweet cherry shipments, both EU member (Lithuania, Estonia) and non-member countries (Ukraine). Among other EU countries, Germany has long been the largest destination of fresh sweet cherry exports. Available data does not provide information about specific varieties shipped to any destination.

Prices of fresh cherries fluctuated between 2010 and 2014 and the period is too short to draw firm conclusions. The highest prices were received by exporters to the three Baltic countries and Germany (on average 1,576 euros per ton in the period 2010-2014) – all EU members. Prices from exports to Russia averaged 1,262 euros per ton between 2010 and 2014. In contrast, the lowest export prices for fresh sweet cherries were obtained by shipping to Kazakhstan and Ukraine, 847 and 796 euros per ton in the period 2010-2014.

Exports of frozen sweet cherries have enjoyed a more diversified geographical destination than fresh sweet cherries. Overall, the direction of shipments is reversed and West European destinations (all EU members) prevail over East European countries. By far, the largest EU importer of Polish frozen sweet cherries between 2010 and 2014 has been Germany. Other countries that consistently imported frozen sweet cherries in the period 2010-2014, include the Netherlands, Great Britain, and Sweden. More recently, the group was joined by Belgium and Italy. Ukraine has decreased its imports, although until 2014 it was the largest overall importer of frozen sweet cherries. In Eastern Europe, Lithuania has been importing a small volume as well. Outside Europe, China intermittently imports frozen sweet cherries.

Prices for frozen sweet cherries were somewhat lower than for fresh product. The average price for frozen sweet cherries shipped to Germany was 1,262 euros per ton in

the period 201-2014. However, the highest average price was 1,368 euros per ton received for exports to Great Britain.

It appears that with a growing production, Polish sweet cherry exports will follow exports of other fruit after the Russian trade embargo. EU destinations and markets outside Europe will become relatively more important and the cherry sector could implement market and promotion programs developed by other Polish fresh fruit sectors.

Sweet cherry attributes and prices

Data

Data used in this study are daily sweet cherry prices recorded during the harvest seasons of 2007 and 2011. They include prices per kg per variety and include the score of color and a measure of size. Color is an essential attribute because it is an indicator of maturity and cherries tend to be sweeter if they are closer to peak maturity. However, sweet cherries also become more susceptible to bruising and cracking at advanced maturity stage posing a challenge to growers who have to balance the color intensity against postharvest handling practices to maximize sales revenues.

Sweet cherry color is commonly evaluated in Europe using a color chart developed in France. The chart distinguished among 7 different shades [Code Couleur Cerise 2015]. Sweet cherries traded at the Poznan-Franowo wholesale market had their color evaluated using this chart, but the actual color score range is narrower than from 1 to 7 because producers usually do not harvest sweet cherries until they reach maturity. Sweet cherries, a non-climacteric fruit, do not ripen once harvested; therefore, color is an important indicator of the stage of maturity. Too early harvest means the fruit is not sweet, while too late harvest considerably narrows that marketing window even when best postharvest handling practices are applied.

Another important attribute is size. Large cherries are preferred to smaller fruit. Although irrigation is becoming common in Polish fruit orchards, sweet cherry trees still depend on precipitation. A regular pattern of precipitation assures steady growth of fruit, while even a short drought followed by substantial rains may lead to rapid growth resulting in fruit cracking, a process that results in irreversible damage and unmarketable fruit. Susceptibility to cracking varies across cultivars and the early maturing cultivars tend to be more affected by cracking [Ruisa 2008]. Of particular importance to this study is the cherry variety because both color and size are, at least in part, influenced by the genetic makeup of the tree, and consumers pay attention to the fruit's appearance, including color and size [Ruisa 2008, Turner et al. 2008]. Generally, dark fruit is associated with maturity and sweetness, but some varieties never develop a deep red or dark color (we exclude varieties of yellow cherries from the discussion) and fully mature fruit remains light to medium red. Consumer visual assessment affects the purchase decision and, consequently, sweet cherry attributes associated with a specific variety must be considered by a grower when selecting a variety (or varieties) for planting [Ruisa 2008]. The examination of the link between fruit color, size, and price is, therefore, crucial in the process of investment decisions because fruit trees represent

a fixed asset with little salvage value. A cherry tree is expected to produce a commercially viable crop for about 20-25 years.

A total of 5 and 11 sweet cherry varieties were priced at the Poznan-Franowo wholesale market in 2007 and 2011, respectively. However, for the purpose of this study and to examine the relationship between selected attributes and prices, we focus on varieties that were traded in both years and for a relatively large number of days implying a substantial supply and, likely, demand.

The location of Poznan-Franowo between two major European agglomerations, Warsaw, the capital of Poland, and Berlin, the capital of Germany, offers opportunities for shipping fresh sweet cherries to large urban markets. Western and west-central regions of Poland have been sweet cherry production regions for decades [Kramer 1985] and correspond to Wielkopolskie and Mazowieckie Voivodships. It is worth mentioning that under the centrally planned economy in Poland (until the late 1980s) and the existence of the CMEA (Council for Mutual Economic Assistance (RWPG in Polish), the regional horticultural cooperative organization in Wielkopolska operated several retail outlets in East Berlin in the German Democratic Republic specializing in fresh and processed fruit and vegetable products. During the season, there were even daily shipments of fresh produce to those outlets. As a result, both Polish suppliers and German buyers had long established commercial relationships before the transition to the market economy in the late 1980s and Poland's accession to the European Union in May 2004.

The data for the 2007 and 2011 harvest seasons refer to the period June-July. Sweet cherry harvest can be expected to begin in the second half of June, somewhat later than in Germany, and lasts from 4 to 6 weeks [Kramer 1985] as various cultivars mature. Specific time periods vary for each variety in response to their genetic makeup and weather conditions throughout the growing season. The differences in response to climatic factors are best captured by the variation in periods of recording prices for the same variety in 2007 and 2011. For example, in the case of 'Schroedera Pozna', the period was June 20-July 5 in 2007, but June 14 - July 2 in 2011.

Results

The examination of the association between prices paid for fruit of various sweet cherry cultivars involved visual analysis of data plots and estimation of trends for each relationship in 2007 and 2011 supplemented by the calculation of descriptive statistics. The crop year of 2007 was unusually small due to a late spring frost. In turn, the crop in 2011 was only slightly lower than in the preceding and following year. Therefore, the examination of the above mentioned associations focuses on how wholesale prices in the major sweet cherry producing region behave in years of short and near-normal supply. We assume that prices reflect the supply of not only the sweet cherries, but also the supply of each of the two attributes that are measured in the sweet cherry trade, namely fruit color and size. Both attributes are important visual cues considered by the final consumer at the time of purchase decision or by importers of sweet cherries from Poland.

Prices of "Hedelfinska" showed slightly different patterns between the two considered years. In the short crop year, the association between price and size was flat, but in the year of near-normal supply the relationship was slightly negative. The estimated linear trend suggests that once the fruit reached score size 25-26 it was discounted. However, the association between price and color was strongly positive in both years (see Table 1 for the estimated trends).

In contrast to "Hedelfinska", "Butnera" showed a clear positive relationship between size and price in both years. Indeed the estimated price-size trend differs little between the two years. Most contrasting results between the year of short supply, 2007, and the near-normal crop year of 2011 are obtained for cultivar "Van". Although the size-price association in 2007 was largely flat, the relationship between price and color was positive, as darker colored fruit was priced higher on average. In 2011, both relationships were clearly negative suggesting that the larger and darker fruit of "Van" were discounted. This is an interesting result as this cultivar is widely planted in other countries and, therefore, familiar to consumers which may facilitate exports.

Similar results were obtained in the case of "Schneidera Pozna". Here, the estimated relationships between size and price as well as color and size are positive. Results for the 2011 season are much different; both estimated trends indicate a negative relationship of color and size with price.

Lastly, "Kordia" showed a strong relationship between color and price and size and price in 2007. But, in 2011, the estimated trends established a negative relationship between price and size, while the color scores did not show any variability (Figure 2 and 3).

Details of the estimation (Table 1) suggest that the market priced both attributes (especially color) higher, as the color score increased in the year of short supply. Such relationship is consistent with the scarcity of a product with a specific attribute. A closer scrutiny of relationships between price and attributes by variety in 2007 reveals that the market distinguishes among varieties and attributes.

Even the small differences in wholesale prices are important to growers. In the short term, such price differences influence harvesting and storage because the shortage of sweet cherries creates price bargaining opportunities. In the long term, the observed differences in price-attribute association are taken into account when growers consider tree replacement or orchard expansion decisions. Although not the sole factor, market evaluation of attributes is important.

Price risk needs to be considered as well. The estimated price trends for data in the short crop year of 2007 showed an increasing trend for all five cultivars. The calculated values of R squared are: 0.8055 for "Butnera", 0.7798 in the case of "Kordia" (Figure 4), 0.5977 for "Hedelfinska", 0.4173 for "Van," and 0.1424 for "Schneidera Pozna". The trends in 2011 were different and for "Van" the trend was negative, implying a decrease in prices as the harvesting season progressed. The explanatory power of the trend equation was weaker in 2011 as reflected in lower values of R squared as compared to 2007. The values were 0.5567, 0.3281, and 0.5416 for "Butnera", "Kordia", and "Hedelfinska", respectively. The price trend in the case of "Schneidera Pozna" was largely flat and the corresponding R squared value was 0.0083. Buyers paid about the same price for that cultivar throughout the harvesting season.

The average prices in each year vary across sweet cherry varieties, but a variance is a measure of price volatility. The larger the variance, the higher the price risk, which

growers and traders need to consider. Prices are likely to fluctuate during the sweet cherry harvesting season, and if there is a shortage of short-term storage, growers face the risk of sudden price dips if they arrive at the Poznan-Franowo wholesale market with a sweet cherry lot on a day other growers also bring their crop. The comparison of price variances across varieties in both years (Table 2) shows larger variance in the year of short crop, i.e., 2007. The larger variance suggests higher price risk, a phenomenon that reflects the varied daily supply of each variety and, possibly, variable quality.

Overall, the average prices and variances were higher in the year of short supply (2007) than in the year of a near-normal crop (2011). Results also show a clear tendency to discount four out of five considered varieties, with the exception of "Kordia". Such tendency is also captured by the larger number of cultivars traded in 2011 than in 2007, but one could argue that it was the result of the short 2007 crop. Therefore, the illustration provided in the next section sheds additional light on what can be expected in the sweet cherry market in the coming years in Poland, namely a major shift away from old standards to new cultivars. The new developments are captured in the production of certified trees for various cultivars between 2005 and 2014.

Future trends

The number of certified trees in nurseries is a good indicator of the future supply of sweet cherries in Poland and the export potential. In the first full year of Poland's EU membership (2005), the number of certified trees was 689,000 and the leading cultivar was "Kordia", with about 154,000 trees. "Burlat" and "Regina" were the other cultivars produced in the largest quantities. In 2008, the total number of trees was already 810,000 and cultivar "Summit" became the second most numerous cultivar among the certified trees. "Kordia" was still the most popular cultivar. By 2012, the total number of certified trees declined to 332,000 and "Regina" was the most popular cultivar (85,000) followed by "Summit" and "Burlat". The total number of trees increased slightly in 2013, but declined in 2014 to a total of 277,000. "Kordia" (84,000), "Summit" (45,000) and "Regina" (41,000) were the most popular cultivars.

It is reasonable to assume that the certified trees reflect the preferences of growers replacing trees or expanding sweet cherry orchards. Surprisingly, the lack of consistently clear relationship between size or color and price, "Kordia" was the most popular cultivar. "Regina" – a late maturing cultivar – was also popular. Its late maturity allows extension of the marketing window, while fruit quality is good. American experts noted that any large, firm, sweet fruit among cherry cultivars is well accepted by consumers. The comment discounted the importance of a specific cultivar, especially "Bing", which dominated the United States domestic and export supplies.

The certified tree numbers suggest that the main expansion in sweet cherry commercial orchards in Poland took place about 5-7 years ago. This expansion seems to have been reflected in the increasing crop size and yield already reported in 2013. Since then, barring any spring frost, the crop size has likely increased improving export opportunities.

Conclusions

The future of sweet cherry production is fairly positive in Poland. Given the health benefits of sweet cherries and increasing fruit consumption, the demand for sweet cherries is potentially high. The aging population of Europe and other well-developed economies of the Northern Hemisphere (notably the United States, Canada, Japan, South Korea, and Taiwan) will continue to spend on fresh, quality fruit.

The structure of sweet cherry production changes rapidly in Poland. Fewer farms operate increasingly large sweet cherry commercial orchards. Similarly to other commercial fruit production, sweet cherry orchards increase in size, use irrigation, and apply higher density plantings than in the past. As a result, yields per hectare increase steadily. There is also a shift towards new cultivars. Among popular cultivars are "Kordia" and "Summit", but especially "Regina", a late-maturing cultivar (therefore more tolerant of frost) that yields large, dark fruit.

The estimated trends of relationships between size or color and price showed that the market prices larger and darker fruit higher, but the relationship is better explained in years of short supply than in near-normal crop years. More importantly, there are differences across cultivars showing that "Schneidera Pozna" and "Van" are more likely to be discounted by the market. Not surprisingly, these cultivars are in small numbers among the produced certified trees in Poland. New cultivars must have superior quality fruit as measured by size, color, and soluble solids influencing the taste to meet consumer expectations (Turner et al., 2008). Good appearance, but lack of flavor is unlikely to sustain sweet cherry sales because of the intense competition in the domestic and international fresh fruit market.

The competition from sweet cherry growers within the EU is not much different than in other fresh fruit production. The competitive advantage reflects production costs, variety selection, and postharvest handling, and is modified by climatic conditions. Polish growers are competitive in labor expenses, while the domestic variety adoption programs focus on testing cultivars released from breeding programs in other countries (such as Canada, the United States, Hungary, the Czech Republic, and Germany) to Poland's growing conditions [Rozpara 2008]. This approach, in combination with rootstock selection, aims at improving sweet cherry tree tolerance of spring frost, which is the primary weather-related source of risk.

References

Agencja Rynku Rolnego [2014]: Owoce z drzew – dojrzały smak natury. *Rynek owoców w Polsce,* 8-9.

Bernalte M.J.; Sabio E.; Hernandez M.T.; Gervasini C. [2003]: Influence of storage delay on quality of "Van" sweet cherry. *Postharvest. Biol. Technol.* 28:303-312.

Beschreibende Sortenliste Steinobst [1997]: Pflaume Süßkirsche Sauerkirsche, Herausgegeben vom Bundessortenamt 2000. Bundessortenamt. Hannover Landbuch Verlagsgesellschaft GmbH.

Borochov-Neori H., Judeinstein S., Harari M, Bar-Ya'akov I., Patil B.S., Lurie S., Holland D. [2011]: Climate effects on anthocyanin accumulation and composition in the pomegranate (Punica granatum L.) fruit arils. *J Agric Food Chem.* 25;59(10):5325-34. doi: 10.1021/jf2003688.

Borovinova M., Tasseva V., Domozetov D., Christov N., and Sredkov I. [2008]: Sweet cherry production in Bulgaria. *Acta Horti.* 795:545-550.

Braun-Lüllemann A., Bannier H-J. [2010]: *Alte Süßkirschensorten (Obstsortenwerk): Genetische Vielfalt in den Kirschanbaugebieten Hagen am Teutoburger Wald und Witzenhausen*. Verlag des Pomologen-Vereins, Detmold 2010.

Bundessortenamt [1997]: Pflaume, SuBkirsche, Saverkirsche, Beschreibend, Sortenliste Steinobst. Hannover handbuch Verlagsgesellschaft GmbH.

Carew R., Florkowski W.J. and Doroundian A. [2012]: Market Integration and Relationship between Farm-Level Prices: Evidence from Cherry Markets in BC, Washington and California. *Journal of International Agricultural Trade and Development*, 8(1):43-64.

COBORU [2015]: *Lista odmian roślin sadowniczych wpisanych do krajowego rejestru w Polsce.* Centralny Ośrodek Badania Odmian Uprawnych. Słupia Wielka.

Code Couleur Cerise [2015]: CTIFL. [Available at:] http://www.ctifl.fr/Pages/Kiosque/Details Ouvrage.aspx?IdType =3&idouvrage=629. [Accessed: July 2015].

Esti M.; Cinquante L., Sinesio F., Moneta E., Matteo M. [2002]: Physicochemical and sensory fruit characteristics of two sweet cherry cultivars after cool storage. *Food Chem.* 76:399-405.

FAOSTAT [2015]: [Available at:] http://faostat3.fao.org/browse/Q/QC/. [Accessed: September 2015].

Faniadis D., P.D. Drogoudib, M. Vasilakakisa [2010]: Effects of cultivar, orchard elevation, and storage on fruit quality characters of sweet cherry (Prunus avium L.). *Scientia Horticulturae* 125: 301–304.

Fernandes de Oliveira A., Mercenaro L., Del Caro A., Pretti L., Nieddu G. [2015]: Distinctive Anthocyanin Accumulation Responses to Temperature and Natural UV Radiation of Two Field-Grown *Vitis vinifera* L. Cultivars. *Molecules* 20:2061-2080.

Ferretti G., Bacchetti T., Belleggia A., Neri D. [2010]: Cherry Antioxidants: From Farm to Table. *Molecules* 2010, 15, 6993-7005; doi:10.3390/molecules15106993.

Florkowski W.J., Klepacka A.M., Nambiar P.M.,. Meng T, Fu S., Sheremenko G. and Sarpong D.B. [2014]: Consumer Expenditures on Fresh Fruit and Vegetables. In Postharvest Handling: A systems approach, W.J. Florkowski, R.L. Shewfelt, B. Brueckner, S.E. Prussia (eds.), Elsevier. Chapter 7, 147-166.

Gao L., Mazza G. [1995]: Characterization, quantification, and distribution of anthocyanins and colorless phenolic in sweet cherries. *J Agric Food Chem* 43:343–346.

Gonzalez-Gomez D, Lozano M, Fernandez-Leon MF, Bernalte MJ, Ayuso MC, Rodriguez AB. [2010]: Sweet cherry phytochemicals: Identification and characterization by HPLC-DAD/ESIMS in six sweet-cherry cultivars grown in Valle del Jerte (Spain). *J Food Comp Anal* 23:533–9.

GUS [2008]: Badanie produkcji roslinnej. Produkcja ogrodnicza. Badanie sadow. [Available at:] http://stat.gov.pl/ cps/rde/xbcr/gus/produkcja_ogrodnicza_badanie_sadow_2007_is.pdf. [Accessed: Septmber 2015].

GUS [2014]: Powszechny Spis Rolny 2010. Warszawa.

GUS [2015]: Rocznik Statystyczny 2014. Warszawa.

Hartmann W. [2003]: *Farbatlas Alte Obstsorten*. Stuttgart: Ulmer, 2003, p. 318.

Hayaloglu A.A., Demir N. [2015]: Physicochemical Characteristics, Antioxidant Activity, Organic Acid and Sugar Contents of 12 Sweet Cherry (*Prunus avium* L.) Cultivars Grown in Turkey. *Journal of Food Science* 80(3): 564-570.

Hewett E., Hofma I. and Weaver N. [2008]: Maintaining cherry quality: supply chain challenges. Acta Hortic. 795: 793-798.

Ing G. [2008]: Where will sweet cherries be grown? *Acta Hortic.* 795: 451-456.

Kramer S. [1985]: Production of cherries in the European socialist countries. *Acta Hortic.* 169: 27-34.

Lech W., Małodobry M., Dziedzic E., Bieniasz M. and Doniec S. [2012]: Analysis of flowering of several sweet cherry cultivars in the climatic conditions of southern Poland. Acta Horticulturae, 932: 143-148.

Liu Y., Liu X., Zhong F., Tian R., Zhang K., Zhang X. and Li T. [2011]: Comparative Study of Phenolic Compounds and Antioxidant Activity in Different Species of Cherries. *Journal of Food Science* 76(4): 633-638.

Milatović D., D. Đurović B. Đorđević T. Vulić and G. Zec [2013]: Testing of sweet cherry cultivars on 'Gisela 5' rootstock. Acta Horticulturae, 981: 167-171.

Rejman A. [1994]: *Pomologia*. Warszawa, PWRiL.

Rozpara E. [2008]: Growth and yield of eleven sweet cherry cultivars in Central Poland. *Acta Hortic.* 795: 571-575.

Rozpara E. [2005]: *Intensywny sad czereśniowy*. Hortpress Sp. z.o.o., Warszawa.
Rozpara E., Z.S. Grzyb and A. Glowacka [2011]: Effect of rootstock and interstock on growth and yield of three sweet cherry cultivars. Acta Horticulturae, 9031:541-545.
Ruisa S. [2008]: Fruit quality of sweet cherries grown in Latvia. *Acta Hortic.*795:883-888.
Sitarek M., Grzyb Z.S. and Koziński B. [2008]: The influence of different rootstocks on the growth and yield of sweet cherry trees during the first four years after planting in the double row system. *Acta Hortic.* 795: 531-536.
Sitarek M., Z.S. Grzyb and L. Sas-Paszt [2011]: The effect of eight clonal rootstocks on the growth and yield of 'Kordia' sweet cherry trees. Acta Horticulturae, 9031: 535-540.
Turner J., Seavert C., Colonna A., and Long L.E. [2008]: Consumer sensory evaluation of sweet cherry cultivars in Oregon, USA Acta Hort. 795: 781-786
Uprawy ogrodnicze. Powszechny Spis Rolny [2010]. [2012]. GUS, Warszawa. [Available at:] http://stat.gov.pl/ obszary-tematyczne/rolnictwo-lesnictwo/psr-2010/powszechny-spis-rolny-2010-uprawy-ogrodnicze,7,1.html. [Accessed: September 2015].
Usenik V., Fabčič J, Štampar F. [2008]: Sugars, organic acids, phenolic composition and antioxidant activity of sweet cherry (Prunus avium L.). *Food Chemistry* 107: 185–192; doi:10.1016/j.foodchem.2007.08.004.
Yahia E.M. [2010]: The Contribution of Fruit and Vegetable Consumption to Human Health. In: *Fruit and Vegetable Phytochemicals Chemistry, Nutritional Value, and Stability*. Wiley-Blackwell, Ames, USA.
Westwood M. N. [1993]: *Temperate-zone pomology. Physiology and culture.* 3rd edtion; Timber Press. Inc., Portland.

Table 1. Descriptive statistics and estimated price trend with regard to size by cultivar in 2007 and 2011

Year	Cultivar	Sales period	Average price	Price variance	Average size score	Estimated linear trend
2007	Buttnera	June 20-July 11	6.79	4.19	25.17	$Y = 0.0485x + 24.683$; R^2=0.0863
	Hedelfinska	June 20-July 11	7.38	4.31	24.84	$Y = 0.0131x + 7.0512$; R^2=5E-05
	Kordia	June 21-July 8	9.04	6.73	26.94	$Y = 1.1487x - 21.9020$; R^2=0.3728
	Schneidera	June 20-July 5	6.74	1.77	26.56	$Y = 0.7568x - 13.3600$; R^2=0.2123
	Van	June 20-July 10	6.75	1.58	25.76	$Y = -0.0409x + 7.8036$; R^2=0.0012
2011	Buttnera	June 16-July 7	7.57	1.82	25.92	$Y = 0.6473x - 9.2054$; R^2=0.0230
	Hedelfinska	June 21-July 11	7.35	1.65	24.54	$Y = -0.4319x + 17.945$; R^2=0.0306
	Kordia	June 17-July 11	10.01	1.44	26.78	$Y = -0.9621x + 35.777$; R^2=0.1055
	Schneidera	June 14-July 2	9.17	0.47	26.47	$Y = -0.0524x + 10.562$; R^2 = 0.0010
	Van	June 13-26	9.16	0.58	26.25	$Y = -0.7314x + 28.356$; R^2 = 0.3161

Source: own elaborations.

Table 2. Descriptive statistics and estimated price trend with regard to color by cultivar in 2007 and 2011

Year	Cultivar	Sales period	Average price	Price variance	Average color score	Estimated linear trend
2007	Buttner	June 20-July 11	6.79	4.19	1.75	$Y = 3.7415x + 0.2415$; R^2=0.6309
	Hedelfilska	June 20-July 11	7.38	4.31	5.77	$Y = 1.5639x - 1.6474$; R^2=0.2818
	Kordia	June 21-July 8	9.04	6.73	5.77	$Y = 2.3149x – 4.3166$; R^2=0.6353
	Schneidera	June 20-July 5	6.74	1.77	5.30	$Y = 0.9370x + 1.7760$; R^2=0.1610
	Van	June 20-July 10	6.75	1.58	4.73	$Y = 0.3876x + 4.9172$; R^2=0.1113
2011	Buttnera	Not available	NA	NA	NA	NA
	Hedelfinska	June 21-July 11	7.35	1.65	5.61	$Y = 1.0564x + 1.4233$; R^2=0.0307
	Kordia	June 17-July 11	10.01	1.44	5.94	$Y = 0.0250x + 9.8625$; R^2=1E-05
	Schneidera	June 14-July 2	9.17	0.47	4.88	$Y = -0.1563x + 9.9365$; R^2 = 0.0043
	Van	June 13-26	9.16	0.58	3.53	$Y = -0.4561x + 10.768$; R^2 = 0.5226

Source: own elaborations.

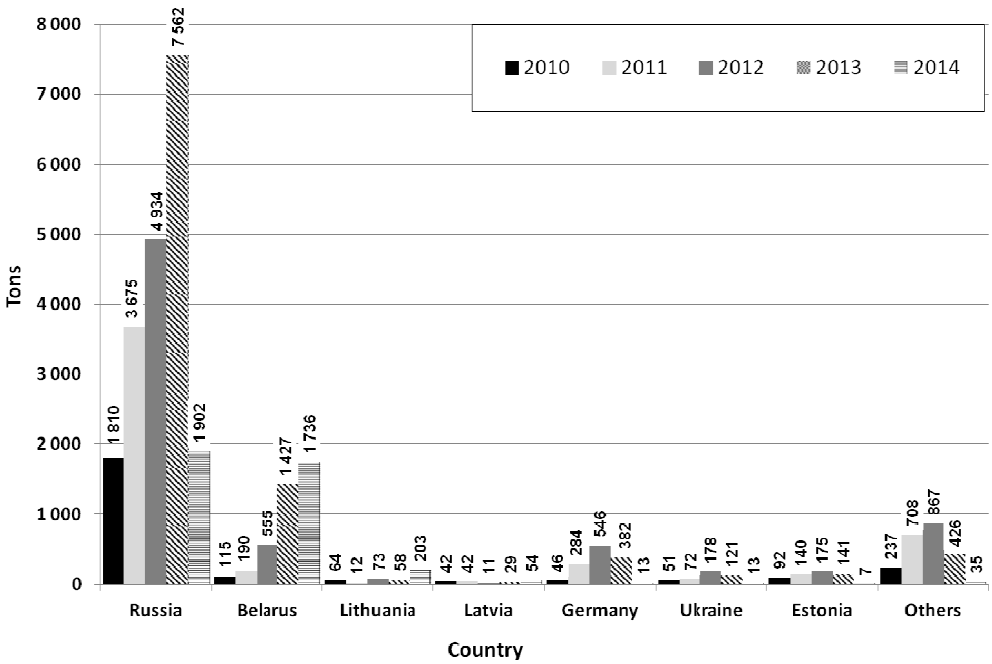


Fig. 1. Major destinations of Polish sweet cherry exports in the period 2010-2014, in tons

Source: Zakład Ekonomiki Ogrodnictwa IERiGŻ-PIB.

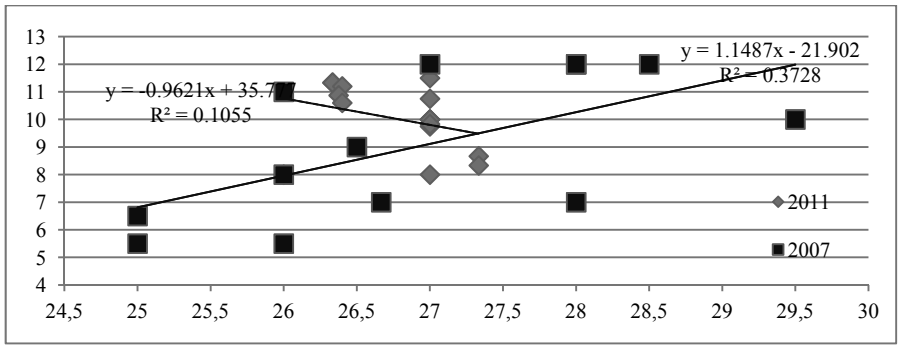


Fig. 2. Plots of actual prices (Y axis) and size scores (X axis) of variety 'Kordia' with calculated trends during the harvest season at Poznan-Franowo wholesale market in 2007 and 2011

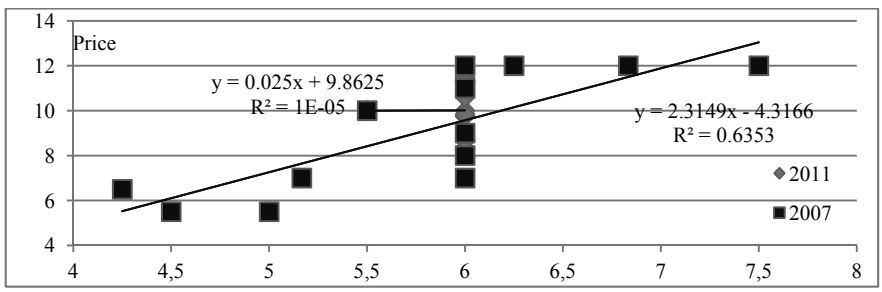


Fig. 3. Plots of actual prices (Y axis) and color scores (X axis) of variety 'Kordia' with calculated trends during the harvest season at Poznan-Franowo wholesale market in 2007 and 2011

Note: The trend was indistinguishable in 2011.

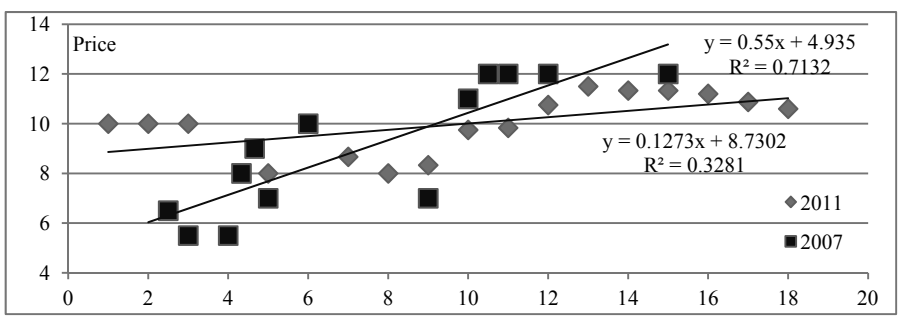


Fig. 4. Plots of actual prices (Y axis) over time (X axis shows consecutive days) of variety 'Kordia' with calculated trends during the harvest season at Poznan-Franowo wholesale market in 2007 and 2011

Note: X axis shows consecutive days of trading.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 56–61

Julia Galchynska[1]
Department of Marketing and International Trade,
National University of Life and Environmental Sciences of Ukraine
Mykola Orlikowskyi[2]
State Agro-Ecological University in Zytomyr, Ukraine
Mariusz Maciejczak[3]
Faculty of Economic Sciences ,
Warsaw University of Life Sciences – SGGW

Development of Bioenergy from Biomass in Ukraine

Abstract. The paper aims to present and assess the current situation of bioenergy production in Ukraine as well as provide insights into its development in the future. It is argued that the great potential of the Ukrainian agrarian sector could ensure not only food needs, but also could become a main source of production and accumulation of bioenergy in agro ecosystems. Under this perspective it can further the increase of energy safety.

Key words: biomass, bioenergy, Ukraine

Introduction

Energy crises prompt European countries to search for alternative sources of renewable energy. Ukraine has good chances and potential for dynamic development of bioenergy. The country has a significant renewable energy potential that can be deployed to enhance the trade balance, create jobs and drive economic activity during a time when the country is facing important economic challenges such as the increased dependence on energy imports and an urgent need to rejuvenate the aging energy capital stock. Deployment of aging energy stocks would also help existing policy goals of reducing the dependency on imported natural gas and help diversify the energy supply.

Objectives and methods

The paper aims to present the current use of biomass for energy production in Ukraine. Attention is paid primarily to the schemes for renewable energy production. Key indicators are presented for concepts of heat and power production from biomass and biogas. Secondary data sources are used, which cover the years 2013-2015.

[1] PhD, e-mail: galchynskaya@gmail.com
[2] PhD, e-mail: agrofam@o2.pl
[3] PhD, e-mail: mariusz_maciejczak@sggw.pl

Results and discussion

As it is emphasized by the International Renewable Energy Agency [2015] in 2015 the annual technically achievable energy potential of renewable energy sources of Ukraine was 68.6 million tonnes of oil equivalent (Mtoe) per year. This is equivalent to 98 million tonnes of fuel equivalent. This would be sufficient to replace approximately half of the total energy consumption in Ukraine today (Table 1). Ukraine's total wind potential is between 16 GW and 24 GW, with 16 GW considered economically feasible. The most promising regions are the southern and south-western regions, where average annual wind speed at the height of 80 meters exceeds 7.5 meters per second (m/s).

Table 1. Potential of renewable sources in Ukraine

Sources	Annual technically achievable energy potential	
	(TWh/yr)	(Mtoe/yr)
Wind	60	15
Solar	38.2	42
Electricity	5.7	1.4
Thermal	32.5	2.8
Hydro	28.9	7
- *Small*	*20.3*	*4.9*
- *Large*	*8.6*	*2.1*
Bioenergy	178	21.7
Electricity	27	7.2
Thermal	151	14.5
Geothermal	98.6	8.4
Energy of environment	146.3	12.6

Source: International Renewable Energy Agency, Report by REMAP 2030 Renewable Energy Prospects for Ukraine, 2015.

Unfortunately, the pace of development of bioenergy in Ukraine is still significantly behind Europe. Today, the share of biomass in total delivery of primary energy in the country is only 1.2%, and in gross final energy consumption - 1.78%. Every year Ukrainian energy uses about 2 mln./year of biomass of different kinds. The main contribution is wood - its share in total annual consumption of biomass amounts to almost 80% (Table 2). Wood has the highest rate of economically feasible potential - 80%, while other kinds of biomass (excluding sunflower husks), have a much lower figure. The least active (at 1%) is the energy potential of straw cereals and oilseed rape.

As argued by Kulyk [2015] and Geletukha et al. [2013] further development of the biofuel industry in Ukraine is mainly determined by state regulation. There are several state programs that foresee increase of the level of ecological and energy security of Ukraine, decrease of dependence on imported fuels and provision of agricultural sector and transport with competitive biodiesel. However, as mentioned by the Tebodin Ukraine CFI consultants [2013], there is a gap between potential and actual biomass processing for energy in Ukraine, which is explained by a range of problems. The most critical of these

are: unregulated procedure of tariff formation and cross-subsidizing of prices for heat and electricity; lack of modern technologies; difficulties with financing. Additionally, as emphasized by Lakemeyer [2007] and further by Royik [2013] from market perspectives on current price ratios of energy and raw materials, biodiesel and bioethanol production in Ukraine is not yet profitable. Hence, exporting grains and oilseeds to benefit from high demand on international commodity markets until price ratios in Ukraine substantially change seems the better strategy. The applied technology is rather simple and investors would quickly react to changing price ratios.

Table 2. Usage of biomass for generation of energy in Ukraine, 2013

	Annual volume of consumption		Share of total volume of annual of consumption of biomass	Share of economically feasible potential
	Physical units	Thousand tons of fuel equivalent		
Straw of cereals and rape	94 000 tons	33.6	18%	1%
Wood (residential)	5 million m^3	840	45.1%	>90%
Woody biomass (non-residential)	3.2 million tons	763	40.9%	
Sunflower shelling	380 000 tons	146	7.8%	41%
Bioethanol	65 000 tons	42	2.3%	6%
Biodiesel	18 000 tons	16	0.9%	4.8%
Biogas from agricultural waste	22.3 million m^3	10	0.5%	4.4%
Biogas from landfills and municipal solid waste	31.2 million m^3	15	0.8%	8.1%
Total		1864	100%	

Source: Geletukha et al. 2015.

The Law of Ukraine "On Electricity Sector" stipulates some exceptions to which the green tariff cannot be applied. Amongst alternative energy sources these are: blast furnace and coke gases. In the hydro sector, large-scale plans do not qualify. For electricity producers using renewable energy, the green tariff is set at the retail tariff for consumers of second class of voltage as of January 2009 and then multiplied by the green tariff coefficient. After 2014, 2019 and 2024 these will decrease by 10%, 20% and 30% of their basic values respectively (Table 3).

Ukraine has high potential to expand biomass use for energy purposes, primarily for heating. The country has abundant agricultural and forestry waste, and this is a key resource for the development of biomass-based heat and power generation capacity. There are 42.8 million hectares of land that can be used for this, equivalent to 71% of the country's total area. 32.5 million hectares of total agricultural land is arable. Furthermore, Ukraine has one of the most fertile soils in the world, the so-called "chernozem". This helps to maintain sufficient agricultural productivity rates in Ukraine, despite the low use of fertilizers [ProMarketing Ukraine, 2013].

Table 3. Green tariff coefficients for facilities commissioned

Tariff Coefficients	Until March 30, 2013 Inclusive	From April 1, 2013 Until Dec 31, 2014	From Jan 1, 2015 Until Dec 31, 2019	From Jan 1, 2020 Until Dec 31, 2024	From Jan 1, 2025 Until Dec 31, 2029
Wind energy <600 kW	1.20	1.20	1.08	0.96	0.84
Wind energy 600 – 2 000 kW	1.40	1.40	1.26	1.12	0.98
Wind energy > 2 000 kW	2.10	2.10	1.89	1.68	1.47
Biomass	2.30	2.30	2.07	1.84	1.61
Biogas	2.30	2.30	2.07	1.84	1.61
Ground mounted solar	4.80	3.50	3.15	2.80	2.45
Rooftop solar >100k	4.60	3.60	3.24	2.88	2.52
Rooftop solar <100k	4.40	3.0	3.33	2.96	2.59
Micro hydro power	1.20	2.00	1.80	1.60	1.40
Mini hydro power	1.20	1.60	1.44	1.28	1.12
Small hydro power	1.20	1.20	1.08	0.96	0.84

Source: International Renewable Energy Agency, Report by REMAP 2030 Renewable Energy Prospects for Ukraine, 2015.

Table 4. Biomass energy potential in Ukraine, 2013

Biomass type	Technical potential	Share of available energy production (%)	Economic potential
Cereal crops	31 Mt	30	131
Rapeseed straw	4 Mt	40	25
Maize processing waste (footstalks, leaves, heads)	40 Mt	40	129
Sunflower wastes (footstalks, heads)	21 Mt	40	50
Agricultural secondary wastes (sugar-beet pulp, sunflower husk, rise hush)	7 Mt	75	33
Woody biomass	4 Mt	90	52
Energy crops – willow, popular, miscanthus, acacia, alder)	11.5 Mt	90	184
Bioethanol	-	-	30
Biodiesel	-	-	14
Biogas from manure, food residue, sugar waste	1.6 billion m^3	50	29
Landfill gas	0.6 billion m^3	34	8
Sewage	1.0 billion m^3	23	8
Energy crops – biogas from corn silage	3.3 billion m^3	90	108
Peat	-	-	12
TOTAL			813

Source: Geletukha et al. 2013.

According to the estimates from SAEE economically feasible bioenergy potential exceeds 800 PJ/yr – equivalent to a quarter of Ukraine's TFEC. This supply potential consists half from agricultural waste and woody biomass and half from energy crops and biogas (Table 4). The resource potential of woody biomass in Ukraine amounts to 4

megatonnes (Mt) annually. It includes sawmill waste, wood-cutting waste (branches, crowns), firewood and some technical timber, which is currently exported. It is unlikely that this structure will change significantly in the near future. While there is additional forest potential, road transportation of lumber is a limiting factor for heating and power generation. More than 10 Mt of surplus straw remains in farmers' fields every year, and collecting it for use is a challenge. Most agricultural enterprises are not able to gather, bundle and adequately store straw.

Table 5. SWOT analysis of bioenergy in Ukraine

Strengths	Weaknesses
- large potential of biomass (to 25 million т. of ton of conditional fuel) - plenty of wastes and grain-crops; - availability of wood and agro industrial wastes; - high cost of traditional energy sources; - comparatively low competition in industry; - an effective instrument of support is a "green" tariff on electric power (makes 12,39 eurocents/kW·hour) produced from proceeded in energy sources, including from biomass.	- low internal consumption of products of bioenergy; - considerable volumes of products of biomass are exported as raw material (wood, rape, seed of sunflower, soy), but not as finish good of bioenergy or biofuels; - unstable deliveries and absence of long-term supply contracts for raw material for the production of biomass; - an insufficient amount of financial resources and capital investments; - seasonal deficit of supplying raw material for the production of biomass; - high cost of transport and logistic services;
Opportunities	**Threats**
- the high level of foreign market and developing internal market lift demand on bioenergy; - certification of products in accordance with the requirements of EC; - exportation of certified raw material for bioenergy and its finish goods to foreign markets; - support of participants in financing of bioenergy projects; - credit lines, technical help and pilot schemes, financed by international financial organizations; - transmission of knowledge and experience in management of biomass	- lack of legislation and absence of operating government programs and complex aims and priorities; - In Law of Ukraine "On Electroenergy" there is improper ("narrow") determination of term "biomass" (according to which biomass wastes of agriculture, forestry and industries of industry technologically related to them, and products, only are considered); - strong lobby of gas, petroleum and coal industries; - problems with the sale of electric power from biomass on the power market; - growing competition in the international market of solid biofuels (for example, the Russian manufacturers of wood fuel products); - the risks inherent in the agricultural and timber business (bad weather conditions, bad harvest of agricultural crops, a significant change in the price of cereals and raw materials for the production of biomass); - did not establish market conditions for the production and use of biodiesel and bioethanol

Source: authors' own elaboration.

In order to analyze strengths, weaknesses, opportunities and threats of biofuel market we used the SWOT analysis, which remains a classical tool of strategic planning for the development of economic models. On the basis of the SWOT analysis results one can say that the biggest strengths of the biofuel market in Ukraine are the following: potential for biomass energy production; availability of wood and agro-industrial wastes; large quantity of waste and crops; high cost of traditional energy sources.

The weaknesses include: low domestic consumption of bioenergy products; significant quantity of biomass is exported as raw materials; seasonal shortage of raw materials supply for biomass production; high cost of transportation and logistics services; state subsidizing of prices for gas and thermal energy for the population [Cabin 2013]. Regarding the

opportunities and threats of the biofuel market in Ukraine, we have observed imperfect state regulations, especially, the Law of Ukraine "On electricity" containing an incorrect ("narrow") definition of the term "biomass" [Geletukha et al. 2015]. The problems with the sale of electricity from biomass on the energy market; the introduction of additional measures and other means by the EU in order to protect domestic markets (new certification requirements, quotas etc.). However, the possibilities of this market, such as product certification according to EU requirements; export of certified raw material for the bioenergy industry and its end-up-products to foreign markets; support of the participants, financing bioenergy projects; modernization of energy infrastructure and supply of modern equipment; construction and equipment of warehouses for raw material base of biomass and its final products, allow to argue about the upcoming development of the biofuel market in Ukraine.

Conclusions

1. Ukraine has made important progress in recent years in planning the future of its energy system and developing a renewable-energy policy. By the year 2030, the increased use of renewable energy will reduce Ukraine's overall energy system costs.
2. The great potential of the Ukrainian agrarian sector could ensure not only food needs, but also could become a main source of production and accumulation of bioenergy in agro ecosystems. In this perspective it can further the increase of energy safety.

Bibliography

Cabin M.A. [2013]: Analysis of strategic planning tools. Print: "Young scientist". №11, p. 500-503.

Geletukha G.G., Zheliezna T.A. , Kucheruk P.P., Oliinyk E.N., Tryboi O.V. [2015]: Bioenergy in Ukraine: state of the art and prospects for development. Part 2. Industrial Heat Engineering, V. 37, N 3, p. 65-73. (Rus.).

Geletukha G.G., Zheliezna T.A., Oliinyk E.N., Geletukha A.I. [2013]: Prospects for production of electrical energy in Ukraine biomass. Industrial Heat Engineering, T. 35, № 6, p. 67-75.

Geletukha G.G., Zheliezna T.A. [2013]: Barriers to bioenergy development in Ukraine. Part 2 / GG Geletukha, TA Zheleznaya, Industrial Heat Engineering, T. 35, № 5, p. 43-47.

Kulyk I., 2015. Bioenergy as the Solution of Energy Crisis in Ukraine. Tokyo University of Agriculture. Tokyo.

Lakemeyer E. [2007]: Bioenergy production in Ukraine: The competitiveness of crops and other raw materials from agriculture and forestry. Institute for Economic Research and Policy Consulting. Policy Paper № 11. Kiev.

ProMarketing Ukraine [2013]: Business opportunities in the bio-based economy in Ukraine. ProMarketing Ukraine, Kiev.

Renewable energy prospects for Ukraine. Report by Remap 2030, 2015.

Royik M., Hanzhenko A., Kurulo V. [2013]: Bioenergy in Ukraine: state of the art and prospects for development // Bioenergy. № 1. C. 5–10. (Ukr.).

The law of Ukraine "On electricity" concerning stimulation of power production from alternative energy sources. [Available at:] http://zakon4.rada.gov.ua/laws/show/5485-17 [Access: November 2015].

Tebodin Ukraine CFI. 2013 Bioenergy & Biobased Opportunities in Ukraine. Market Study Food sectors in Ukraine - Part B: Biomass processing industry. Report number: 71834-B-R.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 62–70

Anna Górska[1]
Department of Agricultural Economics and International Economic Relations
Monika Krawiec[2]
Department of Econometrics and Statistics,
Warsaw University of Life Sciences – SGGW

Calendar Effects in the Market of Crude Oil

Abstract. This paper investigates calendar effects in the crude oil market using daily data over the period January 4, 2000 to December 31, 2014 for two global oil pricing benchmarks: West Texas Intermediate (WTI) and Brent. Results of performing statistical tests of equality of two means and of equality of two variances reveal the presence of both day-of-the week and month-of-the-year effects.

Key words: crude oil, WTI, Brent, day-of-the-week effect, month-of-the-year effect

Introduction

Oil is one of the newest raw materials, dating back 150 years. In the middle of the 19th Century, Americans searching for new sources of lamp oil discovered liquid petroleum. The raw material for crude oil arose from the remnants of algae and plankton, deposited on underwater seabeds as they died. Over millions of years, deoxygenation occurred, and combined with water pressure, the host rock arose. From that organic material, at depths of 1,500 meters and temperatures of 100 to 150 degrees Celsius, were the components of today's oil deposits. The light components of oil advanced up the earth's surface, and formed oil slate and oil sand [Eller and Sagerer 2008].

The term "crude oil" does not really describe any specific type of oil, but rather the generic state of oils prior their refinement. When extracted from the ground, crude oil may be a pale straw-colored liquid or a thick tar-like substance. Moreover, oil is not a homogenous product as there are about 250 different types of crude oil with different chemical characteristics. The value of crude oil lies in what can be produced from the refining process. The following products are usually produced [Schofield 2007]: gasoline, jet fuel, diesel fuel, asphalt.

Over the past 30 years oil has become the biggest commodity market in the world and has attracted a wide range of participants. They are investment banks, asset managers for mutual funds, pension funds and endowments, insurance companies, hedge funds, traditional oil majors like BP or Total, independents and physical oil traders [Geman 2007]. All those oil market participants and policy makers are interested in recognizing some patterns and anomalies in behavior of oil prices and returns. Such anomalies are calendar effects. The best known are the day-of-the-week effect and the month-of-the-year effect. Both of them are the most frequently investigated seasonal anomalies in stock markets. Studies show that Monday and Friday returns differ from returns on other weekdays: Monday returns are statistically significantly negative, whereas Friday returns are positive.

[1] Ph.D., e-mail: anna_gorska@sggw.pl
[2] Ph.D., e-mail: krawiec.monika@gmail.com

Another well-documented anomaly is the January effect. It is proved that returns on stock markets often are much higher in January than in other months. Other monthly effects are: May effect (low returns) and September effect (high returns).

Although these issues are continuously being reexamined and explored using different methodologies, most works focus on financial markets and it appears that very little attention has been paid to the calendar effects in commodity markets. The most common investigations of calendar effects in commodity markets refer to gold (see [Ball *et al.* 1982], [Ma 1986], [Coutts and Sheikh 2000], [Lucey and Tully 2006], [Yu and Shih 2011], [Qi and Wang 2013], [Górska and Krawiec 2014]), and sometimes to agricultural commodities (see [Lee *et al*. 2013] or [Borowski and Lukasik 2015]). Little work has been done on calendar effects in the crude oil market (see paper by Olowe [2010] examining the month-of-the-year effect or paper by Yu and Shih [2011] examining the weekend effect in the oil market). Our paper is an attempt to fill the gap. Its aim is to search for both weekday and month effects in the crude oil market using statistical tests of equality of two means and of equality of two variances. The paper is organized as follows: The next two sections present the data, methodology, and the results obtained. Finally, the last section provides a brief discussion and conclusions.

Data and Methodology

The empirical data covers daily closing prices of crude oil in USD per barrel from January 4, 2000 to December 31, 2014 from the Bloomberg database (www.bloomberg.com). They are displayed in Figure 1. The West Texas Intermediate (USA origin) and Brent (North West Europe origin) crude oil prices are chosen to represent the oil market as they are key global marker crudes that are used as pricing benchmarks.

During the period under consideration WTI traded between a low of \$17.45 (November 15, 2001) and a high of \$145.29 (July 3, 2008) per barrel, while Brent traded between a low of \$17.68 (November 15, 2001) and a high of \$146.08 (July 3, 2008) per barrel. In Figure 1, there are also displayed the continuously compounded daily returns of oil spot price (r_t) defined as:

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

where P_t and P_{t-1} denote the crude oil spot prices at time t and $t-1$.

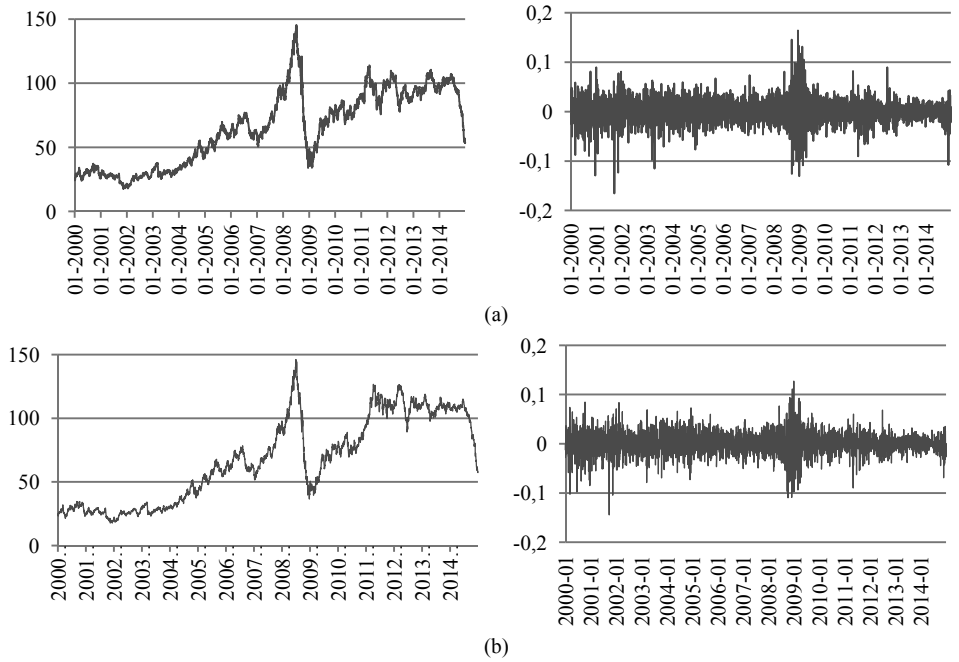


Fig. 1. Oil prices in the period from January 4, 2000 to December 31, 2014 and their logarithmic returns: WTI (a), Brent (b)

Source: own elaboration.

The simplest way to detect calendar effects is to run the test of equality of two means and to verify

H_0: $E(r_1) = E(r_2)$

against

H_1: $E(r_1) \neq E(r_2)$.

The test statistic is given by [Osińska 2006]:

$$z = \frac{\bar{r}_1 - \bar{r}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}, \tag{2}$$

where $\bar{r}_1$ is the arithmetic mean calculated for sample 1 (for example Monday returns), $\bar{r}_2$ is the arithmetic mean calculated for sample 2 (for example Tuesday returns), S_1^2 is the variance calculated for the first sample (Monday returns), S_2^2 is the variance calculated for the second sample (Tuesday returns), n_1 and n_2 are the numbers of observations,

respectively in the first and the second samples. For large samples, z-statistic follows normal distribution.

Investigating calendar effects in relation to risk is based on testing equality of two variances:

H_0: $\sigma_1^2 = \sigma_2^2$

against

H_1: $\sigma_1^2 > \sigma_2^2$.

The test statistic is given by [Witkowska *et al.* 2008]:

$$F = \frac{\max(S_1^2, S_2^2)}{\min(S_1^2, S_2^2)} = \frac{S_1^2}{S_2^2}. \tag{3}$$

The statistic has F-distribution with ($n_1 - 1$) and ($n_2 - 1$) degrees of freedom.

Results

The first part of the research aims at investigating the day-of-the week effects. In table 1, there are given values of mean and variance calculated for separate weekdays. Both, WTI and Brent exhibit negative Monday and Tuesday returns (Monday Brent return is the most negative return: -0.001701). WTI also provides negative Wednesday return. The most positive return is Friday WTI return (0.001731). The highest variance appears for WTI on Wednesday (0.000682), the lowest for Brent on Friday (0.000381).

Table 1. Means and variances calculated for separate weekdays

Weekday	WTI			Brent		
	Number of observations	Mean	Variance	Number of observations	Mean	Variance
Monday	782	-0.000943	0.000561	782	-0.001701	0.000476
Tuesday	782	-0.000624	0.000476	783	-0.000220	0.000402
Wednesday	784	-0.000042	0.000682	783	0.000243	0.000519
Thursday	782	0.000818	0.000544	782	0.001513	0.000461
Friday	782	0.001731	0.000441	782	0.001221	0.000381

Source: own calculations.

To detect the day-of-the-week effects we verify a series of hypotheses for all possible pairs of weekdays. In Table 2 there are displayed estimates of z-statistic whereas Table 3 presents estimates of F-statistic.

Table 2. Estimates of z-statistic for weekdays

Weekday	z -statistic	
	WTI	Brent
Monday-Tuesday	-0.2766	-1.3977
Monday-Wednesday	-0.7149	-1.7240
Monday-Thursday	-1.4810	-2.9363*
Monday-Friday	-2.3617*	-2.7928*
Tuesday-Wednesday	-0.4788	-0.4270
Tuesday-Thursday	-1.2627	-1.6499
Tuesday-Friday	-2.1748*	-1.4411
Wednesday-Thursday	-0.6869	-1.1347
Wednesday-Friday	-1.4801	-0.9122
Thursday-Friday	-0.8136	0.2815

Note: * indicates rejection of null hypothesis at 0.05

Source: own calculations.

Results in Table 2 demonstrate that Brent Monday returns differ significantly from Thursday and Friday returns, whereas WTI Monday and Tuesday returns are significantly different from Friday returns.

Table 3. Estimates of F-statistic for weekdays

Weekday	F -statistic	
	WTI	Brent
Monday-Tuesday	1.1791*	1.1817*
Monday-Wednesday	1.2164*	1.0921
Monday-Thursday	1.0316	1.0306
Monday-Friday	1.2720*	1.2497*
Tuesday-Wednesday	1.4342*	1.2905*
Tuesday-Thursday	1.1430*	1.1467*
Tuesday-Friday	1.0788	1.0575
Wednesday-Thursday	1.2547*	1.1254*
Wednesday-Friday	1.5472*	1.3647*
Thursday-Friday	1.2331*	1.2126*

Note: * indicates rejection of null hypothesis at 0.05

Source: own calculations.

Estimates in Table 3 show that WTI Monday variance differs significantly from Tuesday, Wednesday and Friday variances, WTI Tuesday variance differs significantly from Wednesday and Thursday variances, WTI Wednesday variance is significantly different from Thursday and Friday variances, and WTI Thursday variance differs significantly from Friday variance. Brent exhibits similar results except for Monday – Wednesday, where we cannot reject the null hypothesis.

The analogous procedures were applied to test the month-of-the-year effects. In Table 4, there are given values of mean and variance calculated for separate months. WTI and Brent exhibit September through December negative returns. The most negative is October Brent return (-0.00162), while the most positive is February WTI return (0.00252). The highest variance is December WTI variance (0.00083), the lowest is Brent July variance (0.00028).

Table 4. Means and variances calculated for separate months

Month	WTI			Brent		
	Number of observations	Mean	Variance	Number of observations	Mean	Variance
January	332	0.00071	0.00065	332	0.00101	0.00042
February	303	0.00252	0.00052	303	0.00249	0.00039
March	331	0.00096	0.00060	331	0.00066	0.00056
April	321	0.00028	0.00049	321	0.00078	0.00035
May	334	0.00058	0.00042	334	0.00080	0.00036
June	320	0.00129	0.00044	320	0.00100	0.00044
July	332	0.00049	0.00035	332	0.00056	0.00028
August	333	0.00049	0.00037	333	0.00082	0.00032
September	320	-0.00132	0.00070	320	-0.00145	0.00052
October	334	-0.00155	0.00050	334	-0.00162	0.00050
November	321	-0.00131	0.00065	321	-0.00118	0.00060
December	331	-0.00073	0.00083	331	-0.00119	0.00065

Source: own calculations.

In Table 5 there are displayed only those of 132 estimates (66 for WTI and 66 for Brent) of z-statistic that indicate rejection of null hypothesis at 0.05. Analogously, in Table 6 there are demonstrated only the estimates of F-statistic implying rejection of null hypothesis at 0.05.

Table 5. Estimates of z-statistic for months indicating rejection of null hypothesis at 0.05

Month	z-statistic	
	WTI	Brent
February - September	x	2.30829
February - October	2.27121	2.46687
February - November	1.98209	2.06311
February - December	x	2.04546

Source: own calculations.

Results in Table 5 indicate that Brent February returns differ significantly from September, October, November and December returns, while WTI February returns are significantly different from October and November returns.

Table 6. Estimates of F-statistic for months indicating rejection of null hypothesis at 0.05

Month	F-statistic	
	WTI	Brent
January - February	1.2489	x
January - March	x	1.3312
January - April	1.3167	1.2176
January - May	1.5525	x
January - June	1.4793	x
January - July	1.8645	1.4912
January - August	1.7451	1.3321
January - September	x	1.2365
January - October	1.2826	x
January - November	x	1.4255
January - December	1.2906	1.5293
February - March	x	1.4453
February - May	1.2430	x
February - July	1.4929	1.3736
February - August	1.3973	1.2270
February - September	1.3519	1.3424
February - October	x	1.2801
February - November	1.2551	1.5475
February - December	1.6119	1.6603
March - April	1.2243	1.6210
March - May	1.4435	1.5838
March - June	1.3755	1.2930
March - July	1.7337	1.9852
March - August	1.6227	1.7734
March - December	1.3880	x
April - June	x	1.2536
April - July	1.4160	1.2247
April - August	1.3254	x
April - September	1.4253	1.5056
April - October	x	1.4357
April - November	1.3232	1.7357
April - December	1.6993	1.8621
May - June	x	1.2249
May - July	1.2010	1.2534
May - September	1.6805	1.4711

(continued)

Table 6. (continued)

May - October	1.2104	1.4029
May - November	1.5601	1.6959
May - December	2.0036	1.8195
June - July	1.2604	1.5353
June - August	x	1.3715
June - September	1.6013	x
June - November	1.4866	1.3845
June - December	1.9092	1.4854
July - September	2.0183	1.8439
July - October	1.4537	1.7583
July - November	1.8737	2.1257
July - December	2.4063	2.2805
August - September	1.8891	1.6472
August - October	1.3607	1.5707
August - November	1.7538	1.8989
August - December	2.2523	2.0372
September - October	1.3883	x
September - December	x	1.2368
October - November	1.2889	1.2089
October - December	1.6553	1.2970
November - December	1.2843	x

Source: own calculations.

