

Romanian livestock industry - a comparison study on the impact of  
replacement of live exports of bovine and ovine with  
refrigerated/frozen meat

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## Executive Summary

### *Live Sheep Exports*

- Romania is the world's largest exporter of live sheep. In 2017, total exports of ovines were valued at EUR 174.86m, while the total number of heads was 2.42m.
- About 2/3 (roughly 65%) reached destinations outside the EU in 2017.
- Sheep and lambs for slaughter make up most of the deliveries, while pure-breed sheep for breeding are less important in terms of values.
- Libya (0.4m heads, value of EUR 51.5m) and Jordan (0.63m heads with a value of EUR 40.83m) are top non-EU sheep recipients, and since EU recipients are led by Bulgaria (58.3 thousand heads, value of EUR 3.43m) and Greece (59.3 thousand heads, value of EUR 2.37m), it is visible that there is a strong domination of non-EU destinations in this category.
- Lambs go mostly to EU member states. Greece (0.36m heads, value of EUR 17.92m) and Italy (0.32m heads, with a value of EUR 15.14m) are far ahead the first non-EU destination for lambs which is Jordan (63.2 thousand heads, EUR 4.53m).
- The trend of live sheep exports in Romania has been upward since 1990 and strongly upward since 2000. 2017 has seen values increasing almost 4-fold from 2000.
- Sheep make up most of the exports, and most of the sheep are headed to non-EU destination. After a massive growth in 2012 and somewhat slower in the next 2 years, the value has been fluctuating around EUR 100m.
- It may be interesting to note that, while UK total sheep numbers have been on a decline of 3%, over a range of 10 years from 2005, while Romania's numbers have increased by 25%.
- The majority of sheep and cattle born in Romania are processed domestically. Out of the total population of ovines, exports were about 24.26% in 2017, while for bovines the figure is 10.87%.
- Meat exports have been growing over the last years. In 2017, sheep and goat meat exports were around EUR 35.17m, from EUR 1.74m in 2003 and EUR 4.27m in 2008. The ratio of live animals to meat (value) went from about 42 in 2003 to about 5 in 2017.

### *Live Cattle Exports*

- Romania is a large exporter of live cattle. In 2017, exports of bovines totaled 218.7 thousand heads, with a value of EUR 207.9m.
- The value split between EU and non-EU destinations was roughly balanced, with about 52% going outside the EU.
- In heifers, bulls and calves for fattening between 160 and 300 kg Israel ranked first, with 37.87 thousand heads and an exports value of EUR 24.56m while Turkey was second, with 15.43 thousand heads and a value of EUR 15.88m. In the 80 – 160 kg group, Bosnia and Herzegovina accounts for about two thirds of the non-EU exports with 12.27 thousand heads and a value of EUR 4.85m in 2017.
- In heifers, bulls and calves for fattening between 160 and 300 kg, among the EU members, Croatia received 25.45 thousand animals, which were valued at EUR 13.97m. In the 80 – 160 kg group Croatia appears again, with 42.62 thousand heads, and a value of EUR 15.95m.

- Cattle for breeding is mostly sent outside the EU, with Turkey receiving 9.54 thousand heads, with a value of EUR 7.24m in 2017, while all EU destinations amount to 1.5 thousand heads, EUR 1.25m.
- Trend of exports is strongly upwards, with a more than 4-fold jump in total values from 2000 to 2017. The uptrend is generally quite similar for cattle to the one seen in sheep.
- Bovines for slaughter sent outside the EU have been on an uptrend in the last 6 years, from about 15.24 thousand heads, EUR 7.17m in 2012 to about 22.22 thousand heads with a value of EUR 20.91m in 2017. When looking at the data for bovines for slaughter sent to the EU, there is a downtrend from 34.7 thousand heads, with a value of EUR 16.16m in 2012 to 19.85 thousand heads and a value of EUR 9.17m in 2017.
- Out of the total bovine population, exports were about 10.87% in 2017.
- Bovine meat exports were valued at EUR 43.95m in 2017, up strongly from EUR 0.97m in 2003 and EUR 8.09m in 2008.
- The ratio of bovine live animals to bovine meat exports (value) was about 53 in 2003 and less than 5 (4.7) in 2017
- The ratio of meat to live animals (ovine and bovine) exports has improved almost 9 times from 2003 to 2017. Although the ratio of meat to live animals has been climbing consistently, the potential for further improvement is still considerable. In 2017, live animals' export value was more than 5 times that of meat, for bovines and ovines altogether, with a share of 83% of the total vs. just 17% for meat. The uptrend in meat exports has been stronger than the growth in live animals exports, suggesting significant growth opportunities in meat exports.

### *Economic benefits of reducing/phasing out live animals exports*

- Three scenarios were discussed when estimating the effect on jobs, with a reduction of 50%, 75% and 100% in exports relative to the year 2017.
- At local level, the meat processing sector's spare capacity, estimated at roughly double the total capacity in use as of 2017, would generally be able to absorb the larger processing demand, if designations needed for some export markets (such as halal and kosher) would increase.
- The first (base) scenario assumes that international deliveries of live sheep and cattle is reduced by 50% in 5 years, starting in 2019.
  - Estimated: 1777 new jobs in meat production and preservation and 865 new jobs in meat products fabrication. The jobs lost in transportation are estimated at 143 and those lost in trading live animals at 157
  - Net jobs created: 2342
- The second (accelerated) scenario is based on a reduction of 75% in 3 years, starting in 2019.
  - Estimated: 2665 new jobs in meat production and preservation and 1297 new jobs in meat products fabrication. The jobs lost in transportation are estimated at 215 and those lost in the live animals trading industry sector at 235.
  - Net jobs created: 3512
- The third scenario (total cessation) assumes a cessation of all live sheep and cattle international deliveries in 2022.
  - Estimated: 4180 new jobs in meat production and preservation and 1730 new jobs in meat products fabrication. The jobs lost in transportation are estimated at 286 and those lost in the live animals trading industry sector at 313.

- Net jobs created: 5311
- The gross value added by the creation of these jobs is estimated at EUR 46.26m.
- Creating jobs in the meat production and processing sectors would naturally have further positive effects, generating more consumption, transportation and housing needs, and thus, jobs, with a net positive effect on local and public finances.
- Local farmers producing sheep or cattle could be affected by slowing or the cessation of export activities, depending on the size of the unit, its business segments (whether they have a mix of revenue streams, or mostly or solely depend on selling live animals) and the diversity of its destinations. Large producers seem to be more vulnerable to a cessation in exports than small farmers, especially for sheep producers.
- Some reduction in the business of livestock producers, through volume or price decrease leading to a lower value of production, would adversely affect the activity of some producers. A portion of the top 10 sheep or cattle producers have livestock transport and export divisions, while for some of them the merchant and export business segment is important as a portion of total business. The revenue losses are estimated at EUR 15.98m for sheep in a mild scenario, and at EUR 71.04m in a more severe scenario. Farmers in the bovine sector would not be affected, with revenues actually seen growing by EUR 2.21m or EUR 3.83m depending on the scenario, as a result of high rates of local and export meat markets growth.
- The negative effects would be felt asymmetrically: to a larger extent by the large non-integrated producers, with a focus on exports, the large producers with international transport and trade divisions, and to a lesser extent by some of the smaller farmers who sell their animals to distributors who then redirect them towards international destinations.
- In the hypothesis of cessation of live sheep and cattle exports the impact numbers look different between the sheep and bovine markets. Using different statistical techniques, two sets of price response to supply were estimated. We also took into consideration an estimate of the growth of the local meat market and we estimated trend of meat exports growth, adjusting overall results accordingly.
  - In the mild scenario A, with lower elasticity, the sheep live weight price on the local market would decrease by 5.04% on average. This would mean losses of about EUR 15.98m for producers, per year. In the severe scenario, prices would go down by 22.38%. Sheep farmers would incur revenue losses of about EUR 71.04m per year. In the more severe scenario, businesses would need time to adapt, and some may swing to a deep loss for a transition period of about 3 years. In the mild scenario, losses in revenue would still allow some producers to remain profitable.
  - Interestingly, with strong estimated local market growth for beef of about 32% in 2021 vs. 2017, in the scenario A, with lower elasticity, the supply prices are seen increasing by 1.39% as a result of higher local market demand. Farmers would see revenues increasing by EUR 2.21m. In case of a stronger response to supply, prices would jump by 2.41% translating into a gain of about EUR 3.83m.
- If farmers are given enough advance notice, coherent strategies are put in place to create a sector and country brand and open up new markets, as well as develop the local market, including listening to consumer preference and supporting the association of small producers for more bargaining power against the meat producers and processors, net impact on farmers could be even milder than that of mild scenario B, with limited to negligible effect on profitability
- What if farmers didn't live export?

- Sheep farmers have the option to
  - Shift some of the animals to local consumption
  - Focus on quality and specialize, by choosing whether to produce milk or meat, and select proportion of breeds accordingly. This would also support better export prices and higher volumes on foreign and local markets
  - Redirect previously exported animals to local abattoirs, from where meat products could then be exported, tapping into the growing demand in Middle East and North Africa, with a BMI estimate of 27% growth from 2017 to 2021, since the local market is not ready to absorb the increase in supply generated by cessation of live animals' exports
- Cattle farmers have the option to
  - Switch to specialized breeds. An optimization path would be to shift to growing animals from breeds that the local consumer shows an increasing taste for, such as Angus varieties, over a transition period of 3-5 years.
  - redirect animals to local abattoirs, with part of the meat then exported, with the other part offered to the local market.
- Strategies to mitigate the possible negative impacts
  - Could be based on supporting the shift towards meat and meat products exports through negotiations, in order to reduce administrative, sanitary and veterinary barriers in a number of current key destinations.
  - Should include opening new destinations. This would support a shift in exports from live animals' meat and products. Given that domestic demand cannot absorb a jump in the value of such meat and processed products, the percentage increase in exports of fresh, refrigerated or frozen meat and products becomes the essential variable when estimating the final impact on producers.

## *Conclusions*

- Romania is among the top 10 agricultural producers (plants) in the EU, and in the top 3 European grain exporters. Romania also has the largest surface of all EU countries cultivated with maize and the second cultivated with soy (after Italy) which are key crops for animal feed. A move towards exporting refrigerated or frozen meat and meat products and by-products would create jobs in the local economy, provide additional momentum for the accumulation of value-added operations at local level, with a beneficial impact on Romania's economy.
- For every sheep going to export, about 2 are killed locally. For every bovine, about 3 are killed locally.
- Phasing out live exports could create up to 5,311 jobs in Romania depending on the transition plan put in place. The lower the live animals (ovine and bovine) exports numbers, the more jobs are created. Net jobs created go from 2342 under the assumptions of scenario 1 to 3512 for the 2<sup>nd</sup> scenario and 5311 for the 3<sup>rd</sup> scenario.
- The gross value added by the creation of these jobs is estimated at EUR 46.26m.
- The jobs created locally would also help create other indirect jobs, through the multiplier effect, while public finances would see an increase in revenues through direct and indirect taxation. The added value would increase and support a rise in GDP.
- The estimated negative effects on farmers are seen only on the sheep producing sector. They could be mitigated even in the more severe scenario, through the implementation of at least a few of the

recommendations. Absent that, in the most severe scenario some sheep producers would incur losses. The lost revenues are estimated at EUR 71.04m annually. Such loss of revenue could happen for about 2-3 years, before a market adjustment, without some form of fiscal support. In the mild scenario, losses would be about EUR 15.98m.

- Given current market trends for bovine meat exports and local consumption, and with trend estimates and industry research, the data show that farmers in the bovine sector stand to gain, with revenues increasing by EUR 2.21m in one scenario and EUR 3.83m in the other (with higher elasticity). Farmers raising cattle would need to produce more to cover growing demand, even as exports are shifted partially to local market, meaning that, absent such shift, and without an adequate supply increase, the local prices would increase through 2021.
- Taking into consideration the data collected and their analysis carried out in this study, in a volatile environment both in terms of economic data, production, weather, global relations and regulatory framework, we can conclude that an option of strategic development of the local agriculture would have to take into account the shift towards high added-value products through processing, branding, along with the diversification of product offerings. The goal is to capture, for the local economy, resources that can be reinvested in development, technology, training, and promotion at local and international level, with beneficial effects on Romania's economy.



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# 1. Introduction

## 1.1 Overview of present situation and trends of livestock in Romania

The ovine population in Romania stood at about 9.98m heads in 2017, according to the National Statistics Institute (INS), thus placing the country in the 3<sup>rd</sup> place within the EU. The bovine population was estimated by INS at 1.98m in 2017, according to the same Institute. In this ranking Romania was occupying the 10<sup>th</sup> place in Europe (EU).

**Figure 1. Trends in livestock, 2006 - 2017, values at Dec. 1st**

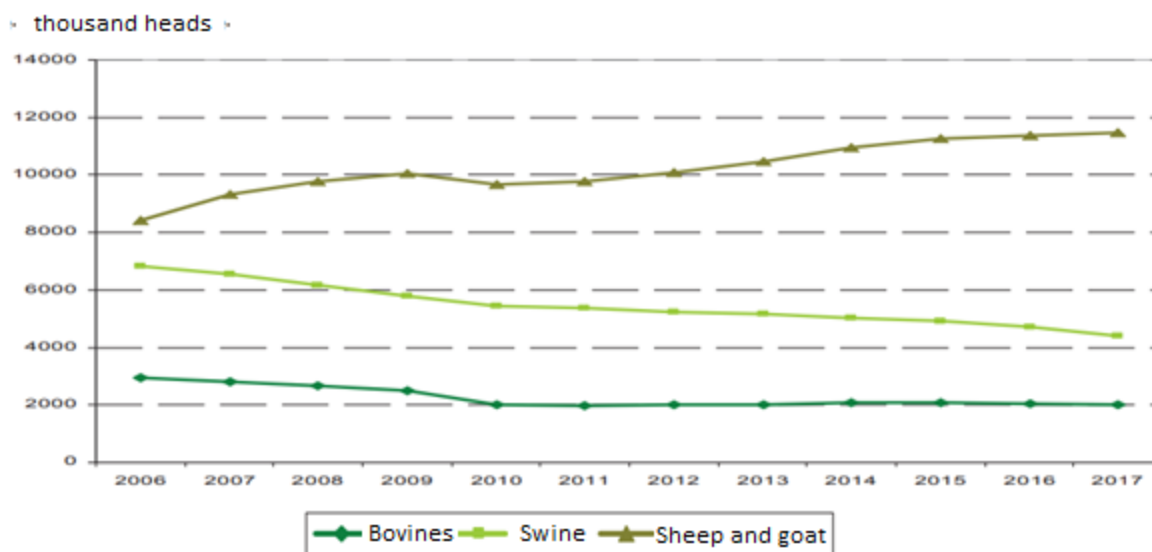


Figure 1. Source:

[http://www.insse.ro/cms/sites/default/files/field/publicatii/efective\\_de\\_animale\\_si\\_productia\\_animala\\_in\\_anul\\_2017.pdf](http://www.insse.ro/cms/sites/default/files/field/publicatii/efective_de_animale_si_productia_animala_in_anul_2017.pdf)

When analyzing the livestock trends one can notice that, apart from a decrease in 2010, sheep and goat populations were increasing, especially between 2011 – 2015. The sheep and goat population increased from less than 8m in 2006 to close to 11.5m in 2017. The bovine population has decreased from 2006 until 2010 (with an acceleration of the trend in 2010), and has remained relatively stable afterwards, at approximately 2m heads.

## 1.2 Export destinations

### 1.2.1 Ovines

Where do exports go (within or outside of the EU)?

Romania has become the largest live ovine exporter in the world in 2017. In that year, 2.42 million heads have been sent abroad. In 2017, livestock deliveries to the European Union amounted to 5555 tons of sheep, 22983 tons of lamb and 49 tons of pure-breed sheep for breeding. Outside the EU, the amounts are as follows: 44897 tons of sheep, 5409 tons of lamb and 1932 tons of pure-breed sheep for breeding.

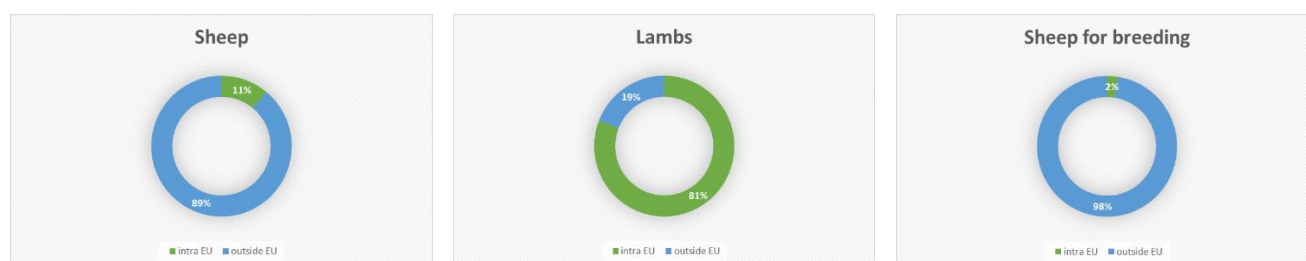


Figure 2. Destinations within or outside the EU for different categories of ovines. Data source: Eurostat, graphics: author

Moving on to components level, we see that for sheep (without the pure-breed sheep for breeding or lambs categories) the deliveries outside the UE are dominant in 2017, comprising 89% of the total. Things look to the opposite direction within the lambs category: preferred destinations are intra-EU for 81% of deliveries. For pure-breed sheep for breeding destinations outside the EU represent 98% of the total (the only outside EU destination being Turkey). In other words, apart from lambs, more than 4/5 of ovines exports go to countries outside EU. Total ovine exports by quantity are delivered 65% outside the EU and 35% to EU member states.

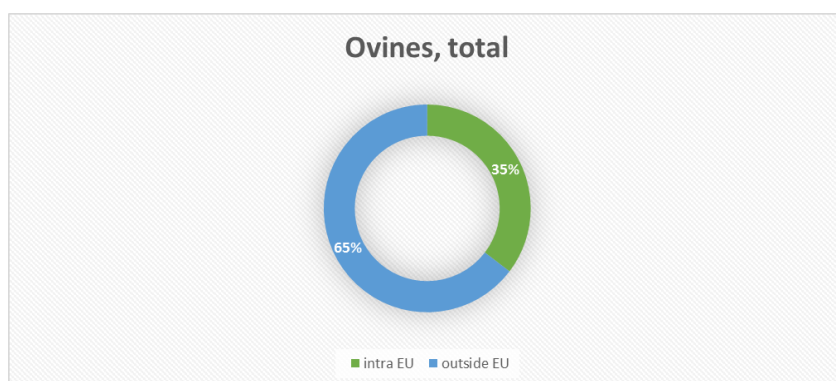


Figure 3. Destinations within or outside of the EU for all ovines. Data source: Eurostat, graphics: author

### 1.2.1.1 Destinations outside the EU

#### 1.2.1.1.a Lambs exported outside the EU

Eurostat data for lambs deliveries outside the EU are discussed further.

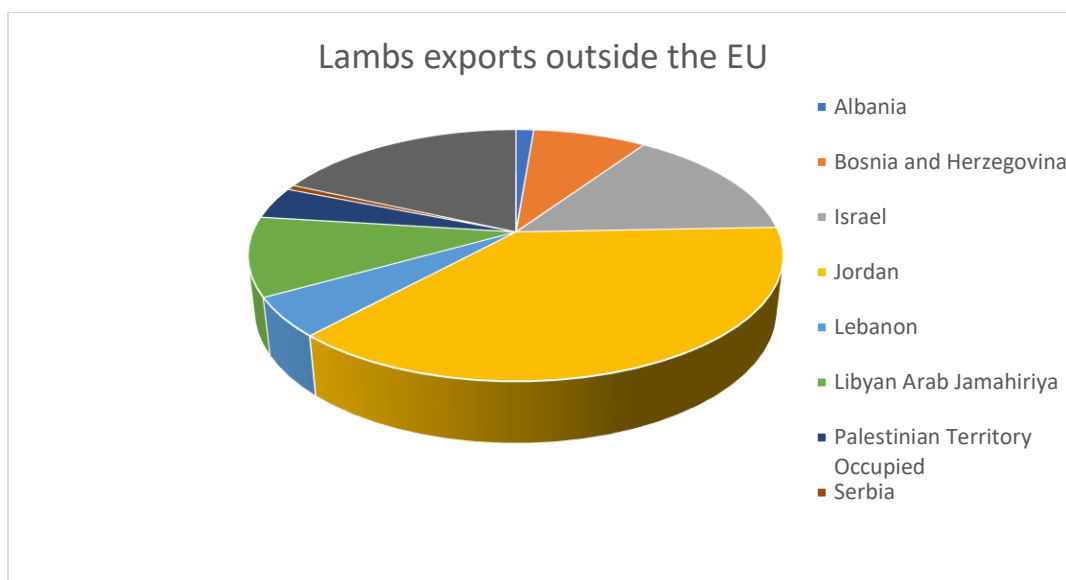


Figure 4. Breakdown by destination of lamb exports outside EU, by value, in 2017. Data source: Eurostat, graphics: author

The top outside EU lambs destination in 2017 is Jordan (63.2 thousand heads, valued at EUR 4.53m), followed by Turkey (18.1 thousand heads, valued at EUR 2.21m), Israel (19 thousand heads, value of EUR 1.80m) and Libya (12.7 thousand heads, EUR 1.23m). Bosnia and Herzegovina appears in 2<sup>nd</sup> place by the number of heads, although the value is relatively low, at EUR 0.99m. The annual data series are very volatile, showing large differences in values per each destination from one year to the next, and even frequent gaps (where one destination may disappear for one or several years in a row). In 2016 Israel was dominant, with lambs exports from Romania to the country of 0.1m heads, valued at EUR 9m. It was followed by Jordan with 0.05m heads, value of EUR 3.48m EUR and Palestine with 14.4 thousand heads, valued at EUR 1.3m. Again, we find the situation where Bosnia and Herzegovina has a low unit value, since the destination is 3<sup>rd</sup> by heads, but with a total value of just EUR 0.97m.

## Trend chart

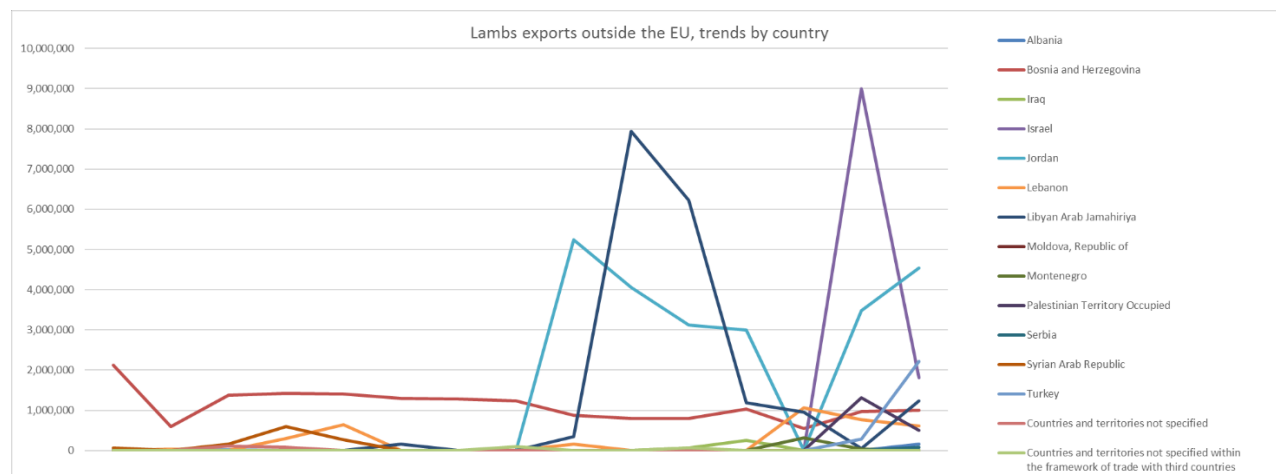


Figure 5. Trends for lamb exports outside EU, per country, by value, between 2003 and 2017. Data source: Eurostat, graphics: author

As we can see, almost every important destination country has large variations in the value of lambs deliveries. Jordan (light blue in figure 5, above) is a strong recipient country from 2011 to 2017, but not in 2015, when it does not even appear as a destination. Libya, important in 2012 and 2013 experiences a steep decline in 2014 and stays at low levels afterwards. Israel dominates in 2016, when it also sets the maximum value of exports per destination at EUR 9m, however it declines below EUR 2m in 2017. A relatively stable present is Bosnia Herzegovina, which fluctuates around EUR 1m, apart from 2003 when it manages to surpass EUR 2m.

### 1.2.1.1.b Sheep exported outside the EU

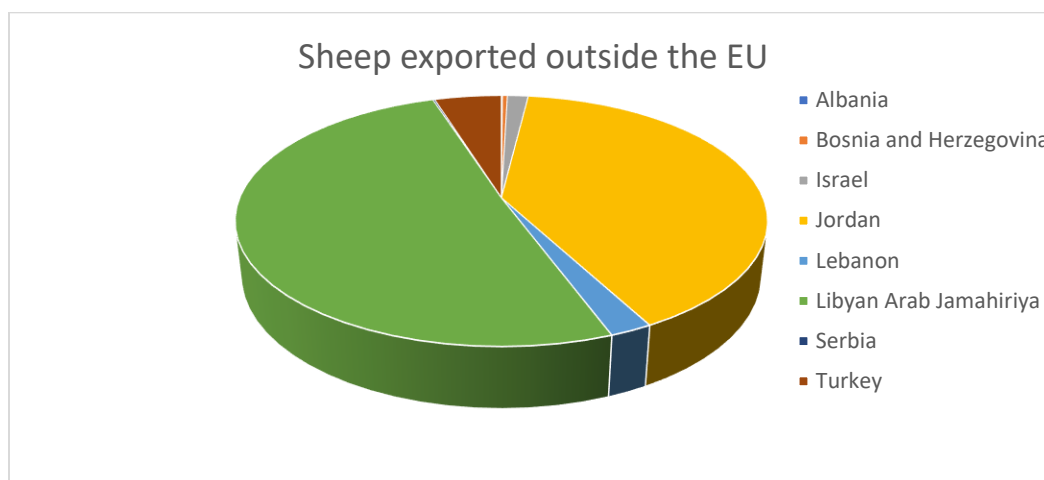


Figure 6. Breakdown by destination of sheep exports outside the EU, by value, in 2017. Data source: Eurostat, graphics: author

It can be noticed that Libya and Jordan dominate the sheep supply structure and taking into consideration the values on different categories (including lambs and sheep), it can be stated, in the general ovine structure, with values of EUR 51.5m, respectively EUR 40.83m in 2017, followed by Turkey with EUR 4.92m. Together, Jordan and Libya represent 91% of the total value of sheep deliveries in 2017. By number of heads, Jordan is first, with 0.625 million, followed by Libya with 0.4 million and Turkey with 0.04 million.

### Trend chart

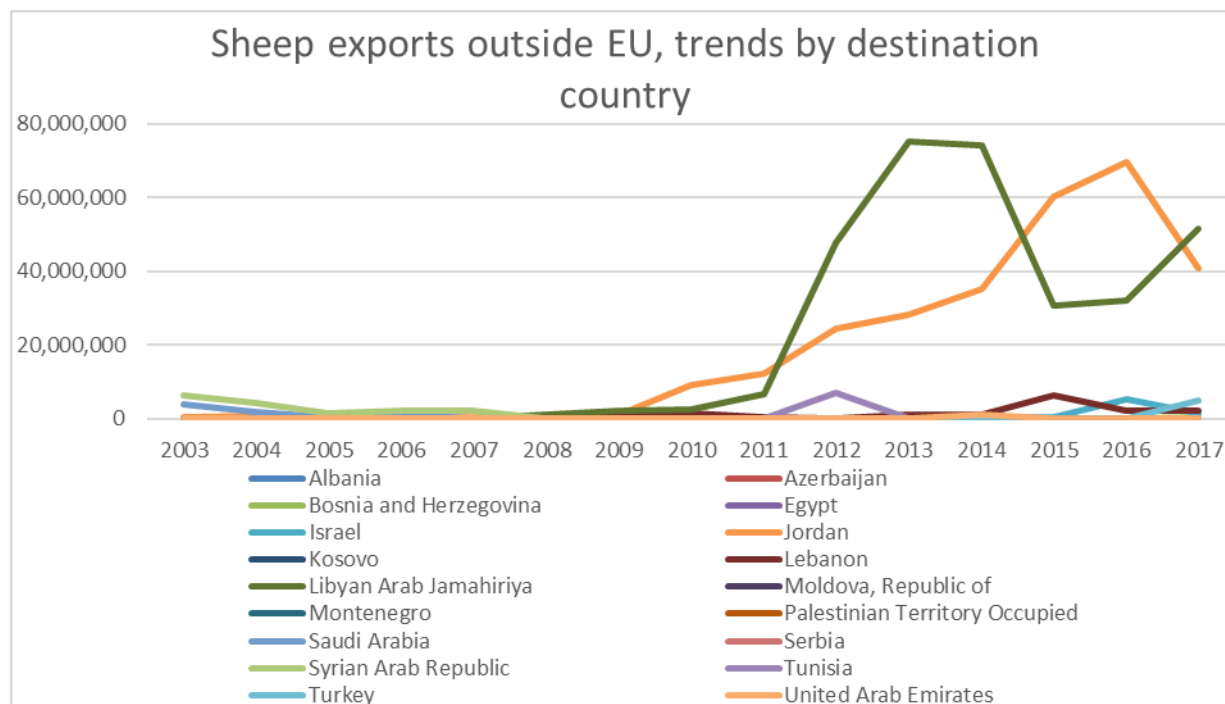


Figure 7. Trends of sheep exports outside EU, per country, by value, between 2003 and 2017. Data source: Eurostat, graphics: author

From 2011 two countries are the leading destinations for exports of live sheep from Romania: Libya (dark green) and Jordan (orange). Libya strongly accelerates from EUR 6.9m in 2011 to EUR 75.3m in 2013, followed by a plateau in 2014 and then slows down to between EUR 30 - 32m in 2015 and 2016. In these years, 2015 and 2016, Jordan is ranked first, surpassing each time EUR 60m, but falling to approx. EUR 40m in 2017.

