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VARIABILITY IN PRICES OF LAMB MEAT IN AUSTRIA AND POLAND

Key words: European Union, sheep, lamb market, lamb carcasses, meat prices

ABSTRACT. The main objective of the study was to present the price volatility of lamb carcasses in Austria and Poland and an attempt to indicate existing regularities. The article presents prices of lamb carcasses obtained for heavy lambs (live weight 23-40 kg). The sources of materials are data from the European Commission and EUROSTAT. The research period covered the years 2007-2019. For the analysis and presentation of materials, descriptive, tabular, graphic methods, dynamics indices with a constant and variable basis, Pearson's linear correlation coefficient and coefficient of variation were used. In Austria, lamb meat prices were definitely higher than in Poland, but also more stable, both on an annual and monthly basis. Seasonal price fluctuations have occurred in both countries. The highest prices occurred in the winter months and the lowest in the summer. The reason was the seasonality of production and consumption. Changes in lamb carcass prices have followed the same direction as changes in the economy. In the case of population, negative correlations were found in Poland, which can be considered consistent with the laws of economics. In Austria, however, positive relationships were found for this parameter.

INTRODUCTION

Agricultural production has specific features, which include: dependence on climatic and soil conditions, seasonality of production and consumption, cyclicality, mutual dependence, linking one agricultural product with another. In addition, individual activities compete with each other for limited resources, e.g. plants for sown land and animals for fodder. The specific relationships presented mean that agricultural production must be treated differently from industrial production. The existence of many conditions in the production, processing and sale of finished products from agriculture also affect the prices of these products [Olson 2004, Gębska, Filipiak 2006].

Prices of agricultural products are subject to large fluctuations, mainly due to the seasonality of production and sales [Wilkin 2009, Kowalczyk, Sobieski 2011]. They also show particularly much greater volatility than on other markets [Heijman et al. 1997].

The determinants of prices of agricultural products (raw materials, i.e. unprocessed) include mutual relations of demand and supply, biological and technical conditions of production, indirect connection of markets with consumers, inter-market relationships, relations in world trade and the impact of macroeconomic factors. In general, the price of agricultural raw materials is also greatly influenced by the price of substitution and complementary goods as well as population income, the population and demographic structure, as well as customer preferences. Customers make their shopping preferences dependent on their income, but also on other individual characteristics. When analyzing prices of agricultural products, socio-economic conditions should also be taken into account [Ferris 2005, Olson 2010].

Unprocessed agricultural products have little price flexibility, it increases with the degree of their processing. Similar relationships relate to the supply chain link, the closer it is to the customer, the more demand elasticity increases. In the case of income flexibility, so-called Engel's law applies, which deals with allocating a smaller share of income to food. Then the structure of the consumer basket changes and he/she purchases better processed products with more valuable functional properties [Kay et al. 1994, Heijman et al. 1997].

In agricultural production, prices depend on supply, which, in turn, results from biological and technical conditions. A greater randomness of conditions occurs in plant production than animal production. On the other hand, plant production, which is the basis for livestock production, also indirectly affects it. The supply of agricultural products is determined by the prices of other products, production technology, prices of means of production and natural conditions. In the short term, most often, the price elasticity of supply for agricultural raw materials is zero, which is related to the real estate of certain factors of production. Changes in supply are possible in the long term, when producers adapt their production structure to profitability and prices achieved in individual activities. High prices in a given year encourage producers e.g. to a larger stocking of animals with higher profitability, while low prices cause a reduction in production. In the following year, increasing supply reduces agricultural market prices [Tomek, Robinson 2001, Trostle 2010, Florey 2012].

Seasonality in price formation is a classic example of how demand and supply interact. Another feature of agricultural production is the impossibility of changing the structure of production in the short term, as it is cyclical. The length of the cycle depends on the nature of the production [Tomek, Kaiser 2014]. Various production support instruments are also being introduced (e.g. through direct payments), which allows low prices to be maintained. Market disturbances caused by state interventionism may lead to a change in the allocation of factors of production and, as a consequence, affect the level of prices of agricultural products [Rembisz, Stańko 2007].

