CROATIAN MEDIUM-TERM SOFT WHEAT MARKET OUTLOOK

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Abstract: With Croatia's accession to the European Union (EU), numerous changes have taken place within the key agricultural markets. This primarily relates to the introduction of Common Agricultural Policy measures and instruments, the convergence of domestic agri-food product prices, the opening of the domestic market and the producer's adjustment to the business conditions within the EU single market. Sophisticated tools such as partial equilibrium (PE) econometric models are commonly used in the impact assessments of the integration processes and for the development of medium-term market outlook simulations. The aim of this research is to develop a medium-term outlook of the soft wheat market in the Republic of Croatia up to 2030. As an appropriate tool, the AGMEMOD (PE) model was used to provide baseline simulations. The model results simulate future trends of main agrarian policy indicators (sown area, production, yield, import, export and average producer price) on the soft wheat market. The Croatian soft wheat market outlook assumes *ceteris paribus* market conditions with the existing agricultural policy structure until the end of the simulated period. The main findings of the simulated outlook indicate a slight growth trend of sown areas, continued growth of yield and production, along with soft wheat exports increase in Croatia by 2030 compared to 2018. Furthermore, the soft wheat degree of self-sufficiency in Croatia is expected to be 114% by the end of the simulated period.

Key words: soft wheat market, outlook, partial equilibrium, simulation, AGMEMOD.

Introduction

Agriculture is defined as a strategic branch of the economy in the Republic of Croatia by the Law on Agriculture (NN 118/18). A significant part of Croatian agricultural production is crop production, and the production of soft wheat as the most important bread-making cereal has great economic significance. Crop production made 59.1% of total gross agricultural production in Croatia, and grain production made 57.2% of total crop production in 2018, according to the Croatian Bureau of Statistics (CBS) data. In the structure of total grain production, soft

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wheat production ranks second after corn (61.6%) production with a share of 26.7%. These two crops account for approximately 80% (corn 51.2%, soft wheat 29.5%) of the total arable land under grains.

Since Croatia joined the EU in 2013, soft wheat production has been stable at an average level of 793.751 tons, while the areas sown to soft wheat in the same period averaged at 152.761 ha. Regarding sown areas, a significant oscillation is noticeable from 203.427 ha of sown areas in 2013 to 116.150 ha in 2017 with a declining trend of soft wheat area sown.

Soft wheat yields in Croatia have had a growth trend since EU accession, amounting to 5.2 t/ha on average in the period from 2013 to 2018. In the same period, the average soft wheat yields at the EU level were 5.8 t/ha (EU-15 Member States averaged at 6.7 t/ha; EU-13 Member States at 4.3 t/ha). Croatia, which belongs to the group of EU-13 Member States, has higher levels of average soft wheat yields than the average yield levels of the new Member States, but it is still closer to EU-13 average yield levels in relation to the average soft wheat yields in the old Member States (Zrakić Sušac et al., 2020).

Croatia is not self-sufficient in its own production of agri-food commodities, and the deficit in the foreign trade of agri-food products amounted to approximately 1 billion euros in 2018 (Grgić et al., 2019; Ministry of Agriculture, 2019). However, as far as grain production is concerned, the situation is different, and Croatia has sufficient levels of production of all main grains, while the degree of self-sufficiency of soft wheat production amounted to 114.17% in 2018.

Average soft wheat producer prices from Croatia's accession to the EU until 2018 were also stable, and since then, they have been below the levels of EU average soft wheat producer prices with a slight downward trend (Kranjac et al., 2020). In the mentioned period, the average soft wheat producer price in Croatia was 106.72 EUR/t.

The aim of this research is to apply the partial equilibrium (PE) econometric model, and to develop a soft wheat market outlook in the Republic of Croatia, including historical (2000–2018) and simulated development of the main agrarian policy indicators within the same market up to 2030. The main agrarian policy indicators related to production, yields, imports, exports and average producer price are the most important indicators while developing evidence and model-based market simulations and assessments (Matthews, 2018; Colen et al., 2016).