#### *1.2.1.1.c Sheep for breeding exported outside EU*

The situation in the sheep for breeding category is atypical. In 2017, outside the EU, the only destination for sheep exports is Turkey, with EUR 5.3m, 54.8 mii de capete. A graphical representation similar to the one in the previous paragraphs is no longer meaningful. Further information about trends is to be found in section 1.2.3.1.

#### Conclusions

A recurring pattern has been noticed: Libya and Jordan frequently appear among sheep and lambs destinations. Turkey is the only destination for pure-breed sheep for breeding, but, with only one presence in the data series in 2017, it is difficult to extrapolate trend information. Israel is the most important destination for lambs in 2016, but the situation seems isolated. In 2017 the export value is over 4 times lower (from over EUR 9m to about EUR 1.8 m), while in the rest of the years the value is 0. Therefore, Libya and Jordan are major markets.



### 1.2.1.2 Destinations within the EU

#### 1.2.1.1.a Lambs exported to EU

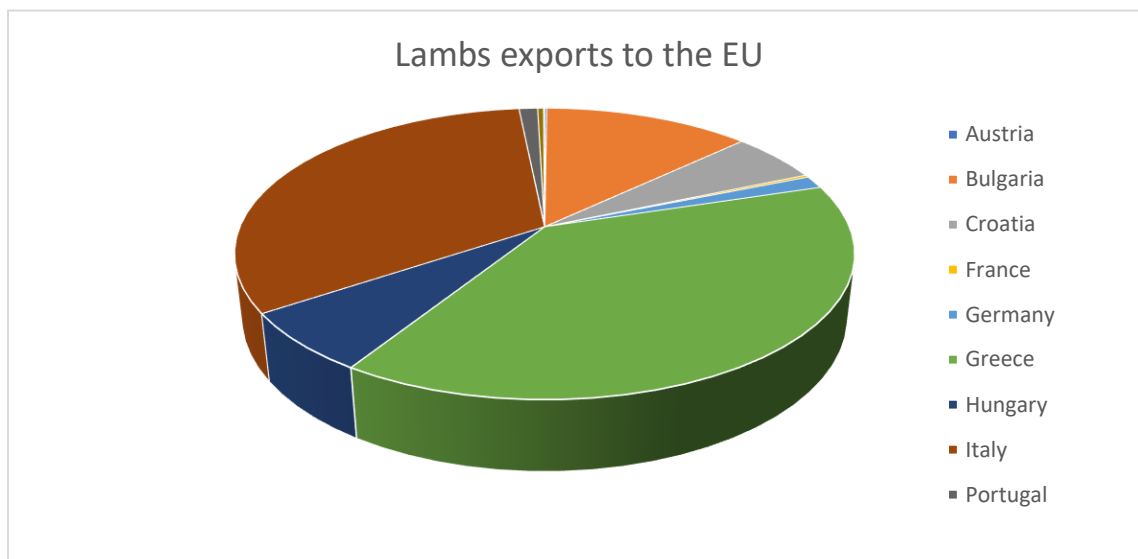


Figure 8. Breakdown by destination of lamb exports, by value, outside EU in 2017. Source: Eurostat, graphics: author

Greece and Italy are at the top of the ranking, with 0.36 million heads and 0.32 million heads, respectively, valued at EUR 17.92m and EUR 15.14m respectively, followed by Bulgaria at some distance, in 2017 data. Together, the first 2 cover 71.6% of the lamb exports, while the three names mentioned account for 84.4% of the total value.

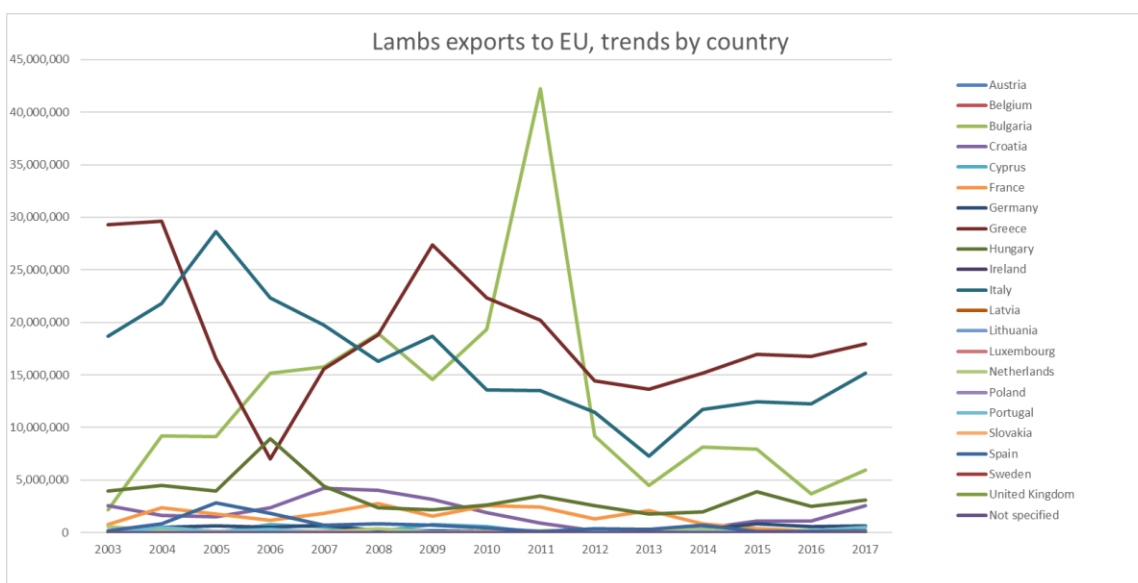


Figure 9. Trends of lamb exports by value between 2003 and 2017, by EU countries. Source: Eurostat, graphics: author

Bulgaria has defined the peak of lamb exports to one EU country, exceeding the EUR 40m and 0.6 million heads in 2011, but falling below EUR 10m in 2012 and in the next years. Among important destination countries, with deliveries of more than EUR 10m, Greece is to be found between 2003 and 2017. It went from almost EUR 30m through a steep slowdown between 2005 and 2006, only to return above EUR 25m in 2009 and to stabilize between approx. EUR 13.6m and EUR 18m after 2012, ranking first in the top destinations in EU. After Greece, starting with 2013, Italy is on a faster upward trend but still far from Greece. Italy ranked first in 2005, with a predominantly downward trend since 2013, from a peak of EUR 28.6m to a minimum of EUR 7.28m. Apart from Hungary in 2006, no other country exceeds a value of exports of EUR 5m.

An interesting observation is that from 2012 onwards the weightings of the various EU Member States in total exported value show relative consistency, especially when compared to the more volatile period, with a lot of changes in the top rankings, of the years 2005 to 2011.

### 1.2.1.2.b Sheep exports to the EU

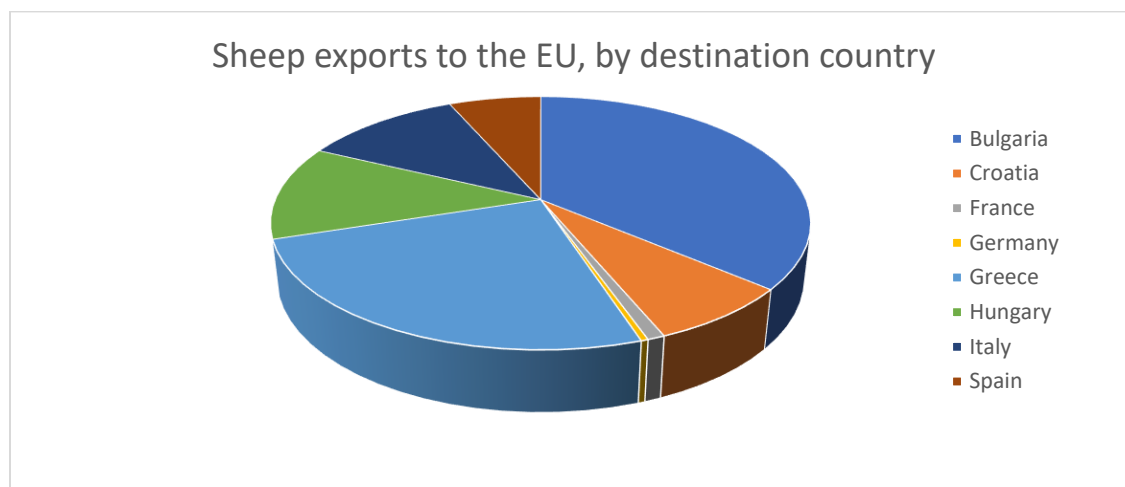


Figure 10. Breakdown by destination of sheep exports to EU, by value, in 2017. Source: Eurostat, graphics: author

Just as with the exports outside EU, two countries cover most of the deliveries: Bulgaria (58.3 thousand heads, valued at EUR 3.43m) and Greece (59.3 thousand heads, valued at EUR 2.37m). The difference is that the share of the other countries is approaching one third, thus showing a more balanced structure compared to the situation of deliveries outside the European Union.

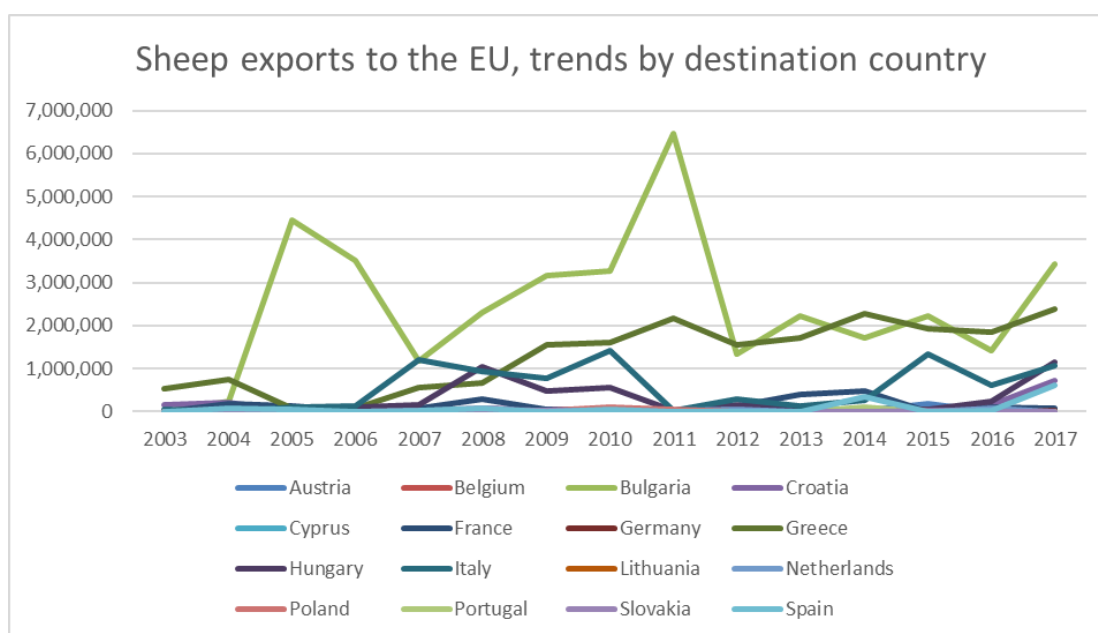


Figure 11. Trend of EU countries in sheep exports by value between 2003 and 2017. Source: Eurostat, graphics: author

In the ranking of EU countries importing sheep from Romania, Bulgaria ranks first in most of the years 2003 to 2017. From 2012 until 2016, Greece gets closer to Bulgaria's value, while most other states are considerably lower.

### 1.2.1.2.c Sheep for breeding exported to EU

Total values are small, and in 2017 do not go over EUR 0.1m (1.7 thousand heads), decreasing from EUR 1.31m (16.4 thousand heads) in 2014. Greece and Italy are the major destinations in 2017, but the absolute values are almost negligible: EUR 0.05m and EUR 0.03m (1.03 thousand heads and 0.57 thousand heads respectively).

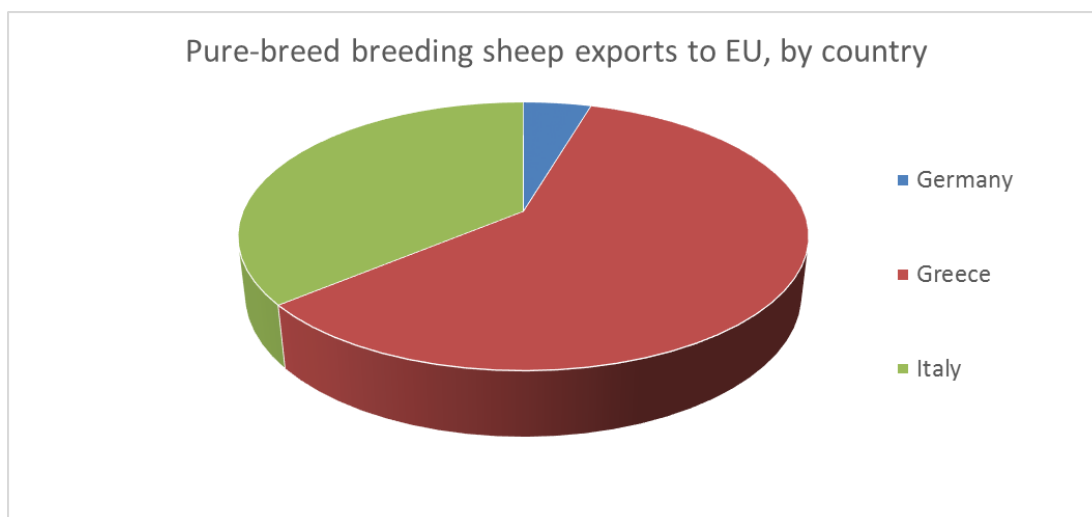


Figure 12. Breakdown by destination of exports of sheep for breeding, by value, to EU in 2017. Source: Eurostat, graphics: author

In terms of trends, a pronounced variability is observed: Italy, the first on the list in 2007, with almost EUR 2m, falls below EUR 0.5m in 2008, returns to EUR 1.2m in 2009 but almost disappears after 2010.

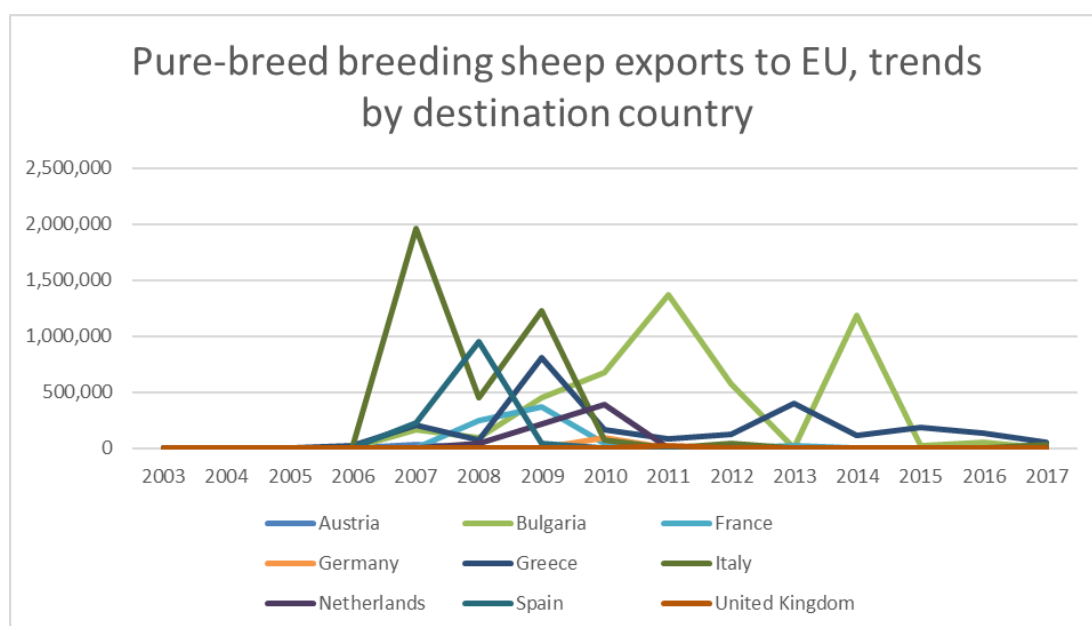


Figure 13. Trend in exports of sheep for breeding, by value and EU country, between 2003 and 2017. Source: Eurostat, graphics: author

### 1.2.2 Bovines

Where are exports going to, in/out of the EU?

Romania is a large exporter of live cattle. In 2017, exports of bovines totaled 218.7 thousand heads. The same year, live animals delivered to the EU amounted to 2220 tonnes of cattle for slaughtering, 15241 tonnes of heifers, bulls and calves for fattening and 634 tonnes of pure-breed cattle for breeding. Outside the EU the quantities were 190 2220 tonnes of cattle for slaughtering, 17004 tonnes of heifers, bulls and calves for fattening and 2221 tonnes of pure-breed cattle for breeding.

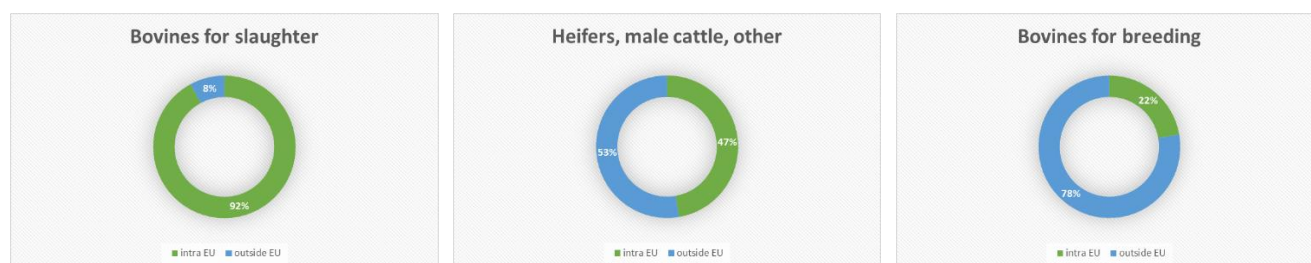


Figure 14. Intra-EU or non-EU destinations for different categories of cattle. Data source: Eurostat, graphics: author

Within the cattle for slaughter group, intra-EU deliveries are clearly dominant, at 92% of the total. By volume, the dominant group is however heifers, bulls and calves for fattening where things are more balanced: destinations outside the EU have the advantage, but with only around 53% of exports. In the cattle for breeding group, outside EU destinations are dominant with 78% of the total.

Total exports of bovines, by quantity, are headed 52% outside EU and 48% to EU Member States. The situation is much more balanced compared to sheep deliveries.

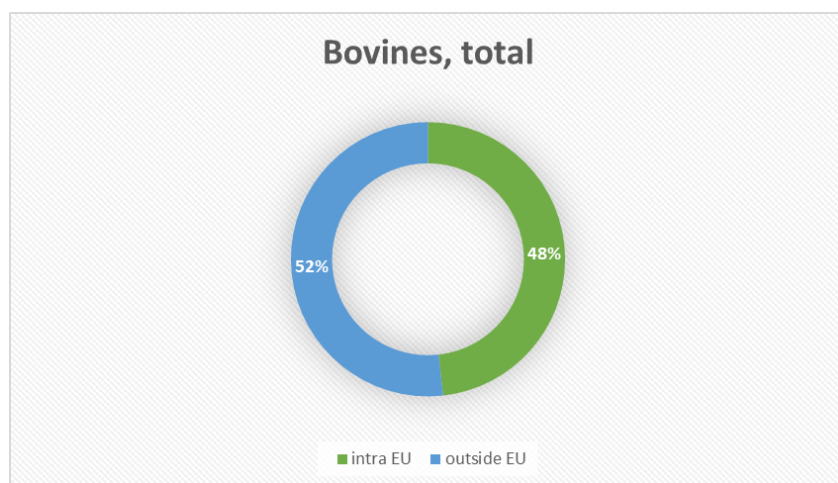


Figure 15. Intra-EU or non-EU destinations for bovines. Data source: Eurostat, graphics: author

### 1.2.2.1 Destinations outside the EU

#### 1.2.2.1.a Bovines for slaughter sent outside the EU

The total values for bovines for slaughtering, between 80 kg and 160 kg, delivered in 2017 to non-EU countries are relatively small: in 2017, Serbia, the main destination, imported animals in total value of EUR 0.24m from Romania, 0.66 thousand heads. Bosnia and Herzegovina ranks second, with only EUR 27.4 thousand, 0.11 0.66 thousand heads.

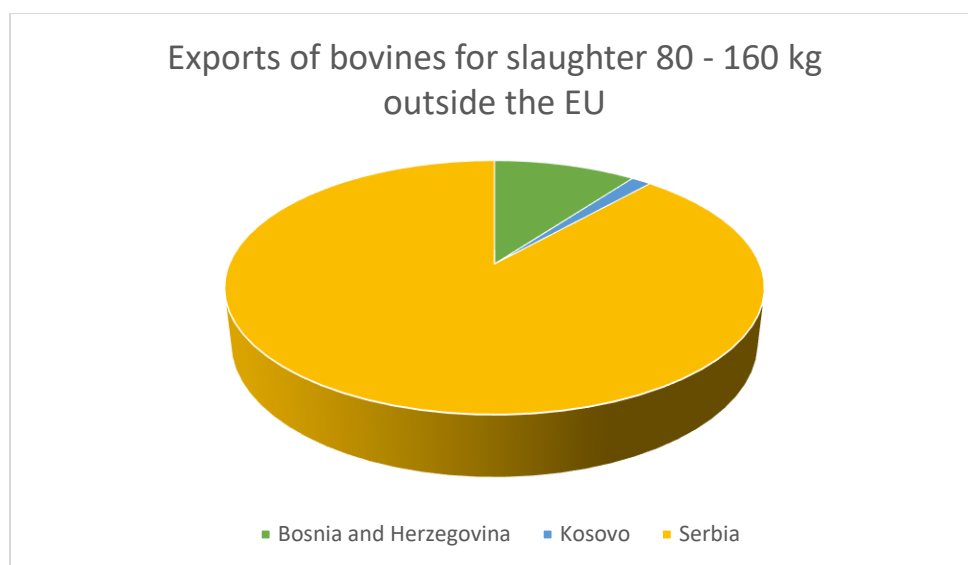


Figure 16. Breakdown by destination of exports of cattle for slaughtering, between 80 and 160 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

In the group of cattle for slaughtering, between 160 and 300 kg, Turkey is in 1<sup>st</sup> place, with EUR 0.12m, 0.16 thousand heads, followed by Albania with EUR 0.04m, 0.16 thousand heads. Absolute values are even lower than for cattle between 80 and 160 kg.

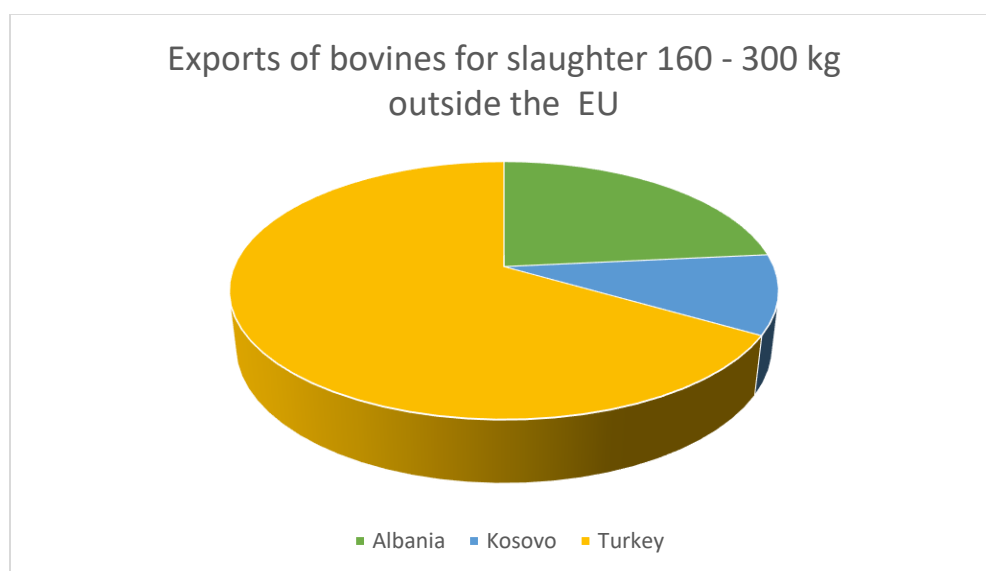


Figure 17. Breakdown by destination of exports of cattle for slaughtering, between 160 and 300 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

Israel, an important destination in 2014, with a value of EUR 2.89m (5.33 thousand heads) goes down to a range of EUR 0.2 to 0.3m in 2015 and 2016, the same area as in 2013. It then disappears in 2017.

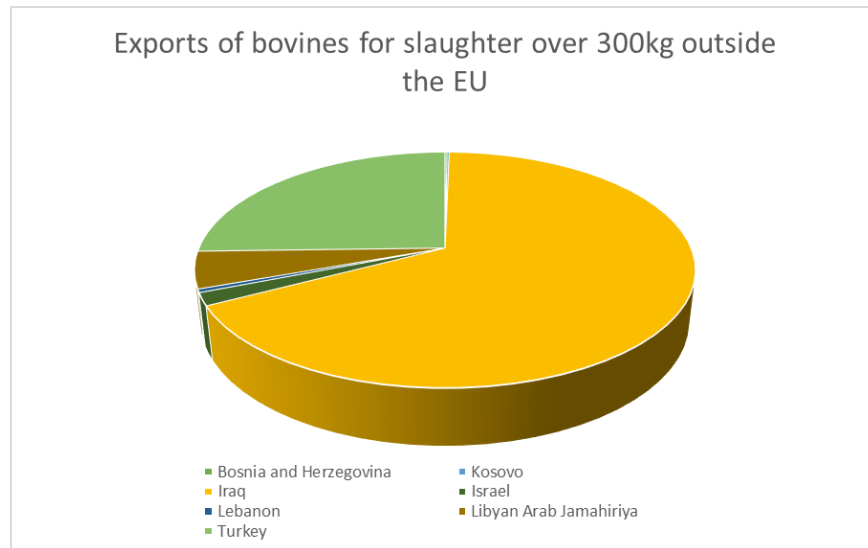


Figure 18. Breakdown by destination of exports of cattle for slaughtering, over 300 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

Bovines for slaughter over 300 kg, show Iraq in the dominating position, which at EUR 13.71m is almost  $\frac{3}{4}$  of the total value, followed by Turkey with EUR 5.20m and Libya with EUR 1.04m. In terms of heads, the data shows 15.68 thousand heads for Iraq, 3.87 0.16 thousand heads for Turkey and 0.98 0.16 thousand heads for Libya.



### 1.2.2.1.b Heifers, bulls and calves for fattening, delivered outside the EU

Bosnia and Herzegovina accounts for about two thirds of the non-EU exports of heifers, bulls and calves for fattening between 80 and 160 kg, with EUR 4.85m in 2017, 12.27 thousand heads. The second place is occupied by Israel, with a value of EUR 1.56m, 4.22 thousand heads. Albania, Serbia and Bahrain are at the end the ranking, with values below EUR 0.4m each.

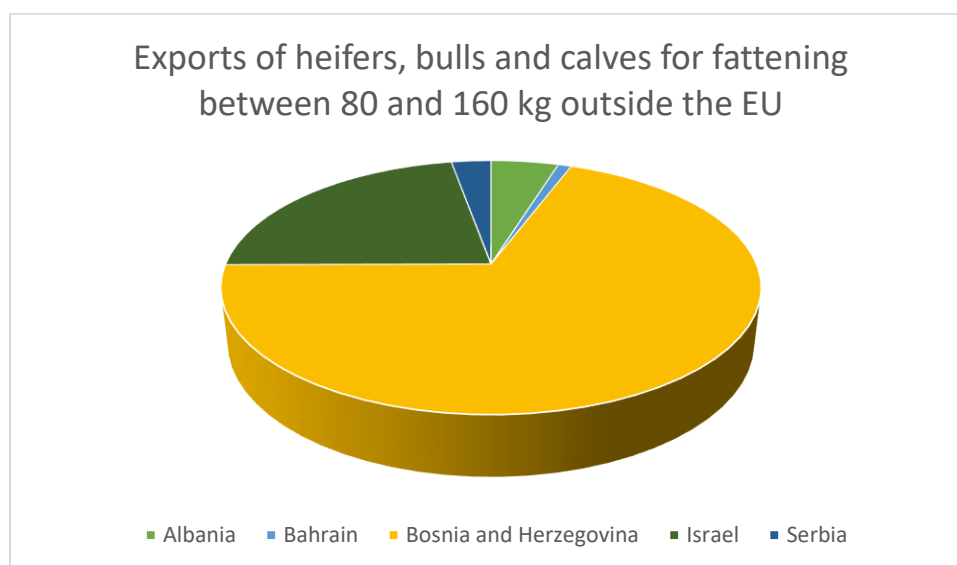


Figure 19. Breakdown by destination of exports of heifers, bulls and calves for fattening, between 80 and 160 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

In the group of heifers, bulls and calves for fattening between 160 and 300 kg, Israel dominates with an import value of EUR 24.56m, 37.87 thousand heads, Turkey ranks second with EUR 15.88m, 15.43 thousand heads, and Albania reaches a distant EUR 1.85m with 5.59 thousand heads.

