ACCURACY OF ECONOMIC SITUATION PROJECTIONS IN THE POLISH AGRICULTURE

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Abstract. The aim of the article is to estimate a degree of compatibility of economic situation projections in the Polish agriculture with opinions on actual changes expressed at the end of the forecast period by farmers. The article includes a graphic analysis and statistical indicators designed for estimating the accuracy of economic situation projections. In Poland in the years 2012-2015 the balances of the farmers' projections of the general situation of farms and their profitability and the balances of evaluations of the real economic situation were negative. The values of projection balances were always greater compared with the values of the subsequent evaluations. The highest accuracy of projections of the general situation of farms and the production profitability pertained to the direction of the economic situation changes. The indicators of the compatibility of the economic situation balance sign almost always equalled to one. The worst projections concerned the similarity of the tendency of the analysed categories. In most cases, the correlation coefficients of projection and opinion were low or very low. The analysis proved that the Polish farms much better predict the future economic situation on a qualitative basis than on the quantitative basis. This complies with the logical analysis of people's behaviour and with empirical research.

Key words: projection, business surveys, agriculture.

JEL code: C19, E37, Q19

Introduction

One of the most fundamental functions of entrepreneurs is to predict the direction, dynamics and force of changes in the environment of their enterprises (Drucker, 2014). The proper prediction results in increasing the effectiveness of the market competition and improving the profitability. This rule also refers to farmers. The mainstream economists want projections to forecast changes to the analysed categories in a precise time and quantity manner. As a result of the complexity of the economic processes, the predictions based on the qualitative-nature measures become increasingly popular. The key method of this type is the business survey. In Poland the business survey has been surveying the agricultural situation since 1992 by the Institute of Economic Development of the Warsaw School of Economics (Szajner, Walczyk, 2015) and since 2012 by the Central Statistical Office (Konjunktura…, 2015).

This article is of an empirical nature. It aims at evaluating a degree of compatibility of economic situation projections in the Polish agriculture with the opinions on actual changes expressed at the end of the projection period by the farmers.

The surveys were conducted in the years 2012 - 2015. This article is based on the original data provided by the Central Statistical Office.

The research methods employed in this article include the graphic analysis and statistical indicators designed for evaluating the accuracy of the economic situation projections. They apply to the compatibility of the economic situation balance sign, the economic situation balance change direction, and the harmonised data.

Economic situation research methods

It is complicated to study the current and future economic situation in the economy and its individual sectors. This complexity is affected by a vast number of factors impacting upon the economic processes, the variable force and direction to their impact, and the complex and variable relations between the analysed category and the factors explaining its course. The key research methods analysing changes in the companies' economic activity are economic situation barometers, business surveys, econometric methods, balance methods, and expert methods (Lubinski, 2004). In practice, the first two methods are most frequently applied in the sector research.

The economic situation barometer is an index comprising respectively selected economic indicators that enable the observation of the current economic situation and the forecasting of its changes (see Matkowski, 2004). The example of parallel indicators is changes to the industrial production, retail sale, and employment. Whereas, leading indicators include changes, for example, to new orders, stock exchange indexes, and money supply. The reference category that describes fluctuations of the business economy is most frequently the gross domestic product. The forecasting based on the economic situation barometer is primarily of a quality nature. It means that it primarily attempts to indicate the direction of future...
changes and considers the pace of those changes to be of minor importance. The obvious advantage of this measure is its comprehensible and clear structure and simple usage. It has, however, disadvantages. The key reservations about the economic situation barometer are (1) a lack of the theoretical justification for selecting variables for the complex index. This selection is conducted on the basis of statistical correlations; (2) a problem pertaining to statistical data. Time series data are recommended to be long. On the other hand, it is pointed out that no attention should be paid to the historical course of fluctuations.

The business survey is based on opinions of entrepreneurs and consumers in order to evaluate the present and predicted economic situation. This survey is most frequently used in economic sectors such as industry or agriculture. It differs from the economic situation barometer as it only uses entities’ subjective responses about changes to the business situation. The business survey, similarly to the barometer, is a qualitative measure (Kowalczyk, 2011). The qualitative information constitutes an important addition to quantitative data (Business ..., 2006). The business survey is voluntary for the respondents. The questions have usually three simple responses: increase, no change, and decrease. Following the answers, the percentage share of each answer is calculated and the balance, i.e. the difference between positive and negative grades, is determined. The balance may range from -100 to +100. The most important advantages of the business survey are the timeliness of information, regularity of opinions, and simplicity of analysis. On the other hand, the key disadvantages are the absence of theoretical principles, the vulnerability of qualitative data to changes to the environment of companies, and the subjectivism of responses (Rog, Strzala, 2011).

