



AGRICULTURAL OUTLOOK UKRAINE

SCENARIOS: PROJECTIONS FOR OPEN & BLOCKED EXPORT

The RF's invasion of Ukraine, the world's one of the biggest agricultural producers, led to skyrocketing of the world market prices of grains and oilseeds. The FAO Price Index has updated the historical maximum with the record value of 159.7 in March 2022 and 154 in June 2022. During the 2020-2021 pandemic years the Index did not exceed 125.7. This makes the world facing unprecedented inflationary pressure. (FAO, 2022) Employing the AGMEMOD model under the assumptions stated below, the paper estimates Ukraine's crop and meat production in 2022-2030 and addresses the issue of export flows impact on sowing and harvesting campaigns.

METHODOLOGY AND ASSUMPTIONS

To assess the future perspectives of the Ukrainian agricultural sector and markets under different war-related scenarios, the AGMEMOD model is applied. It is an econometric, dynamic, partial-equilibrium, multi-country, multi-market model. It covers all EU Members States, some non-EU countries, such as Ukraine, Balkan countries, and Kazakhstan, and a stylized version of the rest of the world (RoW). The model provides annual projections until the year 2030 for markets of the main agricultural commodities. The markets are represented by equations for supply and demand, stocks, international trade, and market prices. They reflect behavioral responses of economic agents to changes in prices and exogenous variables such as agricultural policy instruments, GDP, currency exchange rate, import tariffs, etc. The equations' parameters are usually estimated as time series regressions. Following the partial equilibrium approach, commodity prices adjust to clear each commodity market. Lagged endogenous variables introduce (recursive) dynamic behavior when entered as determinants in the next period's equilibrium supply and/or demand (Nykolyuk et al. 2021).

Two scenarios are defined for the current study: Blocked exports (BE) and Open exports (E). Table 4 summarizes the assumptions for these scenarios.

Table 4 Scenarios description

Assumptions	Applies to crops (C), livestock (L)	Blocked export (BE)	Open export (E)
Level of export blockade	C	1.5 mil tons per month in total	entirely unblocked
Duration of war	C, L	2022-2023	
Reduction of grains area due to occupation and active fighting in 2022-2023	C	-13% from the 2021 grains area harvested in 2021	



Reduction of oilseeds area due to occupation and active fighting in 2022-2023	C	-20% from the 2021 oilseeds area harvested in 2021
Increase in cost for fuel in 2022-2023 compared to 2021 (data of April 2022), %	C	+106.6
Increase in costs for fertilizers in 2022-2023 compared to 2021 (data of April 2022), %	C	+20.4
Factor of wheat, barley, rye, and oats yield reduction due to limited availability of fuel and fertilizers in 2022-2023 (expert opinion), 100 kg/ha	C	-2.3
Factor of maize yield reduction due to limited availability of fuel and fertilizers in 2022-2023 (expert opinion), 100 kg/ha	C	-5.1
Factor of rapeseed yield reduction due to limited availability of fuel and fertilizers in 2022-2023 (expert opinion), 100 kg/ha	C	-9
Factor of sunflower and soya beans yield reduction due to limited availability of fuel and fertilizers in 2022-2023 (expert opinion), 100 kg/ha	C	-7
Domestic market prices in 2022	C L	June 2022, open sources data June 2022, producers' questionnaire
Domestic market prices in 2023–2030	C, L	Defined by the model
World market prices in 2022–2030	C, L	OECD-FAO Outlook 2022
Crops storage assumption	C	Storage available
GDP projections 2022-2030 <i>IMF, April 2022</i> <i>SSSU projections</i> <i>Growth rate projected by USDA in 2021</i>	-	2022-2023: - 35% compared to 2021 2024: rebound by 12.5% 2025-2030: +3.1% annually
GDP deflator <i>As of July 2022, according to the National Bank of Ukraine</i> <i>According to the USDA 2021 projections</i>	-	2022: 30 2023–2030: +5% annual growth
UAH/USD currency exchange rate <i>As of July 2022, according to the National Bank of Ukraine</i> <i>According to the USDA 2021 projections</i>	-	2022–2023: 36.6 2024–2030: +0.2% annual growth
Population <i>Assuming 4 mil people left Ukraine considering 2021 USDA projections until 2030</i> <i>Return of all the war refugees, according to 2021 USDA projections until 2030</i>	-	2022-2023: -4 mil from the projected number 2024-2030: according to the former projections

Source Own elaboration

STRUCTURE OF CROPS AREAS

Areas sown in 2022 have been introduced into the model as data. According to the time series of State Statistics Service of Ukraine (SSSU), the difference with areas harvested rarely exceed 2%. Therefore, it is possible to already observe how shares in crop areas have changed with the war. The shares of areas harvested in 2023-2030 are projections. Figure 3 demonstrates the 2021-2030 shares of grains and oilseeds in the area of arable land.