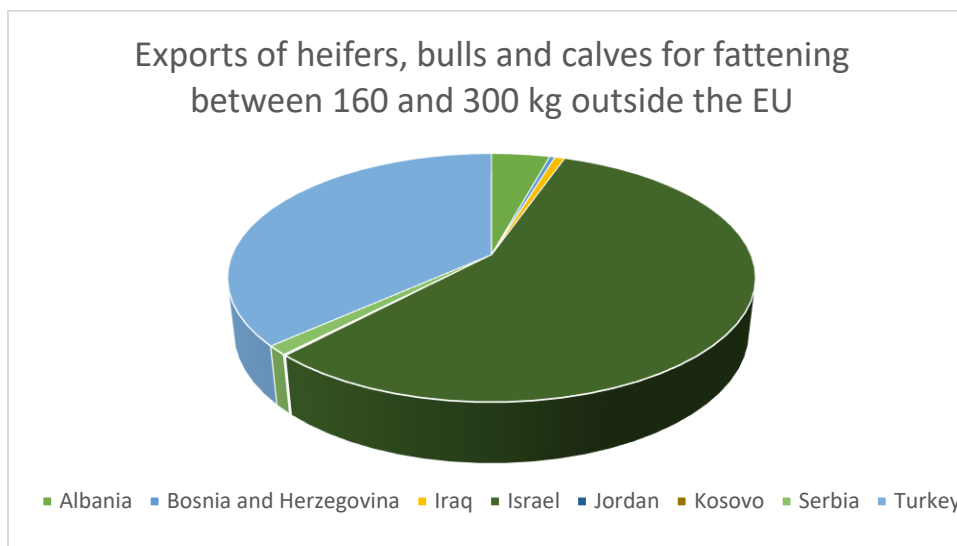


Figure 20. Breakdown by destination of exports of heifers, bulls and calves for fattening, between 160 and 300 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

Turkey appears for the first time in 2017, while Israel is on an upward trend in this category (160-300 kg) since 2012. The value of exports in 2017 is about 12 times higher than in 2012.

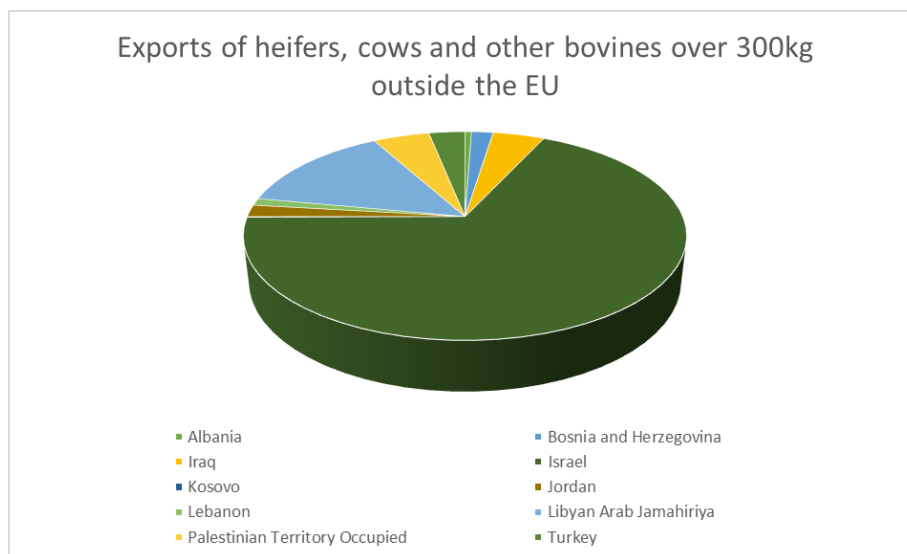


Figure 21. Breakdown by destination of exports of heifers, cows and other bovines for fattening, over 300 kg, by value and country, outside EU in 2017. Source: Eurostat, graphics: author

Israel is the leader of the bovines for fattening over 300 kg group, with EUR 8.99m in 2017, 9.65 thousand heads, followed by Libya with EUR 1.85m, 1.55 thousand heads.

#### 1.2.2.1.c Pure-breed bovines for breeding outside EU

The total value of exports of pure-breed bovine for breeding outside the EU was EUR 7.24m in 2017. The evolution may seem surprising after a 2-year break in which no exports of bovine animals outside EU were recorded, and is a result of exports to Turkey, mainly of heifers (EUR 6.85m, 9.26 thousand heads) and of breeding cattle (EUR 0.26m, 0.18 thousand heads).

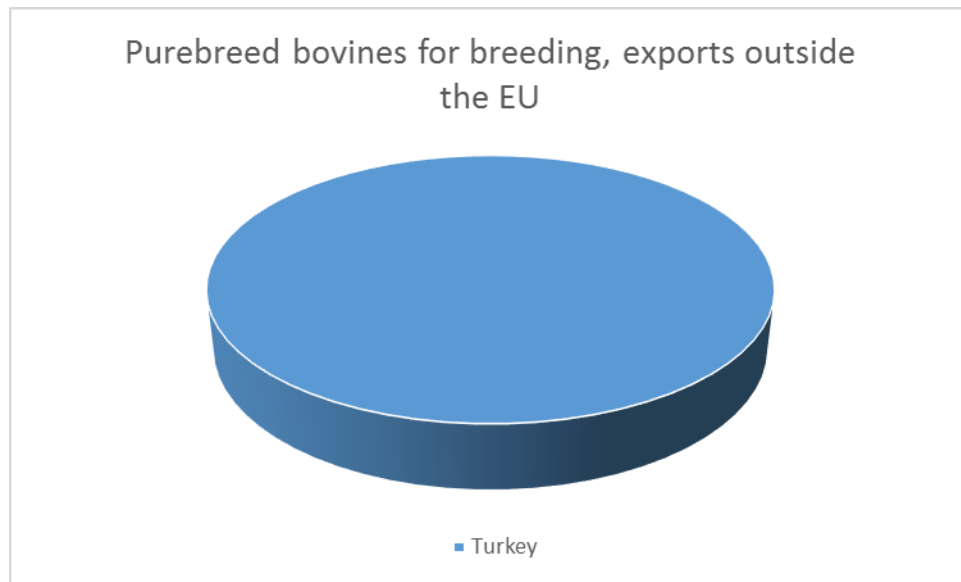


Figure 22. Exports of pure-breed bovines for breeding, outside EU in 2017. Source: Eurostat, graphics: author

### 1.2.2.2 Destinations of exports to the EU

#### 1.2.2.2.a Cattle for slaughtering sent to EU states

When looking at the data for bovines for slaughter sent to the EU, there is a downtrend from 34.7 thousand heads, with a value of EUR 16.16m in 2012 to 19.85 thousand heads and a value of EUR 9.17m in 2017.

Croatia dominates both the 80-160 kg category (13.28 thousand heads, EUR 5.01m) and the 160-300 kg category (1.37 thousand heads, EUR 0.74m) for cattle for slaughter. Spain is the only destination appearing alongside Croatia in the first category, however in the second one there is more diversity: Greece is in second position, followed by Slovenia and Slovakia.



Figure 23. Breakdown by destination of exports of cattle for slaughter between 80 and 160 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

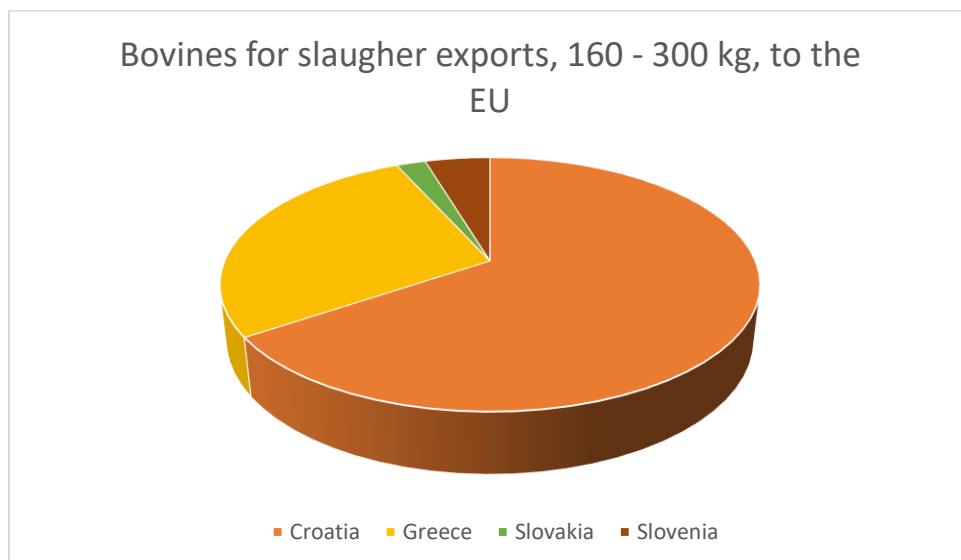


Figure 24. Breakdown by destination of exports of cattle for slaughter between 160 and 300 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

In terms of trends, Croatia ranks first consistently from 2012 until 2017. The year 2012 is known for the widest variety of destinations, most of them, however, only sporadically coming back in later years, including Germany, Greece, Italy, Hungary, or even, as with Slovenia, disappearing after 2012.



Figure 25. Breakdown by destination of exports of cattle for slaughter over 300 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

For the bovines for slaughter over 300 kg, the values are below EUR 1m, smaller than in other segments: thus, Greece reaches EUR 0.83m and Hungary EUR 0.61m in 2017.

#### 1.2.2.2.b Heifers, bulls and calves for fattening, delivered to the EU

For 2017, detailing the structure of exports of heifers, bulls and calves for fattening between 80 and 160 kg is simple: Croatia has "the lion's share" with 42.62 thousand heads, valued at EUR 15.95m which is more than half of the total. Italy follows with 17.25 thousand heads, valued at EUR 6.96m, Hungary is third with 10.96 thousand heads, a value of EUR 3.97m.

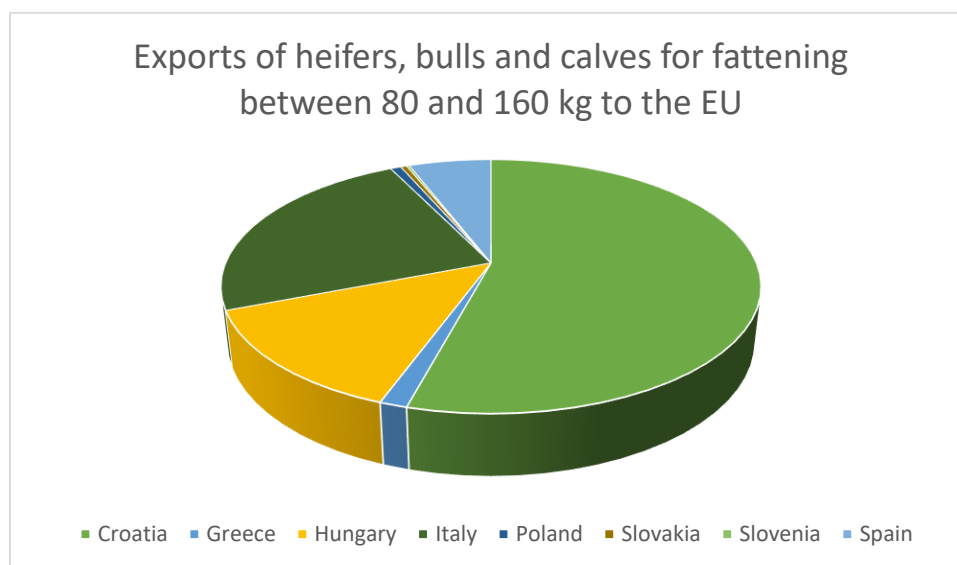


Figure 26. Breakdown by destination of exports of heifers, bulls and calves for fattening between 80 and 160 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

In terms of destination trends, Croatia ranks first consistently from 2015 until 2017. Italy and Spain are in the 1<sup>st</sup> and 2<sup>nd</sup> position from 2012 to 2014, with values that are very close to each other. After 2015, their values fall significantly, leaving room for Croatia to shine brightly. Hungary more than doubles the 2016 value in 2017.

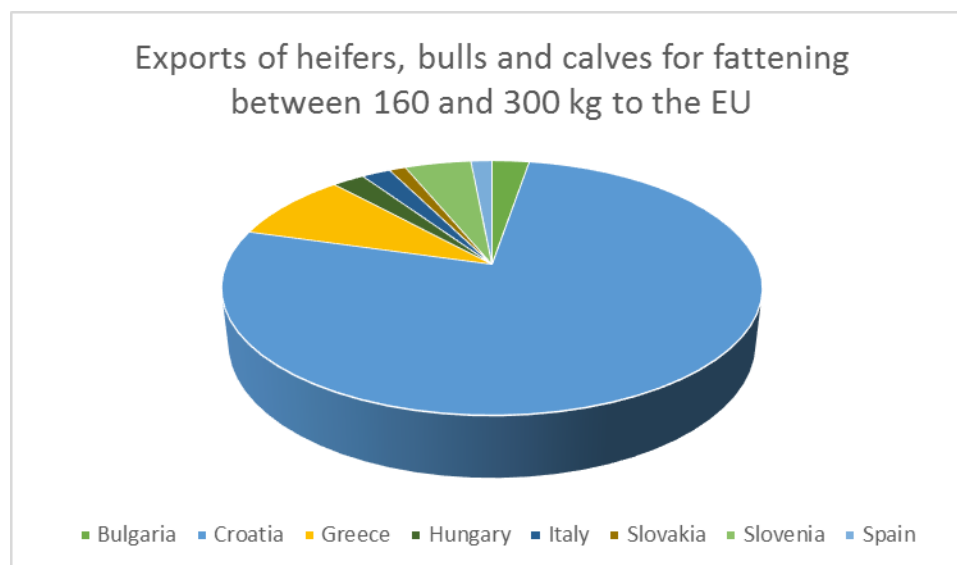


Figure 27. Breakdown by destination of exports of heifers, bulls and calves for fattening between 160 and 300 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

Croatia also dominates by far in the category between 160 and 300 kg, with a value of imports from Romania of EUR 13.97m, and 25.45 thousand heads. Seven other countries compete for approximately one-quarter of the total export value of the category: Greece ranks second after Croatia, with 2.32 thousand heads and EUR 1.59m, and Slovenia ranks third, with 1.45 thousand heads and EUR 0.86m.

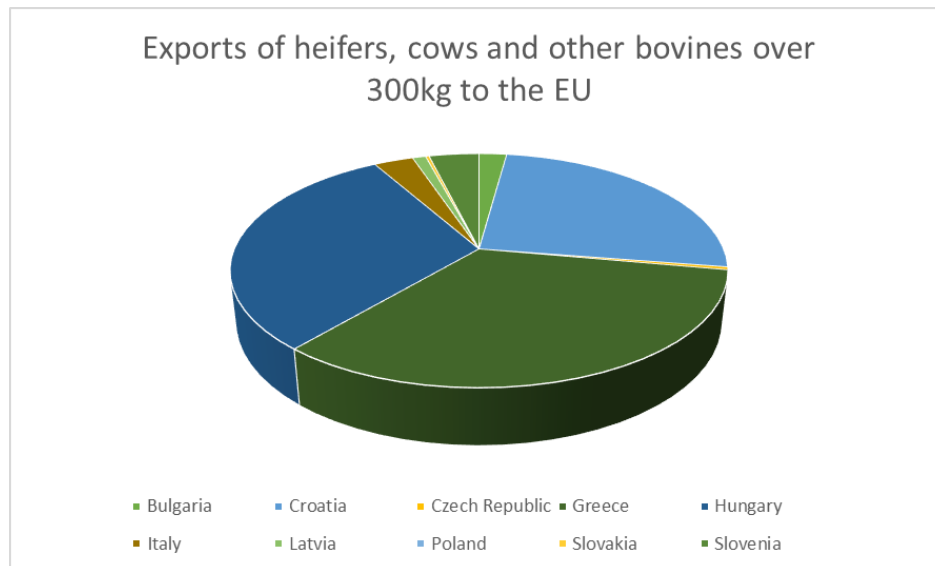


Figure 28. Breakdown by destination of exports of heifers, cows and other bovines for fattening over 300 kg, by value, to the EU in 2017. Source: Eurostat, processing: author

In the segment of bovines for fattening over 300 kg, the first 3 countries are quite close to each other: Greece at EUR 2.24m in 2017, 2.64 thousand heads, Hungary at EUR 2.05m, 2.63 thousand heads and Croatia at EUR 1.70m, 2.28 thousand heads. The situation is more balanced than in the other segments, although we still find Croatia among the top destinations.

#### 1.2.2.2.c Pure-breed bovines for breeding to the EU

The total value of pure-breed bovines for breeding sent towards the EU was EUR 1.25m in 2017.

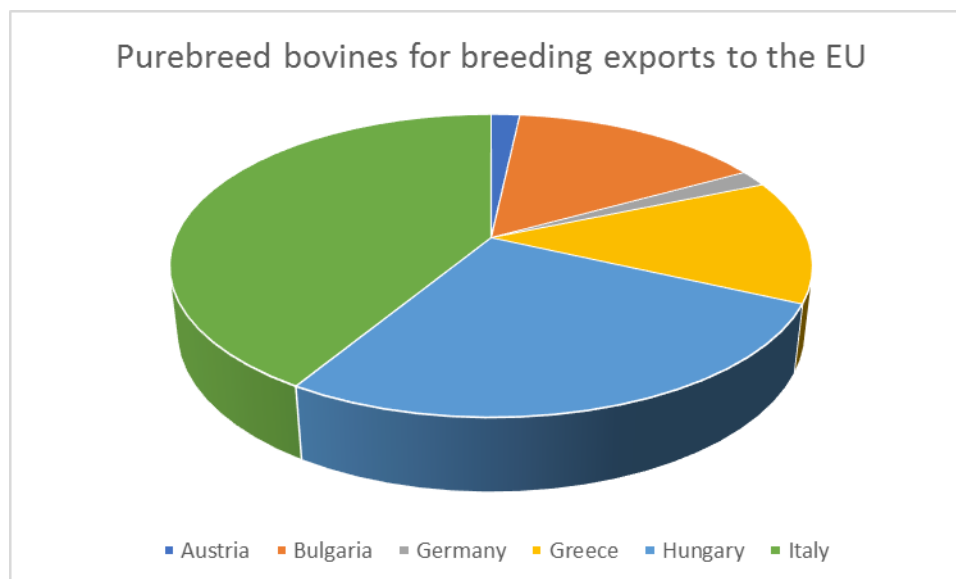


Figure 29. Breakdown by destination of exports of pure-breed bovines for breeding, by value, to the EU in 2017.  
Source: Eurostat, graphics: author

The structure is relatively well diversified, even if the absolute value is low. Italy ranks first with EUR 0.52m, yet only 0.47 thousand heads, followed by Hungary with EUR 0.37m and 0.55 thousand heads. Third comes Bulgaria in terms of values, with EUR 0.19m, 0.17 thousand heads.



### 1.2.3 Export Trends

#### 1.2.3.1 Ovines

Our purpose is to answer the question: What is the trend of the deliveries? We take into consideration the type of product (lamb, sheep, pure-breed sheep for breeding) and the area (intra/extra EU).

##### 1.2.3.1.a Lambs

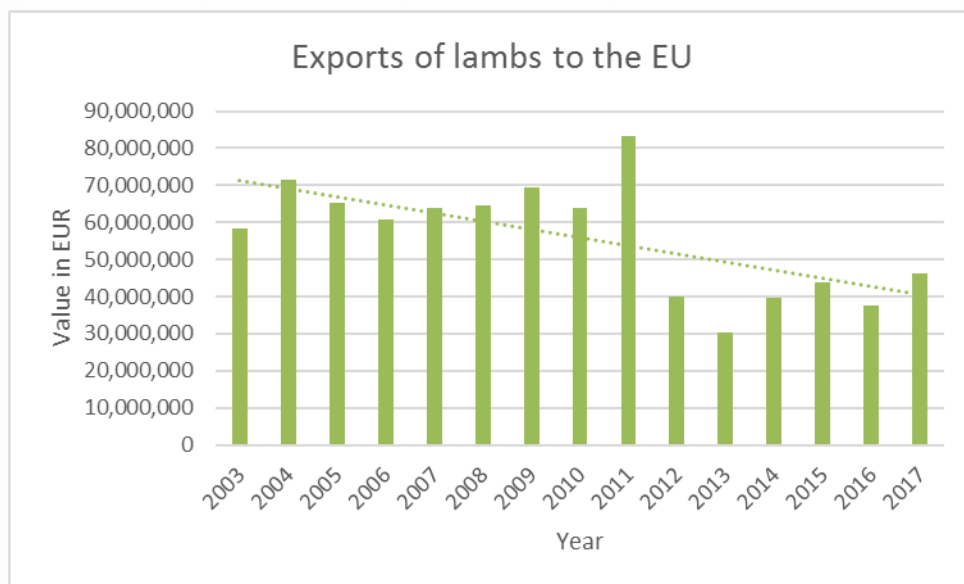


Figure 30. The trend of lamb exports to EU, value in EUR. Source: Eurostat, graphic processing: author.

The trend of lamb exports to EU is downward when looking at the aggregated series. The dotted line represents an estimate of the trend through linear regression based on the data collected between 2003 and 2017. Two periods can be distinguished: a relatively stable period up to 2010 with values of around EUR 60m and a period with higher fluctuations between 2012 and 2017, but with values close to half those of the previous period. 2011 is the peak with a value of EUR 83.14m.

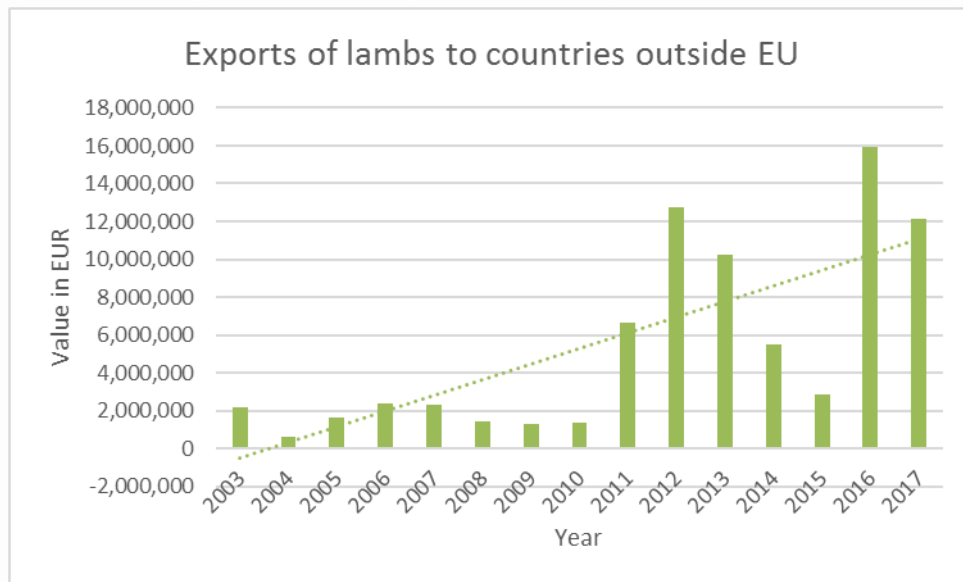


Figure 31. The trend of lamb exports outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

The dotted line represents an estimate of the trend by linear regression, based on the data collected between 2003 and 2017. Although the volatility of the year-to-year series is very high, the increase in the value of exports of live lambs is visible, especially after 2011. Although exports of lambs outside EU from 2012 to 2015 have slowed down considerably, the year 2016 brought a remarkable comeback, while at the same time offering the top value of the series. From this level 2017 meant a slight slowdown.

### 1.2.3.1.b Sheep

The trend of sheep exports to the EU is ascending, even if, as in the case of lambs, the 2012-2016 period marks a visible slowdown. The slope of the dotted line of linear regression is raised by the peak value of 2017 which is EUR 9.46m.

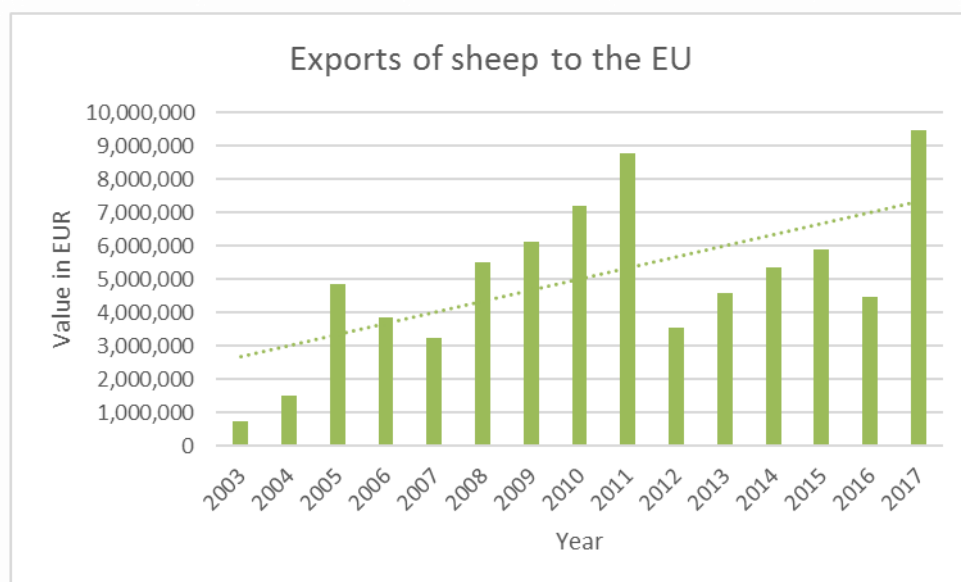


Figure 32. The trend of sheep exports to EU, value in EUR. Source: Eurostat, graphic processing: author.

When looking at the sheep exports outside the EU, the order of magnitude is different, with 2017 values being about 10 times those of sheep sent to countries in the EU. The dotted line represents again an estimate of the linear regression trend based on the data collected between 2003 and 2017. From already low values in 2003, the value of deliveries outside EU drops considerably by 2008. A phase with a higher slope starts in 2008, with the year 2012 inaugurating a new phase of very strong growth, multiplying the export value of 2011 by almost 4 times. Between 2013 and 2017, the value fluctuates around EUR 100m.

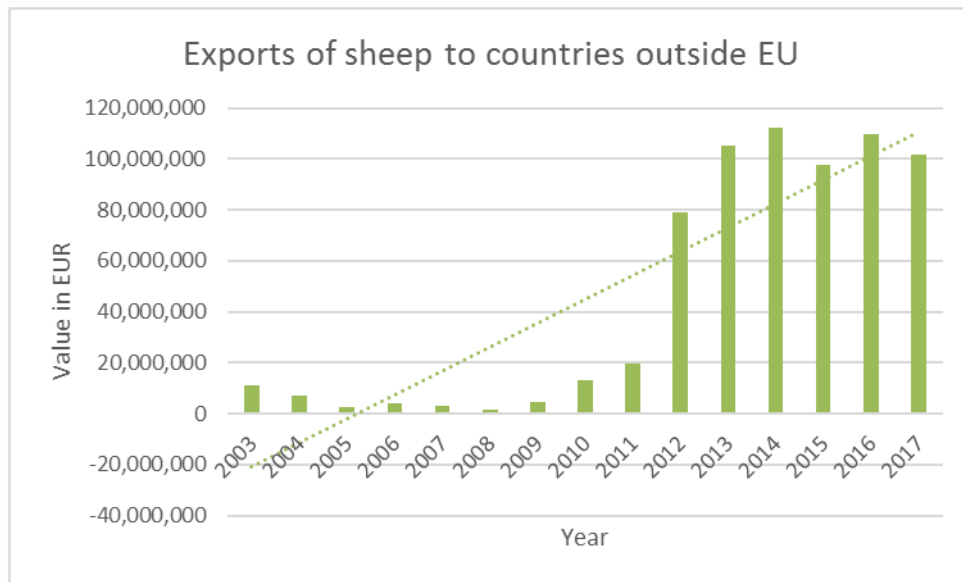


Figure 33. The trend of sheep exports outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

### 1.2.3.1.c Sheep for breeding

Outside the EU, in 2017, the only destination for exports of sheep for breeding is Turkey, with EUR 5.3m. Exports were also made in 2012, 2014 and 2015, with the highest value delivered in all these years being in 2014, EUR 0.17m.

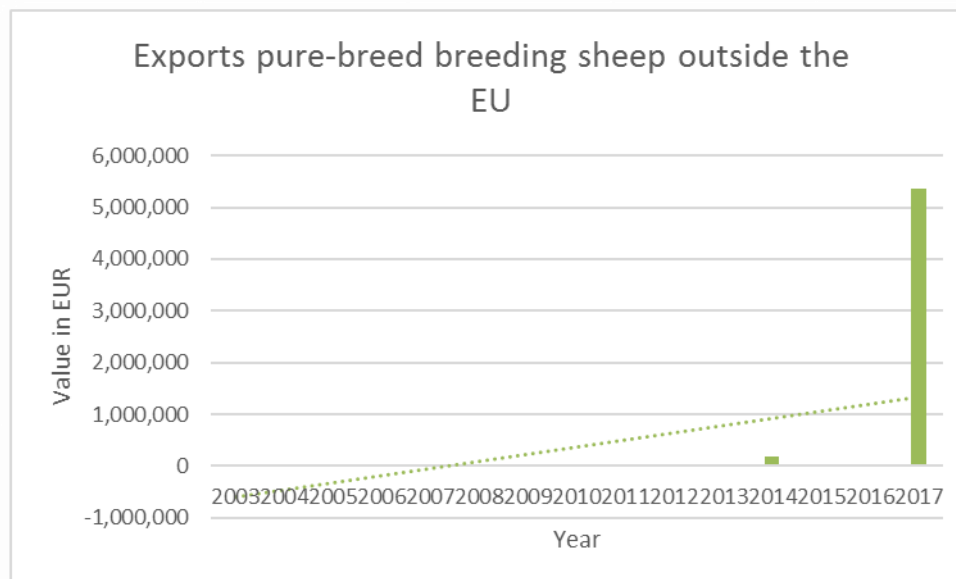


Figure 34. The trend of exports of pure-breed sheep for breeding outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

Although we have kept the regression trend line for consistency reasons, given the incomplete data series and the variation of several orders of magnitude, its relevance is much diminished relative to the other situations presented, in other words the risk of major variations of the value of exports in the years ahead is considerably higher.