Furthermore, medium-term model simulations of key agricultural product markets are an established practice of the European Commission and the scientific community. Such simulations provide impact assessments of existing agricultural policy measures on key agricultural markets (EC, 2020; Kranjac et al., 2019; Salamon et al., 2019; Chantreuil et al., 2013; Erjavec et al., 2006).

Material and Methods

The method used for this research was the AGMEMOD (*Agriculture Member State Modelling*) model, which is an econometric, dynamic, multiproduct, multi-country partial equilibrium (PE) model. The main role of this model is to generate medium-term simulations of key agricultural market products, i.e. *outlooks* up to 2030 (Kranjac et al., 2020). The model has many characteristics as named above, and its dynamic feature realizes in a way that simulated variables are susceptible to exogenous changes (policy and macroeconomic variables). Another model feature is the *bottom-up* approach which is based on the AGMEMOD common country-level model template specifically developed to reflect the state and situation of agriculture in a particular country and then combined into a composite EU model (Donnellan et al., 2001; Chantreuil et al., 2012). Furthermore, the country-level model is composed of many commodity market sub-models. For example, the grain sub-model consists of the following commodities: soft and durum wheat, corn, barley, oats and rye.

Each commodity market is based on annual time-series data, in this case, Croatian soft wheat market historical balance sheet data. Data in the model range from 1995 up to 2018, and they are compiled from national statistical offices or sources and cover data on production, consumption, imports, exports, beginning stocks and ending stocks in the form of balance sheets (CBS, 2019; Ministry of Agriculture, 2019).

In order for the model to satisfy the partial equilibrium condition, it is necessary to establish agricultural market equilibrium for each individual key, which implies the following equality at a certain product price:

$$Production_t + Beginning\ stocks_t + Imports_t = Domestic\ use_t + Ending\ stocks_t + Exports_t$$

Within the commodity market sub-models, in this case, for soft wheat, supply and demand, international trade and prices are endogenously determined within the model (Chantreuil et al., 2012). Country-level models demonstrate changes in the behavior of producers and consumers, changes in exogenous data (macroeconomic variables, technical progress, policy instruments) and prices (Figure 1). From exogenous and endogenous data using sets of econometrically estimated equations, the model generates simulations of endogenous variables.

The general form of the econometric equation according to which the model derives the output variables is the regression equation. Therefore, the general equation of the model can be written as:

$$Y = \alpha + \varepsilon\beta_1 X_1 + \varepsilon\beta_2 X_2 + \varepsilon\beta_3 X_3 \ldots + \epsilon \tag{1}$$
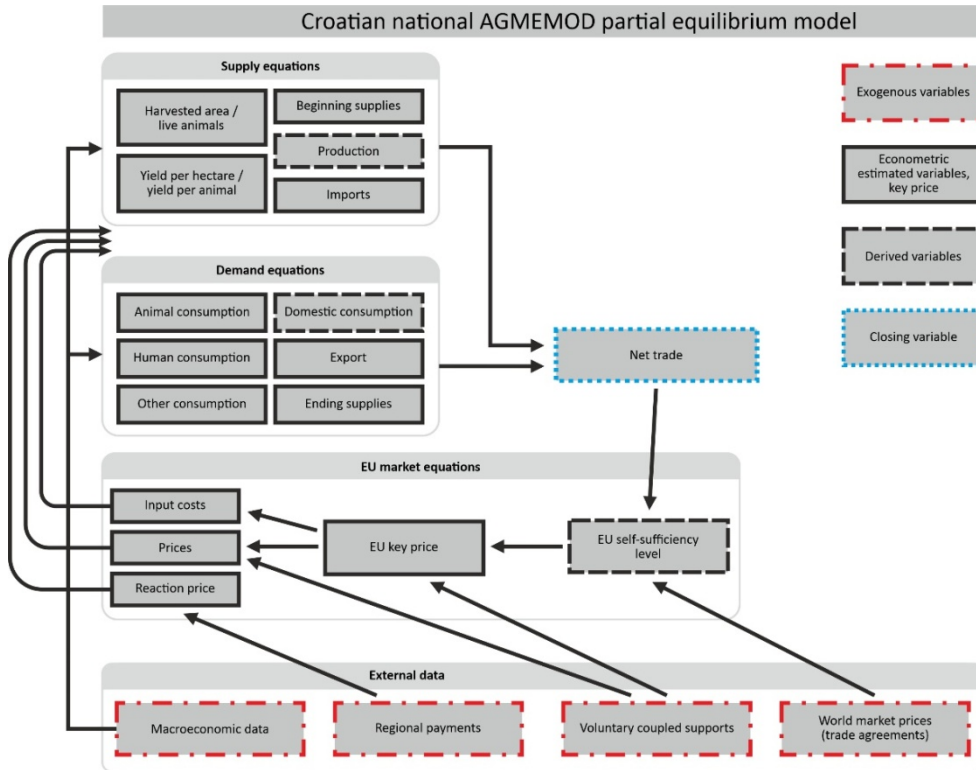
Figure 1. The Croatian AGMEMOD country-level model template.
Source: Authors' elaboration, according to Bartova and M'Barek (2008).

