



Ukrainian Cereals in Global Food Security: Production and Export Components

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ABSTRACT

The research *purpose* was devoted to providing the global food security by cereals and the most demanded crop like wheat. This topic belongs to the dominant issues in the world economic agenda and engages Ukrainian agriculture in supplying such staple crops as much as possible. The explored *hypothesis* dealt with simultaneous improvements in production and export components of a grain segment considering the period 2006-2018 when Ukraine restored its “breadbasket” status. The investigation *methodology* involved the ABC-XYZ analysis and econometric approach. The obtained calculation *results* specified regional ABC-XYZ distributions of 24 national producers into 4 groups by their harvest contributions to growing grain crops as well as discovered upward progress in volumes, values, and shares of Ukrainian cereals exports via linear regressions of high confidence levels. The study *findings* concerning a production component allowed us to propose enhancing cereals yields in Ukraine through implementing a complex of technological, product, management, and marketing innovations witnessed in the effective EU agriculture. The research *conclusions* with regard to an export component were as follows. To stay on the right track of current positive dynamics and face requirements of European consumers, the national farmers were recommended to focus on grain quality. Ukrainian agriculture should develop logistics and product promotions among the overpopulated major cereals importers from Asia. At last, Ukrainian exporters ought to foster increasing quantities and expanding geography of grain supply to African continent to mitigate the sharpest food insecurity around the world.

INTRODUCTION

Food security was elevated to the top of the international agenda for a long time. Food and Agriculture Organization (FAO) of the United Nations identifies availability and stability of food supply, among others, via cereals indicators such as the share of dietary energy input derived from cereals

and the cereal import dependency ratio. Since 1961 FAO statistics has been collecting data on the harvested area, yield, and total production of cereals for over 245 countries (FAO, 2019). The most cultivated food grain crops in the world are wheat and rice which covered around 220 and over 162 million hectares of agricultural lands in 2019. The feed and biofuel components of cereals are presented by the coarse grain crops including barley, maize (corn), millet, oats, rye, and sorghum. The most common one among them is maize that occupied approximately 190 out of 325 million hectares of the harvested areas under the coarse grain crops in 2019 (USDA, 2019).

The prevalent cereals in Ukraine are wheat, maize, and barley which encompass on average 46%, 32%, and 18% of the agricultural lands under grain crops (State Statistics Service of Ukraine, 2019). In 2018 Ukraine provided

- 7.3% of the world wheat export after Russia, Canada, the USA, France, and Australia;
- 10.3% of the world maize export following the USA, Argentina, and Brazil;
- 8.9% of the world barley export surpassed by Australia, France, and Russia.

Cereals segment is the most profitable part of Ukrainian agriculture. It maintains state financial stability, welfare of rural population, makes the largest contribution to the national and global food security (Vasylieva, 2019). This reasoning encouraged to focus the fulfilled research on the paramount development of Ukrainian grain production and export in the context of reinforcing food security system.

1. LITERATURE REVIEW

Scientific community delivers numerous miscellaneous studies on providing food security. To define the issue in question in general, C. Barrett (2010), L. Jarosz (2014), N. Wald and D. Hill (2016) presented multifaceted views about food insecurity phenomenon ranging between restrictions over food trade, agricultural policy, and state food sovereignty down to systematic state disability to eliminate hunger and chronic malnourishment of the country's population. M. Gibson (2012), D. Headey and O. Ecker (2013) revealed the complicated nature of food security starting from the basic international demographic, economic, environmental, political, and cultural conditions up to regional food access, household well-being, individual health dietary and high nutritional status.

Above all, implementation of food security supposes balancing food consumption and production. Therefore, A. Kavallari et al. (2014), R. Grafton et al. (2015) focused on the increasing food demand driven by a rapid population growth towards 9 billion people beyond 2050. Meanwhile, T. Lang and D. Barling (2012), H. Godfray and T. Garnett (2014), F. McKenzie and J. Williams (2015), B. Campbell et al. (2016), E. Fouilleux et al. (2017) and M. Morkūnas et al. (2018) compared food control, capacity, resilience, risks, and sustainability as well as explored the ways of agricultural intensification and rise in food supply which have to facilitate slowed productivity development, limitations of natural resources and environmental impact.