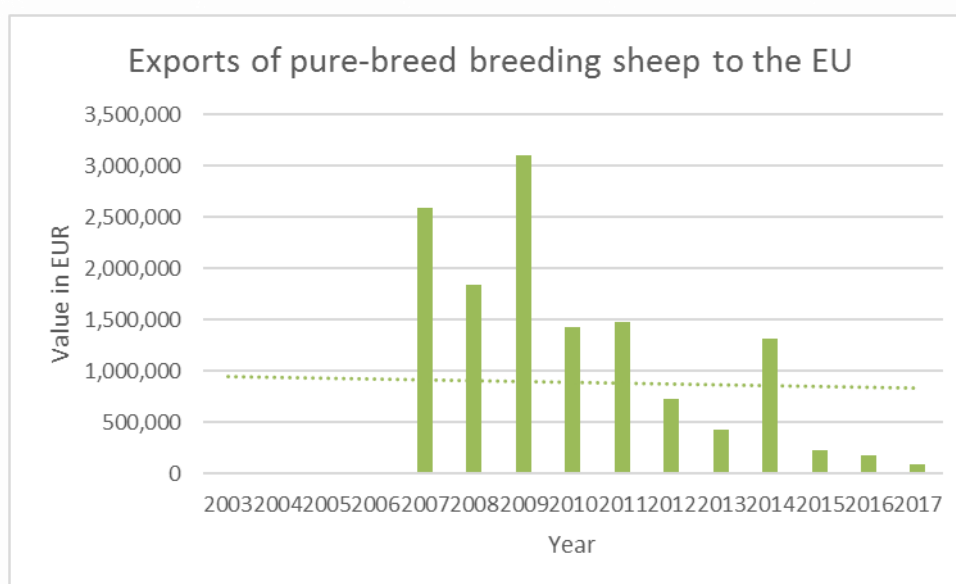


Figure 35. The trend of exports of pure-breed sheep for breeding to the EU, value in EUR. Source: Eurostat, graphic processing: author.

Deliveries of sheep for breeding to the EU are almost insignificant, only reaching EUR 0,09m in 2017. Things have not always been so. The trend of visible downturn starts in 2007, which is also the first year of the data series. There is only a temporary break of the downtrend in 2009, with a peak of above EUR 3m. EUR. From 2015 values stay below EUR 0.25m.

Italy contributed significantly to the performance of 2009, by posting a jump from EUR 0.45m in 2008 to EUR 1.23 m that year. Italy had also been an important destination in 2007, with EUR 1.96 m, approx. 75% of that year's share. After 2010, however, Italy only appears occasionally as a destination, with values below EUR 0.05m.

### 1.2.3.2 Bovines

Trend of exports is strongly upwards, with a more than 4-fold jump in total values from 2000 to 2017. The uptrend is generally quite similar for cattle to the one seen in sheep. Looking into different categories, the trend between 2012 and 2017 is upward for breeding cattle. In the bovines for slaughter group, there is a downtrend in deliveries to the EU, however the trend would be close to flat, had we not considered the year 2012, which was a peak for the period under consideration. The bovines for slaughter sent outside the EU are on a strong uptrend. Bovines for fattening offer a mixed picture, most being either on a downtrend or a mild uptrend, apart from the 160 – 300 kg group of bovines for fattening sent outside the EU that has seen massive growth, with the value of 2017 over 13 times that of 2012.

#### 1.2.3.2.a Bovines for slaughter

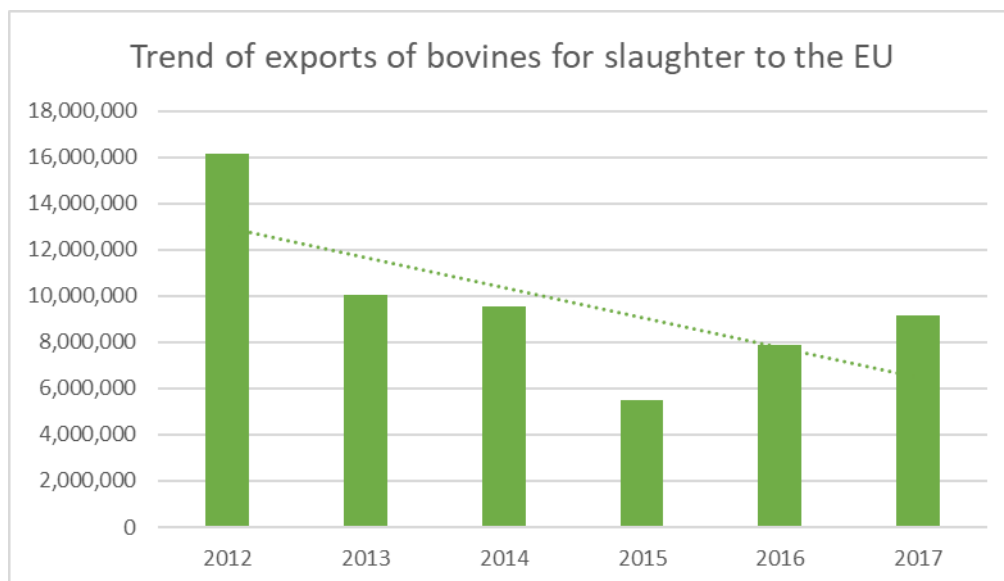


Figure 36. Trend of exports of bovines for slaughter to the EU, value in EUR. Source: Eurostat, graphic processing: author.

2012 is the peak for deliveries of bovines for slaughter to the EU, valued over EUR 16m. The slowdown continues until 2015 with a significant decrease of approximately 66% to EUR 5.48m (from 2012). Since then, there has been a growth trend, reaching EUR 9.17m in 2017. If we eliminated the year 2012, the trend towards exports to the EU would become a slower downtrend. The exports in 2017 remain 43% below those of 2012.

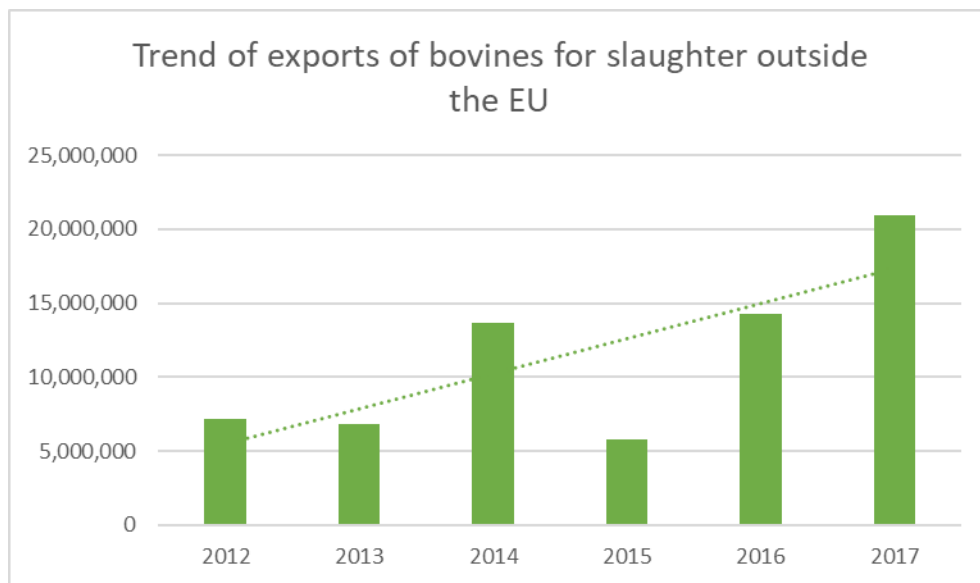


Figure 37. Trend of exports of bovines for slaughter outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

The year 2017 is the peak of deliveries of bovines for slaughter outside EU. As in the case of intra-EU exports, deliveries of cattle for slaughter are not recorded before 2012 in the detailed Eurostat data (using Trade Helpdesk). From EUR 7.17m in 2012, the value of exports outside EU grows to EUR 20.91m in 2017.



### 1.2.3.2.b Heifers, bulls and calves for fattening

Given the large differences of one or more orders of magnitude between subcategories, we decided to treat them separately.

In the category below 80 kg, deliveries outside the EU are missing in 2017, while staying below EUR 120 thousand each of the previous years. Exports to the EU only reach EUR 55 thousand in 2017, declining from EUR 1.76m in 2012 to EUR 1.03m in 2013 and EUR 0.4m in 2014.

The values become significant in the 80 - 160 kg category, so we choose to represent them graphically: in 2017, the value of exports to the EU is EUR 5.33m and outside the EU the figure becomes EUR 29.42m.

There is a downtrend in this category, interrupted briefly in 2013, and with a slight recovery in 2017 from 2016. The value of 2017 is 29.3% below 2012 and 34.4% below 2013.

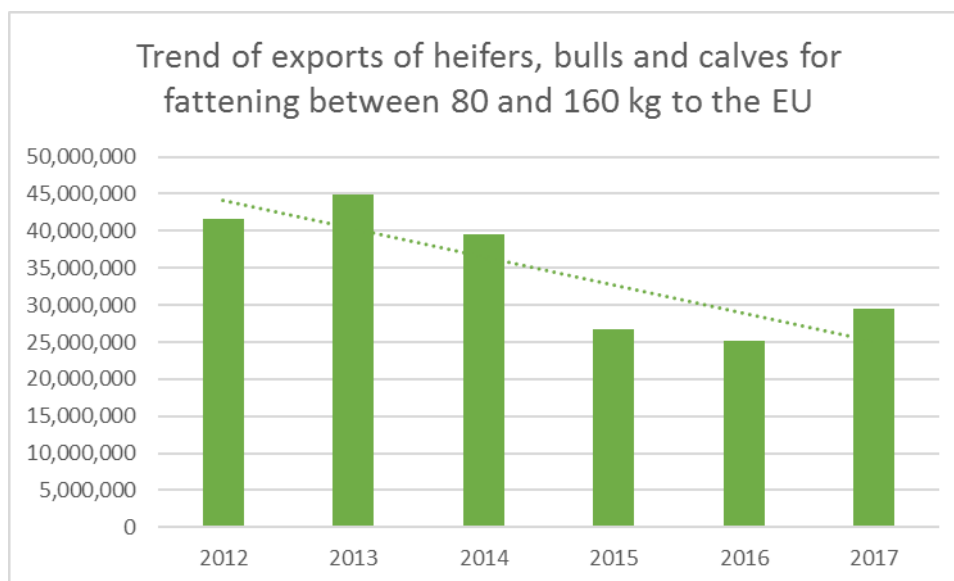


Figure 38. Trend of exports of heifers, bulls and calves for fattening between 80 and 160 kg to EU, value in EUR.  
Source: Eurostat, graphic processing: author.

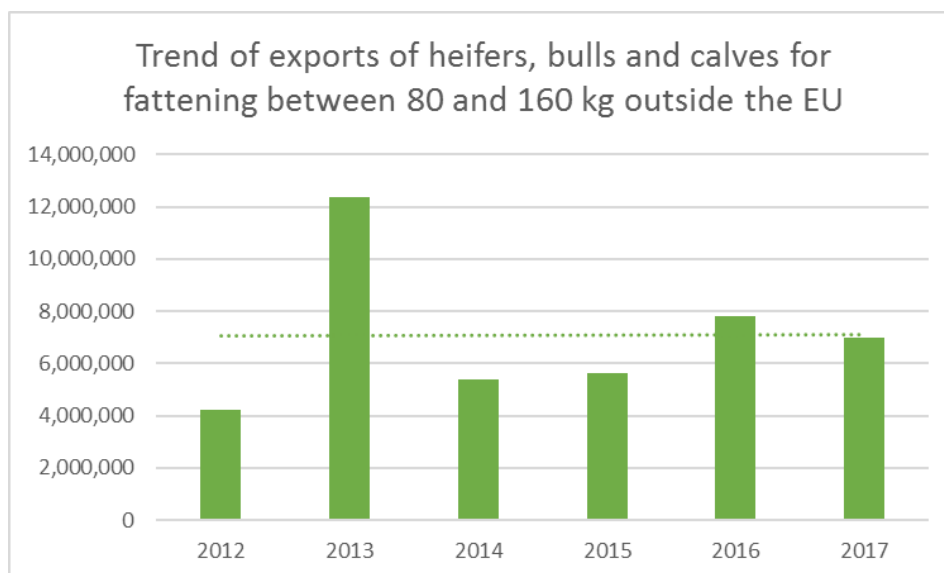


Figure 39. Trend of exports of heifers, bulls and calves for fattening between 80 and 160 kg outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

If we do not take into account the year 2013, the trend of exports to non-EU destinations would become clearly ascending. In the form presented, however, the chart does not indicate a clear trend. 2017 brings a slight decrease of 10% compared to 2016, but the value is 66% above 2012.

The category 160 - 300 kg is dominant in terms of values: in 2017, the value of deliveries to the EU is EUR 18.19m, down from EUR 28.8m in 2012, while the trend is reversed for deliveries outside the EU: EUR 43.34m EUR in 2017, which is over 13 times the value of 2012.

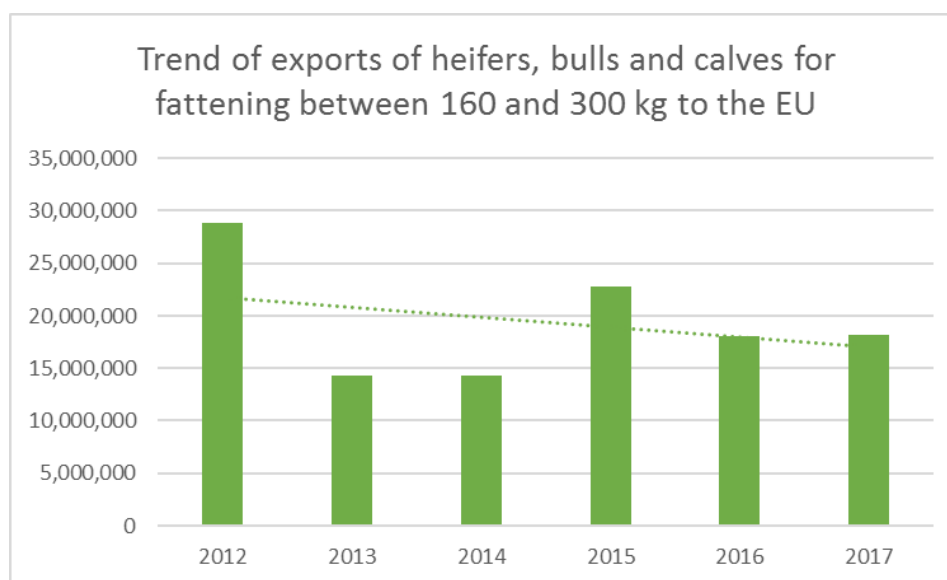


Figure 40. Trend of exports of heifers, bulls and calves for fattening between 160 and 300 kg to the EU, value in EUR. Source: Eurostat, graphic processing: author.

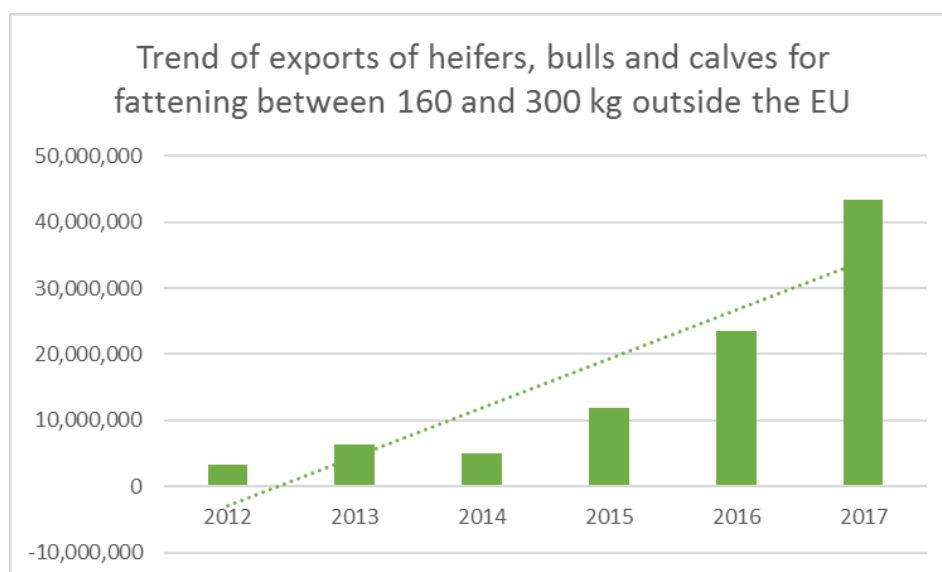


Figure 41. Trend of exports of heifers, bulls and calves for fattening between 160 and 300 kg outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

The shift of export flows from the EU to destinations outside EU is visible, and the trend has accelerated over the last 3 years.

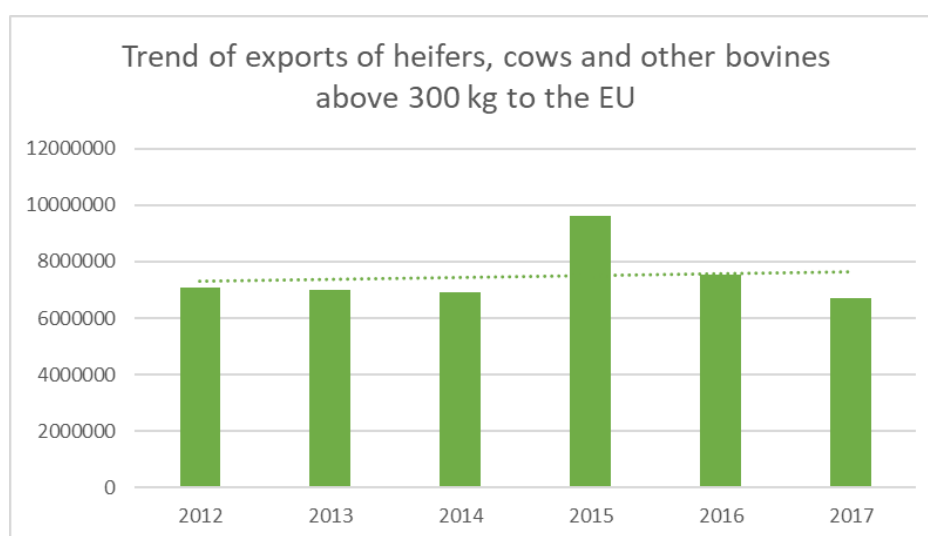


Figure 42. Trend of exports of heifers, cows and other bovines over 300 kg to the EU, value in EUR. Source: Eurostat, graphic processing: author

In the group of bovines over 300 kg sent to the EU (other than bovines for slaughter), there are generally low fluctuations (a relatively stable value of deliveries). In 2015 however, total EU-bound deliveries of EUR 9.6m go significantly above the EUR 7.47m average.

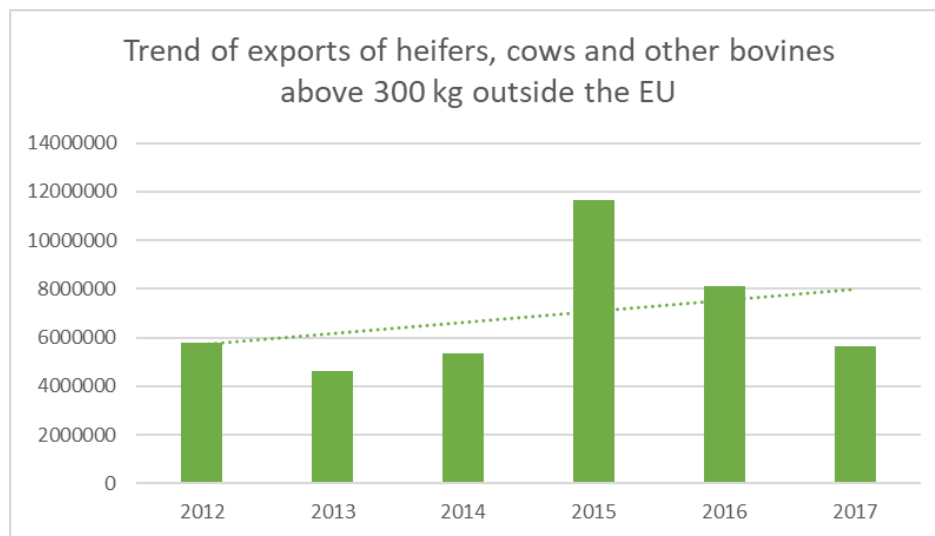


Figure 43. Trend of exports of heifers, cows and other bovines over 300 kg outside the EU, value in EUR. Source: Eurostat, graphic processing: author

For bovines over 300 kg (other than bovines for slaughter), the 2012 – 2017 trend is ascending only with the support of a very strong 2015, which posted a value nearly double that of 2012. Without 2015 and 2016, the trend for this group would become relatively flat. This is shown as well by the values from the years 2012 and 2017: EUR 5.78m and 5.64m respectively.

### 1.2.3.2.c Pure-breed bovines for breeding

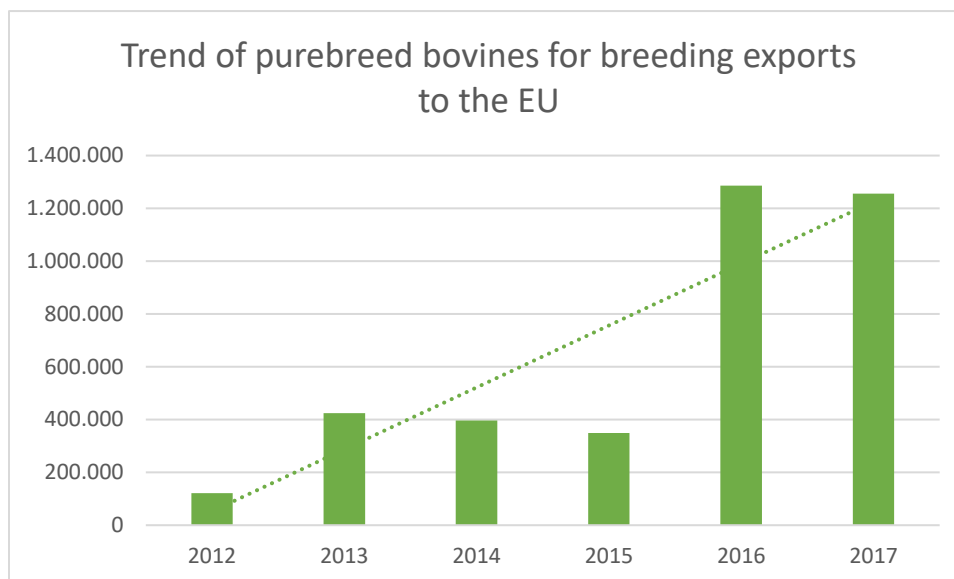


Figure 44. Trend of pure-breed bovines for breeding to the EU, value in EUR. Source: Eurostat, graphic processing: author.

The trend in this category of deliveries towards EU destinations was one of visible growth, although there is a difference between 2012-2015 and 2016-2017: the value over the last 2 years was on average more than three times higher than in the previous three years.

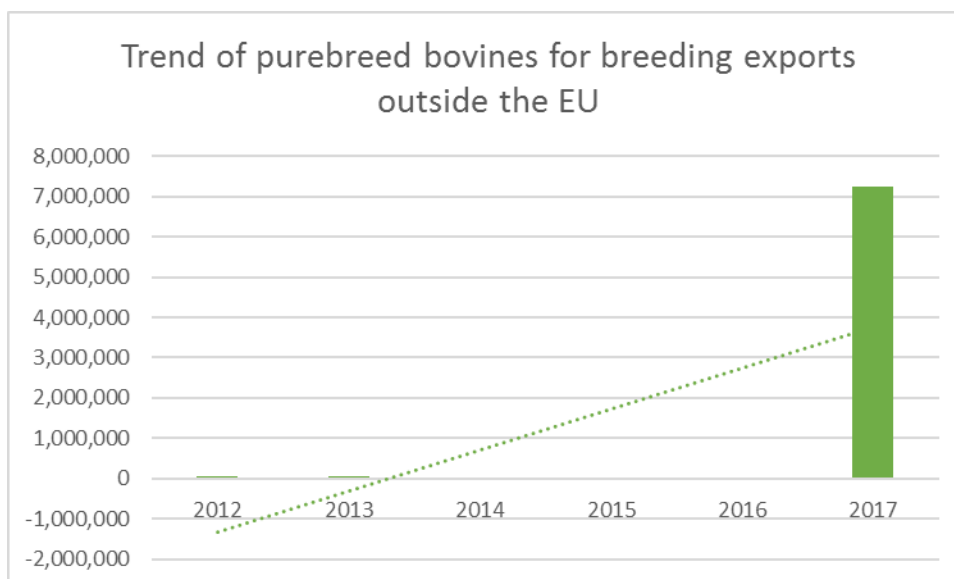


Figure 45. Trend of pure-breed bovines for breeding outside the EU, value in EUR. Source: Eurostat, graphic processing: author.

After non-existent exports before 2012 and negligible values in 2012 and 2013, the value of exports of breeding cattle to non-EU destinations is booming, exceeding EUR 7m in 2017. The dynamic is largely due to deliveries to Turkey (6.85m EUR out of a total of EUR 7.24m).

## 1.3 Meat exports

### 1.3.1 Sheep and lamb meat

The available statistics at INS group together sheep, lamb and goat meat. From the specific Eurostat data series however, it becomes obvious that ovine meat is predominant. Total sheep, lamb and goat, refrigerated or frozen meat exports has been on a rising trend in quantity and value: from EUR 1.74m in 2003 to EUR 3.71m in 2007, EUR 16.96m in 2010, EUR 34.41m in 2014 and EUR 35.17m in 2017.

Thousand EUR	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0204 Sheep or goat meat, fresh, refrigerated or frozen	1740	4011	6274	5928	3716	4267	7617	16961	16822	6261	9725	17438	34413	23905	35171

Table 1. Exports of sheep, lamb and goat, frozen or refrigerated meat (code 0204), aggregated, in EUR thousand. Source: INS

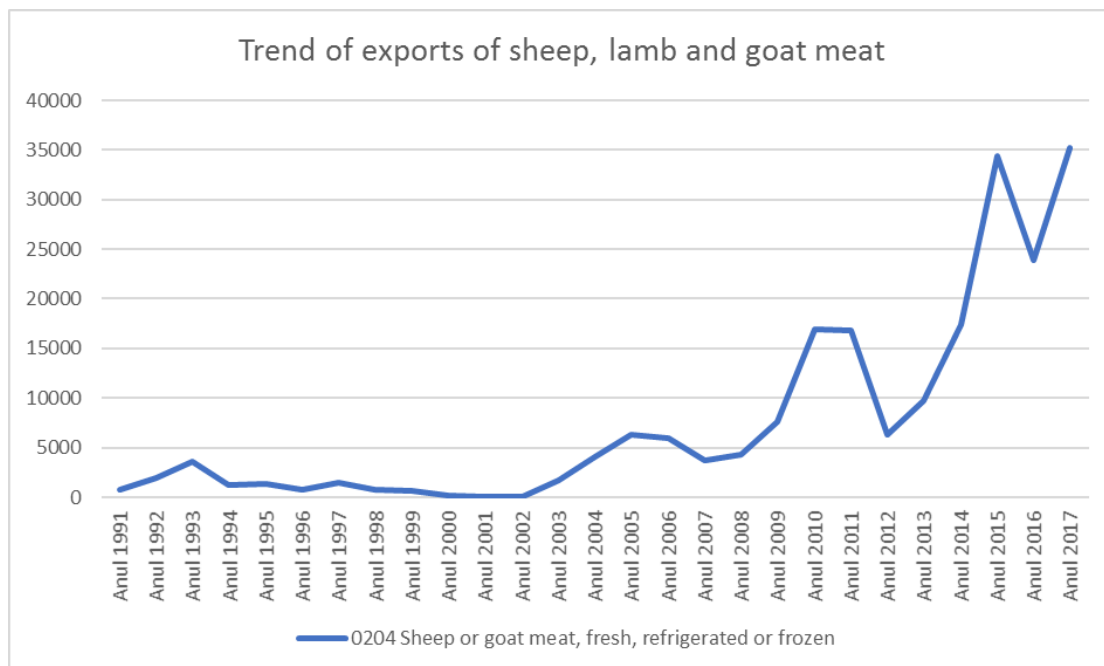


Figure 46. Trend of exports of sheep, lamb and goat meat (code 0204), frozen or refrigerated, aggregated, in EUR thousand. Source: INS, graphics: author.

Between 1991 and 1993 exports of sheep and goat meat are on an upward trend, but after 1993 there is a long decline. It is only in 2002 that the upward trend recovers and 2005 brings a new peak of the period, which will be overtaken rapidly in 2009. The trend, as seen in the chart, is one of accelerating growth: exports in 2017 are over 3.5 times the value in 2013 and nearly 9.5 times higher than in 2007.

### Types of products

For most of the products in Eurostat system nomenclature, total export value, either intra-EU or outside EU are either very small, of the order of thousand, only occasionally hundreds of thousand EUR per year. Although the values are very small, in some cases the trend is upward. To get an idea, deliveries outside the EU of sheep carcasses and half-carcasses go from EUR 5 434 in 2007 to EUR 40 285 in 2013 and after a 3-year break, in 2017 the figure reaches EUR 394 538 (0.39m). Deliveries to the EU reach approx. 770 thousand EUR in 2017. Frozen lamb carcasses and half-carcasses delivered to the EU exceed EUR 0.1m only in 2011 (EUR 103 251), and in 2013, outside the EU, the value is EUR 0.53m, with the whole quantity reaching Hong Kong that year.

In the case of refrigerated meat, the total values for most products are very small, to the order of thousands or tens of thousands of EUR. We make a mention about 2012 when refrigerated sheep meat with bone reached almost 722 thousand EUR, with major destinations being Italy (515 thousand EUR) and Spain (206 thousand EUR).

Notable values of over 1m EUR per year are met for only two categories: fresh or chilled lamb, carcasses and half-carcasses, and fresh or chilled sheep, carcasses and half-carcasses.

#### *Lamb meat, fresh or refrigerated, carcass and half-carcass*

Italy dominates in the ranking of EU destinations for lamb meat, fresh or refrigerated, carcass and half-carcass, with a value of EUR 7.06m. The next destination is Greece, with EUR 2.07m. Croatia is 3<sup>rd</sup>, with EUR 0.86m. Total value of exports in this group is EUR 12.74m.