Equation 1 presents the standard regression equation, where Y is the dependent indicator, α is the intercept, ε – the elasticity coefficient, β – the regression coefficients, X_{123} are independent factors affecting the change of the dependent indicator, and ϵ is an error term.

Next, the general forms of econometric equations in the model used for the simulation of the soft wheat market in Croatia will be presented. Equation 2 presents the model equation for the total soft wheat area harvested, which can be written as:

$$ah_{i,t} = f\left(p_{i,t-1}^{j}, ah_{l,t-1}, V\right) \qquad j = 1,\ldots,n;\ \ i,l = 1,\ldots,3;\ \ i \neq l \qquad (2)$$

where ah presents the area harvested in year t for the culture group i, p is the real price in the year $t-1$ of the culture j belonging to the culture group i, prc presents the change in price reaction in the year $t-1$ of the culture j that belongs to the group culture and V is a vector, indicating an exogenous variable that can affect the harvested area.

Equation 3 presents the general equation used for soft wheat yield, and it can be written as:

$$r_{i,t}^k = f(p_{i,t-1}^j, r_{i,t-1}^k, V) \qquad\qquad j, k = 1, \ldots, n \qquad (3)$$

$r_{i,t}^k$ is the yield of the culture k that belongs to the culture group i for the year t, p is the real price in the year $t-1$, and V presents a vector, indicating an exogenous variable that can affect the soft wheat yields (e.g. political instruments).

Based on the previous equations, the soft wheat production is determined: soft wheat production = soft wheat harvested area x soft wheat yield.

Equations 5 and 6 are general forms of import and export equations in the model, and they can be expressed as follows:

$$Ex_{i,t}^k = f\left(Pr_{i,t}^k, Du_{i,t}^k, Ex_{i,t-1}^k\right) \qquad\qquad (4)$$

$$Im_{i,t}^k = f\left(Pr_{i,t}^k, Du_{i,t}^k, Im_{i,t-1}^k\right) \qquad\qquad (5)$$

$Ex_{i,t}^k, Im_{i,t}^k$ are the export and import of the culture k in the culture group i for the year t, $PR^k{}_{i,t}$ and $DU^k{}_{i,t}$ present the production and domestic consumption of the culture k in the culture group i for the year t.

The equilibrium price of the individual agricultural product is modelled differently depending on whether the national product market is a key market with a key EU price or not. Croatian agricultural products do not have production levels that affect the European price, and agricultural production in Croatia amounts to only 0.62% of the value of EU agricultural production (Grgić et al., 2019). That is why Equation 6, which presents the equilibrium price on the Croatian market for all agricultural products, can be defined as:

$$p_{i,t} = f\left(Kp_{i,t}, p_{i,t-1}, ssr_{i,t}, Kssr_{i,t}, V\right) \qquad\qquad i = 1, \ldots, n \qquad (6)$$

p is the Croatian price of the commodity i in the year t, Kp is the key price of the commodity i in the same year t, ssr presents the self-sufficiency ratio of the Croatian commodity i in the year t, $Kssr$ *presents* the self-sufficiency ratio of the same commodity on the key EU market i in the year t, V presents a vector, indicating an exogenous variable that can affect the domestic soft wheat price.