Although detailed results for WTI and Brent, exhibited in Table 6, are slightly different, in most cases there are similar conclusions for both of them. After selecting only those results where the null hypothesis is rejected for both WTI and Brent, we can observe that WTI and Brent January variances are significantly different from April, July, August and December variances. February WTI and Brent variances differ significantly from July, August, September, November and December variances. March WTI and Brent variances are different from April, May, June, July and August variances. April WTI and Brent variances are different from July, September, November and December variances. Then, May WTI and Brent variances are different from July, September, October, November and December variances. June WTI and Brent variances differ from November and December variances only. July and August WTI and Brent variances are different from September to December variances. Finally, October WTI and Brent variances are significantly different from November and December variances.

Concluding remarks

In this paper we examine calendar effects in the crude oil market using daily data over the period January 4, 2000 to December 31, 2014. The two global oil pricing benchmarks: West Texas Intermediate and Brent are chosen for the purpose of the research. In order to

detect calendar effects in oil daily logarithmic returns we run two basic statistical tests: the test of equality of two means and the test of equality of two variances.

The results of testing equality of two means show the existence of traditional Monday and Friday effects in oil returns. The results are different from findings of Yu and Shih [2011], who revealed a Wednesday effect in the oil market. However, their study, limited to WTI, covers a different period (January 1, 1986 to December 31, 2007) and uses different methodology (a probability distribution approach). Moreover, our results of testing equality of two means demonstrate that a January effect does not appear. Instead, a February effect occurs. These conclusions differ from those of Olowe [2010] who suggests that monthly seasonal effect is absent in the oil price return series. Again, his examination, limited to Brent, covers a different period (January 4, 1988 to May 27, 2009) and uses different methodology (GARCH models).

Tests of equality of two variances indicate a complexity of the phenomenon as significant differences between variances exist for almost all weekdays and months. It may imply that transaction risk can be affected both by the day of the week on which the deal is made and the month of the year. We believe our findings may be interesting for the actors in oil markets, including producers, refiners, financial institutions and individual traders.

References

Ball C., Torous W., Tschoegl A. [1982]: Gold and the Weekend Effect, *Journal of Futures Markets*, 2, 175-182.

Borowski K., Lukasik M. [2015]: Analysis of Selected Seasonality Effects in the Following Agricultural Markets: Corn, Wheat, Coffee, Cocoa, Sugar, Cotton and Soybeans. *Eurasian Journal of Business and Management*, 3 (2), 12-37.

Coutts J.A., Sheikh M.A. [2000]: The January Effect and Monthly Seasonality in the All Gold Index on the Johannesburg Stock Exchange 1987-1997. *Applied Economics Letters*, 7, 489-492.

Eller R., Sagerer Ch. [2008]: An Overview of Commodity Sectors. *The Handbook of Commodity Investing*, John Wiley&Sons, Hoboken, New Jersey, 681-711.

Geman H. [2007]: Commodities and Commodity Derivatives, John Wiley&Sons, Hoboken, Chichester, West Sussex.

Górska A., Krawiec M. [2014]: Analysis of Calendar Effects in Markets of Precious Metals. *Quantitative Methods in Economics,* 15 (2), 392-402.

Lee K., Hsu C., Ke M. [2013]: Testing the Monthly Effect of Agricultural Futures Markets. International Review of Accounting, Banking and Finance, 5, 35-60.

Lucey B.M., Tully E. [2006]: Seasonality, Risk and Return in Daily COMEX Gold and Silver Data 1982-2002. *Applied Financial Economics*, 16, 319-333.

Ma C. [1986]: A Further Investigation of the Day-of-the-Week Effect in the Gold Market. *Journal of Futures Markets*, 6 (3), 409-419.

Olowe R.A. [2010]: Oil Price Volatility, Global Financial Crisis and the Month-of-the-Year Effect. *International Journal of Business and Management*, 5 (11), 156-170.

Osińska M. [2006]: Ekonometria finansowa. PWE, Warszawa.

Schofield N.C. [2007]: Commodity Derivatives. John Wiley&Sons, Hoboken, Chichester, West Sussex.

Qi M., Wang W. [2013]: The Monthly Effects in Chinese Gold Market. *International Journal of Consumption Policy*, 34, 43-66.

Witkowska D., Matuszewska A., Kompa K. [2008]: Wprowadzenie do ekonometrii dynamicznej i finansowej. Wydawnictwo SGGW, Warszawa.

Yu H.C., Shih T.L. [2011]: Gold, Crude Oil And the Weekend Effect: a Probability Distribution Approach. *Investment Management and Financial Innovations*, 8 (2), 39-51.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 71–79

Michał Gostkowski[1]
Department of Econometrics and Statistics
Warsaw University of Life Sciences - SGGW
Piotr Jałowiecki[2]
Department of Informatics
Warsaw University of Life Sciences - SGGW
Agnieszka Tekień[3]
Warsaw University of Life Sciences - SGGW

Regional Diversification of Expenditure Structure in Poland: a GCA Approach

Abstract. The paper presents the results of the analysis of household expenditure structures in Poland using Grade Correspondence Analysis (GCA). Studies have shown that in the analyzed period the structure of consumer expenditure changed. The share of food and non-alcoholic beverages expenditures decreased steadily, while the share of expenses related to maintenance and household equipment, culture and recreation, or restaurants and hotels steadily increased. Further studies have shown that the structure of consumer expenditures in Poland is diversified regionally. The greatest variation occurs between the north-eastern region voivodeships and the central region/south-west voivodeships.

Key words: Grade Correspondence Analysis, expenditure structure, clustering, overrepresentation maps, Grade Stat, Poland

Introduction

From the economic perspective, consumption is described as a process of satisfying human needs, which is closely related to socio-economic development. In addition, consumption plays an important role as a stimulator of economic growth and social development [Świetlik 2012]. The impact of consumption on the country's economic activity is quantified in the System of National Accounts as a component of the Gross Domestic Product (GDP) [Begg et al. 2007]. In Poland, the share of private consumption in the structure of GDP is around 60% [Świetlik 2012].

Household incomes are one of the most important factors determining the level and the structure of consumer spending [Dudek et al. 2012]. In recent years, consumption in Polish households was characterized by constant changes and fluctuations. The increase in household income led to spending increases on consumption goods like food and non-food items, while the share of food expenditures in total expenditures decreased [Badach 2012]. Besides income levels there are also other important non-economic factors like: demographic, social, cultural or psychological factors [Utzig 2013]. The main objective of this study was to identify changes in the structure of consumer expenditures in Polish households during the period from 1999 to 2012. The secondary objective was to verify

[1] MSc, e-mail: michal_gostkowski@sggw.pl
[2] PhD, e-mail: piotr_jalowiecki@sggw.pl
[3] MSc, e-mail: agnieszka.tekien@gmail.com

whether the structure of consumer expenditure in Polish households is regionally diversified.

Data

This study analyses the changes in the household expenditures structure in Poland over the period from 1999 to 2012. Data provided by the Central Statistical Office in Statistical Yearbooks of the Regions were used in the study. Expenditures refers to average monthly household expenditures per capita [4].

Household expenditures were divided into groups according to the classification of expenditures based on COICOP/HBS[5] [GUS 2011]. Twelve groups of expenditures were established: food and non-alcoholic beverages (FOOD), alcoholic beverages, tobacco and narcotics (ALCO), clothing and footwear (CLOTH), housing, water, electricity, gas and other fuels (HOME), furnishings, household equipment and routine maintenance of the house (EQUIP), health (HEALTH), transport (TRAN), communication (COMMU), culture and recreation (CULT), education (EDUC), restaurants and hotels (HOTE), miscellaneous goods and services (OTHER).

Methodology

The method used in the studies was Grade Correspondence Analysis (GCA) [Kowalczyk et al. 2004, Szczesny et al. 2012]. Grade Correspondence Analysis is an original method of data mining developed and supported at the Institute of Computer Science of the Polish Academy of Sciences. A wide variety of tools and software to support data analysis can be found at http://gradestat.ipipan.waw.pl/. An important feature of GCA is the fact that the GCA does not build a new synthetic measure but takes into account the original structure of the phenomenon.

To compare the structure of expenditures the concentration curve was used. The concentration distribution curve $\mathbf{q} = (q_1, ..., q_k)$ relative distribution $\mathbf{p} = (p_1, ..., p_2)$ is a polygonal chain in a unit square that connects the points (0, 0), (p_1, q_1), $(p_1 + p_2, q_1 + q_2)$, ..., $(p_1 + ... + p_k, q_1 + ... + q_k) = (1, 1)$. The slope of the next segments of the polygonal chain to the x-axis determines the quotient q_i/p_i (the slope of the corresponding line). Quotients q_i/p_i can run freely. The concentration curve is obtained after moving coordinate vectors **q** and **p** so that successive quotients are non-decreasing – this is called the maximum concentration curve, whereas the corresponding concentration ratio is called the index of the maximum concentration ar_{max} [Binderman et al. 2010].

Ar concentration ratio is equal to twice the difference of two squares limited concentration curve and the diagonal system: located below and above the diagonal. Formally, this can be written as [Borkowski et al. 2009]:

[4] It should be stressed that data reliability depends on the accuracy of data, methods of data collection and data availability.

[5] COICOP-HBS is Classification of Individual Consumption by Purpose Adapted to the Needs of Household Budget Surveys.

$$ar = 2\int_0^1 (u - C(u))du, \tag{1}$$

where *C(u)* is a function describing the concentration curve.

Ar_{max} concentration ratio and concentration curve are fundamental tools of Grade Correspondence Analysis. Grade Correspondence Analysis belongs to the exploratory data analysis (data mining) and is perfectly compatible with the variables measured on different scales [Ząbkowski and Szczesny 2012, Zmarzłowski and Koszela 2013]. GCA algorithm aims to get such set of rows and columns in a Table P where all indicators *ar* are equal to ar_{max}. It should be noted that maximizing *ar* per pair of variables reduces the value of *ar* for the other pairs of variables. Therefore GCA algorithm aims to ensure that the achieved indicators were as close as possible to ar_{max}. For this purpose the GCA reorders the rows and columns of the table with *m* rows and *k* columns to maximize the Spearman rank correlation coefficient ρ^* at each step:

$$\rho^* = 3\sum_{i=1}^{m}\sum_{s=1}^{k}(p_{is}(2S_{row}(i)-1)(2S_{col}(s)-1)), \tag{2}$$

where: $S_{row}(i) = \left(\sum_{j=1}^{i-1} p_{j+}\right) + \frac{1}{2}p_{i+}$,

$S_{col}(s) = \left(\sum_{y=1}^{s-1} p_{+t}\right) + \frac{1}{2}p_{+s}$,

$p_{j+} = \sum_{s=1}^{k} p_{js}$,

$p_{+t} = \sum_{t=1}^{m} p_{ts}$.

A very important property of the GCA is that the algorithm also sets similar rows (columns) close to each other. Similar rows (columns) always occupy contiguous space in optimal permutation. Moreover, maximization of the ρ^* ratio is equivalent to the maximum variation of these regressions. In other words, when setting the GCA data table, the rows and columns are always sorted by their similarity. Furthermore, the similarities are as varied between them as it is possible.

An important advantage of this method compared to commonly known methods of cluster analysis [Ostasiewicz 1999, Zeliaś 2000] is the simultaneous presentation of features and facilities in overrepresentation maps (Figure 1). The idea is to show the various structures on the background of the structure average. To create an overrepresentation map in the first step, based on the standardized table *P*, h_{ij} overrepresentation indexes are determined for each table cell:

$$h_{ij} = \frac{p_{ij}}{p_{i+}p_{+j}} \tag{3}$$

The overrepresentation index indicates the extent to which the observed value differs from that which would be expected from ideal proportionality distribution (i.e. when there exists no relationship between rows and columns). For such a set of overrepresentation

indicators a map showing a degree of data representation can be created. With a few shades of gray areas of underrepresentation, the ideal representation and overrepresentation of the data can be identified. In the paper the areas are identified as follows:

- value below 0.8 indicates a strong underrepresentation,
- value in the range of 0.8-0.98 determines there is poor underrepresentation,
- a value in the range of 0.98-1.02 is an ideal representation,
- value in the range of 1.02-1.2 determines there is poor overrepresentation,
- value greater than 1.2 means a strong overrepresentation.

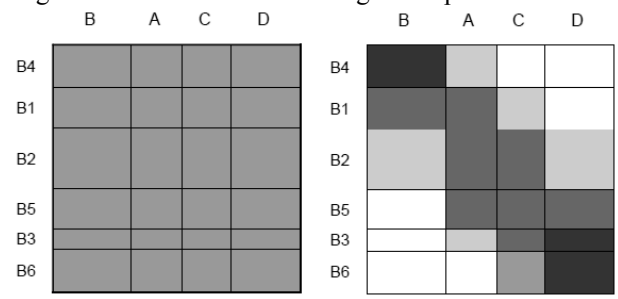


Fig. 1. Examples of overrepresentation maps in the absence of the relationship between the rows and columns (left) and otherwise (right).

Source: Own research.

Results

In the first stage of the study using the method GCA, an overrepresentation map of Poland was created showing the structure of expenditures in the years 1999-2012 (Figure 2). Factors determining the division (or assignment) were average monthly household expenditures per capita.

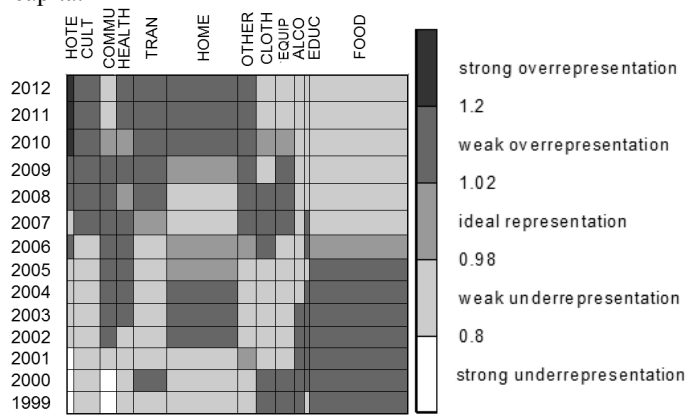


Fig. 2. Overrepresentation map for average monthly expenditure on consumer goods and services per person in Poland.

Source: own research based on Statistical Yearbook of the Regions1999-2012.

As was mentioned earlier, one of the advantages of the GCA algorithm is setting similar columns (rows) close together. Analyzing the overrepresentation map (presented on Figure 2) it can be seen that on the left side of the array were expenditures related to restaurants and hotels, culture and recreation and communication. It can be argued that these are expenses that occur at higher levels of income and can be described as luxury goods [Gostkowski & et al. 2014]. On the other side there are expenses related to food and non-alcoholic beverages, education and alcoholic beverages, tobacco and narcotics. It is quite remarkable that the structure of food and non-alcoholic beverages consumption is similar to the structure of education as well as to alcoholic beverages, tobacco and narcotics, however expenditures on alcoholic beverages, tobacco and drug-specific products may be underestimated by households, which may be reflected in the results. It also should be mentioned that the education group includes only education tuition fees in schools and kindergartens; all the expenses such as purchasing textbooks and school supplies are in the recreation and culture group.

It can also be concluded that the overrepresentation map (Figure 2) can indicate the years 2005-2006 as a key moment of change in the expenditure structure.

Additionally, in order to illustrate the changes in the structure of expenditures in individual voivodeships overrepresentation maps for four deliberately selected periods were created: 1999, 2004, 2008 and 2012 (Figure 3-6).

Based on the information presented in the graphs (Figures 3-6, Table 1) it can be stated that the structure of Polish household expenditures in the analysed period has changed. The largest share of expenditures was allocated to food and non-alcoholic beverages, but from period to period it has systematically decreased. On this basis, the First Engel's Law, which states that an increase in consumer income leads to a decrease in percentage of food expenditures among total consumer expenditures has been confirmed.

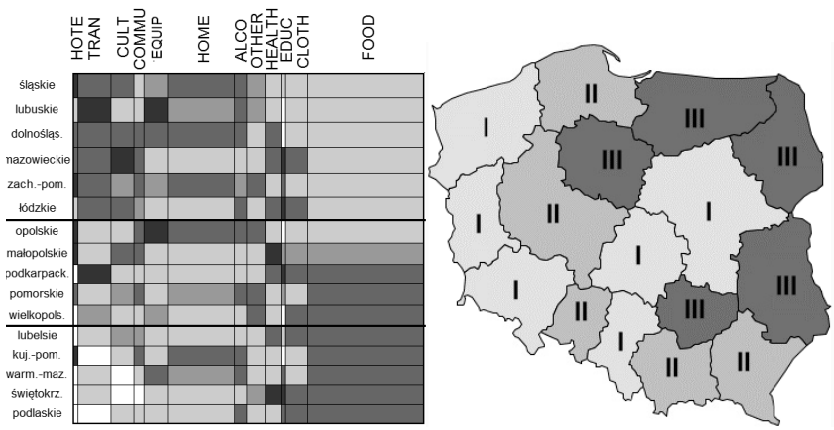


Fig. 3. Overrepresentation map for average monthly expenditure on consumer goods and services per person in each voivodeship in 1999 (left) and Polish territorial map showing the distribution (right).

Source: own research based on Statistical Yearbook of the Regions 1999.

The subsequent expenditure groups characterized by the highest shares were housing, water, electricity, gas and other fuels and those related to transport. Moreover, furnishings, household equipment and routine maintenance expenditures in the final period of the study

were overrepresented, which can be explained by a systematic price increase in various energy sources (Figure 2, Table 1). Additionally, a systematic increase in the share of expenditures on recreation and culture, restaurants and hotels is noticed. Similar changes were observed in the work of Kuśmierczyk and Piskiewicz [2012] about changes in the expenditure structure in European Union countries. The lowest shares in total expenditure are alcoholic beverages, tobacco and narcotics and those related to education (Figure 2).

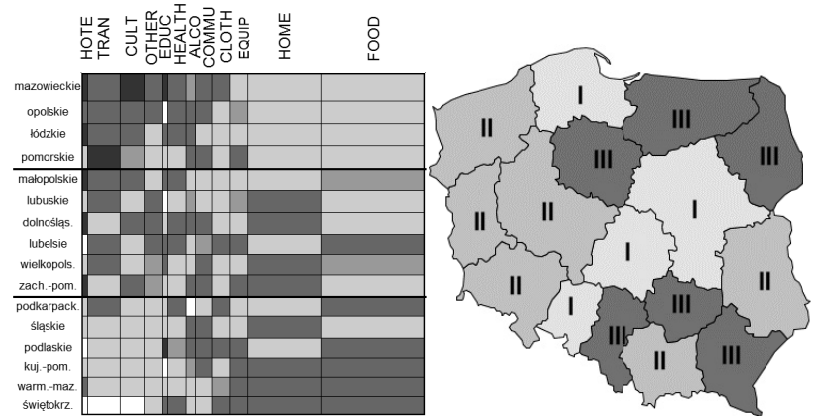


Fig. 4. Overrepresentation map for average monthly expenditure on consumer goods and services per person in 2004 (left) and Polish territorial map showing the distribution (right).

Source: own research based on Statistical Yearbook of the Regions 2004.

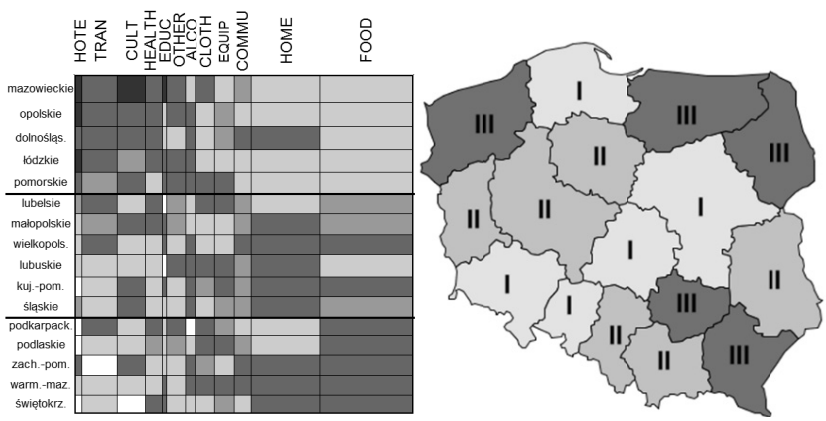


Fig. 5. Overrepresentation map for average monthly expenditure on consumer goods and services per person in 2008 (left) and Polish territorial map showing the distribution (right).

Source: own research based on Statistical Yearbook of the Regions 2008.

Further study leads to the conclusion that the differentiating factor in the expenditure patterns of individual voivodeships is the income situation of households. Typically, the poorest households spend most of their income for basic needs (expenditures on food and non-alcoholic beverages and solid counter charges like energy, water, etc.), resulting in overrepresentation compared to other expenses groups [Dudek et al. 2012].

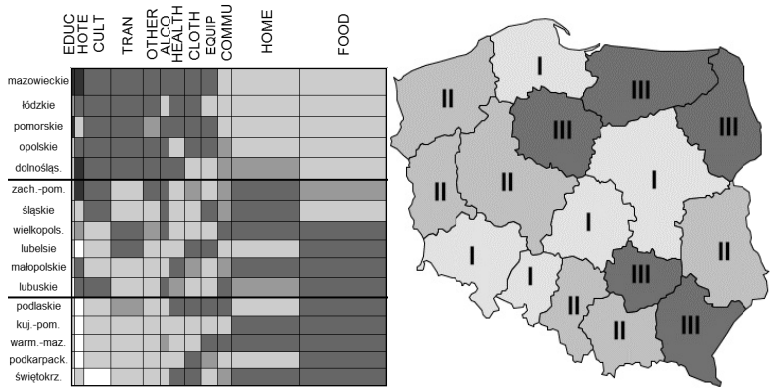


Fig. 6. Overrepresentation map for average monthly expenditure on consumer goods and services per person in 2012 (left) and Polish territorial map showing the distribution (right).

Source: own research based on Statistical Yearbook of the Regions 2012.

Based on the information presented above it can be concluded that the structure of consumer spending is regionally diverse (Figure 6). With the use of the GCCA[6] algorithm, three focus areas (groups) were established containing regions characterized by similar expenditure structures. In the third analyzed focus group **(**Group III) were the eastern and northern voivodeships (Podlaskie, Kujawsko-Pomorskie, Warmińsko-Mazurskie, Podkarpackie, Świętokrzyskie). They are primarily characterized by expenditure overrepresentation in food and non-alcoholic beverages, housing, water, electricity, gas and other fuels. All of them are expenses related to satisfying basic needs. Three voivodeships (Warmińsko-Mazurskie, Podlaskie and Świętokrzyskie) belonged to focus Group III in all the analyzed periods. The other two provinces in earlier periods changed their affiliation.

Table 1. Growth rate of expenditures on particular groups (2012/1999) and the average annual pace rate of expenditures in each group in Poland.

Expenditure group	Growth ratio	Average annual rate of change
food and non-alcoholic beverages	0,99	-0,11%
alcoholic beverages, tobacco and narcotics	1,05	0,36%
clothing and footwear	0,99	-0,09%
housing, water, electricity, gas and other fuels	1,36	2,36%
furnishings, household equipment and routine maintenance of the house	0,93	-0,53%
health	1,42	2,75%
transport	1,29	1,97%
communication	1,76	4,44%
culture and recreation	1,47	3,03%
education	1,09	0,63%
restaurants and hotels	2,52	7,37%
miscellaneous goods and services	1,26	1,77%

Source: own research based on Statistical Yearbook of the Regions 1999-2012.

[6] GCCA (Grade Correspondence Cluster Analysis) is the GCA with posterior clustering

In the second area were voivodeships from north-western and southern regions (ie. Lubuskie, Wielkopolskie, Zachodniopomorskie, Małopolskie and Śląskie). These voivodeships were characterized by a very diversified structure of consumer spending. In the first group were voivodeships from the central and south-western regions (ie. Mazowieckie, Łódzkie, Dolnośląskie, Opolskie) and the Pomorskie voivodeship). The income situation of households in this concentration is better when compared to other clusters, because there is overrepresentation of expenditures for expenses unrelated to the satisfaction of basic needs (eg. culture and recreation, restaurants, and hotels).

The division obtained in the analysis may reflect regional differences in consumption patterns mainly determined by the economic situation of the voivodeships. In order to confirm this finding we made a suitable map (Figure 7). Analyzing the map of Poland (Figure 7). it can be stated that provinces qualified to the first focus area are characterized by a relatively higher level of GDP *per capita*. In contrast, in the third focus area were voivodeships where the values of GDP *per capita* are lower. Exceptions are the Lublin and Opole voivodeships, which despite the relatively lower values of GDP *per capita* were selected to the second focus area.

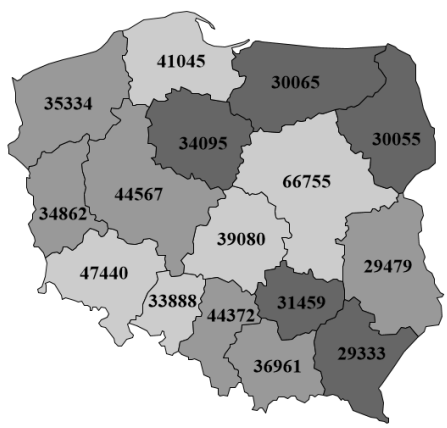


Fig. 7. The map of Poland with applied divisions, created using the GCCA for the year 2012. The values in the graph represent the level of GDP per capita in 2012 in current prices.

Source: own research based on Gross Domestic Product Regional Accounts in 2012.

Summary and Conclusions

Based on the analysis of results presented in the paper, it can be concluded that in the period from 1999 to 2012. the Polish household expenditure structure changed significantly. The largest share of expenditures went for food and non-alcoholic beverages, but over the years, share as a percent of total expenditures for this group shares are in continuous decline. On this basis, it can be stated that the First of Engel's Law has been confirmed. Further studies confirmed the growing share of expenses related to the maintenance and household equipment - which may be the result of rising prices. In addition, studies have shown a growing share of expenditures for culture and recreation, as well as for restaurants and hotels. This may mean that the situation of Polish households

during the period has improved. Obviously this is a preliminary conclusion and requires further study for confirmation.

In addition to changes in the structure of expenditures the analysis showed that in Poland there are regional differences in the structure of consumer expenditures. Differences in the structure of consumer expenditure are most visible between voivodeships from the first and third focus areas. The third focus group includes the voivodeships where expenditures related to the satisfying of basic needs (food and non-alcoholic beverages and solid counter charges) were overrepresented. On the other hand, the first focus area includes voivodeships characterized by a structure of expenditures with overrepresentation of expenditures related rather to higher needs (eg. culture and recreation, restaurants, hotels). Further studies have shown that the structure of expenditures in individual voivodeships may be determined by the economic situation of the voivodeship (Figure 7).

The study also showed that Grade Data Analysis (GCA) and its extension (GCCA) are proper tools for the analysis of structural changes in consumer expenditure. This method can be useful for identifying expenditure patterns, identification of trends and, as a consequence, in planning marketing campaigns and estimating the GDP structure.

References

Badach E. [2012]: Zastosowanie metod statystycznej analizy wielowymiarowej do badania struktury wydatków gospodarstw domowych. *Metody Ilościowe w Badaniach Ekonomicznych* XIII(1). Warszawa.

Begg D., Fischer S., Dornbush R. [2007]: Makroekonomia. Polskie Wydawnictwo Ekonomiczne, Warszawa.

Binderman Z., Borkowski B., Szczesny W. [2010]: Metody wizualizacji danych w analizie zmian poziomu i profilu konsumpcji w krajach UE. *Roczniki Nauk Rolniczych* SERIA G, T. 97(3).

Borkowski B., Dudek H., Szczesny W. [2009]: Spatial Differentiation of Food Production Structure and Consumption Profile in Enlarged European Union. *Journal of Economic Asymmetric* 5(2).

Dudek H., Koszela G., Landmesser J. [2012]: Wpływ sytuacji dochodowej na strukturę wydatków gospodarstw domowych. Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie, *Ekonomika i Organizacja Gospodarki Żywnościowej* 97.

Główny Urząd Statystyczny [2011]: Metodologia badania budżetów gospodarstw domowych. Warszawa.

Gostkowski M., Gajowniczek K., Jałowiecki P. [2014]: Elastyczność dochodowa popytu na poszczególne grupy dóbr konsumpcyjnych w Polsce w latach 1999-2008. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu* XVI(3).

Kowalczyk T., Pleszczeńska E., Ruland F. [2004]: Grade Models and methods for data analysis. Springer, Berlin.

Kuśmierczyk K., Piskiewicz L. [2012]: Konsumpcja w Polsce na tle pozostałych krajów Unii Europejskiej. *Konsumpcja i Rozwój* 2.

Ostasiewicz W. [1999]: Statystyczne Metody Analizy Danych. Wydawnictwo Akademii Ekonomicznej im. Oskara Langego, Wrocław.

Świetlik K. [2012]: Konsumpcja jako czynnik wzrostu PKB w Polsce. *Konsumpcja i Rozwój* 1.

Szczesny W., Kowalczyk T., Wolińska-Welcz A., Wiech M., Dunicz-Sokolowska A., Grabowska G., Pleszczyńska E., [2012]: Models and Methods of Grade Data Analysis: Recent Developments, Institute of Computer Science Polish Academy of Sciences, Warszawa

Utzig M. [2013]: Regionalne zróżnicowanie konsumpcji i dochodów gospodarstw domowych w Polsce. Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu XV(2).

Ząbkowski T., Szczesny W. [2012]: The survey of the offer attractiveness of Internet access via Grade Correspondence Analysis. *Quantitative Methods in Economics* XIII(3).

Zeliaś A. [2000]: Taksonomiczna analiza przestrzennego zróżnicowania poziomu życia w Polsce w ujęciu dynamicznym. Akademia Ekonomiczna, Kraków.

Zmarzłowski K., Koszela G. [2013]: Czynniki różnicujące spożycie wyrobów spirytusowych w polskich gospodarstwach domowych w latach 1999-2008. *Metody Ilościowe w Badaniach Ekonomicznych* XIV(3).

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 80–88

Małgorzata Just[1], Magdalena Śmiglak-Krajewska[2]
Department of Finance and Accounting,
Poznań University of Life Sciences

Extreme Price Risk on the Market of Soybean Meal[3]

Abstract. The price of soybean meal in Poland is related with the price quoted on the Chicago Board of Trade (CBOT). The aim of this study was to assess and compare extreme price risk on the market of soybean meal in Poland and on the market of futures contracts for soybean meal and soybean, quoted on the CBOT. For this purpose analyses were conducted on daily price series for soybean meal ex quay port of destination Gdynia as well as historical time series for daily closing quotes for futures contracts for soybean meal and soybean at the CBOT, from 23 February 2012 to 8 July 2015. Extreme risk was assessed using two measures: value at risk and expected shortfall, applying the extreme value theory. Results of analyses indicate a higher level of extreme price risk on the market of futures contracts for soybean meal and soybean. For both contracts we observe an asymmetry of the risk profile for the long and short positions in these contracts. No marked asymmetry in the risk profile was observed on the market of soybean meal in Poland.

Key words: soybean meal, futures contracts for soybean meal, extreme value theory, extreme price risk, value at risk, expected shortfall, Poland

Introduction

Since the beginning of the 21st Century, we have been observing an increase in world prices for oil seeds, including soybean and its processing products. This is caused by the growing competition on the market of oil raw materials between the food and biofuel sectors among main importers (China, EU, India). These prices undergo huge fluctuations caused by variation in yields, fluctuations of USD exchange rates in relation to other currencies and speculation in the financial markets [Rosiak 2014]. Fluctuations in prices are also significantly influenced by the increasing demand for high-protein raw materials generated by the development of animal production, as well as the crisis caused by BSE and the related ban on the use of meat and bone meal in animal feeding, introduced in many countries. At a high and constantly increasing share of soybean meal in the total ground grain meal production, the world market for protein concentrates is becoming increasingly dependent on soybean [Dzwonkowski, Bodył 2014]. The price for Hi-Pro soybean meal (a by-product of oil extraction from GM soybean) in Poland is connected with the CBOT price. The price ex quay Gdynia for Hi-Pro soybean meal comprises the CBOT quote price plus CIF (cost of transport, cost of loading and unloading, storage, insurance, etc.).

Currently in Poland, soybean meal is the basic component of balanced feeds for poultry and pigs. To meet its feed demand Poland imports annually approx. 2 million tons of GM soybean meal. On the feed market standardised soybean meals are available, with

[1] PhD, e-mail: m.just@up.poznan.pl
[2] PhD, e-mail: smiglak@up.poznan.pl
[3] The publication was prepared as part of the Research Area 5 "The economic conditions of the development of production, infrastructure, market and turnover system and the profitability of using legumes for feeds in Poland", the long-term programme: "The improvement of the domestic sources of vegetable protein, their production and use in feeds".

crude protein content of 42, 44 or 48%. Soy protein is readily available and its amino acid composition is advantageous from the point of view of animal nutrition. However, it is an expensive protein component, thus in feeds for older animals it may be replaced by other components, e.g. rapeseed meal, cake, seeds of native legumes or oil crops and extracts [Zaworska, Kasprowicz-Potocka 2014]. In the Amended Act on Animal Feeds, from 1 January 2017, a ban will be introduced in animal nutrition on the use of genetically modified feed and genetically modified organisms for fodder purposes [Act on Animal Feeds 2006]. It is estimated that after the Act enters into force, banning the use of feeds from genetically modified plant production, costs of poultry meat will increase by 10-15% and egg prices will increase by approx. 10-12%. Implementation of the ban on the use of GM soybean in feed production and animal nutrition will greatly diversify prices. At present, in Poland over 77% of feed protein are imported and only approx. 23% are produced in Poland. A similar problem is observed in the entire European Union, where almost 70% of protein feeds are duty-free imports, mainly from North America [Zaworska, Kasprowicz-Potocka 2014]. As much as 80% of world soybean production originates from three countries: the USA, Brazil and Argentina. China is a definite leader in the production of soybean meal, with its production increasing 3.5-fold over the last 12 years (from 15.6 million to 51.5 million tons in the season of 2012/13), with approx. 75% of meal produced from imported seed. The USA is the second largest soybean meal producer, with the annual production of approx. 35 million tons. Argentina and Brazil are also leading soybean meal producers – within the last three years the production of soybean meal was 26-27 million tons each, with greater dynamics in recent years observed for its production in Argentina. This is connected with the dynamic development of GM soy production, as well as the state policy promoting exports of processed products (lower export taxes on oil and soybean meal than on soybean seeds) [Dzwonkowski, Bodył 2014].

According to the United States Department of Agriculture (USDA), in 28 EU countries the demand for soybean meal in the season of 2014/2015 lasting till the end of September, in comparison to the previous season, will increase to 29.74 million tons, i.e. by 7% (by 1.3 million ton). Over a successive time period from October 2015 to September 2016 the demand for soybean meal in the EU will increase by another 800 thousand tons (by 3%) to 30.54 million tons. Demand for soybean meal will also increase in the USA and Brazil. In the season of 2014/2015 in the USA it will amount to 28.21 million tons, to increase in the season of 2015/2016 to 29.03 million tons. In turn, in Brazil demand is expected to reach 14.98 million tons and 15.45 million tons, respectively. The increase in the world production of soybean meal in the season of 2014/2015 is forecasted to be 13.16 million tons (by 7%) to 202.63 million tons and in the season of 2015/2016 the world production is expected to be 211.0 million tons [www.farmer.pl].

The observed changes in price trends on the soybean market have a critical effect on the stability of economic conditions, operations of enterprises involved in processing of this raw material as well as producers in the agri-food sector. Fluctuations of market prices increase exposure of all these entities to price risk, and thus influence the stability of their income. The aim of this paper is to assess and compare extreme price risk on the market of soybean meal in Poland and on the market of futures contracts for soybean meal and soybean quoted on the CBOT. Extreme risk was measured based on quantile measures of risk, i.e. value at risk and expected shortfall. These measures were determined applying the extreme value theory. A review of studies, in which the extreme value theory was used to

measure risk on agricultural commodity markets, is presented in [Morgan, Cotter and Dowd 2012; Van Oordt, Stork and De Vries 2013].

Material and research method

Empirical studies were conducted using daily price series for Hi-Pro soybean meal ex quay Gdynia [www.agrolok.pl] and historical time series for CBOT daily closing quotes of futures contracts for soybean meal and soybean [www.stooq.pl] for the period from 23 February 2012 to 8 July 2015. The time series of daily closing quotes of futures contracts were created based on the most active series of contracts. Analyses were conducted on prices of Hi-Pro soybean meal expressed in USD/t and PLN/t. On the basis of soybean meal prices and prices of futures contracts for soybean meal and soybean daily logarithmic percentage increments (rates of return) were calculated according to the formula: $r_t = 100\ln(P_t / P_{t-1})$, where P_t denotes the price of a commodity or a futures contract for a commodity in period t.

Extreme price risk on the market of soybean meal and soybean was estimated based on two quantile risk measures, belonging to the group of downside risk measures: value at risk and expected shortfall. These measures were determined based on the extreme value theory.

Downside risk measures are used to measure risk in the negative concept and they measure potential loss. The most frequently applied measure of risk is Value at Risk (VaR). It is defined as such a volume of loss in the value of investment (a financial instrument, commodity or the entire portfolio) that the probability of its occurrence or exceedance within the assumed period of time is equal to the pre-specified level of tolerance. Formally VaR is presented as [Jajuga et al. 2001]:

$$P(P_t \leq P_{t-1} - VaR) = \alpha, \tag{1}$$

where: P_t – value of an investment, instrument, commodity in period t, α – assumed level of tolerance. Loss may also be determined in percent, which makes it possible to compare risks. If r_t denotes a logarithmic percentage rate of return from an instrument, commodity in period t, VaR is defined according to the formula:

$$P(r_t \leq -VaR) = \alpha. \tag{2}$$

VaR for the long position in a financial instrument or commodity generating a loss, when the price of this instrument or commodity decreases, for the level of tolerance α is an opposite number to the quantile of the distribution of returns:

$$VaR_{\alpha,t+1} = -F_{r_t}^{-1}(\alpha), \tag{3}$$

where: $F_{r_t}^{-1}(\alpha)$ is a α -quantile of the distribution of returns r_t. For the short position in a financial instrument or commodity, generating losses, when the price of this instrument or commodity increases, it is a $1-\alpha$ -quantile of the distribution of returns r_t:

$$VaR_{1-\alpha,t+1} = F_{r_t}^{-1}(1-\alpha). \tag{4}$$

However, value at risk does not specify how big losses may be when they exceed value at risk. Expected Shortfall (ES) is a measure of risk informing on the volume of these losses. This measure is defined as the expected value of loss on condition the loss is greater than value at risk.

Tools for the assessment of extreme risk are supplied by the Extreme Value Theory (EVT). Two approaches are used in this theory to model extreme values. The first approach is based on the Block Maxima Model (BMM), estimating the distribution of extremes. The other approach is applied more frequently and it is based on the Peaks over Threshold Model (POT), estimating the tail of the distribution of returns. The tail of the distribution of returns is modeled using the Generalized Pareto Distribution (GPD), while the beginning of the tail is specified by the determination of the threshold value. Modeling only tails of distribution and not the entire distribution facilitates a more accurate estimation of tails of distribution. The POT model makes it possible to present analytically VaR and ES measures.

In the Peaks over Threshold model [McNeil 1999; Morgan, Cotter and Dowd 2012] the starting point for consideration is provided by the conditional distribution of peaks of the random variable X of a certain threshold value u defined according to the formula:

$$F_u(x) = P(X-u \le x \,|\, X > u) = \frac{F(x+u)-F(u)}{1-F(u)}, \tag{5}$$

where: F is an unknown distribution function of random variable X. According to the Pickands-Balkema-de Haan theorem, for a sufficiently large u the distribution function F_u has a limiting distribution, which is a generalized Pareto distribution with the distribution function:

$$G_{\xi,\beta}(x) = \begin{cases} 1-(1+\xi x/\beta)^{-1/\xi}, & \xi \neq 0 \\ 1-\exp(-x/\beta), & \xi = 0 \end{cases}, \tag{6}$$

where: $\beta > 0,\ x \ge 0$ for $\xi \ge 0$ and $0 \le x \le -\beta/\xi$ for $\xi < 0$. This distribution has two parameters: β – the scale parameter, ξ – the shape parameter determining the thickness of the tail. Positive values of the shape parameter denote the occurrence of thick (heavy) tails, which is connected with an increased probability of extreme returns. In turn, negative values of the shape parameter mean that the distribution has thinner tails than the normal distribution. Most typically parameters of the distribution function for the Pareto distribution is estimated using the maximum likelihood method. This estimation requires a selection of a threshold value u, which affects the obtained values of estimators. An

excessive high threshold value u will result in few observations exceeding threshold u, which will be manifested in high variance, while a too low value will cause a great estimator bias. From formulas (5)-(6) we obtain the distribution function of variable X:

$$F(x) = (1 - F(u))G_{\xi,\beta}(x-u) + F(u), \; x > u. \tag{7}$$

Next we replace value $F(u)$ with an empirical estimator $\hat{F}(u) = 1 - N_u / n$, where n is the number of observations and N_u is the number of exceedances u. Then we obtain the following estimator of the distribution function F:

$$\hat{F}(x) = 1 - \frac{N_u}{n}\left(1 + \hat{\xi}\frac{(x-u)}{\hat{\beta}}\right)^{-1/\hat{\xi}}. \tag{8}$$

After x is determined from equation (8), VaR may be noted for the short position using the following formula:

$$VaR_{1-\alpha} = u + \frac{\hat{\beta}}{\hat{\xi}}\left(\left(\frac{n}{N_u}\alpha\right)^{-\hat{\xi}} - 1\right), \tag{9}$$

where: α is the level of tolerance for VaR. In order to determine VaR for the long position, calculations need to be made for rates of return multiplied by minus one.

Using the Peaks over Threshold model we may also present expected shortfall for the short position using the formula [McNeil 1999; Morgan, Cotter and Dowd 2012]:

$$ES_{1-\alpha} = \frac{VaR_{1-\alpha}}{1-\hat{\xi}} + \frac{\hat{\beta} - \hat{\xi}u}{1-\hat{\xi}}. \tag{10}$$

Results

In the first stage of the study the series of logarithmic percentage increments were prepared for prices of soybean meal (SM_PLN, SM_USD) and futures contracts for soybean meal (SM_F) and soybean (S_F). Descriptive statistics of the generated series and values of the Jarque-Bera test are presented in Table 1. Arithmetic means for logarithmic increments for prices of soybean meal and futures contracts for soybean meal and soybean were close to zero and did not differ significantly from zero at the 5% significance level (*t*-test). The greatest volatility, measured by the range and standard deviation, was found for logarithmic increments for prices of futures contracts for soybean meal, which indicates their strong dynamics. Logarithmic increments for prices of soybean meal showed a lower level of volatility than logarithmic increments for prices of futures contracts for soybean meal and soybean. In the next stage of the study it will be verified whether levels of extreme price risk also vary. Skewness was not statistically significant at the significance level of 5% for logarithmic increments for prices of soybean meal (the D'Agostino test). Negative skewness was observed for logarithmic price increments of futures contracts for soybean meal and soybean. This indicates an asymmetry in the risk profile for the short and

long positions in these contracts. In the case of all analysed series of logarithmic price increments the values of kurtosis were significantly greater than three at the significance level of 5% (the Anscombe-Glynn test). This shows that the distributions of price increments for soybean meal, contracts for soybean meal and soybean had thick tails. This means that extreme values in the increment series appear more frequently than in the normal distribution. Moreover, values of kurtosis for logarithmic increments for prices of futures contracts for soybean meal and soybean were much greater than those of kurtosis for logarithmic increments for prices of soybean meal. The hypothesis on the normal distributions for the analysed logarithmic price increments was rejected based on the Jarque-Bera test. Thus it is advisable to model logarithmic increments of the analysed prices using distributions including thick tails and skewness.

Table 1. Descriptive statistics of logarithmic increments for prices and values of the Jarque-Bera test (J-B) for soybean meal, futures contracts for soybean meal and soybean

Statistics	SM_PLN	SM_USD	S_F	SM_F
Maximum	6.02	5.99	5.23	5.47
Minimum	-4.89	-4.41	-12.54	-16.23
Mean	0.0211	-0.0031	-0.0294	0.0034
Standard deviation	1.32	1.27	1.40	1.78
Skewness	-0.01	0.08	-1.06	-1.02
Kurtosis	4.47	4.94	11.24	11.91
J-B	73.30	128.83	2560.30	2957.99

Source: the authors' calculations.

Since the price of soybean meal in a Polish port is composed of the CBOT price plus CIF (cost of transport, cost of loading and unloading, storage, insurance, etc.), dependencies between these prices were also investigated. The Granger causality was also verified. Changes in prices of futures contracts for soybean meal are Granger causes for changes in prices of soybean meal in PLN ex quay a port in Poland (the Granger test with the Wald statistic: 190.27, lag order 1, the series stationarity required in the Granger test was found using an augmented Dickey-Fuller test). This means that increments in prices of soybean meal ex quay a Polish port may be more accurately forecasted if we include the appropriately lagged increments in prices of CBOT contracts for soybean meal. Values of Pearson's linear correlation coefficients for logarithmic increments for prices for soybean meal ex quay Gdynia (SM_PLN, SM_USD) and logarithmic increments for prices of CBOT futures contracts for soybean meal (SM_F_C) are presented in Table 2.

Table 2. Pearson's linear correlation coefficients of logarithmic increments for prices for soybean meal and futures contracts for soybean meal

Specification	SM_PLN	SM_USD	SM_F_C
SM_PLN	1		
SM_USD	0.86	1	
SM_F_C	0.47	0.53	1

Source: the authors' calculations.

Price series of contracts for soybean meal were fitted to the series of prices for soybean meal, including closing quotations of the previous day. The strongest positive correlation was obtained for logarithmic increments for prices for soybean meal in PLN and USD. The correlation between logarithmic increments for prices for soybean meal ex quay Gdynia and increments in CBOT futures prices was moderate.

In the next stage of this study, parameters of the generalized Pareto distribution for the left and right tails of distribution were estimated for logarithmic increments for prices of soybean meal and futures contracts for soybean meal and soybean. Results of these estimations together with standard errors are presented in Table 3. Calculations were made for the threshold at 90% (meaning that the greatest 10% of positive and negative logarithmic increments for prices was regarded as extreme observations). In the case of logarithmic increments for prices of soybean meal the values of the shape parameter for the right tail are greater than for the left tail. This means that the right tail of distribution for logarithmic increments for prices of this commodity is thicker than the left, and that probability of extreme losses is greater for the short rather than the long positions. However, it needs to be added here that the obtained estimations for parameters are burdened with relatively large errors. In turn, in the case of futures contracts for soybean meal and soybean, left tails of distribution for logarithmic price increments are thicker than the right. The thickest tails of distribution for logarithmic price increments were observed for the left tails in the case of futures contracts for soybean meal and soybean. Values of estimated parameters to a considerable extent depend on the assumed threshold value in the POT model.

Table 3. Estimates of parameters of the generalized Pareto distribution with standard errors in brackets

Specification	Left tail			Right tail		
	u	$\hat{\xi}$	$\hat{\beta}$	u	$\hat{\xi}$	$\hat{\beta}$
SM_PLN	-1.4981	-0.2906	1.2205	1.6412	0.1117	0.6649
		(0.0972)	(0.1752)		(0.1464)	(0.1217)
SM_USD	-1.4064	-0.3416	1.2842	1.5726	0.1905	0.6057
		(0.1268)	(0.2104)		(0.1473)	(0.1108)
S_F	-1.6098	0.2545	0.7515	1.5944	-0.0357	0.7339
		(0.1342)	(0.1280)		(0.1276)	(0.1229)
SM_F	-2.0078	0.2624	(0.8519)	1.9982	-0.3524	1.4590
		(0.1215)	(0.1366)		(0.1048)	(0.2128)

Source: the authors' calculations.

Measures of extreme price risk were determined for economic entities in the long and short positions on the market of soybean meal and soybean, i.e. for the left and right tails of distribution for logarithmic increments for prices of soybean meal and futures contracts for soybean meal and soybean. Although estimations of parameters in the generalized Pareto distribution depend to a considerable extent on the assumed threshold value, the estimations of extreme risk are generally relatively stable. In this study, the threshold value was assumed at 90%. Measures of extreme risk were estimated using 814 and 849 logarithmic price increments for soybean meal and futures contracts for soybean meal and soybean, respectively. Calculations were made for four levels of tolerance: 0.005, 0.01, 0.025 and 0.05 are presented in Table 4.

Table 4. Estimates of the value at risk and expected shortfall for the generalized Pareto distribution

VaR	Left tail				Right tail			
α	0.005	0.01	0.025	0.05	0.005	0.01	0.025	0.05
SM_PLN	3.95	3.56	2.90	2.27	4.01	3.40	2.65	2.13
SM_USD	3.82	3.46	2.84	2.21	4.02	3.33	2.55	2.03
S_F	4.99	3.96	2.86	2.18	3.68	3.22	2.59	2.10
SM_F	5.89	4.71	3.44	2.66	4.70	4.30	3.60	2.90
ES	Left tail				Right tail			
α	0.005	0.01	0.025	0.05	0.005	0.01	0.025	0.05
SM_PLN	4.34	4.04	3.53	3.05	5.01	4.34	3.51	2.94
SM_USD	4.15	3.89	3.43	2.96	5.30	4.47	3.51	2.88
S_F	7.14	5.77	4.29	3.38	4.31	3.87	3.26	2.79
SM_F	8.40	6.81	5.10	4.04	5.07	4.78	4.26	3.74

Source: the authors' calculations.

Results of analyses indicate a greater level of extreme price risk on the market of CBOT futures contracts for soybean meal than on the market of soybean meal in Poland. The greatest price risk measured by the value at risk and expected shortfall is found for the long position in the futures contract for soybean meal. The economic entity at the long position in this contract is exposed to the risk of loss resulting from the decrease in contract value of 5.89% or greater during a day with the probability of 0.005, while in the case of soybean meal it is the risk of loss at 3.82-3.95% or greater. This means that losses at these levels or greater may occur once in 200 days. The level of extreme risk for futures contracts for soybean meal and soybean is greater for long positions than for short positions at low levels of tolerance. This confirms earlier observations concerning properties of the analysed distributions of logarithmic price increments. The occurrence of asymmetry in the risk profile for long and short positions in CBOT futures contracts for soybean was indicated by Morgan, Cotter and Dowd [2012] in their analyses conducted on weekly data. In the case of soybean meal for the level of tolerance of 0.005 the values of VaR and ES indicate a slightly greater risk for the entity at the short position.

Concluding remarks

The aim of this study was to assess and compare extreme price risk on the Polish market of soybean meal and futures contracts for soybean meal and soybean. Extreme risk was measured using two measures: value at risk and expected shortfall, applying the extreme value theory.

Results of the conducted analyses indicate a lack of normal distributions for logarithmic price increments in the case of soybean meal and futures contracts for soybean meal and soybean, as well as the occurrence of thick tails. Presented results confirm the potential frequent occurrence of large disadvantageous price fluctuations. Thus it seems justified to model distributions of logarithmic price increments using the POT model originating from the extreme value theory. An advantage of the application of such an approach is connected with modeling only tails of distribution and not the entire

distribution, which facilitates more accurate estimation of distribution tails. Changes in prices of CBOT futures contracts for soybean meal are Granger causes for changes in prices of soybean meal ex quay a Polish port. However, measures of risk and extreme risk indicate differences in the level of price risk for soybean meal ex quay a Polish port and CBOT quotes. A greater risk and extreme price risk are observed on the market of futures contracts for soybean meal. For both contracts, i.e. those for soybean meal and soybean, risk at the long position is considerably greater than at the short position. On the market of soybean meal ex quay a Polish port no marked asymmetry was observed in the risk profile.

Literature

Act of 22 July 2006 on Animal Feeds (the Journal of Laws no. 144, item 1045, with later amendments).

Dzwonkowski W., Bodył M.R. [2014]: Zmiany zapotrzebowania na białko paszowe w kontekście rozwoju produkcji, Zeszyty Naukowe SGGW w Warszawie, *Problemy Rolnictwa Światowego*, vol. 14, no. 1, pp. 13.

Jajuga K., Kuziak K., Papla D., Rokita P. [2001]: Ryzyko wybranych instrumentów polskiego rynku finansowego, *Rynek terminowy*, no. 11, pp. 133-140.

McNeil A.J. [1999]: Extreme Value Theory for risk management, Mimeo ETZH Zentrum, Zurich, pp. 1-22.

Morgan W., Cotter J., Dowd K. [2012]: Extreme measure of agricultural risk, *Journal of Agricultural Economics*, vol. 63, no.1, pp. 65-82.

Van Oordt M.R.C., Stork P.A., De Vries C.G. [2013]: On agricultural commodities' extreme price risk, DNB working paper, no. 403, pp. 1-27.

Rosiak E. [2014]: Krajowy rynek rzepaku na tle rynku światowego, Zeszyty Naukowe SGGW w Warszawie, *Problemy Rolnictwa Światowego*, vol. 14, no. 1, pp. 89-90.

Zaworska A., Kasprowicz-Potocka M. [2014]: Czy rośliny strączkowe uprawiane na terenie kraju mogą stać się alternatywą dla drogiej soi. [Available at]: http://www.portalhodowcy.pl/hodowca-drobiu/324-numer-102013/3546-czy-rosliny-straczkowe-uprawiane-na-terenie-kraju-moga-stac-sie-alternatywa-dla-drogiej-soybean. [Access: June 2015].

www.agrolok.pl. [Access: July 2015].

www.farmer.pl. [Access: July 2015].

www.stooq.pl. [Access: July 2015].

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 89–100

Elżbieta Kacperska[1]
Department of Economics of Agriculture and International Economic Relations
Warsaw University of Life Sciences – SGGW

Are Polish Agri-food Products Competitive on the EU Market?

Abstract. The study contains an analysis of agri-food trade between Poland and the European Union in the years 2004-2014. The aim of the study was to investigate the status, structure and intensity of trade in agri-food between Poland and the European Union and the assessment of the competitiveness of the Polish agri-food sector in the EU market. The paper analyzes the export and import of the agri-food sector with the European Union, points to changes in the dynamics of turnover and calculates indicators of comparative advantage (RCA) and indicators of specialization: B. Balassa and HG Grubnela and PJ Lloyd. Polish agri-food products in the analyzed period showed a competitive advantage in the European market, mainly processed products of animal and vegetable origin.

Keywords: agri-food trade, the European Union, competitiveness, RCA indicator, Poland

Introduction

Ability to compete in the EU market is a big challenge for Polish agri-food producers. The competitiveness of the agri-food sector is a complex problem and at the same time an extremely important issue for the Polish economy. The rising potential of the Polish economy, which is the result of EU requirements in the field of agriculture and the agri-food industry has improved our ability to compete. The increasing agri-food export confirms that Polish producers can compete on the EU market. However, it is also the result of the abolition of trade barriers, liberalization of trade turnover, the occurrence of creation effects and trade diversion. Thus, analyzing the results of the agri-food trade sector, attention should be paid to various factors both internal and external affecting their ability to compete. In this study, applied measures of international competitiveness of the agri-food sector in the European Union are quantitative indicators, i.e. ex-post, shares in international transactions, trade balance, the indicators of revealed comparative advantages or intra-industry trade indicators. In the structure of trade between Poland and the European Union there are the same groups of goods from one branch. This also applies to trade in agri-food products. It is therefore important to know the structure of intra-industry trade and determine the competitive position of Polish products on the EU market [Kacperska 2014].

The aim of the study was to investigate the status, structure and intensity of trade in agri-food between Poland and the European Union and the assessment of the competitiveness of the Polish agri-food sector in the EU market. The analysis of foreign trade covered 2004-2014. The study used statistical data from the Centre for Foreign Trade Team provided by the Foreign Agricultural Markets Monitoring in the annual publication of reports on agri-food trade. Due to the requirements for publication the paper contains a collective statement for all product groups. Analysis of trade since 2004 consisted of 25 countries belonging to the EU and from 2007 – 28 countries.

[1] PhD, email: elzbieta_kacperska@sggw.pl

Polish foreign trade in agri-food products

The share of Polish foreign trade in global trade since 2007 has an average of 1.1% in exports and 1.2% in imports. In the analyzed period Polish turnover increased significantly, with dynamics growth at the same time. Visible collapse of the world economy in 2009 affected the collapse of commodity exports in Poland, maintaining the same trend in export/ import [Roczniki 2006-2014].

Polish foreign trade in agri-food products in the years 2004 - 2014 pointed to the increasing trend in exports and imports. Exports in the analyzed period rose more than four times to € 21.3 billion in 2014. The trade balance in the reporting period was positive. Increases in exports analyzed year on year showed high volatility, especially with the decrease in growth taking place in 2009. This was caused by the global financial crisis. In the following years exports increased.

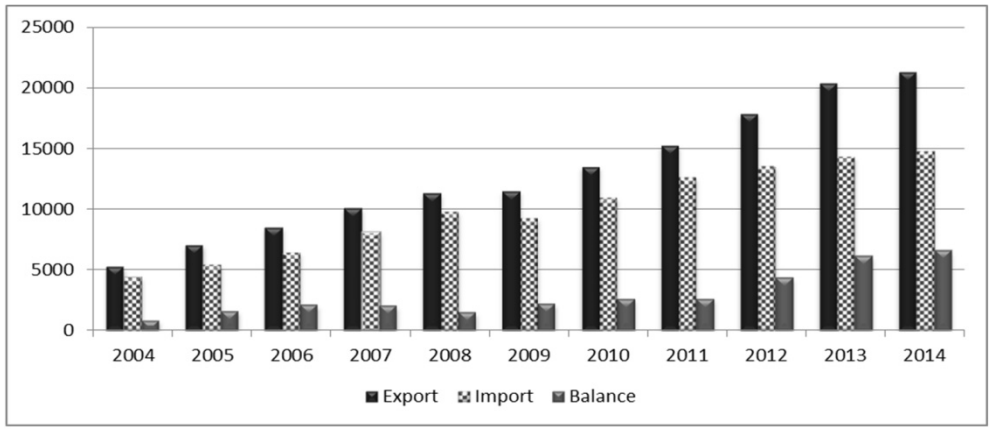


Fig. 1. Polish foreign trade in agri-food products in the years 2004-2014 (billion EURs)

Source: author's own study based on data from Table 2.

A similar tendency was observed in imports. In 2009 there was a decline in the value of imports, but in the following years there was a rapid growth. In the analyzed period the trade balance was positive (Figure 1). The share of trade in agri-food products in total Polish foreign trade has remained at an average of 10.9% in exports and 7.7% in imports.

Trade turnover in agri-food products with the European Union in the period 2004-2014

Polish trade in agri-food products from the EU is characterized by a growing trend both in exports and imports. In 2014, Poland exported agri-food products for EUR 16.8 billion and imported agri-food products for EUR 10.2 billion.