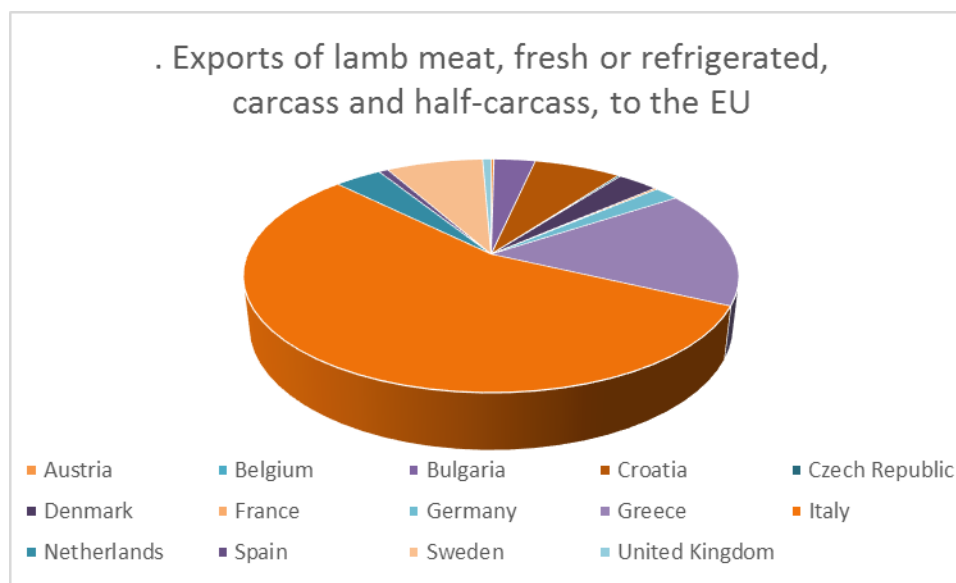


Figure 47. Exports of lamb meat, fresh or refrigerated, carcass and half-carcass, to the EU, by country, in 2017.

Source: Eurostat, graphics: author.

Outside the EU, the export structure is much simplified: Jordan is the main destination, with EUR 16.06m. A British Indian Ocean territory is far away in the ranking, at EUR 0.1m in 2017.



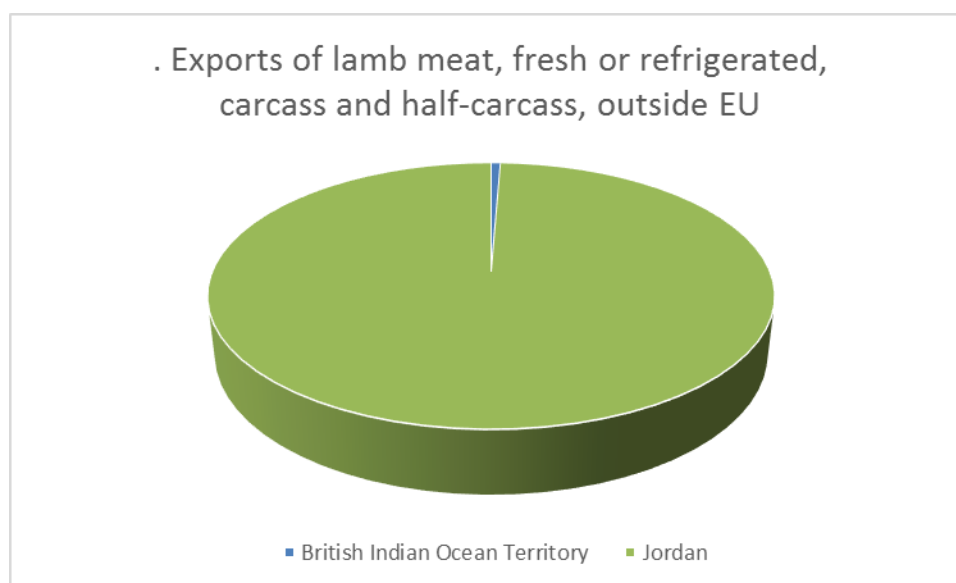


Figure 48. Exports of lamb meat, fresh or refrigerated, carcass and half-carcass, outside EU, by country, in 2017.  
Source: Eurostat, graphics: author.

#### *Sheep meat, fresh or refrigerated, carcass and half-carcass*

In 2017, the value of exports of fresh or chilled sheep, carcasses and half-carcasses to EU destinations was EUR 1.06m. Major destinations: Spain, with EUR 0.38m, Italy with EUR 0.28m and Greece with EUR 0.22m.

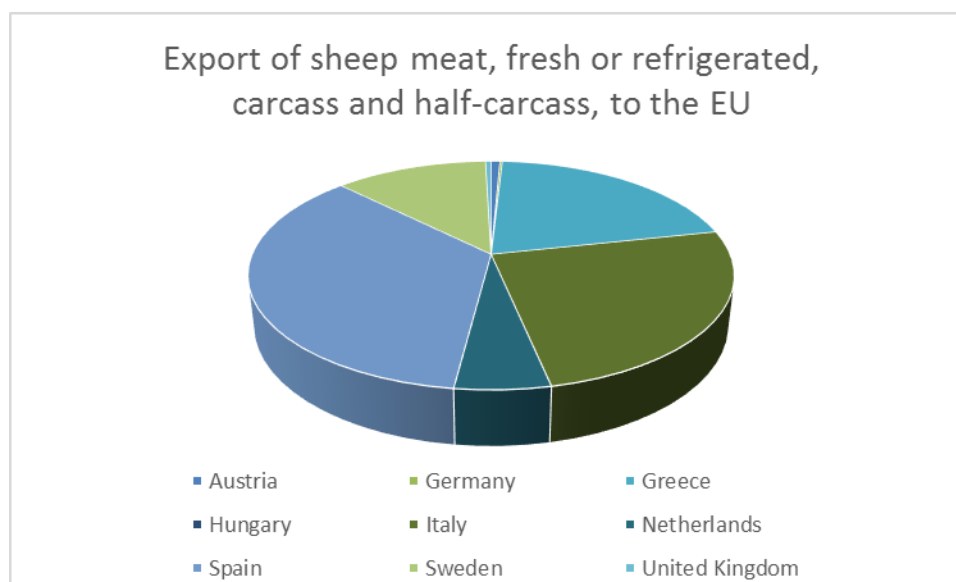


Figure 49. Export of sheep meat, fresh or refrigerated, carcass and half-carcass, to the EU, by country, in 2017.  
Source: Eurostat, graphics: author.

Outside the EU, the main destination of 2017 is Jordan, with a value of EUR 0.12m, followed by the United Arab Emirates by EUR 0.05m and Kuwait by EUR 0.03m.

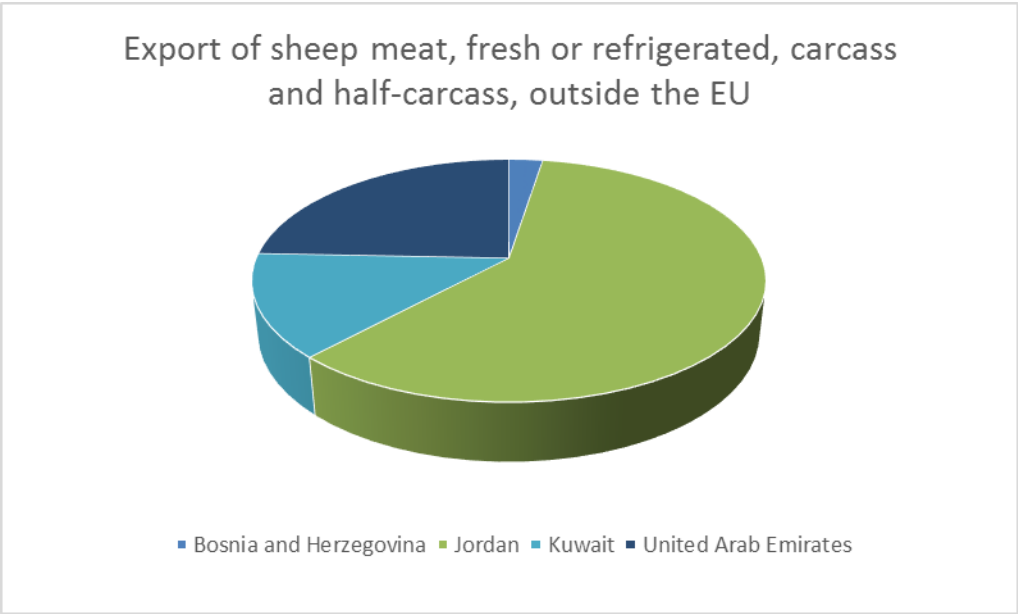


Figure 50. Export of sheep meat, fresh or refrigerated, carcass and half-carcass, outside the EU, by country, in 2017. Source: Eurostat, graphics: author.

### 1.3.2 Bovine meat

Exports of bovine meat, fresh or refrigerated, code 0201 in the Eurostat nomenclature, are on a strong upward trend. In 2003, the value was EUR 0.19m, in 2007 EUR 8.68m, to reach a maximum of EUR 40.44m in 2017, more than 4 times the 2007 level and more than 200 times more than in the year 2003.

In the case of frozen bovine meat, the trend is also upward, but the same multiplier effect is not achieved: from EUR 0.78m in 2003, exports reach EUR 1.36m in 2007 and EUR 3.5m in 2017. The value of 2017 is approx. 2.5 times higher than in 2007 and approx. 4.5 times the value of 2003. Another notable difference to fresh or refrigerated bovine meat is that the peak reached in 2012, EUR 10m is also the peak of the data series, while for the other category, the level reached in 2012 of EUR 18m is a local peak, but it is later exceeded in 2016, and less than half the value achieved in 2017. Both in absolute terms and as a trend, a significantly better performance of fresh or chilled meat is visible to the detriment frozen beef.

Thousand EUR	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0201 Bovine meat, fresh or refrigerated	187	434	466	1108	8681	6357	1126	3783	11865	18017	12052	9311	17061	22645	40441
0202 Bovine meat, frozen	784	764	1335	1731	1362	1733	1757	1760	5788	10002	5911	2952	3032	4891	3505
Total	971	1198	1801	2839	10043	8090	2883	5543	17653	28019	17963	12263	20093	27536	43946

Table 2. Exports of meat of bovine animals, fresh or refrigerated (0201) or frozen (0202), aggregated, in EUR thousand. Source: INS

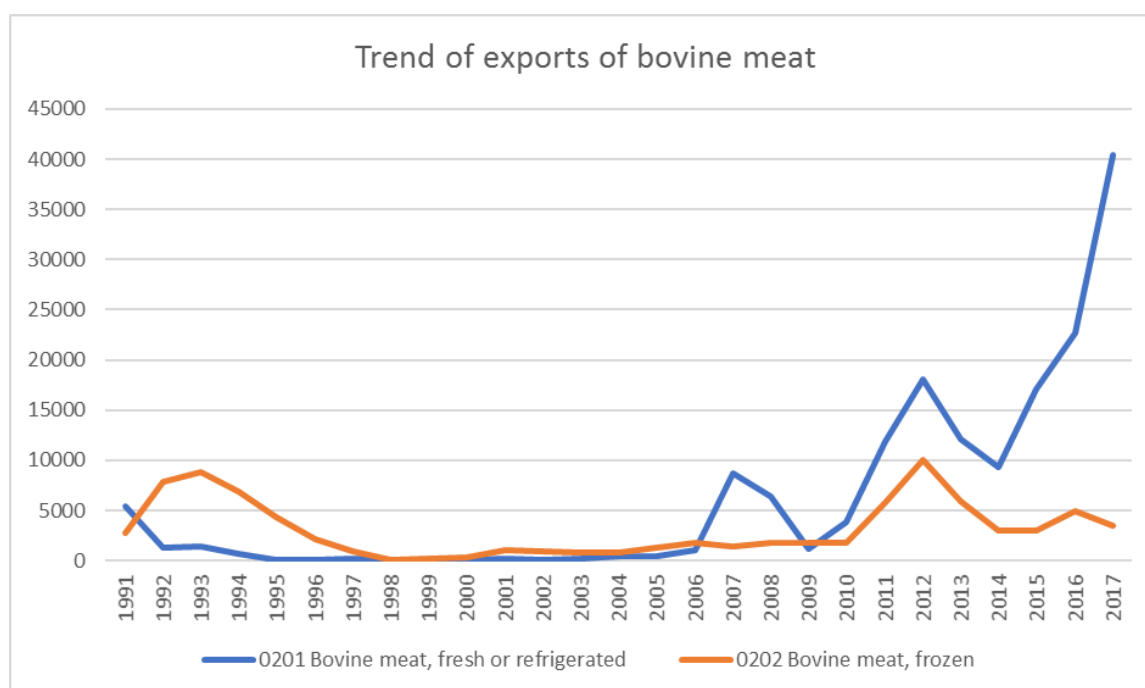


Figure 51. Trend of exports of bovine meat fresh or refrigerated (code 0201) and frozen (0202), aggregated, in EUR thousand, in 1991 - 2017. Source: INS, graphics: author.

It can also be noticed that in the early 1990s frozen meat had a better period with export values of over EUR 5m, although below EUR 10m. Between 1992 and 1997, exports of this category exceeded exports of fresh or refrigerated meat. The second half of the 1990s meant a decline in frozen meat exports.

Between 1998 and 2004, the figures remained low, barely reaching EUR 1m in 2001.

Products with relevant export values are: fresh or refrigerated beef, carcasses or half-carcasses and beef and veal without bone.

### *Beef and veal without bone*

The years 2004-2008 show small volumes of exports to EU. In 2009, Austria heads for USD 0.51m (FAO data) followed by Bulgaria, with USD 0.22m. In 2010 Bulgaria receives deliveries of USD 1.56m, Syria USD 0.67m, and Libya USD 0.36m. After 2010 there is an important acceleration of deliveries. After a period of slowdown between 2012 and 2014, the upward trend is resumed. A peak of EUR 13.83m is reached in 2017.

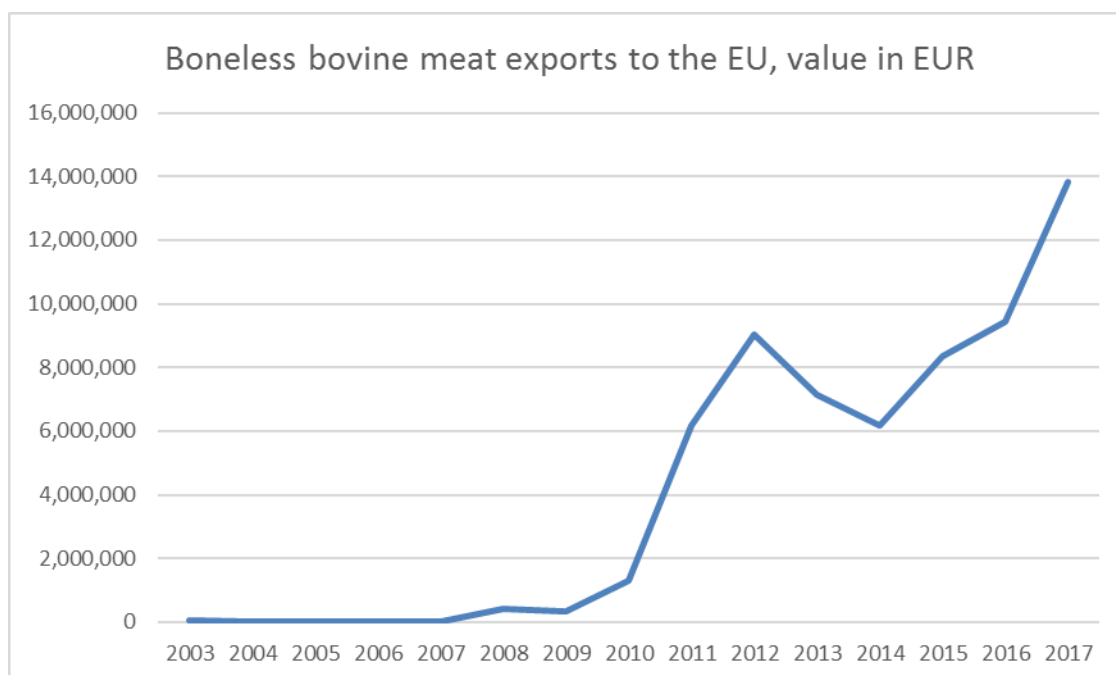


Figure 52. Trend of exports of boneless bovine meat in EUR, 2003 - 2017. Source: Eurostat, graphics: author.

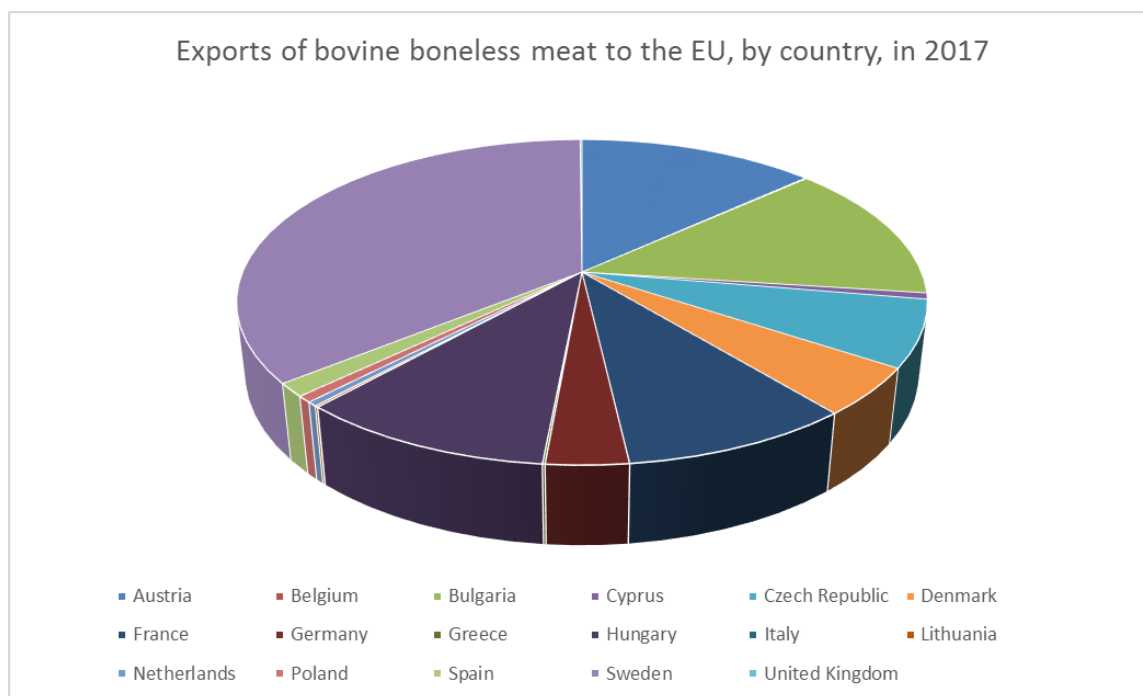


Figure 53. Breakdown of exports of boneless bovine meat to the EU, by country, in 2017. Source: Eurostat, graphics: author.

The main destination for the export of boneless beef and veal, within EU in 2017 is Sweden, with EUR 4.93m. The second and third place are close to each other, Bulgaria with 1.90m EUR and Austria with 1.83m EUR.

There are no exports of boneless beef and veal outside the EU in 2017. Between 2003 and 2016 there are only 2 years where the value goes above EUR 0.1m: 2010, with EUR 0.57m, and 2014 with EUR 0.1m.

### *Fresh or refrigerated bovine meat, carcasses or half- carcasses*

Up until 2007, exports are sporadic and of minor value, in the order of tens of thousands of EUR. Between 2007 and 2016, for 10 years, exports remain below the level of EUR 10m, with an average of EUR 5.04m. 2017 brings spectacular growth to EUR 22.83m, more than 4 times the average of the previous 10 years.

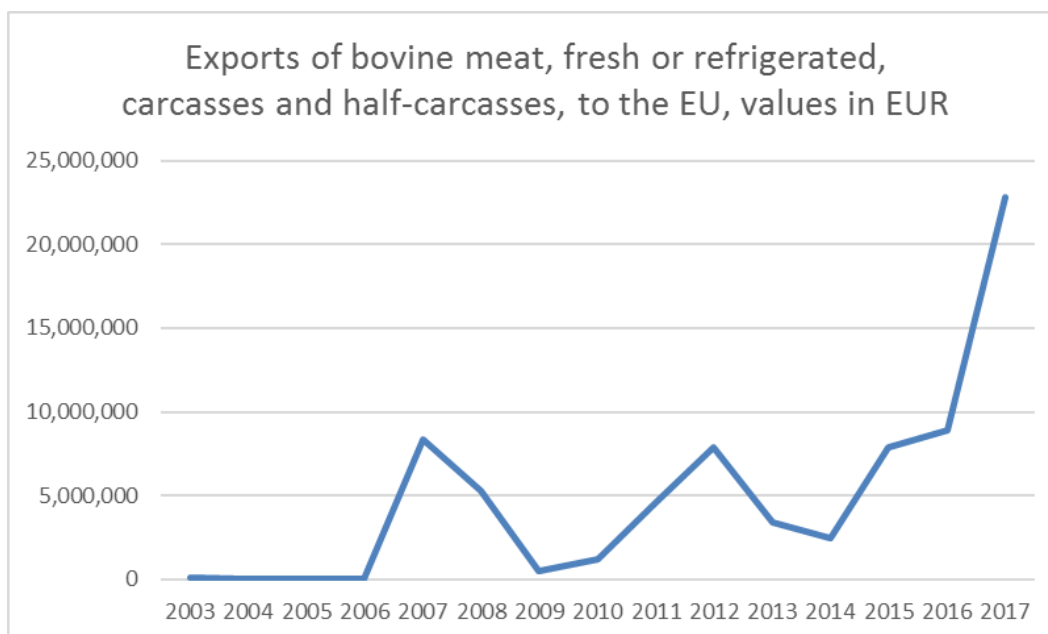


Figure 54. Trends in exports to EU of fresh or refrigerated beef, carcasses and half-carcasses, value in EUR, between 2003 and 2017. Source: Eurostat, graphic processing: author.

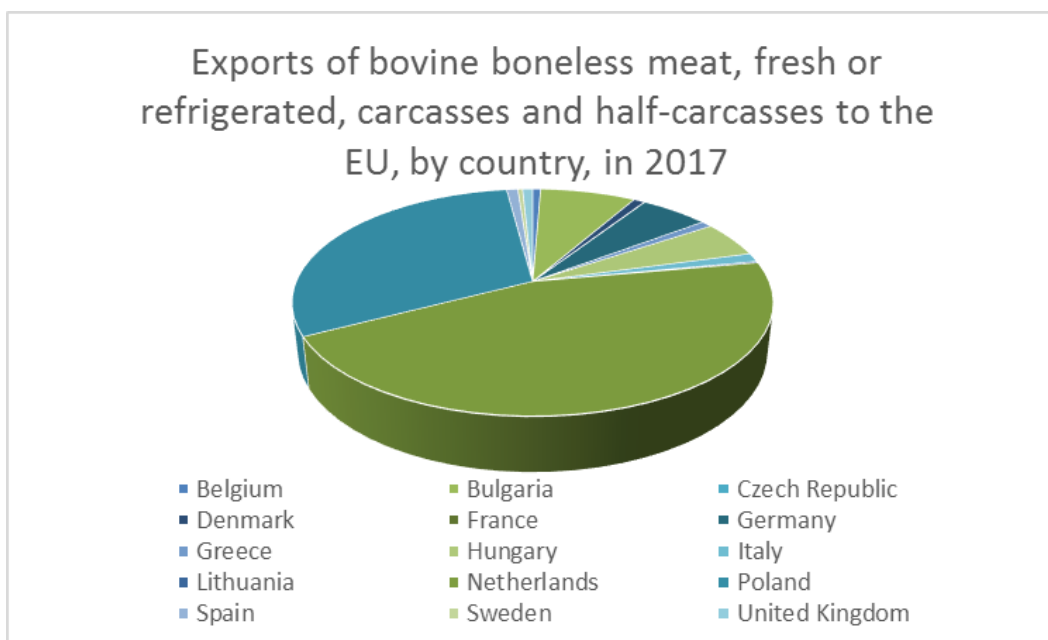


Figure 55. Breakdown by destination of exports to EU of fresh or refrigerated beef, carcasses and half-carcasses, value in EUR in 2017. Source: Eurostat, graphic processing: author.

The main destination among EU countries in 2017 is the Netherlands, with EUR 10.31m. Poland ranks second with EUR 6.97m. Third place is Bulgaria with EUR 1.75m. The total value of exports of meat in this category to the EU is EUR 22.83m.

#### *Deliveries outside EU*

The upward trend in deliveries of meat of bovine animals, carcasses and half-carcasses, fresh or refrigerated, outside the EU is much more irregular than deliveries to the EU. 2016 brings a peak of EUR 2.18m, being the only value of the series over EUR 1m, but in 2017 at EUR 0.86m the value is almost one third of the previous year's value.

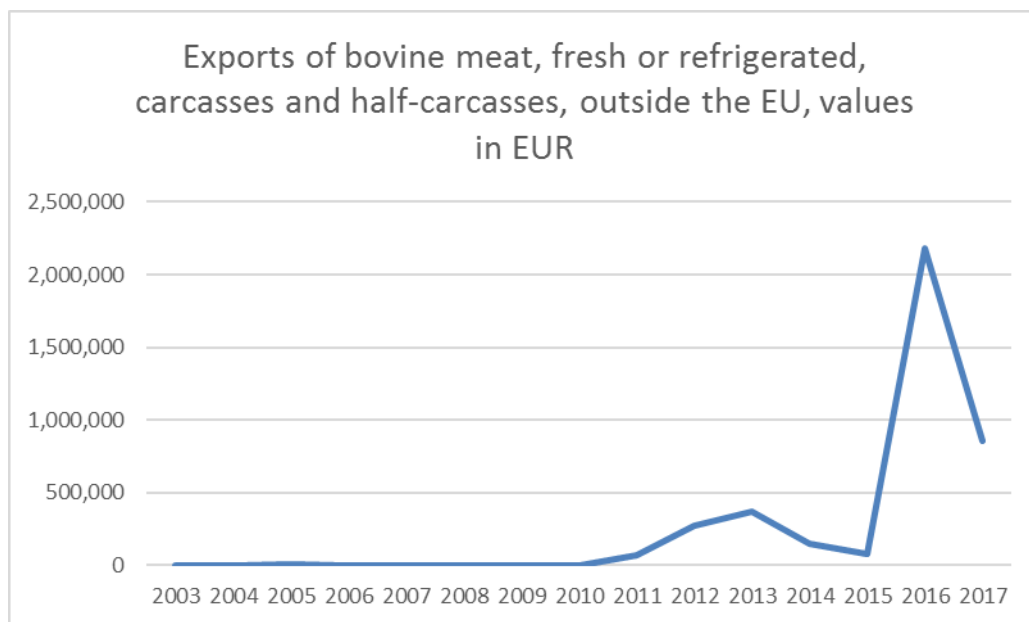


Figure 56. Trend of exports outside EU of fresh or refrigerated beef, carcasses and half-carcasses, value in EUR, between 2003 and 2017. Source: Eurostat, graphic processing: author.

Switzerland is the top destination in 2017, with EUR 0.46m, followed by Bosnia and Herzegovina at EUR 0.3m.

## 1.4 Conclusions

The trend of livestock exports from Romania is ascending. FAO data have the advantage of offering a wider perspective, with a longer data series (than Eurostat or INS), although data before 1989 are either FAO estimates or unofficial data.

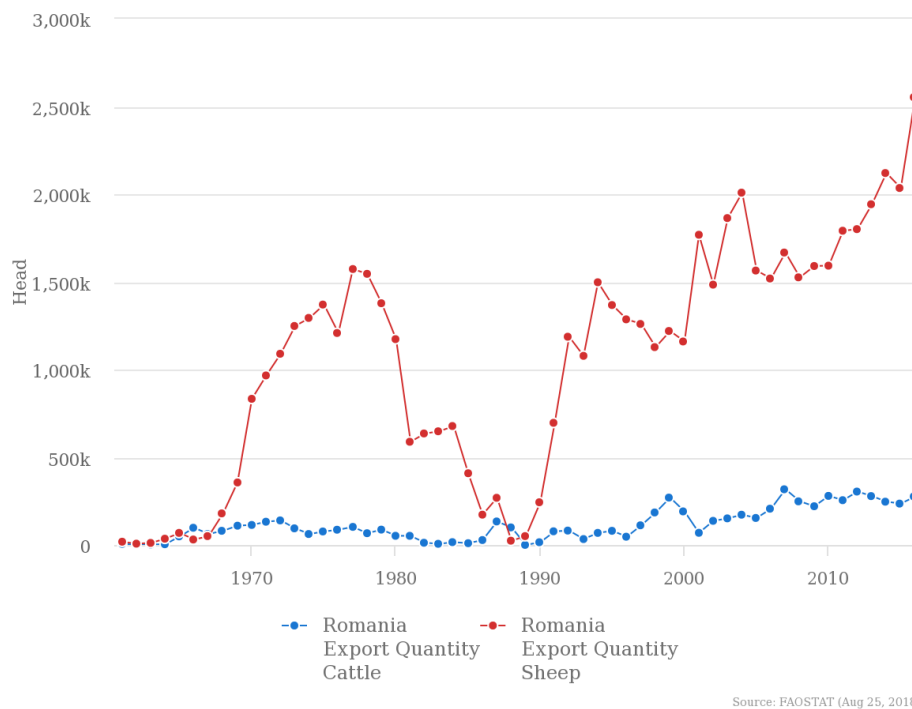


Figure 57. Exports of sheep and cattle from Romania, number of heads. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

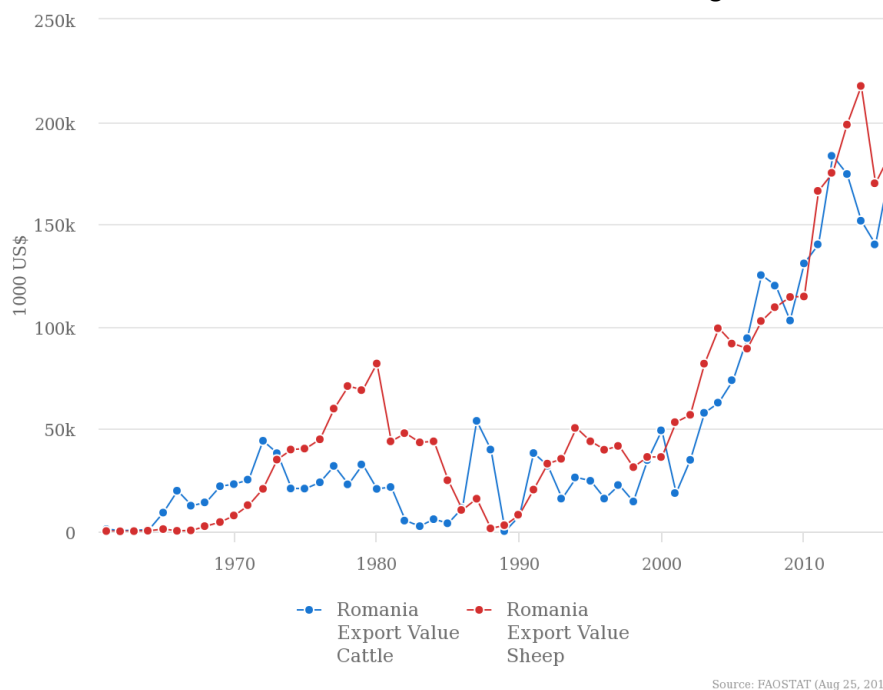


Figure 58. Exports of sheep and cattle from Romania, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures



If differences can be distinguished between the number of sheep and bovine heads, and they are about one order of magnitude, when we speak of total value, the figures become comparable.