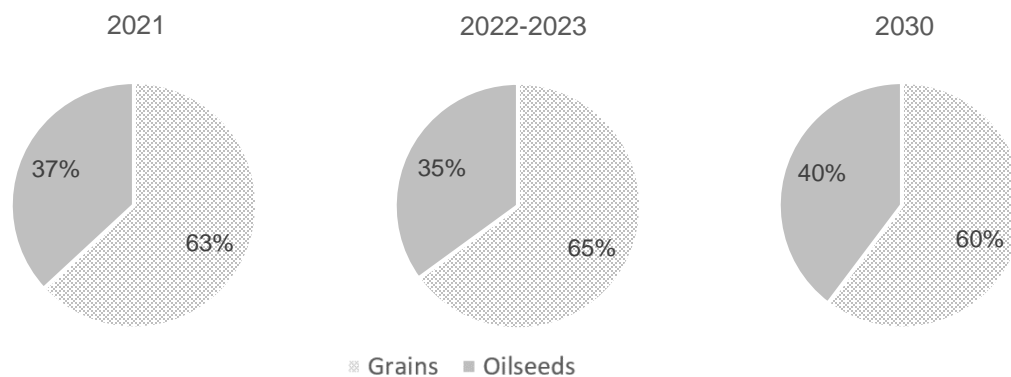


Figure 3 Shares of grains and oilseeds areas in 2021-2030 (scenarios BE (blocked export) and E (export) show similar results), % **Source** SSSU for 2021-2022, own estimation for 2023-2030



Before the RF invasion, shares of grains and oilseeds occupied, respectively, 63% and 37% of the arable land. With the changes in crops profitability in 2022-2023, which stems from changes in domestic market prices and production costs during the wartime, area of oilseeds reduced to 35% in favor of grains. In 2030, with stabilization of the prices and end of the war, area of grains reduces to 60% and of oilseeds increases to 40%. Such trend has been observed before the war. Change in relative profitability of the two groups of crops induced by the relative changes of the domestic and world market prices is the main reason for this. The model produces similar outcome for both scenarios. Figures 3 and 4 demonstrate 2021-2030 changes in shares of areas of crops in the grains and oilseeds groups.

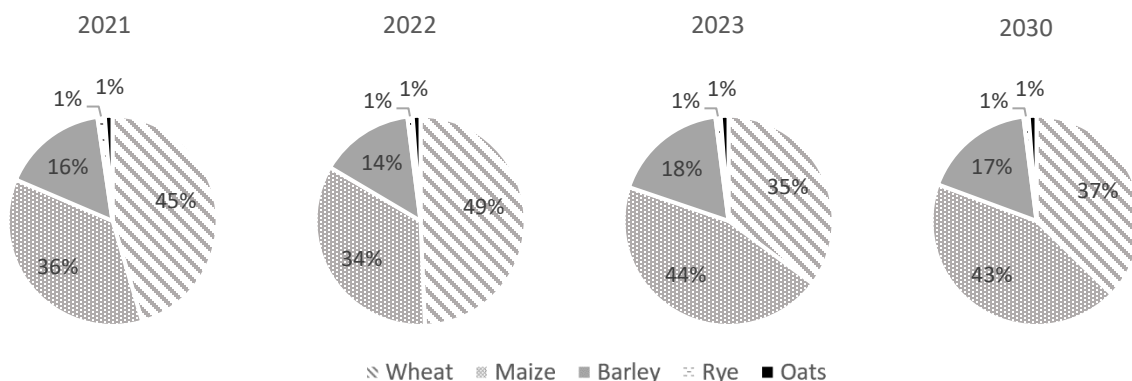


Figure 3 Shares of crops areas in the grains group in 2021-2030 (scenarios BE (blocked export) and E (export) show similar results), %. **Source** SSSU for 2021-2022, own estimation for 2023-2030