**Business survey used in the study**

The accuracy of projections of processes taking place in the Polish agriculture is evaluated according to the data obtained from the business survey conducted by the Central Statistical Office (Badanie ..., 2012). This is a survey-based test carried out in farms every six months, i.e. in June and December of each year. The farmers express their opinions on the past (the end of the half-year period) and the current economic situation in their farms and forecast its changes within the next half-year period.

The survey covered all (over 2.5 thousand) farms run by legal persons and organisational entities without legal capacity, and a randomly chosen group of individual farms (25.5 thousand) whose economic size exceed EUR 4 thousand (in 2012 - over EUR 2 thousand). This group represents over 850 thousand individual farms exceeding the aforesaid economic size. Most of the analysed farms (57.6%) had the agricultural area of 2-10 ha. The average area of the analysed farms equalled to 13.7 ha. The most farms were run in a traditional way, i.e. without any distinctive production channelling (47.7% of the total farms). About 40% of the farms were involved in the plant production, whereas 12.1% of the total analysed farms specialised in the animal production.

For the analysed single-choice survey questions, a simple economic situation indicator, the so-called balance of responses, was calculated:

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1) stage  - the aggregation of the number of indications to each of three response variants: positive (+) which means that the farmer believes that his or her economic situation has improved, neutral (=) which means that the economic situation has not changed, and negative (-) when the economic situation of the farm has worsened;

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2) stage  - the calculation of the three response variant structure amounting to 100%;

3) stage  - the assessment of the balance of responses as a difference between the percentage share of positive responses (+) and the percentage share of negative responses (-).

**The balance of response does not consider the neutral variant.**

The calculated balance informs about the advantage of the obtained positive opinions over negative ones (if the balance is positive) or negative over positive ones (if the balance is negative) (Badanie ..., 2012).

**Statistical methods of the projection accuracy evaluation**

The evaluation of the accuracy of the economic situation projection in the Polish agriculture is conducted according to four statistical measures (\(y_i\)) means the economic situation evaluation (balance) at the end of the t period, and \(y_{i*}\) means the economic situation projection regarding to the t period; \(t = 1, ..., N\), where N is a number of data for which the projections and the evaluations are compared) (Guzik, 2009):

1) compatibility of the economic situation balance sign:

\[y_i - y_{i*}\]
\[ M_s = \frac{1}{N} \sum_{i=1}^{N} s_i, \quad (1) \]

\[ s_i = \begin{cases} 1, & \text{if } y_i \text{ and } y_i^* \text{ have the same sign} \\ 0, & \text{otherwise} \end{cases} \]

The value of the \( M_s \) indicator shows the compatibility of the development direction of the evaluated quantity with the predicted direction. If \( M_s = 1 \), there is a full compatibility.

1) compatibility of the direction of the economic situation balance sign:

\[ M_D = \frac{1}{N} \sum_{i=1}^{N} d_i, \quad (2) \]

\[ d_i = \begin{cases} 1, & \text{if increments } (y_{t+1} - y_t) \\ \text{and } (y_{t+1}^* - y_t^*), \text{ have the same sign} \\ 0, & \text{otherwise} \end{cases} \]

The \( M_D \) indicator shows how often the changes to balances of the evaluations and the projections were unidirectional.

2) compatibility of the economic situation level:

\[ M_L = \frac{1}{N} \sum_{i=1}^{N} l_i, \quad (3) \]

\[ l_i = \begin{cases} 1, & \text{if } y_i - y_i^* \leq |\Delta| \\ 0, & \text{otherwise} \end{cases} \]

The \( M_L \) indicator measures the compatibility of the projected and evaluated force of phenomenon changes. This study provides that the projection and evaluation of the economic situation are similar, if the difference in their balances does not exceed 10 points (\( \Delta = 10 \) or 10% of the boundary).

3) correlation coefficient \( r \).

The evaluation of the data harmonisation concerning the \( y_t^* \) projections and the opinions about the situation in the past period \( y_t \) is carried out by means of a simple correlation coefficient (Sobczyk, 2014). If the correlation coefficient \( r > 0 \), both series have the same direction, that is they are harmonised. When \( r < 0 \), both series have different development directions, so they are not harmonised.

**Evaluation of the accuracy of projections of the general situation of the farms**

The compatibility of the half-year projections of the general situation of the farms in Poland in the period from June 2012 to June 2015 with the evaluation of the general situation in the past half a year conducted by those farms begins from the graphical analysis.