The analysis of the data of the Polish trade in agri-food products for the years 2004 - 2014 shows that the largest share in the trade structure was with the European Union. Its share ranged between 72-80% in exports and 62-68% in imports. In 2014 agri-food products for a total of EUR 16.8 billion were exported to the countries of the European

Union. In the analyzed period, the value of exports increased almost 4.5 times, showing an upward trend. Similarly, agri-food imports in the analyzed period showed a rising trend with a slight slump in 2009, which was the result of the global financial crisis. In 2014 Poland spent over 10.2 billion euros on agri-food products in the European Union. In the analyzed period, the value of imports from EU countries increased by 7.4 billion euros. The balance of agri-food exchange between Poland and the European Union was positive in the years 2004-2014, where trade balance rose by more than 5.6 billion euros (Table 2 and Figure 2).

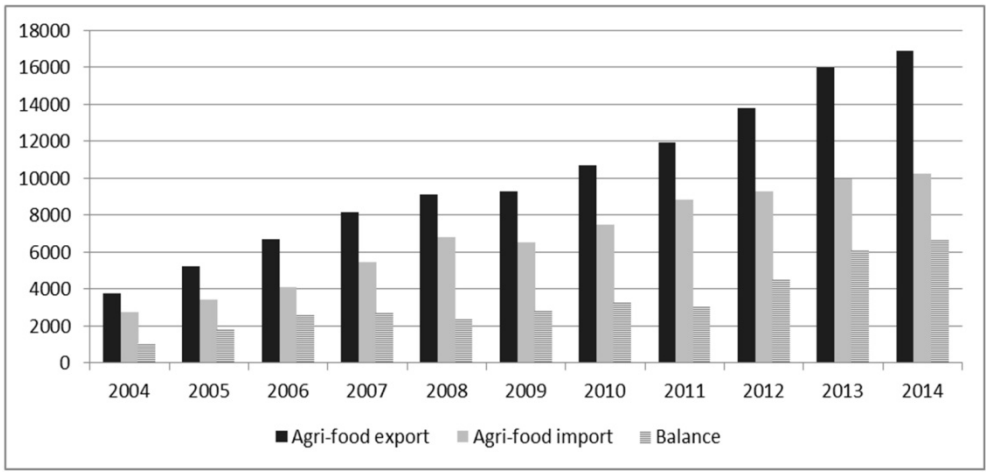


Fig. 2. Polish foreign trade in agri-food products with the countries of the European Union in the period 2004-2012 (billion EURs)

Source: author's own study based on data from Table 2.

In the years 2004-2014 the growth rate of agri-food exports with the European Union stood at 346%, and the rate of change in total exports was higher than 39 percentage points. The average annual growth rate of exports indicates such a trend, which now stands at 16% (in 2003-2008 it amounted to 29%) for the European Union. At that time, the growth rate of imports was lower than the rate of exports by 1 percentage point and indicated the same trend for average growth rate of imports (Table 1).

Table 1. Rates of change in trade of agri-food products in the years 2004 - 2014 and average annual growth rates of trade in agri-food products for Poland and in trade with the European Union (in %)

Item	Agri-food export		Agri-food import	
	Total	with UE	Total	with UE
Rates of change (%)	307	346	236	269
The average annual growth rate (%)	15	16	13	14

Source: author's own data.

The analysis of the data included in Table 1 shows that the average annual growth rates of exports and imports from the EU were higher than an adequate rate of the

recognized total. The high increases of exports were the result of Polish accession to the European Union and the full liberalization of trade.

Table 2. The value and dynamics of Polish agri-food trade with the European Union in the period 2004-2014

Item	Year										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
The value of agri-food trade between the Poland and the European Union in EUR million											
Export	3781.8	5238.0	6692.6	8135.6	9101.7	9283.6	10705.7	11906.5	13763.8	15979.2	16876.7
Import	2763.8	3442.1	4079.3	5438.3	6791.3	6486.9	7481.9	8813.3	9284.3	9944.4	10219.7
Balance	1018.0	1795.9	2613.3	2697.3	2310.4	2796.7	3223.8	3093.2	4479.5	6034.8	6657.0
The dynamics of agri-food articles turnover (year on year)											
in export	100	138.5	127.8	121.6	111.9	102.0	115.3	111.2	115.6	116.1	105.6
in import	100	124.5	118.5	133.3	124.9	95.5	115.3	117.8	105.3	107.1	102.8
The dynamics of agri-food articles turnover (2004 = 100)											
in export	100	138.5	177.0	215.1	240.7	245.5	283.1	314.8	363.9	422.5	446.3
in import	100	124.5	147.6	196.8	245.7	234.7	270.7	318.9	335.9	359.8	369.8
The share of agri-food trade to the European Union in the structure of trade Polish agri-food trade (in %)											
Share in export	72.1	74.1	78.5	80.6	80.4	80.7	79.3	78.2	76.9	78.2	79.1
Share in import	62.7	63.2	63.4	67.4	69.1	69.8	68.5	69.8	68.5	69.5	69.1

Source: author's own study based on data CIHZ.

A similar situation can be observed in imports, where the average annual growth rate of imports to the European Union was 1 percentage point higher than the growth rate in total (Tables 1 and 2).

The geographical structure of agri-food trade with the European Union

Traditionally, Germany is the largest importer of Polish agri-food products from the European Union. In the analyzed period, the share of Germany in Polish exports was over 22%. In 2014 agri-food products for EUR 4.8 billion were exported to Germany. In the period 2004 to 2014 the value of exported agri-food products increased almost 2.5 times. The United Kingdom was in second place for Polish exports, involving nearly 8% recognized as one United Kingdom, however, the value of items sold on the island accounted for only 1/3 of the value of exports to Germany. It is followed by France, the Czech Republic, Italy and the Netherlands. The total share of the five main recipients reached 53.5% in 2014 and increased by 5.7 percentage points in respect of 2004 (Table 3).

MICE structure of agri-food trade with the European Union

Herbal preparations are the largest group in agri-food exports to the European Union. In the analyzed period, export of herbal preparations was characterized by a growing trend. In 2004 herbal preparations for a total amount of EUR 1.5 billion were exported to the European Union, whereas in 2014 this amount reached more than EUR 5 billion. The largest share of this group was in confectionery and processed fruits. The second group of dynamic growth figures were animal products, where the value of exports increased from 1.02 billion euros in 2004 to 4.8 billion euros in 2014. The biggest sales in this group were in red meat, poultry meat, and milk, sour cream and ice cream. The third large group in exports was stimulants and beverages; their share in exports in the period increased 10 times. In 2014 the value of exported drugs and beverages amounted to EUR 3.4 billion versus EUR 322 million in 2004. The largest increase in exports of manufactured tobacco was recorded in this group (53.8 million in 2004. 1.7 billion 2014). Noteworthy is the growing export of fish and fish products. The value of exported fish and their products increased rapidly to EUR 1.3 billion in 2014 in the analyzed period (Figure 3).

Table 3. The biggest recipients of Polish agri-food products from the European Union comparative analysis of the 2004-2014 year

Countries	2004			2014			Change in the period 2004-2014	
	Rank	Value in EUR million	Share (in %)	Rank	Value in EUR million	Share (in%)	Value in EUR million	in %
Germany	1	1343.6	25.6	1	4812.5	22.5	3468.9	258.2
UK	3	303.3	5.8	2	1635.3	7.7	1332.0	439.2
France	6	175.9	3.3	3	1463.2	6.9	1287.3	731.8
Czech Republic	4	280.0	5.3	4	1302.2	6.1	1022.2	365.1
Italy	5	273.8	5.2	5	1152.7	5.4	878.9	321.0
Netherlands	2	313.2	5.9	6	1053.8	4.9	740.6	236.5
Total	1-5	2513.9	47.8	1-5	11419. 7	53.5	8905.8	354.3

Source: author's own analysis.

In the MICE structure of agri-food trade with the European Union, vegetable products dominate over animal products, and in the processing category raw materials dominate processed products (Figures 3 and 5). In 2014, there were changes in the MICE structure of exported goods to the European Union in relation to 2004. The share of drugs and soft drinks increased from 8% in 2004 to 21% in 2014, and exports of processed products of animal origin (an increase of 3 percentage points). The largest decline in exports was recorded in the group of processed vegetable products (10 percentage points) (Figure 4).

Products processed from plants and animals dominated (as in exports) in imports of agri-food products to Poland (Fig. 5). Poland in 2014 purchased vegetable products for a total amount of EUR 4.9 billion from the European Union, increasing the value of these products by EUR 3.5 billion in the period 2004-2014. Animal products had a total amount

of EUR 3.5 billion in 2014, increasing the value of purchases in the analyzed period more than 12 times.

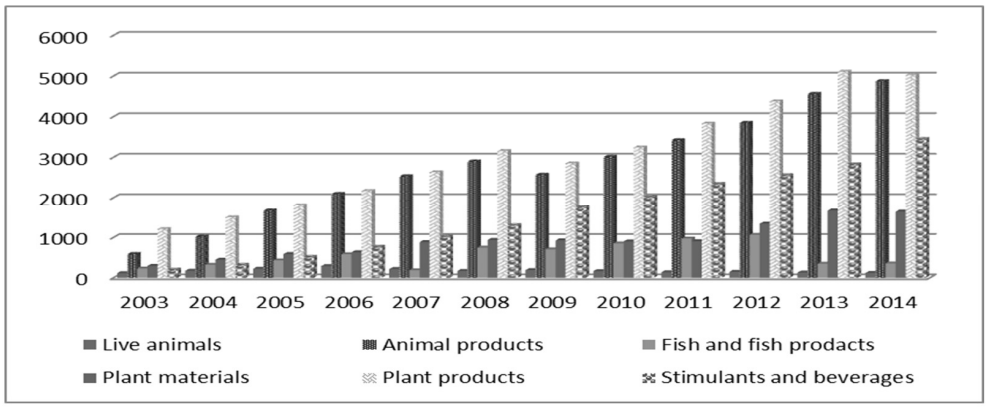


Fig. 3. Structure of MICE exports of agri-food products to the European Union in the years 2003-2014 in EUR million

Source: author's own analysis.

Herbal preparations were characterized by the most dynamic in imports in the group of plant products (increase in imports in the analyzed period by EUR 3.2 billion) and plant materials (increase of imports in the analyzed period by more than EUR 1 billion). Among animal products, preparations of red meat were characterized by the highest rate of dynamics (Figure 5).

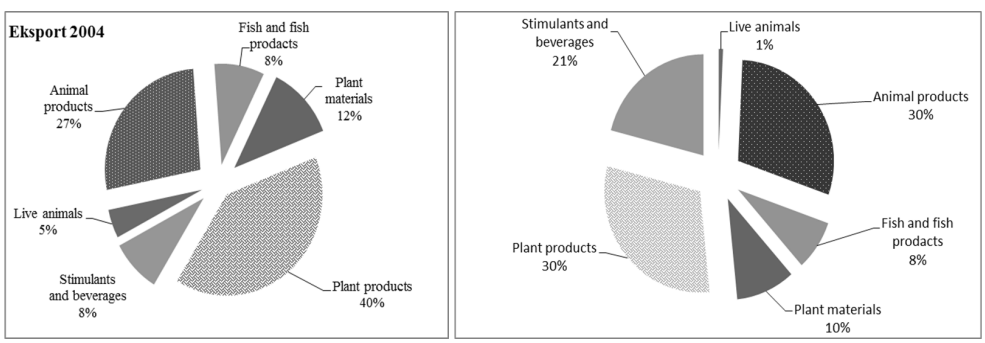


Fig. 4. MICE structure of agri-food exports to the European Union in 2004 and 2014

Source: author's own analysis.

In the years 2004-2014 there were many changes in the structure of exports and imports. These changes occurred in the last few years, changing the current growth trends emerging in the post integration with the European Union to slow growth in recent years. In the analyzed period, stimulants and beverages showed the highest growth rate in exports - 782.1% and animal preserves -364.8%. The biggest increase in imports - 686.5% was recorded for live animals and animal preserves - 572.1%. In the analyzed period, the change

in shares were declining in exports except for animal drugs and milk, while imports for animal products were positive and plant products showed a decreasing trend (Table 4).

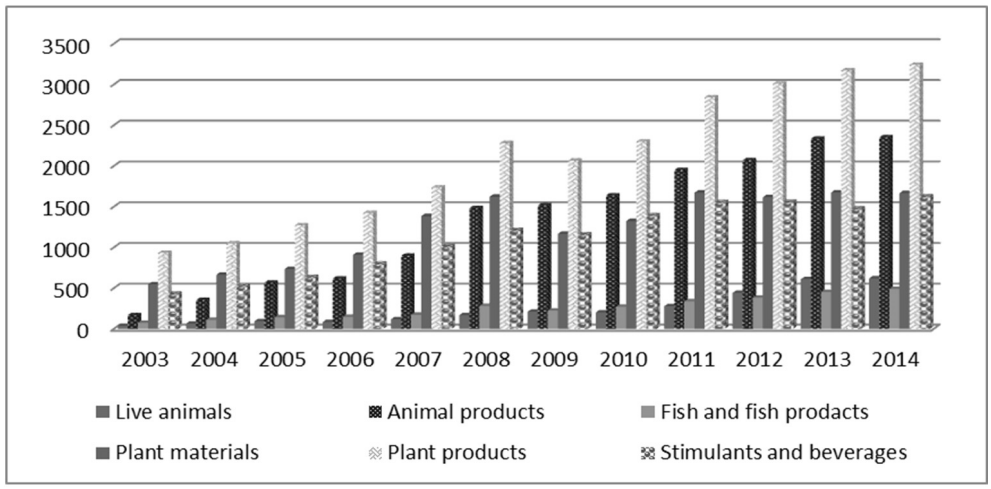


Fig. 5. Structure of MICE imports of agri-food products to the European Union in the years 2003 -2014 in EUR million

Source: author's own analysis.

Net exports ratio is calculated as the ratio of net exports to the total value of imports and exports. The value of this ratio is in the range -1, 1, wherein -1 means that there is only import and one where there is only export [Carraresi, Banterle 2007].

$$NEI = X\text{-}M/\ X+M$$

where:
X - is the value of exports,
M - is the value of imports.

Table 4. Changes in the MICE structure of Polish agri-food exports in the years 2004-2014

Product groups	Growth rate (in %)		Changes in shares (in % pts.)	
	Export	Import	Export	Import
Animal products:				
Live animals	68.8	981.7	1.6	3.9
Processed animal products	477.3	665.5	-3.5	10.8
Fish and fish products	411.1	446.8	-3.6	-7.3
Plant products:				
Plant materials	369.0	250.9	4.9	-7.3
Processed plant products	334.7	309.4	-7.2	-5.4
Stimulants and beverages	1069.2	307.9	7.8	-2.8

Source: own.

Table 5. Indicators of net exports in the agri-food trade to the European Union in the period 2004-2014

Product groups	Years										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	Animal products:										
Live animals	0.47	0.41	0.56	0.30	0.00	-0.05	-0.10	-0.34	-0.50	-0.65	-0.68
Processed animal products	0.49	0.49	0.55	0.48	0.32	0.26	0.30	0.27	0.30	0.32	0.35
Fish and fish products	0.49	0.51	0.60	0.04	0.46	0.52	0.52	0.48	0.47	0.47	0.46
	Plant products:										
Plant materials	-0.20	-0.11	-0.18	-0.22	-0.27	-0.11	-0.19	-0.30	-0.09	0.00	-0.01
Processed plant products	0.18	0.17	0.21	0.21	0.16	0.16	0.17	0.15	0.18	0.23	0.22
Stimulants and beverages	-0.24	-0.10	-0.02	0.00	0.04	0.21	0.18	0.20	0.24	0.31	0.36

Source: author's own analysis.

The analysis in Table 5 shows that most commodity groups throughout the analyzed period showed a positive rate of net exports, which means the dominance of exports over imports. Negative values were observed since 2009 for the live animal group, and in some years for a group of plant materials (Table 5).

The system of revealed comparative advantages in the MICE structure of agri-food trade between Poland and the European Union

For the analysis of trade in agri-food products, the indicator of revealed comparative advantage RCA (Revealed Comparative Advantage) was used and calculated according to the formula:

$$RCA = \ln\left(\frac{x_{ij}^{K}}{m_{ij}^{K}} \div \frac{X_{ij}^{K}}{M_{ij}^{K}}\right)$$

where:

x_{ij}^{K} – the value of exports "i" from the country "K" to the group of countries "j";

m_{ij}^{K} – the value of imports group "i" to the home "K" from the group of countries "j";

X_{ij}^{K} – the value of global exports of the country "K" to the country or group of countries 'j';

M_{ij}^{K} – the value of total imports of the country "K" from the country or group of countries 'j';

i - department / agri-food products by PCN;

K - analyzed country (Poland);

j - other countries (EU countries).

Table 6. Indicators of revealed comparative advantage in the agri-food trade to the European Union in the period 2004-2014

Product groups	Years										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Animal products											
Live animals	0.70	0.46	0.76	0.27	-0.27	-0.46	-0.55	-1.00	-1.48	-1.95	-2.08
Processed animal products	0.75	0.66	0.73	0.70	0.40	0.18	0.25	0.27	0.24	0.26	0.29
Fish and fish products	0.76	0.70	0.87	-0.25	0.71	0.80	0.79	0.76	0.64	0.55	0,50
Plant products											
Plant	-0.72	-0.64	-0.86	-0.79	-0.82	-0.58	-0.74	-0.91	-0.57	-0.41	-0.45
Processed plant products	0.05	-0.07	-0.08	0.08	0.06	-0.03	-0.01	0.00	-0.01	0.07	0.00
Stimulants and beverages	-0.81	-0.63	-0.54	-0.33	-0.20	0.07	0.01	0.11	0.11	0.24	0.31

Source: author's own analysis.

An RCA indicator greater than zero indicates the presence of revealed comparative advantage, and its value indicates the intensity of this advantage. Values less than zero indicate no advantage [Misala 2007]. Analyzing the RCA index values determined for turnover in agri-food products in the years 2004 -2014, it can be noted that in many groups Poland has comparative advantages. The high rates for dairy animals and fish and their products are especially noteworthy. In the group of plants, the RCA ratio was less than zero. Since 2009 products from drugs and drinks, including the biggest for tobacco and its products, have comparative advantage (Table 6).

Intra-industry trade between Poland and the European Union

Intra-industry trade is "the phenomenon of parallel imports and exports by individual countries within the same branch" [Misala et. al 2000]. It develops between countries with similar productive structures giving consumers the opportunity to diversify differentiated products. As part of the changeover there is a complementary of economic structures with the specialization of production of each country and assurance of benefit sharing. There are many methods for measuring intra-industry trade, but the most commonly used is index B. Balassa and specialization index Grubel-Lloyd. To determine the degree of Poland's specialization trade with the European Union in the field of agri-food, the B. Balassa index (IBalassy) was used and it was calculated by the following formula:

$$I_{Balassy} = \frac{\left| x_{ij}^{K} - m_{ij}^{K} \right|}{x_{ij}^{K} + m_{ij}^{K}}$$

(The meaning as in Formula 1.)

B. Balassa index determines the share of intra-industry trade in all the audited turnover of the product under consideration made by a particular country. This ratio has a value in the range of <0.1>, where the rate is closer to zero, the greater intra-industry specialization and the closer unity of the greater specialization of intermodal [Czarny 2002].

Intra-industry trade prevails in Polish agri-food trade. The analysis of specialization B. Balassa index shows that intra-industry specialization exists in the group of plant materials, where in the analyzed period ranged 0 - 0.2 and herbal preparations fluctuation rate range is 0.15 - 0.22. In the group of animal products the intra-industry trade concerned processed meat and fish and their products. Increasing the intensity of intra-industry trade in the Polish agri-food trade helps to strengthen the competitive position in the European Union market. A good competitive position of the sector is a result of entry into the single market, which abolished barriers to agri-food trade sector.

Inter-industry replacement took place mainly in the group of live animals (Table 7).

Table 7. Indicators of specialization (IBalassy) to trade in agri-food between Poland and the European Union in the years 2004 -2014

Product groups	Years										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Animal products											
Live animals	0.47	0.41	0.56	0.30	0.00	0.05	0.10	0.34	0.50	0.65	0.68
Processed animal products	0.49	0.49	0.55	0.48	0.32	0.26	0.30	0.27	0.30	0.32	0.35
Fish and fish products	0.49	0.51	0.60	0.04	0.46	0.52	0.52	0.48	0.47	0.06	0.07
Plant products											
Plant materials	0.20	0.11	0.18	0.22	0.27	0.11	0.19	0.30	0.09	0.00	0.01
Processed plant products	0.18	0.17	0.21	0.21	0.16	0.16	0.17	0.15	0.18	0.23	0.22
Stimulants and beverages	0.24	0.10	0.02	0.00	0.04	0.21	0.18	0.20	0.24	0.31	0.36

Source: author's own analysis.

To determine the intensity and structure of trade in agri-food, the HG Grubnela and PJ Lloyd (IG-L) specialization index was used and calculated according to the formula:

$$I_{G-L} = \frac{\left(x_{ij}^{K} + m_{ij}^{K}\right) - \left| x_{ij}^{K} - m_{ij}^{K} \right|}{x_{ij}^{K} + m_{ij}^{K}} = 1 - I_{Balassy}$$

(The meaning as in Formula 1.)

For comparability of data in various branches/departments of agri-food intra-industry trade was expressed against the total value of foreign trade of the branch/department. This ratio has a value in the range of <0.1>, where if the IG-L = 1 this trade is intra and if the IG-L = 0 then there is inter-industry trade [Budzowski 2003]. The literature identifies four groups of trade intensity measured in the IG-L:

1) 0.00 <IG-L ≤ 0.25 - a strong inter-industry trade,
2) 0.25 <IG-L ≤ 0.50 - weak inter-industry trade,
3) 0.50 <IG-L ≤ 0.75 - weak intra-industry trade,
4) 0.75 <IG-L ≤ 1.00 - a strong intra-industry trade [Pawlak 2013].

Table 8. Indicators of intra-industry trade intensity (IG-L) in total agri-food turnover between Poland and the European Union in the years 2004 -2014

Product groups	Year										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Animal products:											
Live animals	0.53	0.59	0.44	0.70	1.00	0.95	0.90	0.66	0.50	0.35	0.32
Processed animal products	0.51	0.51	0.45	0.52	0.68	0.74	0.70	0.73	0.70	0.68	0.65
Fish and fish products	0.51	0.49	0.40	0.96	0.54	0.48	0.48	0.52	0.53	0.94	0.93
Plant products:											
Plant materials	0.80	0.89	0.82	0.78	0.73	0.89	0.81	0.70	0.91	1.00	0.99
Processed plant products	0.82	0.83	0.79	0.79	0.84	0.84	0.83	0.85	0.82	0.77	0.78
Stimulants and beverages	0.76	0.90	0.98	1.00	0.96	0.79	0.82	0.80	0.76	0.69	0.64

Source: author's own analysis.

Exchange intensity ratio IG-L confirms the existence of intra-industry trade turnover between Poland and the European Union. The closest unity, which is the most intense intra-industry trade in 2014, referred to the trade in raw plant materials index IG-L = 0.99, fish and fish products IG-L = 0.93 and vegetable preserves the IG-L = 0.78. In the period 2004-2014 rates for these groups were changing, however, they were characterized by strong intra-industry trade. Strong intra-industry trade concerned live animals in 2008-2010 and condiments and beverages in 2005-2008. Indicators next to zero, which is strong inter-industry trade, was shown in live animals IG-L = 0.32 in the last two years (Table 8).

Summary

In 2014 the value of Polish agricultural exports and food amounted to 21.5 billion euros, Polish imports amounted to PLN 14.8 billion and the balance was positive at 6.6 billion euros. In trade with the EU, Polish agri-food products in 2014 reached a value of 16.8 billion euros to 15.9 billion euros in 2013 and 3.7 billion euros in 2004. It should be

recognized that over the last 10 years Polish agri-food products have gained recognition on the European Union market. However, the last year pointed to an inhibition of the growth trend of plant materials and animal and vegetable processed products. Polish agri-food products in the period showed a competitive advantage on the EU market. Processed products of animal and vegetable origin dominated in this regard. In 2014 high rates were for sheep, poultry meat and offal, processed meat and cheese and curd group, processed fruits.

Analysis of the Balassa specialization index pointed to a specialization in the group of plant and animal products. The importance of intra-industry trade in agri-food products in Poland increases. The intensity ratio of intra-HG Grubnela and PJ Lloyd confirmed intra-industry trade specialization in the group of plant and processed animals. Among the factors influencing the growth of turnover in agri-food products is the liberalization of trade in the agri-food industry and increased export but also import growth through an increase in the propensity to acquire a variety of new products (Italian cuisine, Spanish, Chinese), which is the result of slow income growth of Poles.

Among the reasons of advantages are modernized agriculture and agri-food industry, modern technologies in manufacturing, high quality raw materials and products and lower production costs. But further innovative measures are necessary to support the competitiveness of Polish food products.

References

Analiza wybranych zagadnień i tendencji w polskiej produkcji i handlu zagranicznym artykułami rolno-spożywczymi w 2006 r. [2007] FAMU FAPA Warszawa.

Analiza wybranych zagadnień i tendencji w polskiej produkcji i handlu zagranicznym artykułami rolno-spożywczymi w 2009 r. [2010] FAPA/FAMA. Warszawa.

Analiza wybranych zagadnień i tendencji w polskiej produkcji i handlu zagranicznym artykułami rolno-spożywczymi w 2012 r. [2013] FAPA/FAMA. Warszawa.

Analiza wybranych zagadnień i tendencji w polskiej produkcji i handlu zagranicznym artykułami rolno-spożywczymi w 2014 r. [2015] FAPA/FAMA. Warszawa.

Budzowski K. [2003]: *Ekonomika handlu zagranicznego,* Acta Academiae Modrevianae, Krakowskie Towarzystwo Edukacyjne, Kraków, p. 28.

Czarny E. [2002]: *Teoria i praktyka handlu wewnątrzgałęziowego*, Monografie i opracowania 496, SGH, Warszawa, p. 182-184.

Carraresi L., Banterle A. [2007]: *Measuring competitiveness in the EU market: a comparison between food industry and agriculture.* 12th Congress of the European Association of Agricultural Economists – EAAE 2008 p. 2. [Available at:] http://ageconsearch.umn.edu/bitstream/43692/2/187.pdf [Access: December 2014].

Misala J. [2007]: *Międzynarodowa zdolność konkurencyjna i międzynarodowa konkurencja gospodarki narodowej*, Wydawnictwo Politechniki Radomskiej, Radom, p.380.

Misala J., Pluciński E. M. [2000]: *Handel wewnątrzgałęziowy między Polska a Unią Europejską. Teoria i praktyka.* Warszawa, Kolegium Gospodarki Światowej, p. 77.

Kacperska E. [2009]: *Trade in agri-food products between Poland and the European Union in years 2003-2008* [in:] Zawojska A. (red.), *Agri-food system and its linkages with global, international and domestic economies*, Warsaw University of Life Sciences Press, Warsaw, p. 59-71.

Kacperska E. [2014]: *Konkurencyjność polskich artykułów rolno-spożywczych na rynku Unii Europejskiej w latach 2004-2012* Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, nr 361, p. 79-89.

Pawlak K. [2013]: *Międzynarodowa zdolność konkurencyjna sektora rolno-spożywczego krajów Unii Europejskiej*. Rozprawy Naukowe nr 448 Uniwersytet Przyrodniczy w Poznaniu. Poznań 2013. p. 88-125.

Roczniki Statystyczne Handlu Zagranicznego za lata2006-2014[2006-2014], GUS, Warszawa.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 101–110

Tomasz Klusek[1]
Department of Agricultural Economics and International Economic Relations,
Warsaw University of Life Sciences – SGGW

The Preferential Conditions for Land Acquisition as a Motivating Factor for Enlarging and Creating Farms in Poland

Abstract. Transformations of the area structure of farms in Poland are determined by various factors among which the ability to acquire land on preferential terms is of critical importance. This thesis is supported, inter alia, by the analysis of sales realized in years 2010-2013 by the Agricultural Property Agency. They would not have been obtained, had it not been for farmer demand supported by the division of payments into installments or subsidizing interest payments on loans by the Agency for Restructuring and Modernization of Agriculture. The circumstances, scale and effects of this type of public aid as related to the creation of new agricultural holdings or enlargement of existing ones, are the subject of this study.

Keywords: acquisition of agricultural land, family-run holdings, public aid, legal regulations, Poland

Introduction

The provision of support from public funds, known in Polish law as public aid, is one of the forms of state intervention in the field of te economic activity. This type of action, using instruments and public institutions, is regulated in detail in the European Union because it is designed to give profits to the beneficiaries, thus infringing the rules of market competition [Woźniak 2008]. The Act of 30 April 2004 on the procedural issues concerning state aid[2] is the basic regulation in Polish legislation under which the aid is granted. The authority monitoring state aid regarding the agricultural sector is the Minister of Agriculture and Rural Development.

The aim of the study is to show the circumstances, the scale and the effects of granting preferential loans with interest payments subsidized by the Agency for Restructuring and Modernization of Agriculture and the division of the selling price into installments by the Agricultural Property Agency. These forms of public aid, in accordance with the EU Council Decision of 20 November 2009 on the granting of a State aid by the authorities of the Republic of Poland for the purchase of agricultural land between 1 January 2010 and 31 December 2013[3], had to be aimed at farmers purchasing land for the purposes of setting up or extending existent agricultural holdings.

The time scope of the study is based on the duration of the above-mentioned decision. For the purpose of its conduct, the information and data from various sources, with particular emphasis on official reports and statements, were used. Attention was also drawn to the legal regulations relevant to the issues which were taken into consideration.

[1] PhD, e-mail: tomasz_klusek@sggw.pl
[2] Consolidated text of Journal of Laws of 2007 No. 59, item 404, as amended.
[3] Official Journal of the European Union, L 4/89, 8.1.2010.

The circumstances, scale and effects of agricultural land acquisition owned by the Agricultural Property Agency of the State Treasury on preferential terms

Under the Act of 30 April 2004 on the procedural issues concerning state aid, the Minister responsible for agriculture shall submit an annual report containing the monitoring results in terms of amount, form, purpose and effects in the framework of competition. The data for the period of 2010-2013 shows that in Poland, state aid in the agriculture sector, except de minimis aid, was granted for the total amount of approx. 11 435.9 million PLN, including approx. 3 043.4 million PLN within the C category[4]. An important part of this aid related to the sale of Agricultural Property of the State Treasury stock, with the division of the selling price into installments using preferential interest rates. Over the period considered, one can observe the annual dynamic growth of its amount and the number of beneficiaries of this type of support (Table 1).

Table 1. Sales of stock of the Agricultural Property of the Treasury with the division of the selling price into installments using preferential interest rates for the years 2010-2013

Specification	2010	2011	2012	2013
The aid provided by the President of the Agricultural Property Agency:				
- in mln PLN	6,7	15,1	153,7	286,2
- in % of public aid of C category	1,0	2,6	20,5	26,7
- in % of total state aid	0,3	0,5	5,2	9,5
- the number of beneficiaries	576	799	1 750	3 816

Source: author's study based on reports on state aid granted in the agriculture and fisheries sector in the Republic of Poland for the period 2010-2013.

The possibility of the payments division into annual or semi annual installments for a period not longer than 15 years by the Agricultural Property Agency is under Art. 31 paragraph 2 of The Act of 19 October 1991 on the Management of Agricultural Property of the Treasury[5]. According to the available estimates, in 2011 about 65 thousand ha[6] were purchased on the basis of this Act, which accounted for more than half out of the 125.1 thousand ha that were available for sale. What should be emphasized is the fact that the share of land, which was sold with the payments division into installments and amounted to approximate 63%, showed an upward trend while moving to the higher area groups [Podgórski, Świętochowski 2012]. A similar phenomenon also occurred in 2012 [Podgórski, Świętochowski 2013].

On 3 December 2011 the Act of 16 September 2011 amending the Act on the Management of Treasury Agricultural Property and other Acts[7] came into force and

[4] The European Commission classifies the state aid types into categories labeled by the letters: A,B,C,D with suffix (1 and 2), representing respectively the budget aid (subsidy) or the tax relief and the letter identifying the type of aid. The C category covers financial transfers in the form of preferential credits and subsidies for interest payments on loans for the banks (C1) as well as deferrals, the rescheduling of the tax repayment scheme or liabilities [Sprawozdanie o pomocy...2013].

[5] Consolidated text of Journal of Laws of 2015 No. 0, item 1014.

[6] 25 thousand ha were purchased using preferential loans with the interest payments subsidized by the Agency for Restructuring and Modernization of Agriculture and the remaining 35 thousand ha were paid in cash.

[7] Journal of Laws of 2011 No. 233, item 1382.

recognized sales as the main form of the Agricultural Property of the Treasury stock management. On its basis, the initial deposit provided by the land buyer for the purchase of land in installments decreased from previous 20% to 10 % of the price and the interest payments on the acquisition for enlargement or creation of family-run holdings changed from 4% to 2% annually (till the end of December 2013[8]). As a result of the introduced changes, the sales realized by the Agricultural Property Agency in the next years grew rapidly. This is visible particularly in 2013, when the land area of over 147 thousand ha, including approx. 88 thousand ha (59.6%) referring to the payments in installments, was sold [Biuletyn ... 2014a]. The record results were accompanied by favorable changes in the internal regulations related to the Agency's functioning[9]. They included, among others, the sale of agricultural land in installments under the limited tender method or pre-emption right for creation or enlargement of the family farm, secured only by a mortgage or a blank bill. The land sales system beneficial for the farmers interested in enlarging the farms was also tightened up. Their representatives, appointed by the Chamber of Agriculture, could be included to the tender committees and, inter alia, at their request the Agency withdrew from conducting tenders in the case of reasonable suspicion concerning the intention of unauthorized persons to participate in it. For this reason, in 2013, 194 tenders were canceled, referring to the area of 4,877 ha, out of which the majority of cases (85%) related to the West Pomeranian province [Biuletyn ... 2014a].

Table 2. Selected data on the sale of land by the Agricultural Property Agency of the State Treasury in 2010-2013

Specification	2010	2011	2012	2013
Sale of land total (thous. ha)	96,5	125,1	132,2	147,7
including non – bid procedure	53,3	67,1	86,9	92,9
Proceeds from the sale of land (million PLN)	1 569,8	1 776,2	1 899,5	lack of data
Number of tenders organized	87 966	93 637	80 554	60 005
The area of land offered for sale in tenders (thous. ha)	174,7	204,6	132,4	109,8
Number of restricted tenders organized	820	798	4 406	4 314
including the farmers enlarging the holdings	820	798	4 405	4 311
The area of land offered for sale in limited tenders (thous. ha)	7,7	9,7	18,4	34,1
Sale of typical agricultural land (thous. ha)	91,3	122,0	130,6	145,2
The average selling price of typically agricultural land (PLN/ ha)	15 281	17 165	19 288	21 813

Source: author's own study based on the reports on activities of the Agricultural Property Agency of the State Treasury in the years 2010-2013.

For several years, the Agency has been pursuing a similar strategy based on selling the majority of land by the tender process, mainly to existing tenants. It also organizes more

[8]Starting from January 1, the interest rate was 3,75% (the base rate announced by the European Commission increased by 1 p.p.) [Biuletyn...2014a].

[9]In 2013 the president of the Agricultural Property Agency (APA) introduced three edicts regarding: the preservation of the APA receivables (no 7/2013), the principles of the property lease of the Agricultural Property Agency of the State Treasury (no 9/2013), the property sale of the Agricultural Property Agency of the State Treasury (no10/2013). The first one came into force on January 13, the two remaining on January 21.

limited tenders, thus favoring a specific group of buyers listed in Art. 29 of the Act of 19 October 1991 on the Management of Agricultural Property of the Treasury. These are mainly individual farmers who fulfill the conditions defined in the Act of 11 April 2003 on the Formation of Agricultural System[10]. In the years 2010-2013, 10,334 auctions were organized resulting in the acquisition of approx. 69.9 thousand ha (Table 2).

The dynamic growth in the number of the limited tenders has emerged from the state policies in terms of offering the land to farmers extending the holdings [Biuletyn ... 2013]. Numerous Agency activities are subordinated to this goal including, inter alia, the exclusion of land from properties of larger area covered by the lease agreements and their acquisition at the private market on the basis of pre-emptive and buy-back rights aimed at redistribution by means of sale [Podgórski, Świętochowski 2014].

Although in the course of economic growth agricultural land has been relatively losing its importance by the process of its being substituted by other factors [Johnson 2002], the changes of the area structure still are a prerequisite to improve the production performance of farms and the income situation of the population associated with them.

From the historical perspective, the increase in farm size is one of the fundamental regularities of their development. This depends, however, on a number of internal and external factors [Steinhouser and others...1982]. As the estimates of the Agricultural Property Agency show, within the 20 year period over half of the acquired land became part of private households. During this period, inter alia, 330 thousand of such units from the area group below 100 hectares increased their property by an average of 5.3 hectares and further 5.2 thousand from the area group over 100 hectares by 324 hectares respectively [Biuletyn ... 2014c]. What should be emphasized is the fact that the area structure of farms in regions of the state-owned land location (mainly west and north), is much more beneficial than in other parts of the country, and the impact of the Agency is being weakened by the decreasing acreage of land that is available for distribution [Rynek ziemi ... 2014].

The intensification of the privatization of state-owned agricultural land through sales for the benefit of so-called family farms has recently been the main functional objective of the Agricultural Property Agency. This follows directly the basic law[11], which indicates in Art. 23 that these type of units are the basis of the agricultural system in Poland. This is of vital importance in the upcoming perspective of 2016, when the restrictions on the sale of agricultural property to foreigners will be lifted. Until then, the Agency intends to sell the maximal area of land and to bind the remaining part by lease agreements in such a way which will enable its future purchase under the pre-emptive right [Aktualne możliwości ... 2012].

The amendment to the Act on the Formation of Agricultural System, which was recently adopted by the Parliament and comes into force on 1 January 2016[12], introduces, inter alia, the changes to the Law on Management of Agricultural Property of the Treasury,

[10]In the light of the Art.6, the individual farmer is a natural person who is the owner, has the right to perpetual ownership, is an *autonomous possessor or* the leaseholder of that agricultural property with the total area not exceeding 300 hectares, has the agricultural qualifications and is, for at least 5 years, the resident of the commune where one part of that farm is situated and operates this farm personally (consolidated text of Journal of Laws of 2012 No. 0, item 803).

[11] The Constitution of the Republic of Poland of April 2, 1997 (Journal of Laws No. 78, item 484, as amended)

[12] The Act of August 5th, 2015 on the development of the agricultural system (Journal of Laws of 2015 No. 0, item 1433).

favoring the formation of this type of unit. One of the reasons is the exclusion from the turnover of agricultural land owned by the Agency of all speculative-focused buyers, for the benefit of individual farmers who intend to use it for running their own farms. This should be conducive to protection of this precious and increasingly deficient production factor.

Determinants, scale and effects of the preferential land purchase loans subsidized by the Agency for Restructuring and Modernization of Agriculture

The recently observed development of the agriculture sector would not have been possible without the participation of the Agency for Restructuring and Modernization of Agriculture, which from the beginning of its operation was implementing the state aid instruments. These were mainly the subsidies to interests on investment loans granted by banks from their own capital, available through country-wide branch networks providing farmers with access to preferential loans. In 2013 the Agency cooperated with 7 banks. As the result of support in the form of interest rate subsidies, it paid out a total amount of more than 516.2 million PLN, relating both to newly granted subsidies and to loan liabilities from previous years[13].

Table 3. The scale and effects of preferential land purchase with loans subsidized by the Agency for Restructuring and Modernization of Agriculture in the years 2010-2013

Years	Outstanding loans (mln PLN)	The area of land acquired (thous. ha)
2010	1 067,0	73,2
2011	1 443,1	89,6
2012	1 157,0	65,7
2013	1 214,6	55,6
Total	4 881,7	284,1

Source: author's own study based on reports on the activities of the Agency for Restructuring and Modernization of Agriculture in the years 2010-2013.

Over the period considered, aid was granted in accordance with the principles set out in the Regulation of the Council of Ministers dated 22 January 2009 on the implementation of certain tasks of the Agency for Restructuring and Modernization of Agriculture[14]. It broadly defined the purpose of loans, allowing the implementation of various types of projects. The individuals running the farms could, inter alia, take a loan to purchase agricultural land, but none of the preferential credit lines could be allocated for this purpose

[13] In 2013 the Agency continued the realization of financial support in the form of subsidies for interest on loans granted before 30 April 2007 and loans granted under the conditions set out by the European Community guidelines on state aid in the agriculture and forestry sector for the period of 2007-2013. Poland, after a three-year transition period, was obliged to adjust the state aid rules to the ones applied by the European Union. Granting preferential loans under new terms began on May 1, 2007 [Sprawozdanie z działalności ... 2013].

[14]The Regulation of the Council of Ministers dated 22 January 2009 on the implementation of certain tasks of the Agency for Restructuring and Modernization of Agriculture (Journal of Laws of 2009 No. 22, item 121, as amended).

if it resulted in exceeding the farm area over 300 hectares. Taking into consideration the purpose of loans, it can be stated that in the period of 2010-2013 they allowed to purchase more than 284 thousand ha with total allocation of 4 881.7 million PLN for this purpose (Table 3).

The aid related to the purchase of agricultural land was granted within the lines marked by symbols nIP, nKZ, nMR and nGR[15] and in the form of partial repayment of the loan capital for investment in agricultural holdings (CSK symbol). The latter instrument, introduced for the first time at the end of 2010, has become the alternative to the already existing investment loans, for which the Agency on the behalf of the borrowers paid the interest rates dues to the banks (Table 4).

Table 4. Selected parameters of credit lines enabling the financing of the agricultural land purchase (at the end of 2013)

Specification	Credit lines			
	nMR	nKZ	nGR	nIP
The maximum loan period (number of years)	15	15	20	8
The maximum grace period for the loan repayment (number of years)	2	2	2	2
The loan interest rate (%) *	4,125	4,125	4,125	4,125
The interest rate paid by the borrower to the bank (%)	3,0	3,0	3,0	3,0

*Variable interest rate not higher than 1.5 rediscount rate for banks bills accepted by the Polish National Bank to rediscount on an annual basis

Source: author's own study based on the report on the activities of the Agency for Restructuring and Modernization of Agriculture in 2013.

The analysis of lending purposes on the basis of credit lines shows that the improvement of the area structure of farms was mainly the result of support from preferential credit lines with the nKz symbol. Due to the financing obtained from this line, over the period considered, farmers bought in total land of over 236 thousand ha, with the majority falling into the regions of Greater Poland, Kuyavian-Pomeranian, Warmian-Masurian, Mazovian and Lower Silesia. It should be noted that, out of more than 24 thousand loans granted, 95.2% of them were aimed at enlarging existing holdings and the remaining 4.8% to create new ones (Table 5).

Over the period considered, the regulation dated 22 January 2009 was amended several times. Significant modifications in the existing rules on granting loans by banks cooperating with the Agency were introduced, inter alia, on 18 September 2012[16]. They were particularly associated with the reduction of the maximum amount of preferential loans for the purchase of farmland by a single entity, resulting in the possibility of granting them to a larger number of interested people. There was also the prohibition, extended to all

[15] nIP - loans for investments in agricultural holdings, the special agricultural production sections and processing of agricultural products and the purchase of shares or stakes; nKZ - loans for the purchase of agricultural land; nMR - loans for the farm creation and its equipment by the individuals under 40 years of age; nGR - loans for the purchase of agricultural land for creating or extending the family farm under the Act of 11 April 2003 on the Formation of Agricultural System.

[16] The date when the Regulation of the Council of Ministers dated 21 August 2012, amending the regulation on the implementation of certain tasks of the Agency for Restructuring and Modernization of Agriculture, came into effect (Journal of Laws of 2012 No. 0, item 988).

credit lines, against using this kind of financing for creating new farms with an area below the average for the given province, which was announced on the basis of the payment provisions under the direct support scheme.

Table 5. The scale and the effects of preferential crediting for the purchase of agricultural land under the credit line nKZ by voivodeship (accumulated data for the years 2010-2013)

Voivodeship	The number of loans granted			Outstanding loans mln PLN	The area of land acquired in thous. ha
	total	for the aim of			
		the extension of existing farms	the creation of new farms		
Lower Silesia	1 654	1 580	74	323,9	21,3
Kuyavian-Pomeranian	3 195	3 107	88	533,4	24,7
Lublin	2 738	2 645	93	192,6	15,6
Lubusz	487	447	40	121,8	13,1
Łódź	1 871	1 760	111	159,9	10,9
Lesser Poland	188	183	5	14,7	1,1
Mazovian	3 688	3 474	214	383,8	23,3
Opole	1 432	1 397	35	255,3	19,1
Subcarpathian	330	315	15	44,4	4,4
Podlaskie	1 855	1 772	83	213,8	13,7
Pomeranian	978	952	26	236,3	13,9
Silesian	158	150	8	39,3	2,3
Świętokrzyskie	633	571	62	39,5	3,7
Warmian-Masurian	1 218	1 158	60	276,3	23,5
Greater Poland	2 986	2 832	154	618,9	29,8
West Pomeranian	616	534	82	181,3	16,0
Total	24 027	22 877	1 150	3 635,2	236,4

Source: author's own study based on reports on the activities of the Agency for Restructuring and Modernization of Agriculture in the years 2010-2013.

The possibility of granting the proper aid under the European Union Council decision, which was mentioned in the introduction, expired at the end of December 2013. In order to ensure the continuation of support for the purchase of agricultural land from the national funds after that date, the Ministry of Agriculture and Rural Development prepared an amendment to this regulation, which came into force on 9 May 2014[17]. The introduced legislation provided the possibility for aid to be executed in two forms: by loan financing in part not exceeding 10% of investment costs including the purchase of agricultural land[18]

[17] The Regulation of the Council of Ministers dated 4 April 2014, amending the regulation on the implementation of certain tasks of the Agency for Restructuring and Modernization of Agriculture, came into effect (Journal of Laws of 2014 No. 0, item 527).

[18] Aid is granted under the European Commission Regulation No 1857/2006 of 15 December 2006 on the application of Articles 87 and 88 of the Treaty to State aid to small and medium-sized enterprises active in the production of agricultural products and amending Regulation (EC) No 70/2001.

and financing the purchase of agricultural land only in the formula of de minimis aid in the agriculture sector[19] [Biuletyn ... 2014b]. The currently applied Regulation of the Council of Ministers of 27 January 2015 on the detailed scope and execution of certain tasks of the Agency for Restructuring and Modernization of Agriculture[20] allows, inter alia, to provide a new kind of support to young farmers. Pursuant to § 4.1, they can use partial repayment of the loan granted for the creation or enlargement of the farm. It should be noted that, as it is the same for the considered period, the loan on the purchase of agricultural land may be granted if, in the last 10 years preceding the date of application, this type of project was not covered by aid from public funds [Biuletyn ... 2015].

The operation of farms is connected with various barriers which could include the barrier of scarce investment and accumulation capacity [Tomczak 1997]. The accumulation of capital from internal agricultural sources is slow and insufficient for the dynamic structural changes in agriculture and therefore, with its growth, the importance of external sources of funding is increasing [Kulawik 1995], including loans granted on preferential terms. The loan facilitates undertakings which would not be viable without external funding [Woś 1985].

The opponents of preferential crediting of agriculture believe that this places a burden on the state budget and the financial resources excluded from circulation in this way hit the market sector, characterized by the low effectiveness of their use. It is difficult to agree with such a statement, taking into consideration the fact that subsidies to preferential loans in Poland have recently accounted for no more than 0.3% of budget expenditures. On the other hand, their share in total investments in agriculture was incomparably higher [Kulawik 2013]. There are many examples of a positive impact of preferential loans on the situation in the sector. This is based, inter alia, on the experience of economically developed countries which for many years pursued a policy of active support [Woś 1996].

Summary

The basic determinants of the development of business entities include their propensity to invest, thus the investing directions depend on the nature of the entity. In the case of farms, with their core business focused on different forms of agricultural land management, the expenses are particularly targeted at land extension, either by its purchase or lease.

The mechanism of investment decisions made by farmers is complex because of the overlap of the long-term objectives - relating to the evolution of the farming business and the short-term goals - resulting, inter alia, from changes in agricultural policy. It could be postulated that in the period of 2010-2013, one of the main motivating factors to purchase agricultural land was the preferential conditions of its acquisition. This can be confirmed, inter alia, by the analysis of sales for that period realized by the Agricultural Property Agency. It showed a steady increase and their cumulative amount surpassed by over a quarter the results obtained in 2006-2009. Although currently there still is a possibility of dividing the payments into installments, but starting from 2014 it is a worse option in terms of value for money. As a result, the sales reported by the Agency in 2014 amounted to

[19] The aid is granted under the European Commission Regulation No 1408/2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to de minimis aid in the agriculture sector.
[20] The Journal of Laws of 2015 No. 0, item 187.

approx. 120.5 thousand ha which represents a decline of more than 18% in comparison to the record-breaking 2013.

The sales deterioration is also visible in the case of land purchased on the basis of loans granted by banks cooperating with the Agency for Restructuring and Modernization of Agriculture. In 2014, farmers using this type of aid bought only approx. 11.8 thousand ha, with the average annual result of approx. 71 thousand ha obtained over the period considered. Just as in the case of the Agricultural Property Agency, this is the effect of the introduction of new solutions in the forms of public aid resulting from the adoption of European Union regulations.

The study confirms the opinion presented in different sources about setting out favorable conditions for Polish farmers over the period considered for acquisition of agricultural land for the creation of new farms and expansion of existing ones. The question remains, however, whether the results achieved in the form of purchased land could be better. The question is justified by the results of the survey presented in the report Poland, Village and Agriculture in 2013. They show, inter alia, that only 37% of respondents living in villages were aware of the existence of the possibility of purchasing the land from the Agricultural Property Agency with the division of payments into installments or through a low-interest-bearing loan with a subsidy from the Agency for Restructuring and Modernization of Agriculture. Even the smaller part of respondents from this group (33%) knew that the Agricultural Property Agency might organize limited tenders aimed at the local farmers planning the extension of their holdings. Although the outcome of the survey presented above is better in comparison to that obtained in previous editions of this study, it can be interpreted as the result of the low effectiveness of the information policy.

References

Aktualne możliwości powiększania i tworzenia gospodarstw rodzinnych. ANR, Warszawa 2012.
Biuletyn Informacyjny nr 3 MRiRW i ARiMR, Warszawa 2013.
Biuletyn Informacyjny nr 2, MRiRW i ARiMR, Warszawa 2014.
Biuletyn Informacyjny nr 5, MRiRW i ARiMR, Warszawa 2014.
Biuletyn Informacyjny nr 11-12, MRiRW i ARiMR, Warszawa 2014.
Biuletyn Informacyjny nr 1-2, MRiRW i ARiMR, Warszawa 2015.
Johnson D.G. [2002]: The declining importance of natural resources: lessons from agricultural land. Res. Energy Econ. 24.
Kulawik J. [1995]: Kapitał w rolnictwie. Studia i Monografie nr 76, IERiGŻ, Warszawa.
Kulawik J. [2013]: Globalny i makroekonomiczny kontekst kredytowania rolnictwa. *Bank i rolnictwo*, sierpień.
Podgórski B., Świętochowski L. [2012]: Uwarunkowania trwałego rozdysponowania nieruchomości Zasobu Własności Rolnej Skarbu Państwa. *Wieś i rolnictwo* nr 2 (155).
Podgórski B., Świętochowski L. [2013]: Stan rozdysponowania nieruchomości Zasobu Własności Rolnej Skarbu Państwa. *Wieś i rolnictwo* nr 2 (159).
Podgórski B., Świętochowski L. [2014]: Gospodarowanie nieruchomościami Zasobu Własności Rolnej Skarbu Państwa. *Wieś i rolnictwo* nr 2 (163).
Polska wieś i rolnictwo 2013. Prezentacja wyników badania, październik.
Raport z działalności Agencji Nieruchomości Rolnych na Zasobie Własności Rolnej Skarbu Państwa w roku 2010. ANR, Warszawa 2011.
Raport z działalności Agencji Nieruchomości Rolnych na Zasobie Własności Rolnej Skarbu Państwa w roku 2011. ANR, Warszawa 2012.
Raport z działalności Agencji Nieruchomości Rolnych na Zasobie Własności Rolnej Skarbu Państwa w roku 2012. ANR, Warszawa 2013.
Raport z działalności Agencji Nieruchomości Rolnych na Zasobie Własności Rolnej Skarbu Państwa w roku 2013. ANR, Warszawa 2014.

Rozporządzenie Rady Ministrów z dnia 27 stycznia 2015r. w sprawie szczegółowego zakresu i sposobów realizacji niektórych zadań Agencji Restrukturyzacji i Modernizacji Rolnictwa (Dz. U. z 2015r. nr 0, poz. 187).
Rozporządzenie Rady Ministrów z dnia 21 sierpnia 2012 roku zmieniające rozporządzenie w sprawie realizacji niektórych zadań Agencji Restrukturyzacji i Modernizacji Rolnictwa (Dz. U. z 2012r. Nr 0, poz. 988).
Rozporządzenie Rady Ministrów z dnia 22 stycznia 2009 roku w sprawie realizacji niektórych zadań Agencji Restrukturyzacji i Modernizacji Rolnictwa (Dz. U. Nr 22, poz. 121).
Rozporządzenie Rady Ministrów z dnia 27 stycznia 2015r. w sprawie szczegółowego zakresu i sposobów realizacji niektórych zadań Agencji Restrukturyzacji i Modernizacji Rolnictwa (Dz. U. z 2015r nr 0, poz. 527).
Rynek ziemi rolniczej. Stan i perspektywy nr 17. IERiGŻ, Warszawa 2014.
Sprawozdanie o pomocy publicznej udzielanej w sektorze rolnictwa i rybołówstwa w Rzeczypospolitej Polskiej w 2010 roku. Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa 2011.
Sprawozdanie o pomocy publicznej udzielanej w sektorze rolnictwa i rybołówstwa w Rzeczypospolitej Polskiej w 2011 roku. Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa 2012.
Sprawozdanie o pomocy publicznej udzielanej w sektorze rolnictwa i rybołówstwa w Rzeczypospolitej Polskiej w 2012 roku. Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa 2013.
Sprawozdanie o pomocy publicznej udzielanej w sektorze rolnictwa i rybołówstwa w Rzeczypospolitej Polskiej w 2013 roku. Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa 2014.
Sprawozdanie z działalności Agencji Restrukturyzacji I Modernizacji Rolnictwa za rok 2010. ARiMR, Warszawa 2011.
Sprawozdanie z działalności Agencji Restrukturyzacji i Modernizacji Rolnictwa za rok 2011. ARiMR, Warszawa 2012.
Sprawozdanie z działalności Agencji Restrukturyzacji i Modernizacji Rolnictwa za rok 2012. ARiMR, Warszawa 2013.
Sprawozdanie z działalności Agencji Restrukturyzacji i Modernizacji Rolnictwa za rok 2013. ARiMR, Warszawa 2014.
Steinhouser H., Langbehn C., Peters U. [1982]: Einfuhrung in die landwirtschaftliche Betriebslehre. Band 1: Allgemeiner Teil. Verlag Eugen Stuttgart.
Tomczak F. [1997]: Gospodarstwo rodzinne i jego ewolucja [w:] Gospodarstwo rolnicze wobec wymogów współczesnego rynku i Unii Europejskiej. Wydawnictwo SGGW, Warszawa.
Ustawa z dnia 30 kwietnia 2004 r. o postępowaniu w sprawach dotyczących pomocy publicznej (t.j. Dz. U. z 2007 r. Nr 59, poz. 404 z późn zm.).
Ustawa z dnia 16 września 2011 r. o zmianie ustawy o gospodarowaniu nieruchomościami rolnymi Skarbu Państwa oraz o zmianie niektórych innych ustaw (Dz. U. z 2011 r. Nr 233, poz. 1382).
Ustawa z dnia 19 października 1991 r. o gospodarowaniu nieruchomościami rolnymi Skarbu Państwa (t.j. Dz. U z 2015 r. Nr 0, poz. 1014).
Woś A. [1985]: Ekonomiczne narzędzia sterowania rolnictwem. PWN, Warszawa.
Woś A. [1996]: „Agrobiznes". Makroekonomika. Wydawnictwo Key Text, Warszawa.
Woźniak B [2008]: „Pomoc publiczna" [w:] System finansowy w Polsce, t. 2 (ed.) B. Pietrzak, Z. Polański, B. Woźniak. PWN, Warszawa.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 111–118

Sviatlana Kandratsenka[1]
The Institute of System Research, Agro-Industrial Complex of National Academy of Science, Belarus

Food Security Monitoring in the Republic of Belarus

Abstract. The article investigates theoretical and methodical aspects of food security monitoring and reveals significant development tendencies in the world market of food and agricultural raw materials. It also discusses the experience of the Republic of Belarus in the assessment level for physical and economic food availability to the population. The monitoring algorithm of national food security of the Republic of Belarus including assessment criteria, indicators and their liminal values, and an information support model is presented. The monitoring algorithm assumes complex application of techniques adapted for social and economic conditions of the Republic, including tendencies assessment and development factors of the world market food security level and independence, threats on life quality of the population, and methodical recommendations about ensuring stability of food security. The applied system of basic indicators and their threshold values allows the creation of a full picture of security and threats from different directions, and ways of developing mechanisms to deal with them.

Key words: world food market, Belarus, food security, monitoring

Introduction

The present stage of development in the system for national food security in Belarus is characterized through realization of its conceptual bases. The sustainable innovative development strategy of the National Agroindustrial Complex is focused on increasing competitiveness of the major production types, realizing the potential of export branches, and growth in quality of life for the population in all components, including physical and moral health, ecologically safe food consumption, working conditions and life harmonization [Lukaszenko 2014, Концепция… 2004].

Belarus produces a volume in the agro-food sphere that is one and a half times more than the requirement of the domestic market, and ensures its safety. At the same time, the Republic is compelled to get expensive energy resources and earn the means for exporting food competitively. National producers have to compete on the commodity markets where products are made in the best climatic conditions with a higher level of export support. Tendency development research of the world food market helps reveal and classify the most significant of them. There are three groups of factors.

The first group includes a number of factors. Capacity of the world market grows at deterioration of formation conditions of resources and unstable production dynamics. Annual growth rates of the population (1.4%) advance the corresponding indicator of food production (0.9%). According to experts of the Food and Agricultural Organization, global food production has to increase by 60% by 2050 in order to feed the increasing global population.

[1] Candidate of Economics, doctoral candidate, e-mail: Kondraatenko-0703@mail.ru
The Institute of System Researches of Agroindustrial Complex of NAS of Belarus
BY – 220108, Minsk, Kazintsa street, 103.

It is difficult to provide such growth on the principles of sustainable development of agriculture without damage to ecological safety because natural resources are declining, owing to the suffering caused by system intensification of agriculture ecosystems, and climatic changes can be observed [Food outlook… 2014, Food and nutrition… 2014]. The main production growth occurs at the expense of agriculture of developing countries because the developed countries have already settled ecologically safe reserves. The volume of carry-over grain stocks remains the defining stability factor of the world food system. Reduction of carry-over stocks in relation to the general requirement in 2007–2008 by 18.4% had a strong destabilizing impact. The output growth of grain allowed restoring stocks in 2014 to the level of 576.6 mln tons or 23.4% of requirement [Food and nutrition…2014].