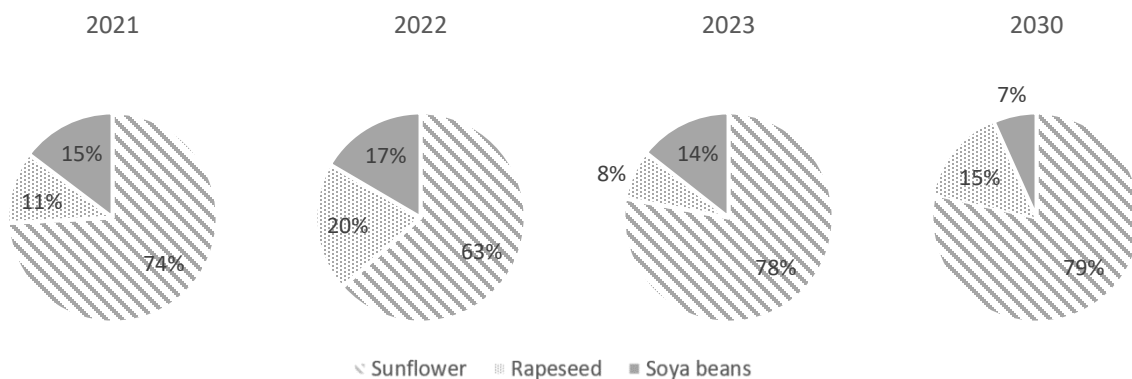


Figure 4 Shares of oilseeds areas in the oilseeds group in 2021-2030 (scenarios BE (blocked export) and E (export) show similar results), %. **Source** SSSU for 2021-2022, own estimation for 2023-2030

Before the RF invasion, the shares of wheat, maize and barley, the main agricultural crops in Ukraine (i.e., export-oriented crops), were, respectively, 45%, 36% and 16% of the total grains area. Oats and rye occupied around 1% each. In 2022, share of wheat increased by 4%, and shares of maize and barley drop by 2% each, demonstrating the substitution in favor of wheat. The shares of oilseeds were 74% for sunflower, 11% for rapeseed and 15% for soya beans in the total oilseed's areas. In 2022, they changed to, respectively, 63%, 20% and 17%. The changes in crops area shares result from changes in profitability of crops (within grains and oilseeds groups) relatively to each other. In the model, domestic market prices and production costs combine into the, so-called, expected gross margins. The latter represent profitability of crops production. Decreased prices (apart from sunflower seeds, domestic market prices for which increase by 2% in 2022) and increased costs in 2022 change this relative profitability in favor of wheat for the grains group, and in favor of rapeseed and soya beans for the oilseeds group. Thus, although, the areas of crops sown are introduced into the model as data, the relative profitability changes support these observations.



CROPS PRODUCTION

For 2023 the model assumes real production costs equal to those of 2022, and for 2023-2030 projects the recovery of domestic market prices by 27.7-56.6% depending on the crop (see Figure 5).