Since AGMEMOD is a sectoral model, it integrates policy instruments well into the observed key agricultural market products. It does so through a policy harmonized approach (Salputra et al., 2011), including 2015–2020 CAP measures (SPS regional payments and coupled payments along with state aid payments for Croatia). These policy instruments are recalculated and included as policy price add-ons on the producer price for a specific commodity, in this case, soft wheat. Different levels of the reaction price affect production levels, harvested area, and so on. Rural development support measures are not included in the model because these types of models cannot include this type of supports.

The Croatian soft wheat market outlook is modelled using an appropriate econometric methodology as described by the general rules of the AGMEMOD

modelling approach (Hanrahan, 2001; Erjavec and Donnellan, 2005). The outlook simulation assumes stable market conditions without market distortions with stable climatic and weather conditions (*ceteris paribus*) and with the continuation of existing agricultural policy measures up to 2030.

Results and Discussion

The quantities of soft wheat sown areas in Croatia have a declining trend. This trend is particularly pronounced after Croatia's accession to the EU (Figure 2). The soft wheat sown area declining trend is related to the relatively low soft wheat average producer prices in Croatia, which are below the levels of average producer prices in the EU (Iljkić et al., 2019). Therefore, a significant part of domestic soft wheat producers have reoriented their production to other field crops whose average producer prices are closer to the EU average producer price levels (Kranjac et al., 2020).
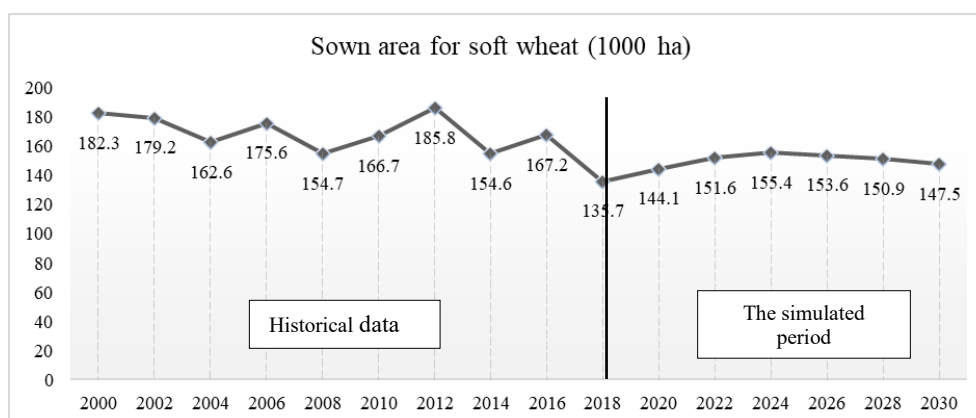

Figure 2. The medium-term outlook on the Croatian sown area for
soft wheat by 2030.
Source: AGMEMOD v8.0 modelling results.

In the following period, according to the AGMEMOD model simulation results, the stable quantity of soft wheat sown areas with a slight growth trend until 2030 compared to 2018 is expected. The reason for this is the increase in demand for soft wheat for human and industrial consumption on the single market in the coming period with the stabilization and a slight increase in soft wheat prices.

Soft wheat yields in Croatia are stable as well and have a growth trend in the pre-accession and in the period after Croatia's accession to the EU (Figure 3). However, in general, the state of production technology related to arable farming in Croatia is still worse than in the old Member States, especially in terms of the