Evidently, cereals are the key crops in agricultural economics. In this context, studies of B. Carver (2009), A. Danforth (2009), S. Elfson (2011) are worth mentioning among recent investigations on enhancing effectiveness of growing grain crops. These scientific works accumulated contemporary results concerning production management and logistics, economical soil cultivation, advanced machinery, applying improved seeds and fertilizers, safe technologies of plant protection, minimal waste of harvest, optimal storage, quality control, and profitable grain sales.

In spite of high priority and cohesive scientific assistance, Ukrainian current achievement is far from the existing potential in cereals segment (Samarets and Nuzhna, 2019; Zavorotniy and Bilyk, 2017). Thus, problems and prospects of increasing Ukrainian grain endowment to the global food security needs further elaboration and updated findings.

2. RESEARCH METHODOLOGY

The goal of this research was to assess conditions and find reserves to develop Ukrainian grain component of food security at the national and global scales. To reach this aim, the conducted study was divided into two tasks, namely:

- to evaluate cereals production and ground options on increasing their harvests applying best foreign innovative experiences;
- to specify trends in Ukrainian grain export as well as clarify its promising competitive advantages by continents and countries.

Following the announced topic and practical evidence of Ukrainian agriculture, the research was expanded over cereals in general and wheat in particular like a core grain crop around the world. To accomplish the first research task, it was relevant to choose a mathematical base of the ABC-XYZ analysis (Waters, 2003; Muller, 2011). The considered units were 24 regions in Ukraine all of which, to some extent, participate in production of grain crops. In our case, A, B, and C grades associated with Large, Average, and Small regional harvests sorted in the descending order. Like in the classic ABC approach, the grade A accumulated 80% of grain producers, while the grades B and C contained their parts of the next 15% and last 5%. X, Y, and Z grades corresponded to High, Medium, and Low yields compared to the average yields around the whole country. Adjusting the classic XYZ approach to the research purposes, first, regions with higher yields by 10% and more were embedded in the grade X. Second, the grade Y aggregated regions where yields deviated by $\pm 10\%$ around the average one in Ukraine. Third, the grade Z enveloped the rest of the regions with lower yields by -10% and less.

The offered distribution arranged 4 groups of regional producers with specific common values interpreted as follows:

- the cells AX, AY, BX, BY are the main contributors to the global food security;
- the cells AZ, BZ determine Ukrainian potential in increasing grain production and export;
- the cells CX, CY are responsible for a local food security;
- the cell CZ depicts regions with a relatively wrong agricultural specialization in the cereals segment.

Phillips et al. (2013), and Norton et al. (2014) are quite convincing that a contemporary agricultural development requires comprehensive innovative improvements. In our case, Ukraine grain producers in

- the cells AX, AY, BX, BY need Marketing innovations to promote their commodity and perfect purchase practices;
- the cells AZ, BZ would benefit from Technological innovations rising their yields;
- the cells CX, CY should focus on Management innovations to enhance their output volumes;
- the cell CZ would gain from Product innovations identifying alternative crop varieties.

European gravitation of Ukrainian economy convinces that the effective EU patterns and practices are reliable sources of the necessary agricultural innovations (Hebinck and Oostindie, 2018).

The mathematical base of the second research task was econometrics (Greene, 2007; Studenmund, 2016). First, describing Ukrainian dynamics of grain export resulted in creating Time-Series linear regressions to volumes, values, and shares of cereals and wheat exports. In this way, the regressions' slopes and R-squared enabled to measure annual trends and their input to explaining export dynamics. Second, to examine export tendencies by continents, it was feasible to create Time-Series linear regressions to cumulative volumes and values of cereals and wheat exports over the considered period. Third, the performed examination of Top-importers of Ukrainian

cereals gave recommendations on export progress and expanding Ukrainian involvement in the global food security system in the foreseeable future (Schroeder and Meyers, 2015).