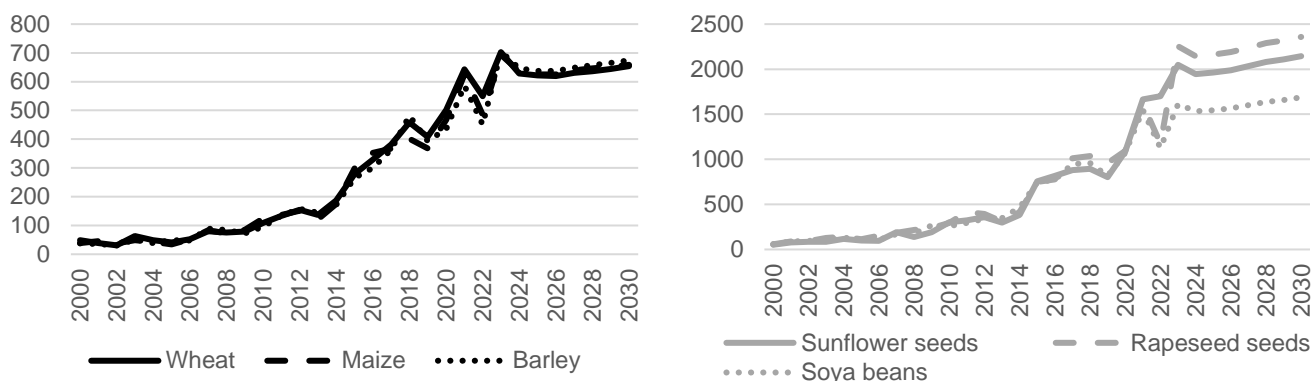


Figure 5 Domestic market prices for wheat, maize, barley, sunflower seeds, rapeseed seeds and soya beans in 2000-2030 (scenarios BE (blocked export) and E (export) show similar results), UAH/100 kg. **Source** SSSU for 2000-2022, own elaboration for 2023-2030

The price recovery stems from two factors. First, is the assumption of storage availability during export blockade (scenario BE). It allows the producers to go on with their production plan even with the delayed export. Second, is the return of connectedness of domestic market prices to the world market prices coupled with the increased UAH/USD conversion rate (i.e., around 36 UAH per 1 USD in 2023-2030 as opposed to 29 UAH per 1 USD in 2021). Re-establishment of the price connection is based on the assumption that the producers, having available storage facilities, will not rush into selling their crops at low prices (to save the harvest and at least partially cover their production costs). Instead, they will be able to claim better market price. The model, however, does not include increased storage costs which occur due to longer storage period and increased storage capacity (i.e., investment/amortization costs).

With the change in relative gross margins in 2023-2030, wheat area will drop to 35-37% of the grains area, and maize and barley areas increase to, respectively, 44-43% and 18-17% (Figure 3). Increase in maize area will as well result from the long-term observed trend of change of weather conditions towards being more favorable for production of this crop. Sunflower and rapeseed area shares are expected to increase to, respectively, 79% and 15% at the expense of soya beans area.

Crop yields changes in 2022-2030 vary due to unequal relative changes in crops gross margins (which define the readiness of the producers to invest in crop protection products and fertilizers) and yield change factors (see Table 4). Thus, in 2022 maize yield drops significantly, by 42.8% compared to 2021, barley yield by 25.1% and wheat yield is affected the least, i.e., -1.6%. Yield of sunflower seeds drops by 7.2% of rapeseed seeds by 37.9% and of soya beans by 33.8%. With the recovery of prices, the yields grow back and resume to steadily increasing trends by 2030.

Figure 6 demonstrates the projections for production and export of wheat, maize, barley, sunflower and rapeseed seeds, soya beans and the respective oils for 2023-2030.