Figure 1 shows the balances of responses obtained during the business surveys. These balances only include positive and negative responses. The data analysis proves that in the entire analysed period the balances referring to the evaluation of the farmers’ real economic situation and to the projections were negative. The average evaluation balances equalled to -23.1 and the projection balances amounted to -10.1. The lowest balances of the evaluations and the projections were observed in June 2015. Those data prove the advantage of the farmers’ pessimistic opinions over optimistic opinions on the real economic situation in agriculture and on perspectives of their farms. In the entire analysed period the most farmers neutrally evaluated the past half a year and predicted the next half year. In each survey, the number of neutral opinions exceeded 50% of the responses and in some periods this number was over 70% of the responses (Koniunktura..., 2015).
The interesting observation is that in all the analysed half-year periods the values of balances of the general economic situation of farms have been greater for projections than for any evaluations of the general situation formulated at a later date. This proves that the farmers are less pessimistic when projecting or excessively pessimistic when evaluating the economic situation at the end of the half-year period. More negative evaluations may result from the farmers’ subjective opinions and the actual deterioration of the economic situation in the Polish agriculture. The identical dependencies were also observed in other sectors of the Polish economy (Guzik, 2009, Kazmierska-Zaton, Zaton, 2014). The general adjustment of the course of projections to the evaluations until the first half of 2014 was good. However, they considerably deteriorated at a later date.

Following the graphic analysis, the quality of predictions obtained from the economic situation surveys concerning the general conditions of the farms will be evaluated more formally, that is by using statistical indicators. The general projections and opinions of particular farm groups (total farms, plant production-oriented farms, animal production-oriented farms, and multidirectional farms) will be examined.

In the years 2012-2015 the compatibility of the economic situation balance sign for most types of the farms equalled to 1 (Table 1). This proves the complete compatibility of the direction of the evaluated development of the farms’ general situation with the previously predicted direction. It was, however, slightly lower for the farms specialising in the animal production due to a symbolic positive value of the balance of positive and negative responses obtained in June 2014. The analysed data show that the Polish farmers almost always declared their negative attitude towards the changes in agricultural markets.

Another key measure used to evaluate the results of the business survey which - as a qualitative method - concentrates on the direction of changes to the analysed categories, is the compatibility of the economic situation balance change direction. For all the analysed types of the farms this indicator equalled to 0.8. This is a high value. This proves that 80% of the farmers’ predictions of and opinions on the dynamics of changes to the general situation of all the farms were unidirectional. Consequently, the farmers were able to predict correctly the direction of the situation changes in the Polish agriculture to a greater extent.

### Table 1

<table>
<thead>
<tr>
<th>Compatibility measure</th>
<th>Farms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td><strong>Balance sign</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Direction of balances</strong></td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Level of balances</strong></td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Correlation</strong></td>
<td>0.33</td>
</tr>
</tbody>
</table>

Source: authors’ calculations based on the data of the Central Statistical Office.

The following measures are employed to support the evaluation of the business survey data: the economic situation level compatibility indicator and the correlation coefficient that is the measures that take quantitative changes into account. In the analysed period, the economic situation level compatibility
indicator (the prediction and evaluation were assumed to be at a similar level, if the difference between their balances is not greater than 10 points) was the highest for the total farms and for the plant production-oriented farms and amounted to 0.67 (Table 1). This is a relatively good effectiveness of the quantitative-based projections. However, it would be considerably worse provided that the difference in balances did not exceed 5 points.

The poor accuracy of the quantitative-based projections made six months ago is proved by the correlation coefficient data. It may be concluded that only animal production-oriented farms were able to predict effectively on a moderate basis. The Pearson correlation coefficient calculated for the projections and opinions expressed at the end of the past half a year amounted to 0.55. The low quality of projections complies with the assertions of the opponents of the rational expectation hypothesis (O’Driscoll, Rizzo, 1996). They prove that entities, in their projections, are not able to expect correctly the development of the situation in the industries and the entire economy on a current basis due to their subjectivism, and limited and dispersed knowledge. They primarily formulate their projections on the basis of the evaluations of the current and past situation. This opinion is proved by statistical research. The Pearson correlation coefficient for the projections and the evaluations of the Polish farms’ general situation formulated in the same period for the total farms amounted to 0.92, 0.82 for the plant production-oriented farms, 0.98 for the animal production-oriented farms, and 0.92 for multidirectional farms. Those figures prove the very strong relationship between the current evaluations and projections of the situation in the agriculture.