3. RESULTS AND DISCUSSION

3.1 Findings on improving cereals production

The performed calculation to the first research task was arranged over the official average data from State Statistics Service of Ukraine over the last three years (see Table in Appendix). Such approach allowed to align climatic risks of production volatility but retain similar economic conditions in Ukrainian farming. Tables 1 and 2 stored the found regional distributions in Ukrainian cereals and wheat segments.

In more detail, data in Table 1 persuaded that 12 or 50% of Ukrainian regions with the total harvest of 61.7% establish a stable backbone of Ukrainian contribution to the cereals segment of the global food security. 3 or 13% of the national regions with the total grain harvest of 2.6% are engaged in a local food security. 2 or 8% among Ukrainian regions with the total harvest of 3.7% should update their cereals varieties. At last, 7 or 29% of the national regions with total grain production of 32.1% have unsatisfactory yields and can increase their common share at least by 8.1 percentage point, i.e. 5.4 million tons of cereals worth \$932 million in 2018 export prices.

Table 1. Regional Distribution of Ukrainian Cereals Producers

| Harvest | Yield | | |
|-------------|--|---------------------------|---|
| | X - High | Y - Medium | Z - Low |
| A - Large | Cherkasy Chernihiv Khmelnyskiy Kyiv Poltava Sumy Vinnytsya | Kirovohrad | Dnipropetrovsk Kharkiv Mykolayiv Odesa Zaporizhya |
| B - Average | Ternopil Zhytomyr | Lviv Rivne | Donetsk Kherson |
| C - Small | Ivano-Frankivsk | Chernivtsi Zakarpattia | Luhansk Volyn |

Source: compiled by the author based on data from State Statistics Service of Ukraine (2019).

Likewise, data in Table 2 substantiated that 13 or 54.2% of Ukrainian regions with the total harvest of 61.6% constitute a stable core of Ukrainian input to the wheat segment of the global food security. 4 or 16.7% of the national regions with the total wheat harvest of 6% are valuable for a local food security. 1 or 4.1% among Ukrainian regions with the total harvest of 0.4% should revise its agricultural specialization. At last, 6 or 25% of the national regions with total wheat production of 32% confront poor yields and can raise their common share at least by 5.5 percentage point, i.e. 1.4 million tons of wheat worth \$258.4 million in 2018 export prices. In both cases the fulfilled ABC-XYZ analysis confirmed additional production capacities in 5 regions including Dnipropetrovsk, Donetsk, Kherson, Mykolayiv, and Zaporizhya areas. As a matter of fact, it can be tackled via implementing Marketing, Management, Technological, and Product innovations (Velychko and Velychko, 2017; Khalatur et al., 2019). The successful EU farmers offer the nearest pool of reliable novelties applicable to Ukrainian agriculture (Tomich et al., 2019).

Table 2. Regional Distribution of Ukrainian Wheat Producers

| Harvest | Yield | | |
|-------------|--|---|--|
| | X - High | Y - Medium | Z - Low |
| A - Large | Cherkasy Khmelnyskiy Sumy Ternopil Vinnytsya | Kharkiv Kirovohrad Odesa Poltava | Dnipropetrovsk Donetsk Kherson Mykolayiv Zaporizhyya |
| B - Average | Kyiv Lviv | Chernihiv Volyn | Luhansk |
| C - Small | Chernivtsi Ivano-Frankivsk Rivne | Zhytomyr | Zakarpattya |

Source: compiled by the author based on data from State Statistics Service of Ukraine (2019).

To pick exemplary Marketing and Management innovations to Ukrainian regions by the grades A, B, C, it makes sense to analyze indicators of the total harvest and production per capita. On average in Ukraine they amounted to 61.8 million tons and 1.47 tons for cereals as well as 25.6 million tons and 0.63 tons for wheat. Hence, first, the most appropriate agricultural innovations can be delivered by France with the total grain harvest of 64 million tons as well as by Denmark, Hungary, and Lithuania where cereals production per capita ranged between 1.55 and 1.89 tons. Second, the best agricultural innovative objectives represent France with a wheat harvest of 36.4 million tons as well as Bulgaria, Denmark, Latvia, and Lithuania where wheat production per capita varied from 0.8 to 1.41 tons (FAO, 2019).