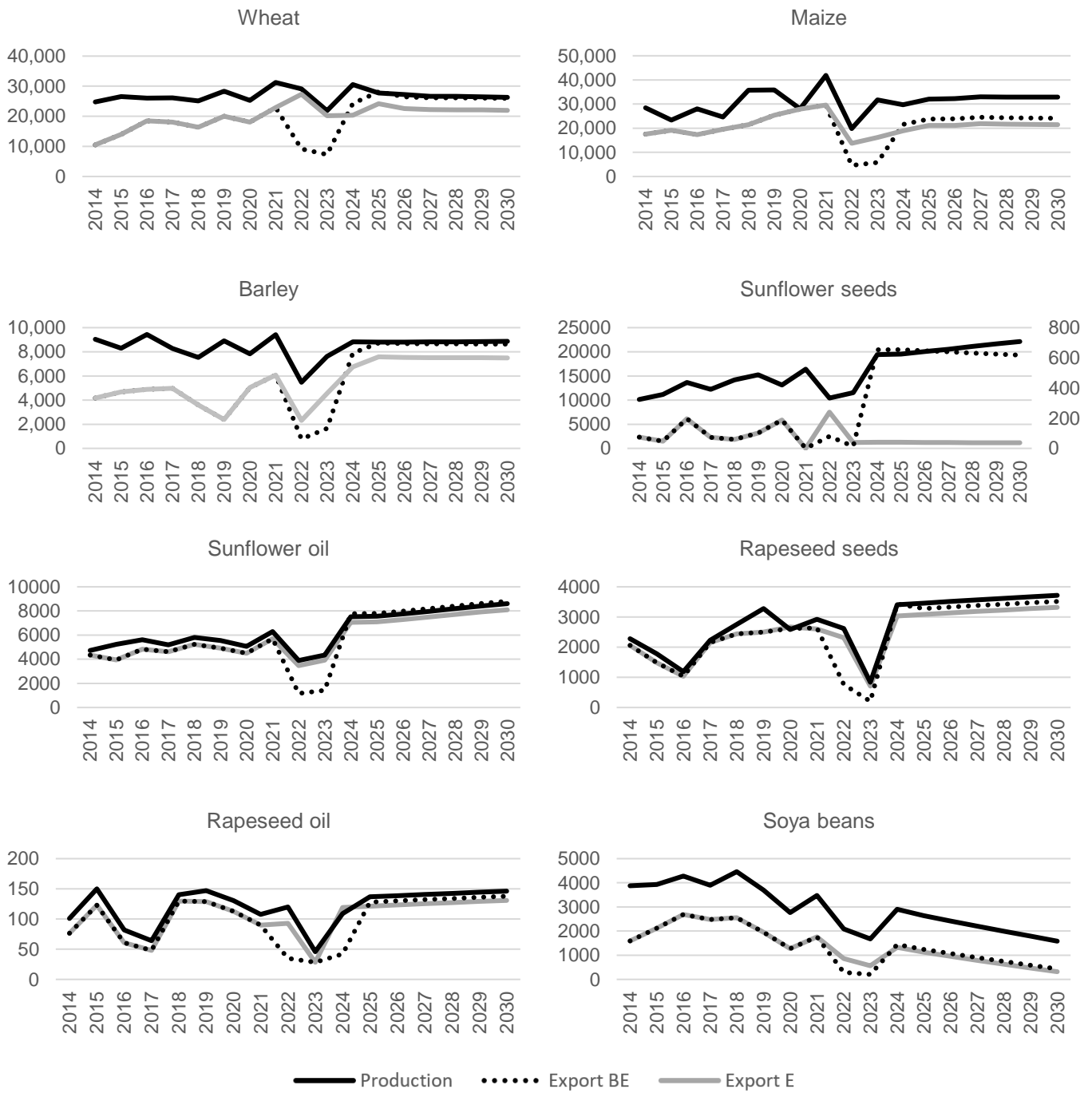


Figure 6 Wheat, maize, barley, sunflower and rapeseed seeds, soya beans and oilseed oils production and export in scenarios BE (blocked export) and E (open export) in 2014-2030, thsd tons. **Source** SSSU for 2014-2022 for production (for oils 2014-2020, FAOSTAT), own elaboration for 2023-2030 for production and 2022-2030 for exports

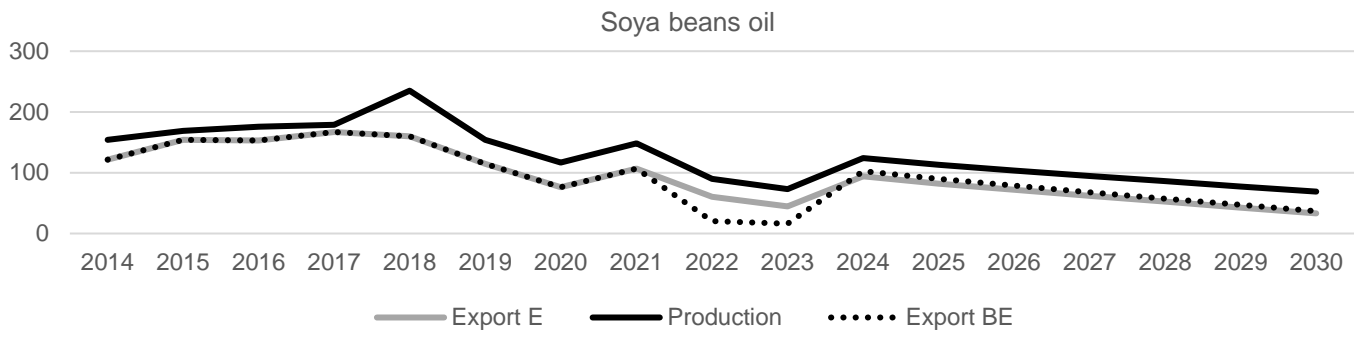


Figure 6 (cont.) Wheat, maize, barley, sunflower and rapeseed seeds, soya beans, and oilseed oils production and export in scenarios BE (blocked export) and E (open export) in 2014-2030, thsd tons. **Source** SSSU for 2014-2022 for production (for oils 2014-2020, FAOSTAT), own elaboration for 2023-2030 for production, and 2022-2030 for exports