The second group includes the following points. Hunger rates are reduced (in 2010–2014 the number of the chronically starving reached 805 mln people, in 1990–1992 – 1014 mln people [Food and nutrition… 2014, The state… 2014]). There was a new form of hunger – chronic malnutrition in developing countries that covers more than 2 bln people consuming only 1000–1800 kcal per day, rather than the norm of food that FAO recommends – 2400–2500 kcal per day. Only 40% of global inhabitants are provided with good nutrition [Food and nutrition…2014]. Essential changes happen in food ration of the population of developing countries – more high-calorie, protein-rich food replaces traditional grains and beans. Milk consumption per capita in this group increased by 2 times, meat 3x and eggs 5x over 20 years [Food outlook… 2014]. Consumers in developed countries created the priority of ecological safety and food quality (the demand growth for ecological production is 0.5% per year) [Food outlook… 2014].

The third group is a conjuncture of factors. Competition in food markets amplifies and becomes complicated owing to application measures of tariff and non-tariff regulation of the GATT/WTO. Instability of food and raw material prices remains in the long-term period owing to volume increase of world consumption and international trade: the index of Food Prices in relation to the basic level of 2002–2004 (100%) in 2008 was 201.4%, in 2011 – 230.1%, in 2013 – 210.5% [The state… 2014].

Considering world tendencies, the strategic direction of domestic food market development of the Republic of Belarus is the achievement of production stability focused on export through an innovative basis during the use of advantages of international regional integration.

The purpose of the article is the research of theoretical and methodological aspects of monitoring food security of the Republic of Belarus.

Research methods

Identification and anticipation of food security threats and providing measures of sustainable development of the Agroindustrial Complex cause the necessity of continuous improvement of monitoring methods and forecasting of social and economic processes, food consumption dynamics [Концепция… 2004].

Monitoring of national food security is carried out annually according to the assessment criteria designated by the Concept of National Food Security of the Republic of Belarus, approved by the Resolution of Ministers Council of the Republic of Belarus on March 10th, 2004.

The purpose of food security monitoring is to reveal internal and external factors and potential threats on national, regional and house farm levels, to develop mechanisms of their anticipation, providing strategy of sustainable development of rural territories.

The main criteria of the reached level of food security are the following:

- satisfaction degree of physiological needs for components and power maintenance of a diet;
- compliance of a diet to restrictions of unhealthy substances existing in products;
- physical and economic availability food level to various categories of the population;
- dependence degree of food supply of the country and resources providing agro-industrial complex from import;
- volumes of strategic and operational food stocks according to standard requirement;
- efficiency of use of an export potential [Концепция… 2004].

The monitoring algorithm systematizes the original technique adapted for social and economic conditions of regions and provides the following investigation stages:

Stage I. The analysis of global tendencies and development factors of the world market (purpose – to reveal the potential of external threats and stability factors);

Stage II. The reached level assessment of food security of the country and regions (purpose – to estimate the level and food quality of the population, possibility of self-sufficiency by main food types);

Stage III. The influence threat assessment on life quality of the population (purpose – to determine the level of threat impact on quality of food allowance of the population in a section of social groups, house farms of city and rural areas);

Stage IV. The assessment of stability potential of the regional food markets (purpose – to reveal the factors forming adaptability potential to environment changes);

Stage V. Development of analytical balance model of grocery markets (purpose – to estimate the potential of deficiency threats of food resources connected with instability of agricultural production);

Stage VI. Development of methodical recommendations about ensuring food security including regulation mechanisms.

Basic indicators of food security threats of the Republic of Belarus are developed taking into account FAO recommendations including:

The Ist group – the level and quality of food ration of the population (the power value of food ration is at 1 person per day (not less than 3000 kcal), the main products consumption on 1 person a year (90–110% of medical norm), specific weight in a diet of animal proteins (not less than 55 %, etc.);

The IInd group – health state of the population (natural increase of the population, the expected life expectancy in city and rural areas, disease prevalence, characteristic for the low food status, etc.);

The IIIrd group – education level (specific weight of the competent population, etc.);

The IVth group – physical food availability (growth rate of agricultural production (not less than 5–7% a year), the functioning agricultural organizations (not less than 60%), stability of grain production (not less than 75%), ratio creditor and receivables of the agricultural organizations (1:1), profitability of agricultural activity (not less than 40%), specific weight of investments into agriculture in a total amount (not less than 10%), etc.);

The Vth group – economic food availability in a section of social groups of households in city and rural areas (a share of food costs in expenses (not more than 35%), growth rate

of purchasing power of the real monetary income of the population (not less than 1% a year), the population with the income below a living wage (not more than 8% to city and 10% to rural areas), the concentration level of income (not more than 45%), unemployment rate (not more than 4%), specific weight of import in internal consumption (not more than 20%), etc.

The monitoring algorithm of food security in Belarus is automated in a ystem of information support of innovative activity in the national market of raw materials and food – joint development of the Institute of System Research in Agroindustrial Complex of NAS of Belarus and the United Institute of Informatics Problems of NAS of Belarus [Eurasian Economic… 2015].

Information system represents the integrated environment with remote access providing food monitoring of security and stability of the agrarian market containing the following elements.

Common database of scientific and technical information in the sphere of food security:

– methodical means of ensuring monitoring;

– database of scientific and technical development and innovative projects in the sphere of ensuring food security (patents, projects, scientific articles, conferences materials, reports on research and development, abstracts, etc.);

– monitoring results of food security, balance forecast of grocery markets for supply and demand;

– analytical materials about the environment of world markets, markets of the State Parties of the Eurosian Economic Union.

Management subsystem of the database (provides creation and maintaining database, the organization of access for users, information input, etc.).

Web-application of navigation access to information resources (organizes input control and access to database, search via the Internet browser by users' inquiries, etc.).

Management subsystem of service and administration (provides maintaining news, support of the statistical analysis, the organization of feedback in the Forum mode, etc.).

Information support of the system is based on modern technologies of maintaining databases.

Table 1. Agricultural production per capita in participant-states of the Common Economic Space, kg

Product	The Republic of Belarus						The Russian Federation	The Republic of Kazakstan
	2000	2005	2010	2012	2013	2014	2013	2013
Grain	486,1	658,5	737,1	975,0	803,1	1010,1	637	1070
Potato	872,6	839,4	826,0	730,3	624,6	663,3	210	196
Vegetables	138,0	205,8	246,3	167,1	171,8	183,1	102	190
Sugar beet	147,5	314,3	398,0	504,3	459,0	507,6	236	4
Meat	85,5	105,0	147,7	164,5	176,1	163,5	60	55
Milk	449,4	582,1	698,7	715,1	703,2	708,2	214	287
Eggs, pcs	329,1	318,2	373,0	406,4	418,4	417,3	288	228

Source: author's calculations based on data of the Eurasian Economic Commission.

The initial socio-economic indexes are necessary for monitoring performance at the regional level that are entered from the automated remote workplaces by correspondents in regions by means of special entrance forms. The regional correspondents get access to a uniform database of scientific and technical information from the analytical center as feedback. The period of research is years 2000-2014. Data sources are statistics of the Republic of Belarus, of Eurasian Economic Union and of FAO.

Research results

The monitoring of national food security of the Republic of Belarus during 1995–2013 executed by system means of basic indicators and their liminal value allowed to create a full picture of security and potential threats to security in the manifestation directions and to develop mechanisms and packages of measures on their anticipation.

Table 2. The main food consumption in the Republic of Belarus per capita per year, kg

Product	Medical consumption norm	2000	2005	2012	2013	Ensuring of medical norm, %
Meet and meat products	80	59	62	89	89	118
Milk and milk products	393	295	262	281	280	72
Eggs, pcs	294	224	259	310	315	110
Fish and fish products	18,2	9,5	18,6	13	16	86
Sugar	33	34,9	39,1	42	41	124
Oil	13,2	8,7	14,7	17	18	140
Vegetables	124	93	128	145	146	120
Fruit and berries	78	25	47	64	60	79
Potato	170	174	183	186	184	108
Bread products	105	110	96	90	88	83
Total kilocalories per day	3500	2900	3100	3200	3300	94

Source: author's calculations based on data of the National Statistical Committee of the Republic of Belarus.

According to the monitoring results of food security significant factors of food security are revealed, the most important of which are the following:

Physical food availability:

- high level of main types of food production and agricultural raw materials allows to provide a food ration in a power assessment at the rate of 3200 kcal on average on 1 person per day that corresponds to the optimistic safety level and testifies to accurately expressed export orientation of Agroindustrial Complex;
- the output of main types of food per capita made 803 kg of grain in 2013, vegetables – 172, potatoes – 624, meat – 176, milk – 703 kg, eggs – 418 pcs that exceeds the reached level in the State Parties of the Common Economic Space on many positions (Table 1);
- food ration of population approaches the optimum life-supporting products and made 89 kg of meat and meat products in 2013, 280 – milk and milk products, 16 – fish and fish products, 41 – sugar, 18 – vegetable oil, 146 – vegetables, 60 – fruits and berries, 184

kg – potatoes and 315 pcs of eggs, at medical norm – 80; 393; 18,2; 33; 13,2; 124; 78; 170 kg and 294 pcs respectively (Table 2);

- foreign trade balance in agricultural production and food is positive in recent years. The main export-oriented products – meat and meat products, milk and milk products, eggs, fish canned food, rawhide;
- products existence of critical import including fish and seafood – 81,3%, vegetable oil – 54,1; groats – 51,7%;

Economic food availability:

- social situation in the Republic can be characterized as stable, the actual unemployment rate is 0,5%;
- factor constraining improvement of qualitative structure of the population diet is purchasing power of the real monetary income which doesn't allow to increase consumption of products with high cost (beef, veal, fish, caviar);
- share of food costs in total of households is high, in 2013 the indicator was 37,7% (Table 3).

Table 3. Food security indicators of the Republic of Belarus, 2000-2013

Indicators	Liminal values	Actual value					Indicator stability in 2013, %
		2000	2005	2010	2012	2013	
		Level and quality of population food ration					
Specific weight in a diet of animal origin proteins, %:							
total	No less than 55,0	49,5	55,7	61,9	61,8	63,3	115,1
in rural areas		42,1	49,1	54,7	55,3	55,4	100,7
		Economical food availability					
Growth rate of the real population income, %	No less than 1,0	113,8	118,1	115,1	121,5	115,4	114,3
Costs share of private households on food, %	No more than 35,0	58,0	42,4	39,0	43,0	37,7	107,7
		Physical food availability					
Growth rate of agricultural production, %	No less than 5,0–7,0	109,3	101,7	102,5	106,6	96,0	91,4
Profitability of agricultural activity, %	No less than 40,0	3,0	–	–0,5	14,7	7,9	19,8
Specific weight of investments into agriculture in total, %	No less than 10,0	6,8	13,3	17,8	16,1	14,0	140,0
		Market functioning efficiency					
Balance of foreign trade of agricultural raw materials and food, mln USD	–	–614,6	–388,9	626,2	1393,0	1600,0	Positive balance
Specific weight of import in internal consumption, %	No more than 25,0	18,5	15,5	14,0	13,6	14,5	Acceptable level

Source: see table 2.

The monitoring results testify the existence of potential threats of food security in such spheres as food ration quality of population, economic food availability to separate social groups, insufficient efficiency level of economic entities and competitiveness production, instability of agricultural production under the influence of difficult climatic factors.

Conclusions

The executed research of methodical and practical aspects of monitoring of national food security in the Republic of Belarus allows making the following conclusions:

1. Environment conjuncture instability of the world market and moving food problem from the commercial into the political sphere promotes continuous emergence of negative manifestations of competition, food security monitoring gains increasing practical value.
2. Developed system usage of the indicators and their liminal values adapted for social and economic conditions of the country and regions allows not only to estimate a self-reliance condition but also to predict balance of the grocery markets determining the potential threats and necessary measures for anticipation.
3. The country food security is guaranteed with a set of economic and social conditions, its providing and stability increase of system assume realization of measures package. The most important are the following:
   - effective agrarian policy formation, the economic prerequisites for managing stability conditions;
   - employment population guarantee and policy activization directed on poverty eradication and an inequality in food availability;
   - complex strategy introduction of branches development of Agroindustrial Complex for the increase in food production and efficiency increase;
   - usage of advanced technologies and programs in the field of production and processing of agricultural raw materials;
   - ensuring adequacy of food deliveries to requirements satisfaction of the population, ecological safety guarantee of products;
   - carrying out the foreign economic activity, usage of international labour division advantages, optimization of deliveries on export and import;
   - improvement of the reaction mechanism in emergency situations in the food market.

References

Lukaszenko A.G. [2014]: Послание президента белорусскому народу и Национальному собранию / Беларусь сегодня. – №76 от 23 апреля 2014 г., 2–8.

Концепция национальной продовольственной безопасности / Р.И. Внучко [и др.] Минск: Ин-т аграрной экономики НАН Беларуси, 2004, 96 .

Food Outlook. Biannual report on global food markets // Food and Agriculture Organization of the United Nations [Available at:] www.fao.org/3/a-i4136e.pdf [Access: March 2015].

Food and nutrition in Numbers // Food and Agriculture Organization of the United Nations [Available at:] www.fao.org/3/a-i4175e.pdf [Access: March 2015].

The state of food and agriculture // Food and Agriculture Organization of the United Nations [Available at:] www.fao.org/docrep/013/i2050e/i2050e.pdf. [Access: March 2015].

Innovative activity in the market of agricultural products and foodstuffs [Available at:] http://prod.refor.by [Access: March 2015].

Eurasian Economic Union [Available at:] http://www.eurasiancommission.org/en/act/integr_i_makroec/dep_stat/Pages/default.aspx [Access: March 2015].

National statistical committee of the Republic of Belarus [Available at:] http://belstat.gov.by/en [Access: March 2015].

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 119–126

Dorota Kozioł-Kaczorek[1]
Department of Agricultural Economics and International Economic Relations,
Warsaw University of Life Sciences – SGGW

Agricultural Property Market in Norway – Basic Information

Abstract. The agricultural structure in Norway is strongly dependent on agricultural policy, which is a major determinant of its development. The structure of farming – comprised by the distribution of farms, size of farms, forms of ownership, transfer of land rights act – is controlled by legal and economic instruments. The objective of the publication is to describe a background of the market of agricultural properties in Norway. In particular, the paper details laws that are the basis of Norwegian agricultural policy and the agricultural property market. It is important and also interesting because these aspects of human life and national reality are so different from Poland. Some part of the publication is devoted to presenting the situation of the agricultural properties market in Norway in 2014.

Key words: Norway, agricultural property, agricultural policy, legalization instruments

Introduction

This publication is only a preliminary article about the agricultural property market in Norway. This study is part of research which has been conducted under the framework of "Scholarship and Training Fund Mobility Projects In Higher Education. Individual Training Programme For Staff Training Mobility" in Østfold University College in Norway. The author of this study is planning further publications and analysis dedicated to the market of agricultural property, as well as agricultural policy in Norway.

The objective of the publication is to describe the background of the agricultural property market in Norway. In particular, the paper details legal and economic instruments that are the basis of Norwegian agricultural policy and of the agricultural property market. It is important and also interesting because these aspects of human life and national reality are so different from Poland. A part of the publication is devoted to presenting the situation on the Norwegian agricultural properties market in 2014.

Norway is a country with a small population, the number of persons registered as living in Norway is equal 5,204,434 persons as of 1 October 2015 [sb.no 2015]. It is also a country with a rather large area divided between the mainland, Svalband and Jan Mayen. The area of each part is shown in Table 1 [www.ssb.no].

Table 1. Land and fresh water in Norway in square kilometres (km^2)

	In all	Land	Fresh water
The Kingdom of Norway	385,171	365,191	19,980
The mainland	323,772	304,193	19,579
Svalbard	61,022	60,627	395
Jan Mayen	377	371	6

Source: Statistics Norway [www.ssb.nob].

[1] PhD, e-mail: dorota_koziol@sggw.pl

The Norwegian subdivision consists of five geographical regions i.e. Eastern Norway, Southern Norway, Western Norway, Trøndelag, and Northern Norway. The administrative division of Norway takes place at three levels. The first one is the kingdom covering the mainland, Svalbard and Jan Mayen. The second level is 19 counties (*fylker* in Norwegian). The third level is 430 municipalities (*kommune* in Norwegian). There are also three dependent external uninhabited territories located in the Southern Hemisphere: Bouvetøya, Queen Maud Land and Peter I Island [www.ssb.no].

The total agricultural and forest area is 80,124 km^2, which is 26% of the land on the mainland part of Norway. The agricultural area in use covers 9,859 km^2 (3.2% of land) of which fully cultivated is 8,103 km^2 (2.7% of land). Whereas the forest area is 70,264 km^2 (23% of land) [www.ssb.no]. The map of the agricultural area and of the forest area, in counties, is presented in Figure 1.

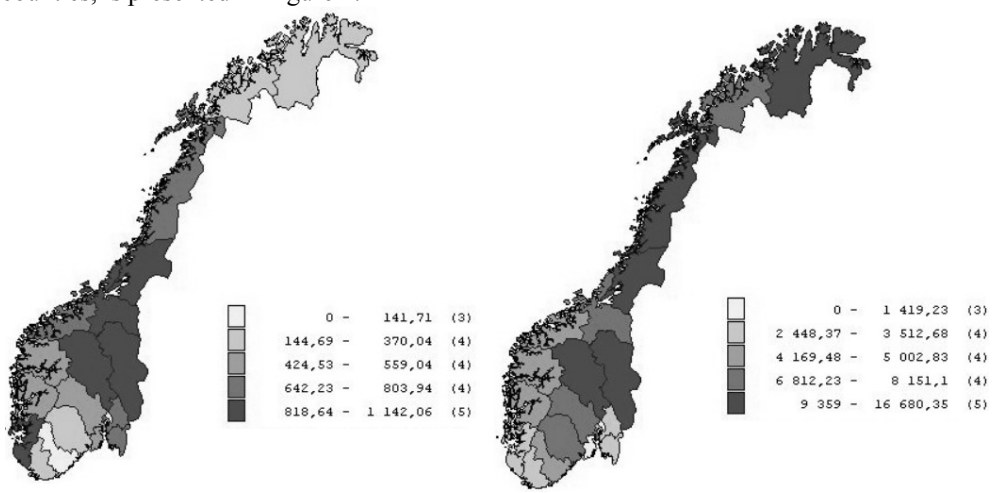


Fig. 1. The map of the agricultural area (left) and of the forest area (right)

Source: Statistics Norway [www.sssb.no 2014].

The agricultural structure in Norway is measured by numbers of agricultural and forestry properties. The Statistics Norway defined agricultural property as property that is used (or could be used) for agriculture, belonging in its entirety to the same owner within a single municipality. It is property with at least 0.5 ha of productive area. Forestry property is similarly defined, as property that is used (or could be used) for forestry and belonging to the same owner within a single municipality. Forest property is property with at least 2.5 ha of productive forest area [www.ssb.no].

In 2014 the total number of agricultural and forestry properties was 185,732 of which 89% were property with agricultural area and 71% were property with productive forest area [www.ssb.no]. The structure of agricultural and forestry properties in numbers is presented in Table 2.

Table 2. Agricultural and forestry properties in 2014

	Number	Percent
Total	185,732	100
Type of property		
Property with agricultural area	164,484	89
Property with productive forest area	132,510	71
Property with dwelling house	149,654	81
Uninhabited property with dwelling house	31,103	17
Type of owner		
Male	125,548	68
Female	47,125	25
Properties of persons deceased/legal person/unknown	13,059	7

Source: Statistics Norway [www.sssb.no 2014].

The agricultural structure in Norway is strongly dependent on agricultural policy, which is a major determinant of its development. The structure of farming, which comprises the distribution of farms, size of distribution of farms, size of farms, forms of ownership, and transfer of land rights act, is controlled by legal and economic instruments. Both are applied to obtain the main goals of Norwegian agricultural policy [Magnar et al. 2014, Dramstad W.E., et al. 2010].

The main objective of Norwegian agricultural policy is to ensure self-sufficiency and security in the field of agricultural production (especially food production). Emphasized, above all, is the need to maintain (increase) the area of cultivated land while striving to maintain existing agricultural land in good condition and not worsening its quality. All mentioned objectives are realised under rather unfavourable geographical and climatic conditions. This is one of the main reasons for which the Norwegian agricultural policy is still strongly state regulated, through legislation and economic instruments. In this publication there is a short description of only those legal instruments that have the biggest impact on the Norwegian agricultural properties market [Magnar et al. 2014, Dramstad et al. 2010].

Legislation on the agricultural property market

The relations of agricultural property are regulated by three different legislative instruments, i.e. the Allodial Act, the Concession Act, the Agricultural Act.

The Allodial Act is an ancient law that is derived from Roman law. It is an almost distinctively Norwegian law. Some vestiges of allodial law are also found in the Scotland market [Magnar et al. 2014, Mackenzie 2004].

In Norway, the allodial right is an old legal tradition and it is a right to reclaim property, but not to inherit it. It means that family members have the status of preferred buyer of "family" property in situations where this property is available for sale. In other words, the owner of property with allodial rights can sell (or even give) the property to whom he wishes. The sale cannot be stopped by those with allodial rights, but they can claim the property from a new owner. The Allodial Act has several sets of rules that define which property can become allodial properties, who has allodial rights, how to rank owners

of allodial right in order of priority, when to claim allodial rights, procedures for claiming rights, and rules for surviving spouses or partners. The property can be allodial property under two conditions: The first is that the property must have at least 2.5 ha of cultivated land or at least 50 ha of forest productive area. The second condition is that the property must to have the same owner for a period of 20 years. The first person who is the owner of the property for 20 years establishes allodial rights for himself and his descendants. The descendant in allodial right is a grandchild, a child, a nephew. A child has a higher priority than a grandchild, and a grandchild has higher priority than a nephew. The eldest grandchild or child or nephew has higher priority than the younger [Forbod 2006, Gjerdåker 2001, Landbruks- og matdepartmentet 2011 – 2012, Lilleholt 1998, Magnar et al. 2014].

The first Concession Act was established in 1974, the second came into effect in 2004. The concession law, just as allodial law, is definitely rare in other countries and can be treated as a specificity of Norwegian legislation. The Concession Act regulates state control of all methods of transferring ownership of agricultural property in Norway i.e it applies to sales, inheritance, donation, gift, lease, rental, etc. Each kind of transfer of agricultural property requires a Concession Permit. It also regulates the price to acquire farm property. There are a lot of rules stated in the Concession Act. Three of them are treated as primary and are of specific interest to changing land ownership. First of all, the investor must have the concession if the area of cultivated land is larger than 2.5 ha or the total area of farm is larger than 10 ha. Secondly, there is a general obligation of residency i.e the buyer has to reside on the agricultural property for at least five years after transaction. This is a part of agricultural policy which prevents farm expansion through land purchase and regulates the number of farm properties that can be owned by one person. And, thirdly, this Act provides preference to those investors who are active farmers and regulates purchase by legal persons [Forbod 2006, Lilleholt 1998, Magnar et al. 2014].

The Agricultural Act was adopted in 1994. One of the objectives of this Act is to provide that all agricultural land is used and treated in the best possible way. Land areas including forests and mountains and all land resources must be used in a manner that is most beneficial to society and to those working in the agricultural sector. For example, the area of cultivated land or some areas of pasture land must be farmed. This means that soil must be cultivated and harvested at least once a year and pasture land must be kept in good condition. In the case of omission of duties by the farmer, the municipality can decide on sanctions. One of the sanctions is that local authorities can order the owner to lease the land or can lease the land for the owner. All mentioned resources shall be disposed with a view to the needs of future generations. The management of it shall take into consideration protection of the soil (production factor) and preservation of land and cultural landscapes as a basis for life, health and well-being for human beings, animals and plants. The Act lays stress inter alia on promoting rural settlement, employment and agricultural development. Another aspect of the Agricultural Act concerns the conditions of eventual partition of agricultural property, which generally is not allowed. There are only few exceptions for partition of farmland [Magnar et al. 2014, www.regjeringen.no].

The current situation on the market of agricultural property

The Norwegian real estate market can be classified in two ways. Firstly, by method of transfer of property. In this situation the transfer is defined as not only an ordinary sale, but also as a donation, compulsory sale and eminent domain, licensed decedent property, inheritance of decedent property. The above-mentioned donation is defined as transfer of property for a price lower than the tax base or the market value. The main class of transfer of title for property is free market sale. This means that rights for the property are sold for a price corresponding to the market value. The classification of type of transfer by registered transfer of real property covers:

- establishment of lease
- transfer of lease
- transfer of title
    - free market sale
    - donation
    - compulsory sale and eminent domain
        - expropriation
        - forced sale
    - licensed decedent estate
    - inheritance of decedent estate
    - other or not specified [www.statbas.ssb.no].

Table 3. The classification of type of properties by purpose of use

First level	Second level	Third level
Dwelling property	With building	Detached houses/ Semidetached houses/ Row-houses/Flats in multi-dwelling houses/Semidetached houses/Other
	Without building	
Holiday property	With or without building	
Agricultural/forestry/fishery property	With or without building	
Commercial/office property	With or without building	
Industrial/mining property	With or without building	
Transportation properties	Public roads	With or without building
	Transportation area	With or without building
Other properties	Protected area	With or without building
	Institutions	With or without building
	Recreation purposes	With or without building
Not specified		

Source: Statistics Norway [www.ssb.no].

An essential, important and significant part of the market of agricultural real estate is establishment of lease and transfer of lease. This is due to legal restrictions regarding the possibility of acquiring agricultural land. The reasons for this state of affairs can also be discerned in the Norwegian tradition and socio-spatial relationships between people and

property. It can be assumed that owners have a propensity to enact their properties according to a view of ownership evoked by the 'emotions of property' [Flemsæter 2009]. These aspects of the Norwegian market of agricultural properties will be discussed in the next publication.

Table 4. The structure of transfers of agricultural properties by type of transfer in 2014

Type of transfer	Number
Free market sale	2826
Donation	1938
Licensed and inheritance of decedent estate	3271
Compulsory sale	76
Other	1204
Total	9315

Source: Statistics Norway [www.ssb.no].

A second way of classification is by a property's purpose of use. This classification is presented in Table 3. The basis of this classification is in the General register of real properties addresses and buildings.

Table 5. The structure of transfers of agricultural properties by type of properties in 2014

Type of properties	Number
Dwelling	2077
Holiday	968
Agriculture	5676
Other	594
Total	9315

Source: Statistics Norway [www.ssb.no].

As was mentioned above, in 2014 the total number of agricultural and forestry properties was 185,732. The Norwegian market of agricultural properties is rather small. In 2014, the total number of transfers of agricultural properties was 9315, so it concerned only 55% of all agricultural property [www.ssb.no]. The structure of transfers of agricultural properties by type of transfer is presented in Table 4. The structure of transfers of agricultural properties by type of properties is presented in Table 5.

Table 6. The agricultural properties sold on the free market depending on the purchase price (in 2014)

Price in NOK	Number of properties by purchase price
Until 999 000	1153
1 000 000 - 1 999 000	701
2 000 000 - 2 999 000	462
3 000 000 - 4 999 000	351
More than 5 000 000	159
Average purchase price per transfer	1 989 000 NOK

Source: Statistics Norway [www.ssb.no].

As can be seen, the share of transfers in category "Free market sale" in the total number of transfer in 2014 is around 30% and it is only 1.5% of the total number of agricultural properties [www.ssb.no].

The agricultural properties on the free market in Norway are expensive. The average purchase price per transfer in 2014 was 1,989,000 NOK. Almost 60% of sold properties received a price above 1,000,000 NOK and almost 10% of them received a price above 5,000,000 NOK [www.ssb.no]. The empirical distribution of prices of property on the Norwegian agricultural real estate market in 2014 is presented in Table 6. The distribution of the number of transactions and the distribution of the average purchase price per transfer between the counties is presented on Figure 2.

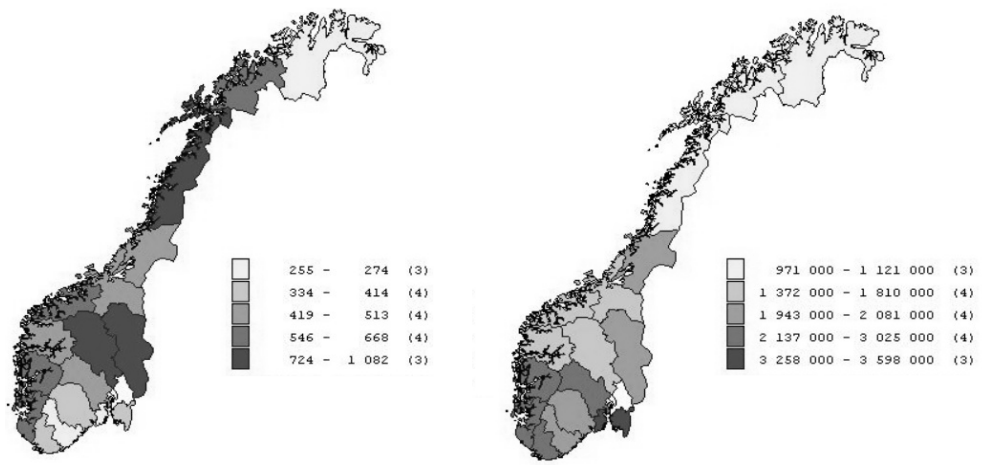


Fig. 2. The map of the distribution of the number of transactions (left) and the distribution of the average purchase price per transfer between the counties (right)

Source: Statistics Norway [www.ssb.no].

The biggest average price (in approximation) per 1m^2 was achieved for properties with an area less than 4 ha and for properties with an area between 10 ha and 20 ha. The lowest average price (in approximation) was achieved for properties with an area between 0.5 ha and 10 ha [www.ssb.no]. The distribution of the purchase price of sold agricultural property depending on agricultural area is presented in Table 7.

Table 7. The purchase price of sold agricultural property by agricultural area (in 2014)

Area of agriculture property	Average purchase price in NOK	Approximate average price in NOK per 1m^2
0,0 - 4,0 ha	1 479 000	73,95
0,55 - 9,9 ha	1 772 000	37,70
10,0 - 19,9 ha	2 679 000	54,12
20,0 ha and more	5 190 000	51,90

Source: Statistics Norway [www.ssb.no] , own calculations

For a better overview of prices of the agricultural area it is worth mentioning that the average monthly earnings in Norway were 42,300 NOK and average monthly earnings in section of "Agriculture, forestry and fishing" were 38,800 NOK in 2014.

Conclusions

Norway is one of the last European countries in which the structural development of agriculture is really strongly regulated by legislative acts and economic instruments. It is also one of the European countries with a large number of very small farms. Similar to agricultural policy and structure of agricultural land, the Norwegian agricultural real estate market is strongly regulated by law, especially by the Allodial Act, the Concession Act, the Agricultural Act and also other legal requirements.

As it was shown, the Norwegian market of agricultural property is closed, small and very expensive. High prices and the small number of transactions on the market of agricultural property stem not only from the Norwegian agricultural policy and the above-listed legislatine acts. It can be assumed that they are also the result of tradition and socio-spatial relationships between people and property which will be the subject of another publication [Flemsæter 2009]. In Norwegian society 'the rural way of living' has been the hegemonic norm for 'quality of life', and rural values have played a significant part in how Norwegians want to live their lives [Flemsæter 2009].

Due to the nature of Norwegian agricultural policy as well as the Norwegian market of agricultural real estate and due to single publications in English (also in Norwegian) the author plans further studies and subsequent publications.

References

Dramstad W.E., Sang N. [2010]: Tenancy in Norwegian agriculture. *Land Use Policy.* no 27, pp. 946-956.

Flemsæter F. [2009]: Geography, Law, and the Emotions of Property. Property Enactment on Norwegian Smallholdings. Doctoral thesis at NTNU. Departament of Geography. Norwegian University of Science and Technology, Trondheim.

Forbod M. [2006]: En gjennomgang av odelsloven, konsesjonsloven og jordloven og endringer I nyere tid. Notat 5/06. Norsk senter for bygdeforskning„ Trondheim.

Forbord M., Bjørkhaug H., Burton R.J.F. [2014]: Drivers of change in Norwegian agricultural land control and the emergence of rental farming. *Journal of Rural Studies* no 33, pp. 9-19.

Gjerdåker B. [2001]: Til ode log eige. Odels- og åsesrettane gjennom eit millennium, med vekt på dei siste 250 åra. Rapport 15. Norsk institutt for landbruksøkonomisk forskning, Oslo.

Landbruks- og matdepartmentet [2011 – 2012]: Melding til Stortinget nr. 9 Landbruks- og matpolitikeken, Oslo

Lilleholt K. [1998]: Knophs Oversikt over Norges Rett, 11. Utgave. Universitetsforlaget, Oslo.

Mackenzie A.F.D. [2004]: Re-iamging the land, North Sutherland, Scotland. *Journal of Rural Study*. no 20, pp. 273-287.

www.regjeringen.no

www.statbas.ssb.no

www.sssb.no

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 127–136

Elwira Laskowska[1]
Department of Agricultural Economics and International Economic Relations,
Warsaw University of Life Sciences – SGGW

Property Tax Systems in Selected European Union Countries and the Proposed Tax Reform in Poland

Abstract. The purpose of this article is to compare the property tax systems applied in the European Union countries in the context of the proposed tax reform in Poland. In addition, an attempt was made at identifying the advantages and disadvantages of this reform. The results of the analyses allow us to conclude that the experience of the countries where the cadastral property taxation system is applied corroborates the validity of introducing such a system in Poland. The importance of the cadastral property tax in terms of budgetary revenues in individual EU countries varies because of the different way of determining the so-called property tax value (the tax value of the real estate). Nevertheless, determination of the tax in relation to the value of the property will allow for a more equitable distribution of the tax burden, especially with the application of a tax relief and preference system for taxpayers. The related literature exposes certain social unrest associated with the increase of the tax burden due to the introduction of the cadastral tax. However, it should be noted that, as a consequence, such burden will be correlated with the financial situation of the taxpayer. In addition, the possible increase in the tax revenues paid to the local government budgets is hardly a negative effect of the proposed tax reform, while the high cost of the creation of cadastre, perceived as a disadvantage, is a natural consequence of economic changes in the country, in particular, in the case of justified future benefits.

Key words: property tax system, cadastral tax, property tax, European Union, Poland

Introduction

Real estate (or property) tax is a type of property taxation applied in more than 130 countries in the world, providing a source of income for local government budgets (with a few exceptions, e.g. in Sweden, it is paid to the state – central – budget) [Firlej et al. 2014]. Different property taxation systems provide for a variety of solutions, which are specific for a given country. "The system of property taxation is interpreted differently depending on the country in which it is applied" [Etel 1998, p. 13]. However, you can differentiate two main systems among such solutions: the first system in which the taxable base is determined in accordance with the real estate value (cadastral systems), and the other one which is based on the area of the real estate (the area-related system). Property tax which is levied *ad valorem*, i.e. on the value of the real estate, is applied in most Western European countries. For the proper operation of the system, we need to establish a register of real estate, known as cadastre, including such information as the value of each property. On the other hand, area-related systems are applied in countries where such a register (cadastre) does not exist, e.g. in Poland. Property tax reforms currently being undertaken and implemented in Central and Eastern Europe are aimed at moving away from the systems based on the area of the real estate, towards a system of taxation based on the value of the real estate determined in the cadastre. In turn, this requires solutions to problems related to

[1] PhD., e-mail: elwira_laskowska@sggw.pl.

the valuation of real estate, establishment of the cadastre and introduction of a tax based on real estate value. This process may be facilitated through the analysis of regulations applied in other countries, and afterwards, adoption of proven and well-functioning solutions [European systems … 2003].

The purpose of this article is to compare the property tax systems applied in European Union countries in the context of the proposed tax reform in Poland. In addition, an attempt was made at identifying the advantages and disadvantages of this reform.

The study involved an analysis of related literature and the data published in the EUROSTAT and GUS databases. The following study methods were applied: simple statistical method, as well as descriptive and causal analysis.

Property Tax Systems

The issue of property taxes is not covered by any European Union harmonisation directives. It is also difficult to identify any international standards defining the basic principles of the property tax structure. Hence, the property tax systems applied in European countries are varied and may be divided into two main groups, namely [European Systems … 2003]:

- systems based on the value of the property specified in the real estate register – cadastre,
- systems in which the tax base is determined by the area of the property.

The first group, known as cadastral systems, are prevailing in the countries of the European Union. All the data which is necessary for the determination of the tax amount is included in the cadastre. The taxpayer, i.e. the entity (person) disclosed in the cadastre (owner or user of the property), pays the tax on the value of the property defined in the cadastre. Depending on the material scope of the tax, two solutions may be applied [Felis 2013]:

- a single tax with a broad material scope, i.e. a uniform tax structure in relation to certain categories of real estate (applicable in most European countries),
- a number of different taxes on specific types of real estate assets (e.g. in France or UK).

The cadastral system requires the application of a formal (standardised) method of real estate valuation and principles of revaluation. For the purpose of cadastral tax, several methods of evaluation of real estate are applied [Felis 2013]:

- common taxation, performed in comparative or income terms by authorised bodies of government or local government administration. In the first case, the capital value of the property is estimated on the assumption that such value corresponds to the value of the so-called representative property, taking into account any adjustments for characteristics distinguishing both properties and the time factor. In the second case (income), the so-called rental value is determined as a potential revenue derived from the rental of the property, less any operating expenses incurred in connection with the maintenance of the property. The estimates are made on the basis of actual revenues and a comparative analysis of revenues generated by properties which are similar to the one which is evaluated;
- self-taxation, in which the tax base is determined by the taxpayer himself/herself by assigning the property to a specific range of values determined by the tax authorities;
- accounting book method, in which the tax base is determined in accordance with the carrying book value. This method applies predominantly to buildings and structures used by entrepreneurs.

Most countries of the European Union apply the common taxation method. However, the value of the property for the purpose of cadastral tax is usually determined below its market level. In updating the cadastral value (revaluation), these systems provide for time limits for revaluation or annual indexation involving adjustment of the property value in accordance with specific market trends.

As in the case of the tax base, the rules for determining cadastral tax rates may vary in individual countries [Firlej et al. 2014]. Local government administration units may individually determine such rates or, in the most prevailing scenario, their authority in this regard may be subject to certain tax limits. Nevertheless, all countries apply varying levels of tax rates depending on the type, location and intended purpose of the real estate.

In the case of area-related systems, the rules of determining property tax differ from the ones described above. Such systems exist in countries where a real estate register, i.e. cadastre, has not been established or does not operate properly. These are mainly countries of Central and Eastern Europe where until recently the real estate market was inactive, while most of the land was owned by the state which determined the rules of its acquisition, quite often in disregard of the actual market value of the real estate. Lack of uniform and reliable information on the value of property made it necessary to look for other criteria to determine the amount of the property tax. As a result, the area of the real estate became the basis of its taxation, as a parameter which is relatively easy to determine and verify using the registers established for surveying and mapping purposes. Nevertheless, the area-related systems also provide for certain solutions linked to the value of the property [European Systems … 2003]:

- certain types of real estate are taxed at the rates referenced to the values determined for other purposes. The taxation system applied to structures in Poland may serve as an example, where the tax base is the value adopted for the purposes of depreciation of fixed assets, and their market value is applied only if such structures are not depreciated by the taxpayer;
- the amount of the tax depends on the type and intended purpose of the real estate. As a rule, any property which is used for economic activity is subject to higher tax rates than e.g. the property occupied for residential purposes;
- real estate is assigned to a specific tax area, depending on its location;
- any property which does not generate income or any property which is used for socially useful activity may be exempt from property tax.

One of the main disadvantages of the area-related taxation of property is the fact that it is not linked to the value of the property or the taxpayer's payment capabilities: "Tax on $1m^2$ of a palace is the same as per $1m^2$ of a shanty house" [European Systems … 2003, p. 20]. In addition, a characteristic feature of area-related systems is preferential taxation treatment of agricultural real estate which is designed for farmers but frequently applied by persons who are not involved in any agricultural activity. Tax calculation according to the area of the property also reduces the amount of revenues which may be obtained by local governments from property taxes. Such revenues constitute a material part of incomes generated by local governments. On the other hand, area-related systems offer simple solutions at the stage of taxation – tax determination and collection. In order to determine and collect such taxes, you do not need an extensive and specialised treasury system or expensive mechanisms of valuation and revaluation of real estate which are characteristic of cadastral systems.

Property Taxes in Selected European Union Countries

In most European countries taxation of property is associated with a cadastral system. The adopted solutions often differ greatly from one another in terms of the object of taxation (taxation item), the method of determining the value of the property and the level of tax rates. Taxation rules applied in selected European countries are presented below.

In Germany, the legal basis for property taxation is the Land Tax Act of 1973 [Grundsteuergesetz 1973]. Taxation items are divided into two groups: agricultural and forest enterprises and plots of land. In most cases, the market value of the property is used to determine the land tax base, which in turn is calculated in accordance with the Act on the Basis of Estimation of Assets for Tax Purposes [Bewertungsgesetz 1991]. The Act provides for a different method of determination of the market value for each land tax item:

- with regard to the land owned by agricultural and forest enterprises, as well as private land and the land owned by small enterprises located in the old states (alte Bundesländer) – market value from 1964,
- with regard to the land owned by agricultural and forest enterprises (excluding housing estates) located in the new states (neue Bundesländer) – substitute value established for the year 1964,
- with regard to land property – market value established for the year 1935,
- with regard to the real estate created before 1991 in the new states for rental purposes, and single-family homes – substitute value per one square metre of usable area.

The value of built-up land and residential buildings is determined by estimating average profitability, with reference to the average rent that would be paid to the property owner in the case of rental of his/her property. Other items of land property are measured in separate proceedings aimed at determining the market value. As a result of such proceedings, the following values are determined separately: the value of the building, the value of land (plots of land) and the value of structures or any part thereof.

Afterwards, such values are multiplied by the relevant coefficient, specified in the regulations and expressed in *per mille (parts per thousand)*, and the resulting amount is the tax base. Such coefficient values are as follows [Grundsteuergesetz 1973, §13-15]:

- for land property located in the old states – depending on its type – from 2.6 to 3.5 per mille,
- for land property located in the new states – depending on its type – from 5 to 10 per mille,
- for agricultural and forest enterprises – 6 per mille in each case,
- single family homes – for the first 75 000 German marks – 2.6 per mille, for values in excess of this amount – 3.5 per mille,
- for two-family homes – 3.1 per mille,
- for other developed and undeveloped land properties – 3.5 per mille.

The tax rates are expresses as percentages and determined by municipalities by way of a local parliament resolution, separately for agricultural and forest land, and separately for the land property subject to land tax. Because of the considerable

autonomy of municipalities, in determining the amount of such rates by way of resolution, the tax burden of the relevant property may vary depending on the municipality. In 2000, the average rate in municipalities amounted to 278% for agricultural and forest land, and 367% for other land and buildings [European Systems … 2003, p. 69]. With the tax base as the result of the value of the property multiplied by the rate expressed in per mille, the effective tax rate in Germany ranges between 0.98% and 2.84%, and on average – 1.9%, of the value of the property [Cukiernik 2012].

In the United Kingdom, the structure of the current property tax system was shaped at the beginning of the 1990s, in the Local Government Finance Act of 1992 [Local Government Finance Act 1992]. Residential property is subject to "Council Tax" and non-residential property is taxed at the "Non-Domestic Rate".

Table 1. Tax valuation bands for dwellings in England ,Wales and Scotland after 1st April 2005

Valuation band	Range of values		
	England	Wales	Scotland
A	up to £40 000	up to £44 000	up to £27 000
B	£40 000 to £52 000	£44 000 to £65 000	£27 001 to £35 000
C	£52 000 to £68 000	£65 000 to £91 000	£35 001 to £45 000
D	£68 000 to £88 000	£91 000 to £123 000	£45 001 to £58 000
E	£88 000 to £120 000	£123 000 to £162 000	£58 001 to £80 000
F	£10 000 to £160 000	£162 000 to £223 000	£80 001 to £106 000
G	£160 000 to £320 000	£223 000 to £324 000	£106 001 to £212 000
H	£320 000 and above	£324 000 to £424 000	£212 001 and above
I	x	£424 000 and above	

Source: [Local Government Finance Act 1992 with changes, section 5].

The Council Tax rate depends on the range of values in which the property is placed. Each residential property in England, Wales and Scotland is placed on the so-called valuation list, together with the information regarding its market value, and thus qualifies to a specific range of values marked with letters A to H in England and Wales, and A to I in Scotland (Table 1). The relevant tax is calculated taking into account the range of values in which the property is placed and the specific proportions between such ranges [Local Government Finance Act 1992 with changes, section 5]. These proportions are as follows: 6(A), 7(B), 8(C), 9(D), 11(E), 13(F), 15(G), 18(H), and 21(I)[2]. The average rate for a property placed in the middle range of values – D – in the fiscal year 2013/2014[3] stood at a level ranging from 0.87% of the value of the property (Westminster) to 2.18% (Rutland UA), and amounted to: GBP 681 and GBP 1701 per annum respectively [Council Tax Rate 2013/2014]. By introducing a new property tax, the British government also provided for a number of exemptions and

[2] Which means, for instance, that the tax on a property in the range of values "H" amounts to twice as much as for a property in the range of values ""D, or even three times in comparison to a property in the range of values "A".

[3] Fiscal year begins on 1 April and ends on 31 March of the following calendar year.

reliefs in order to overcome a relatively large increase in the tax burden, including a tax benefit (Council Tax Benefit).

In the UK, real estate used for conducting economic activity is taxed on different terms than residential properties. The tax base in the case of "Non-Domestic Rate", known as UBR (Uniform Business Rate), is the amount of the annual net rent (the rental value of the property) multiplied by a coefficient determined annually by the government (taking into account inflation). The regulations provide for lower multipliers for smaller properties (Small Business Rates Relief) with rental values below GBP 10 thousand (in London - GBP 25 thousand), and properties with rental values below GBP 6 thousand are temporarily exempt from tax [Business Rates Facts… 2015].

Table 2. Uniform Business Rate Multipliers in England, Scotland, City of London and Wales

Rate year	Multipliers [%]					
	England and Scotland		City of London		Wales	
	Large Business	Small Business	Large Business	Small Business	Large Business	Small Business
2013/2014	47,1	46,2	47,5	46,6	46,4	-
2014/2015	48,2	47,1	48,6	47,5	47,3	47,1
2015/2016	49,3	48,0	49,7	48,4	48,2	no data

Source: [Business Rates Facts… 2015].

The value of the property is also used to determine the tax base in France, Belgium, Spain, Greece, Ireland, Austria, Estonia, Latvia, Lithuania, Italy, Slovenia and other European countries. In France, the rental value is reduced by lump-sum costs of property maintenance. For instance, for undeveloped properties it amounts to 80% of their value, and for developed properties – 50%. 100% of the cadastral rental value constitutes the tax base only in the case of housing estates [Felis 2013]. The originality of the Irish tax system, introduced in July 2013, consists in the determination of the value of the property by the taxpayer himself/herself, which simplifies the whole system and drives down its costs. However, the value stated by the taxpayer must be accurate as fines may be imposed in the case of any property sold below 110% of its declared valuation. Ireland has quite moderate tax rates: 0.18% for buildings with a value of up to EUR 1 million, and 0.25% for more expensive properties [Budget 2013]. In Latvia, in the case of residential property, the system is similar to the British model, i.e. it is progressive, with rates ranging from 0.2 to 0.6%, depending on the value of the flat or house. In Lithuania, the system is quite similar, with cadastral tax for building properties ranging between 0.3 and 1% of their estimated value. The changes in the Slovenian property taxes (introduced in 2014) are definitely noteworthy. The rates of the new tax on the market value, determined by mass valuation, are as follows: 0.15% for residential buildings; 0.75% for commercial and industrial properties; and 0.50% for construction areas. In 2014, the value of residential buildings used for tax base purposes was reduced to 80%, and in 2015 to 90% [Taxation trends… 2014].

The fiscal significance of property taxes is evidenced by their contribution to the GDP proceeds [Felis 2013]. The share of these taxes in the GDP of EU countries is presented in Table 3.

Table 3. The share of property taxes in GDP in European Union countries during 2000-2012

Countries	The share of property taxes in GDP [%]					Difference	Ranking
	2000	2005	2010	2011	2012	2000 to 2012	2012
Belgium	1,2	1,2	1,3	1,3	1,3	0,1	6
Bulgaria	0,1	0,1	0,3	0,3	0,3	0,2	22
Czech Republic	0,2	0,2	0,2	0,2	0,2	0,1	24
Denmark	1,7	1,8	2,1	2,1	2,1	0,4	3
Germany	0,4	0,5	0,5	0,4	0,5	0,0	18
Estonia	0,4	0,3	0,4	0,3	0,3	-0,1	21
Ireland	0,6	0,6	1,0	0,9	0,9	0,3	9
Greece	0,3	0,2	0,4	1,2	1,4	1,1	5
Spain	0,7	0,7	1,0	1,0	1,2	0,5	8
France	1,6	1,8	2,2	2,4	2,4	0,8	2
Croatia	:	0,0	0,0	0,0	0,0	:	27
Italy	0,8	0,8	0,6	0,7	1,6	0,8	4
Cyprus	0,4	0,6	0,6	0,5	0,5	0,1	17
Latvia	0,9	0,7	0,8	0,9	0,8	-0,1	10
Lithuania	0,5	0,3	0,4	0,3	0,3	-0,2	23
Luxembourg	0,1	0,1	0,1	0,1	0,1	0,0	26
Hungary	0,2	0,2	0,3	0,3	0,4	0,2	20
Malta	0,0	0,0	0,0	0,0	0,0	0,0	28
Netherlands	0,5	0,6	0,6	0,6	0,7	0,2	13
Austria	0,2	0,2	0,2	0,2	0,2	0,0	25
Poland	1,1	1,3	1,2	1,2	1,2	0,1	7
Portugal	0,4	0,5	0,6	0,7	0,7	0,3	12
Romania	0,5	0,5	0,7	0,7	0,6	0,2	15
Slovenia	0,4	0,4	0,5	0,5	0,5	0,1	16
Slovakia	0,4	0,4	0,4	0,4	0,4	0,0	19
Finland	0,4	0,5	0,7	0,6	0,7	0,2	14
Sweden	1,0	0,9	0,8	0,8	0,8	-0,2	11
United Kingdom	3,1	3,2	3,4	3,3	3,4	0,3	1
EU-28 averages							
weighted	:	1,3	1,3	1,3	1,5	:	:
arithmetic	:	0,7	0,8	0,8	0,8	:	:

Source: [Taxation trends… 2014].

The increase of the share of the property taxes in the GDP is reported by countries where such ratio is relatively low (e.g. Bulgaria, Finland, Portugal, Romania), and countries where such ratio is relatively high (e.g. Denmark, France, UK). A slight downward trend may be observed in such countries as Sweden, Lithuania, Latvia and Estonia. The highest increase was reported in Italy in 2012. In 2012, the Italian real estate properties were revaluated and a tax was imposed on any property owned by taxpayers outside Italy

[Decreto-legge 2011]. In the analysed period, in the EU countries, property taxes amounted to 0.8% of the GDP on average. However, in older member states, which apply cadastral systems only, the ratio of the share of property taxes in the GDP was in general higher than the EU average. The highest ratios are observed in the United Kingdom and France, where the relatively high tax rates are referenced to the rental value of the property. However, there are also old EU member states, such as Austria and Germany, where the ratio in question amounts to 0.2 and 0.5% respectively. Undoubtedly, this is due to the prolonged lack of revaluation of the property tax base in these countries.

Subject to a few exceptions, the significance of property taxes is negligible, which translates into a material reduction of the local government's potential in comparison to central authorities [Felis 2013].

Rationale of the Property Tax Reform in Poland

In Poland, the property tax system is based on the area-related model and currently consists of three taxes: property tax [Act on Local Taxes and Fees, 1991], agricultural tax [Act on Agricultural Tax, 1984] and forest tax [Act on Forest Tax 2002]. Property tax has the broadest material scope since it applies to land, buildings and structures, while agricultural and forest taxes apply to land only. Property tax has the biggest share in the revenues from property taxes in general (91.3%), with minor proceeds from agricultural tax (7%) and even less significant revenues from forest tax (1%) [Financial Management … 2015]. In addition to the diverse material scope of the taxes, this is due to the significantly higher rates of property tax in comparison to agricultural or forest taxes.

The coexistence of the three different types of real estate tax in Poland contributes to a number of problems, in theory and practice, which is one of the arguments for the property tax reform [Nowak 2005]. Other arguments include, inter alia, the unsatisfactory fiscal performance of taxes, as well as the archaic and unfair taxation in the area-related system in comparison to the cadastral ones, i.e. those relying on the actual value of the real estate [Etel 1998]. The current property tax system is also blamed for the low efficiency of space utilisation [Gnat 2013, Piekut 2014].

The concept of the change of the Polish property tax system, through the introduction of the cadastral tax, originated 1993. The government appointed the so-called Tax System Reform Team at the Ministry of Finance whose task was to develop the main objectives of property taxation. On 5 March 1994, the Council of Ministers was instructed to prepare the concept of the cadastral tax, which contributed to intensification of the work related to the taxation of the real estate. As a result, six months later the government published a study titled "Detailed Assumptions of the Draft Act on the Real Estate Register (Cadastre) and Taxation of the Real Estate". The study made assumptions on the following objectives of the tax reform [Etel 1998]:

- creation of a fiscal cadastre,
- introduction of cadastral tax as of 1 January 1999,
- increase of municipal revenues from property taxes,
- creation of stable conditions for investments, in construction and economic terms.

According to the draft, cadastral tax was to replace the existing taxes: property, agricultural and forest taxes, while the tax base was to be calculated in accordance with the

value of each property, determined in the process of general taxation. Another argument for the introduction of the cadastre was associated with tax purposes.

Unfortunately, 20 years after the cadastral tax concept was created, the work related to its introduction is still in progress. First of all, Poland lacks a nationwide, complete and uniform property information system, i.e. a function which should be performed by a real estate register (cadastre) and a prerequisite for general taxation.

Conclusions

The experience of the countries where the cadastral property taxation system is applied corroborates the validity of introducing such a system in Poland. Although the significance of the cadastral tax may vary in individual EU countries, because of the different way of determining the so-called tax value of the property (market or rental value), its revaluation and the rates of the tax, a property tax determined on the basis of the value of the real estate will allow for a more equitable distribution of the tax burden, especially in the view of application of a tax relief and preference system for taxpayers. Undoubtedly, the adoption of the value of the property as the basis for its taxation will activate the real estate market, resulting in the more rational use of the real estate itself, which is, e.g., currently unused or used contrary to its intended purpose. Although related literature and media reports emphasise social unrest associated with the increase in the tax burden, in connection with the introduction of the cadastral tax, it should be noted that ultimately such burden will be correlated with the financial position of the taxpayer. In addition, the possible increase in the tax revenues paid to the local government budgets is hardly a negative effect of the proposed tax reform, while the high cost of the creation of the cadastre, perceived as a disadvantage, is a natural consequence of economic changes in the country, in particular, in case of justified future benefits. The opinion that introduction of cadastral tax is not a good idea due to its lack of adaptation to the specifics of the Polish real estate market [Jędrysiak 2013, p. 12] is yet another unsupported argument. The real estate market is inherently imperfect. The creation of the real estate register (cadastre) will allow for greater transparency of the market in terms of information regarding real estate, and especially its value, thus leading to increased safety of transactions and improved efficiency of the real estate market in Poland.

References

Bewertungsgesetz [1991]. Bewertungsgesetz in der Fassung der Bekanntmachung vom 1. Februar 1991. BGBl. I S. 230.

Budget 2013 (Ireland). Annex B Local Property Tax (LPT). [Available at:] http://www.budget.gov.ie [Access: December 2015].

Business Rates Facts & Figures 2015/2016 [2015]. Knight Frank, London. [Available at:] http://www.knightfrank.co.uk/resources/commercial [Access: November 2015].

Council Tax Rate (2013/2014 tax year). [Available at:] http:/council-tax-rate.com [Access: December 2015].

Cukiernik T. [2012]: Podatek katastralny. Jak działa na świecie? Czy wprowadzać w Polsce? [Available at:] http://nczas.com [Access: November 2015].

Decreto-legge del 6 dicembre 2011 n. 201. Disposizioni urgenti per la crescita, l'equita' e il consolidamento dei conti pubblici. [Available at:] http://www.agenziaentrate.gov.it [Access: December 2015].

Etel L. [1998]: Reforma opodatkowania nieruchomości w Polsce. Temida 2, Białystok, pp. 275.

Europejskie systemy opodatkowania nieruchomości [2003]. Praca zbiorowa pod red. L. Etela. Biuro Studiów i Ekspertyz, Kancelaria Sejmu, Warszawa, pp. 254.

Felis P. [2013]: Podatek od nieruchomości w Europie. „Infos" No 1 (138), Wydawnictwo Sejmowe dla Biura Analiz Sejmowych, Warszawa, pp. 4.

Firlej K. A., Firlej Ch. [2014]: Porównanie systemów opodatkowania nieruchomości w Unii Europejskiej. „Progess in Economic Sciences" No1 (2014), Instytut Ekonomiczny PWSZ im. Stanisława Staszica w Pile, pp. 289-301.

Gnat S. [2013]: Symulacja zmian obciążeń podatkowych – podatek rolny a podatek katastralny. „Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania" No 31/2013 t. 1. WNEiZ Uniwersytetu Szczecińskiego, Szczecin, pp. 145-154.

Gospodarka finansowa jednostek samorządu terytorialnego 2014 [2015]. GUS Warszawa.

Grundsteuergesetz [1973]. Gesetz zur Reform des Grundsteuerrechts vom 7. August 1973. BGBl. I S. 965.

Jędrysiak M. {2013]: Doktrynalne koncepcje reformy systemu opodatkowania lokalnego w Polsce. „Societas et Ius" No 3/2013(1). [Available at:] http://apcz.pl/czasopisma/index.php/SeI/article/view/7743/7041 [Access: December 2015].

Local Government Finance Act [1992] with changes. SI 1992, No. 554. [Available at:] http://www.legislation.gov.uk [Access: December 2015].

Nowak A. {2005]: Projekt opodatkowania wartości nieruchomości w Polsce, na tle doświadczeń innych państw. [in:].Funkcjonowanie gospodarki polskiej w warunkach integracji i globalizacji. Praca zbiorowa pod red. Danuty Kopycińskiej. Katedra Mikroekonomii Uniwersytetu Szczecińskiego, Szczecin, pp. 343-352.

Piekut J. [2014]: Wady i zalety wprowadzenia podatku katastralnego. „Kwartalnik Naukowy Uczelni Vistula" No 3 (31), Wydawnictwo Grupy Uczelni Vistula, Warszawa, pp. 82-90.

Taxation trends in the European Union. Data for the EU Member States, Iceland and Norway [2014]. Publications Office of the European Union, Luxembourg, pp. 308.

Ustawa o podatkach i opłatach lokalnych z dnia 12 stycznia 1991 r. [Consolidated text:] Dz. U. 2014 poz. 849.

Ustawa o podatku leśnym z dnia 30 października 2002 r. [Consolidated text:] Dz.U. 2013 poz. 465.

Ustawa o podatku rolnym z dnia 15 listopada 1984 r. [Consolidated text:] Dz.U. 2013 poz. 1381.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 137–146

Mariusz Maciejczak[1]
Faculty of Economic Sciences,
Warsaw University of Life Sciences – SGGW

What are Production Determinants of Bioeconomy?

Abstract. The concept of bioeconomy focuses on clustering different socio-economic processes of both traditional and innovative sectors of economy that focus on the use of renewable resources, and by applying knowledge and innovative technologies, and delivering products and services that are important from private and public points of view. Such an approach requires utilization of resources that differ from classical economic classification of production factors. The paper argues that instead of land, labor, capital and entrepreneurship, from the bioeconomy point of view it is more important to look at: renewable resources such as biomass sources, investments in research and development activities and people engaged in such activities as well as innovations, which could be considered as production determinants. Based on the latest Eurostat data for the year 2011, the paper presents the state of these determinants in the European Union's main bioeconomy sectors.