For selecting Technological and Product innovations best fitted to the grades X, Y, Z, we compared indicators of yields. In more detail, regions of the grade X (Table 1) had productivity between 51 and 63.5 centners per hectare that matched to the ranks from 17 to 9 among the EU cereals producers. The relevant innovations for these regions can be found in Austria, Belgium, Denmark, Germany, France, Ireland, the Netherlands, and the United Kingdom which had cereals yields between 65.7 and 86.7 centners per hectare. Ukrainian regions of the grade Y obtained yields between 42.2 and 48 centners per hectare that associated with the ranks from 20 to 18 among the EU cereals growers. The affordable innovations for these areas can be conveyed from Austria, Bulgaria, the Czech Republic, Croatia, Hungary, Italy, Luxembourg, Slovakia, Slovenia, and Sweden, where cereals yields varied from 49.9 to 61 centners per hectare. Regions of the grade Z had productivity between 27.9 and 40.2 centners per hectare being ranked from 27th up to 23rd among the EU cereals producers. Such Ukrainian regions are invited to start with implementing innovations from Latvia, Lithuania, Malta, Portugal, and Romania which had cereals yields between 42 and 47.6 centners per hectare (FAO, 2019).

In this fashion, regions of the grade X (Table 2) had productivity between 44.3 and 56.3 centners per hectare that corresponded to the ranks from 20 to 11 among the EU wheat producers. The relevant innovations for these regions can be found in Belgium, the Czech Republic, Croatia, Denmark, Germany, France, Ireland, the Netherlands, Sweden, and the United Kingdom which had wheat yields between 56.7 and 101.3 centners per hectare. Ukrainian regions of the grade Y obtained yields between 37.1 and 43.5 centners per hectare that associated with the ranks from 24 to 21 among the EU wheat growers. The proper innovations for these areas can be conveyed from Austria, Bulgaria, Hungary, Latvia, Lithuania, Luxembourg, Malta, Poland, Slovakia, and Slovenia, where wheat yields varied from 47 to 56.3 centners per hectare. Regions of the grade Z had productivity between 30.2 and 34.9 centners per hectare being ranked 25th among the EU wheat producers. These Ukrainian regions are invited to follow the innovative patterns from Estonia, Fin-

land, Italy, and Romania which had wheat yields between 39.3 and 42 centners per hectare (FAO, 2019).

3.2 Findings on improving grain export

And now, let us delve in the export component of Ukrainian agricultural engagement in the global food security system. The research results to the second task were calculated on the basis of the available data for 2006-2018 (State Statistics Service of Ukraine, 2019). So far, Ukraine exports 41.4 million tons of cereals for approximately \$7.2 billion, including 16.4 million tons of wheat for over \$3 billion. Overall grain export amounts to approximately 15% in total Ukraine's foreign trade in goods. To a great extent, contemporary development of Ukrainian cereals production and export is incentivized by relatively fair prices. They reached on average \$158.6 per ton of grain at the domestic market which was consistent with the common export price of \$173.7 per ton of cereals or \$163.2, \$178.9, and \$177.6 per ton of grain to Europe, Asia, and Africa in 2018. By comparison, similar gaps between domestic and export prices were \$65-83 in 2011-2013. It is obvious that now economic transparency has become much better.