Scenarios BE and E produce similar projections for the production of grains and oilseeds due to the similar projected expected gross margins (see above). The projections for quantities exported, however, are different. In 2022-2023, scenario BE (blocked export) shows a tremendous drop in exports and starting from 2024 a quick recovery. Furthermore, exports often exceed production in this scenario. Quick recovery is explained by the fact that as long as the total volume of exports does not exceed the maximum loading capacity of the Ukrainian sea ports which is 75 mil tons per year, no obstacles to such a trend are foreseen. Exports exceed production in scenario BE for many of the presented commodities because non-exported produce which is accumulated in storage facilities in 2022-2023 is exported. In scenario E, exports follow production. Overall, we observe increase at a low steady rate production of maize, increase of production of sunflower and rapeseed seeds and of the respective oils, and decreasing production of wheat and soya beans and soya beans oil. Changes in production follow the changes in yields and areas harvested.

POULTRY AND EGGS PRODUCTION

With the start of the war, production and export of poultry meat and eggs are projected to drop due to the increased production costs (Figure 7). Whereas the poultry meat sector recovers in 2024, the eggs sector leaps already in 2023. The latter is related to the households resuming their production activity. Scenarios BE and E produce similar results because livestock commodities are not usually exported through the seaports. Respectively, export remains unblocked for these products even in scenario BE. Although the production of bovine and pig meat is expected to be strongly affected by the war due to the shortages and increased prices of feed, as well as the loss of livestock heads due to the battles and occupation, the current model setting does not project the respective changes.

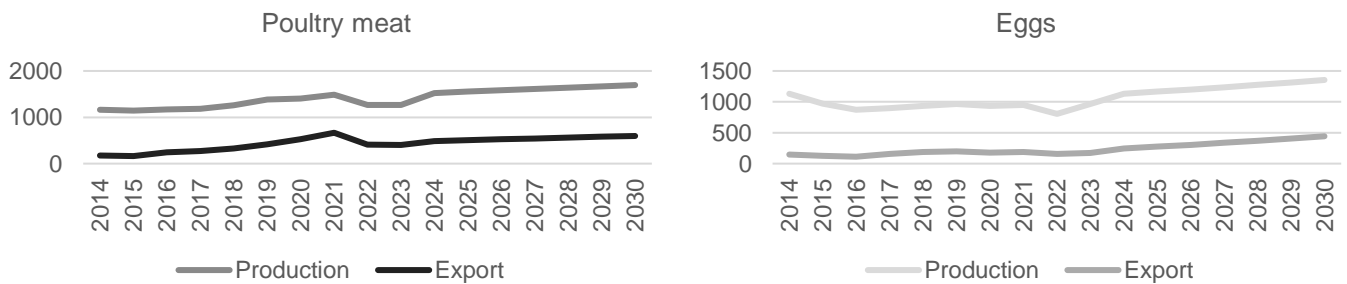


Figure 7 Poultry meat and eggs production and export in 2014-2030 (scenarios BE (blocked export) and E (export) show similar results), thsd tons. **Source** SSSU for 2014-2021, own elaboration for 2022-2030



CONCLUSIONS

As the RF's war in Ukraine goes on, the producers struggle to cope with its consequences. High fuel and fertilizer prices, low domestic market prices for grains and oilseeds, reduced export possibilities due to the sea ports blockade and high level of infrastructure and production facilities' damage put the agricultural sector at risk of low profitability and production reduction. Since more than two thirds of grains and oilseeds harvest is exported, the main income from producing these kinds of agricultural commodities comes from external trade. The scenario analysis demonstrates that availability of storage facilities has the potential to support the producers in case of limited export: knowing that the harvest could eventually be sold, the producers would stay in the sector. For the harvest of 2022, however, neither the availability of additional storage capacities nor the improvement of export possibilities is certain.

SOURCES

FAO (2022): World Food Situation, <https://www.fao.org/worldfoodsituation/foodpricesindex/en/>

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