Agricultural products mainly belong to basic goods. Sheep meat can be treated differently in different countries and regions. In some of them, it will be Veblen goods, while in others it will be a functional or widely used good. Similarly, profitability aspects can be considered, so lamb meat can be a basic or higher order good. Socio-economic factors are of great importance [Milewski 1999].

The reference prices for lamb are given for heavy and light lambs. The reference unit is the slaughter weight. The production of heavy lambs (23-40 kg live weight)

dominates in Great Britain, France, Germany, Austria and Poland [Rokicki 2005, Rokicki, Ringdorfer 2020]. In practice, the weight of the carcass of slaughtered lambs is 40-50% of the weight of a live animal. Slaughter yield depends on the breed, fattening method, etc. An important factor differentiating the price of lamb carcasses is the month of sale. In most EU countries, the largest demand for lamb occurred during the Christmas season (Christmas, Easter) [Rokicki 2006b]. In general, the lowest prices in both purchase and sale occurred during the summer holidays [Rokicki 2006a]. The reference prices of lamb carcasses make it possible to compare price competitiveness in different countries [Knecht, Środoń 2013]. Price comparisons in Poland and other EU countries in relation to other agricultural markets have already been made by several authors [Matysik-Pejas 2007, Hamulczuk, Klimkowski 2011, Figiel et al. 2012]. There is, however, no current compilation regarding prices on the lamb market.

MATERIAL AND METHODS

The main objective of the study was to determine the volatility of prices for lamb carcasses in Austria and Poland, and an attempt to identify existing regularities. The specific objectives were to present changes in lamb meat prices in 2007-2019, indicate periods with the highest and lowest prices, determine regularities that occurred in Austria and Poland as well as determine the relationship of prices with the situation in the economy and with the production potential expressed in the sheep population, meat production and slaughter of lambs. The paper hypothesizes that lamb meat prices in Austria were more stable than in Poland. The article presents the prices of lamb carcasses obtained for heavy lambs (live weight 23-40 kg). Austria and Poland were adopted for the targeted selection method. These were countries that kept a similar sheep population and produced heavy lambs. The sources of materials are data from the European Commission and EUROSTAT. The research period covered the years 2007-2019. These were the years before the economic crisis, during it and the period of overcoming the economic crisis. For the analysis and presentation of materials, descriptive, tabular, graphic methods, dynamics indicators with a fixed and variable basis, Pearson's linear correlation coefficient and the coefficient of variation were applied.

RESULTS AND DISCUSSION

The average annual prices of lamb meat per 100 kg of slaughter weight were definitely higher in Austria than in Poland (Figure 1). In Austria, they grew systematically, while in Poland there were periods of falling price levels, as in 2013 and 2016. The biggest difference between the prices of lamb meat was in 2017 (they were higher by 209 euros/100 kg of slaughter weight in Austria) and the smallest in 2011 (by 122 euros).

To show the volatility of prices for lamb carcasses, single-base indices were calculated for individual countries in which the previous year was used as the base (Table 1). In Austria, the largest increase in prices was recorded in 2009 (by 6.7%), and a decrease in 2010 and 2014 (by 0.5%). In Poland, the highest increase was recorded in 2018 (by
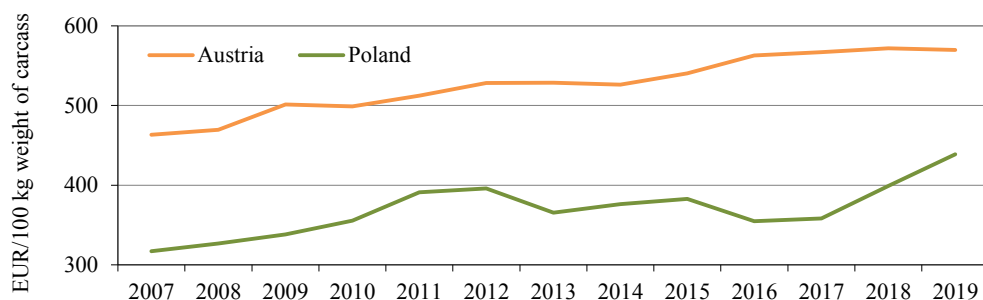
Figure 1. Average annual prices of lamb carcasses in Austria and Poland in 2007-2019
Source: own elaboration