Table 3 contained the computed figures concerning quiet encouraging upward tendencies in Ukrainian grain export. With a high level of confidence they say that average annual increments of cereals export amounted to 3024.6 thousand tons or \$502.3 million. These trends explained 86% and 76% of deviations in the national grain export. Its share in Ukrainian cereals production raised by 3.4 percentage point per annum. Similarly, the data in Table 3 revealed that Ukrainian average annual increments of wheat export reached 1153.3 thousand tons or \$201.8 million. These trends verified 67% and 79% of changes which occurred in the national wheat sales abroad. Their share in Ukrainian wheat production increased by 3.7 percentage point per annum. It should be noted that in the short-run the expected export acceleration will not encounter with the enhanced domestic demand for feed since the national animal husbandry has been weakened by the reduced industrial financing and low purchasing power of Ukrainian population (Vasylieva, 2017; Vasylieva and Velychko, 2017).

Table 3. Export Dynamics of Ukrainian Cereals and Wheat

| <i>Regression Name</i> | <i>Regression Slope</i> | <i>P-Value</i> | <i>R-Squared</i> | <i>F-Significance</i> |
|------------------------|-------------------------|----------------|------------------|-----------------------|
| Cereals export: | | | | |
| volume | 3024.6 | 0.000 | 0.86 | 0.000 |
| value | 502.3 | 0.000 | 0.74 | 0.000 |
| share | 3.4 | 0.001 | 0.62 | 0.001 |
| Wheat export: | | | | |
| volume | 1153.3 | 0.001 | 0.67 | 0.001 |
| value | 201.8 | 0.000 | 0.79 | 0.000 |
| share | 3.7 | 0.006 | 0.52 | 0.006 |

Source: calculated by the author based on data from State Statistics Service of Ukraine (2019).

Currently, the quantities of Ukrainian cereals export are distributed between Europe, Asia, and Africa in proportion of 32.4%, 43.4%, and 23.8% in total Ukrainian grain sales abroad. Turning to wheat, the corresponding ration is 8.9%, 53.6%, and 36.3% (State Statistics Service of Ukraine, 2019). The latter ones define that the European importers are more inclined to Ukrainian coarse crops while the buyers from Asia and Africa prefer wheat. It seems logical because on average poorer and overpopulated countries in Asia and Africa have to respond to an insufficient food supply. Meanwhile, wealthier European countries need more crops for processing them in animal feed and biofuel (Yatsenko et al., 2017).

Trends to cumulative grain export made it possible to highlight strategic prospects of Ukrainian involvement in the global food security by continents (see Table 4). Actually, now the cumulative values of Ukrainian cereals exports are distributed between Europe, Asia, and Africa in proportion of 24.5%, 47%, and 26.9% over the considered period of 2006-2018. With regard to wheat, the corresponding ration looks like 12.9%, 47.8%, and 37.9%. Table 4 with high level of confidence informed about the annual increases in shares of cereals export volumes to Europe and Africa by 0.83 and 0.77 percentage points. These trends determined 78% and 76% of the respective trade dynamics. Simultaneously, European and African shares in cereals export values enhanced by 0.89 and 0.91 percentage points per annum. Such indicators explained 77% and 75% of the observed changes in the revenues of Ukrainian cereals exporters. Unfortunately, Asian shares in cereals export volume and value dropped annually by 1.1 and 1.28 percentage points. Besides, these tendencies were pretty strong since they determined 83% and 81% of the discussed relative trade decline.

Table 4. Ukrainian Export of Cereals and Wheat by Continents

| <i>Regression Name</i> | <i>Regression Slope</i> | <i>P-Value</i> | <i>R-Squared</i> | <i>F-Significance</i> |
|---------------------------------|-------------------------|----------------|------------------|-----------------------|
| <i>Share of cereals export:</i> | | | | |
| volume to Europe | 0.83 | 0.000 | 0.78 | 0.000 |
| value to Europe | 0.89 | 0.000 | 0.77 | 0.000 |
| volume to Asia | -1.10 | 0.000 | 0.83 | 0.000 |
| value to Asia | -1.28 | 0.000 | 0.81 | 0.000 |
| volume to Africa | 0.77 | 0.000 | 0.76 | 0.000 |
| value to Africa | 0.91 | 0.000 | 0.75 | 0.000 |
| <i>Share of wheat export:</i> | | | | |
| volume to Europe | -1.29 | 0.000 | 0.84 | 0.000 |
| value to Europe | -1.26 | 0.000 | 0.84 | 0.000 |
| volume to Asia | 0.64 | 0.024 | 0.39 | 0.024 |
| value to Asia | 0.39 | 0.107 | 0.30 | 0.107 |
| volume to Africa | 0.90 | 0.002 | 0.60 | 0.002 |
| value to Africa | 1.15 | 0.001 | 0.65 | 0.001 |

Source: calculated by the author based on data from State Statistics Service of Ukraine (2019).