Key words: bioeconomy, production determinants, biomass, investments in research and development, research personnel, innovations, European Union

Introduction

The bioeconomy is widely recognized as a concept whose core function is the use of natural resources by applying the cross sectoral and innovative approach, with a basis in circular economy. In the circular economy the material flows are of two types: biological nutrients, designed to reenter the biosphere safely; and technical nutrients, which are designed to circulate at high quality without entering the biosphere [European Commission 2014]. It encompasses more than the production and consumption of goods and services, including a shift from non-renewably resources to renewable, and from fossil fuels to the use of renewable energy, and the role of diversity as a characteristic of resilient and productive systems [World Economic Forum, 2014]. Several authors [Takács and Takács-György 2013, Pfau et al. 2014, Gołębiewski 2013] point out that wider application of circularity and use of renewable resources is a basic contribution of bioeconomy to development based on sustainable principles. In this context, bioeconomy is perceived as a concept that could contribute to more sustainable growth in various ways, achieving a positive environmental and social impact, while ensuring economic growth through innovative products and the preservation of traditional sectors, such as food production. As such, bioeconomy is perceived very holistically in a wide systemic approach [Maciejczak 2015b].

Taking into account such systemic a approach, one needs to emphasize that in the bioeconomy concept the traditional Pareto criteria of allocative efficiency, which have predominated in economics up to today, are tainted with a definite static character and therefore are inadequate to be applied as normative guidelines to the rich dynamics of real-life socio-economic conditions. Efficiency in dynamic terms means to make such a choice between current and future consumption, which provides the expected increase in

[1] PhD, e-mail: mariusz_maciejczak@sggw.pl

consumption per capita while maintaining the internal and external equilibrium of the economy in the long term [De Soto 2004]. The essence of dynamic efficiency, is the ratio of the level of savings and investments, which can increase consumption in the future [Abel et al. 1989; Szudy 2014].

However in order to ensure consumption, savings and investments, the bioeconomy sector, under dynamic and constant changes, needs to produce added value from raw materials, which in turn will serve as a basis for income and profits. Classical and neoclassical economic theories distinguish between three basic factors of production: land, labor and capital. Some authors on the basic factors of production include also entrepreneurship and knowledge. It is argued in this paper that while these factors have been much discussed and extended at different points in economic evolution, in any of the advanced economies of the world today, especially in such emerging concepts as bioeconomy, they are vastly antiquated. There is a need to focus on the basic economic assumptions, such as the production functions, and to fill in the gaps in current understanding of the bioeconomy, in order to describe the main factors that drive its development.

Objectives and methods

The paper aims to make an attempt to name the new production factors under the bioeconomy concept, with the prerequisites of heterodox economics, and describe them using the example of the Member States of the European Union. The presented research is based on the heterodox assumptions of deductive and descriptive reasoning, and on secondary data coming from the Bioeconomy Observatory of the European Commission, which captures statistics related to bioeconomy. In order to present a comprehensive picture of the situation in the analyzed region, the time frame was limited to the year 2011.

There is no single heterodox economic theory, but there are many different programs and theories in existence. What they all share, however, is a rejection of the neoclassical orthodoxy as representing the appropriate tool for understanding the workings of economic and social life today [Lee 2011, Mearman 2011]. For example, the concept of market equilibrium has been criticized by Austrians, post-Keynesians and others, who object to applications of microeconomic theory to real-world markets, when such markets are not usefully approximated by microeconomic models [Lawson 2005]. However, under the umbrella of the heterodox economics there are several provisional elements, such as critical realism, non-equilibrium, institutions and agency, the socially embedded economy, as well as circular and cumulative change, which have emerged from a synthesis of arguments, and are associated to social processes in complex systems.

New production determinants used for bioeconomy

In mainstream economic theory there are assumed three main factors of production: land, labor and capital. Land as a factor of production is understood very broadly. This concept includes minerals, underground and surface waters, territory, fauna, flora and atmosphere. Labor, and more precisely – work – is understood as a physical person's ability to perform certain actions, together with his/her skills and motivations. Today the

identification of working with human capital is spreading. Capital as a factor of production is understood in substantive terms (rather than financial). It consists of machinery and equipment for the production of other goods. Some authors on the basic factors of production include entrepreneurship and knowledge. Entrepreneurship is sometimes included in the labor factor [Samuelson and Nordhause 2009; Perloff 2008].

The above classification of factors has come under criticism by many economists [Malkiel 2003, Grossman and Stiglitz 1980, Harcourt 2010]. Firstly, from many of critical assumptions one can distinguish problems with substitution. Each unit of a factor can be distinguished from other units of that factor, but one factor can be substituted for some other factor. For instance, land can be used intensively by employing more labor or more capital in the form of fertilizers, better seeds and superior techniques. By so doing, one can substitute labor or capital for land. Similarly, labor can be substituted for capital, and capital for labor in a factor. The degree of substitution of one factor for another will, however, depend on the most efficient method of production to be used relative to the cost of the factor to be substituted. Secondly, another problem arises as a critique because land, labor and capital often get intermixed into one another and it is difficult to specify the contribution of each separately. For instance, when land is cleared, canals are dug and fences are erected, the productivity of land increases. But all these improvements on land are possible by making capital investments and through labor. In such a situation, it is not possible to specify the contribution of land, labor and capital in increasing productivity. Finally, there are arguments against too wide a meaning of factors of production. It is argued that it is more convenient to consider only the land which can be bought and sold as a factor of production, rather than such elements as sunshine, climate, etc. which do not enter directly into costs. Similarly, it is not accurate to group together the services of an unskilled worker with that of an engineer, or of an engine driver with that of a serviceman in the railways. Therefore as shown by [Xu et al. 2009, Xu 2009] who proposed an alternative theory of six forces of essential factors of production, several authors find it more accurate to lump together all homogeneous units, whether hectares of land, workers, or capital goods, and to consider each group as a separate factor of production. This method gives a large number of factors of production and each group is regarded as a separate factor.

Thus, in the large body of economic literature one can identify more than just classical production factors. Due to technical and technological advancements some name technology as a new production factor [Brynjolfsson and Hitt 1994]. They argue that, thanks to technology, firms can capture high growth under dynamic changes in the environment. There is a big group of economics with its classical frontman Schumpeter [1964] that consider innovations as a new production factor. These authors [i.e. Bowman and Zilberman 2013, Takács-György 2014, Smolny 2000] focus on marginal utility of innovations as a source of growth. Other scientists pay attention to institutions as a fundamental cause of long-run growth [Engerman and Solkoloff 1995; Chavas and Kim 2010, Maciejczak 2015a]. One could argue, if the above approaches and the variables indicated are new factors, they could be considered, especially from an epistemological point of view [see Mises 1981], really as new production factors. Having in mind the epistemological understanding of production factor as a durable input employed in production activities, once could name new variables influencing and employed in the production processes as determinants. Such understanding was used by Binswanger and Rozenzweig [1986] as well as Mundlak et al. [1997]. The determinant is a factor which

decisively affects the nature or outcome of something and a thing that decides whether or how something happens [Oxford Advanced Learner's Dictionary 2011].

There is, however, no particular focus on the bioeconomy as a special subject of research from the production factor point of view, so far. This is not due to the novelty of the idea, but rather from its complexity. As argued by Maciejczak [2015b], bioeconomy brings together processes that have so far been disparate: business and sustainability, ecosystem services and industrial applications, innovations and technologies, biomass and products, all for mainstream economies in order to meet growing consumer expectations. It actively establishes links between industries, both old (which for a long time formed a chain of added values) and new (which previously had no connections) within a new, symbiotic relationship where one industry utilizes the by-products of another. Thus it forms a new network-oriented platform. The bioeconomy creates a new dimension within existing elements of the socio-economic system, in which large-scale progress in various forms, especially biological and technical, is created, as well as successfully introducing product and process innovations.

Having in mind the common definition of bioeconomy, which states that it is the knowledge-based production and use of biological resources to provide products, processes and services in all economic sectors within the frame of a sustainable economic system [German Bioeconomy Council 2010], it needs to be stated that the sources of biomass are primary production determinants of the bioeconomy. The biological resources exclusively are acting as substitutes for other (fossil) resources. Two other production determinants are also included in the above definition. They are related to knowledge, and focus on the investment in research and development (R&D) in the bioeconomy system as well as people employed in it, who have obtained sufficient knowledge to explore, commercialize and develop products and processes important from the point of view of firms and society. Finally, the fourth determinant is connected to the organization of the system. It is the institutional arrangements that enable implementation of solutions that ensure competitiveness under dynamic changes. The four production determinants of bioeconomy are presented in Figure 1. These factors are characterized by the homogeneity and the orientation on generating the highest marginal utility and added value not only from the firm but also from the network.

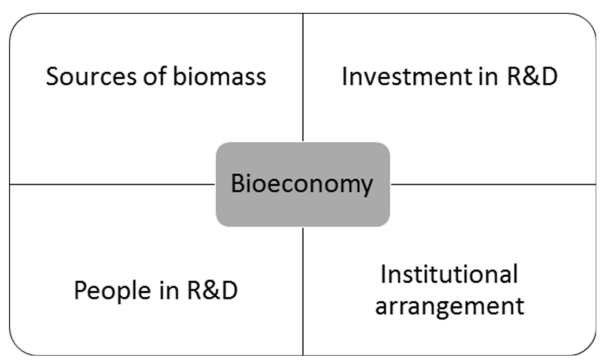


Fig 1. Production determinants of bioeconomy

Source: author's own elaboration.

Bioeconomy's production determinants in the European Union

The basic bioeconomy production determinants are sources of biomass. Biomass is organic, non-fossil material of biological origin that can be used as biogenic feedstock in food supply, other products, and for generating energy in the form of heat or electricity. The sources of biomass are crops (excluding fodder crops): cereals, nuts, vegetables, fruits, fibres, etc.), crop residues (fodder crops and grazed biomass), animals (fishing, hunting, cultivated land/aquatic animals, animal products, etc.), wood as well as wastes (household, industrial, communal, etc.).

Table 1. The production of biomass resources in the European Union Member States in 2011

Member State	Resurces of biomass			
	Agriculture [in 1000 t of dry matter of biomass]	Aquaculture [in 1000 t of living weight]	Wood [in 1000 cubic meters]	Waste [in 1000 t]
Austria	8,5	1,3	18696	179,1
Belgium	10	22,3	5128	1120,5
Bulgaria	12	16,1	6205	903,2
Croatia	7	87,3	5258	75,1
Cyprus	2	5,8	8	150,5
Czech Republic	14	2,4	15381	196,1
Denmark	16	793,4	2583	201,1
Estonia	20	78,4	7116	77,1
Finland	6	136,1	50767	3157,9
France	110	680,5	55041	1616,5
Germany	80	270,6	56142	648,9
Greece	7	174,1	1196	9,9
Hungary	15	0,1	6232	430,5
Ireland	5	250,5	2635	101,2
Italy	19	376,7	7744	310,9
Latvia	6	156,7	12833	2,8
Lithuania	7	140,4	7004	455,9
Luxembourg	1	0,2	261	1,2
Malta	1	6,1	1	2,6
Poland	51	201,7	37180	1952,8
Portugal	3	223,1	10961	83,4
Romania	23	8,9	14359	18352
Slovakia	6	1	9213	549,4
Slovenia	2	2,1	3388	164,8
Spain	27	241,2	15428	5496,5
Sweden	8	195,6	71900	273,1
The Netherlands	8	408,7	982	4946,5
United Kingdom	31	793,6	10020	748,4

Source: author's own elaboration based on DataM web, provided by the European Commission/ Joint Research Centre, www.datamweb.com. Data accessed on 21/12/2015.

Table 1 presents the capacity of biomass resources in the European Union (EU) Member States (MS). There are distinguished agricultural resources (both plant and livestock), aquaculture resources (both maritime and inland), wood and waste resources. In 2011, three MS: France, Poland and United Kingdom produced 38% of agricultural biomass. Accordingly over 50% of total production of aquaculture biomass was produced by four MS: United Kingdom, Denmark, France and The Netherlands. Similarly 53% of total production of wood biomass in the EU comes from four countries, namely: Sweden, Germany, France and Finland. The biggest producers of biomass from waste in the EU are Romania, Spain, The Netherlands and Finland, which together account for 75,7% of total biomass production from wastes. The above date shows high polarization of resources of biomass production among the EU's MS.

Table 2. Private enterprise expenditures on R&D in 2011 [mln Euro]

Member State	Direct bioeconomy sector				
	Agriculture	Food and beverages	Leather	Paper and pulp	Wood
Austria	2	28,7	2,6	23,6	15,27
Belgium	25,8	121,6	7,7	10,4	5,67
Bulgaria	0,4	0,2	*	*	*
Croatia	0,1	9,1	*	*	0,2
Cyprus	*	0,6	*	*	*
Czech Rep.	4,6	13,4	0,7	1,3	1,7
Denmark	7	68,4	*	1,7	1,44
Estonia	0,1	1,4	*	*	*
Finland	4,9	*	*	75,9	9,6
France	150,4	*	6,1	40,9	14,39
Germany	126,1	*	5,5	61,3	22,6
Greece	1,5	*	*	*	*
Hungary	14,3	15,5	*	2	0,9
Ireland	2,1	*	*	*	8,09
Italy	3,3	150,3	120,7	48,3	13,6
Latvia	*	*	*	*	*
Lithuania	*	2	0,1	0,2	*
Luxembourg	*	1,1	*	*	*
Malta	0,6	0,6	*	*	*
Poland	6,6	*	*	3,6	*
Portugal	2,9	41,4	5,2	13,2	9,52
Romania	1,3	1,5	*	*	*
Slovakia	1,5	1,2	*	*	*
Slovenia	0,4	3,6	1	1,9	1,79
Spain	53,3	*	11,8	24,9	12,66
Sweden	22,3	*	*	100,7	*
The Netherlands	172,3	388,5	0,6	8,8	1,95
United Kingdom	14,3	244,7	1,5	10,1	1,61

Source: author's own elaboration based on DataM web, provided by the European Commission/ Joint Research Centre, www.datamweb.com. Data accessed on 21/12/2015. * - no data available.

Similar polarization is observed as another factor is considered, namely: private (firms) investment in research and development. According to available data, the leading MS are The Netherlands, United Kingdom and Italy (Table 2). Analyzing particular bioeconomy industries 45,1% of investments are made in the food sector, 25,5 in the agricultural sector, 17,7% in paper and pulp sectors, 6,7% in the leather sector, and 5% in the wood sector.

Table 3. R&D personnel and researchers in business enterprise sector by economic activity in 2011 [in total working units]

Member State	Direct bioeconomy sector				
	Agriculture	Food and beverages	Leather	Paper and pulp	Wood
Austria	22	312	35	156	137
Belgium	293	1178	42	104	90
Bulgaria	65	21	*	*	*
Croatia	4	173	*	*	7
Cyprus	*	14	*	*	*
Czech Rep.	186	192	27	19	7
Denmark	49	642	*	21	18
Estonia	3	40	*	*	*
Finland	37	*	*	509	73
France	1414	*	84	468	208
Germany	1189	*	66	581	173
Greece	50	*	*	*	*
Hungary	475	427	*	2,7	41
Ireland	20	551	*	*	*
Italy	79	1978	1572	570	241
Latvia	5	9	*	8	*
Lithuania	4	81	7	9	3
Luxembourg	*	21	*	*	*
Malta	20	28	*	*	*
Poland	258	*	*	51	76
Portugal	46	543	117	108	109
Romania	143	*	37	*	*
Slovakia	65	35	*	*	*
Slovenia	4	85	17	16	25
Spain	882	*	170	266	168
Sweden	*	*	*	*	11
The Netherlands	2219	3130	9	130	40
United Kingdom	196	3021	40	107	29

Source: own elaboration based DataM web, provided by the European Commission / Joint Research Centre, www.datamweb.com. Data accessed on 21/12/2015. * - no data available.

Analyzing total R&D personnel and researchers in bioeconomy sectors of the EU, according to available data, without any surprise, similar to investments, the leading MS are The Netherlands, United Kingdom and Italy (Table 3). An also similar structure for investment is observed as the engagements in the particular sectors are concerned. 46,2% of R&D staff is working in the food sector, 28,6% in the agricultural sector, 11,6% in paper and pulp sectors, 8,2% in the leather sector, and 5,4% in the wood sector.

Table 4. Patent applications to the European Patent Office (EPO) by sector of economic activity in 2011

Member State	Direct bioeconomy sector			
	Agriculture	Food and beverages	Paper and pulp	Wood
Austria	21	17	11	2
Belgium	19	19	8	1
Bulgaria	0	0	0	0
Croatia	0	0	0	0
Cyprus	0	0	0	0
Czech Rep.	3	3	1	0
Denmark	14	13	6	1
Estonia	0	0	0	0
Finland	10	9	7	1
France	58	68	37	7
Germany	252	225	130	18
Greece	2	3	0	0
Hungary	1	2	1	0
Ireland	5	4	1	0
Italy	43	63	30	6
Latvia	0	1	0	0
Lithuania	0	0	0	0
Luxembourg	0	1	1	0
Malta	0	0	0	0
Poland	1	4	3	1
Portugal	1	1	1	0
Romania	1	1	1	0
Slovakia	0	0	0	0
Slovenia	0	2	0	0
Spain	16	25	7	1
Sweden	9	12	8	1
The Netherlands	57	38	15	2
United Kingdom	26	48	21	3

Source: author's own elaboration based on DataM web, provided by the European Commission/ Joint Research Centre, www.datamweb.com. Data accessed on 21/12/2015.

The fourth new bioeconomy determinant of production is institutional arrangement. It is difficult to illustrate this by exact data. However for the purposes of this paper it was assumed that the quality of institutional arrangement in the MS of the EU can be presented as patent applications to the European Patent Office (Table 4). Patents are used as a quantified factor of arrangements that enable development and utilization of knowledge. The highest number of patents: 625 were filled in Germany, in each of three other countries: United Kingdom, The Netherlands and France there were filed more than 100 patent applications. The highest share of patent applications was filled from the food sector: 39,1% and agricultural sector: 37,8%. Accordingly, from the paper sector was filled 20,2% of applications and from the wood sector only 3%.

Conclusions

The bioeconomy as a network system has a unique characteristic that requires special theoretical, methodological and analytical frameworks in order to capture its diversity, complexity, adaptability and dynamics. Its complex structure, processes and objectives should be analyzed from the economic perspectives not as heterogeneous, but rather as a homogenous factors. Such an approach, close to other heterodox economic theories, can be applied once production functions of bioeconomy are concerned. The analysis executed in this paper led to the replacement of classical production factors by new determinants applicable to bioeconomy conditions. These new production determinants of bioeconomy are: sources of biomass, investment in R&D, competent people engaged in R&D as well as institutional arrangements of the sector. The analysis of these determinants in the Member States of the European Union show that among 28 countries there is large polarization in the engagement of these factors. Accordingly, the main sectors of bioeconomy that use the production factors are agriculture and food. There is big potential for the wood sector and yet undiscovered chances for waste resources.

Bibliography

Abel A.B., Mankiw N.G., Summers L.H., Zeckhauser R.J. [1989]: Assessing Dynamic Efficiency: Theory and Evidence. *Review of Economic Studies* 56, p. 1-20.

Biswanger H., Rosenzweig M.R. [1986] Behavioral and Material Determinants of Production Relations in Agriculture. The Journal of Development Studies 22, pp.503-539.

Bowman, M. S., and Zilberman D. [2013]: Economic factors affecting diversified farming systems. *Ecology and Society* 18(1): 33.

Brynjolfsson E. and Hitt L. [1994]: Technolgy as a Factor of Production. *Sloan Working Paper* 3714, MIT Sloan School, Cambridge, Massachusetts.

Chavas, J. P., and K. Kim. [2010]: Economies of diversification: A generalization and decomposition of economies of scope. *International Journal of Production Economics* 126:229-235.

De Soto J.H. [2008]: The Theory of Dynamic Efficiency, 1st Edition. Routledge. London.

Engerman S.L. and Sokoloff K.L. [2003]: Institutional and non-institutional Explains of Economic Differences. NBER WorkingPaper no. 9989.

European Comission [2015]: Biomass estimates - database DataM, www. www.datamweb.com. Data accessed on 21/12/2015.

European Commission [2014]: Towards a Circular Economy. A Zero-Waste Program for Europe. Com (398). Brussels.

German Bioeconomy Council [2010]: Bioeconomy Innovation. Berlin.

Gołębiewski J. [2015]: Zrównoważona biogospodarka - potencjał i czynniki rozwoju [in:] Czyżewski A., Klepacki B. (eds) Problemy rozwoju rolnictwa i gospodarki żywnościowej w pierwszej dekadzie członkostwa Polski w UE. Polskie Towarzystwo Ekonomiczne, Warszawa.

Grossman S. J. and Stiglitz J.E. [1980]: On the Impossibility of Informationally Effcient Markets. *American Economic Review,*70:3, pp. 393–408.

Harcourt G. [2010]. The crisis in mainstream economics. Real-world Economics Review, issue no. 53., Cambridge University, UK.

Lawson T. [2005]: The nature of heterodox economics" Cambridge Journal of Economics 30 (4): 483–505.

Lee F. [2011]: A History of Heterodox Economics: Challenging Mainstream Views in the 21st Century. Routledge.

Maciejczak M. [2015a]: Will the institution of coexistence be re-defined by TTIP? Contributed paper prepared for presentation at the Seventh International Conference on Coexistence between Genetically Modified (GM) and non-GM based Agricultural Supply Chains(GMCC-15) Amsterdam, The Netherlands, November 17-20.

Maciejczak M. [2015b]: How to analyze bioeconomy. Annals of Polish Association of Agricultural Economists and Agribusiness, vol. XVI, issue 6.

Malkiel B. [2003] The Efficient Market Hypothesis and Its Critics. Journal of Economic Perspectives, Volume 17, Number 1.

Mearman A. [2011]: Who Do Heterodox Economists Think They Are? American Journal of Economics and Sociology, 70(2): 480–510.

Mises von L. [1981] Epistemological Problems of Economics. New York University Press.

Mundlak Y., Larson D., Butzer R. [1997]. The determinants of agricultural production. Policy Research Working Paper no. 1827. World Bank.

Oxford Advanced Learner's Dictionary of Current English. Oxford University Press.

Perloff J. M. [2008]: Microeconomics. 5th ed. Addison Wesley.

Pfau S.F., Hagens J.E., Dankbaar B., Smits A.J.M. [2014]: Visions of Sustainability in Bioeconomy Research. Sustainability no. 6, p. 1222-1249.

Samuelson P., Nordhaus W. [2009]: Economics 19th Edition. McGraw-Hill Education. London.

Schumpeter J.A. [1947]: Theoretical Problems of Economics. Journal of Economic History, Vol 7/1947.

Smolny W. [2000]: Endogenous Innovations and Knowledge Spillovers. A Theoretical and Empirical Analysis. The ZEW Economic Studies. Springer.

Szudy M. [2014]: Efektywność ekonomiczna w ujęciu dynamicznym a sprawność systemu gospodarczego. Studia Ekonomiczne Uniwersytetu Ekonomicznego w Katowicach nr 176, p. 22-29.

Takács I., Takács-György K. [2013]: Arguments for the optimisation of using biomass for energy production. Applied Studies in Agribusiness and Commerce, Volume 07, Number 2-3.

Takács-György K. [2014] Imitation vs. Innovation in the SME sector. Annals of Polish Association of Agricultural Economists and Agribusiness, vol. XV, issue 2.

World Economic Forum [2014]: Towards the Circular Economy: Accelerating the scale-up across global supply chains. Geneva.

Xu, B., Chaudhry, S. S. and Li, Y. [2009]: Factors of production: Historical theories and new developments. Syst. Res., 26: 219–224.

Xu, S. [2009]: Theory of six forces of essential factors of production. Syst. Res., 26: 211–218.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 147–155

Mariya Peneva[1], Yanka Kazakova-Mateva[2]
Department of Natural Resources Economics,
University of National and World Economy, Bulgaria

Local Food Systems and Rural Development in Bulgaria

Abstract: Recently there has been a renewed interest in alternatives to shorten the food supply chain, allowing more direct links between producers and consumers and localizing food systems. This paper examines alternative local food chains as part of rural development and how to encourage and facilitate their growth in order to contribute to rural vitality and sustainable agriculture. It focuses on some research findings of the Bulgarian team in the project entitled "Farming transitions: Pathways towards regional sustainability of agriculture in Europe" (FarmPath), financed by the 7th FP of the EC. The innovative initiatives that define development of new alternative forms of agricultural local food supply chains, combined with nature-friendly production practices, rural tourism, traditional food production and development of the territory of three rural areas are presented and analysed. The sustainability dimensions that the alternative supply chains may lead up to in the rural regions were also drawn.

Key words: local food system, rural development, sustainable agricultural production, Bulgaria

Introduction

Recently, there has been a renewed and continuously growing interest in alternatives to shorten the food supply chain, allowing more direct links between producers and consumers and localized food systems. This paper examines alternative local food chains as part of rural development, and how to encourage and facilitate their growth in order to contribute to rural vitality and sustainable agricultural production. It presents innovative initiatives (novelties) that define development of new alternative forms of agricultural local food supply chains combined with nature-friendly production practices, rural tourism, traditional food production and development of the territory of three rural areas in Bulgaria.

The agri-food sector in Bulgaria is a key component of the national economy, accounting for over 9.8% of gross added value and approximately 21.7% of employment (MAF, 2014), as in the rural areas the percentages are higher (MAF, 2014). The sector is geographically dispersed with a dualistic structure characterized by a few big farms and a large number of small ones (91% of the farms in the country operate less than 5 ha of land, which results in cultivating 5.2% of the total utilized agricultural area and giving 8.7% of total production volume). Also, it is recognized that horizontal and vertical networks within the food supply chain in Bulgaria are weak. Farmer participation in farmer's groups and producer organizations is very limited. Most of them, particularly in the fruit and vegetables sub-sector, do not have preliminary negotiations and/or contracts with middlemen, processors, etc. The direct sales of agricultural and food products and local product marketing are in the initial phase and still need to be developed, as do the necessary preconditions, such as market and transport infrastructure, appropriate legislative

[1] associate professor, e-mail: peneva_mm@yahoo.co.uk
[2] assistant professor, e-mail: yanka.kazakova@gmail.com

frameworks, normative rules, financing and stimulus for small and medium-sized farmers, etc. Moreover, international developments and the accession of the country to the European Union (EU) have strengthened the trend towards consolidation and rationalisation for the other actors of the food supply chain, with an emphasis on integration, specialization and globalization. This model gives advantages to large scale farms and processors, further breaks the traditional direct and local links which existed before, and weaken small shops, butchers, producer markets, etc.

At the same time, in the last five years, there has been a renewed interest and growth in alternative food supply chains, allowing and facilitating connection between producers and consumers in new and more direct ways. Furthermore, farmers have been developing additional on-farm activities in order to increase their incomes and to adapt to consumer preferences. In line with this change of consumer and producer behaviour, a number of farmers markets, farm shops/stands, on-farm shops, community groups, online sales, box-delivery, etc., have been launched and further developed. On the other hand, society has become increasingly interested in the quality and safety of food products and has started questioning the methodologies of the conventional food supply chain related to their environmental and animal welfare effects.

The paper is organized as follows: it begins with an Introduction in Section 1. Section 2 presents a short review of the literature on local food chains, while Section 3 is devoted to the theoretical framework of the study and the research methods used. Section 4 continues with the main socio-economic developments of the three case studies and presents the paper's empirical focus. In Section 5, we present the main findings and analyse the key issues of development of local food chains and their importance for rural region vitality and sustainable local food production and consumption. Section 6 presents Conclusions.

Definition of Local Food System

There is more than one definition of local food systems (LFS) in scientific literature. In most cases, they are defined in opposition to conventional food supply chains and as a new form of food production, marketing and consumption based on an increased link between producers and consumers (personal relationships between the various stages of the chain). Other very important, relevant and commonly used criteria are spatial distances and restrictions to a certain geographic area. It also includes chains where the number of intermediaries between farmers and consumers are reduced to one or ideally zero and which enable identification and traceability of the foods by and to the farmer (information embedded with the product, quality of products, social values [Marsden et al. 2000]. Several forms and examples could be identified in the literature: community-supported agriculture, on-farm sales, on-line sales, farmers markets, delivery schemes (box schemes), collective deliveries in public institutions, etc. In general, they are dominated by small and medium-sized farms and/or microenterprises, producing at small scale. [(Galli & Brunori 2013; Kneafsey et al. 2013; Renting et al. 2003; Schönhart et al. 2009]

In terms of policy instruments at the EU level, there is no single specific EU labelling scheme (which potentially could bring recognition and more protection to the products and producers). However, there are special tools implemented under the regional/national Rural Development Programmes (including LEADER and thematic sub-programs) to address specific needs, identified in particular in relation to young farmers, small farms, mountain

areas and the creation of short supply chains in each country. They fund local food chain development and are considered important for territorial development. Short supply chains were integrated in the regulation for Rural Development Programmes 2014-2020 by the European Commission. According to that, a short supply chain is "a supply chain involving a limited number of economic operators, committed to co-operation, local economic development, and close geographical and social relations between producers and consumers." This definition is used for the purpose of this analysis. (Regulation (EU) No. 1305/2013)

Table 1. Summary of the identified effects of the LFS on the three sustainability dimensions

Dimensions of Sustainability	Ecological	Conserving traditional agricultural practices and landscapes
		Reducing specialization and intensification in agriculture
		Reducing environmental effects of transportation and production - lower transport costs, limiting CO2 emissions or packaging
	Social	Preservation of traditional production techniques and consumption patterns
		Keeping small processing enterprises and local traditional food
		Enabling vital small and manageable structures; creating and securing jobs
		Increasing quality (freshness, specific taste, healthier, better nutrition) and security of food
		Rising awareness about environmental and social effects of consumption and consumer behaviour
		Enhancing personal relationships and community consciousness; strengthening rural-urban linkages
		Better local and international social justice
	Economic	Raising income for farmers and food processors; reducing market power of processing and distribution businesses
		Creating employment opportunities, innovation and creativity
		Reducing consumer prices of seasonal products
		Increasing the regional added value

Source: own research.

It is also recognized that LFSs have specific environmental, social and economic impacts at regional and farm level as well as to the consumers. Table 1 provides a summary of the effects cited in the literature [Galli & Brunori 2013; Kneafsey et al. 2013; Schönhart et al. 2009] according to the three dimensions of the sustainability.

Method

The paper focuses on research findings of the Bulgarian team under the international project entitled "Farming transitions: Pathways towards regional sustainability of agriculture in Europe" (FarmPath)[3], financed by the 7th FP of the European Commission

[3] http://www.farmpath.eu/

(EC). The theoretical framework of the project, as well as of the paper, is based on the intersection of the concepts of transition theory and sustainable regional development.

The transition studies are based on the multi-level (socio-technical landscape, regime and niche level) and multi-actor perspectives that emphasize the radical novelty (initiative) that emerges at niche (micro level), carried by "small networks of dedicated actors" [Geels and Schot 2007], and transforms the dominant regime. The regime operates at a meso/regional level and includes technological developments, infrastructure, techno-scientific knowledge, societal groups and networks, rules and regulations, markets, etc. It is also assumed that within the regime several sub-regimes might be distinguished (e.g. production, processing, consumption, marketing, etc.) which might shape various configurations (interaction, interdependence, constraint, influence, etc.). The current paper deals with marketing regime and innovation of the LFSs. The socio-technical landscape (macro level) forms an exogenous environment (macro-economic and demographic trends, macro-political developments, climate changes, societal values, consumer patterns, etc.) and normally cannot influence directly on niche and regime actors, since changes at the landscape level usually take place over a period of decades [Geels and Schot 2007, Darnhofer 2011].

The understanding of sustainable rural development in the paper is based on the above approaches and refers to the changes in farming and marketing activities (such as pluri-activity, diversification and multi-functionality) with the transition studies where the transition process is central and is driven by the niche(s) and their novelty.

In the paper we will not focus especially on the impact of the socio-technical landscape that influences (indirectly) the regime and transition to innovation. We will consider the initiative as multi-actor novelty that may induce changes towards regionally sustainable agriculture and rural development, provoking establishment of new local food chains.

A multidisciplinary approach was followed, including participation of researchers from various fields – economists, sociologists, geographers as well as active participation of the stakeholders at various levels. The research was undertaken in seven European countries: Bulgaria, the Czech Republic, France, Germany, Greece, Portugal and the United Kingdom. Within each country, initiatives reflecting the heterogeneity of agriculture and the diversity of 'agri-food' models were selected. Then they were clustered according to their common characteristics and development. [Vlahos et al. 2011] The three initiatives studied in Bulgaria were: 1) cluster Lifestyle farming: Sustainable rural lifestyle in Zhelen; 2) cluster Certification programmes: Integrating rural tourism and local food production for sustainable development in Elena, and 3) cluster High nature value (HNV) farming: New agricultural practices in protected areas in Besaparski hills.

In the case study areas, semi-structured in-depth interviews were conducted with farming representatives, including young farmers and new entrants, local and regional authorities, agricultural officers and experts, NGOs, and entrepreneurs. Documentary analysis and desk research were performed on the contextual analysis and policy related issues. A participatory 'visioning' process was adopted and encompassed the following steps: 1) individual semi-structured interviews with each stakeholder representing a) official interests; or b) those who run the land; or c) young farmers; or d) those who benefit from the land; 2) focus group discussions with individuals from the same group to produce visions for the future of agriculture and other land-based activities in each region; 3) a final

workshop with all participants to construct possible pathways to achieve previously defined visions [Pinto-Correia et al. 2014].

Local context

As specified earlier, the three initiatives studied in Bulgaria are: New agricultural practices in protected areas focused on HNV Farming in Besaparski Hills - Natura 2000; Integrating rural tourism and local food production for sustainable development on the case of Elena municipality, and Sustainable rural lifestyle as part of the community supported agriculture initiative in Zhelen. Each of them is located in different NUTS 2 regions in Bulgaria with different types of farming, agricultural production and socio-economic development.

Besaparski Hills is a territory located in the South Central planning region. It is a Natura 2000 site. designated as a Specially Protected Area (SPA) under the EU Birds Directive, and part of the territory is a proposed Site of Community Interest (pSCI) under the EU Habitats Directive. The overall objective of its study is to identify and explore the implementation of various traditional agricultural practices (extensive grazing, low livestock density, no chemical inputs, late mowing, etc.) towards nature protection and biodiversity conservation. The Besaparski Hills lay in the second most densely populated region in Bulgaria. Human activity is intensive and influences the biodiversity in the region. In 2007, the Bulgarian Society for Bird Protection started a project which aimed to conserve important grasslands by encouraging farmers to adopt land management practices sympathetic to the needs of biodiversity. Later, in 2011, the implementation of national agri-environmental measures which encouraged the introduction of environmentally friendly agricultural practices in HNV areas was begun. The implementation of HNV farming practices in the region of Besaparski hills leads to important technological, institutional and structural changes, including stimulus to diversify agricultural activities and develop new local HNV products, and to change local food chains, values and norms, policies and institutional arrangements. The research addresses the complexity of HNV farming as an environmental solution with a broader impact on the economic and social sustainability of agriculture at the regional level [Peneva et al. 2012A].

The municipality of Elena is located in the central north part of Bulgaria. Before the political changes in 1989, relatively big industrial enterprises formed the backbone of the regional economy. Nowadays, new small and medium enterprises – mostly private – have restored traditional businesses and currently operate successfully in different sectors by utilising local sources. The municipality also has a tradition in organized tourism services. In agriculture, the main changes are: renewal and increase of areas with permanent crops; cultivation and collection of wild herbs and mushrooms; livestock breeding and bee-keeping. The studied initiative implemented the idea of integration between tourism and agriculture. Its main aim is to achieve a synergetic effect resulting in sustainable development of the whole municipality as an economic region and territory. Therefore, the initiative focuses on building new facilities for rural tourism, preservation of natural and cultural heritage, recovery of traditional agriculture with special attention to the marketing and certification of local agricultural products [Draganova et al. 2012].

The third initiative promotes the idea of community-supported agriculture. Its main aim is to provide healthy and locally grown food to consumers during the natural growing

season. In exchange, producers receive financial and/or in-kind support during the spring. There is an additional benefit of sharing a lifestyle and production methods that treat environment and nature in a sustainable way. All this is reinforced by the producers' and consumers' understanding that future generations must be able to live in a clean and a safe world, at least as much as we do today. The initiative started in Zhelen village in the municipality of Svoge (46 km from the capital Sofia). The main activities are: promotion of environment-friendly lifestyle, preservation and restoration of natural heritage and traditions, revival and development of crafts and folklore music, and changing the supply chain of local food through encouraging tourist visits and participation in labour-intensive and low-input agriculture, together with enjoying the countryside and experiencing rural living and its people [Peneva et al. 2012B].

Discussion

Over the course of the study, a number of pressures were identified at the macro level (the socio-technical landscape in transition studies), representing the exogenous environment for the three initiatives and indirectly influencing LFS development. In the transformation process, pressures create windows of opportunities for innovations that might be used. For the three case studies in Bulgaria they are: the common awareness for biodiversity protection and nature conservation at regional, national, European, and supra-national levels; as well as a growing consumer awareness regarding food quality and safety, together with an increased willingness for preservation of cultural identity and traditional knowledge (a nostalgic notion regarding the cultural values of traditional farming and tasty food products); integration of traditional agri-food products in the EU rural development and food policies, etc. [Draganova et al. 2012, Peneva et al. 2012A, 2012B, 2014A].

Concerning the LFSs in the case study areas, the regime level (regional level in transition theory) encompasses several sub-regimes: production, processing, consumption and marketing. Within these sub-regimes, different relations between actors were identified: interaction, interdependence, constraint and influence. It is also important that the process of setting up and developing local food chains has been preceded by the process of networking and creation of some bridges between actors within the agro-food regime, and between them and other domains. The collaboration between actors and social links has led to the development of social capital and economic opportunities for local actors.

The niche level of the initiatives is presented by three innovations in local food chains: direct marketing of local food and HNV products, diversification and integration between tourism and local food production, and community-supported agriculture with promotion of traditional foods to new customers. These novelties induce changes towards regionally sustainable agriculture, economic viability and vitality both for farmers and small businesses, and development of the rural areas. This process required new skills and knowledge concerning implementation of good hygiene practices; design skills (jar choice, packing, and labelling); marketing techniques to retain customers and to build long-term relationships, management of sales, etc. It includes learning and collaboration, which are running differently in the three studied initiatives due to the differences in their aims, actors involved, and connections between them.

In the case of Besaparski hills, an NGO was implementing a project and played an important role in the learning process (through organized training, special practices, travel

for international experience sharing, provision of information, advice, and practical tools for farmers). The trainings and learning are central to collaboration and are focused on the implementation of agri-environmental measures and production of local products on the farm. As a result, the knowledge and skills of farmers has deepened – from general awareness to more specific learning of techniques related not only to production but also to marketing, standards and ethical issues.

In the municipality of Elena, new knowledge and skills about information processing and management were developed. The innovativeness is related more to the development of an integrated tourism product, which incorporates local food offers. There are also a lot of organized seminars, events or workshops, which have given possibility to farmers to exchange experience, to learn from each other, to get new information and to establish contacts. From this perspective, organizing joint events is useful, not only to receive specific information on a concrete topic, to exchange experience or to make contacts, but also to promote local food products. Often such contacts lead to agreement on joint activities.

Within the Zhelen initiative, new knowledge and skills are obtained through the nature-agriculture interaction practices such as learning in practice and training (seminars, workshops, etc.) both for local stakeholders and tourists. The initiative fosters the process of exchanging products, art and craft articles between its members and tourists and visitors; and developing new marketing activities, which are more socially and environmentally oriented than economic.

Table 2. Summary of the identified effects of the LFS in the three case studies in Bulgaria on the three sustainability dimensions

Dimensions of sustainability	Ecological	Conserving traditional agricultural practices and landscapes
		Diversification of local land use
		Encouraging environmentally friendly production methods (HNV farming, low input production, organic production, etc.)
	Social	Preservation of traditional agricultural and food production
		Better satisfaction of farmers and producers for personal achievements
		Rising awareness about environmental and social effects of consumption and consumer behaviour
		Building new relationships between various actors of diverse interests at different levels: local, regional and national levels
		Engaging public institutions in its promotion
	Economic	Raising income for farmers and producers; higher selling prices
		Securing new sources of income and creating employment opportunities
		Increasing the regional added value
		Reducing dependencies on intermediaries

Source: see table 1.

Central for the three case studies is shortening the distance between farmers and consumers and advancing the communication between them, thus providing more flexibility and more choices for both sides. Farmers can plan and achieve their goals for sales – better pricing conditions and reducing their dependence on intermediaries; and

consumers can enjoy the taste, freshness and quality of traditionally produced food. Another step in short supply chain development is the application of local certification schemes and engagement in the development and expansion of local festivals, fairs of local agricultural products, traditional foods and crafts, etc. Furthermore, the development of LFSs is a complex issue at regional level and combines quality products, marketing, and rural tourism activities. The diversifications expand the promotion of local heritage and contribute to the regional-specific characteristics of agricultural and rural areas. All these changes create potential opportunities to secure new sources of income and employment in rural areas, as well as opportunities to increase the viability and the long-term sustainability of farm enterprises. Another important effect of the initiatives' development is the increased confidence of farmers in their work and place in the community as a result of their involvement with local food marketing activities.

Finally, the sustainability dimensions of the alternative local supply chains of the three initiatives are drawn. They are based on the normative framework of sustainability and its analytical concept generally consisting of an ecological, economic and social dimension. Table 2 provides a summary of the effects identified in the case studies.

Furthermore, some unfavourable issues are identified as hindering factors for LFS development in the case studies, which need to be addressed by all stakeholders. These are: marketing channel limitations due to variation in product quality and small quantities of produce; lack of adequate consumer information both in terms of quantity and quality; absence of strategic promotion of the study regions; limited access to financial sources for investments; legislation and policy support regulations.

Conclusions

The critical analysis of the three case studies have shown their complexity and diverse character, which is in accordance with the literature and the lack of a single definition of LFS. The identified effects on rural development and sustainable agriculture depend on the specific circumstances of each case, taking into account the different patterns of production, consumption, goals and actors involved. Nevertheless, the successful implementations of these differences show the potential of short supply chains to address the complexity of LFSs and interactions between society, nature and economy. In this regard, further studies are needed to identify the problems and formulate recommendations on possible marketing strategies; strengthening consumer-producer relations; investments in infrastructure and farms; improvements in legislation and regulations; setting up certification processes; advancements in trainings and extension services.

References

Darnhofer Ika [2011]: Initial Conceptual Framework. FarmPath working document.

Draganova M., Peneva M., Kazakova Y., Mishev P. [2012]: Case Study report: Rural development based on sustainable tourism and local food production: The municipality of Elena, FarmPath working report.

Galli F., Brunori G. (eds.) [2013]: Short Food Supply Chains as drivers of sustainable development. Evidence Document. Document developed in the framework of the FP7 project FOODLINKS (GA No. 265287). Laboratorio di studi rurali Sismondi, ISBN 978-88-90896-01-9, [Available at:] http://www.foodlinks community.net/fileadmin/documents_organicresearch/foodlinks/CoPs/evidence-document-sfsc-cop.pdf.

Geels F., Schot J. [2007]: Typology of sociotechnical transition pathways. Research Policy 36: 399-417.
Kneafsey M. et al. [2013]: Short Food Supply Chains and Local Food Systems in the EU. A State of Play of their Socio-Economic Characteristics. EC Report, [Available at:] http://ftp.jrc.es/EURdoc/JRC80420.pdf .
MAF [2014]: Agricultural Report 2014, Ministry of Agriculture and Food of Bulgaria.
Marsden T., Banks J., and Bristow G. [2000]: Food supply chain approaches: exploring their role in rural development, Sociologia Ruralis, Vol 40, No 4, pp. 424–438.
Peneva M., Kazakova Y., Draganova M., Mishev P. [2012A]: Case Study report: High Nature Value Farming in Besaparski Hills (Natura 2000), FarmPath working report.
Peneva M., Draganova M., Mishev P. [2012B]: Case Study report: Countryside Consumption Cluster, Community Support Agriculture in Zhelen, Bulgaria (Solidarno), FarmPath working report.
Peneva M., Draganova M., Gonzalez C., Diaz M., Mishev P. [2014A]: "High Nature Value Farming", Transition Pathways Towards Sustainability in European Agriculture. Edited by: L-A. Sutherland, I. Darnhofer, G. Wilson and L. Zagata, pp 97-113, CABI publisher.
Peneva M., Kazakova-Mateva Y., Mishev P. [2014B]: High Nature Value Farming for sustainable local food production and consumption, EAAE 2014 Congress: 'Agri-Food and Rural Innovations for Healthier Societies', August 26 to 29, 2014, Ljubljana, Slovenia.
Renting, H., Marsden T. K., Banks J. [2003]: Understanding alternative food networks: exploring the role of short food supply chains in rural development. Environment and Planning, vol. 35, pp. 393 – 411.
Regulation (EU) No 1305/2013 of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation(EC) No 1698/2005, [Available at:]:http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32013R1305.
Schönhart, M., Penker, M., Schmid, E., [2009]: Sustainable local food production and consumption: Challenges for implementation and research, Outlook on Agriculture, Volume 38, Number 2, pp. 175-182(8).
Pinto-Correia, T., McKee A., Guimarães H. [2014]: "Transdisciplinarity in deriving sustainability pathways for agriculture", Transition Pathways Towards Sustainability in European Agriculture. Edited by: L-A. Sutherland, I. Darnhofer, G. Wilson and L. Zagata, pp 171-188, CABI publisher.
Vlahos G., Karanikolas P., Tsakalou E. [2011]: Evaluation Matrix with Final Selection of Initiatives. FarmPath working document.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 156–165

Agnieszka Poczta-Wajda[1]
Department of Macroeconomics and Agricultural Economics
Poznań University of Economics

Feeling of Relative Deprivation as a Driver for Higher Agricultural Subsidies*

Abstract. Because people tend to compare themselves with others from their own surroundings, even a person rich in absolute terms can feel poor in relative terms, if people from their reference group are richer. This phenomenon is called relative deprivation. Farmers in developed economies claim to be poor, because they compare themselves not with farmers from poor economies, but rather with other members of their own society who work outside of agriculture and whose incomes are usually higher. Feeling relatively deprived, farmers in developed economies demand stronger financial support and act intensively to convince policymakers to support them. The main aim of this paper is to analyze the relation between relative deprivation of farmers and support for farmers in countries with different development levels. Results of this study prove that levels of support for farmers are positively related with the average level of relative deprivation of farmers dependent on the size of farmer groups. Hence the idea of relative deprivation might provide additional political explanation of different levels of support for farmers in countries with different development levels.

Key words: agricultural policy, support for farmers, relative deprivation, political economy

Introduction

Under conditions of perfect competition prices are determined by demand and supply. However, agricultural markets in most countries are far from what we call perfect competition. The agricultural sector is subject to government intervention in most world economies and prices of agricultural products are influenced by a wide range of domestic and trade policies. However, the character of these actions takes different form in developed and developing countries. Rich economies usually support farmers, whereas poor economies typically or often tax them. As a result, world food prices are strongly distorted. Although lack of financial support in developing countries might be explained through fiscal reasons, it is much harder to understand why developed economies continue to support farmers. Moreover, farmers from developed economies, though rich in comparison to the farmers from developing economies, claim to be poor and demand financial support, which they ultimately receive. Hence the main research problem of this paper is to find some possible explanations of this situation, since such patterns of agricultural policies make little sense from a classic economic point of view.

In the literature there are several answers to this phenomenon provided by political economy theories [Swinnen 2010, Gawande and Hoekman 2010]. A set of arguments is related to the effectiveness of political organization and the power of farmer lobbying. Studies drawing on Olson's [1965] theory of collective actions argue that incentives to act collectively increase as interest groups get relatively smaller and gather more political power, because a group requires measures of organization, communication and

[1] PhD, e-mail: agnieszka.poczta@ue.poznan.pl
* This work was supported by the Polish National Science Center under Grant DEC-2011/01/D/HS4/01954.

coordination among its members and the transaction costs of organizing a lobby are lower – with higher potential gains per capita – in smaller groups. Baldwin and Robert-Nicoud [2007] explain that in expanding industry, with low barriers to entry, new entrants reduce potential political rents, however in declining industries this is not the case. The result is that members of declining industries invest more resources in lobbying activities. Other economists [Freund and Özden 2008, Tovar 2009] stress the importance of aversion to loss in determining political reactions; hence governments support groups or industries that would face significant short-term loss, as in many cases for the agricultural sector in developed countries. Another group of studies emphasized the importance of income and asset inequality in explaining why rich countries support farmers and poor countries tax them. Olper [2007] argues that inequality is negatively correlated with protection, which is contrary to Olson's line of argument. He refers mainly to land inequality and the ideology of the ruling party. He claims that democratic governments tend to reduce inequalities and are more willing to support farmers than dictatorships, which prefer to maintain assets in only a few hands[2]. On the other hand, La Ferrara [2002] proves that inequality causes collective problems, which is often the case in developing countries and results in lower levels of support.

However, there might be another explanation for why farmers in developed countries receive greater financial support. One can look at the problem of group size and the problem of inequality from another perspective. Farmers in developed economies demand support because they feel poor, even though in absolute terms their incomes are much higher than the incomes of farmers in developing countries. Prosperity looks different in relative terms. Farmers in rich economies compare themselves not with farmers in poor economies, but rather with other members of their own society who work outside of agriculture and who are usually richer[3]. Moreover, because in developed countries the number of people employed in agriculture is small, the percentage of those who are richer than farmers is significant. Seeing that most of society is better off, farmers in developed economies claim to be poor. This phenomenon is called relative deprivation and is used in theories of social movement to explain why people join social movements or advocate social change [Runciman 1966]. Feeling relatively deprived, farmers in developed economies demand stronger financial support and act intensively to convince policymakers to support them. In addition, farmers from rich countries are aware that their actions will not meet with social opposition and that the rest of society will not act against agricultural subsidies, due to the fact that increases in income reduce the relative cost of such support for consumers. As a result, the average level of support for farmers in developed countries is higher than in other parts of the world.

Hence the main aim of this paper is to assess the relative deprivation of farmers in countries with different development levels and to compare it with levels of support for farmers. The following research hypothesis is assumed: there exists a positive relation between the level of a country's average support for farmers and the level of a country's average relative deprivation of farmers, which is related to the percentage of society working outside of agriculture. The first part of this paper gives some methodological

[2] Issue of ideology, inequality and lobbing is also widely discussed by Dutt and Mitra [2010].

[3] Frank [2007] stresses the importance of reference group and explains that people tend to compare themselves with others from their own surroundings; hence "...a house of a given size is more likely to be viewed as spacious the larger it is relative to other houses in the same local environment".

background. The second part presents an empirical analysis, which proves the assumed hypothesis.

Material and methods

World Bank estimates of distortions to agricultural incentives

The empirical analysis of the level of support for farmers was based on the NRA estimate (nominal rate of assistance) available in the World Bank database on estimates of distortions to agricultural incentives 1955-2007, updated in June 2013 [Anderson, Valenzuela 2008; Anderson, Nelgen 2013]. The final data set includes data for 82 countries with different development levels and over the years 1955-2010. The NRA for a single product indicates what percent an agricultural producer's income is higher (or lower) from the one he would obtain in the absence of any interference from the state. It can be defined as:

$$NRA = \frac{P_d - P_f}{P_f}$$

where:

P_d – is observed domestic price in local currency

P_f – is the domestic price that would hold in the absence of commodity-market or exchange-rate intervention.

NRA would be zero if there was no government intervention, positive if farmers were supported, and negative if producers were taxed [Masters and Garcia 2010]. NRA for the sector is calculated as a weighted average, where the weights are based on the value of production measured in world prices. Analysis in this paper was based on $NRA_{totd,}$ which includes also non-product specific support and decoupled payments.

Relative deprivation index

Though NRA estimate is a well-established and well-known way of measuring levels of support for farmers, the methodology for measuring relative deprivation is not so evident. The most common way to measure relative deprivation is to use the index proposed by Oded Stark in several of his papers [Stark, Micevska, Mycielski 2009; Stark 2013]. Relative deprivation of an individual earning x_i in population P with an income vector $x = (x_1,...,x_n)$ is equal to the fraction of those whose incomes are higher than x_i times their mean excess income:

$$RD(x_i, x) = [1 - F(x_i)] \cdot E(x_i - x_i | x_j > x_i)$$

In order to calculate the average level of farmer relative deprivation we need do modify the equation as follows:

$$\overline{RD}(ag) = [1 - F(x(ag))] \cdot (\bar{x}(nonag) - \bar{x}(ag) | \bar{x}(nonag) > \bar{x}(ag))$$

Hence the country's average level of farmer relative deprivation is equal to the fraction of those working outside agriculture times the difference between average income in the non-agricultural sector minus average income in the agricultural sector, providing that average income outside agriculture is higher than average income within agriculture.

Because comparable and reliable data on income within and outside the agricultural sector in countries with different development levels is not available, I decided to use gross value added data available in the World Bank database. In the case of the agricultural sector, gross value added is an even better measure, since it does not include income subsidies. Hence the value added can be seen as an approximation of what a farmer would earn if there was no government support. Following, the average level of farmer relative deprivation in a single country can be calculated as a fraction of the work force in non-agricultural sectors multiplied by a difference between mean gross value added per worker in non-agricultural sectors and mean gross value added per worker in the agricultural sector:

$$\overline{RD}(ag) = \left[1 - F\left(GV(ag)\right)\right] \cdot (\overline{GV}(nonag) - \overline{GV}(ag) | \overline{GV}(nonag) > \overline{GV}(ag))$$

A positive result means that farmers are relatively deprived in comparison to other members of the society, but if a result is negative, then the relative deprivation equals zero.

However, the index of relative deprivation proposed by O. Stark is useful when analyzing individuals or countries in the same reference group. For example, it can be used to compare relative deprivation between farmers within one country or between farmers from countries with similar levels of income per capita, like France and Germany. It makes less sense when comparing the level of relative deprivation between farmers in countries with significant differences in levels of income per capita[4]. To solve this problem, an assumption was made that even though farmers in high-income economies are relatively less poor (in comparison to non-farmers) than farmers in most of the low-income countries, they still feel relatively deprived and their relative deprivation is even stronger because those earning more (non-farmers) are higher than in the low income economies. In other words, in international comparison it makes no difference how big the income excess is. What farmers care about is the percentage of society working in non-agricultural sectors when they earn more than farmers. Following this assumption, I used a dummy variable set to one if mean gross value added per worker in non-agricultural sectors was higher than mean gross value added per worker in agricultural sector and modified the relative deprivation index:

$$\overline{RD}(ag) = \left[1 - F\left(GV(ag)\right)\right] \cdot (1 | \overline{GV}(nonag) > \overline{GV}(ag))$$

or

[4] Since mean excess depends on difference in average absolute income, it would also influence relative deprivation index.

$$\overline{RD}(ag) = 0 | \overline{GV}(nonag) < \overline{GV}(ag)$$

Hence, the average level of farmer relative deprivation in a given country is assumed to be equal to the fraction of people working in non-agricultural sectors in the case when average gross value added in the non-agricultural sector is higher than in the agricultural sector, and zero (farmers are not deprived) in the case when average gross value added in the non-agricultural sector is lower than in the agricultural sector.

Panel data analysis

The above-described data set on support for agricultural sector and relative deprivation is an example of macro-economic panel data. This kind of data describes observed population in more than one dimension, for example time and spatial dimension. The main advantage of panel data is the ability to increase the research sample, thus increasing the number of degrees of freedom and efficiency of estimation. Panel data also allows for greater heterogeneity of the observed individuals. For these reasons, panel data is often used in social studies, including economics. The most commonly used models for panel data are: pooled model, model with fixed effects and model with random effects [Gruszczyński 2012].

Pooled model regression can be used in a situation where the sample is homogeneous or when all individuals are similar. Estimated parameters of the model are the same for all individuals and in each time unit. Differences between the empirical and the theoretical values result only from random noise. In other words, the individual effects do not occur or are irrelevant. In that case, we treat data as cross-sectional data and estimate regression with use of ordinary least squares (OLS) method. The model is denoted as:

$$y_{it} = \beta_0 + x_{it}\beta + \varepsilon_{it}$$

where:

$i = 1 \ldots N$ - individual dimension
$t = 1 \ldots T$ - time dimension
y_{it} - dependent variable,
x_{it} - independent variable,
β_0, β - coefficients,
ε_{it} - error term

In order to decide whether to use the OLS method, it is worth running the Breusch-Pagan test, which verifies the hypothesis about the existence of random effects [Kufel, 2007]. In practice, the null hypothesis that variances across entities are zero can rarely be accepted.

The second type of panel data estimation is the fixed-effects model. This model assumes that objects have their own individual characteristics, which means that their variances differ. In order to eliminate differences in variances, the model includes individual coefficient α_i, [Wyrobek 2004], which can be interpreted as an individual intercept for each observation. This model can be denoted as:

$$y_{it} = x_{it}\beta + \alpha_i + \varepsilon_{it}$$

where:
$i, t, y_{it}, x_{it}, \beta, \varepsilon_{it}$ - same as above,
α_i - the unobserved time-invariant individual effect for each observation i. The significance of the individual effects can be assessed with the Wald test.

Another method of panel data analysis is the random-effects model. This model assumes that individual effects are a random variable and are uncorrelated with the independent variable. In order to estimate the RE model, one must use a generalized last square (GLS) method. The model is denoted as

$$y_{it} = \beta_0 + x_{it}\beta + v_{it}$$

where:
$i, t, y_{it}, x_{it}, \beta_0, \beta$ - same as above,
$v_{it} = \alpha_i + \varepsilon_{it}$ - error term being a sum of between-entity error and within-entity error.

To decide between fixed or random effects, one can run a Hausman test where the null hypothesis is that unique errors are not correlated with the regressors [Kufel 2007].

Results and discussion

The final data set includes 70 countries and 1560 observations[5]. The full dataset is presented in Figure 1, which suggests a positive relation between nominal rate of assistance (NRA) and average relative deprivation (RD) of farmers. This figure suggests also that for some observations RD equals zero, which means that average gross value added in the non-agricultural sector is lower than in the agricultural sector. Such a situation happened regularly in Argentina, Bulgaria, Nicaragua, Nigeria, Ukraine and Slovenia[6].

Table 1, which presents the top ten countries with the highest and the lowest level of NRA estimate in year 2001-2004[7], provides further support to this tendency. Share of non-agricultural labor force, which determines the level of relative deprivation, is high in countries with the highest level of nominal rate of assistance. On the other hand, in countries with low level of NRA (or even negative), the share of the non-agricultural labor force is much lower. There are exemptions like Argentina, Nicaragua or Niger, where the majority of the labor force works outside agriculture and the NRA is negative. Auxiliary dummy variable equal to zero suggests, however, that in these countries average gross value added in the non-agricultural sector is lower than in the agricultural sector, hence farmers are not deprived and they have no incentive to lobby for support.

[5] Although there is inevitably much measurement error and lack of data regarding both NRA estimate and relative deprivation index, this data still covers a very large fraction countries over a very long time period, which makes it possible to detect new trends and patterns.
[6] Value added in agricultural sector happened to be higher than in non-agricultural sector also in Armenia, Bosnia and Herzegovina, Guyana, Kyrgyz Republic, Lebanon, Macedonia, Micronesia, Moldova, Mongolia, Tonga and Uzbekistan. These countries were, however, excluded from analysis because NRA data were not available.
[7] This time range was chosen because of the highest number of available data.