11.4%) and a decrease in 2013 (by 7.7%). The average price of lamb in the years 2007-2019 amounted to EUR 570.11 per 100 kg of slaughter weight, and in Poland EUR 399.88. The coefficient of variation for average annual prices in the given period was 10.24% in Austria and 11.52% in Poland. In 2004-2019, prices of lamb meat increased in Austria by 26% and in Poland by 36%. With such a rate of change, the price level of lamb meat in Austria should be higher in upcoming years than in Poland.

Table 1. Changes in the prices of lamb carcasses in Austria and Poland in 2007-2019

Countries	Changes in the prices of lamb carcasses in years (previous year = 100)												
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Austria	100.0	101.3	106.7	99.5	102.8	103.0	100.1	99.5	102.7	104.2	100.8	100.8	99.6
Poland	100.0	103.0	103.5	105.2	109.9	101.3	92.3	102.9	101.7	92.7	100.9	111.4	109.9

Source: own elaboration

Average annual prices do not always show changes resulting from fluctuations in demand and seasonality. That is why monthly prices for the whole study period have been compiled (Figure 2). The price fluctuations shown in the figure were higher in Poland than in Austria. In Austria, the largest positive amplitude of fluctuations was found between October and November 2008 (price increase by EUR 29.57 per 100 kg post-slaughter weight), and negative amplitude between April and May 2014 (price drop by EUR 20.74). In Poland, the largest increase in prices was recorded between November and December 2009 (by EUR 82.45), and the largest decrease between January and February 2011 (by EUR 63.38).

The next statement shows the changes occurring in individual months and highlights the recurring periods of increase and decrease in lamb meat prices every year. In the case of Austria, the highest prices were generally reached during the largest holidays, i.e. Easter and Christmas (Figure 3). These were the periods of greatest demand associated with the tradition of consumption of this type of meat during such holidays. An additional reason was insufficient supply in these months. During the summer, oversupply occurred and
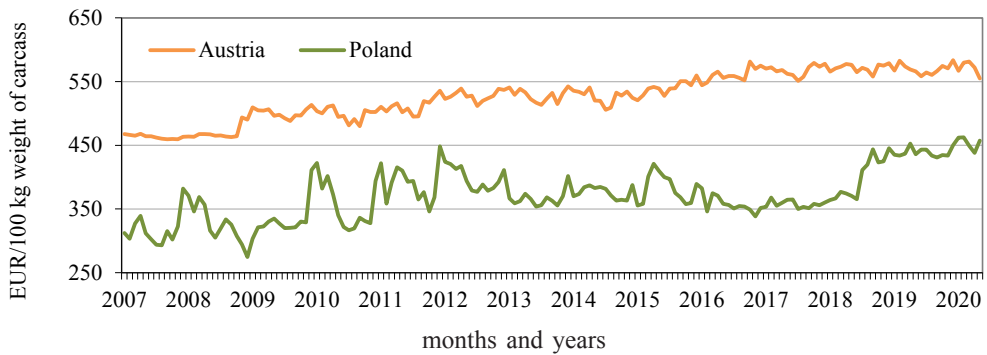
months and years