Aggregate FAO data show several periods: growth in the '60s and '70s for sheep, declining almost to a halt in the 1980s. Since 1990 there has been a recovery period for both sheep and cattle. The peak level before 1989 is exceeded in the first half of 2000. The increase in the value of exports of sheep and bovine animals is approaching USD 0.37 billion (EUR 0.34 billion) in 2016. In 2017, the cumulative value of exports of sheep and cattle was EUR 0.39 billion, up 14.8% vs. 2016.

## Exports of ovine and bovine meat

FAO data show a generally ascending trend for sheep meat in the 1980s, followed by a steep fall in 1990. Since 2000, a recovery begins and the deliveries reach new highs after 2010. The beef profile is different : the 1970s brought strong growth, from USD 18.8m in 1970 to USD 86.8m in 1973 (which was a local peak followed by 2 years of decline) and USD 186.6m in 1979. The peak was reached in 1981: USD 197.8m, after which declines begin. In 1989 the value is USD 40.2m. After 1990 there are several years of recovery, but the values are modest. It is noted, however, that the category of boneless meat appears after 1990. Before 1989 the volume was made up entirely of deliveries of meat with bone, although it is possible that a lack of details in the data led to this categorization. The total value of exports of bovine meat, with and without bone, does not exceed USD 12m until 2007. In 2017, the total value does not exceed the value of 1989, although the only category visible then was that of boneless meat.

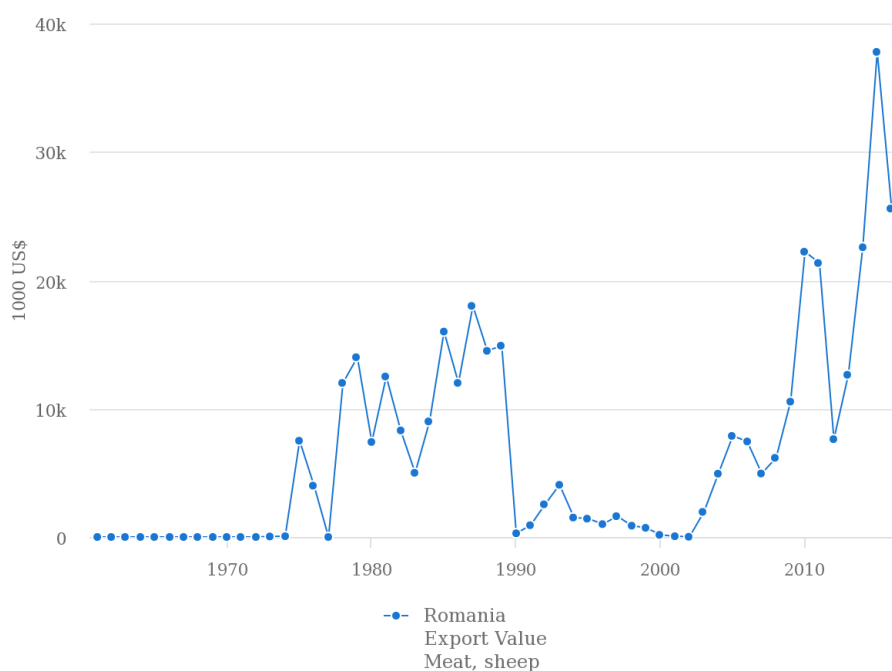
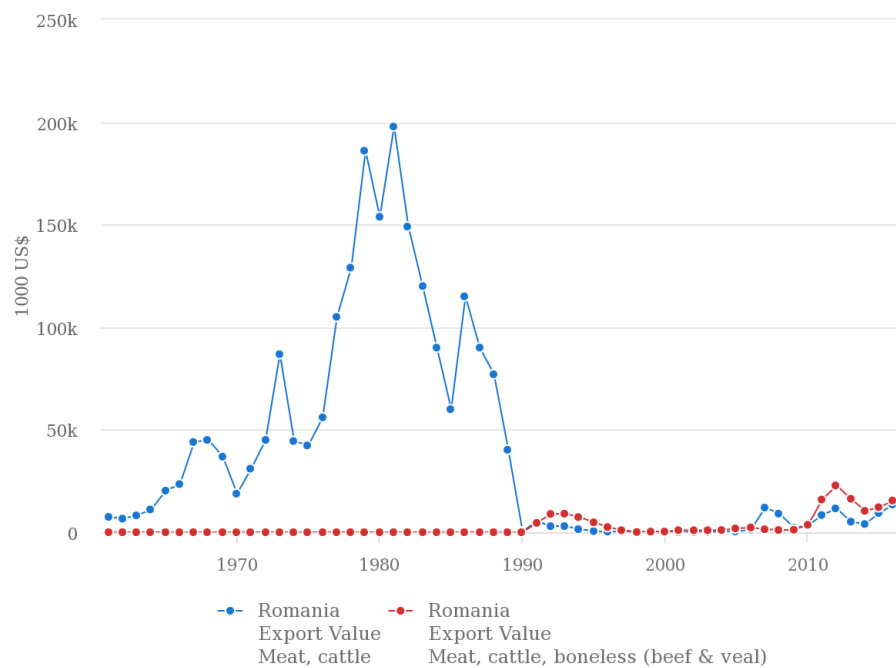


Figure 59. Exports of sheep meat from Romania, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures



Source: FAOSTAT (Sep 16, 2018)

Figure 60. Exports of bovine meat (with bone, blue and boneless, red) from Romania, value in thousand USD.  
Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

## Exports of live animals vs. meat

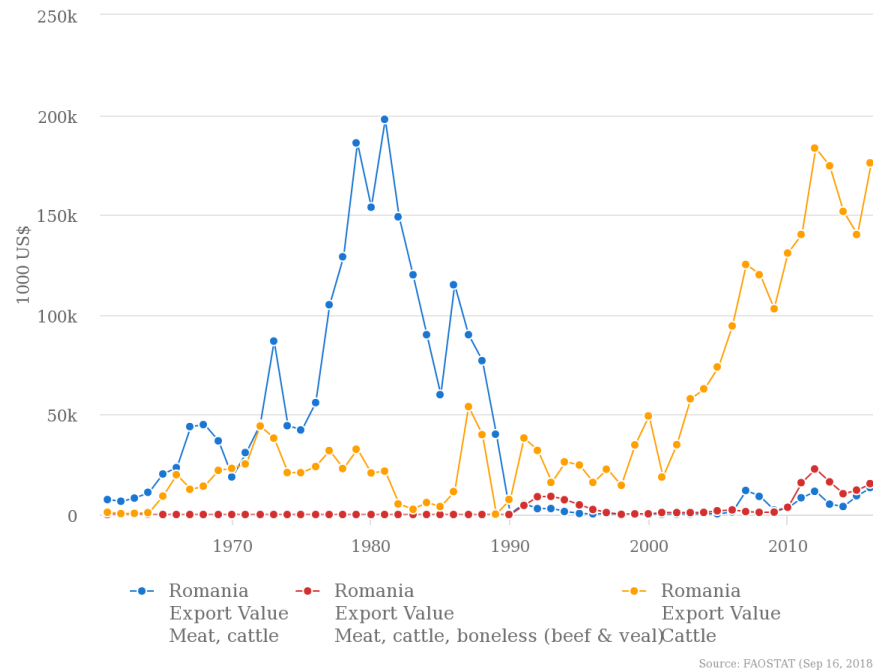


Figure 61. Exports of bovines (yellow), bovine meat (with bone, blue and boneless, red) from Romania, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

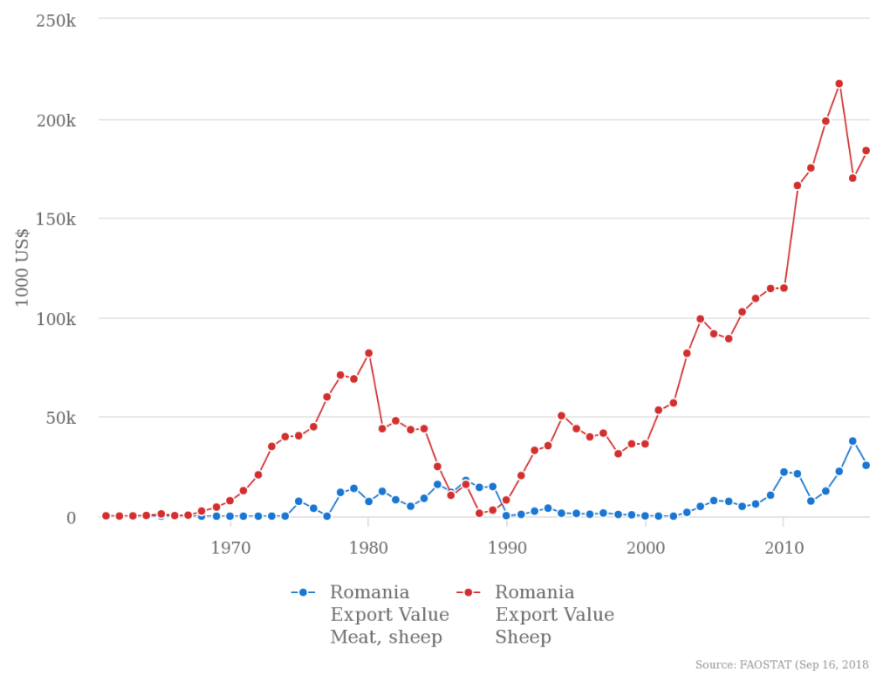


Figure 62. Exports of sheep and sheep meat from Romania, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

It can be noticed that in cattle, during almost the whole 1970-1989 period, meat exports exceeded those of live animals. The peak is reached in 1981, when the value of meat exports, of USD 197.8m, is almost ten times higher than that of cattle deliveries (USD 21.7m). In sheep, the situation is different, between 1970 and 1985 live animals are exported at higher levels than sheep meat. Since 1986, the situation is reversed, but the differences are small for 2 years. In 1988 and 1989 meat exports amount to 14.5 and 14.9m dollars, while the values for sheep are at 1.5 and 3.07m dollars, respectively.

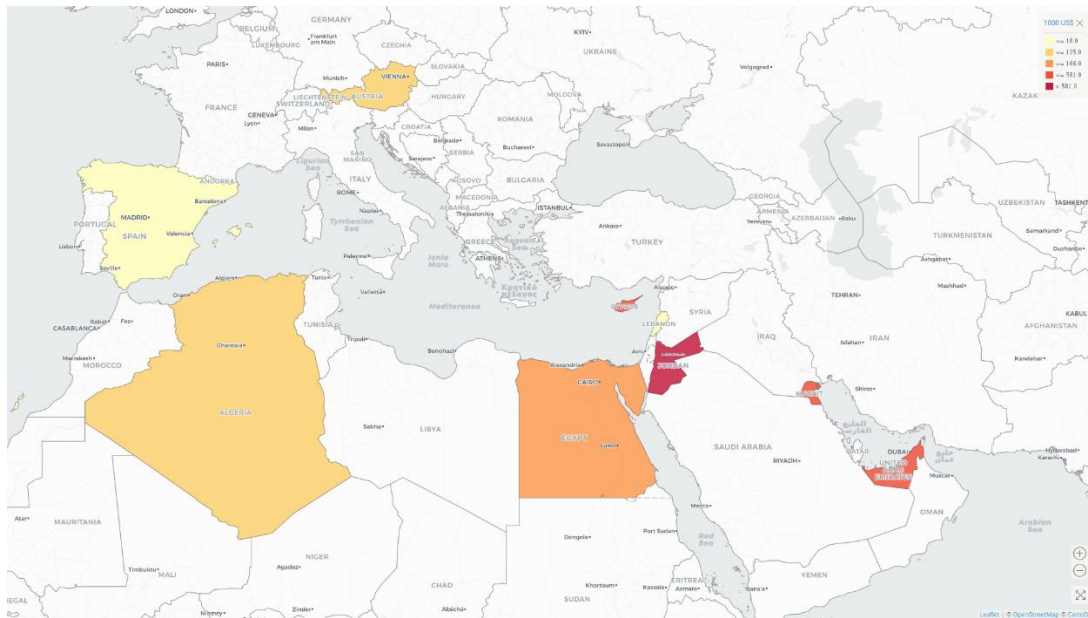


Figure 63. Exports of sheep meat from Romania, by destination, cumulative, 1986 - 1989, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

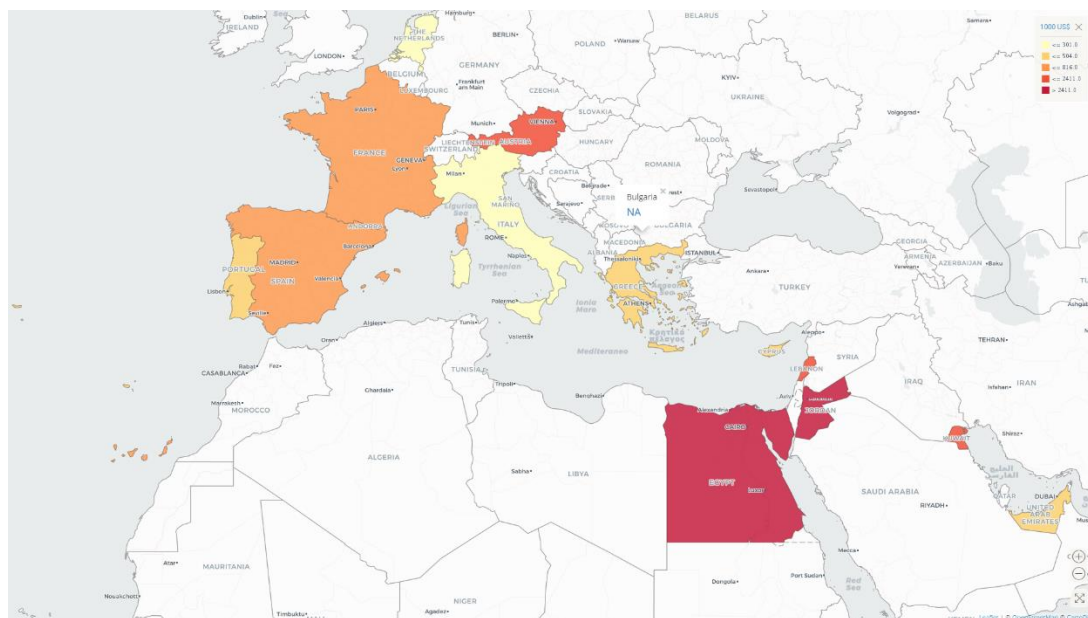


Figure 64. Exports of bovine meat (not including processed meat) from Romania, by destination, cumulative, 1986 - 1989, value in thousand USD. Source: FAO. Official data since 1989. Pre-1989 data are FAO estimates and unofficial figures

For sheep meat, between 1986 and 1989 the main destination is Jordan, with a cumulated value of USD 13.26m. No other country is even near: the second largest destination is UAE (United Arab Emirates) with USD 0.58m.

For bovine meat, between 1986 and 1989 the main destination is Jordan, with a cumulative value of USD 12.2m, followed by Egypt, with USD 3.41m and Kuwait with USD 2.41m. A European country: Austria, with USD 2.26m, is only on the 4<sup>th</sup> position.

The focus has been on meat exports, with higher added value, since the second half of the 1970s, especially in cattle. Sheep meat exports had a fluctuating dynamic, failing to dominate the value of livestock visibly until 1988. Since 1998 they manage to overtake live sheep outbound deliveries due to a consistent decline of the live animals' exports values. Starting in the second half of the 1970s, the widening the trade deficit along with the rapid increase in foreign debt had generated a growing concern in Romania, which requested a loan from the IMF in 1981. The decision to repay the entire external public debt has defined the economic policies up to 1989. The most important destinations, Jordan and Egypt were countries with which Romania had close bilateral relations at that time. It is possible that the downward trend in exports of live animals, with a more clearly defined trend for sheep, since 1980, was also the result of the development of an internal network of collection and processing centers for wool and other by-products. The development of wool processing chain was made possible generally through better control of breeding conditions, raising and keeping sheep during the winter. After 1990, the dismantling of local logistics chains, in the face of increasing competition from China's textile products, has reduced demand for wool. Competitiveness has decreased in parallel with a decrease in quality due to diminishing attention to some parameters regarding purity of species, feeding conditions, winter conservation and pasture.

*Focus on more recent developments: 2003 - 2017*

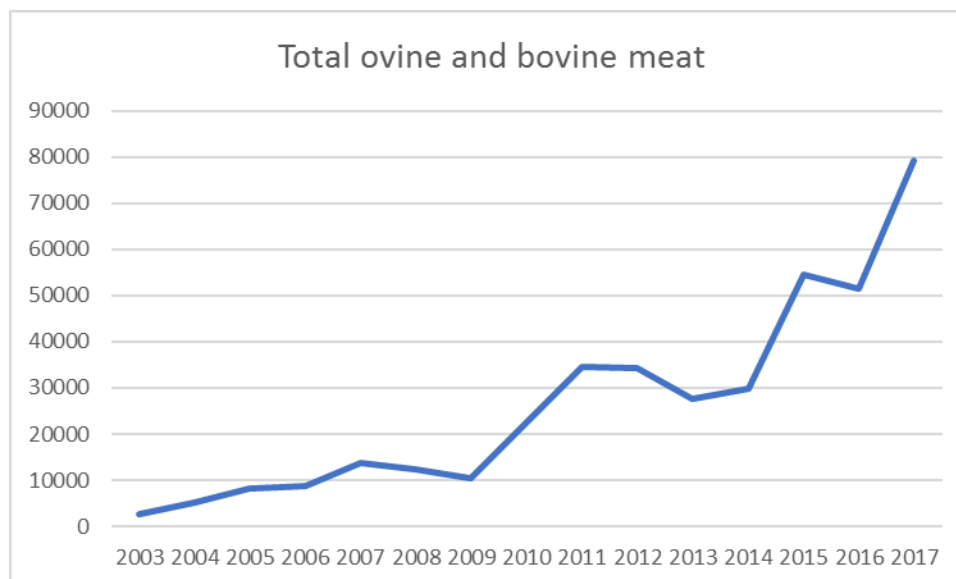


Figure 65. Exports of sheep meat and bovine meat from Romania, from 2003 to 2017, values in thousand EUR.  
Source: INS, graphics: author.

Moving nearer to present time, in the period 2003-2017, meat exports are considerably lower than livestock exports. In 2017, according to INS, sheep and cattle export values were EUR 388.21m in total, while sheep and cattle meat reached EUR 79.11m, a level 4.9 times smaller than the live animals one. However, when we analyze the trend of the ratio between the value of animal exports and the export of meat, we find that since 2003, with some small corrections, the trend is descending, meaning an increase in the relative share of meat exports. The phenomenon shows the growing ability to capture market share for meat and processed products but, in absolute terms, still suggests a relatively low performance of meat exports, although markedly improved over the period 2003-2009.

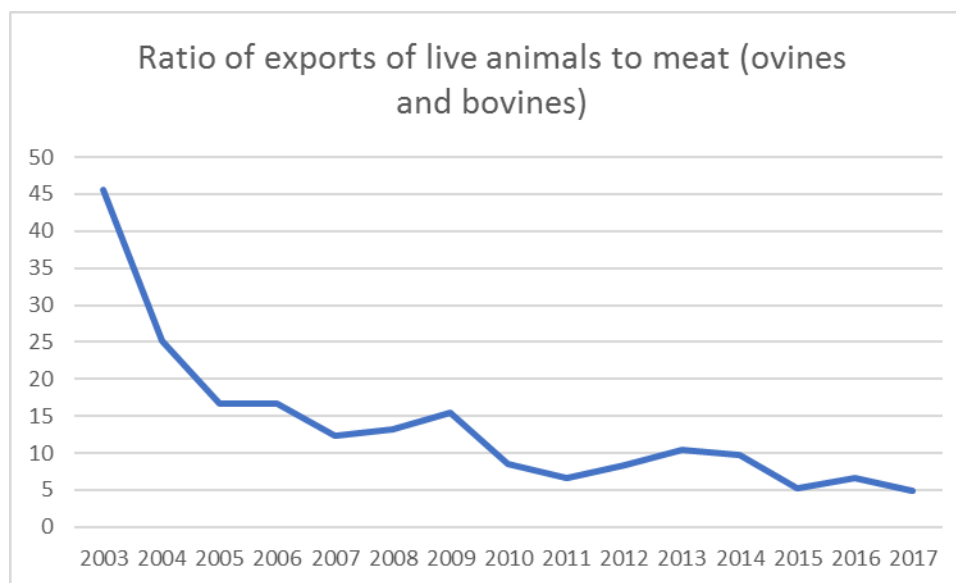


Figure 66. Ratio of exports of sheep and bovine to meat of sheep and bovines from Romania, from 2003 to 2017, values in thousand EUR. Source: INS, graphics: author.

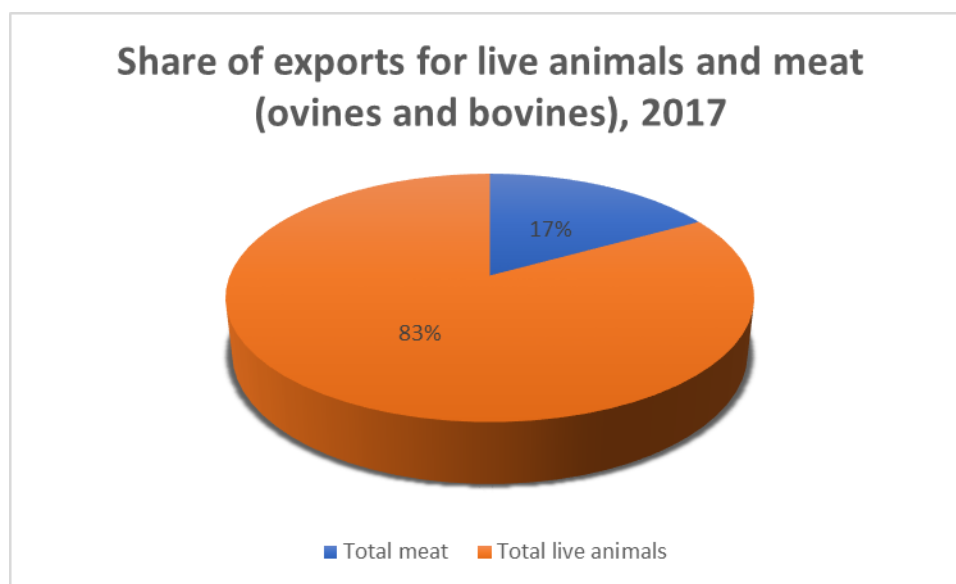


Figure 67. Breakdown by meat or live animals of exports de ovines and bovines from Romania, in 2017. Source: INS, graphics: author.

In 2017, the best year for the relative value of exports of sheep and cattle meat to live animals, they accounted for 17% of a total export value including cross-border meat and livestock deliveries.



## Exports as percentage of bovines and ovines livestock

Between 1998 and 2017, the trend of the percentage of the cattle herd going for export was generally upward, but distinct phases can be observed. Between 1999 and 2001 there was a marked decrease from 8.85% to the minimum value of the series, namely 2.47%. From this low, there is a gradual increase until 2006, to a rate of 7.05% with a notable jump in 2007 to 11.26%. After a 2-year correction, growth is resuming in 2009, with the highest rate reached in 2012: 15.15%. From 2012, the downward trend is broken only in 2016. At the level of 2017, the percentage reaches 10.87%, one that is below the 2007 level.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Bovine Export Percentage	5.23%	6.14%	5.38%	7.05%	11.26%	9.27%	8.78%	13.98%	12.83%	15.15%	13.77%	11.92%	11.27%	13.49%	10.87%
Ovine Export Percentage	25.03%	27.05%	20.56%	19.79%	19.69%	17.18%	17.40%	18.92%	21.00%	20.39%	21.26%	22.28%	20.75%	25.85%	24.26%

Table 3. Percentage of exports out of total bovines and ovines livestock. Source: INS, FAO, Eurostat

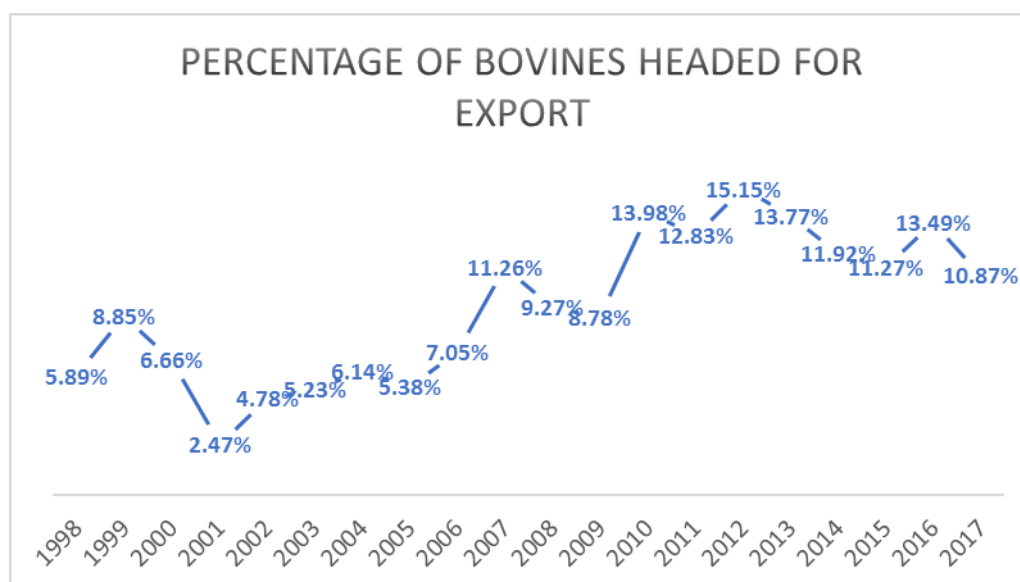


Figure 68. Percentage of exports out of total bovines livestock. Source: INS, FAO, Eurostat, graphics: author.

For sheep exports, the trend is also upward: compared to 13.41% of the herd exported in 1998, the value of 25.85% in 2016 is almost double. In 2017 there was a slight decrease to 24.26%. The peak year was 2004, with 27.05% of total exports, followed by a decline period, with a minimum of 17.18% reached in 2008. From 2008 to 2016, the trend was up. Percentages are generally double or more than double those in the ovine data series.

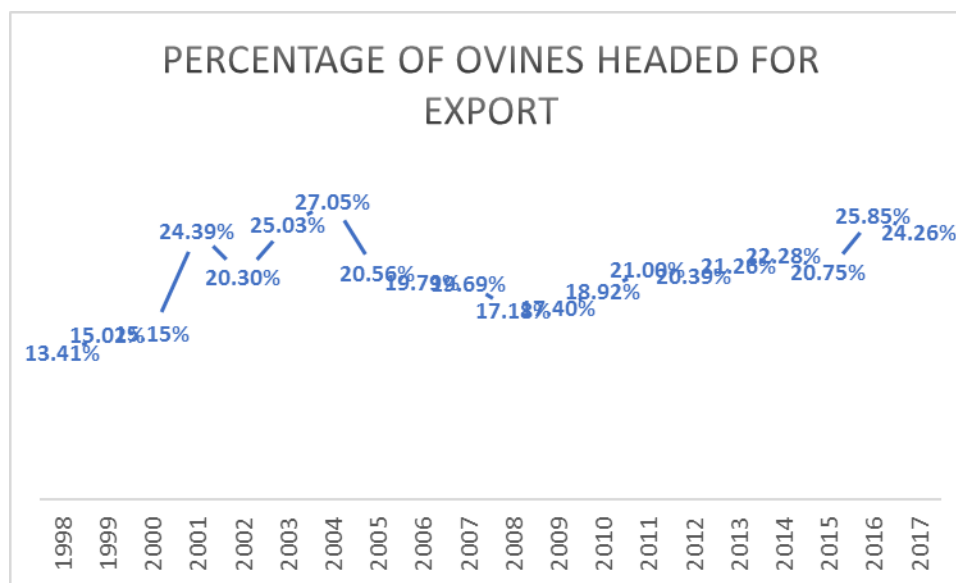


Figure 69. Percentage of exports out of total ovines livestock. Source: INS, FAO, Eurostat, graphics: author.

At present, as in recent years, domestic demand does not rise up to the livestock production. On the other hand, the trend of exports of live animals from Romania has been on an upward trend. In the case of sheep, both the exported percentage and the flock have increased since 2006, while in the case of cattle, the herd has been declining especially in the first years after 2006, while the trend of the exported percentage was generally upward.