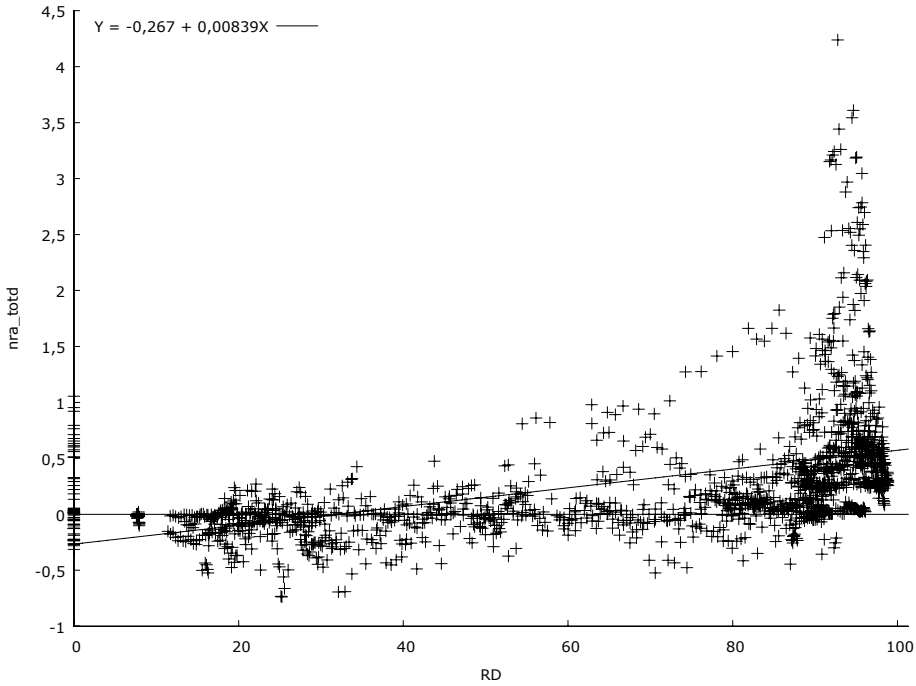


Figure 1. Relation between average relative deprivation of farmers (RD) and nominal rate of assistance for farmers (NRA), 70 countries, 1560 observation, (1980 to 2011).

Source: author's own derivation based on World Bank data base.

The preliminary visual analysis of the dataset suggests that there might be a positive relation between average level of relative deprivation of farmers and a country's level of support for farmers. Panel data analysis seems to be an adequate method to verify this hypothesis.

Table 1. Top ten countries with the highest and the lowest level of NRA estimate (2000-2004 average).

Country	NRA	Share of non-agricultural labor force (in %)	Auxiliary RD dummy variable	Country	NRA	Share of non-agricultural labor force (in %)	Auxiliary RD dummy variable
Switzerland	2.31	96	1	Zimbabwe	-0.38	39	1
Norway	2.22	96	1	Coted'ivoire	-0.28	54	n.a.
Iceland	1.82	93	1	Argentina	-0.19	91	0
Korea	1.45	92	1	Zambia	-0.14	32	1
Japan	1.15	97	1	Tanzania	-0.10	21	1
Ireland	0.80	91	1	Ethiopia	-0.09	19	1
Romania	0.66	87	1	Nicaragua	-0.05	82	0
Morocco	0.64	70	1	Nigeria	-0.04	69	0
Netherlands	0.57	97	1	Sudan	-0.01	42	1
Austria	0.56	95	1	Senegal	-0.01	27	1

Source: author's own derivation based on World Bank data base.

A dependent variable in the regression equating one used the NRA estimate for the total agricultural production, which includes also non-product-specific assistance and decoupled payments (nra_totd). Two potential independent variables were introduced. The first of these is a relative deprivation index (RD). This variable is equal either to a fraction of the non-agricultural labor force or to zero, depending on the relation between average gross value added in the agricultural sector and in non-agricultural sectors. The assumption is made that only the economically active population is willing to engage in collective actions, since only this group of society possess required resources. The second independent variable is the real GDP per capita calculated at constant prices from year 2005 in U.S. $ (gdppcp00). This variable helped to verify the hypothesis that due to Engel's law, increase of income reduces public opposition to agricultural subsidies, since the relative cost of such support for consumers declines[8]. In substantive reasons, the Breusch Pagan test and the Hausman test suggested that the best method of analysis of collected panel data would be a fixed-effects model. Results are presented in Table 2.

Table 2. Results of fixed-effect model; 70 countries: dependent variable: NRA estimate (nra_totd); independent variables: relative deprivation index (RD), real GDP per capita at constant prices from 2005 in U.S. $ (gdppcp00).

	Model 1 - All countries	Model 2 - Developed countries	Model 3 - Developing countries
RD	0.226 ***	2.880 *	0.172 ***
	(0,059)	(1.570)	(0.046)
Gdppcp00	0.004 ***	0.006 ***	0.0001
	(0.0002)	(0.001)	(0.0005)
Adjusted R^2	0.75	0.62	0.74
Wald test	74.95	81.88	38.76
	p < 0.000	p < 0.000	p < 0.000
Observations	1560	479	1081

Standard errors in parenthesis, significance *** p<0.01, ** p<0.05, * p<0.10

Source: author's own derivation based on World Bank data base

Adjusted determination coefficient R^2 shows that variability of the independent variables (relative deprivation and income per capita) explains the variation of NRA in 75%. Both independent variables are statistically significant and with the expected sign. The Wald test confirms the significance of the individual effects. When this panel data is separated by region, results varies. The model for developed countries explains less variation of NRA and the RD variable is significant only with p less than 0.1. The model for developing countries explains the variation of NRA almost as well as the model for the full data set, however income per capita turned out to be insignificant. All three models confirm the assumed hypothesis, that there exists a positive relation between level of a country's average support for farmers and level of country's average relative deprivation of farmers.

[8] Relations between income per capita and assistance to agriculture have been extensively analyzed by agricultural economists. For some examples see Krueger (1992) or de Gorter and Swinnen (2002).

Conclusions

The main aim of this paper was to analyze the phenomenon of relative deprivation of farmers and its relation to assistance for agricultural producers. The author suggested that the feeling of relative deprivation, which depends upon the percentage of the wealthier part of society, might serve as an incentive for farmers to act collectively and lobby for greater support. Theoretical considerations and empirical analysis have led to the following conclusions:

1. Support for farmers measured with the use of NRA estimate and the relative deprivation of farmers measured with the use of modified index of relative deprivation are positively related, which confirms the assumed hypothesis;
2. Empirical analysis confirms also that the relation between GDP per capita and agricultural support is significantly positive, which verifies the hypothesis that increase of national income reduces public opposition to agricultural subsidies, since the relative cost of such support for consumers declines;
3. Farmers in high-income economies compare themselves with other members of their own society and see that a significant fraction of society has higher incomes. Additionally, since the opposition to agricultural subsidies is reduced by high income per capita, farmers act intensively and with success to lobby for support from policymakers.
4. Farmers in developing countries, even though their incomes are also lower than incomes of non-farmers, constitute the majority of society. Seeing most of the society as equally poor, they feel less deprived and have weaker incentives to lobby for support. Additionally, because of the lower national income per capita, the cost per capita of supporting agriculture would be high and would cause social opposition.
5. The author of this paper is aware of the limitations of this approach and sees the need for further deepening of these considerations, since there are some countries, like New Zealand and Australia, where there is a high level of relative deprivation of farmers, but level of support for agricultural producers is low. Another issue worth consideration would be including data on owned assets such as land.

References

Anderson, K., Valenzuela E. [2008]: Estimates of Global Distortions to Agricultural Incentives, 1955 to 2007, www.worldbank.org/agdistortions.

Anderson, K., Nelgen S. [2013]: Updated National and Global Estimates of Distortions to Agricultural Incentives, 1955 to 2011, www.worldbank.org/agdistortions.

Baldwin, R., Robert-Nicoud, F. [2007]: Entry and Asymmetric Lobbying: Why Governments Picks Losers. *Journal of the European Economic Association*, Volume 5(5), 1064–1093.

de Gorter, H., Swinnen, J., [2002]: Political Economy of Agricultural Policies [in:] The Handbook of Agricultural Economics, Volume 2. ed. B. Gardner, G. Rausser. Elsevier, Amsterdam.

Dutt, P., Mitra, D. [2010]: Impacts of Ideology, Inequality, Lobbying and Public Finance [in:] The Political Economy of Agricultural Price Distortions. ed. K. Anderson. Cambridge University Press, New York.

Frank, R. [2007]: Falling Behind. How Rising Inequality Harms the Middle Class, University of California Press. Berkeley.

Freund, C., Özden, C. [2008]: Trade Policy and Loss Aversion. American Economic Review, Volume 98(4), 1675–1991.

Gawande, K., Hoekmen, B. [2010]: Why Governments Tax or Subsidize Agricutural Trade [in:] The Political Economy of Agricultural Price Distortions. ed. K. Anderson. Cambridge University Press, New York.

Gruszczyński, M., Bazyl, M., Książek, M., Owczaruk, M., Szulc, A., Wiśniowski, A. i Witkowski, B. [2012]:

Mikroekonometria. Modele i metody analizy danych indywidualnych, red. M. Gruszczyński. Wolters Kluwer Polska S.p. z o.o., Warszawa.

Kruger, A., [1992]: The Political Economy of Agricultural Pricing Policy, Volume 5: A Synthesis of the Political Economy in Developing Countries. Johnson Hopkins University Press, Baltimore.

Kufel, T. [2007]: Ekonometria. Rozwiązywanie problemów z wykorzystaniem programu GRETL. PWN, Warszawa.

La Ferrara, E. [2002]: Inequality and Group Participation: Theory and Evidence from Rural Tanzania, *Journal of Public Economics*, Volume 85(2), 235-273.

Masters, W., Garcia, A. [2010]: Agricultural Price Distortions and Stabilization [in:] The Political Economy of Agricultural Price Distortions. ed. K. Anderson, Cambridge University Press, Baltimore.

Olper, A. [2007]: Land Inequality, Government Ideology and Agricultural Protection. *Food Policy*, Volume 32(1), 67-83.

Olson, M. [1965]: The Logic of Collective Action: Public Goods and the Theory of Groups. Yale University Press, New Haven.

Runciman, W. [1966]: Relative Deprivation and Social Justice, Routledge and Kegan Paul, London.

Stark, O. [2013]: Stressful Integration. *European Economic Review*, Volume 63, 1-9.

Stark, O., Micevska, M., Mycielski, J. [2009]: Relative poverty as a determinant of migration: Evidence from Poland. *Economics Letters*, Volume 103, 119-122.

Swinnen J. [2010]: Political Economy of Agricultural Distortions: The Literature to Date [in:] The Political Economy of Agricultural Price Distortions. ed. K. Anderson. Cambridge University Press, New York.

Tovar, P. [2009]: The Effects of Loss Aversion on Trade Policy: Theory and Evidence. *Journal of International Economics,* Volume 78(1), 154–167.

Wyrobek, J. [2004]: Polityka dywidend w spółkach notowanych na Giełdzie Papierów Wartościowych w Warszawie w latach 1994-2002. *Zeszyty Naukowe PTE*, nr 2, 237-261.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 166–179

Daniela Grigore Popa [1]
The State Agricultural University of Moldova, Chisinau, Republic of Moldova
Toma Adrian Dinu [2]
University of Agricultural Sciences and Veterinary Medicine of Bucharest

Correlations between fragmentation of farms in the Republic of Moldova and its impact on farm incomes compared to Poland and Romania

Abstract. The paper presents selected problems of farm management in terms of fragmented agriculture. The problem of land fragmentation was exemplified in these three countries of Central and Eastern Europe. The main purpose of the study was to compare the effectiveness of selected indicators of agricultural production in the three selected countries. For the analysis, the data on the concentration indexes was selected from: Lorenz concentration coefficient, the Gini index, and territorial concentration coefficient (Gini C and Stuck formula). In selected countries, there are a large number of small and very small farms. They represent the majority of farms managed by private owners. To a large extent, they are called semi-subsistence farms or social farms. Some of them provide part of their products on the market. Small farms are part of the so-called European Model of Agriculture – a model that consists of small family farms. It is difficult to indicate a correct definition of "small farm", as it may be defined differently depending on the region or country. In the EU, small farms occupy a dominant position, being a constant subject of debates and policy. The authors of the article stressed the need for strengthening the small farm position, for example by enlarging their acreage or by initiating horizontal or vertical cooperation in a way that shall not impair the role of small farms. They are important in biodiversity protection, preserving the rural landscape, as well as maintaining local tradition, culture and heritage.

Key words: land fragmentation, concentration index, land productivity, European model of small farms, farm management, the role of small farm, Moldova, Poland, Romania

Introduction

Nearly 14 million farmers exist in the EU and the average farm size is 15 hectares. The biggest agricultural holdings are located in the Czech Republic (the average farm size is 90 hectares) and Denmark (60 hectares) and the lowest are in Romania (3 hectares), Poland (6 hectares), Bulgaria (6 hectares), Hungary (7 hectares) and Italy (8 hectares) [Eurostat 2014].

Land fragmentation and the system of small farms is known as the European Model of Agriculture (EMA) [Kowalczyk, Sobiecki 2011]. Fragmented agriculture, family farms and, what should be stressed, high diversity, characterize European agriculture. There are many agricultural enterprises and organic farms, nevertheless very small and medium-sized farms have a dominant position [Musiał, Drygas 2013]. European agriculture still represents a fragmented model of agriculture and is mostly family-managed. Very often, the land is cultivated from generation to generation: retired owners pass the farm into the hands of their children [Poczta 2010]. The use of direct payments under the Common Agricultural Policy of the European Union provides strong incentive to keep small farms. It

[1] PhD, e-mail: d.popa@uasm.md
[2] PhD, e-mail: tomadinu@yahoo.fr

also significantly affects the increase in land prices [Światły, Turnau, Majchrzak 2011]. Therefore, introducing modulation (reduction of direct payments for the largest farms) will result in splitting the big farms into smaller ones [Zegar 2008].

Although the European Model of Agriculture is fragmented and based on family farms, the concept of "small farm" is not very clear. For the criterion of defining, the utilized agricultural area can be considered, as well as economic output, added value, allocation of production, work force, the source of income, etc. [EU Agricultural Economic Briefs: What is a small farm? 2011; The European Model of Agriculture – Challenges Ahead 2006]. Because of the size, a "small farm" may be a farm of 2 hectares in Poland, Romania or Moldova, while in France or Great Britain, we may consider a small farm as having an area of 30 or 50 hectares.

One-third (i.e. 3.6 million) of European agricultural holdings are in Romania, with an average area of 3.6 hectares, and 41% of them are managed by people over 65, according to recent data of Eurostat. Data shows some of the information obtained from the agricultural census conducted in 2013 - 2014 in all Member States. In the European Union in 2013, there were about 10.8 million agricultural properties, including over one third (33.5%) in Romania. The vast majority of the 3.7 million farms are subsistence farms and patches of agricultural land belonging to rural households.

Over the years, we can observe slow increasing in the average farm size in the EU: between 2003 and 2010, the average farm size increased from 12 to 14 hectares. At the same time, the number of farms reduced between 2003 and 2010 by 20% [Eurostat 2014]. However, small farms still dominate in Europe, and those above 50 hectares are only 5% of all farms. In relation to other countries in the world, e.g. the USA or Australia, these farms are still very small [Tóth 2014].

Materials and methods

The main purpose of the research was to assess the degree of land fragmentation in three countries in Central and Eastern Europe (Poland, Romania and Moldova), taking into account its impact on land productivity and management. The rate of land productivity was defined as the value of agricultural production per 1 hectare of utilized agricultural area (UAA).

To assess the degree of land fragmentation the calculations of Majchrzak [2014] were used: Lorenz concentration coefficient and the Gini index.

The Lorenz coefficient reaches values of <0,1>, where the closer to 0, the lower the concentration; the closer to 1, the greater the concentration with respect to a fixed variable. In the paper, concentration with respect to farms greater than 50 hectares was taken into account. In turn, the Gini index is a measure of inequality of a random variable. It also ranges from 0 to 1, but the value of zero means complete uniformity and the growth of rate represents the increase of inequality [Statystyczne studium struktury agrarnej w Polsce, 2010]. For the Moldova case study, the territorial concentration coefficient (Gini C and Stuck formula) were also used.

For calculations, statistical data of Eurostat, data from the Central Statistical Office in Warsaw, the data of the Agency for Restructuring and Modernization of Agriculture and Ministry of Agriculture from Moldova Republic, and National Bureau of Statistics from Republic of Moldova were used, as well as scientific publications and research results.

The study focused on the analysis of mentioned factors in relation to three selected countries: Poland, Romania and Moldova. A strong similarity can be indicated in the level of development in agriculture, and similar problems faced by these countries. They are characterized by a fragmented agrarian structure, low average farm size and high employment in agriculture [Gospodarstwa rolne…, 2013].

Results and discussion

Agriculture in Poland is very fragmented: the average farm size in 2014 amounted to less than 11 hectares (but significantly differs in different regions) [www.arimr.gov.pl]. Despite a slight impact on the creation of benefit, this sector involves a large group of employees – about 12% (3.8 million people working in agriculture). Poland is among the countries with a large number of farms: more than 1.5 million according to Eurostat. Nearly 1.3 million farmers receive direct payments [Rolnictwo w 2014; Agricultural census, Eurostat 2010]. Unfavorable structure of agriculture is the result of many factors, including agrarian overpopulation, agricultural reforms (especially the reform of 1944), social conditions, the results of political transformation, as well as the current EU Common Agricultural Policy [Struktura agrarna – Land structure].

As we can see in Figure 1, small farms dominate: half of Polish farms had less than 5 hectares of agricultural land. Only 8% of all farms have more than 20 hectares but they manage almost half of the utilized agricultural area in Poland. Farms with more than 100 hectares covered 22% of agricultural land, but they represent only 1% in the structure of all farms (Figure 1).

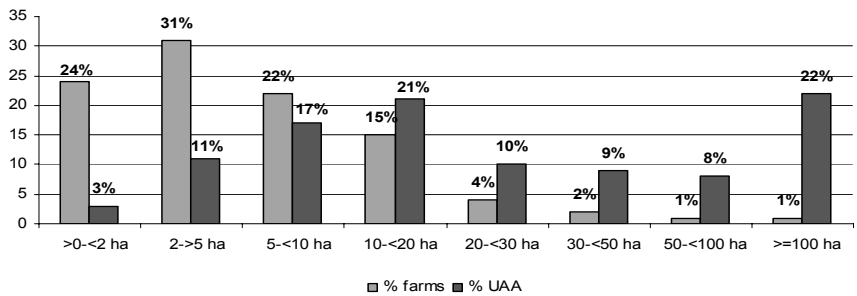


Fig. 1. Distribution of agricultural holdings and UAA in Poland in 2010 (in %)

Source: Agricultural census, Eurostat 2010.

Agriculture is a very important sector in the Romanian economy. It covers more than 3.5 million farms and employs over 28% of the national workforce – taking first position in the EU-27, followed by Poland. Family-run and semi-subsistence farms have a dominant position [Popescu, Condei 2015]. The utilized agricultural area is also very large compared to other countries. a huge decrease can be observed in the number of farms (-14% between 2003 and 2010) but still Romania struggles with a very fragmented agriculture [Agricultural census, Eurostat 2010]. Around 90% of all farms manage no more than 5 hectares, which means that there is a huge fragmentation (Figure 2).

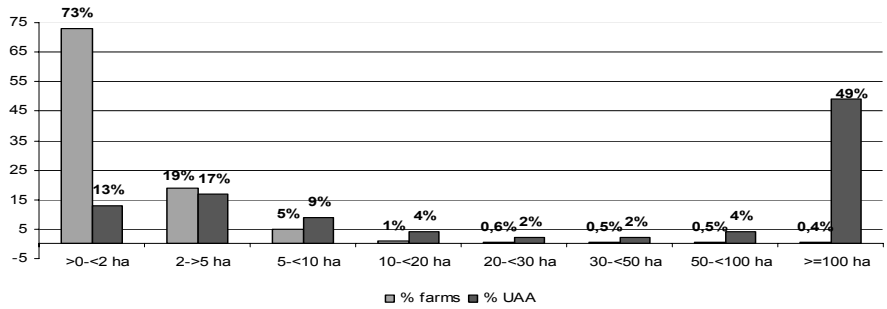


Fig. 2. Distribution of agricultural holdings and UAA in Romania in 2010 (in %)

Source: Agricultural census, Eurostat 2010.

The average farm size in Romania is about 3.7 hectares; farms are fragmented because they consist of many small parcels. The land fragmentation is partially the result of the land restitution from the 1990s. According to Popescu [2009] due to a large fragmentation of agricultural land, there is a need for initiating the processes of land consolidation.

Agriculture in Moldova is also very fragmented. The land reform of 1991 and post-land reform development have resulted in a polarized agricultural structure with an average land individual farm of 2 hectares, typically distributed in 3-4 parcels. Unfavorable structure of agriculture is the result of many factors, including agricultural reforms (especially the reform of 1990-1992), social conditions and the results of political transformation. In many cases, the fragmentation of land parcels has prevented the land market from developing [www.fao.org.nr]. Now the average private farm size in 2014 amounted to less than 4 hectares (but significantly differs in different regions). Farms with large acreage (more than 100 ha) are usually agricultural holdings (companies or cooperatives), and small farms with an area up to 5 hectares are run privately by farmers. Despite a slight impact on the creation of benefit, this sector in Moldova involves a large group of employees – about 361 thousand people work in agriculture [www.statistica.md].

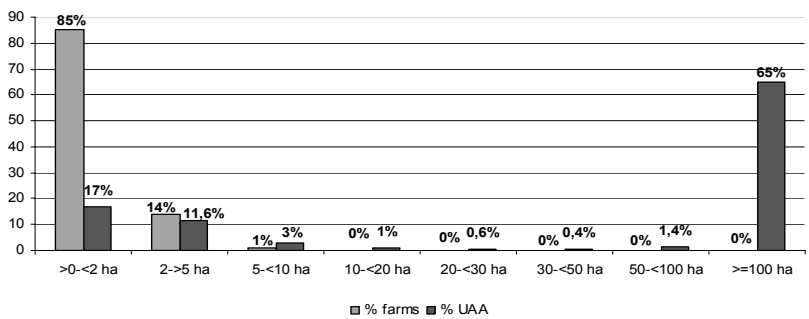


Fig. 3. Distribution of agricultural holdings and UAA in Moldova in 2010 (in %)

Source: Statistical Yearbook of the Republic of Moldova, National Bureau of Statistics 2011.

According to Eurostat, in 2010 there were over 12 million farms in the EU and almost 30% of them were located in Romania [Eurostat 2014]. A significant share in the structure

of EU farms is taken by Polish farms, with a share of 12.3% (Table 1). Currently, Poland has about 715 thousand farms with an area of 5 hectares, in Romania over 3 million. Moldova has almost 400 thousand peasant farms (33% of all farms). The remainder are agricultural cooperatives (232), joint stock companies (161) and limited liability companies (36240) [www.statistica.md]. In the group of Moldova, family (peasant) farms almost all manage an area of 5 hectares or less.

A systematic decrease in the number of farms in the EU can be observed, the same in Poland, Romania and Moldova, with the largest reduction found in farms with the smallest area [Alexandri, Luca 2012; Poczta, Śledzińska Mrówczyńska-Kamińska 2009]. At the same time, the number of larger farms, over 20-30 hectares, is growing. Despite the positive changes, in these countries there is still a very large group of small farms compared to the other European regions [Poczta 2010].

Table 1. Chosen characteristics of agriculture in the EU, Poland, Romania and Moldova

Year	EU 27	Poland	Romania	Moldova
		Number of farms [thousand]		
2003	15021	2172	4484	1125
2005	14482	2476	4256	1113
2007	13700	2390	3931	987
2010	12248	1506	3859	902
Change (2007-2003)	-2773	-665	-625	-223
		Number of farms <5 ha [thousand]		
2003	10959	1440	4205	746
2005	10349	1750	3870	427
2007	9644	1637	3530	229
Change (2007-2003)	-1314	+196	-674	-517
		Number of farms 5-<20 ha [thousand]		
2003	2538	619	256	127
2005	2615	608	355	158
2007	2553	628	370	187
Change (2007-2003)	+15	+9	+113	+60
		Number of farms 20-<50 ha [thousand]		
2003	835	90	9	8
2005	825	96	16	7
2007	804	101	16	6
Change (2007-2003)	-30	+11	+6	-2
		Number of farms <=50 ha [thousand]		
2003	688	17	14	12
2005	691	20	13	9
2007	698	23	14	5
Change (2007-2003)	+9	+5	0	-7
		Farm labour force [%]		
2010	5.7	13.5	28.7	15.8

Source: based on Eurostat 2014, BAEL data of Poland and Statistical Yearbook of the Republic of Moldova.

The share of farms with an area of 5 hectares in the structure of all farms in Poland is 55% and in Romania 92% (Table 1), in Moldova almost 30%. In addition, almost 40% of

farms in Poland and twice as many in Romania allocate half of their agricultural production for family consumption [Agricultural census, Eurostat 2010]. Taking into account the number of farms (private ownership) in Moldova, changes can be seen (Table 1). Over the years, the number of farms is increasing. The effects of consolidation can be seen: the number of larger farms is growing and the number of small farms is reducing. The biggest increase is seen in the group of 5 to 50 hectares. This is the result of systematic enlargement of small farms with the area of 5 hectares. However, still 98% of family farms in Moldova have less than 5 hectares, and these farms work on 42% of total agricultural land [Ignat, Moroz 2013].

The efficiency of agricultural production is largely determined by the spatial nature of the land factor [Podstawka, Ginter 2006]. Efficiency of the productivity factor in agriculture depends primarily on the areas of farms [Ryś-Jurek 2009]. According to Nowak [2011], the structure of agricultural land is the basic criterion for assessing the way in which agricultural land is managed. Farm size is influenced by many factors, including the nature of agricultural production, soil quality, climate, terrain, access to market, land prices, etc. [Majchrzak 2014; Zawadzka, Strzelecka 2012].

Considering the analyzed countries a systematic increase in the average farm size can be observed (Table 2). For the EU, the average farm was almost 15 hectares, in Poland it was 10 hectares. The average size of a farm in Romania is still small and is almost 4 hectares, while in Moldova we can observe an increase from 1 to almost 3 hectares (Table 2).

Table 2. Utilised agricultural area (UAA) and the average farm area in the EU, Poland, Romania and Moldova

Specification	Utilised Agricultural Area, UAA [thousand hectares]	Average area of farm [hectares]				
	2013	2003	2005	2007	2010	2012
EU 27	184202.0	11.8	12.1	12.9	14.4	14.7
Poland	14409.0	6.7	6.0	6.5	9.6	10.4
Romania	13055.0	3.2	3.4	3.6	3.8	4.1
Moldova	378418.8	1.9	2.2	2.5	2.6	2.9

Source: based on the data of Eurostat 2014, ARiMR Poland 2014 and National Bureau of Statistics of the Republic of Moldova 2014.

Fragmentation of land results in increasing costs for transport, it reduces labour productivity and farm income, and limits opportunities of development [Alboiu et al. 2012; Zawadzka, Strzelecka 2012]. Fragmentation of agricultural land can be analyzed using the Lorenz factor and the Gini index. Lorenz coefficient was determined around the farms with an area exceeding 50 hectares. The higher the ratio, the greater the concentration of farms of 50 hectares or more. In Poland and Romania, this figure falls far from the average for the EU 27. For Moldova, this figure also falls far from the EU 27 median (Table 3). In turn, the inequality coefficient of random variable (Gini index) for farms shows strong disparities in the structure of farms and their significant differences (the closer to 1, the greater the inequality).

Based on Gini indexes for each year, small changes can be noticed. According to Majchrzak [2014] we can observe slight concentration processes in Poland, which means creation of larger and medium-sized farms, and elimination of the smallest at the same time. In Romania, however, these processes occur slowly, the visible trend is even further

concentration of agricultural land around the farms of small and very small size. On the other hand, many more farms (holdings) exist in Moldova, with surface area over 50 hectares [www.statistica.md]. There, as in Poland, persists the process of slight deconcentration, creation of larger and medium-sized farms, with a tendency for small size farm cooperation.

Table 3. Lorenz concentration coefficient and the Gini index for agricultural land in the EU, Poland, Romania and Moldova

Specification	Lorenz concentration coefficient around farms up to 50 hectares	Gini index of concentration of agricultural land			
	2007	2003	2005	2007	2010
EU 27	0,78	0,82	0,81	0,81	0,82
Poland	0,63	0,67	0,69	0,67	0,62
Romania	0,59	0,73	0,70	0,70	0,77
Moldova	0,48	0,57	0,65	0,66	0,67

Source: Majchrzak 2014, and authors' calculations based on Statistical Year book of the Republic of Moldova 2014.

Land fragmentation hinders development; it makes achieving competitiveness impossible, and significantly impacts the level of agricultural income. Table 4 shows the changes in land productivity per 1 hectare of UAA in analyzed countries and the EU 27.

Table 4. Changes in land productivity in the EU, Poland, Romania and Moldova in 2000-2008

Specification	Land productivity per 1 hectare of UAA [euro]						
	2000	2003	2004	2005	2006	2007	2008
EU 27	1848.9	1904.0	1897.7	1907.0	1768.2	2084.6	2134.0
Poland	864.6	815.5	874.0	1020.0	1011.0	1288.3	1399.2
Romania	579.1	772.5	955.2	924.2	1017.6	1039.9	1326.2
Moldova	225.2	315.7	435.2	412.0	552.6	509.3	771.5

Source: Eurostat 2014, General Agricultural Census in the Republic of Moldova.

The average land productivity in the EU is not very high, reaches values oscillating around 2 thousands euro per 1 hectare. Land productivity in Poland and Romania is much lower than the average of the EU 27, as well as in Moldova (Table 4). Over the years 2000-2008, a significant increase can be seen in this rate (especially in Romania). According to Eurostat [2014] in almost all countries, the rate of land productivity is increasing year-on-year, with the highest values in the Netherlands, Malta, Cyprus and Belgium. Nowak [2011], on the basis of the analyses, concluded that the highest productivity growth occurred in the new member states (e.g. Romania), which according to the author, is a result of direct payments absorption and other aid programs for farmers.

The farm size versus economic efficiency: the case of Moldova

Below are the results of analysis carried out in the North Moldova districts (Table 5). The study involved the analysis of agricultural land and the value of agricultural production. Next, these data were used to calculate the concentration of the variables.

Table 5. Agricultural characteristics of the North of Moldova districts

Districts	In the period of 2008-2012			
	Utilized agricultural land		The value of agricultural production in the comparable prices [euro]	
	[thousand hectares]	[%]	[thousand]	[%]
Mun. Balti	836	5.0	19.9	1.0
Briceni	1720	10.0	631.3	29.2
Donduşeni	1123	6.8	118.8	5.5
Edineț	190	1.2	27.3	1.2
Făleşti	1322	8.0	147.1	6.8
Floreşti	1002	6.0	107.6	5.2
Ocnița	3998	24	361.2	16.7
Râşcani	444	2.6	52.0	2.4
Sângerei	2520	15.0	367.5	17.0
Soroca	3546	21.4	324.5	15.0
Total	16701	100.0	2157.5	100.0

Source: author calculations based on data specialized form T 6.1. and 9.64 in territorial T., National Bureau of Statistics of the Republic of Moldova 2014.

The research shows that farms in the north of Moldova are very diverse in terms of agricultural land and global production. The Balti farms occupy only 5% by area and less than 1% by volume of production. Briceni, occupying 10% of the surface, has the global production share at 29.2%. Farms in Edinet region occupy 1.2% of all utilized agricultural area, and in the Soroca - 21.4% (Table 5).

Based on the data in Table 5, the territorial concentration coefficient (territorial distribution) was determined using the square root of the sum of squares ratio (n) administrative (territorial) units reflecting the total amount of northern districts by formula Gini C (CG) and the ratio of the concentration Struck (Gs)

$$C_G = \sqrt{\sum g_i^2} \Rightarrow \sqrt{\frac{1}{n}} \le C_G \le 1$$

where:

g_i – the share of agricultural land.

The second concentration ratio is calculated as:

$$C_S = \sqrt{\frac{n\sum g_i^2 - 1}{n-1}} \Rightarrow 0 \le C_s \le 1$$

From calculations, the average of 2004-2006, the following results of the coefficients were obtained and shown in Table 6.

Table 6. Gini index, Struck farmland and overall output (in comparable prices of the 2005) in farms of 50 hectares and more of UAA, in the North of Moldova, average 2008-2012

Indicator	Type of coefficient	
	C ^{G}	C_S
Utilized agricultural land [hectares] *(S)*	0.374	0.209
The value of global production (in comparable prices 2005) thousand *(VPG)*	0.412	0.277

Source: author calculations based on data specialized form T 6.1. and 9.64 in territorial T., National Bureau of Statistics of the Republic of Moldova 2014.

The calculations resulted in low Gini index, which indicated low uniformity of agricultural land distribution in the studied districts, and agricultural production is even lower.

$$C_{G_{(S)}} = \sqrt{g_i^2} = \sqrt{0.14} = 0.374 \qquad C_{G(VPG)} = \sqrt{0.17} = 0.412$$

Struck coefficient confirms this conclusion:

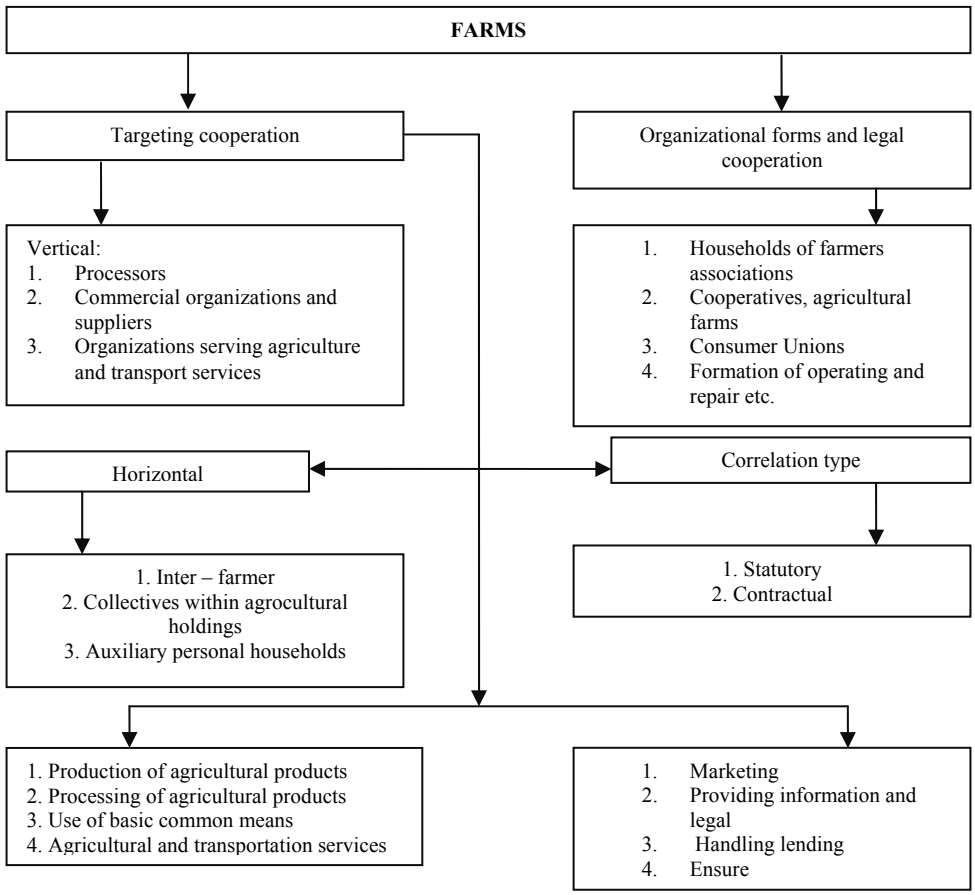
$$C_{S_{(S)}} = \sqrt{\frac{10 \cdot 0.14 - 1}{10 - 1}} = \sqrt{\frac{1.4 - 1}{9}} = \sqrt{\frac{0{,}4}{9}} = \sqrt{0.044} = 0.209$$

$$C_{S(VPG)} = \sqrt{\frac{10 \cdot 0.17 - 1}{10 - 1}} = \sqrt{\frac{1.7 - 1}{9}} = \sqrt{\frac{0.7}{9}} = \sqrt{0.077} = 0.277$$

The study allows concluding that the concentration of agricultural production is very low. The concentration of agricultural production of farms can be achieved by grouping the factors of production (consolidation of farms of the same profile) branches and units of various sizes, growth providing technical agricultural and professional qualification to act positively towards the concentration of production, to increase the weighted branches and crops in regions of fragmented agriculture.

Fragmented agriculture: new model of small farm

According to Dacko and Dacko [2014], area structure reflects the state of a country's agricultural system and can change due to the impact of the components of this system, as well as external factors. Therefore, a system consists of many interacting elements. Despite the obstacles posed by a fragmented system of agriculture, there are many voices supporting small, family-run farms in Europe. Small farms should have a permanent place in European agriculture [Musiał 2010; Zegar 2012]. The argument supporting small farms is primarily the fact that they have a social character, they are very often environmentally friendly, they help to preserve rural landscape, contribute to biodiversity, tradition and culture [Kiełbasa 2015]. The system of agriculture in Europe should be changed, but it cannot be based on the elimination of small, family farms. The need to create a network of processing enterprises in rural areas is the cornerstone of sustainable development of the rural areas. The new form of small farm management should include for example cooperation between producers and processors of raw materials (Scheme 1).



Scheme 1. The forms of farms cooperation

Source: prepared by the authors based on their scientific research.

According to Scheme 1, we can observe two directions of farm cooperation: vertical and horizontal. Vertical cooperation includes processing, supplies and transport of agricultural production; while horizontal cooperation involves interrelationships from farming – this means sharing and applying marketing activity, providing information, with service credit, insurance and other levers of economic mechanism.

The land consolidation process is a very long operation. In Western European countries, it lasts for hundreds of years. This process gained momentum in EU countries in the early 1950s and still continues today. Strengthening small and medium-sized farms provides a real opportunity to: increase the effectiveness of using agricultural land on the principles of regional and erosion control; organize and implement complex necessary measures to protect the soil - the main natural wealth of a country; implement actual performance of agriculture; and the create sustainable development [Popescu 2009]. Achieving this goal will be possible by land consolidation and owner cooperation in producing good quality and competitive products [Popa, Timofti 2009].

Table 7.

Holdings and utilised agricultural area in the EU Member States, 2013

	Number of holdings			Utilised agricultural area			Average area per holding, hectares	
	in thousands	Share of EU total	Change 2013/2003	In 1000 hectares	Share of EU total	Change 2013/2003	2003	2013
EU*	**10 841.0**	**100.0%**	**-27.5%**	**174 606.6**	**100.0%**	**0.1%**	**11.7**	**16.1**
Belgium	37.8	0.3%	-31.3%	1 307.9	0.8%	-6.2%	25.4	34.6
Bulgaria	254.4	2.3%	-61.8%	4 650.9	2.7%	60.1%**	4.4	18.3
Czech Republic	26.3	0.2%	-42.6%	3 491.5	2.0%	-3.9%	79.3	133.0
Denmark	38.8	0.4%	-20.1%	2 619.3	1.5%	-1.5%	54.7	67.5
Germany	285.0	2.6%	-30.9%	16 699.6	9.6%	-1.7%	41.2	58.6
Estonia	19.2	0.2%	-47.9%	957.5	0.5%	20.3%	21.6	49.9
Ireland	139.6	1.3%	2.9%	4 959.4	2.8%	15.4%	31.7	35.5
Greece	709.5	6.5%	-13.9%	4 856.8	2.8%	22.4%	4.8	6.8
Spain	965.0	8.9%	-15.4%	23 300.2	13.4%	-7.4%	22.1	24.1
France	472.2	4.4%	-23.1%	27 739.4	15.9%	-0.2%	45.3	58.7
Croatia	157.4	1.5%	:	1 571.2	0.9%	:	:	10.0
Italy	1 010.3	9.3%	-48.6%	12 098.9	6.9%	-7.8%	6.7	12.0
Cyprus	35.4	0.3%	-21.7%	109.3	0.1%	-30.1%	3.5	3.1
Latvia	81.8	0.8%	-35.4%	1 877.7	1.1%	26.1%	11.8	23.0
Lithuania	171.8	1.6%	-36.9%	2 861.3	1.6%	14.9%	9.2	16.7
Luxembourg	2.1	0.0%	-15.1%	131.0	0.1%	2.2%	52.3	63.0
Hungary	491.3	4.5%	-36.5%	4 656.5	2.7%	7.0%	5.6	9.5
Malta	9.4	0.1%	-14.8%	10.9	0.0%	0.8%	1.0	1.2
Netherlands	67.5	0.6%	-21.1%	1 847.6	1.1%	-8.0%	23.5	27.4
Austria	140.4	1.3%	-19.2%	2 726.9	1.6%	-16.3%	18.7	19.4
Poland	1 429.0	13.2%	-34.2%	14 409.9	8.3%	-0.1%	6.6	10.1
Portugal	264.4	2.4%	-26.4%	3 641.6	2.1%	-2.2%	10.4	13.8
Romania	3 629.7	33.5%	-19.1%	13 055.9	7.5%	-6.3%	3.1	3.6
Slovenia	72.4	0.7%	-6.2%	485.8	0.3%	-0.1%	6.3	6.7
Slovakia	23.6	0.2%	-67.1%	1 901.6	1.1%	-11.0%	29.8	80.7
Finland	54.4	0.5%	-27.4%	2 284.4	1.3%	1.7%	29.9	42.0
Sweden	67.1	0.6%	-1.1%	3 028.6	1.7%	-3.1%	46.1	45.1
United Kingdom	185.2	1.7%	-34.0%	17 327.0	9.9%	7.6%**	57.4	93.6
Norway	43.7	-	-24.9%	987.1	-	-5.1%	17.9	22.6

* At EU level, the changes 2013/2003 have been calculated excluding Croatia for which data are not available for 2003.
** See country note.
Shares might not add up to 100% due to rounding.

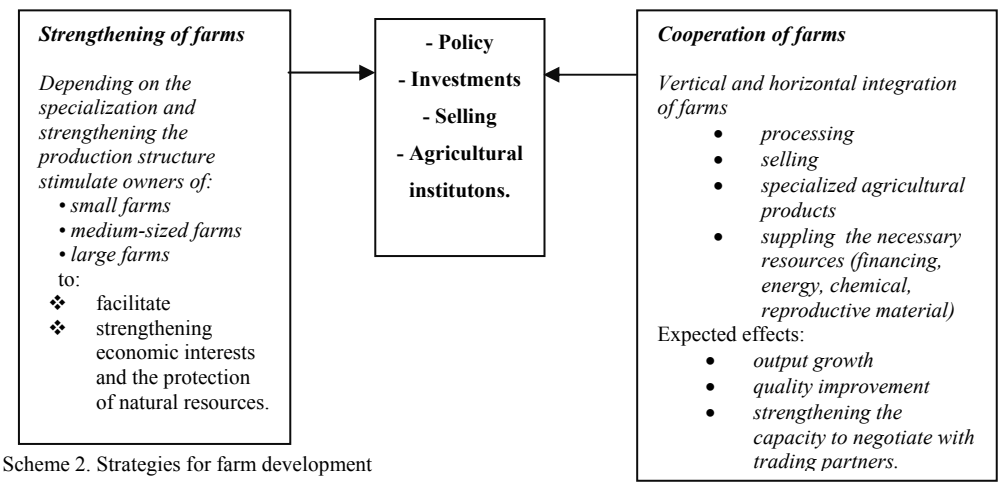
Source: Eurostat 2014.

To address the situation in agriculture a complex set of economic, legal and organizational structures must be developed. This strategy envisages sustainable development of agriculture by implementing advanced technologies of cultivation, processing, packaging and marketing, etc., which ensure the country`s food security and increase farmers income [Strategies of development of the agro food sector in Moldova in the period 2006-2015]. Therefore, the fundamental subject of farm development should contribute to economic efficiency and consolidation (Scheme 2). Achieving these basic policies would serve a solid foundation for the development of private initiative, a favourable environment for the activity of all categories of farmers to resist competition. At the same time it would promote the development of rural areas as the natural, social and cultural regeneration of the economy will help rural communities in which they operate. The process of consolidation is inevitable - not only purchase and sale, but in exchanging or leasing term, as well as by associations or union landowners. It means building the future

shape of a more rational and efficient use of land. A good example is the government programme of land consolidation in Moldova. The Moldovan Ministry of Agriculture and Food Industry proposed to create the so-called "consolidation centers" [Land Consolidation Program, Moldova].

Eurostat Analysis shows developments on them for 10 years (between 2003 and 2013) and demonstrates that Romania did not produce too high a concentration of holdings: if in 2013 the average area was only 3.1 ha, in a decade it rose only 0.5 ha.

The largest farms are in the Czech Republic - where the average area of a farm is over 133 hectares (it almost doubled in 10 years), and the UK - where the average area increased from 57 ha in 2003 to 93, 6 ha in 2013.



Scheme 2. Strategies for farm development

Source: developed and shaped by authors on the basis of "Strategy of development of the agrifood sector in Moldova in the period 2006-2015".

The Czech Republic has the average area of holdings because they occurred as a property concession. Most received shares from former agricultural cooperatives. Although the country has broken into agriculture in Europe, the number of properties decreased in 10 years to only 19.1%.

Conclusions

The problem of fragmented agriculture has concerned Europe for many years, especially in its Eastern parts. The three European countries that were analyzed – Poland, Moldova and Romania – struggle with similar problems in development of their agriculture and competitiveness. When it comes to small family farms, it can be noted that in these countries they are very fragmented and achieve poor economic results. The following conclusions were indicated on the basis of the analysis and discussion:

1. In these countries enlargement processes can be seen. The number of small farms is reducing, and larger farms are increasing. There is also an increase in the average size of a farm (in Poland currently it is 10 ha, in Romania 4 ha and in Moldova 3 ha).

However, these processes are slow and face a number of barriers (natural conditions, traditional model of farm management, the lack of funds for investments, etc.).

2. Large fragmentation of the agrarian structure adversely affects economic results and land productivity. Fragmentation contributes to a significant reduction in small farm competitiveness.
3. Indexes of land concentration indicate processes of deconcentration of small farms and creation of a greater number of larger farms in Poland. In Romania, these processes occur slowly due to the large number of very small family farms. Slightly better are indicators for Moldova, because this country has a large number of agricultural companies, but the problem of small farms still exists.
4. The case of the north of Moldova shows a large distribution of indicators within one country. The authors indicate the possibility of farm consolidation of the same profile in certain regions, which goal would be the improvement of small farm competitiveness and providing a source of income.
5. The structure of farms and land structure points to a system of agriculture in Europe. This system consists of many different elements, mutually dependent and influencing each other. Increasing small farm effectiveness requires the cooperation of small holders, for example through cooperation between producers and processors of raw materials.
6. To improve the competitiveness of small farms the processes of land consolidation are essential. However, is should be remembered that these are long-term processes, so the effects can be seen after several years.
7. The role of small farms should be emphasized, especially for environmental protection and sustainable development. Their social role is also very important: they manage small plots, which, to some extent, provide food for farm families. Usually products are not sold on the market, and most are consumed on the farm (semi-subsistence farming). Therefore, the European model of agriculture should not exclude small family farms.

References

Agricultural census, Eurostat 2010, http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census (access 20.11.2015)

Alboiu C., Alexandri C., Grodea M., Ionel I., Toderiou F., Moldovan M., Luca L. [2012]: The main direction of the Romanian agricultural sector evolution following the UE integration: European Union Food Sector after last enlargements – conclusions for the future CAP, IERiGŻ-PIB, Warszawa: 30-62.

Alexandri C., Luca L. [2012]: The role of small farms in Romania and their future in the face of challenges of the CAP post 2013, Problemy Drobnych Gospodarstw Rolnych: Problems of Small Agricultural Holding, no. 1/2013:

Dacko M., Dacko A. [2014]: Poprawa struktury obszarowej polskiego rolnictwa – podejście systemowe, Problemy Drobnych Gospodarstw Rolnych: Problems of Small Agricultural Holding, no. 2/2014: 23-37.

EU Agricultural Economic Briefs: What is a small farm? Brief no 2, July 2011, European Commission, Agriculture and Rural Development. [Available at:] http://ec.europa.eu/agriculture/rural-area-economics/briefs/pdf/02_en.pdf [Access: November 2015].

Gospodarstwa rolne w Polsce na tle gospodarstw Unii Europejskiej – wpływ WPR, Red. W. Poczt, Powszechny Spis Rolny 2010, GUS Warszawa 2013.

Ignat A., Moroz V. [2013]: Agricultural land-use changes and rural transformation in the Republic of Moldova. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, vol. 13, issue 1: 181-186.

Kiełbasa B. [2015]: Selected aspects of the young farmers management in the light of the fragmented agriculture in Poland. Journal of Agribusiness and Rural Development, Poznań.

Kowalczyk, S., Sobiecki, R. [2011]: Europejski model rolnictwa – uwarunkowania ewolucji, Roczniki Nauk Rolniczych, seria G, t. 98, z. 3: 9-20.
Majchrzak A. [2014]: Ewolucja Wspólnej Polityki Rolnej a zmiany zasobów i struktury ziemi rolniczej w państwach Unii Europejskiej: rozprawa doktorska, Uniwersytet Ekonomiczny w Poznaniu: 97-110.
MEGA Moldova Economic Growth Moldova Analysis: Analysis of Economic Growth in Moldova / aut. Ana Popa (eds.), Valeriu Prohnițchi Alex Oprunenco [et al.] Independent Analytical Center "Expert Group". - Ch. "Offices bones" SRL, 2011. - ISBN 978-9975-80-302-1.
Musiał W. [2010]: Wyzwania wobec gospodarstw drobnotowarowych w Polsce – przyczynek do rozważań, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu no 150: 385-398.
Musiał W., Drygas M. [2013]: Dylematy procesu delimitacji drobnych gospodarstw rolnych, Wieś i Rolnictwo no 2(159): 55-74.
Nowak A. [2011]: Zmiany wydajności rolnictwa Polski i innych krajów Unii Europejskiej. Zeszyty Naukowe SGGW Problemy Rolnictwa Światowego, z. 1, t. 11(26): 130-139.
Poczta W., Śledzińska J., Mrówczyńska-Kamińska A. [2009]: Determinanty dochodów gospodarstw rolnych Unii Europejskiej według typów rolniczych. Zeszyty Naukowe SGGW, Ekonomika i Organizacja Gospodarki Żywnościowej, no 76: 17-30.
Poczta W. [2010]: Gospodarstwa osób prawnych w rolnictwie Unii Europejskiej w świetle realizacji idei rozwoju rolnictwa zrównoważonego i Europejskiego Modelu Rolnictwa, Zeszyty Naukowe Uniwersytetu Ekonomicznego w Poznaniu no 150: 363-385.
Podstawka M., Ginter A. [2006]: Sytuacja dochodowa gospodarstw rolniczych w warunkach różnego poziomu rozwoju rolnictwa, Roczniki Naukowe SERiA, t. VIII, z. 1: 145-149.
Popa D., Timofti E. [2009]: The efficiency of the economic mechanism in agriculture. Monograph. Chisinau Complex IEFS Publishing, ISBN 978-9975-9823-3-7: 128-130.
Popescu A., Condei R. [2015]: Research on Romania's employment in agriculture and its position in the European Union. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, vol. 15, issue 2: 281-290.
Popescu G. [2009]: Wiejskie gospodarstwa domowe na drodze od przeżycia do kapitalizmu: Przemiany strukturalne wsi i rolnictwa w wybranych krajach europejskich, nr 128, IERiGŻ PIB, Warszawa: 162-173.
Rolnictwo w 2014, Departament Rolnictwa GUS 2015.
Ryś-Jurek R. [2009]: The output, incomes and assets-capital relations in the individual farms. Journal of Agribusiness and Rural Development, no 1(11): 177-188.
Strategy of development of the agrifood sector in the period 2006-2015.
Statystyczne studium struktury agrarnej w Polsce, Red. K. Kukuła, 2010, Wydawnictwo Naukowe PWN, Warszawa: 79-90.
Struktura agrarna – Land structure. Institute of Geography and Spatial Organization Polish Academy of Sciences. [Available at:] https://www.igipz.pan.pl/tl_files/igipz/.../06.Struktura%20agrarna.pdf [Access: November 2015).
Statistical Yearbook of the Republic of Moldova. Ch.: Statistics 2013, 2014 (I.SFE-P. "Central Painting"). ISBN978-9975-4068-4-0
Światły P., Turnau J., Majchrzak A. [2011]: Gospodarowanie gruntami rolnymi w wybranych krajach UE; wnioski dla Polskim: Rozwój rolnictwa i obszarów wiejskich w warunkach ewolucji WPR: wybrane problemy, Kujawsko Pomorska Szkoła Wyższa w Bydgoszczy, Bydgoszcz: 147-166.
The European Model of Agriculture – Challenges Ahead, 2006, A Background Paper for the Meeting of Ministers of Agriculture, 26.9.2006, Oulu, http://www. agriregionieuropa.univpm.it/materiale/background_paper.pdf (acess: 10.10.2015).
Tóth O. [2014]: Farm Structure and Competitiveness in Agriculture. [Available at:] http://ageconsearch.umn.edu/bitstream/139504/2/Toth.pdf [access: November 2015].
Zawadzka D., Strzelecka A. [2012]: Analiza dochodów gospodarstw rolnych w Unii Europejskiej, Zeszyty Naukowe Uniwersytetu Szczecińskiego – Finanse, Rynki Ubezpieczeniowe, Ubezpieczenia no 690(51): 413-422.
Zegar J.S. [2012]: Rola drobnych gospodarstw rolnych w procesie społecznie zrównoważonego rozwoju obszarów wiejskich, Problemy Drobnych Gospodarstw Rolnych nr 1: 269-278.
Zegar J. [2008]: Dochody w rolnictwie w okresie transformacji i integracji europejskiej IERiŻ-PIB, Warszawa.
www.arimr.gov.pl [Access: November 2015).
www.statistica.md [Access: November 2015).
www.fao.org.nr [Access: November 2015).
www.eurogeographics.org/country/moldova [Access: November 2015).

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 180–193

Wojciech Sroka[1]
Institute of Economic and Social Sciences, University of Agriculture in Krakow
Bernd Pölling[2]
Department of Agriculture, South Westphalia University of Applied Sciences

The Potential and Significance of Urban Agriculture on the Basis of the Ruhr Metropolis and the Upper Silesian Metropolis[3]

Abstract. The paper attempts to evaluate the potential and importance of agriculture in the two largest (post)industrial metropolitan areas of Europe. It has been demonstrated that urban agriculture constitutes an important spatial component of studied urban organisms, as almost 40% of these consist of agricultural land. Analysis of chosen characteristics of agriculture in the researched metropolitan areas explicitly shows that their agricultural potential is comparable to the overall regions where they are located. This mainly concerns the average size of farms, the employment ratio and the intensity of both animal and plant production. The studies also led to the conclusion that, in spite of very similar natural environments, agriculture in the Ruhr Metropolis is characterized by significantly higher production potential than agriculture in the Upper Silesian Metropolis.

Key words: urban agriculture, production potential, Ruhr Metropolis, Upper Silesian Metropolis

Introduction

Agricultural activities on land located within the administrative limits of towns or cities tend to be perceived as an obsolete form of economic activity, occurring in very strong regression [Krzyk et al. 2013]. Agricultural land in towns is also of marginal importance in spatial planning, while urban land, which is in shortage, is frequently treated as a reserve for other, more profitable activities [Petts 2001, Jiang et al. Giecewicz 2005]. This arises from the effect of (urban) land rent, a mechanism which was presented by von Thünen and then modified by Alonso and referenced to urban agglomerations [von Thünen 1826, Alonso 1964]. Both authors have proven that activities yielding higher economic rent push other economic activities away from cities. Although regression of agriculture and farm land is a natural process occurring in city centers or in highly urbanized areas, very large unoccupied areas in the outskirts of towns could or even should remain in agricultural usage. City land used for agricultural activities, apart from its production functions, has a number of additional functions which are extremely important, yet difficult to measure (in terms of economy), including recreational and health functions, or ecological functions [Wagner 2005].

Today, many researchers claim that the concept of “urban agriculture" can no longer be treated as an oxymoron [Mougeot 2010, Lohrberg and Timpe 2011, Tjeerd et al. 2001, Zasada 2011]. In many cities in Europe and worldwide, the proportion of agricultural land

[1] PhD, e-mail: w.sroka@ur.krakow.pl
[2] Diplom-Geograph, e-mail: poelling.bernd@fh-swf.de
[3] Analysis realized within a designated subsidy No. 4170 for a scientific research or a developmental study, aimed at the advancement of young researchers and members of doctoral studies, implemented following a competitive procedure on Institute of Economic and Social Sciences, University of Agriculture in Kraków and COST-Action TD 1106: Urban Agriculture Europe (UAE)

within cities, towns and metropolitan areas is higher than the share of areas occupied by such functions as housing, or transport infrastructure. This applies to Polish cities (Warsaw – 29.2% of agricultural land, Krakow - 47% of agricultural land) as well as to German cities (Hamburg 25% of agricultural land, Ruhr Metropolis 39% of agricultural land) and those in Canada (Vancouver - 14%) [Born and Pölling 2014, Sroka 2014]. Such a spatial relevance of agriculture derives from intensive urban expansion processes which began in highly developed countries in the second half of the 20th century and continue to the present day [Szymańska 2007, Bański 2008]. According to FAO [2007], in 1996 there were already as many as 800 million people worldwide who were engaged in various forms of urban agriculture (including allotment gardens).

Subject-matter literature states that in highly developed countries, (post)industrial cities should be recognized as a special case on the map of urban agriculture [Viljoen, Howe 2012, Colasanti et al. 2012, Kost 2015, Goldstein et al. 2011]. This is due to several factors: firstly, these cities expanded strongly in their best times and at the moment, they have relatively large areas of land that can be used for agricultural operations. Secondly, (post)industrial issues on the job market would often force the local inhabitants to seek alternative sources of income. In the United States, urban agriculture and urban allotment gardens began to grow rapidly in such cities as, for example, the (post)industrial crisis-ridden Cleveland, Detroit, or Philadelphia [Goldstein et al. 2011], while in Europe, this phenomenon mainly concerns the Ruhr Metropolis and the Upper Silesian Metropolis [Landwirtschaftskammer NRW, 2013, Sroka 2015].

Even though the issue of urban agriculture in Europe is flourishing, it is still barely recognized. In many countries, including Poland, it is widely, yet erroneously acclaimed that agriculture in highly industrialized areas is less important. This paper touches upon the hypothesis that the potential of agriculture in the Ruhr Metropolis and the Upper Silesian Metropolis is similar to the potential of regions where these two metropolitan areas are located.

Research goals and methodology

The main aim of this paper is to assess the potential and significance of urban agriculture on the basis of two (post)industrial European metropolitan areas - the Ruhr Metropolis and the Upper Silesian Metropolis. This analysis touches mainly upon the comparison method. Characteristics of agriculture in the Ruhr Metropolis and the Upper Silesian Metropolis, which described their potential, were correlated not only with each other, but also with the pattern of agriculture in regions where the Ruhr Metropolis and the Upper Silesian Metropolis (North-Rhine Westphalia and Silesian Voivodeship respectively) are located. Apart from the comparison method, descriptive as well as quantitative methods, including analysis of dynamics and structure, were incorporated. Hence, the test procedure covered such stages as:

- definition of the research problem (aim of the research),
- selection of research subjects (explanation included),
- selection of features describing potential and significance of agriculture,
- indication of disparities not only in the potential of agriculture in the researched metropolitan areas and regions where they are located, but also in agriculture in the Ruhr Metropolis and the Upper Silesian Metropolis,

- evaluation of the results obtained from descriptive research.