Figure 2. Average monthly prices of lamb carcasses in Austria and Poland in 2007-2019
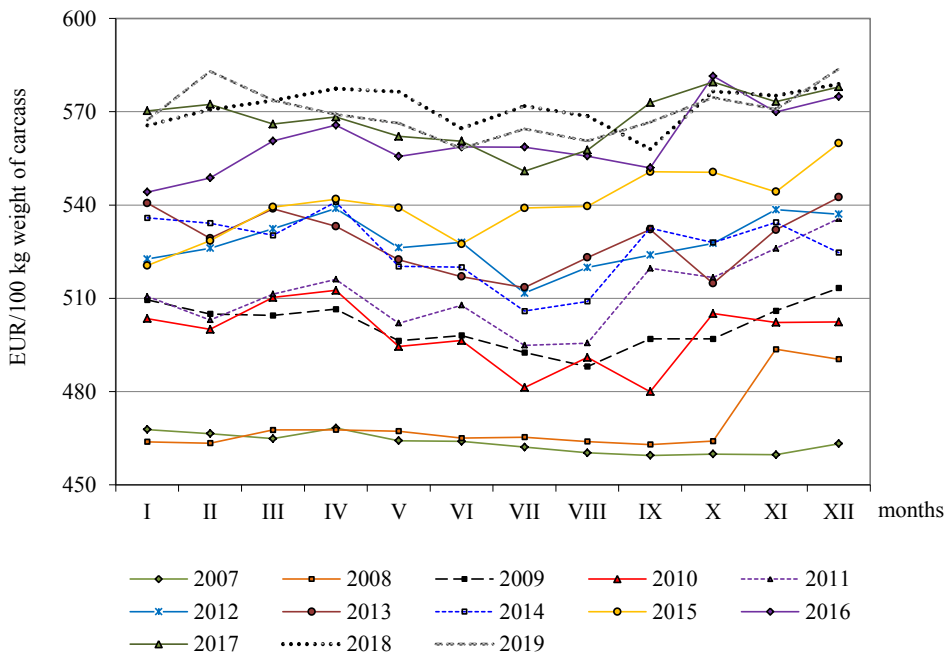Source: own elaboration

Figure 3. Average monthly prices of lamb carcasses in Austria in 2007-2019
Source: own elaboration

consumption dropped, thus resulting in lower prices. In Poland, the relationships were quite similar (Figure 4). The highest prices were definitely achieved in the first months of the year, until Easter and in December. Demand and supply factors were decisive in determining the price of lamb meat. Prices were usually the lowest during the holiday season.

Another study concerned the analysis of monthly price variability of lamb carcasses. In individual years, average monthly prices were calculated, for which coefficients of
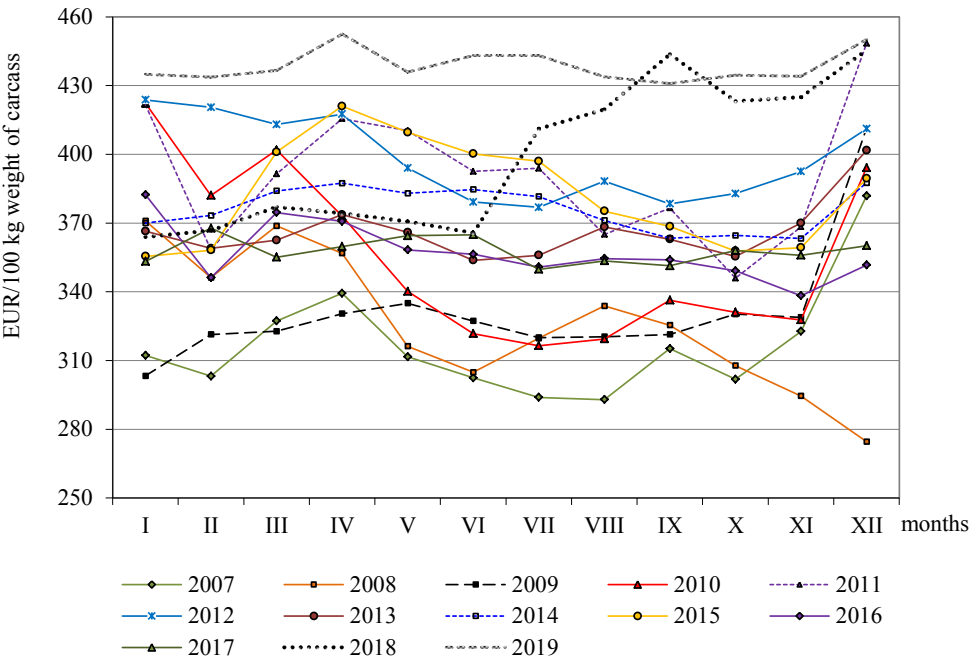
Figure 4. Average monthly prices of lamb carcasses in Poland in 2007-2019
Source: own elaboration