Effectiveness of projections of the agriculture production profitability

Identical to the comparison of the evaluations and the projections of the general situation of the Polish farms, all the balances of positive and negative responses obtained from the business survey and referred to the agricultural production profitability were negative (Fig. 2). In the entire period of 2012-2015 the level of those balances was considerably lower than those referring to the general situation of the farms. The average evaluation balances amounted to 39.3 whereas the average projection balances -16.3. The farmers’ considerable pessimism which deepened in the second half of 2014 referred to the projections concerning the forthcoming period covered by the survey and to the assessment of the ending half year. The actual changes to the production profitability were particularly negatively assessed. Since then the negative responses have been greater even compared with the neutral opinions. In the first half of 2015 they equalled 70% of all the responses. The key reasons for this situation were sharp declines in prices for basic products manufactured by the farms. This particularly affected products of animal origin. Those changes were a consequence of the increased supply of agricultural products, the decline in prices in the global markets and the Russian restrictions on food import from the European Union, including Poland (Rolnictwo..., 2015, Ceny..., 2015). The decrease in prices for the agricultural products was accompanied by the increase in prices for lands and agricultural production means or by their slight decline that primarily affected all prices for mineral fertilisation and energy products.

In the analysed years of the production profitability projections were systematically higher than the farmers’ opinions on the ending half year. The Polish farmers always had more hope for the better situation in the future than it turned out later.

The calculations included in table 2 show that the compatibility indicator of the economic situation balance sign for all types of the farms equalled one. The evaluations made by the total farms, plant production-oriented farms, animal production-oriented farms, and multidirectional farm that refer to the actual direction of the development of the agricultural production profitability completely complied with the projected direction. Unfortunately, those evaluations and projections were always negative. Only the level of this critical approach in specific half-year periods changed.
Fig. 2. Evaluation of agricultural production profitability in the t period and its projection made at the beginning of the t-period

Table 2

<table>
<thead>
<tr>
<th>Compatibility measure</th>
<th>Farms</th>
<th>Total</th>
<th>Plant production</th>
<th>Animal production</th>
<th>Multidirectional farms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance sign</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Direction of balances</td>
<td>0.4</td>
<td>0.6</td>
<td>0.8</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Level of balances</td>
<td>0.17</td>
<td>0.17</td>
<td>0.33</td>
<td>0.17</td>
<td></td>
</tr>
<tr>
<td>Correlation</td>
<td>0.08</td>
<td>0.01</td>
<td>0.45</td>
<td>0.07</td>
<td></td>
</tr>
</tbody>
</table>

Source: authors’ calculations based on the data of the Central Statistical Office

In Poland, in the analysed period the compatibility indicator of the economic situation balance change direction for the analysed types of the farms was considerably diversified. The highest value was obtained by the animal production-oriented farms (0.8), whereas the lowest one was acquired by non-specialised farms (0.2). For the animal production-oriented farms the changes to the evaluations and the projections were almost always unidirectional. Therefore, the high compatibility of dynamics of changes to opinions on the actual and forecast development of the agricultural production profitability was observed. This high level of the indicator is a result of several reasons. The animal production-oriented farms are highly specialised. Their range of products is usually limited. Their owners must have profound knowledge on the agricultural technology and economics. Further, they have to analyse a fewer number of the detailed agricultural markets compared with the multidirectional farms. They often observe only one market, so they know it better. All this makes their predictions more accurately.

In the years 2012-2015 the accuracy of the half-year production profitability projections with respect to quantitative changes in all types of the analysed farms was very low. This is proved by the economic situation level compatibility indicators and the correlation coefficients (Table 2). The economic situation level compatibility indicator was the highest for the animal production-oriented farms (0.33). This means that only 33% of the predictions about the force of changes to the analysed profitability were in compliance with the opinion on the actual force of changes. If the approved difference in balances does not exceed 5 points, the economic situation level compatibility indicator for most types of the farms equalled to zero.

For most of the analysed types of the Polish farms the correlation coefficient of the projections and of the subsequent evaluations was nearly zero. Therefore, there is no connection between the projections on profitability formulated just before the beginning of the half-year period and at the end of that period. The projections were mainly affected by the current production profitability evaluations. Most of the Pearson correlation coefficients for the projections and for the evaluations formulated in the same period were greater than 0.8. The exception was the plant production-oriented farms.

Conclusions

In Poland in the years 2012-2015 the balances of the farmers’ the half-year projections of the general situation of farms and their profitability and the balances of evaluations of the real economic situation...
were negative. This proves the general pessimism of the farmers.

The examination showed that the projections concerning the development direction and the dynamics of changes to the general situation in the agriculture made by all types of the farms covered to a great extent with the opinions on the changes on the actual situation of the farms. The indicators of the economic situation level compatibility were average. In most cases the correlation coefficients of the projections and the opinions were low (from 0.28 to 0.55).

Bibliography