Additionally, Table 4 with high level of confidence detected the annual fall in European wheat export volume and value by 1.29 and 1.26 percentage points per annum. On the contrary, wheat export to Africa demonstrated essential growths in volume and value by 0.9 and 1.15 percentage points per annum which explained 60% and 65% of the identified trade progress. The volume and value of Ukrainian wheat export to Asia also had annual upward trends by 0.64 and 0.39 percentage points. However, they were less convincing and accompanied significant fluctuations in Asian wheat demand during 2006-2018.

For reflecting Ukrainian participation in the global food security, we analyzed the mainstream countries in the national export. More specifically, the Top-importers of Ukrainian wheat in Europe were Italy and Spain. The latter one absorbed on average 61.6% of the continent purchases. It is quiet logical since Italy and Spain were ranked 4th and 9th among the World Top wheat importers or were the two largest ones in Europe. Among the coarse grain crops European consumers prefer maize. Therefore, Ukrainian barley needs an active promotion within the Top European importers such as the Netherlands, Belgium, and Spain ranked 4th, 5th, and 7th among the World Top barley buyers. The major importers of Ukrainian maize were the Netherlands and Spain with the shares of purchases of 21% and 41.9%. It is no wonder because these countries were ranked 8th and 4th in the list of the World Top maize buyers. Overall, Spain remains the major European importer of

Ukrainian cereals which encompass over 45% of Ukrainian goods' export to Spain (State Statistics Service of Ukraine, 2019).

The long-term core consumer of Ukrainian wheat in Asia was Bangladesh acquiring on average 16.8% of Ukrainian export. For the last three years Top-importer of Ukrainian wheat to Asia was Indonesia embracing 22.8% of Ukrainian wheat sales to the continent. Overall, wheat sales covered 76.7% and 79% of the total goods' export to these countries from Ukraine in 2018. Wheat export to Asia is a clear and sound evidence of Ukrainian commitment to the global food security. Actually, being the 4th most populous country in the world Indonesia has to be the major importer of wheat across the globe. Similarly, Bangladesh is the 8th most populous state with the highest density of population among the countries with over 8 million people. The sole robust major buyer of Ukrainian barley during 2006-2018 was Saudi Arabia with the average import share of 69%. It is worth mentioning that Saudi Arabia have the second greatest demand for barley in the world. And it was barley sales that absorbed 60% of international trade between Ukraine and Saudi Arabia in 2018. Unfortunately, Ukraine does not gain from exporting barley to its mainstream world importer China. Undoubtedly, improvements in this area would offset the sharpest misbalance of \$5.4 billion displayed by Ukrainian foreign trade in goods with China. The lasting consumer of Ukrainian maize was Iran with the average share of 24.7% in Ukrainian export to Asia. The Top-importer of maize for the past five years was China acquiring on average 39.7% of Ukrainian export to the continent.

The key buyers of Ukrainian wheat in Africa were Morocco, Tunisia, and Egypt. The latter one was the long-term prevalent importer which acquired on average 41.8% in Ukrainian wheat export to Africa. Egypt was also a leading African consumer of Ukrainian maize with the share of 65.7%. As before, these export links confirm strong Ukrainian involvement in the global food security. It is true because Egypt is the first African importer of wheat and maize necessary to meet challenges of feeding the 14th most populous country in the world. Ukrainian barley was the most sellable in Libya which encompassed on average 56% in Ukrainian export to Africa. As before, this Ukrainian input to the global food security provided the demanded coarse grain crop to the largest importer in the continent.