For sheep, it is interesting to note that, according to Eurostat<sup>1</sup>, the total European sheep population dropped in the 14 reporting countries, with 11.4m animals between 2005 and 2014. The largest losses were in Spain (31% of the 7.1m heads), Portugal (30%), Ireland (22%), Germany (21%) and France (18%). The largest sheep meat producer, the UK, with 28% of the total EU, lost 3% of the herd. On the first place in the growth ranking, was Romania during the same period, with a 25% jump, followed by Greece with a plus of 4%. The dynamics of the sheep population is correlated with a higher demand for the export of live sheep.

Romanian exports of live animals have found their way abroad. In certain periods, the imposed sanctions have led to the blocking of exports for some destinations (Israel in March and June 2017), while other markets are opening up, such as Saudi Arabia, according to information from May 2018<sup>2</sup>. In the case of Saudi Arabia, the announced opening for live animals is not doubled by the domestic meat market: negotiations on this are ongoing.

The trend of live livestock exports in Romania has been upward since 1990 and strongly upward since 2000.

The reasons for these dynamics are varied, but they can be grouped as follows:

- Economic reasons: the price of live animals from Romania is attractive. There are comparative advantages of local production in terms of land price, labor cost and energy. (Yet the tendency is to get price increases in all these areas). Strong demand for meat and sheep products,

<sup>1</sup> [https://ec.europa.eu/eurostat/statistics-explained/index.php/Meat\\_production\\_statistics](https://ec.europa.eu/eurostat/statistics-explained/index.php/Meat_production_statistics)

<sup>2</sup> <https://www.gazetadeagricultura.info/stiri-agricole/20934-romania-intruneste-conditiile-pentru-exportul-de-bovine-si-ovine-in-regatul-arabiei-saudite.html>

especially in some Middle Eastern countries with markets where domestic production is deemed insufficient. Trade barriers, customs duties and administrative measures do not constitute an impediment in the main destination countries. In some countries, such as Turkey, customs duties may constitute a major barrier to the export of meat and meat products.

- Logistics: lack of developed cold chain logistics for transportation and storage at low temperatures, for chilled and frozen meat (see AFI 2016, p.2)
- Consumer preference: the local races, including tsurcana and karakul, are being sought after by consumers in the Persian Gulf<sup>3</sup>
- Cultural: the preference of slaughter close to consumption, for respecting cultural and religious customs
- Authorization and regulation: sanitary-veterinary or other types of authorizations may delay or block the entry of fresh, refrigerated or frozen meat products on the market, to the benefit of exports of live animals

#### *Information on the customs duty regime in several non-EU states*

In Jordan, the top destination for sheep exports, the customs duties are 0 for live animals. For EU countries the level is 0 for sheep meat as well. This is a preferential status of the EU Member States as compared to the average of the customs duty for the WTO Member States which receive MFN conditions (MFN – most favored nation) of 12.5% (minimum 5% and maximum 20%), in 2017 for sheep meat, boneless, fresh or refrigerated.

In Libya, an important destination of sheep exports, customs duties are 30% for sheep and cattle. For the meat of bovine or ovine animals that is fresh or refrigerated, customs duties are 5%, for frozen meat the level is 30%. The data is taken from the European Commission's Market Access Database (MADB).

For Israel, the first importer of cattle in the bulls, oxen and heifers of weight 160-300 kg category in 2017, and occasionally important importer of sheep (especially lambs), customs duties are 0 for imports of live cattle in general but also on meat products in 2017. The exceptions are the imports of calves for slaughter after exceeding a quota of 1200 tonnes, charged with 1.15 ILS / kg. For sheep, the fees are 0 for imports of pure-breed breeding animals but reach 6.22 ILS, at most 110%, for other sheep (Harmonized System Code HS 0104.10.90). For bovine meat, fresh or refrigerated, customs duties are 0 only for the first 1120 tonnes imported, reaching 12% + 6.5 ILS / kg after exceeding this quota. Frozen meat of bovine animals is subject 0 to customs duties. Sheep meat has 0 customs duties for the first 800 tonnes, above which the level is 7 ILS / kg but not more than 30%.

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<sup>3</sup> <http://agrointel.ro/96926/veste-ingrijoratoare-pentru-ciobani-arabii-incep-sa-si-faca-stane-in-romania/> and <https://www.stiriagricole.ro/export-de-1-000-de-miei-in-iordania-ce-pretentii-au-cumparatorii-de-ovine-din-orientul-mijlociu-41049.html>

Turkey, a cattle importer (in the top 3 in 2017 in the 160-300 kg category, bulls, oxen and heifers) and occasionally sheep (especially lambs), imposes 0% customs duties on the first 500 thousand imported bovine heads, and 26% on what exceeds this quota. By way of exception, pure-breed breeding animals of the bovine species and those of up to 80 kg benefit from 0 customs duties. The sheep for breeding also benefit from the exemption. The first 475 thousand heads of sheep have 0 customs duties, and 40% above this quota. Fresh or refrigerated bovine meat is exempt from duty for a quota of 75,000 tonnes, followed by a customs duty of 40%, in general, or 225% for boneless meat. Frozen meat of bovine animals is subject to a tax of between 20% and 225%, depending on the product range, the levels are between 20% and 40% for meat with bones and 225% for boneless. Sheep meat is subject to customs duties between 100% and 225%.

## **2. Methodology**

### **2.1 Data**

Specific databases were consulted, with Eurostat, the European Statistical Institute as an essential source. INS, the Romanian National Statistics Institute has been used for a variety of livestock data, commercial developments and others, and the USDA and FAO have provided supplementary and aggregated data – in case of FAO, heads numbers and the total value of ovine and bovine exports from the 1960s to 2016.

In order to get an understanding of the realities, trends and challenges in the study area, discussions were conducted with a variety of entities: associations and public institutions, meat producers and meat processing firms, traders of live animals or meat, livestock producers, yarn producers for the textile industry.

Key information on companies' balance sheets was used based on data published by the Ministry of Finance. When a selection was considered relevant, the sorting provided by ListaFirme.ro was used to select large players in different areas (cattle breeding, sheep breeding, mixed-activity farms, cutting and processing of meat) sorted by 2017 turnover.

In the data presentation, precision was maintained up to 2 decimal places. When appropriate, the 3rd decimal was rounded, e.g. 1.925 became 1.93.

### **2.2 Scope**

The study has been conducted in Romania. Its scope is regional and international, depending on the main destinations of trade. The focus is on the bovines and ovines sector.

### **2.3 Technical aspects**

Econometric techniques have been used in predicting trends for relevant variables. Linear regression was the basic tool for estimating trends for sheep and cattle, based on historical data.

In the economic impact section, the method used for evaluation started from a series of variables of some meat production and processing companies. The variables are: turnover, number of employees. The same data was also used at sector level. Salary data was obtained from the INS.

For each export reduction scenario (50%, 75% or 100%) the change in value of exports and in locally processed value was estimated. Information on available processing capacity was used, considering that, in our hypothesis, the meat processing and product fabrication facilities already built would be able to process the added demand, given an appropriate rise in the number of employees. Based on these

assumptions, calculations were made about the additional local processed value, that was then used to estimate the number of new employees needed.

To estimate the added processed value, we have used data on turnover and number of employees of large meat processing companies (CAEN 1011) and meat products (CAEN 1013). We have used average values over the past 5 years for the top 10 economic actors in each field. Concretely, if live animals are no longer exported, and thus are being processed locally, it is of interest how the need for additional staff can be quantitatively estimated. Thus, among the variables that were estimated in the process there are value multipliers for ovines and bovines. This coefficient describes the increase of the value of processed ovine or bovine meat from the live animal value, which gets reflected in the turnover. For estimation, FAO information on the percentage of carcass weight against live animal weight (60% for beef, 50% for lambs meat on average) was used, alongside live animals prices provided by INS and bovine and ovine meat from the Meat Market Observatory of the European Commission. For bovines, we used the average of bone and boneless meat. For ovines, most abundant data available, both live and meat, were for lambs, thus estimations were done starting from this category.

In order to evaluate the value added (VA) by processing meat and fabricating meat products, Eurostat data on value added at factor cost was used. As defined in the field of structural business statistics, value added at factor cost is the gross income from operating activities after adjusting for operating subsidies and indirect taxes. The data available was not detailed enough, so further calculations were needed to obtain specific meat processing VA data, using the aggregate VA data for the "production, processing, preserving of meat and meat products" and the "production, preserving of meat" as well as their share of VA in manufacturing total. The data available on the Eurostat site at the time of conducting the research is, however, for the years 2001 – 2008. We used average data over the years with complete and positive data (2008 lacks meat production and preserving data, and 2001 has an abnormal negative value for production, processing, preserving of meat and meat products), therefore we had to take the period 2002 – 2007 in our calculation. Thus, we calculated that the value added through meat processing is about 29.43%.

In the livestock trade and transport sector, the economic logic supports the idea of job losses. For merchants, the method we used was similar to that used in the meat processing and meat products sector: the effect on turnover (decreasing, in this case) was assessed in different scenarios. The variation in the number of employees is deemed proportional to the change in sales. Results were estimated using sales per employee, less a reserve coefficient (which was set at 15%) to account for a certain lack of elasticity of some staff to sales. In other words, in our estimation, about 1 in 7 employees would remain in place, even in the context of very broad changes in sales numbers, a similar assumption to that in the previous domains, such as meat processing. In the area of transportation, we studied the financial situation of the ANSVSA (sanitary and veterinary authority) registered companies for the naval and long-duration (applicable to international shipments) road transport of livestock. Since the number of companies in the shipping sector is limited, the financial data of all of these companies has been taken into account. The lack of detail on business segments presents, however, a challenge, as no shipping carrier is presented as having 100% live animal transport activity. We have used an assumption that  $\frac{3}{4}$  of the business volume is derived from live animal transport services. In addition, a 1.5x factor applied to the total number of naval operators' employees was used to account for the indirect effects of other employees, including crew members, loading / offloading, port facilities, and others.

In the road transport sector, the market is composed of farmers and producers with different CAEN codes, generally large and very large firms, which have their own transport divisions, traders with their own means of transport, and specialized transporters, organized into independent legal entities. We took into account, in our estimation, the data we considered relevant, starting from relatively large firms, with over 3.5 million RON of sales in 2017, that are specialized, with the respective CAEN codes showing transport services, authorized by ANSVSA. We also corroborated all the data with the information on their respective websites. A generic estimate, in the absence of precise data, was such that we considered that in the rest of the firms, small firms and those with other main objects of activity, besides road transport services, would account for about two-thirds of the total business of the sector of road transportation. At the same time, it is to be expected that a significant part of live animals' transport will be re-routed to the transport of meat and meat products. The level we used as a replacement rate is 35%, a level we consider, however, conservative, providing a margin of safety in the calculation.

In the econometrics processing, the data series have been tested for stationarity, using the ADF (Augmented Dickey Fuller) test, and where the series were shown to be non-stationary, log differences have been used (function `dlog` in EViews). These newly obtained series have been shown to be stationary. The data series have monthly or yearly frequency. To maintain economic relevance, the deflated series have been put to work. The deflated series have been generated using the INS (National Statistics Institute) CPI.

Monthly price and quantity (supplied to the local market for ovines and bovines) data series have been used to get the response coefficients of live animals prices to variations in the supply. When specifying the models for these elasticity coefficients, different models were tested, included ones that also take into account the offer (quantity) and price for pigs and poultry. The best models were selected according to econometric criteria, including adjusted *r*-square in case of regressions and information criteria for VAR models. When monthly series were used, given the strong seasonal effects, seasonal adjustments were implemented using the TRAMO/SEATS method also in use at the ECB. As a result of varied methods, 2 data sets for elasticity coefficients for both ovines and bovines were estimated. The series were deemed useful to construe two scenarios, related to the low sensitivity and the high sensitivity versions of live animals prices' response to a change in supply.

Based on the elasticity coefficients thus generated, the effects of a change in offer - resulting from a shift to the internal market of the animals that would no longer be sent abroad – were estimated. The trends in demand for both local and international markets in the relevant destinations have also been taken into consideration. Then, based on these hypotheses, we estimated the variation of the total sales values for farmers in the ovine and bovine sector.

The gross added value generated by the newly created jobs was a result of the estimated numbers and the mean gross value added per employee, according to Eurostat, in the sector of production, preservation and processing of meat and meat products.

One should keep in mind that the favorable / unfavorable impact of job creation / loss on the economy would generate further impact, including: the multiplier effect - the increase in revenue implies greater consumption of goods and services, which in turn develops other segments of the economy - together with additional taxes and fees paid to the State, which then can be made available for public investment, social or other expenses at the disposal of central or local authorities.





### 3. Current Conditions

In this section, we discuss other relevant aspects of the study, including significant aspects in areas such as farms, processing units, transport firms, insurance of livestock or the situation of certain categories of sheep or bovine secondary products.

#### Large sheep and cattle farmers

The analysis of the large sheep and cattle producers, legal entities, top 10 in each sector (sheep and cattle, selection by national activity type (CAEN) code and filtering of companies that chiefly perform other activities, such as Dutch Trading), generally reveals a trend of growth in turnover. For our assessment, it was interesting to calculate the net profit margin. Companies with high profitability are more resilient to fluctuations in prices and quantities delivered, can create reserves and invest more easily in development, while receiving better financing conditions.

To mitigate the influence of temporary factors, we have taken the average net profit margin over the past 3 years. The results are as follows:

For ovines:

- The highest net profit margin average in the last 3 years is 14.88% (interesting, this is also the first company in the top-of-the-line turnover in 2017, with a level of 63.46m RON)
- The lowest average net profit margin over the past 3 years is -1.1% (the last firm in the top 10 by turnover in 2017, with sales of 17.72m RON)
- The sectoral average profit margin thus calculated: 7.56%

The company ranked first by profit margin average is Rom Balkanellas Impex SRL. The profit margin reached 12.95% in 2017, 20.18% in 2016 and 11.53% in 2015. The firm's Administrator and sole associate (shareholder) is Sandor Komporaly, a Romanian citizen. The sole associate is present with 80% in the company K S D Impex as well, a firm with the declared object of business: retail trade in non-specialized stores and a turnover of RON 10.2m in 2016, the last year for which data is available. At the same address in Crizbav, Braşov as Rom Balkanellas Impex another firm operates as well: Romland Transilvania SRL, with shareholder Catalin Adrian Galan owning 100% of the shares. Rom Balkanellas Impex's email address suggests that this is the same person as Mr. Galan. The turnover of Romland Transilvania SRL, with activities in sheep and goat breeding, is RON 23.22m and the profit is RON 3.45m for 2017.

For bovines:

- The highest net profit margin average of the last 3 years is 12.36% (this being the 7th of the 10 companies sorted by turnover, having sales of RON 19.98m in 2017)
- The lowest value of the net profit margin average over the past 3 years is 0.83% (the penultimate firm by turnover in our selection, while the last company has a net profit margin average rate of 0.85%);
- The sectoral average of the profit margin thus calculated: 5.34%

The company ranked first by profit margin is Interglobal. In 2017, the profit margin was 11.07%, in 2016, 16.53%, and in 2015, 9.49%. The Administrator is Pacho Zocche, of Italian nationality, while the company's associate is the Italian legal entity Meditpart Holding SA.

## Processing units

The trend of turnover is ascending for large units in this sector, be it meat processing (CAEN 1011 - Processing and preserving of meat) or the production of meat products (CAEN 1013 - Manufacture of meat products (including poultry meat)). In our analysis, we tried to separate segments as much as possible: since some units in the meat products sector process both sheep and cattle meat and swine meat or sometimes even poultry, we checked the information available on the firms' own websites and in the press, and we have removed the units that do not include sheep or cattle meat at all. Generally, when we analyzed the big meat product manufacturers, we found that there is a mix of origins for the meat in the products. Given the poor granularity of data - the lack of precise information on segments of sheep and cattle products, distinct from other animals - we decided to use the financial data of these companies, considering that the approximation can be made, in other words the staffing need for processing and generating products of a certain value of sheep or cattle meat would not differ significantly from other types of meat. We consider relevant to make such notice, as well as to understand that this procedure, inevitable from our point of view, increases the margin of error of the results with a difficult value to quantify.

With regards to the slaughtering sector for sheep and cattle, the analysis pointed to a reduced capacity utilization. Estimated calculations generally confirmed press information<sup>4</sup> indicating a 35-40% capacity utilization for the largest companies in the industry. In some situations, however, the capacity utilization rate exceeded 50% (53% for Agro Ardeal and 54% for Maria Trading). Considering the available capacity, we believe that it is possible to absorb considerable additional quantities of sheep and cattle for processing. In order to satisfy the increasing demand of Middle East markets, information provided by a major association of farmers suggests that there is an important need to obtain halal and kosher certifications for more slaughter facilities. The turnover of the first 14 names in the meat processing and preserving sector was EUR 411.68m (Ministry of Finance via the Lista Firme (List of Companies), with EURRON at 4.5681 taken from the National Bank's website, average in 2018 as of September). The remaining unused capacity, according to the available data, would allow at least a doubling of the processed value, meaning that there is potential for absorbing the quantities that should be further processed and processed locally in various scenarios of diminishing the value of livestock exports. Aggregate figures, however, do not provide a sufficiently clear picture of the need to have slaughterhouses distributed in the territory - it is thus possible that in some regions the construction, authorization and commissioning of new slaughterhouses could be required.

An essential aspect to be given consideration is the labor force. Given the general shortage in the labor market, it may be estimated that staff increases could pose a challenge. An increase in wage pressures is likely, in our view, in the case of a considerable increase in the volumes of processed meat, in scenarios of significant decrease in livestock deliveries abroad.

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<sup>4</sup> <https://www.revistafermierului.ro/romania-agricola/zootehnie/item/3287-crestere-exploziva-a-exportului-alimentelor-romanesti-de-la-un-an-la-altul-am-solicitat-in-mod-repetat-sprijinul-ambasadei-romaniei-oficial-roman.html>

## Transportation

The transport of live animals is mainly done by road to EU countries, along with countries such as Bosnia - Herzegovina or Turkey, and by shipping to other destinations outside the EU, including Jordan and Israel. Data about transporters licensed to deliver livestock can be found on the ANSVSA website. Among the naval transporters registered with ANSVSA, with active authorizations, Eastern Shipping is ranked first, with sales of 20.55m RON in 2017, followed by Arados Shipping, with RON 7.19m and Lion Shipping with RON 4.17m in sales. Together, the three firms have 70 employees in 2017. Altogether, 8 firms are authorized by ANSVSA in 2018, with a total turnover of RON 37.32m in 2017. No company is presented as offering exclusively live animals transport services, and none of them directly refers to these operations on their own sites, so it can be assumed with a reasonable margin of confidence that only part of the turnover is achieved through the transport of live animals.

Long-term road transport includes the transport of various animal species. Starting from the information of the authorized ANSVSA companies, there are companies with a significant number of vehicles, which have as main object of activity processing and preserving the meat, by CAEN code (Doly Com Distribution, which, however, has an important share of distribution of goods in its activity, as shown even by its name, Industrializarea Cărnii Kosarom), trade in live animals (Maria Trading, Al Kastal Chartering, Hunland, CC Bovine, Primo Caesar, Gellaan), meat products (Aldis), wholesale of meat and meat products (Samcom As), sheep and goat breeding (Rom Balkanellas, Horatiu Bistrita Nasaud, Gagea Timis, Margineana Arad), raising cattle (Mimagi, ITL Agrocomplex, Agroluserna, Polzoo), auxiliary activities for livestock production (United for Food & Livestock, Al Nawres ), cultivation of cereals and plants (Holder Trade Tulcea) or activities in mixed farms (Tolil Company, Mahmud Impex, Bejo Chans Arad). Some companies are associated with producers and processors, such as Karpaten Meat Siebenburgen (from the Karpaten Meat group, object of activity: raising other types of cattle). Among the companies that deal mainly with transport are: Ovinex Gligor, sales of RON 14.26m in 2017, Banat Ovinex with business of RON 12.86m in 2017, Brutaru Dambovita, business of RON 7.88m in 2017, Interexpres with business RON 7.22m, Dobrota Trans, business to the tune of RON 7.16m in the same year.

There are specific regulations for the transport of live animals: animals must be fed, have feed and water available, adapted drinking beans, along with other equipment. Specialized trucks are used in road transport and ships have a special, fencing-type structure on deck or inside ships. Before the journey, animals must be checked for veterinary and health reasons. The carrier must only accept identified animals with the necessary documents and check the correspondence between the documents and the loaded animal when boarding. The route must include stopping points for rest and feeding - minimum watering and feeding intervals, and maximum travel times are regulated. Cattle cannot be transported with other animals, and, for safety reasons, bulls, cows and young animals are kept separate. For sheep, the recommendation is to perform the transportation at moderate temperatures, those too low or too high being harmful to the animals.

## Insurance

A CMR policy, carrier liability for cargo transported as carrier is commonly used by freight transport companies. The CMR insurance policy does not, however, cover the transport of live animals. Livestock transport policies follow a set of specific rules.

The logistics company Asstra AG, founded in Zurich in 1993, but with operations in Central and Eastern Europe and relatively recently in Romania, offers, with the help of partners, services of transport of sheep and cattle, by road and by sea. The firm has concluded an insurance product with Zurich Insurance Switzerland, worth EUR 3m per insured event. Further details on the nature, volume, contract participants for livestock transport insurance are difficult or not accessible at all, as the segment transparency is very low.

With regard to livestock insurance, the total subscribed premiums were between 1 and 10m dollars in 2015, according to a report by Swiss Re, which ranks Romania in the class of countries with the lowest total premiums, among those for which it has made estimates.

Livestock insurance premium worldwide, 2015

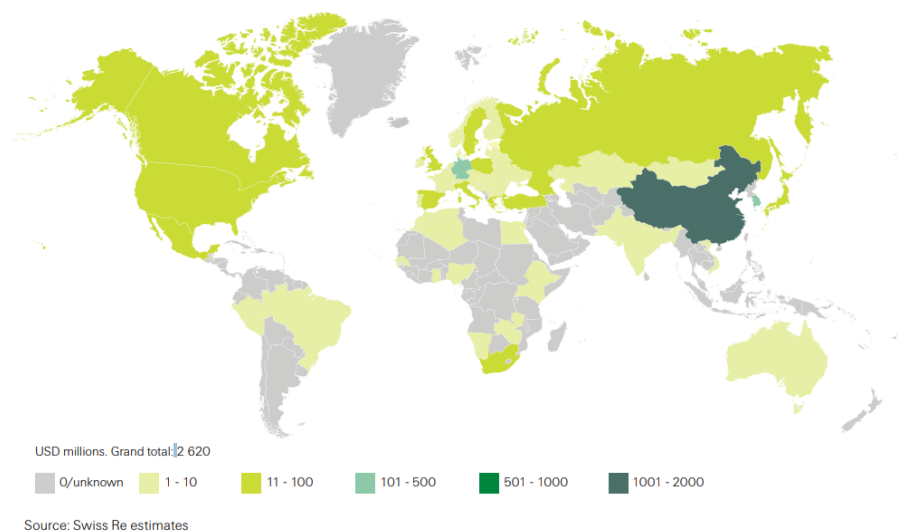


Figure 70. Insurance premiums for livestock, globally, estimated for 2015, Swiss Re. Source: Closing the insurance gap for livestock, Swiss Re, 2017.

## **Edible by-products (subproducts)**

As a result of slaughtering, besides the carcass, a variety of edible by-products also known as slaughter subproducts are produced. These include internal organs: liver, tongue, heart, kidneys, brain, spinal cord, lamb intestines. The liver contains glycogen, which has energy storage and detoxification function. The bovine heart contains significant amounts of calcium. Several organs contain valuable vitamins (A, B, D) and mineral substances (potassium, iron). The glands are used in the pharmaceutical industry.

Another by-product is blood. It is used in some traditional foods in Europe or Asia, or it may be used to obtain other substances. Some proteins in the blood have emulsifying and jellifying properties that allow for use in the food and supplements industry. They can enrich protein products, they can be used as color adjuvants or as a binder of meat<sup>5</sup>. Derivatives are used in the pharmaceutical industry. When used in the food industry, delivery is made on the day of collection for use on the same day.

It is especially important for animals to be healthy, otherwise the risk of transmission of diseases is high.

Following the evaluation of the offer presented on the slaughterhouse sites, it is noticed that among the organs on the offer generally it may be found such cattle by-products: liver, heart, kidney, brain, sting, testicles, belly, tubular bones, tallow. The availability of organs / by-products of sheep is significantly lower: some producers, including Agro Invest, Agro Ardeal, although slaughtering both sheep and cattle, have only bovine organs on the presentation site. The largest slaughterhouse of sheep and cattle, managed by Maria Trading, does not offer bovine or ovine organs on the firm's site.

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<sup>5</sup> <http://www.meat-milk.ro/valorificarea-superioara-a-sangelui-animalelor-abatorizate/>

## **Other by-products: bovine and sheep hides**

The first 3 companies in the field of tanning and finishing of hides; fur production and dyeing (CAEN 1511) have turnover of respectively 46.69, 16.83 and 13.36m RON in 2017, and 24, 34 and 40 employees respectively. Increasing the number of employees for the 2<sup>nd</sup> and 3<sup>rd</sup> place in this ranking could suggest a profile of partial outsourcing or a variety of business segments for the first 1 or 2 firm(s) in this sector. Part of the turnover is also made with imported skins. The processed leather is used in products such as: footwear, leather goods, protective and military footwear, equitation, upholstery. The leather processing process includes intensive chemical steps, resulting in wastewater that needs to be treated to limit the impact on the environment.

Exports of bovine hides go mainly to EU countries. Deliveries outside the EU on the groups discussed below are small, below € 0.1m, exceeding this value only occasionally, marginally and without consistency. In the category of sheep and cattle skins delivered to the EU, we observe several product groups with relevant volumes:

- Bovine hides over 16 kg, wet salted, value of EUR 13,37m in 2017, of which EUR 12,65m to Italy
- Bovine hides under 16 kg wet salted EUR 4.3m in 2017, the entire value being delivered to Italy
- Sheep or lamb skin additionally prepared after tanning or crusting: EUR 2.76m intra-EU, the peak of the period 2003-2017 is EUR 4.72m in 2015. The main destination is Italy over the entire period. In 2017, exports to Italy amount to EUR 2.03m.
- chamois leather (in fact, often sheepskin): EUR 2.22m to EU countries in 2017. The peak of the period 2003-2017 was EUR 3.2m in 2010
- varnished and metallized leather: downward trend after 2011 (the year in which the value of exports to the EU was EUR 3.65m), in 2017 the value reaches EUR 0.49m
- saddles and harnesses for any animal: the volume delivered to the EU reaches EUR 2.48m in 2017. Between 2003 and 2017 the value fluctuates between EUR 1.64 and EUR 2.96m. The main destination is Germany, with EUR 1.8m in 2017.

## **Other by-products: Wool**

In 2017, imports of wool and horsehair from EU countries (this category is dominated by wool, horse hair is negligible) totaled EUR 299.3m<sup>6</sup>. Important sources were Italy with EUR 171.9m, Germany with EUR 69.7m, Czech Republic with EUR 23.5m, Portugal with EUR 7.1m, United Kingdom, value of EUR 6.1m. Exports to the EU amounted to EUR 125.3m, mainly to Italy with a value of EUR 61.7m, Germany EUR 55.3m, and the UK EUR 1.6m. There is a trade deficit of EUR 174m in this category.

Why is Romania, a country with the third sheep population in the EU, an importer of wool? The answer seems to be: the challenge to adapt to market requirements in terms of quality. From discussions with wool processors while preparing this study, in order to get a quality thread, some aspects are very important. Maintaining the genetic purity of the breed, including the supervision of sheep flocks and the potential intrusion of non-pure rams, is one of them. Another aspect is food. A third aspect relates to the time spent outside the shelters, depending on the outside temperature. Under such conditions, locally made wool often gets not only matted or entangled and with plenty of impurities (issues that solvable to a point by pre-processing in specific machines) but rather an insufficient quality for fabrics that could become garments or blankets of a certain fineness by further processing.

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<sup>6</sup> [https://ccir.ro/wp-content/uploads/2018/04/State-Mediului-Economic\\_2017.pdf](https://ccir.ro/wp-content/uploads/2018/04/State-Mediului-Economic_2017.pdf)



#### **4. Effects of partial replacement of livestock exports with meat exports. Scenarios**

This section of the study aims to assess the impact of reductions in livestock deliveries, both to the EU and outside the EU, on the Romanian economy. During the evaluation procedure, we considered the following theoretical scenarios:

##### **Scenario 1, Base (moderate)**

International deliveries of live sheep and cattle are reduced by 50% in 5 years from the time of the assessment, starting in 2019. In 2024 the volume of sheep and cattle exported from Romania reaches 50% of the value of 2017.

##### **Scenario 2, Accelerated (pronounced)**

International deliveries of live sheep and cattle are reduced by 75% within 3 years of the assessment, with 2019 as the start year. In 2022 the volume of sheep and cattle exported from Romania reaches 25% of the value of 2017.

##### **Scenario 3, Total Cessation (Aggressive)**

International deliveries of live sheep and cattle are reduced by 100% within 3 years of the assessment. In 2022 the volume of sheep and cattle exported from Romania reaches 0.

The primary variable estimated is the number of new employees that would need to be hired (new jobs created) in order to process locally the meat that would be exported refrigerated or frozen, whether turned to meat products or not, instead of live animals, or redirected to local consumption.

## 4.1 Scenario 1

Livestock exports of live sheep and cattle are reduced by 50% over 5 years starting in 2019 (first full year after evaluation time). In 2024, the volume of sheep and cattle exported from Romania reaches 50% of the 2017 value. The pace of adjustment is a year-on-year compounded decrease of about 13% in exports, for example, in 2020, the figure would be 13% below 2019, while in 2021 the level would be 13% below that of 2020.

### Value of exports

In 2017 the value of sheep exports was 174.86m EUR. The export value of cattle was EUR 207.89m. A reduction in export value of 50% over 5 years with 2017 as the base or referential year involves a bovine export value of EUR 103.945m and EUR 87.43m for sheep in 2024.

Such a static calculation takes into account the level of 2017, but not any general trends in export value. Given the assumption that natural evolution would be one of growth, the values calculated in the static version mean an even more severe braking of exports than the baseline static scenario which would be no change from 2017 onwards.

The assumption of the scenario is that those animals that are not exported will be slaughtered locally.