The first stage of that research encompassed denotation of the spatial scope of research. It was established that the significance and potential of urban agriculture would be presented on the basis of the two biggest (post)industrial European metropolitan areas - the Ruhr Metropolis and the Upper Silesian Metropolis. These two regions constitute polycentric agglomerations and demonstrate quite a similar course of the processes of economic development [Mikołajec 2013]. Moreover, the structure of land usage, including 40% share of agricultural land, is comparable as well. It makes agriculture one of the most important elements in the urban area. Apart from the evident similarities between the Ruhr Metropolis and the Upper Silesian Metropolis it should also be pinpointed that agriculture in these regions, analogous to agriculture in Germany and Poland, over a span of several years developed under completely diverse political and industrial conditions. Delay in the restructuring process of the economy (including agriculture) in Upper Silesia is estimated at about 20-30 years [Mikołajec 2013]. Hence, this analysis is based foremost on a comparison of the potential of agriculture in the researched metropolitan areas and the regions where they are located. Correlation between Poland and Germany is aimed at demonstrating that agriculture in the Upper Silesian Metropolis is less developed than that in the Ruhr Metropolis.

According to source literature, urban agriculture includes the agricultural production which is used in cities and their functional areas [Mougeot, 2010, Lohrberg and Timpe 2011, 2010, Sroka 2014]. Thus, it is established in this analysis that the scope of research encompasses districts that form particular metropolitan areas. Apart from analyses of the whole area of both the Ruhr Metropolis and the Upper Silesian Metropolis, city counties (within those metropolitan areas) are distinctively analyzed. These cities are among the biggest and are characterized by high population density and by some of the highest pressures of the non-agricultural sector on agricultural production. The general description and explanation of the researched metropolitan areas is depicted in the following section.

The Ruhr Metropolis (German: Regionalverband Ruhr) is the biggest polycentric agglomeration in Germany. The origins of the Ruhr Metropolis, seen as a formalized union of districts, go back to 1920. Today, this Metropolis is comprised of 11 city counties (German: kreisfreie Stadt) and 4 rural counties (53 rural and urban communes altogether[4]). Together, they build a polycentric metropolitan area with more than five million inhabitants.

Contrary to its German counterpart, the Upper Silesian Metropolis tends to be delimited in various ways[5]. The *Metropolitan Association of Upper Silesia* was established in Upper Silesia in 2005, comprising 14 city counties that in fact constitute a single city organism, yet this area is not comparable to the Ruhr Metropolis. For the purposes of this paper, the delimitation defined by the Marshal's Office of the Silesian Voivodeship [UWMŚ 2012] was implemented, and the Upper Silesian Metropolis was considered to

[4] A detailed list of municipalities can be found in [Landwirtschaftskammer NRW 2013].

[5] Many attempts can be found in subject-matter literature at delimiting the Upper Silesian Metropolis properly. The most important of these include: [Runge, Krzysztofik 2011]; [Parysek 2008]; [UMWŚ 2012]. In addition, many problems are referenced in literature regarding the nomenclature of the area under consideration, which tends to be described as the Upper Silesian Conurbation, the Silesian Conurbation, the Upper Silesian Metropolitan Area, etc. In this paper, both the delimitation and the nomenclature of the metropolitan area was adopted as originally stated by the Marshal's Office of the Silesian Voivodeship.

comprise 23 core municipalities (of which 14 are city counties), as well as 29 communes within the functional area[6].

The primary data source comprises the results of the agricultural censuses conducted in 2010, information available from the Polish Central Statistical Office (GUS) and the Statistical Authority of the German federal state of North Rhine-Westfalia (IT.NRW), data published by the German Agricultural Chamber seated in Münster/Bonn (Landwirtschaftskammer NRW 2012), and subject-matter literature.

General characteristics of the compared regions

Ruhr Metropolis is located at the Northwest of Germany in the federal state of North Rhine-Westphalia and is among the largest metropolitan areas in Europe in terms of population size (Table 1). The region is characterized by a very convenient geographic location, and well-developed infrastructure of both roads and waterways. The region occupies in total of nearly 4,500 km^2 [Wuppertal Institut für Klima, Umwelt, Energie 2013]. The Upper Silesian Metropolis is located in the south of Poland, in the central part of the Silesian Voivodeship. The total area, including the functional surrounding municipalities, is approximately 3,500 km^2, which is approx. 20% smaller than its German counterpart. Like Ruhr Metropolis, it has very well developed road infrastructure (A-4 and A-1 motorways cross the center of the metropolitan area) and is the largest cluster of population and heavy industry in Poland [Runge, Krzysztofik 2013]. Both metropolitan areas are characterized by very high population density and are primarily formed by municipalities with a town status (a city county). City counties also have a very significant share in the overall area. Across the Ruhr Metropolis, these occupy as much as 37.9% of the total area, compared to 34.7% for the Upper Silesian Metropolis.

Table 1. Characteristics of the Metropolitan Areas under comparison (2013)

Specification	No. of municipalities	Area (km^2)	Population (thousand)	Population density (person per km^2)
Ruhr Metropolis	53	4 435.3	5 150.1	1 161
City counties in the Ruhr Metropolis	11	1 681.4	3 309.2	1 968
North-Rhine Westphalia	396	34 110.4	17 553.0	515
Upper Silesian Metropolis	52	3 508.2	2 513.7	716
City counties in the Upper Silesian Metropolis	14	1 216.2	1 917.5	1 576
Silesian Voivodeship	169	12 333.0	4 599.4	373

Source: authors' research, based on data from: BDL GUS and IT.NRW

Both the Ruhr Metropolis and the Upper Silesian Metropolis are located within densely populated regions. The current structure and growth potential of both the metropolitan areas and the regions as a whole (the North-Rhine Westphalia and the Silesian

[6] A detailed list of municipalities included in the Upper Silesian Metropolitan Area and its functional areas can be found in: [UMWŚ 2012].

Voivodeship) under comparison are largely dependent on (partially shared) historical background.

The Ruhr Metropolis and most of the Upper Silesian Metropolis were established and continued to develop during a certain time within a single State organism, i.e. in Prussia, and in Germany as of 1871 [Mikołajec 2013]. Both conurbations flourished mainly through exploration of hard coal (as well as silver, zinc ores in Upper Silesia), followed by growth of heavy industry afterwards. Coal mining in the Ruhr Metropolis began as early as the Middle Ages, and significantly later in the Upper Silesia – only in the 18th century [Pudlik, Garus 2009]. During the following years, the metropolitan areas were developing according to a similar model, with Upper Silesia's economic backwardness continuing throughout that time. Its peripheral location, compared to the core of European growth (England, Germany), as well as various other turbulences (divisions of Silesia, polls, change of the political system of the State), led to the studied conurbations following their consecutive phases of emergence, flourishing and restructuring at different times. Subject-matter literature even mentions the existence of an absolute law of delayed development and decline of mining districts, which is the more prevalent the further to the east the district is located [Mikołajec 2013]. The period of greatest flourish of the industry (and mining) for the Ruhr Metropolis was the 1950s, while the processes of restructuring the economy commenced in the 1970s and continue till the present day [Lageman et al. 2005, Heinze 2013]. The prosperity period for Upper Silesia ended in the late 1970s, and the first attempts at restructuring the mining industry were made during 1998-2001 [Walewski 1999, Pudlik, Garus 2009]. These undertakings have not yielded the desired effects, while the financial and materials crisis still aggravates the issues of Upper Silesian mining and at the same time the entire economy of the region. The proposed objectives of the EU energy policy suggest that the presented "delay theory" will continue to measure up, and in 20-30 years the Upper Silesian economy will, like in the Ruhr Metropolis, cease to be based on coal mining.

The example of Ruhr Metropolis shows that land development and creation of a sustainable urban landscape are among the key tasks faced by (post)industrial metropolitan areas, including the Upper Silesian Metropolis. In the Ruhr, attention was drawn to the fact that the region grew and developed on the basis of hard coal exploitation, yet agriculture used to prevail in the region by the 18th century. Development and support of urban agriculture is currently perceived as one of the major landscape revitalization directions, including development of (post)industrial land and building an image of a green city, friendly to its inhabitants. Hence, it should be unambiguously depicted that there are reasons to carry out comparative studies and the Ruhr Metropolis may be seen as an example for agriculture development in the Upper Silesian Metropolis.

The potential and significance of agriculture in the (post)industrial Ruhr Metropolis and the Upper Silesian Metropolis

In subject-matter literature, there are only few comparative studies concerning urban agriculture in countries with developed economies. According to Danso et al. [2003], few research projects are based mainly on case studies and they are often focused on developing countries where the growth potential of agriculture is compared primarily to the ability to satisfy the nutritional needs of the urban poor. There are also relatively frequent studies on

microeconomic level (case studies), analyzing such factors as profitability, competitiveness, productivity, etc. [Nugent 2001]

In economic studies, growth potential of agriculture can be interpreted and defined in different ways [Pawlak, Poczta 2010]. The word 'potential', derived from Latin *potentia,* means strength, power, but also productive capacity inherent in something or somebody. This is a certain state, which can be judged and evaluated. In cities, agricultural growth potential is determined by such factors as, inter alia, natural conditions, availability of the land element, economic conditions (production size, size of farms, relationship to the market, etc.), socio-cultural conditions (qualities of farm managers and users, their education, motives for working in agriculture, etc.) [Indraprahasta 2013, Abdalla 2012, Van Veenhuizen and Danso 2007, Egyir, Beinpuo 2009]. Furthermore, one of the most essential variables determining the potential and ways of agricultural development are both the condition and the structure of economy, including the unemployment rate, the number and structure of enterprises, demographical or legal conditions (e.g., concerning land management, plans of spatial planning, etc.). Hence, this analysis touches only upon the comparison of chosen indexes concerning the condition of agriculture.

Natural environment should be considered primary for determining the production potential of agriculture. For the regions under comparison, both the climate conditions and soil conditions are quite similar. Since the climate in the Ruhr Metropolis and the North-Rhine Westphalia is more favourable than the climate in the Upper Silesian Metropolis and the Silesian Voivodeship, the vegetation period is prolonged [Witek, Górski 1977].

In the case of soil quality and fitness for agricultural production, there are very significant differences between the soils of the two studied conurbations, but their structure in terms of quality is similar. The best soils in the Ruhr Metropolis are located in the central part of the region, along the east-west axis. Good quality sandy loessial soils stretch from the southern part of the town of Hamm, through the district of Unna, the towns of Dortmund, Bochum, Essen and Mülheim. The soils in that region are characterized by good hydration and high availability of nutrients [Landwirtschaftskammer 2012]. There is also a stretch of good soil in the Upper Silesian Metropolis, located in the central part of the region, from the south-west (Knurów) towards the north-east (to Piekary Śląskie). Of all the largest cities of Upper Silesia, very good soils can be observed in such towns as: Gliwice, Chorzów, Zabrze, Bytom, Świętochłowice, and Piekary Śląskie [Witek 1981]. Despite the local fragments of good soils, the prevailing proportion of soils, both in the Upper Silesian Metropolis and Ruhr Metropolis covers relatively low quality spodic soils and podzols. In the Ruhr, these are located mainly in the northern part, while in the Upper Silesian Metropolis - in the north and south [Landwirtschaftskammer 2012, Witek 1981]. Summing up, it should be concluded that the natural conditions for development of agriculture are similar in both conurbations and they exhibit average natural potential.

When comparing the quality of soils in the Ruhr Metropolis with the regional conditions it should be noted that there are slightly better soils in the North-Rhine Westphalia. While fertile brown earth predominate in these regions, in the northern part poor podzols can be found [Geologischer Diesnst NRW 2011]. The opposite situation is found in the Upper Silesian Metropolis where the soils are better than on average in the Silesian Voivodeship. The Silesian Voivodeship is diverse in terms of environmental conditions of agricultural production because the southern part is largely mountainous with poor podzols while the northern part is dominated mainly by sandy soils. It should be

highlighted that quite good soil conditions are visible foremost in the central part of this Voivodeship [Witek 1981].

In urban conditions, availability of land is one of the most important variables, determining the actual growth potential of agriculture. Very high competition for land means that agriculture is pushed away from towns and land is taken over for different types of activities. However, research shows that within the studied metropolitan areas, agricultural land occupies relatively large portions. As much as 39.2% of the total area of the Ruhr Metropolis is occupied by agricultural land (Table 2). In the Upper Silesian Metropolis, this proportion is even higher - it amounts to 42.7%. It is worth mentioning that in both conurbations, even in city counties, over one quarter of the land is dedicated as agricultural land[7]. The share of agricultural land in the total surface of the Silesian Voivodeship is 49.6% while in the North-Rhine Westphalia it amounts to ca. 48.5%.

Table 2. Selected characteristics of agriculture in the Upper Silesian Metropolis Area and Ruhr Metropolis (2010)

Specification	Share of agricultural land in total area* (%)	Share of agricultural lands managed by farms in total area (%)	Average agricultural land area of farms over 1 ha**(ha)	Labour resources AWU[8]/ 100 ha of agricultural land	Percentage of farms earning more than 50% of their incomes from agricultural activities (%)
Ruhr Metropolis	39.2	32.7	40.0	4.6	55.4
City counties in the Ruhr Metropolis	24.7	19.2	39.6	5.2	53.0
North-Rhine Westphalia	48.5	42.9	40.9	4.3	53.7
Upper Silesian Metropolis	42.7	29.6	10.1	11.5	11.0
City counties in the Upper Silesian Metropolis	33.3	12.3	6.6	16.3	8.6
Silesian Voivodeship	49.6	35.3	7.1	13.8	10.7

*The data concerns area measured for geodesic purposes

**In Germany, an entity will be considered a farm if its size exceeds 5 hectares, or if it holds an appropriate quantity of livestock (e.g. 10 cattle). In Poland, agricultural farm is an establishment at least 0.1 hectare in size, or having an appropriate quantity of livestock (e.g. 1 cattle).

Source: authors' research, based on data from: LDB GUS and IT.NRW

Nevertheless, only some of the agricultural land presented in geodesic registers belongs to farms. In the towns of the Upper Silesian Metropolis, only 12.3% of land represents agricultural land of farms, while the same ratio for Ruhr Metropolis is at 19.2%. Taking the share of agricultural land managed by farms into account, it should be highlighted that agriculture in the researched metropolitan areas, especially in the city counties, has less importance than in the North-Rhine Westphalia and the Silesian Voivodeship.

[7] These differences arise from the different method of defining agricultural land for the purposes of agricultural censuses and land registry. In addition, some agricultural land may be held by parties other than farms (e.g. businesses, municipalities, etc.).

[8] AWU – Annual Work Unit - The work performed by one person who is occupied in farms on a full-time basis. Persons with a minimum working time of 1,800 hours annually are considered as full-time workers and count as one AWU.

The development potential of agriculture in the given area is not only determined by the available land resources but also by their organization. Only with the right scale and concentration of production is it possible to earn parity incomes and to achieve growth of farms [Ziętara 2009]. Research has shown that the average area of agricultural land in farms in the Upper Silesia is ca. 10 hectares, and is even lower in city counties, at 6.6 hectares. Moreover, only 70% of all agricultural land is available to farms with the area exceeding 10 hectares. These values are significantly lower than in the Ruhr Metropolis, yet higher than the average for the Silesian Voivodeship, where the average size of agricultural land per farms is ca. 7.1 hectares. The proximity of town centers has a positive effect on structural transformations, while in Polish towns and suburbs, the processes of increasing the average area per farm proceed much faster than the Polish average for at least 10 years [Sroka 2014]. Comparing the studied characteristics of the structure of agriculture by farm size between the Upper Silesian Metropolis and Ruhr Metropolis, we should emphasize that farming in the Ruhr is characterized by much more positive values because the average farm has approximately 40 hectares of agricultural land, while 97% of all agricultural land in the area is available to farms larger than 10 hectares. These indexes are comparable to the data applicable for the entire North-Rhine Westphalia.

Highly distributed agrarian structure, including a large number of entities with a small area, usually involves excessive workforce resources. The Upper Silesian Metropolis, like the entire area of southern Poland (including the Silesian Voivodeship) is among the regions with high agrarian overpopulation, based on historical and economic factors [Musiał 2009]. On average 11.5 people work full time (AWU) at the farms in the Upper Silesia per 100 hectares of agricultural land, which is more than twice higher than the value for the Ruhr Metropolis, but lower than it is on average in the Silesian Voivodeship. In both conurbations, employment ratios at farms located in towns are slightly higher than in the remaining areas. The reason for this difference is the higher proportion of intensive cultivation (including vegetable plantations) in overall crop structure. In the Upper Silesian Metropolis, further reasons for this situation can be sought in the farms being more scattered. To evaluate the labour resources in agriculture, it must be emphasized that as a consequence of excessive AWU, incomes are reduced per one worker, which limits growth of the farms that lack adequate funding of investments. Thus, we should conclude that agriculture in the Upper Silesian Metropolis is characterized by less positive qualities of work resources.

The factor derived from low average area of farms and high levels of employment in the Upper Silesian Metropolis is the low proportion of farms that earn their incomes primarily from farming. In 2010, only 11% of individual owners of farms on average would earn over 50% of their income from agriculture. For comparison, all other farms in the Ruhr Metropolis can be defined as being dependent mainly on farming. Thus, it can be clearly concluded that agriculture in the Upper Silesia exhibits significantly lower earning potential. Nevertheless, both in the Ruhr Metropolis and Upper Silesian Metropolis the share of urban farms earning their income mainly from agriculture is higher in the North-Rhine Westphalia and the Silesian Voivodeship respectively.

The potential and importance of agriculture in any given territorial unit or country is not only determined by production resources but also by production volume. Moreover, production volume itself, and its scale and structure, indicates the actual utilization of production factors. One of the most important variables that illustrate the condition of plant production is the structure of agricultural land (Table 3). In both conurbations, the vast

majority of agricultural land (over 2/3) is occupied by crops, and in the city counties of the Upper Silesian Metropolis their share is over 16 percentage points (p.p.) lower than in the city counties of the Ruhr Metropolis. Similarly, there is less permanent pasture in Upper Silesian towns (by 8.6 p.p.). The relatively low share of crops and grassland is due to the high proportion of land excluded from agricultural production. In towns in particular, but across the entire Upper Silesian Metropolis as well, over 16% of all agricultural land is not maintained in good agricultural condition (wasteland). To this, we should add the large areas of permanent pasture which is not used for production (ca. 17% of total grassland). In fact, this data can be even slightly understated, as it does not include agricultural land in possession of farms. For comparison, agricultural land not maintained in good agricultural condition represents ca. 5.8% of total agricultural land in Poland, however outside the south of Poland which is a highly scattered territory in terms of agriculture, this ratio is below 3%.

Table 3. Structure of agricultural land of farms in the Upper Silesian Metropolis and Ruhr Metropolis (2010).

Specification	Percentage of crops in agricultural land (%)	Percentage of permanent pasture in agricultural land (%)	Percentage of permanent crops in agricultural land (%)	Percentage of other land in agricultural land (%)
Ruhr Metropolis	69.2	30.2	0.4	0.2
City counties in the Ruhr Metropolis	71.8	27.1	0.6	0.5
North-Rhine Westphalia	71.9	27.1	0.9	0.1
Upper Silesian Metropolis	67.3	15.5	0.9	16.3
City counties in the Upper Silesian Metropolis	55.5	18.5	1.5	24.5
Silesian Voivodeship	60.9	19.6	0.8	18.7

Source: authors' research, based on data from: LDB GUS and IT.NRW.

As we evaluate the scale of exclusion of land from agricultural production in the Upper Silesian Metropolis, it should be considered even three times higher than in other regions of Poland, but lower than it is on average in the Silesian Voivodeship. A large share of agricultural land that is not maintained in good agricultural condition is depicted only in city counties. In Ruhr Metropolis cities, wasteland constitutes a very small proportion of land owned by farms, and is usually only temporary (due to greening processes). The German legal solutions seem to be more effective in protecting the market of agricultural land from undesired activities, particularly speculative activities that can be enhanced around towns. Trading in agricultural land, including the processes of splitting or withdrawal of agricultural status, tends to be very carefully monitored and evaluated by the agricultural chambers, *inter alia* [Sroka and Ender 2011]. High percentages of land excluded from agricultural production in the Upper Silesian Metropolis can be partially explained by the different method of defining farms. Nevertheless, it should be expressly stated that the production potential of agriculture in Upper Silesia is not fully utilized. There are invasive plants or shrubbery frequently prevailing on set-aside land, which significantly limits the possibility of returning land to productive use in the future.

Land is the primary production factor in agriculture, and land resources constitute only a dormant potential. The intensity of agriculture organization is important as well, including

the structure of crops and intensity of animal production. Within the studied metropolitan areas, the structure of crops is dominated by cereals, mainly wheat and barley (Table 4). Still, certain major differences can be noticed here, as the percentage of cereals in the Ruhr Metropolis is almost 20 p.p. lower than in the Upper Silesian Metropolis. It turns out that cereals often give way to plants grown for industrial purposes there (oily plants) and fodder plants (e.g. corn, leguminous plants for forage). The latter constitute over 20% of crops and are located mainly in regions with high intensity animal production. Similar structure of crops is prevalent also in the North-Rhine Westphalia.

Farming in the Upper Silesian Metropolis is quite clearly no match for farming in the Ruhr Metropolis in terms of the share of vegetables in the overall area of crops. There, the percentage of land occupied by vegetables is ca. 2.5%, yet as many as 12% of all farms in Ruhr Metropolis are engaged in growing vegetables [Pölling, Born 2015]. This percentage is twice as high as the average for North Rhine-Westphalia, and more than 20 times higher than in the Upper Silesian Metropolis.

Table 4. Selected characteristics of the production potential of agriculture in the Upper Silesian Metropolis and Ruhr Metropolis (2010)

Specification	Percentage of cereals in crops area (%)	Percentage of vegetables in crops area (%)	Percentage of farms with animals (%)*	Stocking density (LSU per 100 hectares of agricultural land)
Ruhr Metropolis	61.1	2.5	79.7	122.6
City counties in the Ruhr Metropolis	65.7	2.6	72.9	88.7
North-Rhine Westphalia	61.3	1.9	77.5	120.7
Upper Silesian Metropolis	80.1	0.8	45.7	73.2
City counties in the Upper Silesian Metropolis	76.6	2.1	36.8	63.7
Silesian Voivodeship	79.5	0.6	49.3	69.5

*Farms over 1 ha are used as a basis for calculations

Source: authors' research, based on data from: LDB GUS and IT.NRW.

The relatively high proportion of vegetable crops in city counties, both in Ruhr Metropolis and the Upper Silesian Metropolis, is worth emphasizing. This index outnumbers average indexes for the Silesian Voivodeship and the North-Rhine Westphalia.

The interest of urban farmers in growing vegetables is a product of the mechanism of land rents. Specifically, in urban conditions where alternative forms of development of agricultural land are relatively highly available, agricultural producers will decide to cultivate the land only if it brings higher benefits than the other types of activities. This is often only possible in the case of high intensity crops, such as vegetables, potatoes, and permanent crops. High levels of interest among the Ruhr farmers in vegetable production is also due to the increasing demand for regional products, i.e. those produced as close as possible to the point of sale [Banik et al. 2007].

Another very important division of agricultural production is animal production. In highly urbanized areas, particularly in close proximity to large populations, animal production is often not permitted, due to disease hazards, or risk of water contamination [Schulz et al. 2013]. Another reason for prohibition to set up new farms in urban zoning plants, particularly farms with animals, is the unpleasant odor [Tokajuk 2011]. Nevertheless, despite the potential conflicts between animal production and towns, there are

still numerous farms at the outskirts of town that breed cattle, swine and horses. As many as 73% of all farms in Ruhr Metropolis have animals, and some of them (ca. 30% of all farms) keep horses that are used for riding. There are as many as 10 horses per 100 hectares of agricultural land, which is five times higher than for the Upper Silesian Metropolis. The regions being compared exhibit relatively significant differences in terms of animal production intensity: livestock density in the Ruhr Metropolis exceeds 122 LSU per 100 hectares of agricultural land, while in the Upper Silesia it is at 73.2 LSU per 100 hectares of agricultural land. These two cases show that the values are higher than they are, on average, in regions where these metropolitan areas are located.

Considerable difference should be noted when comparing the data of the researched metropolitan areas. There are 90 cattle per cattle-breeding farm on average in the Ruhr Metropolis (ca. 10 animals in the Upper Silesian Metropolis), and 590 swine per swine-breeding farm (ca. 90 animals in the Upper Silesian Metropolis). The analogous indexes for both the North-Rhine Westphalia and the Silesian Voivodeship are from several to a few hundred percentage points lower, but the greatest differences are evident in Poland. The average size of a herd of cattle in the Silesian Voivodeship, for example, consists of 30 head, which is 3 times smaller than in the Upper Silesian Metropolis. In contrast, in the North-Rhine Westphalia the average head of cattle amounts to 83 head, which is 9 head less than in the Ruhr Metropolis.

Analytic studies have confirmed that in city counties of the conurbations under comparison, livestock density is relatively low, at 88 LSU per 100 hectares of agricultural land in the Ruhr Metropolis and 63.7 LSU per 100 hectares of agricultural land in the Upper Silesian Metropolis. In the Ruhr, large animal stocks are mainly located in the "rural" part of the conurbation, i.e. in Wesel and Recklinghausen districts, where the natural conditions (poor soils) predispose these areas mainly from agricultural production, with the use of permanent pasture.

To sum up, it should be emphasized that both metropolitan areas indicate quite higher intensity of animal production than the regions where they are located. This is indicated both by higher density of livestock and by higher concentration and perhaps professional character of agricultural production.

Summary and conclusion

The development conditions, and the importance and potential of urban agriculture in densely populated and urbanized regions of Europe seem to be insufficiently recognized. This is due to the decreasing importance of the agricultural sector and the seemingly antagonistic relation of towns to agriculture. Still, research shows that farming has been and will probably continue to be present even in the largest metropolitan areas of Europe. (Post)industrial agglomerations have a special place here, as they expanded strongly in their times of greatness, flooding the surrounding locales. Research has shown that despite the strong pressure on urbanization, there are still large agricultural land areas present there. Almost 40% of the total area, both in the Ruhr Metropolis and the Upper Silesian Metropolis, comprises land identified in the registers as agricultural land. Thus, it should be emphasized that in the studied metropolitan areas, agricultural land constitutes the key component of urban space in terms of the area it occupies.

Analysis of selected characteristics of agriculture of the Ruhr Metropolis and the Upper Silesian Metropolis has clearly proven that they are characterized by a quite similar potential than the regions where these metropolitan areas are located. The average size of the surface of farms in the Upper Silesian Metropolis is slightly higher than in the Silesian Voivodeship (in the Ruhr Metropolis it is lower than in the North-Rhine Westphalia). The researched metropolitan areas, especially city counties, are marked by a considerably higher share of vegetables in the structure of crops than it is on average in the analyzed regions. Even the intensity of animal production measured in terms of stock density is larger in the researched metropolitan areas than in the Silesian Voivodeship and North-Rhine Westphalia. The conducted research has shown that in city counties, namely big urban centers, the significance and potential of agriculture is slightly lower. Farms are smaller than in the entire metropolitan areas and the indexes of employment as well as the intensity of animal production are less beneficial.

Comparing the analyzed metropolitan areas it should be highlighted that the differences in the level of development of agriculture and of the entire economy of the Upper Silesian Metropolis and the Ruhr are the product of certain historical background, i.e. different conditions for development that prevailed during the last several hundred years. The Upper Silesian Metropolis indicates considerably lower potential of agriculture than the Ruhr Metropolis. This concerns almost all analyzed indexes. The main problem of the Silesian Voivodeship is seen in the huge acreage (above 16% of agricultural land) of land out of agricultural production and not maintained in good agricultural condition.

In order to sum up the conducted analyses, a positive verification of the hypothesis saying that the potential of urban agriculture in the Ruhr Metropolis and the Upper Silesian Metropolis is similar to the North-Rhine Westphalia and the Silesian Voivodeship respectively should be made.

References:

Abdalla I. F. [2012]: Socioeconomic Aspects of Urban and Peri-urban Agriculture: A Diagnostic Study in Khartoum, Sudan. Kassel University Press GmbH, Kassel.

Alonso W. [1964]: Location and land use. Toward a general theory of land rent. Harvard University Press. Harvard.

Banik I., Simons J., Hartmann M. [2007]: Regionale Herkunft als Erfolgsfaktor für die Qualitätswahrnehmung von Verbrauchern in Nordrhein-Westfalen. Research paper, Faculty of Agriculture, University of Bonn.

Bański J. [2008]: Strefa podmiejska - już nie miasto, jeszcze nie wieś. [w]: Gospodarka przestrzenna w strefie kontinuum miejsko-wiejskiego w Polsce. Red. Aleksandra Jezierska-Thoele, Leszek Kozłowski. Toruń: Wydaw. Nauk. UMK s. 29-43.

Born R., Pölling B. [2014]: Urbane Landwirtschaft in der Metropole Ruhr. B&B Agrar, No. 2, s. 9-12.

Colasanti K. J., Hamm M. W., Litjens C. M. [2012]: The City as an Agricultural Powerhouse? Perspectives on Expanding Urban Agriculture from Detroit, Michigan. Urban Geography, 33(3), s. 348-369.

Danso G.K., Drechsel P., Akinbolu S.S., Gyiele L.A. [2003]: Review of studies and literature on the profitability and sustainability of urban and peri-urban agriculture. FAO Final Report (PR 25314), IWMI, Accra.

Egyir I. Beinpuo E. [2009]: Strategic innovations in urban agriculture, food supply and livelihood support systems performance in Accea, Ghana.

FAO, [2007]: Profitability and sustainability of urban and peri-urban agriculture. Agricultural Management, Marketing and Finance Occasional Paper 19.

Geologischer Dienst Nordrhein-Westfalen [2011]: Boden in Nordrhein-Westfalen Erkunden-Nutzen-Erhalten. Verlag Geologischer Dienst Nordrhein-Westfalen.

Giecewicz J. [2005]: Obszary rolne jako czynnik przyrodniczej rewitalizacji miasta. Teka Kom. Arch. Urb. Stud. Krajobr. - OL PAN, s. 128-134.

Goldstein M., Bellis J., Morse S., Myers A., Ura E. [2011]: Urban agriculture: A sixteen city survey of urban agriculture practices across the country. Survey written and compiled by Turner Environmental Law Clinic at Emory University Law School, Atlanta.

Heinze R. [2013]: Strukturwandel und Strukturpolitik in Nordrhein-Westfalen: Entwicklungstrends und Forschungsperspektiven. Vol. 3. Springer-Verlag. Wiesbaden.

Indraprahasta G. S. [2013: The potential of urban agriculture development in Jakarta. Procedia Environmental Sciences, no 17, s. 11-19.

IT.NRW. Information und Technik Nordrhein-Westfalen. https://www.landesdatenbank.nrw.de/

Jiang L., Xiangzheng D., Karen C. [2013]: The impact of urban expansion on agricultural land use intensity in China. Land Use Policy 35, s. 33-39.

Kost S. [2015]: Urbane Landwirtschaft in der Metropole Ruhr. In: Landschaftswandel-Wandel von Machtstrukturen. Springer Fachmedien Wiesbaden, s. 183-199.

Krzyk P., Tokarczuk T., Heczko-Hyłowa E., Ziobrowski Z. [2013]: Obszary rolne jako element struktury przestrzennej miast – problemy planistyczne, Instytut Rozwoju Miast, Kraków.

Lageman, B., Bauer, T. K., Dürig, W., Kambeck, R., Kluve, J., Neumann, U., Schmidt, C. M. [2005]: Strukturwandel ohne Ende? Aktuelle Vorschläge zur Revitalisierung des Ruhrgebiets und ihre Bewertung (No. 20). Rheinisch-Westfälisches Institut für Wirtschaftsforschung. Essen.

Landwirtschaftskammer NRW [2012]: Landwirtschaftlicher Fachbeitrag zum Regionalplan"Metropolregion Ruhr". Landwirtschaftskammer Nordrhein-Westfalen. Düsseldorf.

Landwirtschaftskammer NRW [2013]: Zahlen und Daten zu Landwirtschaft und Gartenbau in der Metropole Ruhr. Landwirtschaftskammer Nordrhein-Westfalen. Münster.

LDB GUS. Local Data Bank. http://stat.gov.pl/bdlen/app/strona.html?p_name=indeks.

Lohrberg F., Timpe A. [2011]: Urbane Agrikultur – Neue Formen der Primärproduktion in der Stadt. Planerin Fachzeitschrift für Stadt-, Regional und Landesplanung 5/2011, s. 35-37, Berlin.

Mikołajec J. [2013]: Dwie konurbacje górnicze - próba porównania. *Zeszyty Naukowe Politechniki Śląskiej*. Seria Organizacja i Zarządzanie. Zeszyt 65. s. 217-226.

Mougeot L. [2010]: Agropolis: The Social, Political and Environmental Dimensions of Urban Agriculture. IDRC, Canada.

Musiał W. [2009]: Demograficzne i społeczne uwarunkowania powstawania wiejskich obszarów problemowych. Acta Scientiarum Polonorum, Nr 8 (2) s. 93 – 102.

Nugent R. A. [2001]: Using economic analysis to measure the sustainability of urban and peri-urban agriculture: A comparison of cost-benefit and contingent valuation analyses. Presentation at Workshop on Appropriate Methodologies in Urban Agriculture, Nairobi, Kenya.

Parysek J. [2008]: Aglomeracje miejskie w Polsce oraz problemy ich funkcjonowania i rozwoju. [w:] Wybrane problemy rozwoju i rewitalizacji miast: aspekty poznawcze i praktyczne. Bogucki Wydawnictwo Naukowe, Poznań, 29-48.

Pawlak K., Poczta W. [2010]: Potencjał polskiego rolnictwa pięć lat Po akcesji do UE jako przesłanka jego konkurencyjności. Wieś i Rolnictwo, nr 1 (146), s. 21-47.

Petts J. [2001]: Urban agriculture in London. WHO. Regional Office for Europe. London.

Pölling, B., Born, R. [2015]: Urbane Landwirtschaft in der Metropole Ruhr. Natur und Landschaft. 90 (8), s. 376-382.

Pudlik M., Garus C. [2009]: Jak Feniks z popiołów. Rozwój struktur metropolitalnych w Zagłębiu Ruhry jako wzór dla rozwoju Górnego Śląska?. *Studia regionalne i lokalne*, 1 (35), s. 32-51.

Runge J., Krzystofik R. [2013]: Delimitacja Regionu Górnośląsko-Zagłębiowskiej Metropolii "Silesia". http://www.gzm.org.pl/project/zdjeciaDodatkowe/Delimitacja%20regionu%20GZM%20Silesia.pdf

Schulz K., Weith Th., Bokelmann W., Petzke N. [2013]: Urbane Landwirtschaft und"Green Production" als Teil eines nachhaltigen Landmanagements. Leibniz-Zentrum für Agrarlandschaftsforschung (ZALF), Müncheberg.

Sroka W. Ender H. [2011]: Struktura agrarna oraz rynek ziemi rolniczej w Niemczech – aspekty organizacyjne oraz tendencje rozwojowe. Krakowskie Studia Małopolskie. s. 199-214.

Sroka W. [2014]: Rolnictwo w obrębie miast – wybrane aspekty zmian strukturalnych przed i po przystąpieniu Polski do Unii Europejskiej. Zeszyty Naukowe SGGW Ekonomika i Organizacja Gospodarki Żywnościowej. nr 108, s. 33-44.

Sroka W. [2015]: Resources and use of agricultural land in Polish cities according to chosen theories of location of agricultural production. Acta Sci. Pol. Oeconomia 14 (3) 2015, 135–147.

Szymańska D. [2007]: Urbanizacja na świecie, Wydawnictwo Naukowe PWN, Warszawa.

Tjeerd D., Boyd D., Van den Biggelaar [2001]: Multifunctional land use: an opportunity for promoting urban agriculture in Europe. Urban Agriculture Magazine 4, s. 33-35.

Tokajuk, J. [2011]: Konflikty przestrzenne na styku istniejącej zabudowy zagrodowej i planowanej zabudowy mieszkaniowej na terenach wsi strefy podmiejskiej włączonych do obszaru miasta Białegostoku. Przestrzeń i Forma, 311-320.

UMWŚ [2012]: Delimitacja metropolii i aglomeracji oraz ich obszarów funkcjonalnych w województwie śląskim. Urząd Marszałkowski Województwa Śląskiego. Katowice.

Van Veenhuizen R., Danso G. [2007]: Profitability and sustainability of urban and periurban agriculture (Vol. 19). Food & Agriculture Org. Rome.

Viljoen A., Bohn K.. Howe J. [2012]: Continuous Productive Urban Landscapes. Routledge.

Von Thünen, J.H. [1826]: Der isolirte Staat in Beziehung auf Landwirthschaft und Nationalökonomie oder Untersuchungen über den Einfluss, den die Getreidepreise, der Reichtum des Bodens und die Abgaben auf den Ackerbau ausüben. Perthes. Hamburg.

Wagner K. [2005]: Funktionen der Landwirtschaft in stadtnahen Grünstrukturen: EU-COST Aktion C11 Greenstructure and urban planning (No. 19), AWI Bundesanstalt für Agarwirtschaft, Wien.

Walewski M. [1999]: Restrukturyzacja tradycyjnych branż przemysłowych w krajach Europy Zachodniej - wybrane przykłady. Centrum Analiz Społeczno-Ekonomicznych. Warszawa.

Witek T., Gorski T. [1977: Evaluation of the natural capability of agricultural areas in Poland, Wydawnictwo Geologiczne, Warsaw.

Witek T. [1981]: Waloryzacja rolniczej przestrzeni produkcyjnej Polski według gmin. Wyd. IUNG Puławy.

Wuppertal Institut für Klima, Umwelt, Energie [2013]: Metropole Ruhr – Grüne Hauptstadt Europas. Wydawnictwo KSBG Kommunale Beteiligungsgesellschaft GmbH & Co. KG, Essen.

Zasada I. [2011]: Multifunctional peri-urban agriculture - A review of societal demands and the provision of goods and services by farming. Land use policy 28 (4), s. 639-648.

Ziętara W. [2009]: Model polskiego rolnictwa–wobec aktualnych wyzwań. Zeszyty Naukowe SGGW – Ekonomika i Organizacja Gospodarki Żywnościowej, nr 73, 5-21.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 194–203

Elena Timofti[1]
The State Agricultural University of Moldova, Chisinau

Developing an Integrated Methodology for Estimating Economic Efficiency of Production in Agricultural Enterprises Republic of Moldova

Abstract. This paper presents an analysis to estimate the economic efficiency of agricultural products and global production in agricultural enterprises in Moldova. It was determined by using a system of partial indicators of economic efficiency dynamics from 2005-2012. Along with traditional indicators, a calculation methodology developed by a synthetic indicator for (full) efficiency was used, taking into account basic indicators of production and sales. The recommended methodology enables: trace-back to each farm unit for economic efficiency compared with border hierarchy of optimal studied (standard) levels of identification, with results by influence; determining reserves to increase economic efficiency etc. The following methods are based on economic statistics research: monographic method, method table, DEA (Data Envelopment Analysis). In the research the author used data from specialized forms of agricultural enterprises from the Statistical Yearbook (NBS).

Key words: economic efficiency, full indicator, methodology of assessment, system of indicators, the optimal frontier (benchmark), Moldova

Introduction

The research conducted allow us to state that the essence of efficiency of agricultural production is the formation of complex requirements and conditions necessary to ensure extended reproduction in a competitive economy, enabling the industry to meet society's needs not only for food, but also to develop harmony under operation ties and economic relations, organizational, legal, social, moral and also in terms of ensuring sustainable agriculture. Increasing useful effects must be the aim of all economic activities, but with the condition of keeping ecological balance. The organization's extended reproduction depends on the level of economic efficiency, because profits create prerequisites and conditions necessary to enlarge reproduction processes.

Material and Methods

In the research the author used data from the Statistical Yearbook; specialized forms of agricultural enterprises in Moldova [2011-2012]. The research issues addressed in the paper were used: monographic method, method of comparison, graphics, table, grouping method, economic indices, the method of envelopment (DEA).

[1] Professor, e-mail: e.timofti@uasm.md

Results and discussion

Changing business conditions in agricultural units with different legal forms of ownership and organization require new approaches and complex analytical research. Results should determine not only changes in dynamic links between phenomena, but also serve as a basis for taking appropriate decisions in planning and foreseeing future development of production. Practical benchmarking of existing production efficiency in terms of the forms of production is represented by very different indicators, which often characterize various aspects of the production process conditions and do not reflect the full extent of the functioning link between the results of production and means of obtaining them.

We must mention that results from the production of agricultural production relate to each type of resource (factor) basis. But it is obvious that the results of are for fully participating resources (agricultural land, capital goods for agricultural production), consumption of materials, labor, etc.) and market conditions (supply, demand, competition etc.).

To feature any sector of production efficiency in the agricultural branch we must use a system of indicators expressing special factors that influence the final results of production. These indicators reflect the level of use of agricultural land, means of production, indicates material costs, labor etc.

The efficiency of production is characterized by the effect achieved, which should always affect production. Based on data for agribusinesses in Moldova, according to the system of indicators to determine economic efficiency we looked at producing grapes for 2005-2012. A high economic efficiency was achieved in 2005, 2011 and 2012, when grape productivity had high levels recorded and when the correlation between the sales price and the cost of finished products sold was the greatest. For every 1 leu consumed, businesses achieved an average profit of 31.02 and 36.99 cash money.

Productivity of vine plantations is a basic indicator characterizing economic efficiency in viticulture, while increasing the intensification and financing remains a problem for agricultural enterprises. Increasing or reducing the productivity of plantations and changing their quality determines the effectiveness of grape production. But only on the basis of partial indicators, it is not possible to assess the full economic efficiency. These indicators reflect partial economic efficiency, as each of them relates only to a certain category of resource. The latest research studies aimed at production efficiency use the stochastic frontier method, which is a method to estimate the production frontier and, therefore, a method of measuring the efficiency of production.

Maximum efficiency is often called "best practice," which always is the production possibilities frontier, and therefore efficiency change means changing the distance from the border [Лисситса 2003]. The method of analysis - tire belongs to Farrelly [Farrell 1957], according to which efficiency is calculated as the ratio of agricultural enterprises productivity maximum productivity.

Nonparametric techniques, envelopment, were further developed by Charnes, Cooper and Rhodes [Charnes et.all. 1978]. It's all about methodology called DEA, which uses mathematical programming models to build tire production possibilities crowd. The peculiarity of this method is that all observations are assumed to be the same for the production side of the border and the term "error" only captures inefficiency.

We agree with the Russian researcher A. P. Zincenco, who is of the opinion that the selection of characteristics necessary to comply with the qualitative requirements regarding homogeneity inexistence have contradictions between them. This condition can be considered fulfilled if the characteristics usually has changes in direction and the strength of their bond is high [Зинченко 2007]. Studying Russian economic literature shows that this method is not used in practice and it is unknown. However, the potential need to use the method and effect can be large [Лисситса 2003 et. all.].

DEA envelopment priority method as an alternative to other methods of estimating the efficiency consists of the following:

• multiples border outputs can be found easily;

• there is no need to search for the type and form tool because the production possibilities frontier is determined as a data envelopment.

We believe that to determine the full economic efficiency of production it is necessary to calculate, along with traditional indicators, a synthetic indicator (Full) efficiency, such as a multi-criteria environmental coefficient calculated on each farm in the total crowd under the main indicators which characterizes the efficiency. The proposed methodology is based on the principles of the method, which is called analysis - tire.

Each combination of resources yield maximum results, but your results may actually coincide with the maximum level or may be lower. Undertaking obtaining maximal results with respect to a resource unit is taken as a yardstick by which compares all companies studied by the use of resources. Businesses efficient form "efficient production frontier". So estimating efficiency is determined by calculating the distance between enterprises and the studied efficiency frontier.

When selecting characteristics necessary to comply with the qualitative requirements regarding the nonexistence homogeneity contradictions between them. This condition can be considered fulfilled if the lot is changing characteristics usually in one direction and strength of their bond is high.

At the product level is proposed to compute the average multi-criteria after following relationship is apparent in the methodology developed:

$$\overline{C}_i = \frac{\frac{p_i}{p_{opt}} + \frac{Cp_{opt}}{Cp_i} + \frac{Pm.v_i}{Pm.v_{opt}} + \frac{Pq_i}{Pq_{opt}} + \frac{Nr_i}{Nr_{opt}}}{n} = \frac{\sum_{n=1}^{n}\left(\frac{x_{i_n}}{x_{opt}}\right) + \frac{x_{opt}}{x_i}}{n} \quad (1)$$

where:

$\overline{C}_i$ - the average coefficient for the multi-criteria of economic efficiency units;

p_i şi p_{opt} – crop yield from 1 ha, (q) for the unit and the unit with optimal frontier level (standard);

Cp_işi Cp_{opt} – unit cost of production (millions) for the unit and the unit optimal border;

$Pm.v_i$ şi $Pm.v_{opt}$ – the average price of one stock q (MDL) for the unit and the unit with optimal border;

Pq_işi Pq_{opt} – profit calculated to q product (MDL) for the unit and the unit with optimal border;

Nr_i şi Nr_{opt} – level of profitability (%) for the unit and the unit optimal border;

x_{i_n} – xn characteristic meaning (for features maximized) for i units;
x_i – meaning characteristic (for features minimized) for the unit;
x_{opt} – feature importance for optimal frontier level (standard) – x_n;
i – the number of units surveyed the crowd;
n – feature number.

We be mention that part of the production in the agricultural enterprises is not sold on distribution channels but is processed. We consider it necessary to express our opinion and to complete the proposed methodology taking into account the results obtained from the processing of their products, including an additional four indicators:

c'_{p_i} şi c'_{opt} – unit cost of finished products sold, lei for the unit and the unit optimal border;

$p'_{m.v._i}$ şi $p'_{m.v.opt}$ – stock price of one unit sold (tons, dal etc.), lei and drive units for the optimal frontier;

Pq'_i şi Pq'_{opt} – profit calculated per unit of product sold (millions) for the unit and the unit with optimal border;

Nr'_i şi Nr'_{opt} – profitability level (%) for the unit and the unit optimal border

Then the companies that process their own production determining the economic efficiency of different types of products taking into cosniderare the results obtained from the industrial processing of their plan to be carried out by the following relationship:

$$\overline{C}_i = \frac{\sum_{n=1}^{n}\left(\frac{x_{i_n}}{x_{opt}} + \frac{x'_{i_n}}{x'_{opt}}\right) + \frac{x_{opt}}{x_i} + \frac{x'_{opt}}{x'_i}}{n} \qquad (2)$$

where:
Meaning x'n feature (for features maximized) for the units;
x'_i – significance characteristic (for features minimized) for the unit.
x'_{opt} – importance for the border optimal feature (standard) - x'n;
i – number of units surveyed the crowd;
n – number feature.

Based on the data of 130 agricultural enterprises of the South and ATU "Gagauz" - producing commodity production (grapes) was estimated as economic efficiency indicator system. Under the proposed methodology individual indices were calculated based on average coefficients which were determined using multi-criteria assessment of the effectiveness of each enterprise in the competitive environment. Based on average salary levels Multicriterial businesses were arranged in descending order, then determined the place it occupies in the competitive environment hierarchical organization from one enterprise to another.

The data shows that there is high competition agrarian market where sellers sell a lot of quality grapes with an assortment of different goods (varieties, the percentage of sugar, acidity, shape, color, etc.). The basic factor influencing the competitive priority is resource potential. Effective use of qualitative and quantitative indicators which determine the company's activity and efficiency of different products and marketing opportunities for

retention of businesses depending on the potential competitiveness of the product presented.

To estimate the competitive potential of grapes expressed through the system of economic efficiency indicators, the statistical groups were divided into 6 groups of all firms surveyed, which we considered to be appointed as follows:

Group I: 0.61 and more (business leaders) - 11.5%; Group II: 0.51 to 0.60 (business outlook) - 15.4%; Group III: 0.41 to 0.50 (average efficiency) - 21.5%; Group IV: 0.31 to 0.40 (moderate efficiency) - 24.6%; Group V: 0.30 and lower (low efficiency) - 13.2%; Group VI: profitable enterprises - 13.8% (Figure 1).

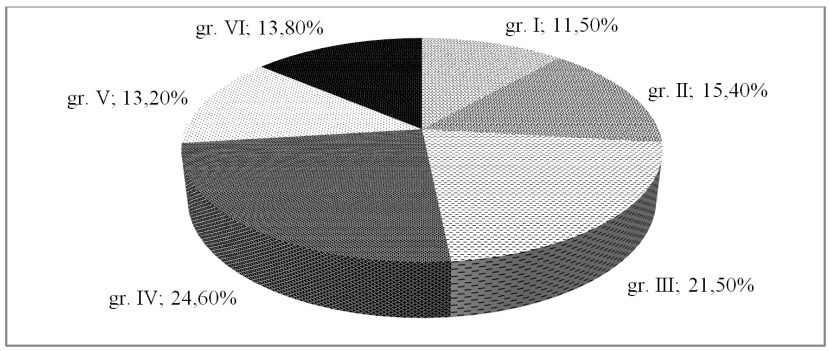


Fig. 1. Groups of Enterprises Development South and Gagauzia after multicriterial

Source: calculated by the author.

To determine the economic efficiency of the whole global agricultural production besides the traditional indicators and proposed average coefficient is calculated on the basis of multi-criteria main indicators characterizing efficiency using the following equation:

- For profitable businesses:

$$\overline{C}_{rentab}=\frac{\frac{R_{i_{t.a.}}}{R_{opt_{t.a.}}}+\frac{R_{i_{l.}}}{R_{opt_{l.}}}+\frac{R_{i_{m.f.}}}{R_{opt_{m.f.}}}+\frac{R_{i_{c.p.}}}{R_{opt_{c.p.}}}+\frac{P_{i_{t.a.}}}{P_{opt_{t.a.}}}+\frac{P_{i_{c.p.}}}{P_{opt_{c.p.}}}+\frac{R_i}{R_{opt}}}{n} \quad (3)$$

- For unprofitable businesses:

$$\overline{C}_{nerentab}=\frac{\frac{R_{i_{t.a.}}}{R_{opt_{t.a.}}}+\frac{R_{i_{l.}}}{R_{opt_{l.}}}+\frac{R_{i_{m.f.}}}{R_{opt_{m.f.}}}+\frac{R_{i_{c.p.}}}{R_{opt_{c.p.}}}+\frac{P_{opt_{t.a.}}}{P_{o_{t.a.}}}+\frac{P_{opt_{c.p.}}}{P_{i_{c.p.}}}+\frac{R_{opt}}{R_i}}{n} \quad (4)$$

$\overline{C}$ – multi-criteria environmental coefficient of economic efficiency and global agricultural production units;

$R_{i_{t.a.}}, R_{opt_{t.a.}}$ – yield agricultural land (MDL) for the unit and the unit with optimal frontier level (standard);

$R_{i_l}, R_{opt_{l.}}$ – the average labor productivity of a worker annually (MDL) for the unit and the unit with optimal frontier level (standard);

$R_{i_{m.f.}}, R_{opt_{m.f..}}$ – the yield of agricultural productive fixed assets (MDL) for the unit and the unit with optimal frontier level (standard);

$R_{i_{c.p.}}, R_{opt_{c.p.}}$ –yield production costs for the unit and optimal frontier level unit (standard);

$P_{i_{t.a.}}, P_{opt_{t.a.}}$ – profits (losses) from the sale of agricultural production from 1 ha of agricultural land and drive units for optimal border level (standard);

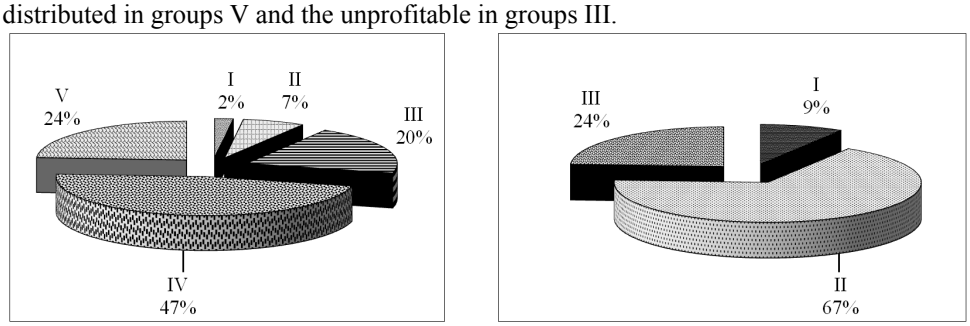
$P_{i_{c.p..}}, P_{opt_{c.p..}}$ – profits (losses) from the sale of agricultural production to 1 leu and unit production costs and optimal frontier level unit (standard);

R_i, R_{opt} – level of profitability (unprofitable) for the unit and the unit with optimal frontier level (standard);

n - number of characteristics;

i – the number of units surveyed the crowd.

Based on the data of 894 agricultural enterprises in Moldova it was estimated economic efficiency by the system of indicators. Under the proposed methodology indices were calculated individually for each feature, based on average coefficients which were determined multi-criteria assessment of the effectiveness of each enterprise. Based on average salary levels Multicriterial businesses were arranged in descending order and appreciated the place it occupies in the competitive environment hierarchical organization from one enterprise to another. Next, using the statistical groups, profitable enterprises were distributed in groups V and the unprofitable in groups III.



Companies profitable

I gr. - Business leaders
II gr. - Business outlook
III gr. - Enterprises with average efficiency
IV gr. - Enterprises with moderate efficiency
V gr. - Enterprises with low efficiency

Companies unprofitable

I gr. - Enterprises with prospects of becoming profitable
II gr. - Profitable enterprises with average
III gr. - Profitable enterprises with high level

Fig. 2. Distribution of agricultural enterprises in Moldova in groups after multi-criteria of economic efficiency coefficient of global agricultural production

Source: calculated by the author on the initial data base from agricultural enterprises.

Next, using the statistical groups, profitable enterprises were distributed in groups V and the unprofitable - in III group (Figure 2).

Distribution of agricultural enterprises into groups according to the range limits show that 15.4% of the total were negative return (Figure 2). And the cost is shared with only a 2% share in the group-leading companies, 7% in group enterprises perspective, 20% in the average level of efficiency, and the rest - 71% efficient businesses an moderate and low.

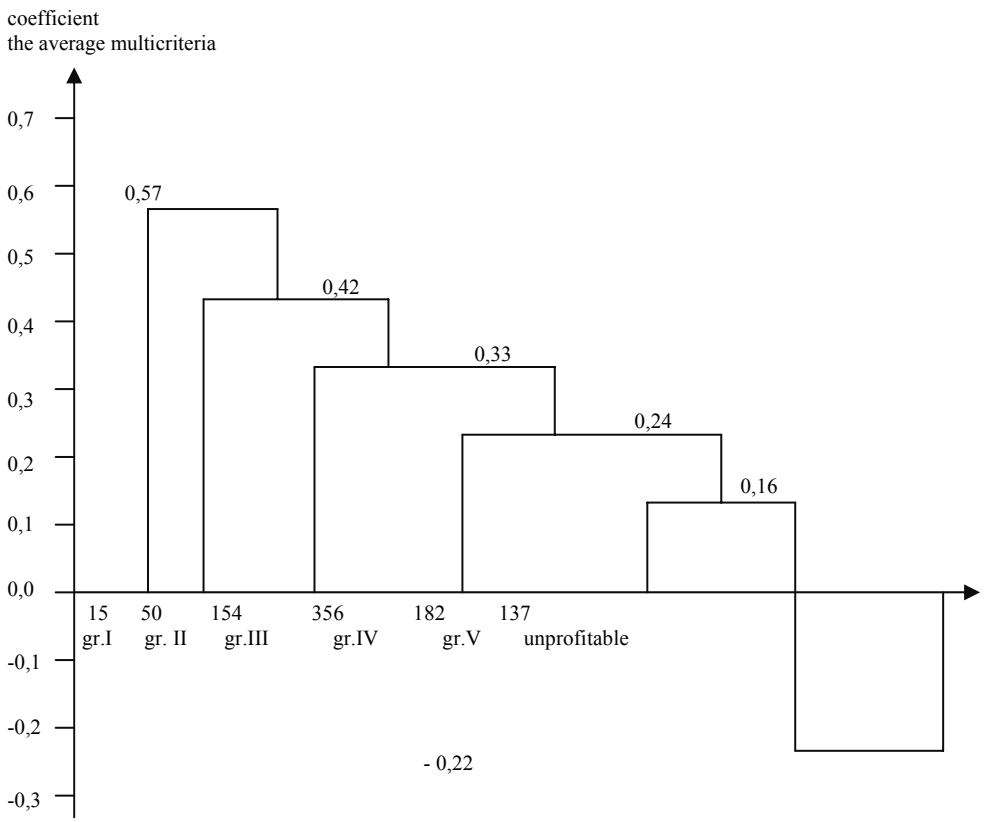


Fig. 3. Diagram vertical distance agribusinesses to leading enterprises groups

Source: Calculated by the author on the initial data base from agricultural enterprises.

Figure 3 shows that individual indices depending on concrete indicators are at different distances relative to the optimal level, and group V relative deviation is 0.41 lower than in Group I. According to the results obtained in the first group with membership from 15 companies poducției indicators of overall economic efficiency are the highest. For example, Ltd. "Codru ST" r. Strășeni, ordering 984 hectares of agricultural land, a herd of workers and average annual value of fixed assets 146 persons for agricultural production of 7.041 million lei, with the potential for high yields Resources obtained revenues of 9.944 million lei, gross profit amounted to 5.981 million lei, and the level of profitability of 113.25%, which allowed him to be ranked first in the hierarchy of the 894 businesses surveyed competitive.

Table 1.Grouping of the agricultural enterprises in Moldova after the average coefficient of efficiency economical multi-criteria global agricultural production (relative to the optimal level)

Groups of undertakings after multicriterial average coefficient of economic efficiency of global agricultural production (optimal frontier)	The number of enterprises	This weighted average multi-criteria of economic efficiency of global agricultural produției	Global agricultural production value, calculated in lei:				Profit from sale of agricultural production, lei calculated at:		Level of profitability,%
			1 ha of agricultural land	1 average annual worker	1 leu value of fixed assets	1 leu production costs	1 ha of agricultural land	1 leu production costs	
Rentabile									
I. 0,51 and more (leaders)	15	0,57	5235,6	40828,0	0,92	1,08	3239,0	0,67	74,8
II. 0,41 – 0,50 (business outlook)	50	0,42	4524,3	32277,2	0,91	1,15	1638,3	0,42	53,4
III. 0,31 – 0,40 (the average level of efficiency)	154	0,33	3907,2	32244,2	1,34	1,02	965,7	0,25	29,3
IV. 0,21 – 0,30 (moderate efficiency)	356	0,24	3101,9	25937,0	0,81	0,89	477,1	0,14	16,7
V. mai puțin de 0,2 (low efficiency)	182	0,16	2184,9	16156,3	0,44	0,82	150,9	0,06	6,61
Total average cost on businesses	757	0,25	3212,5	25905,3	0,82	0,93	624,4	0,18	21,7
Unprofitable									
I. 0,41 and more	33	0,42	2112,4	28765,8	2,36	0,89	-42,4	-0,02	-1,63
II. 0,21 – 0,40	92	0,24	2143,2	18158,1	0,58	0,80	-206,5	-0,08	-8,7
III. 0,2 and less	12	0,15	1065,7	10006,8	0,88	0,70	-318,5	-0,21	-21,8
Total, on average unprofitable businesses	137	0,22	1815,2	16217	0,67	0,78	-229,4	-0,10	-10,9
TOTAL	894	X	3045,3	24846,6	0,81	0,92	522,2	0,16	18,7

Source: calculated by the author.