CONCLUSION

Overall, the study findings revealed that now the cereals segment of Ukrainian agriculture has returned and successfully justifies its name of 'breadbasket' at the global scale (Babenko et al., 2017). It is important since further development of grain production is a primary issue in the world agenda. Really, the present global indicator of cereals production per capita amounted to 0.34 tons. In particular, wheat production of 0.1 tons per capita agrees with the recommended level of the healthy dietary (USDA, 2019). But the annual growth of the world population at a rate of around 1.1% implies the same imperative increment in grain harvest. The outlined results of this research substantiated the options to desired steady progress.

Concerning Ukrainian cereals production, it supposes implementing innovations to raise regional yields applying the checked practices from the EU countries. Consequently, an additional grain production will boost export quantities. To expand its market shares, Ukrainian cereals growers should focus on:

- grain quality to satisfy strong requirements of European consumers, including those ones in Belgium, Germany, Italy, the Netherlands, and Spain;
- logistics and product promotion in Asia with regard to the overpopulated countries which are the largest world cereals producers, like China, India, and Pakistan or the major world grain importers, involving Bangladesh, Indonesia, Japan, Malaysia, the Philippines, South Korea, and Vietnam;
- increasing volumes and expanding geography of grain export to African continent which have

the most rapid growth in population at an average rate of 2.6% per annum, meaning Nigeria as well as richer countries, such as Algeria, Egypt, Libya, Morocco, and Turkey.

Eventually, the offered improvements targeted at the production and export components of the cereals segment in Ukrainian agriculture would facilitate existing positive dynamics of Ukrainian contribution to the global food security.

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APPENDIX

Table. Initial Data to ABC-XYZ Analysis

| Region | Share of Harvest, % | | Deviation of Yield, % | |
|-----------------|---------------------|-------|-----------------------|-------|
| | Cereals | Wheat | Cereals | Wheat |
| Cherkasy | 5.9 | 3.8 | 31.9 | 14.8 |
| Chernihiv | 6.4 | 3.3 | 35.9 | 8.2 |
| Chernivtsi | 0.9 | 0.7 | 1.9 | 10.8 |
| Dnipropetrovsk | 5.3 | 6.3 | -30.2 | -16.6 |
| Donetsk | 2.5 | 4.4 | -32.9 | -13.0 |
| Ivano-Frankivsk | 1.2 | 1.2 | 12.4 | 19.7 |
| Kharkiv | 6.1 | 7.9 | -11.3 | 3.7 |
| Kherson | 3.6 | 5.7 | -26.1 | -15.5 |
| Khmelnyskiy | 5.2 | 5.1 | 37.6 | 40.2 |
| Kirovohrad | 5.2 | 4.1 | -6.9 | -7.7 |
| Kyiv | 5.1 | 3.5 | 27.1 | 10.4 |
| Luhansk | 1.9 | 3.3 | -30.1 | -13.8 |
| Lviv | 2.2 | 3.1 | 5.8 | 17.0 |
| Mykolayiv | 4.1 | 5.2 | -30.8 | -15.3 |
| Odesa | 6.6 | 8.8 | -19.9 | -4.9 |
| Poltava | 8.3 | 4.1 | 26.9 | 6.3 |
| Rivne | 1.9 | 1.8 | 4.4 | 12.2 |
| Sumy | 6.0 | 3.7 | 38.9 | 19.2 |
| Ternopil | 3.9 | 4.2 | 22.8 | 29.1 |
| Vinnytsya | 8.3 | 7.4 | 40.1 | 32.3 |
| Volyn | 1.8 | 2.7 | -11.8 | 7.9 |
| Zakarpattya | 0.6 | 0.4 | -2.8 | -18.6 |
| Zaporizhya | 3.9 | 7.1 | -38.5 | -24.7 |
| Zhytomyr | 3.3 | 2.3 | 14.1 | 7.1 |

Source: compiled by the author based on data from State Statistics Service of Ukraine (2019).