average age and the working efficiency of agricultural machinery (Zrakić Sušac et al., 2020).
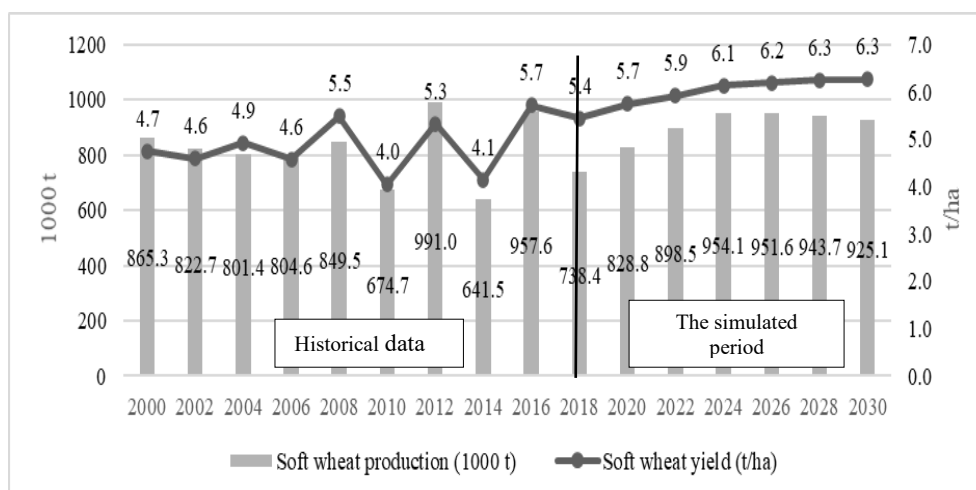

Figure 3. The medium-term outlook on Croatian soft wheat yields and production by 2030.
Source: AGMEMOD v8.0 modelling results.

The soft wheat market outlook simulation indicates that soft wheat yields in Croatia will continue to grow up to 2030. Respectively, further convergence of productivity per unit area is expected, where Croatia should approach the old Member States in terms of productivity levels. The introduction and development of new technologies in arable farming production, EU funding sources, Common Agricultural Policy (CAP) direct payments and mechanisms, changes in the landowner structure in favor of larger and more efficient farms should significantly contribute to such developments. Given the expected growth in yields and stable levels of sown areas, soft wheat production is also expected to grow by 25.28% by 2030 compared to 2018.

As we can observe from Figure 4, Croatia is self-sufficient regarding its own soft wheat production, and except in climate-unfavourable years, soft wheat exports are far higher than imports. Since Croatia's accession to the EU, the amount of exported soft wheat has increased as was the case in the other EU-13 Member States after their accession to the EU because direct payment measures effectively support intensive crop production (Csáki and Jámbor, 2009).

The model results indicate that soft wheat exports will increase slightly by 2030, with a slight decrease in imports compared to 2018.

By joining the EU, Croatia had to adjust domestic prices to EU prices, i.e. domestic agri-food product prices had to converge with prices on the single market. Given that domestic average producer soft wheat prices before joining the EU were approximately 15% higher than EU average soft wheat producer prices, it means that convergence of domestic prices caused additional pressure on domestic soft wheat producers (Kranjac et al., 2020). Since Croatia joined the EU, the average soft wheat producer price on the domestic market has remained below the levels of EU average soft wheat producer prices.
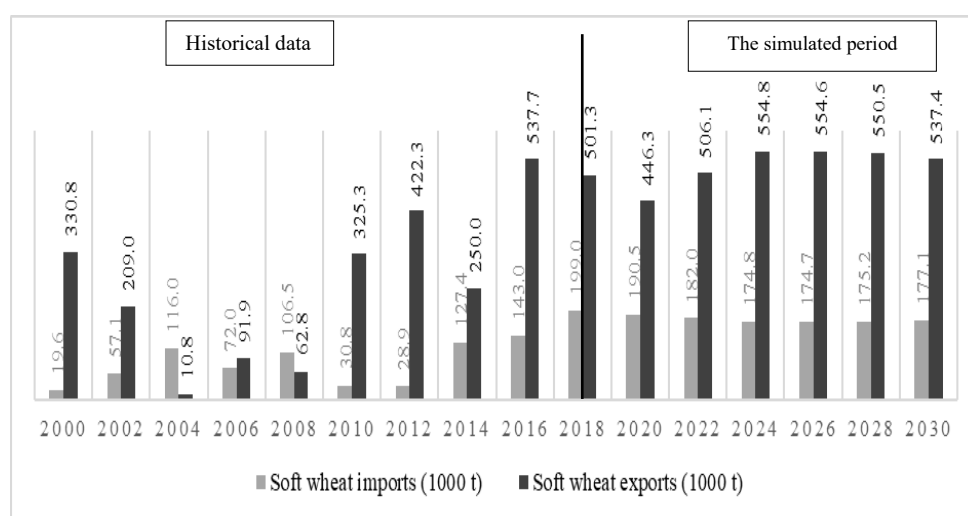