Businesses of I degree have a high competitive potential and their competitive abilities leading agricultural enterprises are defined in Table 1. It should be mentioned that these companies are leaders in Moldova and own performance and very high level of competitiveness.

The research results allow us to demonstrate the advantages of the proposed methodology for calculating the synthetic indicator (full) efficiency used along with traditional indicators of competitive economy, which are:

- This methodology is based on complex multi-criteria assessment approach complex system of economic efficiency of production;
- Multi-criteria assessment is based on the weighted average method of comparison and take into account the actual results of all businesses;
- Estimate is made based on public data of specialized forms of enterprises surveyed, which are used in traditional practice of assessment of effectiveness;
- Does not restrict the number of indicators years, businesses etc.
- Corresponds to the existing practice of competitive economy, where each producer aims to surpass its competitors in all positions (indicators) that characterizes the competitiveness and economic efficiency of production.
- Between economic efficiency indicators calculated in the hierarchy of competitive businesses there is a reciprocal link, are harmonized, have an increase (decrease) consecutive and are comparable.
- Estimate the full economic efficiency enables to identify the location of all agricultural units after the economic efficiency in the hierarchy studied compared with optimal frontier (benchmark).
- Dividing the group gives opportunity to highlight the types of units: leaders, business outlook, with the average level of efficiency, with moderate efficiency, low efficiency, unprofitable and place each undertaking within the group.
- Give the opportunity to identify the results according to the factors highlighted by types of businesses.
- Gives opportunity to identify funds for increasing economic efficiency compared to optimal levels and levels compared with previous groups.
- Comparability of indicators is kept whole, because they are standardized optimal frontier level (standard).
- Is a reliable method for measuring the increase in business competitiveness and production efficiency.

Conclusion

- Agriculture in Moldova is characterized by low efficiency and does not create conditions for extended reproduction. Agriculture in Moldova is characterized by low efficiency and does not create conditions for extended reproduction.
- Number of enterprises in the first and second groups (leaders and perspective) is only 65 units (9.0%), from Gk. III - 154 (20.0%) and of the groups IV and V taken together - 538 (71.0%). The situation became possible primarily because of lack and inefficient use of resources potential, competitive level low priority growth to increased costs of selling prices of agricultural products, insufficient state subsidies, reduced implementation of

technical progress and fertilizers etc. This means that within the agricultural sector is a process of differentiation.

- In reality, we believe that it creates four types of agricultural economics, which are dispersed and poorly linked:
  - *a progressive economy* - a small number of enterprises (9.0%), stable working and practicing a breeding enlarged;
  - *a balanced economy* - some 20% of businesses have extended breeding with fewer opportunities;
  - *a weak economy* - a considerable number of companies (about 71%) is operating profit, but provides a simple reproduction;
  - *a stagnant economy* - profitable enterprises with weak material base, where the debts exceed the value of assets and provides a breeding regressive.

Bibliography

Charnes A., Cooper W.W., Rhodes E. [1978]: Measuring the Efficiency of Decision Making Units, European Journal of Operational Research, 2, 429-444.

Farrell M.J. [1957]: The measurement of productive efficiency, Jornal of the Royal Statistical Society, series A, 120, 253-281.

Лисситса А., Вабичева Т. [2003]: Анализ оболочки данных (DEA) – Современная методика определении эффективности производства. Discussion Paper No. 50.

Лисситса А., Оденинг М., Бабичева Т. [2003]: Анализ эффективности и продуктивности предприятии. Discussion Paper No. 51.

Зинченко А.П. [2007]: Практикум по статистике. М.: «Ко лос-С», 342.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 204-214

Miroslaw Wasilewski[1]
Department of Economics and Organization of Enterprises,
Warsaw University of Life Sciences
Olena Oliynyk[2]
Department of Banking,
National University of Life and Environmental Sciences of Ukraine
Viktor Adamenko[3]
Department of Economy and Finance Company,
Kyiv National University of Trade and Economics

Financial System and Agricultural Growth: Evidence from Poland and Ukraine

Abstract. We built simplified models of integral indicators for the level of development of the financial system and for agricultural growth using the principles of "moderate middle way". We then used these models to compare the levels of financial system development, economic and agricultural growth, and trends of financial development and agricultural growth, in Poland and Ukraine. We used the integral indicators and econometric methodologies to assess the relationship between financial development and agricultural growth in both countries. The results of the study revealed the absence of a statistical relationship between integral indicators of financial system development and agricultural growth in Poland and Ukraine. We can ascertain the presence of arguments regarding the existence of the impact of the banking component of the financial system on agriculture in these countries. The regression models showed significant directly proportional relationships between certain aspects of agriculture and some components of the banking sector (resources and effectiveness).

Key words: financial system, agricultural growth, integral indicator of agricultural growth, integral indicator of financial system development, Ukraine, Poland

Introduction

The link between financial development and economic growth has been explored seriously by scholars only in the last 10-15 years. Some contributions investigating the finance-growth nexus are theoretically oriented, while others have an empirical focus.

The first attempt to define the relationship between financial development and economic growth was made by Goldsmith in 1969. Using cross-country data, Goldsmith found evidence of a positive trend in the ratio of financial institution assets to GDP for 35 countries from 1860-1963 [Goldsmith 1969]. Later, many authors extended this line of inquiry and confirmed Goldsmith's findings. They have provided additional information on the finance-growth nexus and have offered a much bolder assessment: firm-level, industry-level, and cross-country studies. Cross-country studies suggest that the level of financial development exerts a positive effect on economic growth [Beck et al. 2000; Levine et al 1998; Levine 2002; Rajan 2003].

[1] Professor , Doctor habilitated, e-mail: miroslaw_wasilewski@sggw.pl
[2] Associate professor, Doctor habilitated, e-mail: olenaooliynyk@gmail.com
[3] Assistant of professor, e-mail: v_adamenko@ukr.net

The existing literature on the finance-growth nexus uses three approaches: cross sectional analysis, a time-series approach, and panel data methods (a combination of both techniques). Each of these approaches has made useful contributions to the investigation of the relationship between finance and growth. However, Schmidt emphasized [Schmidt et al 2006] that all approaches suffer from some important limitations which do not allow us to take all results at face value. The general problem of all empirical studies is that, to examine the relationship between financial development and growth, one has to define appropriate measures of financial development. Researchers come up with various definitions and measures. Some studies use the size of the banking sector typically measured by the deposit liabilities to GDP or bank claims on the private sector to GDP. Others use the size of the stock markets, defined as market capitalization to GDP or total value of domestic equities traded on the stock exchanges to GDP. However, these measures have been criticized by some [Schmidt et al 2006].

In our opinion, the best option for solving methodological problems of evaluation of the finance-growth nexus is compliance with the concept of "moderate middle way", which includes[1]:

- using publicly available statistical data – quantitative objective indicators calculated using generally accepted methods and openly published on the Internet;
- maximum avoidance of subjective assessments and indicators that are characterized by uncertainty regarding the methods of collection or calculation;
- using mathematical approaches of the average level of complexity and using average dimension data sets. However, data sets must be sufficient to identify the main statistical regularities on the basis of regression analysis;
- visualization of assessment results.

In this paper, we build simplified models of integral indicators of the level of financial system development and agricultural growth by using the principles of "moderate middle way". We use the simplified models of integral indicators to compare the level of financial system development, economic and agricultural growth and trends of financial development and agricultural growth in Poland and Ukraine. Finally, we use the integral indicator and econometric methodologies to assess the relationship between financial development and agricultural growth in both countries.

Methodology and Data

We suggest using the principles of "moderate middle way", as mentioned above, to build a simplified model of integral indicators of level development, which is associated with generalization of three types of indicators: 1) scale (extent of development); 2) resources; 3) efficiency. The composition of these indicators is illustrated in Table 1.

We divide the financial system into two components – the banking sector and financial markets. We propose to call the model of the integral indicator of the relative level of financial system development as «3+3» [2].

[1] A more detailed explanation of the concept of "moderate middle way" is found in Wasilewski et al [2015].
[2] A more detailed explanation of the model “3+3” found in Oliynyk et al [2015].

Table 1. The indicators of the simplified model of the integral indicator

The integral indicator	Components of integral indicator		
	Scale (extent of development)	Resources	Efficiency
1. Financial system development:			
banking sector	Commercial bank branches (per 100,000 adults)	Deposit liabilities (% of GDP)	Domestic credit to private sector by banks (% of GDP)
financial markets	Listed domestic companies (per 1,000,000 adults)	Market capitalization of listed companies (% of GDP)	Stocks traded, total value (% of GDP)
2. Economic growth	Employment to population ratio, 15+, total (%) (modeled ILO estimate)	Gross capital formation (% of GDP)	GDP per capita (current US$)
3. Agricultural growth	Arable land (hectares per person)	Agriculture, value added (% of GDP)	Agriculture value added per worker (constant 2005 US$)

Source: authors' analyses based on data [World Bank 2015a, 2015b].

We offer to consider the significance of each indicator as being equal. This allows us to avoid result distortion, which is associated with subjective judgments, regarding the ranking of each indicator.

The integral indicator of level development is calculated as an area of a geometric figure (triangle is for economic and agricultural growth, hexagon – for financial system), with the tops in a coordinate system of 3 or 6 axes. Each axis corresponds to one of the indicators listed in Table 1. On each of the three or six axes, we plot the relative values, which are defined as a share of the maximum (or reference) value of the indicator.

The integral indicator of the financial system development level as an area of the hexagon can be calculated by the formula:

$$II_{FS} = \frac{1}{2} \times \left[(I_1 \times I_2) + (I_2 \times I_3) + ... + (I_6 \times I_1) \right] \times \sin 60^\circ, \quad (1)$$

where II_{FS} – the integral indicator of the financial system development level;

$I_1, I_2, ...I_6$ – relative values of indicators used in the model "3 + 3" (6 indicators): I_1, I_2, I_3 – relative values of banking sector indicators, I_4, I_5, I_6 – relative values of the financial market indicators (see Table 1).

The integral indicator of the economic growth level as an area of the triangle can be calculated by the formula:

$$II_{EG} = \frac{1}{2} \times \left[(I_1 \times I_2) + (I_2 \times I_3) + (I_3 \times I_1) \right] \times \sin 120^\circ, \quad (2)$$

where II_{EG} – the integral indicator of the economic growth level;

I_1, I_2, I_3 – relative values of indicators of scale, resources and efficiency.

The integral indicator of agricultural growth, as well as the integral indicator of the economic growth level, is calculated by Formula 2, using three indicators according to Table 1.

The integral indicator describes the relative development level and it cannot be calculated only for one country for one year without comparison with another country or establishing reference values or time-series data[1].

Results

If the level of the financial system significantly affects the agricultural growth, then, obviously, we should observe a significant statistical relationship between the relevant integral indicators. Nevertheless, the conducted research has revealed that the relationships between the integral indicators of the financial system and agriculture in Poland and Ukraine for 2004-2012 are not observed (see Fig. 1).

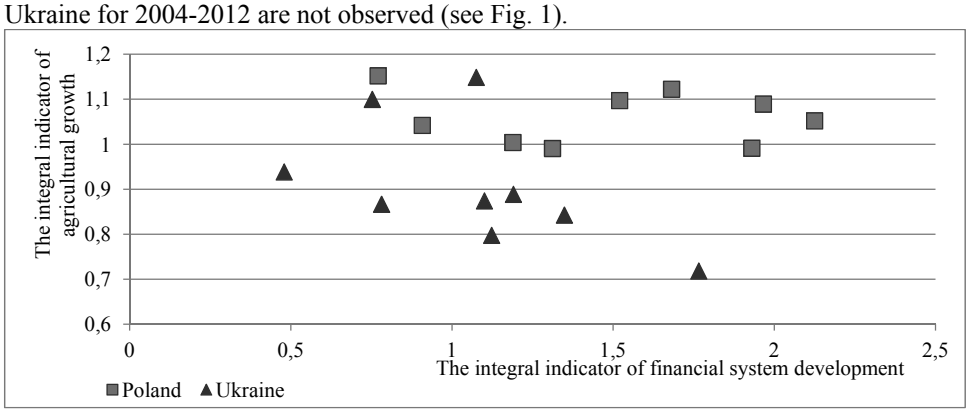


Fig. 1. The interdependence between the integral indicators of financial system development and agricultural growth in Poland and Ukraine, 2004 – 2012

Source: authors' calculations based on data [World Bank 2015a, 2015b; ECB 2015, NBU 2015].

Consistent statistical patterns between integral indicators of financial system development and agricultural growth are absent, but a strong relationship between the integral indicator of financial system development and economic growth is present. In this case, we can assume that agriculture should be viewed as one of those industries, for which the complex impact of the financial system does not have significant value. We may apply this assumption to Poland's agriculture, which developed steadily in 2004 - 2012, despite substantial transformational processes and crisis phenomena that occurred in the financial system, as well as significant changes in economic development (Fig. 2).

[1] A more detailed explanation of the concept of "moderate middle way" is found in Wasilewski et al (2015).

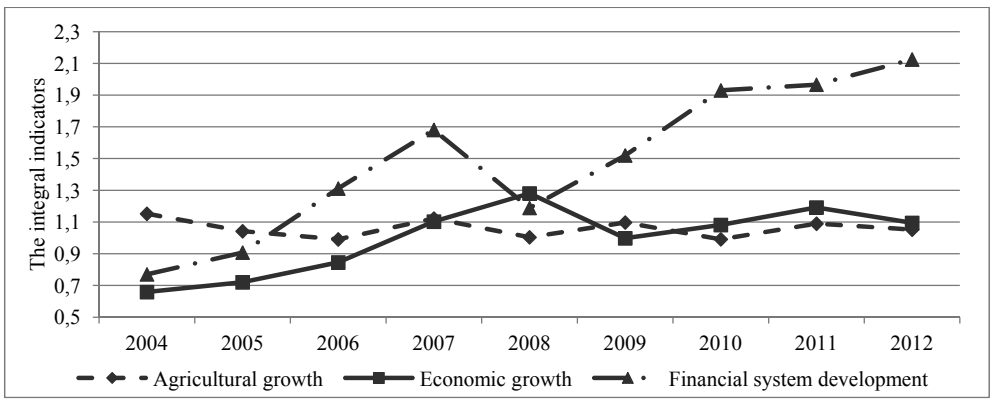


Fig. 2. The trend of integral indicators of financial system development, economic and agricultural growth in Poland, 2004 – 2012

Source: authors' calculations based on data [World Bank 2015a, 2015b; ECB 2015].

Poland's integral indicator of economic growth dynamics significantly differed from agriculture and was connected with the financial system development. Substantial correlation between the integral indicator of financial system development and the economic growth indicator is illustrated by the regression model (Fig. 3).

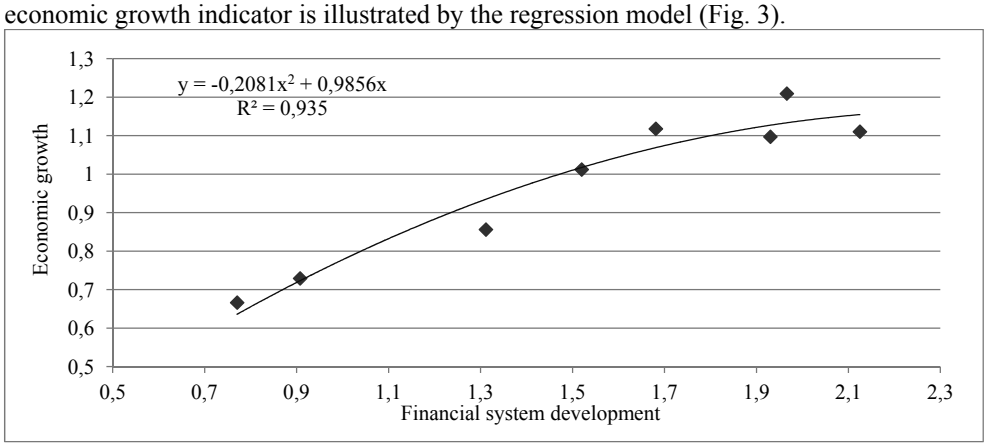


Fig. 3. The regression model describing the interdependence between integral indicators of financial system development and economic growth in Poland, 2004 – 2012 (data of 2008 is excluded)

Source: authors' calculations based on data [World Bank 2015b; ECB 2015].

The situation in Ukraine is slightly different from Poland. However, it is reasonable to assume that the complex influence of financial system development on agriculture is not substantial. This statement is based on the fact that relatively stable development of agriculture took place within a turbulent financial system and economic development processes in the background (Fig. 4).

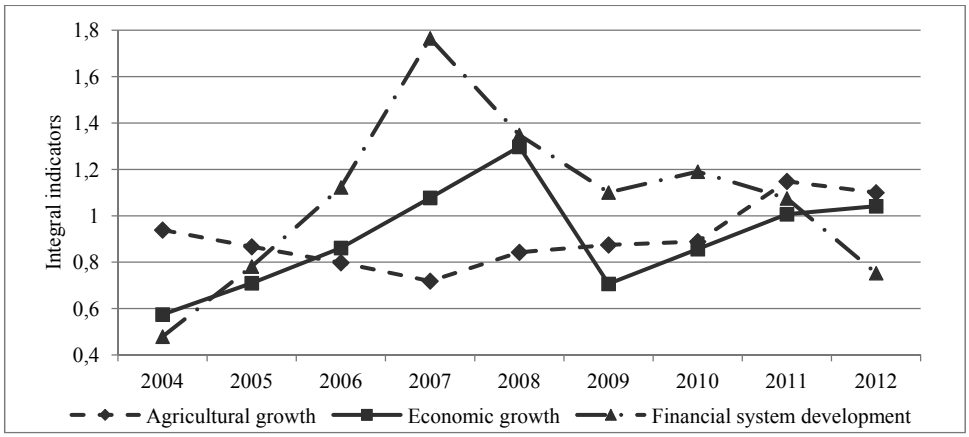


Fig. 4. The trend of integral indicators of financial system development, economic and agricultural growth in Ukraine, 2004 – 2012

Source: authors' calculations based on data [World Bank 2015a, 2015b; NBU 2015].

The study reveals a strong statistical relationship between the integral indicator of financial system development (taken with 1 year in advance) and the integral indicator of economic growth of Ukraine (Fig. 5), despite the fact that any similar interdependencies with the integral indicator of agricultural growth were not observed (Fig. 6).

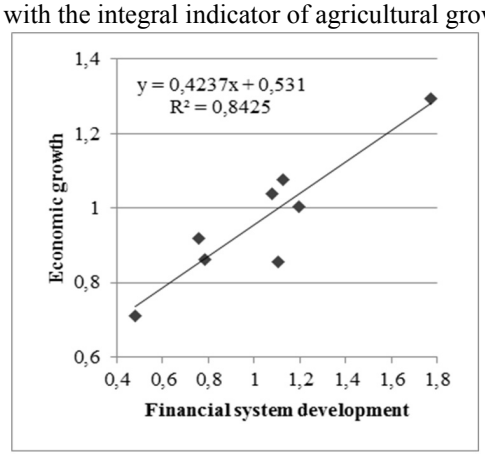


Fig. 5. The regression model describing the interdependence between integral indicators of financial system development (for the previous year) and economic growth in Ukraine (the values of integral indicators of the financial system development are for 2004-2011, data of 2008 is excluded; the values of integral indicators of economic growth are for 2005-2012, data of 2009 is excluded).

Source: authors' calculations based on data [World Bank 2015b; NBU 2015].

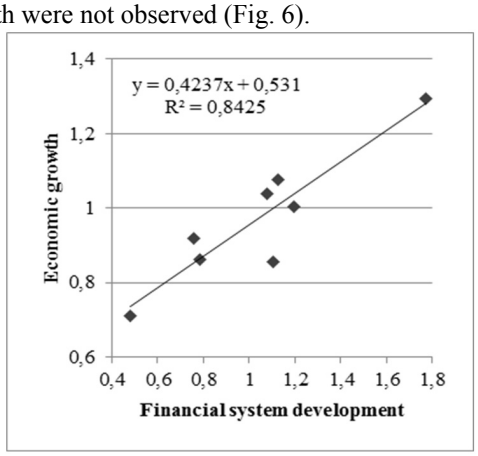


Fig. 6. The regression model describing the interdependence between integral indicators of financial system development (for the previous year) and agricultural growth in Ukraine (the values of integral indicators of financial system development are for 2004-2011; the values of integral indicators of agricultural growth are for 2005-2012).

Source: authors' calculations based on data [World Bank 2015a, 2015b; NBU 2015].

Although an absence of the complex influence of financial system development on agricultural growth was observed in Poland and Ukraine during the studied period (according to the integral indicators analysis), this does not give any reasons to conclude that the development of the financial system does not influence the development of agriculture in these countries. Important relations may exist between indicators characterizing separate aspects of the financial system and agricultural growth.

Taking into consideration only the development of the banking component of the financial system as being the most significant one (as many researchers assume) for small and medium agricultural producers, and analyzing the correlation between its integral indicator and separate indicators of agricultural growth, we can identify certain statistical dependencies (Table 2).

Most notably, in Table 2 we can observe that: in the case of Poland, there is a strong positive correlation between the development of the banking component of the financial system and value added per worker in agriculture (in constant 2005 US $); in the case of Ukraine, there is a strong negative correlation between the development of the banking component of the financial system and value added in agriculture (% of GDP). Regression models (Fig. 7 and Fig. 8) illustrate the identified dependencies.

Table 2. Correlation coefficients between the integral indicator of the banking component of the financial system and separate indicators of agricultural growth in Poland and Ukraine, 2004-2012

The indicator of agricultural growth	Correlation coefficients with integral indicator of the banking component of financial system	
	Poland	Ukraine
Arable land (hectares per person)	-0.817	0.583
Agriculture, value added (% of GDP)	-0.377	**-0.899**
Agriculture value added per worker (constant 2005 US$)	**0.914**	0.310

Source: authors' calculations based on data [World Bank 2015a, 2015b; ECB 2015; NBU 2015].

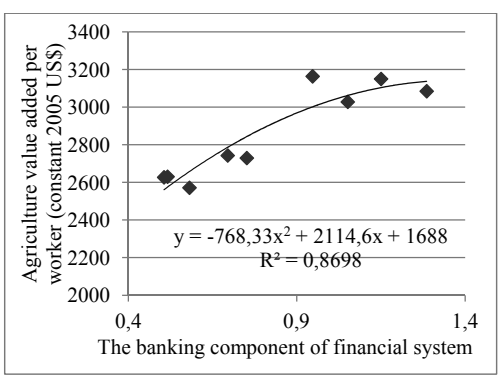


Fig. 7. Regression model that describes the relationship between the integral indicator of banking component of financial system and agriculture value added per worker (constant 2005 US$) in Poland, 2004 – 2012.

Source: authors' calculations based on data [World Bank 2015a, 2015b; ECB 2015].

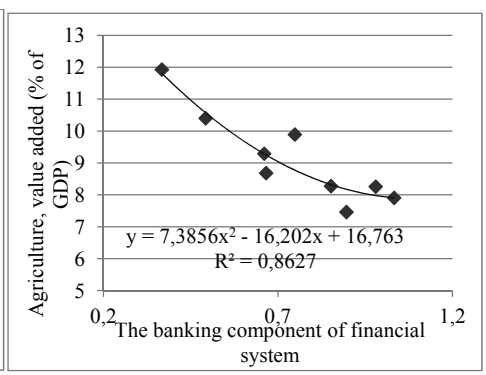


Fig. 8. Regression model that describes the relationship between the integral indicator of banking component of financial system and agriculture, value added (% of GDP) in Ukraine 2004 – 2012.

Source: authors' calculations based on data [World Bank 2015a, 2015b; NBU 2015].

The regression model in Fig. 7 confirms the significance of the banking component for the efficiency of the agricultural sector in Poland. The explanation to this may be the existence of significant demand for bank loans among small and medium-sized agricultural producers, due to relative scarcity of agricultural subsidies (compared with other EU countries). For example, in Germany, where the amount of subsidies per 1 hectare of land is several times higher than in Poland, such dependence was not observed – the coefficient of correlation between the integral indicator of banking component development and value added per worker in agriculture was 0.216.

We observe even tighter correlation (R^2=0.908) in the case of building multiple linear regression models with the dependent variable (Y) being value added per worker in agriculture (constant 2005 US $), and independent ones representing the resource base and the efficiency of the banking sector in Poland:

$$Y = 27{,}317\ X_1 + 12{,}386\ X_2 + 1208{,}5 \tag{3}$$

where X_1 – Deposit liabilities (% of GDP);
X_2 – Domestic credit to private sector by banks (% of GDP).

In the case of Ukraine, the relationship between the development of the banking component of the financial system and value added per worker in agriculture is very weak in comparison to Poland. This fact, combined with the existence of inverse relationship between the development of the banking component of the financial system and value added in agriculture, can be evidence to the following. Firstly, in Ukraine and Poland the importance of the financial system for agriculture is fundamentally different, and secondly, agriculture in Ukraine should be viewed as one of those industries for which the complex influence of the banking component of the financial system development is insignificant or negative.

To confirm this preliminary conclusion about Ukraine we attempted to check two hypotheses based on statistical data of the National Bank of Ukraine.

The first hypothesis: the presence of the above-mentioned inverse correlation is the result of the fact that the development of Ukrainian agriculture is less dependent on bank credit compared to other sectors of the economy. According to this hypothesis, the development of the banking component in Ukraine has to lead to increase in value added of more credit-dependent sectors as a share of GDP with the decrease in the share of agriculture, which is a less credit-dependent branch of the economy.

According to the analysis, this hypothesis is not confirmed. In the result, comparison of the lending and economic activity volume dynamics at current prices revealed that the volume of agricultural production is more sensitive to changes in lending than to the activity of other industries and the economy as a whole (Table 3).

Table 3. Simple linear regression model parameters describing the relationship between the volume of lending and the volume of economic activity at current prices in Ukraine in 2004-2012 p.

Industry	The indicator of the economic activity	Parameters		R-squared values
		slope coefficient	constant	
Agriculture	Gross output	5.6442	42.406	0.8706
Trade	Retail turnover	1.5855	32.274	0.9484
Economy as a whole	GDP	1.209	279.2	0.8966

Source: authors' calculations based on data [World Bank 2015a, 2015b; NBU 2015].

Particularly in trade, which during the period of the study was the driver of economic growth in Ukraine, the UAH 1 increase in lending was accompanied by UAH 1.59 growth in retail turnover on average, while in agriculture – by UAH 5.64 growth in gross output. When comparing agriculture to the economy as a whole, it is possible to identify a 4.7 times excess sensitivity of this branch to changes in lending. It is observed that the gross output of agriculture increases exponentially in the case of bank lending growth in this sector and nominal GDP growth becomes slower if bank lending volumes in economy decrease (Fig. 9, Fig. 10). Similarly, slowdown can be seen in the retail trade turnover in the case of shrinking volumes of trade sector crediting.

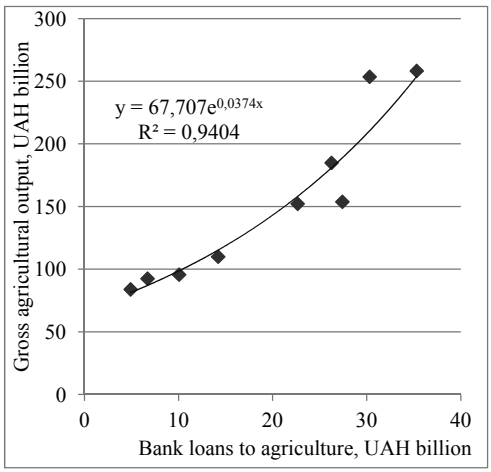


Fig. 9. Regression model that describes the relationship between the volume of bank loans to agriculture and the gross agricultural output in Ukraine, 2004 - 2012 (at current prices).

Source: authors' calculations based on data [World Bank 2015a; NBU 2015].

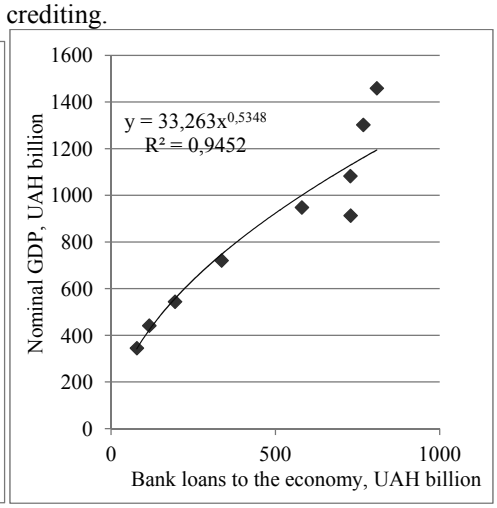


Fig. 10. Regression model that describes the relationship between the volume of bank loans to the economy and nominal GDP in Ukraine, 2004 - 2012 (at current prices).

Source: authors' calculations based on data [NBU 2015].

Revealed patterns not only deny the first hypothesis, but also illustrate the importance of bank financing for the development of Ukrainian agriculture, since it is of even higher significance than for most other sectors and for the economy as a whole.

The second hypothesis: the existence of an inversely proportional relationship between the development of the banking component of the financial system and value added in agriculture (% of GDP) in Ukraine is connected with the fact that the indicator that characterizes the performance of the banking sector – domestic credit to private sector by banks (% of GDP) – has inadequate dynamics if the bank loan elasticity to GDP is greater than one. In this case, the banking sector development, accompanied by growth in lending to the real sector, leads to relatively higher GDP growth. As a result, the domestic credit lent to the private sector by banks (% of GDP) is decreased.

The analysis of interdependence between the volume of bank credits at current prices and nominal GDP in Ukraine for the period from 2004 till 2012 provides an argument in favor of the second hypothesis – an increase in lending is accompanied by relatively higher GDP growth (as shown in Table 3, the UAH 1 increase in lending is accompanied by an

average UAH 1.2 GDP growth). Thus, the existence of an inversely proportional relationship between the integral indicator of the banking component of the financial system and agriculture, value added (% of GDP) in Ukraine is not evidence of a negative financial system development impact on agriculture.

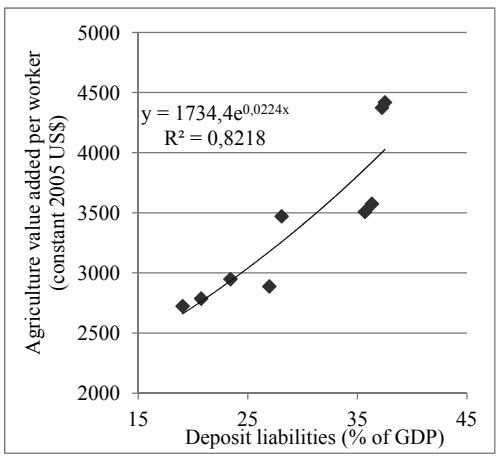


Fig. 11. Regression model that describes the relationship between deposit liabilities (% of GDP) and agriculture value added per worker (constant 2005 US$) in Ukraine, 2004 - 2012.

Source: authors' calculations based on data [World Bank 2015a; NBU 2015].

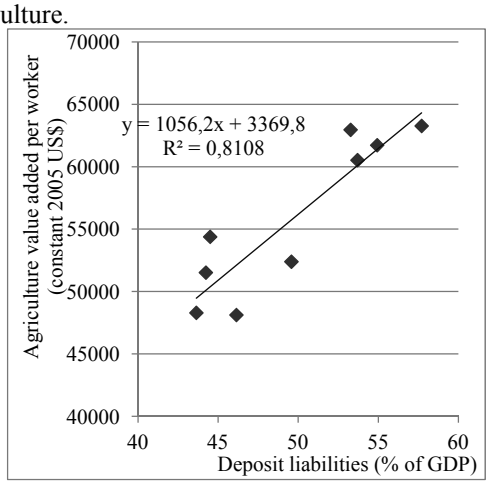


Fig. 12. Regression model that describes the relationship between deposit liabilities (% of GDP) and agriculture value added per worker (constant 2005 US$) in USA, 2004 - 2012.

Source: authors' calculations based on data [World Bank 2015a; FRS 2015].

The importance of financial system development (particularly its banking component) for agriculture of Ukraine is confirmed by a regression model that describes the relationship between deposit liabilities (% of GDP) and value added per worker in agriculture (constant 2005 US $) (Fig. 11) This model, unlike the case of Poland (Fig. 7), provides an exponential growth rate of value added per worker in agriculture, which may indicate the existence of substantial potential for productivity increase in agriculture, which can be reached with stimulation of financial system development through increase of its resource base. It should be noted that the positive relationship between deposit liabilities (% of GDP) and value added per worker in agriculture (constant 2005 US $) for the period from 2004 to 2012 was observed also in the US (Fig. 12) and in many other countries with developed agriculture.

The market component of the financial system, unlike the banking component, is characterized by an absence of significant statistical dependence between certain aspects of agricultural growth, taking into consideration the integral indicator as well as its separate components, in Poland and Ukraine.

Conclusions

This study provided that the financial system has positive impact on development in Poland and Ukraine, despite the lack of significant statistical dependency between the

relevant integral indicators in these countries. We proved that the banking component of the financial system has a significant impact on agricultural growth, as evidenced by regression models built on the basis of effectiveness and resource base indicators.

We found that the indicator "domestic credit to private sector by banks (% of GDP)", which was used to characterize the performance of the banking sector as part of the integral indicator of financial system development, showed specific dynamics in the case of Ukraine. This means that when the number of loans was increased, the level of the indicator decreased over 2004-2012. The reason was a high dependence of the Ukrainian economy on bank lending, which was reflected in the high elasticity of GDP to changes in lending. The specific dynamics of indicator "domestic credit to private sector by banks (% of GDP)" may be considered as one of the reasons for the absence of statistical dependence between the integral indicators of financial system development and agricultural growth. As evidenced by the results of the study, agriculture is much more dependent on bank lending than the vast majority of other branches of the economy.

The results indicate the feasibility for further scientific search on the ways to increase the efficiency of agricultural activities in Poland and Ukraine through the creation of conditions for further development of the financial system, especially its banking component.

Literatura

Beck T., Demirguc-kunt A., Levine R. and Maksimovic V. [2000]: Financial Structure and Economic Development: Firm, Industry and Country Evidence. World Bank.

Goldsmith R.W. [1969]: Financial Structure and Development. New Haven, CT: Yale University Press.

Levine R. [2002]: Bank-based or market-based financial systems: which is better? *Working Paper* No 9138. Cambridge, MA: NBER.

Levine R. and Zervos S. [1998]: Stock markets, banks and economic growth. *American Economic Review*.

Oliynyk O., Adamenko V., Oliinyk L. [2015]: The Comparative Analysis of Financial System of Czech Republic, Poland and Ukraine. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. – Upcoming.

Rajan R. and Zingales L. [2003]: Banks and markets: the changing character of European finance. The transformation of the European financial system, eds. In: V. Gaspar, P. Hartmann, O. Sleijpen. European Central Bank, Frankfurt.

Schmidt R. and Hryckiewicz A. [2006]: Financial systems – importance, differences and convergence. Working Paper Series No. 4. Institute for Monetary and Financial Stability, Johann Wolfgang Goethe-Universität, Frankfurt am Main.

The European Central Bank [ECB 2015]: MFI balance sheets. [Available at:] http://sdw.ecb.europa.eu/reports.do?node=1000003159. The European Central Bank, Frankfurt, Germany.

The Federal Reserve System [FRS 2015]: Statistical Releases and Historical Data. [Available at:] http://www.federalreserve.gov/releases/h8/default.htm. The Federal Reserve System, Washington D.C..

The National Bank of Ukraine [NBU 2015]: Bulletin of the National Bank of Ukraine. http://bank.gov.ua/control/en/publish/category?cat_id=66894. The National Bank of Ukraine, Kyiv.

The World Bank [2015a]: World DataBank. Indicators. http://data.worldbank.org/indicator. The World Bank, Washington DC.

The World Bank [2015b]: World Development Indicators. [Available at:] http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=world-development-indicators#. The World Bank, Washington DC.

Wasilewski M., Oliynyk O., Adamenko V. [2015]: Financial system and economic growth: evidence of Poland and Ukraine. *Scientific Papers of the University of Szczecin - Finance, Financial Markets, Insurance*. – Upcoming.

Scientific Journal Warsaw University of Life Sciences – SGGW
Problems of World Agriculture volume 15 (XXX), number 4, 2015: 215–222

Izabela Wielewska[1]
University of Technology and Life Sciences in Bydgoszcz
Dagmara K. Zuzek[2]
University of Agriculture in Kraków

Environmental Awareness of Rural Population in the Light of the Authors' Research

Abstract. High regard for the natural environment is a value which is widely accepted and declared by Polish society. However, this positive attitude toward nature does not fully correspond with actual choices of environmental values and environmentally friendly consumer behavior.
This article is an attempt to determine the environmental awareness of inhabitants of rural areas of the Chojniki powiat (county) located in the Pomeranian Voivodeship. The study was conducted in the second quarter of 2014 using the diagnostic poll method, which included 224 rural inhabitants. The study shows that only a small percentage of inhabitants of rural areas make the type of environmentally-friendly choices in their everyday lives which would make them environmentally conscious consumers.

Key words: environmental awareness, rural areas, sustainable development, Poland

Introduction

Increasing technical and technological progress as well as more intensive production resulting from a growing population may contribute to excessive use of natural resources. The phenomenon of rarity, stemming from a limited amount of such resources, is the most visible in developed countries. Therefore, it is of the essence to develop environmental awareness, which leads to thoughtful shopping decisions and everyday behaviors in keeping with requirements of environmental protection (saving water and electricity, waste sorting and recycling, etc.).

The aim of this study was to analyse the level of environmental awareness among inhabitants of rural areas. The research assumption was that people's environmental awareness is expressed not only in their level of environmental knowledge and imagination, but also in their value systems. Values play the role of criteria in the choice of social goals, they are a standard of an individual's integration with society, and they differentiate the social sphere of human personality.

The study, conducted in 2014, used the diagnostic poll method. As T. Pilch writes, this method is used for gathering data on characteristic features of a given community, both its structural and functional aspects. It also serves to diagnose opinions, attitudes, views, and the dynamics of the direction of change of social phenomena, which due to their non-institutionalised character can be examined on the basis of a targeted representative sample of a given population [Pilch 1998]. The poll was conducted with the participation of 224 randomly selected inhabitants of the rural areas of the Chojnicki *powiat* (county). The basis of the research method was a survey using a structured questionnaire. The results are

[1]PhD, e-mail: izabel2000@wp.pl
[2] PhD, e-mail: dagzuz@gmail.com

broken down by men (99) and women (125). The obtained data underwent a statistical analysis. A Microsoft Excel spreadsheet was used to prepare the calculations.

The concept of environmental awareness

Environmental awareness refers to the ideas, values, and opinions about the environment as a place in man's life and development, common for certain social groups during a historical period. It can also refer to the state of people's knowledge, opinions, and notions about the role of the environment in human life, including the state of knowledge about methods and tools for the management of using, protecting, and shaping the environment [Zarządzanie środowiskiem… 2007].

People develop their environmental awareness under the influence of commonly accepted social norms, information in the mass media, and various forms of environmental education. It is also dependent on the conditions in which economic entities function. Therefore, in protected areas, due to their specific conditions, environmental awareness will be higher and will usually develop under the influence of personal experiences which result from functioning in such a specific territory.

Z. Hull, defining the concept of environmental awareness, gave it two dimensions: individual and collective. In the individual dimension, the term referred to experiencing ways of thinking about the natural environment by individuals, whereas in the collective dimension, it referred to standards of understanding, experiencing, and evaluating the biosphere. Environmental awareness is, according to him, "a form of social awareness manifesting itself both in the thinking and experiences of individuals and in standards of understanding, experiencing, and evaluating the biosphere which function in society" [Hull 1984].

Environmental awareness is also developed under the influence of instruments of social interaction used by the state, which can be divided into formal and informal instruments. The former involve legal regulations, where environmental education, access to information about the environment, and lobbying in legislative organs play a special role [Zarządzanie środowiskiem… 2007].

Informal instruments include, among others, informal environmental education (such as conversations in informal groups of stakeholders), informational activities (such as publishing educational materials, organising exhibitions, seminars, and mass campaigns promoting environmental protection), social pressure (paying attention to aspects connected to the protection of and danger to the environment), or social services (such as information centres) [Zarządzanie środowiskiem…, 2007].

Another dimension of environmental awareness is the awareness of dangers which can threaten the environment as a result of its misuse. As P. Gliński notes, it is an indicator of environmental values and includes:

1. intuitive beliefs about environmental risks or a negative impact of such risks on man's needs (the most common type of awareness),
2. knowledge of mechanisms of risk, processes of environmental degradation, and awareness of how the environment (or its elements) impact people,
3. an emotional reaction connected with a stress-inducing and confirmed by research influence of a devastated environment on the mental sphere; and a behavioural level related to pro-environmental activities, both individual and collective [Gliński 1998].

Results and discussion

The basis of building social awareness, including environmental awareness, as an integral part of sustainable development, is knowledge, its accumulation, processing, and application in practice [Hłobił 2010]. This is also the case of inhabitants of rural areas. Table 1 presents issues which are components of education for sustainable development, which in practice should translate into environmental awareness and environmentally-conscious consumer attitudes.

Table 1. Issues of education for sustainable development

Area of sustainable development	Issues
SOCIAL	human rights
	peace and safety
	gender equality
	cultural variety and mutual understanding of cultures
	health, incl. AIDS prevention
	good governing
ENVIRONMENTAL	natural resources
	climate change
	development of agriculture
	sustainable urbanization
	prevention of disasters and alleviation of their effects
ECONOMIC	decreasing the scale of poverty
	responsibility of businesses
	market economy

Source: J. Godlewska, Education for Sustainable Development [in:] Sustainable Development – aspects of the development of local communities, Fundacja Forum Inicjatyw Rozwojowych, Białystok 2009:16-17.

For a common sustainable future, it is of vital importance what kind of environmental awareness is shown by a society and whether it translates into creative behaviors concerning the natural environment and its resources.

The polled inhabitants of rural areas were asked to evaluate the level of their environmental awareness (Fig. 1). The majority of the polled inhabitants of rural areas (73.7%) evaluated the level of environmental awareness as low. It can be deduced that some respondents do not have knowledge of environmental and eco-conscious consumer behaviours, and others are not aware of such knowledge. Only 26.3% of the respondents cannot claim to use environmental knowledge in practice. Interestingly, a slightly higher number of women admit to a lower level of environmental awareness.

Narrowly defined environmental awareness is understood in the categories of knowledge, opinions, and notions about the environment. A broad definition of environmental awareness is understood as a result of "noting and appreciating the significance of the connection between a society's economic activity and the process of environmental devastation and degradation" [Papuziński 2006].

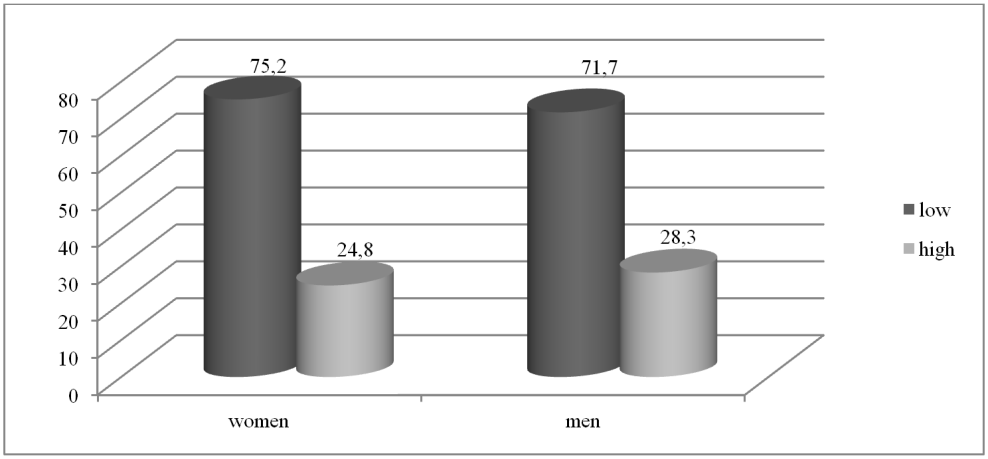


Fig. 1. Evaluation of the level of environmental awareness by respondents [in %]

Source: authors' research

Contemporary environmental problems increasingly focus on man and his activity, as well as the values he represents. This leads to the ability to apply environmental knowledge in practice and to the growth of this awareness.

A practical application of their awareness in everyday life (Fig. 2) is declared by only 32.1% of the respondents (with a slight majority of women). 23.7% of the respondents (with a clear majority of men) admitted to a complete lack of implementation of sensible environmentally-friendly recommendations. Slightly more than 44% of the respondents could not say whether they use their environmental knowledge in everyday life.

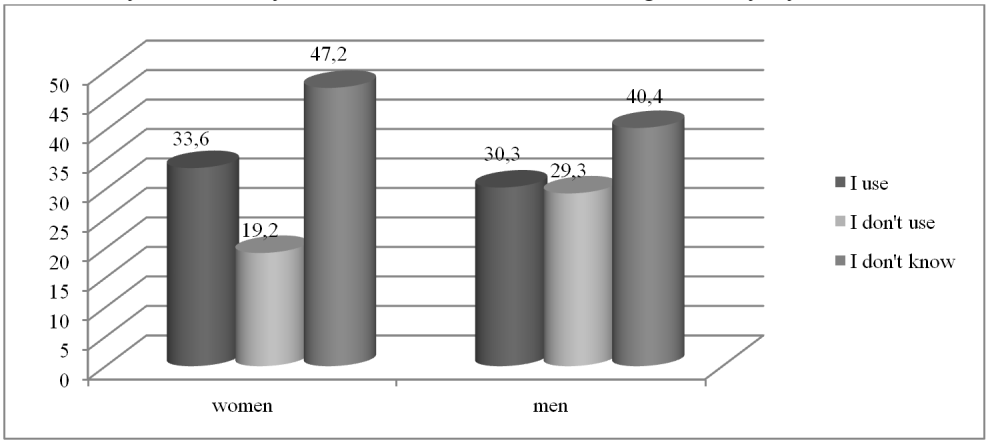


Fig. 2. Practical use of respondents' awareness in everyday life by respondents [in %]

Source: authors' research

Common environmental awareness is developed in everyday life, in economic activity, in education, in generational legacy, etc. It is a complicated social process, usually closely related to the state of the natural environment and the resultant quality of people's life. On the other hand, informal environmental awareness is formed mainly under the influence of heard opinions, views, and stereotypes, which do not constitute a consistent whole. Unfortunately, knowledge, usually partial, and people's own experiences play a much smaller role in building environmental awareness.

Environmental awareness is born in specific circumstances; it is a consequence of man's concern for the quality of human life in the face of progressing environmental degradation, especially such elements of the environment which have a direct impact on man's physical and mental health [Papuziński 2006]. The polled inhabitants of rural areas acquire their environmental knowledge mainly from the media (Fig. 3). Out of the 224 respondents, as many as 107 (47.8%) admitted to this. Some respondents declared that they acquired their knowledge of environmentally-friendly behaviours at school (15.2%), which means that school, which should educate and develop environmentally-friendly attitudes, did not fulfill its educational role. Another source of environmental knowledge is practice and the respondents' own experience (27.2%).

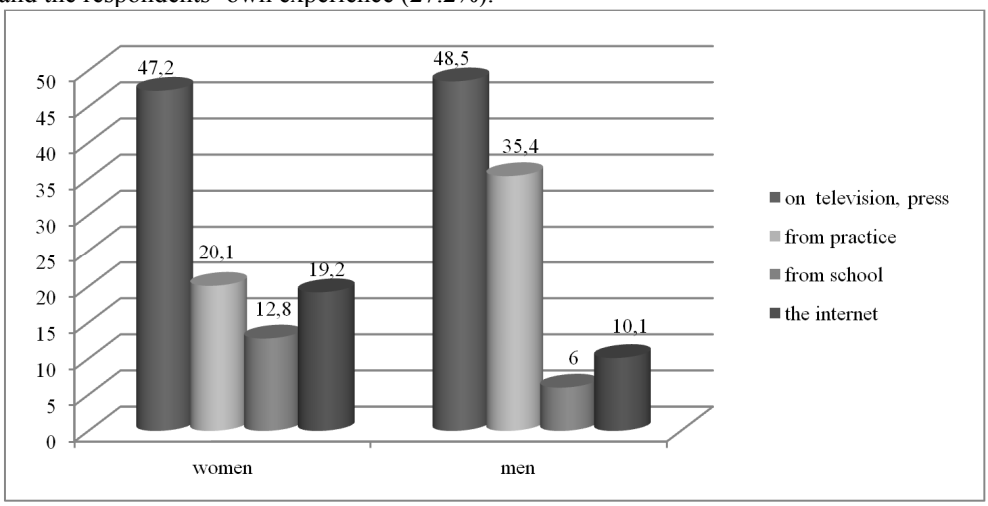


Fig. 3. Sources of ecological knowledge by respondents [in %]

Source: authors' research

Holistic ethics not only impose certain obligations on people with regard to the natural world, but even require sacrifice (concessions) in their favour, similar to interpersonal relations. According to this theory, man should be in a way subordinate to nature and fulfill his obligations towards it [Kryk 2005]. One of such obligations is making wise decisions with regard to shopping.

Slightly more than a half of the polled inhabitants of rural areas have never paid any attention to the type of packaging in order to reuse it. On the other hand, 22% of the respondents always do, with women doing so slightly more often (22.4%). 36.4% of men and 20.8% of women sometimes pay attention to the choice of packaging while making purchases (Fig. 4).

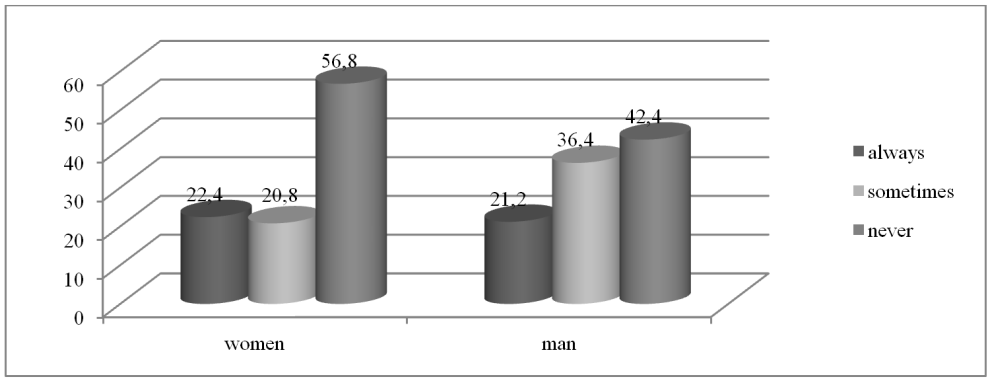


Fig. 4. Paying attention to the type of packaging (possibility of secondary use) while making purchases by respondents [in %]

Source: authors' research

Not all consumers are aware of the importance of packaging choices. The respondents who are aware of the negative impact it can have on the environment chose products in environmentally-friendly packaging more often. They felt that if packaging could be recycled and reused they were contributing to environmental protection.

The polled respondents tried to save water and electricity (Fig. 5), which may stem not only from their concern for the environment but mainly from the fact that these goods constitute the largest expenses in their household budgets. The respondents interested in the subject of environmental protection were considerably more influenced by the energy class of products in their purchases of household appliances and consumer electronics (women – 47.2%, men – 39.4%). Using energy-efficient light bulbs was important to 30.4% of the respondents, with men showing greater interest (28.8%). The issue of water saving was important to only 26.3% of the respondents participating in the study, with 1.9% more women than men.

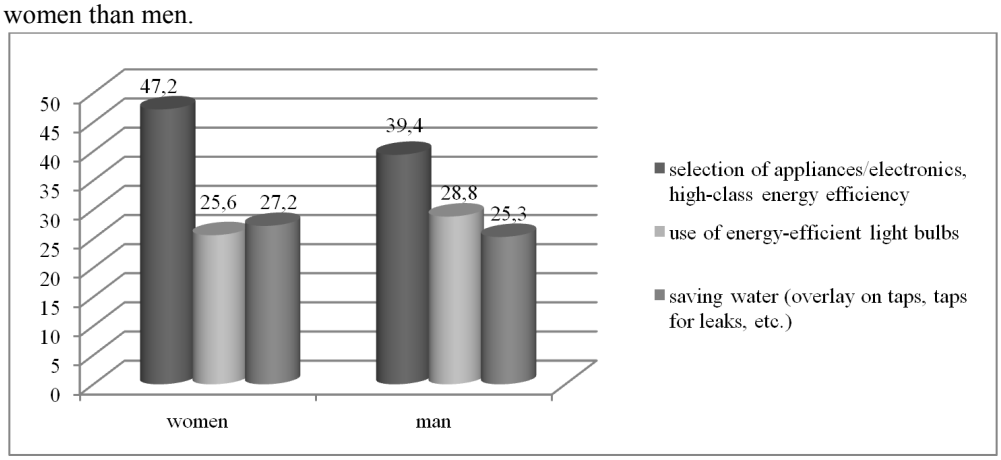


Fig. 5. Saving water and electricity by respondents

Source: authors' research

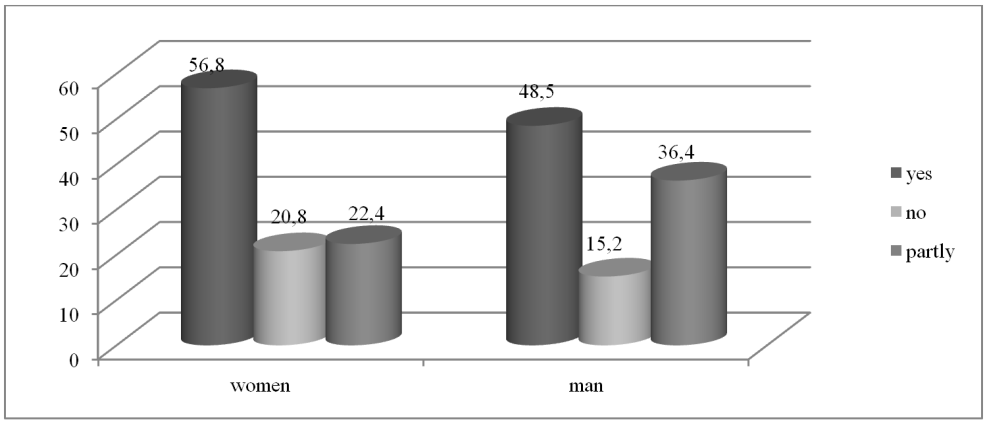


Fig. 6. Waste sorting [in %]

Source: authors' research.

One of the elements of an integrated system of managing household waste in rural areas is its sorting, without which environmental protection would be impossible to consider. Sorting facilitates the reuse and utilisation of waste. Slightly more than a half of the respondents (53.1%) sort waste. Only 28.6 of the respondents partly sort waste. Unfortunately, almost one fifth of the respondents do not sort waste.

Conclusions

The improvement of the state of the natural environment does not happen automatically since it requires an increase of social awareness which translates into environmentally-friendly behaviors. High significance is attached to environmentally-conscious consumption. A high level of environmental awareness allows consumers to make correct choices with regard to their shopping decisions, saving water and electrical power, waste sorting etc. An environmentally-conscious consumer will use energy-efficient light bulbs, will pay attention to the energy class of household appliances and consumer electronics, will not waste water, will sort waste, will pay attention to the type of packaging and the possibility of its reuse when shopping, and will use biodegradable or reusable shopping bags.

The social potential of the readiness to undertake individual actions for the benefit of the environment is large, and environmental values are considered to be important by many Poles. However, this includes both actual actions and the readiness to undertake actions, as well as declarations resulting from political correctness. There is a visibly large discrepancy between declarations and actual actions and behaviors of Poles. In order to take advantage of the mentioned potential, large-scale and diverse actions need to be taken by public institutions, the system, education, and non-government organisations alike. Favourable conditions should be created to encourage environmentally-friendly actions and such behaviors should be encouraged in a much more forceful way, for example through economic and administrative instruments and proper social engineering.

References

Gliński P. [1998]: Świadomość ekologiczna społeczeństwa polskiego. Kultura i Społeczeństwo. 3, 181-196.
Godlewska J. [2009]: Edukacja dla zrównoważonego rozwoju. [in:] Zrównoważony rozwój – aspekty rozwoju społeczności lokalnych, Fundacja Forum Inicjatyw Rozwojowych, Białystok, 16-17.
Hłobił A. [2010]: Teoria i praktyka edukacji ekologicznej na rzecz zrównoważonego rozwoju, Problemy Ekorozwoju, 2, 87.
Hull Z. [1984]: Świadomość ekologiczna (II). Aura, 11, 3-4.
Kryk B. [2005]: Etyka środowiskowa a potrzeby ekologiczne konsumentów, Zeszyty Naukowe Uniwersytetu Szczecińskiego, Prace Katedry Mikroekonomii, 405, 145.
Papuziński. A. (2006). Świadomość ekologiczna w świetle teorii i praktyki. (Zarys politycznego modelu świadomości ekologicznej), „Problemy Ekorozwoju", 1, 33-40.
Pilch T. [1998]: Zasady badań pedagogicznych, Wydawnictwo Akademickie „Żak", Warszawa, 51.
Zarządzanie środowiskiem, ed. B. Poskrobko., [2007]: PWN, Warszawa, 61.

Information for Authors of papers published
in Scientific Journal Warsaw University of Life Science – SGGW
Problems of World Agriculture

1. The Scientific Journal of Warsaw University of Life Science – SGGW Problems of World Agriculture, publishes scientific papers based on original research, compliant with the profile of the journal, in Polish and English.
2. The manuscripts submitted, accepted by the Editor, will be subject to the double-blind peer review. If the manuscript is written in English at least one of the reviewers is affiliated with a foreign institution. The list of reviewers is published in the journal.
3. The written review contains a clear reviewer's finding for the conditions of a scientific manuscript to be published or rejected it (the review form can be found on the website of the journal).
4. In order to prevent the "ghostwriting" and "guest authorship" the authors are requested to fill out and sign an Author's Ethical Declarations (the declaration form can be found on the website of the journal).
5. Authors have to send to the Editor text of the paper prepared according to the editorial requirements (editorial requirements can be found on the website of the journal). Author is responsible for the contents presented in the paper.
6. The original version of the scientific journal issued is a print version. An electronic version is posted on line on the journal's website.
7. The authors of the papers contribute to the costs of printing (issuing).
8. The journal is published quarterly. Each paper published in the Scientific Journal of Warsaw University of Life Science – SGGW Problems of World Agriculture receives 13 points (Decision from the Minister of Science and Higher Education on the list of scientific journals dated. Dec. 23, 2015).

Editorial Office:
Scientific Journal Warsaw University of Life Science: Problems of World Agriculture / Zeszyty Naukowe Szkoły Głównej Gospodarstwa Wiejskiego w Warszawie Problemy Rolnictwa Światowego
Faculty of Economic Sciences WULS-SGGW
Department of Agricultural Economics and International Economic Relations
166 Nowoursynowska St.
02-787 Warsaw, Poland
Phone: +48 22 593 41 03, +48 22 593 41 02, fax: +48 22 593 41 01
e-mail: problemy_rs@sggw.pl

Web page:
http://www.wne.sggw.pl/czasopisma/problemy-rolnictwa-swiatowego/