Table 2. Coefficients of variation of prices of lamb carcasses in Poland and Austria in 2007-2019

Country	Price volatility coefficients for lamb carcasses in 2007-2019													Medium
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Austria	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.0164
Poland	0.07	0.09	0.08	0.10	0.07	0.04	0.03	0.02	0.06	0.03	0.02	0.08	0.02	0.0546

Source: own elaboration

variation were established (Table 2). In 2007-2019, greater price stability occurred in Austria. Prices deviated from the average value in this country by an average of 1.64%. In Poland, the volatility was higher, because the average change was 5.46%. In this country, the largest price differentiation was recorded in 2008-2010, and the smallest in 2014, 2017 and 2019. Greater price stability is beneficial for both producers and processors.

To determine the relationship between changes in lamb carcass prices and the economy and production potential, Pearson's linear correlation coefficients were calculated (Table 3). $P = 0.05$ was used as the limit of significance. Important results are marked in bold. Correlation coefficients were calculated for Austria and Poland in 2004-2018. The paper attempted to check the correlation, which does not indicate that a given factor affects another, but that there is a strong or weak relationship between them. It was found that

Table 3. The correlation coefficients between the prices of lamb carcasses and selected parameters in Austria and Poland in 2007-2019

Tested parameters	Pearson's linear correlation coefficients			
	Austria		Poland	
	r	p-value	r	p-value
Correlation coefficients between lamb meat prices and:				
GDP value [current prices]	0.966	0.001	0.716	0.003
GDP per capita value [current prices]	0.962	0.001	0.712	0.003
Inflation [difference index]	0.978	0.001	0.826	0.001
Final consumption of households [current prices]	0.982	0.001	0.728	0.002
Final consumption of households per capita [current prices]	0.977	0.001	0.722	0.002
Export of goods and services [current prices]	0.918	0.001	0.701	0.004
Import of goods and services [current prices]	0.925	0.001	0.703	0.004
Sheep population [all animals]	0.882	0.001	-0.673	0.006
Lamb meat production [in weight]	0.260	0.350	-0.616	0.015
Slaughter of lambs [heads]	-0.056	0.843	-0.798	0.001

Source: own elaboration

the same regularities in Austria and Poland exist in the relationship between changes in lamb meat prices and economic parameters. In Austria, the strength of the union was very strong, while in Poland a little weaker. Lamb meat prices were positively correlated with the level of GDP, GDP per capita, inflation, total and per capita consumption of households as well as the value of exports and imports of goods and services. Another report concerned the prices of lamb carcasses and sheep population, which determines the production potential. A very strong significant positive correlation was found for Austria and a strong negative correlation for Poland. The dependencies were therefore different. In Austria, the sheep population increased steadily over the period considered, while in Poland it decreased. Regularity, in line with market laws known from economics, has been observed in Poland. It was similar in the case of lamb production and the slaughter of lambs. In this case, the relationships were also negative. In Austria, these relationships were irrelevant.

In studies of other authors, it was found that the demand for meat is more inflexible at higher prices, and the demand for meat products is non-linear [Lusk, Tonsor 2016]. Higher income societies tend to be less responsive to fluctuating meat prices than lower income societies [Ding, Xiao 2014]. This regularity works well with lamb meat [Sans, Combris 2015]. Jayson Lusk [2019] also stated that along with higher incomes of people, their inclination to experiment with food increases. Lamb meat can be such a novelty for many consumers. Therefore, there are periods of increased consumption. Yanwei Mao et al. [2016], on the basis of the Chinese market, stated that the requirements for lamb meat in terms of quantity and consumption are increasing, and with them the price has increased.