Figure 4. The medium-term outlook on Croatian soft wheat market imports and exports by 2030.
Source: AGMEMOD v8.0 modelling results.

In the following period, a slight increase in the average soft wheat producer price in Croatia is expected (Figure 5), and an increase of 19.78% by 2030 compared to 2018 has been simulated.

So far, the individual agrarian policy indicators analyzed through the model simulation within the soft wheat market in Croatia have had a positive trend, and its continuation is expected in the coming period. This primarily refers to a slight increase in soft wheat sown areas, continued growth in yields and soft wheat production in Croatia up to 2030. Given the positive aforementioned indicators, the degree of self-sufficiency on the soft wheat market in the Republic of Croatia is expected to be 114% by the end of the simulated period (Figure 6).
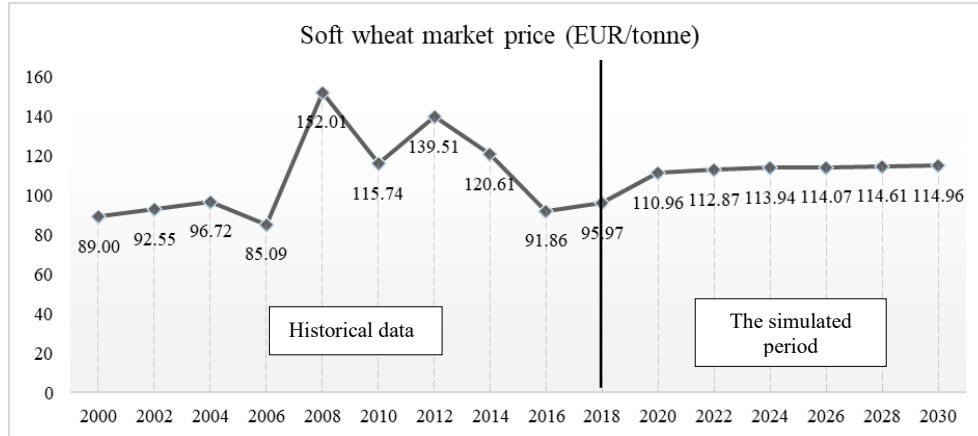
Figure 5. The medium-term outlook on the Croatian soft wheat average
producer price by 2030.
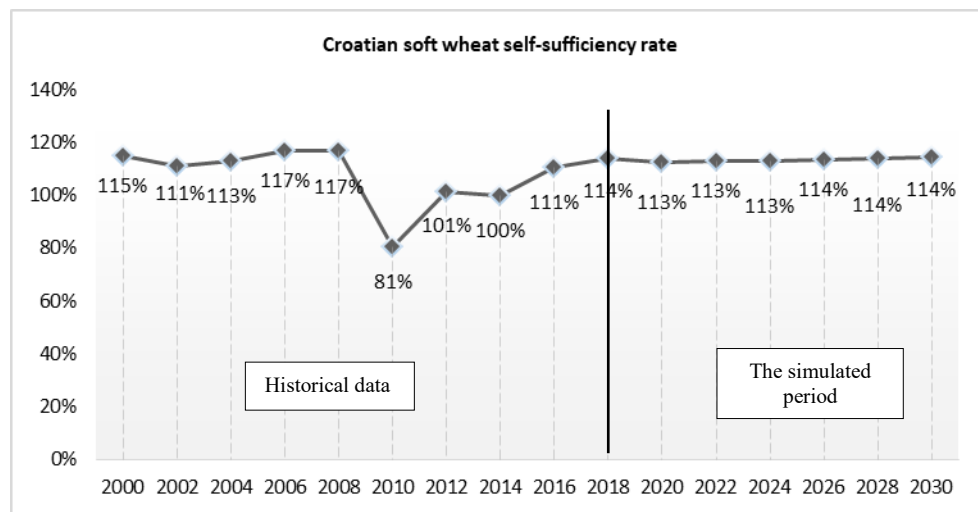Source: AGMEMOD v8.0 modelling results.

Figure 6. The simulated soft wheat self-sufficiency rate in Croatia by 2030.
Source: AGMEMOD v8.0 modelling results.

Conclusion

The AGMEMOD partial equilibrium model was used to simulate a medium-term outlook of the soft wheat market development in the Republic of Croatia up to 2030. The model results were simulated under *ceteris paribus* market conditions

assuming the existing (2015–2020) structure of Common Agricultural Policy measures by the end of the simulated period. Simulated soft wheat market outlook results indicate an increase in soft wheat sown area, yields, production and net trade exports in Croatia by 2030. At the same time, domestic soft wheat average producer prices are expected to rise by the end of the simulated period, which will have a positive impact on the soft wheat growers. Furthermore, Croatia is expected to maintain a level of self-sufficiency on the soft wheat market, which is expected to be 114% by 2030.

Model outlook market simulations are not considered as forecasts but more as projections that correspond to the expected development of the individual agricultural market given the already existing average trends that are econometrically estimated and calibrated in the model. Also, partial equilibrium sector models of this type cannot include exogenous market shocks in their projected variables that are common in agricultural markets (sudden changes in market prices, unfavorable weather conditions, structural breaks, etc.). In addition, the model cannot assess the impacts of rural development measures and agri-environmental and climate policy instruments, which also play an important role in key agricultural market products. Therefore, further improvements are needed regarding the modelling approach that would include a stochastic modelling approach, rural development measures, agri-environmental and climate policy instruments in its simulated results.

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SREDNJOROČNI PREGLED TRŽIŠTA MEKE PŠENICE U REPUBLICI HRVATSKOJ

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R e z i m e

Pristupanjem Hrvatske Evropskoj uniji (EU) dogodile su se brojne značajne promene na ključnim poljoprivrednim tržištima. To se prvenstveno odnosi na otvaranje domaćeg tržišta i prilagođavanje proizvodnje i poslovanja unutar jedinstvenog EU tržišta, uvođenje mera i instrumenata Zajedničke poljoprivredne politike i konvergencija domaćih cena poljoprivredno-prehrambenih proizvoda. U procenama uticaja integracionih procesa, te za razvoj srednjoročnih simulacija tržišta poljoprivrednih proizvoda obično se koriste sofisticirani alati poput ekonometrijskih modela parcijalne ravnoteže (PR). Cilj ovog istraživanja je razviti srednjoročni pregled na tržištu meke pšenice u Republici Hrvatskoj do 2030. godine. U istraživanju je korišten AGMEMOD (PR) model pomoću kojeg je razvijana simulacija pregleda tržišta meke pšenice u Republici Hrvatskoj. Rezultati modela simuliraju buduće trendove glavnih agrarno-političkih pokazatelja (setvenu površinu, proizvodnju, prinos, uvoz, izvoz i prosečnu proizvođačku cenu) na tržištu meke pšenice. Pregled tržišta meke pšenice na hrvatskom tržištu pretpostavlja *ceteris paribus* tržišne uslove sa postojećom strukturom poljoprivredne politike do kraja simuliranog perioda. Glavni nalazi simuliranog pregleda ukazuju na blagi trend rasta zasejanih površina, nastavak rasta prinosa i proizvodnje, kao i porast izvoza meke pšenice u Hrvatskoj do 2030. godine u odnosu na 2018. godinu. Takođe, očekuje se da će stepen samodovoljnosti meke pšenice u Hrvatskoj iznositi 114% do kraja simuliranog perioda.

Ključne reči: tržište meke pšenice, pregled tržišta, parcijalna ravnoteža, simulacija, AGMEMOD.

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