CONCLUSIONS

Prices for lamb carcasses for heavy lambs varied in Austria and Poland. In Austria, the price level was definitely higher. During the period considered, the price difference was between 122 and 209 euros per 100 kg of post-slaughter weight. Annual average prices were more stable in Austria than in Poland, as evidenced by the calculated coefficients of variation. They amounted to 10.24 and 11.52%, respectively. Lamb meat prices in Poland increased by 36% against 26% in Austria. At such a rate of change, the equalization of prices will require several or several dozen years.

Considering prices on a monthly basis, larger differences between the surveyed countries were visible. The amplitude of fluctuations was definitely higher in the case of Poland. Prices fluctuated by up to plus 82 or minus 63 euros on a month-to-month basis. In Austria, it was a maximum of plus 30 and minus 21 euros. The comparison of monthly prices in individual years has revealed some regularity. In Austria and Poland, the highest prices were obtained during Easter and Christmas and during a period of smaller supply of lamb on the market, from December to April. In this case, the law of supply and demand applied. There was also a much higher stability of monthly prices in Austria than in Poland. This is evidenced by the results of volatility indices for monthly prices in individual years. As a result, the hypothesis presented in the work was confirmed, according to which lamb meat prices in Austria were more stable than in Poland.

The last part of the study concerned the determination of the relationship between the price level of lamb carcasses and the parameters of the economy and sheep production. In both countries, changes in lamb carcass prices went in the same direction as changes in the economy. In Austria, the strength of the relation was very big, in Poland a bit smaller. Different relationships were found for the sheep population. In Austria, the prices of lamb meat were positively correlated with the population, and in Poland negatively. In the latter country, regularities were consistent with the laws of economics regarding supply and demand. In addition, only in Poland were significant relationships found between the prices of lamb meat and the production of this meat and the slaughter of lambs. These relationships were negative. The conducted research shows similarities and differences between countries. In Austria, the economy and agricultural production were more stable than in Poland. However, changes were visible towards a greater stabilization of lamb meat prices in Poland.

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ZMIENNOŚĆ CEN MIĘSA JAGNIĘCEGO W AUSTRII I W POLSCE

Słowa kluczowe: Unia Europejska, owce, rynek mięsa jagnięcego, tusze jagnięce, ceny mięsa

ABSTRAKT

Głównym celem badań było przedstawienie zmienności cen tusz jagnięcych w Austrii i w Polsce. Podjęto także próbę wskazania występujących prawidłowości. Przedstawiono ceny tusz jagnięcych otrzymywane za jagnięta ciężkie (w wadze żywej 23-40 kg). Źródła materiałów stanowiły dane Komisji Europejskiej i Eurostat. Okres badawczy obejmował lata 2007-2019. Do analizy i prezentacji materiałów zastosowano metody: opisową, tabelaryczną, graficzną, wskaźniki dynamiki o podstawie stałej i zmiennej, współczynnik korelacji liniowej Pearsona, współczynnik zmienności. W Austrii ceny mięsa jagnięcego były zdecydowanie wyższe niż w Polsce, ale też bardziej stabilne, zarówno w ujęciu rocznym, jak i miesięcznym. W obu krajach występowały sezonowe wahania cen. Najwyższe ceny były w miesiącach zimowych, a najniższe w letnich. Przyczyną tego była sezonowość produkcji i konsumpcji. Zmiany w cenach tusz jagnięcych podążały w tym samym kierunku, co zmiany w gospodarce. W przypadku pogłowia, stwierdzono ujemne zależności w Polsce, co można uznać za zgodne z prawami ekonomii. Natomiast dodatnie zależności odnośnie tego parametru stwierdzono w Austrii.

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