Another assumption is that local capacity could absorb the need for animal processing into meat and the production of meat products. In order to reach half the value of 2017 exports in 5 years, the annual redirection of about 13% of previous year's exports to the domestic market seems manageable, as a pace to which major actors can adapt over time.

### *Sales and sales per employee average in the relevant sectors*

Data on the largest firms in the field of meat production and preservation, but also on fabrication of meat products were collected and processed. A special situation: Maria Trading SRL. The slaughterhouse is the biggest in the country for sheep, but the company also records other activities, including the retail of live animals, which appears as the main activity. For this reason, we decided not to include the data of the company in this section of the study.

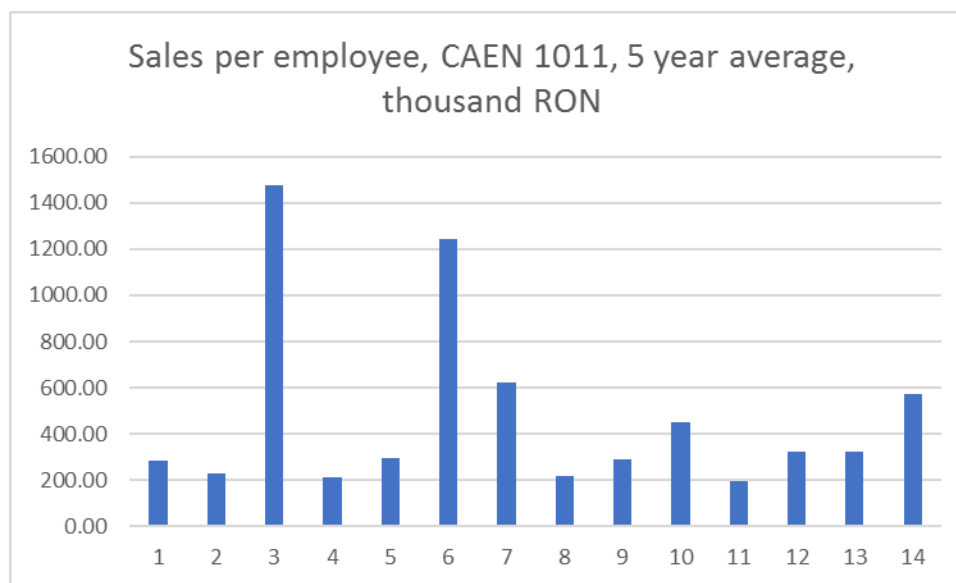


Figure 71. Sales per employee, average over last 5 years (to 2017) for the biggest 14 meat production and preservation firms. Source: Finance Ministry, ListaFirme, graphics: author.

Two companies show unusually high turnover figures per employee, a possible sign of a mix of activities, some with a reduced need for labor coupled with large sales numbers. A situation of this kind is observed in the traders' sector, where the turnover per employee frequently exceeds RON 2m. Most companies in the meat processing and preserving sector have a turnover of less than RON 0.5m (500 thousand) per employee.

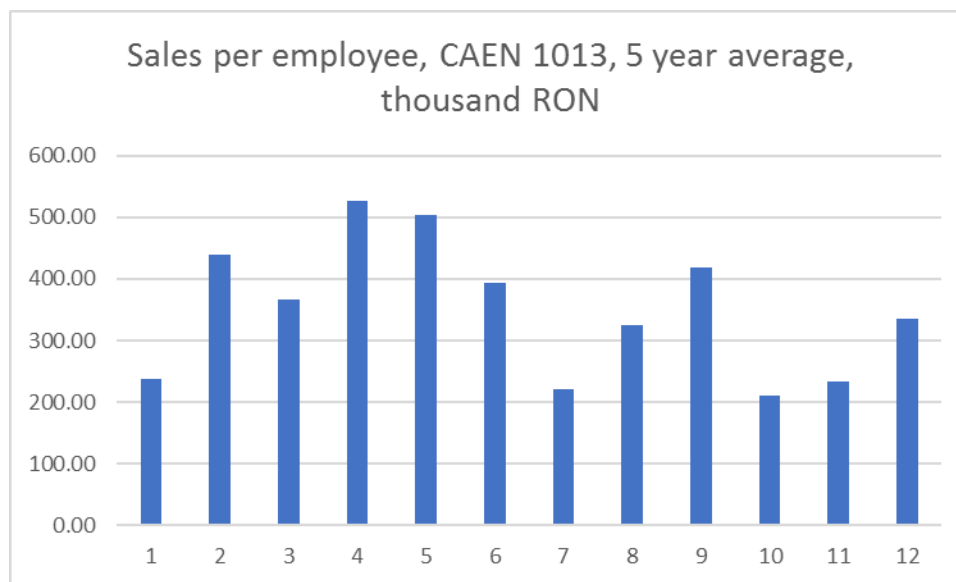


Figure 72. Sales per employee, average over last 5 years (to 2017) for the biggest 12 fabrication of meat products firms. Source: Finance Ministry, ListaFirme, graphics: author.

The distribution provides a more balanced perspective, without the outliers of the previous sector. While processing data, for the company in the 9<sup>th</sup> position, the figures for the last 3 years (2015 – 2017) were used, since bovine products were included only from 2015.

Average turnover per employee, using data from the previous 5 years (2013-2017 period) where available and relevant:

- meat production and preservation: RON 481.49 thousand
- fabrication of meat products: RON 351.12 thousand

### *Variables in use*

To get values in EUR from RON and back, we used the NBR (National Bank) average rate for 2018, published on the website in early September, which has been obtained by averaging monthly rates. The rate used is: EUR/RON 4.5681.

The following coefficients were used in estimating the turnover generated in the meat production, preservation and fabrication of meat products, from sheep and cattle:

- ovine value multiplier: 1.39 - the change in value from live to processed kg, for ovines
- bovine value multiplier: 1.48 - the change in value from live to processed kg, for bovines
- meat production, preservation coefficient: 0.8 – weight estimation of fresh, refrigerated or frozen meat, out of total usable from the animal
- meat products coefficient: 0.2 – weight estimation of meat products, out of total usable for the animal
- added value coefficient for meat products: 0.42 – estimated based on value-added calculations in total production for the processing sector, based on available Eurostat data
- reserve coefficient: 0.15 - an increase in turnover can also be done through productivity gains, using the same number of employees; also, some employees may be in positions relatively inelastic relative to the growth in business volumes (leadership, back office, accounting)

### *Results*

Following the application of the evaluation model, based on the data and variables presented above, the results show an increase in the number of jobs in the meat production and preservation and fabrication of meat products industry, as follows:

- job growth in meat production and preservation: 1777
- job growth in meat products fabrication: 865

On the other hand, it is estimated that there would be a loss of jobs for traders and transporters of livestock. For merchants, an estimate of the turnover per employee was made, taking into account in the assessment of impact the 15% reserve coefficient for staff that would not be affected, being relatively inelastic in relation to the change in turnover volume. Data of the companies registered with the sanitary-veterinary authority, ANSVSA, were analyzed to make estimations in the transport area. For the shipping sector, all companies were considered, but since companies are not described in their own presentation documents and websites as having the sole activity of transport, some assumptions have been made: 75% of the activity, and implicitly number of employees, was considered to be related to livestock transport, plus a factor of 1.5 against the number of operators employed to capture indirect effects: crews, loading / unloading, port facilities and more.

For the firms in road transportation, some assumptions were needed in view of the structure of the market: in addition to the firms specializing in livestock transportation, a wide range of traders and farms or producers with trade divisions also have their own carrier divisions and means of transport, although they may not be set up as separate legal entities. It is true that part of the effect was captured in the calculation of job cuts in livestock traders. On the other hand, besides the specialized companies for which data were collected - relatively large companies with a turnover exceeding 3.5m RON in 2017, authorized by ANSVSA for long-term road transport, and with corresponding CAEN main activity, with the added layer of verification of the information available on their own websites - the activity of small firms and the activity of transport by the divisions integrated in farmers' firms and production or processing companies was taken into account by using a multiplication factor of 2 applied to the number of employees in the specialized firms. In the estimations, a replacement rate of 35% was assumed, meaning relocation of employees to fresh, refrigerated or frozen meat transport operations.

Thus, it has been estimated:

- a drop in jobs numbers for carriers: 143
- a drop in jobs numbers for livestock merchants: 157

Assuming that a large part of the live animals that are no longer exported is locally processed and the products obtained are exported, the drop in jobs in the livestock transporters sector will be partly offset by the increase in the jobs of the transporters of refrigerated and frozen products. A similar phenomenon would occur among traders where, according to our opinion, the re-assigning rate could be even higher than among transporters.

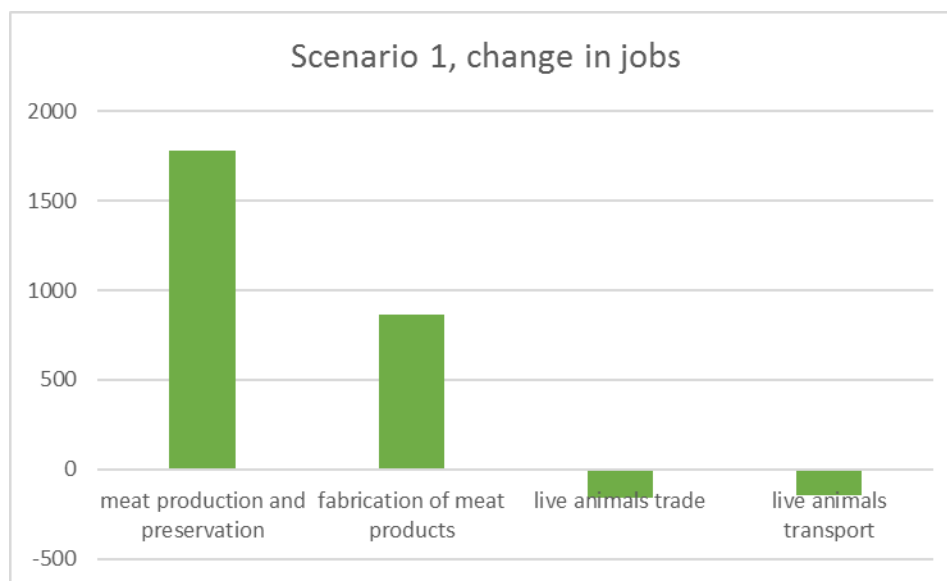


Figure 73. Changes in jobs numbers by sector in Scenario 1, ovine and bovine livestock exports cut by 50%.  
Source: author estimates

## 4.2 Scenario 2

Livestock exports of live sheep and cattle are reduced by 75% over 3 years starting in 2019 (first full year after evaluation time). In 2022, the volume of sheep and cattle exported from Romania reaches 25% of the value from 2017. The pace of adjustment is a year-on-year compounded decrease of about 37% in exports, e.g., in 2021, the figure would be about 37% below 2020.

### *Exports value*

In 2017 the value of sheep exports was 174.86m EUR. The export value of cattle was EUR 207.89m. A reduction in export value of 75% over 3 years with 2017 as the base or referential year involves a bovine and ovine export value of EUR 51.97m and EUR 43.71 m respectively, in 2022.

Again, it is worth noting that such a static calculation takes into account the level of 2017, but not any general trends in export value. Given the assumption that natural evolution would be one of growth, the values calculated in the static version mean an even more severe braking of exports than the baseline static scenario which would be no change from 2017 onwards.

The assumption of the scenario is that those animals that are not exported will be slaughtered locally.

Another assumption is that local capacity could absorb the need for animal processing into meat and the production of meat products. In order to reach half the value of 2017 exports, in 3 years, the annual redirection of about 37% of previous year's exports to the domestic market might be a serious challenge. In real terms, there could be issues with recruitment and training of the work force, together with some logistical challenges. For large firms in meat production, preservation and processing, with ample financial resources even more so after a series of profitable years, in a favorable economic period, the challenges can be overcome.

### *Sales and sales per employee average in the relevant sectors*

The relevant variables, coefficients and sales data are similar to Scenario 1, apart from exports value data.

### *Results*

The previous remarks that have been discussed on the first scenario remain valid. Following the application of the evaluation model, based on the data and variables previously discussed, the results show an even larger increase in the number of jobs in the meat production and preservation and fabrication of meat products industry:

- job growth in meat production and preservation: 2665
- job growth in meat products fabrication: 1297

The losses of jobs for carriers and merchants of livestock have been estimated to be:

- drop in jobs numbers for carriers: 215

- drop in jobs numbers for livestock merchants: 235

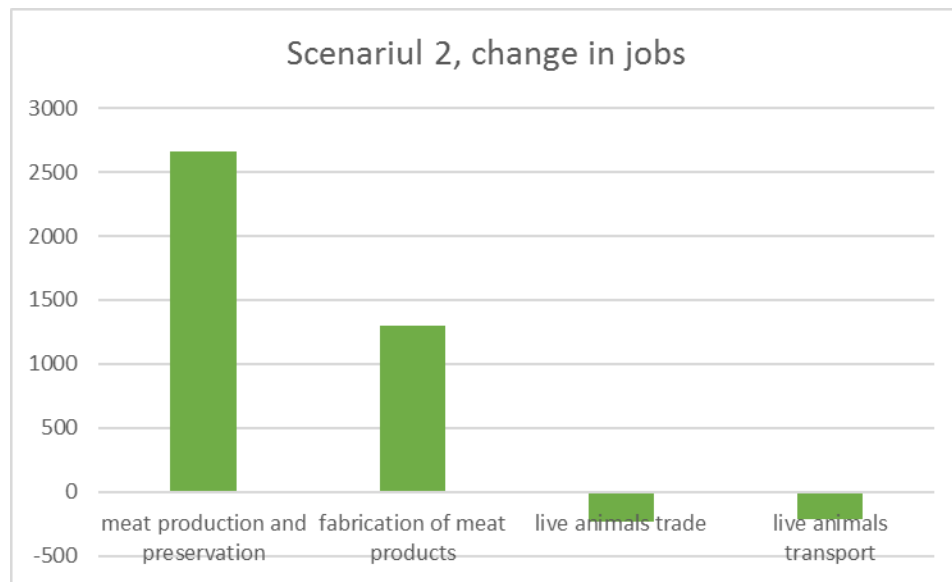


Figure 74. Changes in jobs numbers by sector in Scenario 2, ovine and bovine livestock exports cut by 75%.  
Source: author estimates

### 4.3 Scenario 3

In this scenario, exports of live ovines and bovines are cut by 100% over 3 years starting in 2019 (first full year after evaluation time). In 2022, the volume of sheep and cattle exported from Romania reaches 0. The pace of adjustment is a decrease of about 33% of the 2017 exports, each year.

#### *Exports value*

In 2017 the value of sheep exports was 174.86m EUR. The export value of cattle was EUR 207.89m. In 2022, in this hypothesis, live ovines or bovines' exports stop.

Naturally, as in the previous scenarios, the calculation does not take into account the possible dynamic of growth in export value, that would continue the recent trend. When compared to an inertial dynamic scenario, which would include a continuation of the growth trend, the complete halt of international deliveries in 2022 means an even more abrupt brake than in the conservative scenario of maintaining in the following years the levels of the 2017 reference year.

The assumption of the scenario is that those animals that are not exported will be slaughtered locally.

Another assumption is that local capacity could absorb the need for animal processing into meat and the production of meat products. In fact, although available information and our own estimations show available capacity around 50 to 60%, it is possible that, in some regions, the construction of meat production or processing facilities could be needed. Local or regional logistics facilities could also be needed. There is a number of firms in meat production, preservation and processing fields that control ample financial resources that can be used for investment, even more so after a series of profitable years, in a favorable economic period. Additionally, smaller farms are allowed to create integrated slaughter centers<sup>7</sup>.

#### *Sales and sales per employee average in the relevant sectors*

The relevant variables, coefficients and sales data are similar to Scenario 1, apart from exports values which are now set to 0.

#### *Results*

With the evaluation model, based on previously discussed data and variables, results show a significantly larger increase of jobs in than in previous scenarios, in the meat production and preservation and fabrication of meat products industry:

- job growth in meat production and preservation: 4180
- job growth in meat products fabrication: 1730

The losses of jobs for carriers and merchants of livestock have been estimated to be:

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<sup>7</sup> <https://www.gazetadeagricultura.info/animale/19621-micii-crescatori-de-animale-isi-pot-infiinta-centre-de-sacrificare-puncte-de-taiere-integrate-in-ferma.html>



- drop in jobs numbers for carriers: 286
- drop in jobs numbers for livestock merchants: 313

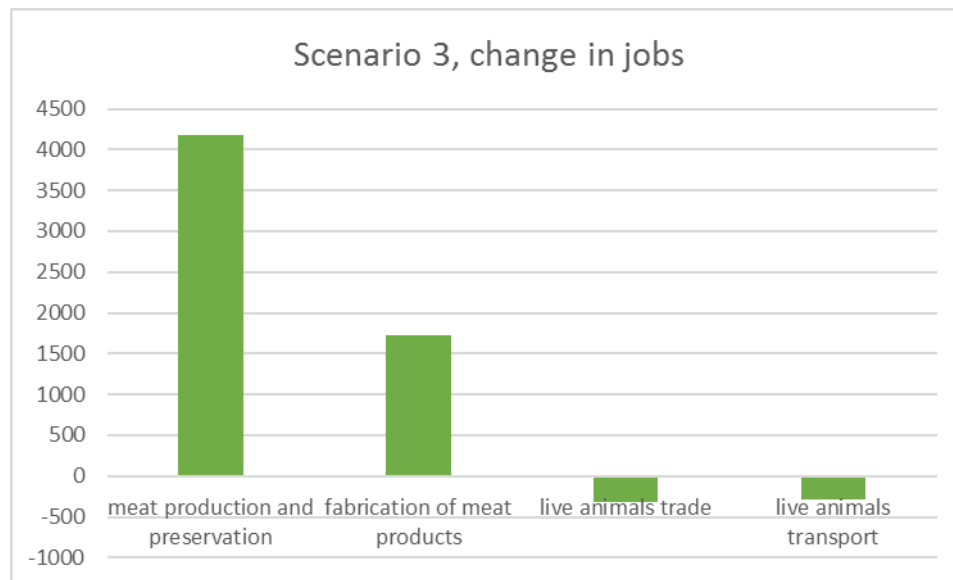


Figure 75. Changes in jobs numbers by sector in Scenario 3, ovine and bovine livestock exports cut by 100%.  
Source: author estimates

#### 4.4 Scenario Comparison

By comparing the three scenarios it becomes obvious that there is a significant increase in the number of jobs generated in the meat processing and fabrication of meat products sectors: in the 3rd scenario, the total number of jobs created in these sectors, 5910, is 49.17% higher than in the 2<sup>nd</sup> one and 123.69% above the first one. However, the number of jobs lost in transport and commerce also increases, but from a lower base. In scenario 3, a total of 599 jobs are lost, 33.11% above scenario 2 and 99.67% above scenario 1. Given the lower absolute values in sectors where jobs are lost, the net effect is generating stronger jobs as we move from moderate to more aggressive livestock exports reductions.

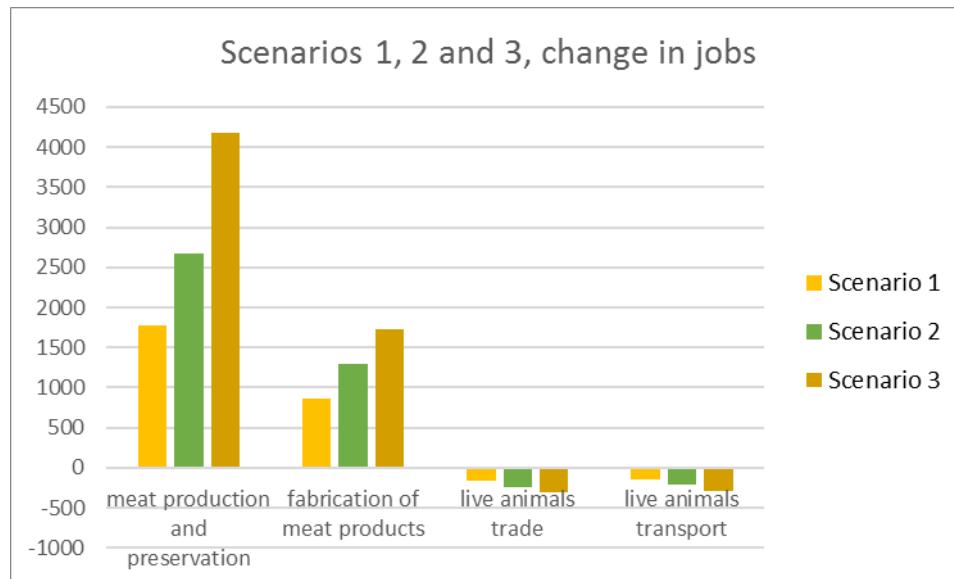


Figure 76. Changes in jobs numbers by sector in the three scenarios of cutting livestock exports of ovines and bovines by 50%, 75% and 100% respectively. Source: author estimates

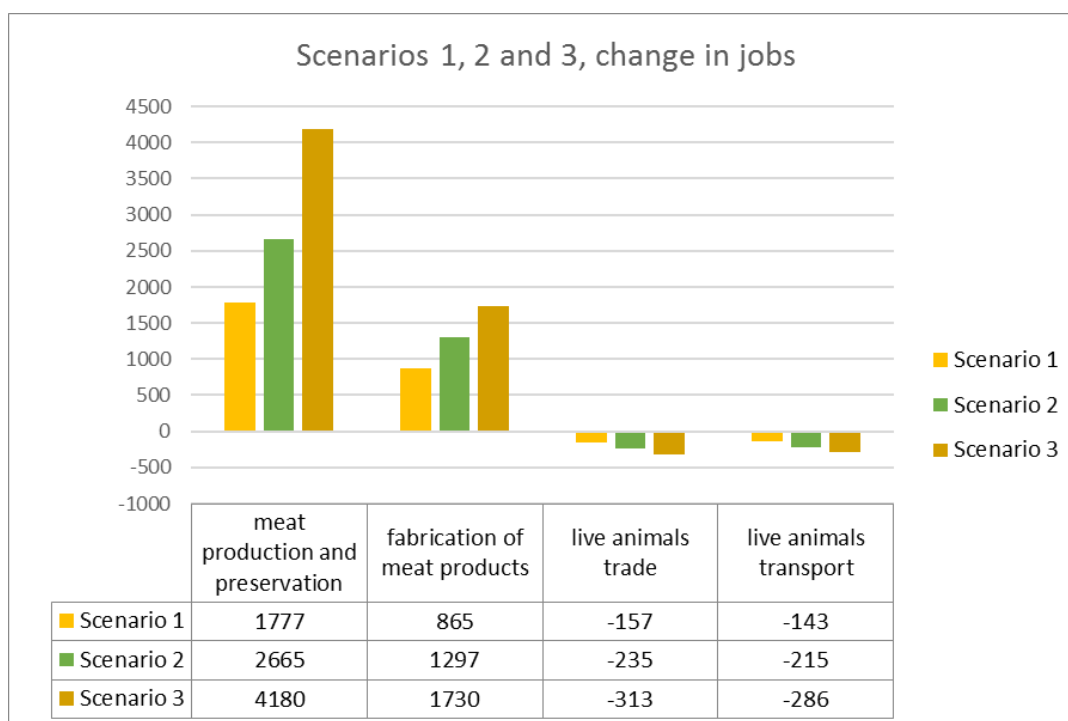


Figure 77. Changes in jobs numbers by sector in the three scenarios of cutting livestock exports of ovines and bovines by 50%, 75% and 100% respectively, with quantitative information. Source: author estimates

Net effect on jobs created in scenario 1, meaning all the jobs created minus all the jobs destroyed under the assumptions of scenario 1: 2342. For scenario 2, net jobs created: 3512. For scenario 3, number of net jobs created is: 5311.

Starting from the number of new jobs created, in each scenario, it is possible to estimate the gross value added (GVA) to the economy, by using the average GVA between 2008 and 2016 per employee, for the production, preserving and processing of meat and meat products sector. According to calculations based on Eurostat data, the average GVA in the aforementioned period is 8.71 thousand EUR per employee. Thus, in the first scenario we would get a gross value added of EUR 13.35 million, in the second scenario the value increases to EUR 20.02 million while in the third scenario the GVA reaches EUR 46.26 million. These are annual values, therefore over 10 years in the hypothesis of ending livestock exports of ovines and bovines, the GVA reaches an estimated EUR 462.6m (or EUR 0.46 billion).

## **5. Impact of livestock exports reduction on local farmers. Scenarios**

Local farmers producing livestock could be affected by slowing or the cessation of export activities. Depending on the size of the unit and the diversity of its destinations, temporary and unanticipated events such as closing of the Israel market for exports of sheep and cattle (twice in 2017) may have some notable effects among some producers.

Thus, within the major producers with a profit margin of 5.34% for cattle and 7.56% for sheep on average in the last 3 years, the ability to absorb shocks is present but limited.

A reduction in the business of livestock producers, through volume or price decrease leading to a lower value of production, would adversely affect the activity of a large number of producers. A portion of the top 10 sheep or cattle producers have livestock transport and export divisions, while for some of them the merchant and export business segment is important as a proportion of total business. The negative effects would be felt more strongly on the large non-integrated producers, with a focus on exports, the large producers with international transport and trade divisions, and some of the smaller farmers who sell their animals to distributors who then redirect them towards international destinations.

If the activity of some producers is reduced, effects will also be observed in other sectors: feed producers, manufacturers and distributors of veterinary medicines, veterinarians, apart from the indirect effects in the rest of economy.

Strategies to mitigate these negative effects could be based on supporting the shift towards meat and meat products exports through negotiations, in order to reduce administrative, sanitary and veterinary barriers in a number of current key destinations. There could also be helpful to search for and actively support the opening of new destinations. This would increase the rate of replacement of the external demand for live animals with the domestic demand for live animals for processing and processing, with the meat and products being then sent abroad. Given that domestic demand cannot fully absorb the value of such meat and processed products, the percentage increase in exports of fresh, refrigerated or frozen meat becomes the essential variable when estimating the final impact on producers.

In 2017, the value of ovine exports was EUR 174.86m, and EUR 207.89m for bovines. In the context of cessation of the export of live animals over a three-year horizon, with prior announcement in order to give the main economic actors time for adjustment, we define the following scenarios:

Scenario A: The response of the prices of live animals, sheep and cattle is of high sensitivity to the changes in supply (high price elasticity in relation to supply).

Scenario B: The response of livestock, sheep and cattle prices is of low sensitivity to the changes in supply (low price elasticity in relation to supply).

In view of the high growth rate of meat exports (in 2017, a jump of 47.1% compared to 2016, versus a 14.2% increase in live animal exports the same year, and a steady increase in the share of meat in total exports - meat and live animals) and good dissemination of information to and anticipation of trends by producers and processors, a scenario with the estimated values - including increases for domestic and international demand seems achievable. To get an increase above that that has been estimated for the domestic and foreign meat market would require an effort to open new markets and better serve

current ones, aggregate and well-defined marketing and promotion strategies. In the absence of these, the set of targets would appear to be relatively optimistic. It is not impossible, in our view, that the scenarios for the dynamics of meat demand are reached or even exceeded, if macroeconomic conditions remain favorable, and most of the recommendations of the current study are put into practice. A few sets of actions that could limit the negative effects of the slowing or cessation of international livestock deliveries are:

- clear notifications well in advance of the proposed slowing or cessation implementation date, to allow the farmers to prepare long-term plans
- putting in motion coherent strategies to create a sector and country brand in order to open new markets and develop the local one, with the help of close attention paid to consumer preferences
- providing support to small producers to associate in order to gain bargaining power in relation to meat producers and processors

The net impact on farmers would thus be reduced, and the effect on profitability would thus be limited.

In light of the discussions held with an Angus cattle producer, which also has a direct to customers sales division for cut pieces, the growth potential for certain breeds of cattle is massive. A discussion held in September 2018 with a representative of Karpaten Meat revealed an increase above 100% a year in domestic demand for the Angus beef segment. Although such high rates are unlikely to be sustainable long-term, a rapid development of the internal market would be possible, especially in those segments where a latent demand is identified, which can be addressed through promotion and direct offer (online orders) or through the large retailer networks or through restaurants. Such a hypothesis could lead to, under certain conditions that are related to both consumer preferences and macroeconomic developments (especially net disposable income and purchasing power), a significant increase in the share of reallocation to the internal market. This would generate a significant reduction in the losses of livestock producers, or possibly even their elimination.

Local farmers raising sheep or cattle may be impacted by the slowing down or cessation of export activities, depending on the size of the production unit, its segments (if they have a mix of income sources, or depend mainly on the sale of live animals) and the diversity of their destinations. Large producers appear to be more vulnerable to a hypothetical cessation of exports than small farmers, especially in the ovines area. Negative effects would be asymmetrically felt: to a greater extent by large, non-integrated, export-oriented producers, and large producers with international transport and trade divisions, and to a lesser extent by some smaller farmers selling their livestock to distributors who then send the animals to international destinations.

## Scenario A

The ways in which the price of sheep and cattle would respond to an increase in supply were estimated, using econometric techniques. A growing supply of live animals naturally leads to a fall in price. Coefficients were estimated at -0.8 for cattle and -0.889 for sheep for the high elasticity scenarios, meaning a stronger response of livestock prices to an increase in supply. Thus, using these coefficients and information on the additional supply of live animals that would no longer be exported, the impact on livestock farmers' incomes was obtained. In order to get the values that would be added to the supply of the live animal market in 2021, we estimated the trends for the domestic and export markets for sheep and cattle. Thus, starting with data from the 2010-2017 period, the value of exports of ovine and bovine meat was estimated: compared to 2017, an increase of 14.5% for bovine meat and 42.4% for ovine meat would be recorded in 2021. In terms of the domestic market, the average of the estimated growth rates for meat and meat products for ovines was 13.8%. For bovine meat and products the BMI Market Research growth rate estimate was used, leading to an increase in demand in 2021 of about 32.1% from 2017. The year of reference for local livestock output is 2017, and it was used as the basis for the 2021 calculations in a static version, without making an estimate of the volatility in livestock production. The years 2015-2017 showed relatively stable levels for local ovines and bovines heads (see charts in the introduction chapter), which supports the static hypothesis in ovine and bovine populations. In view of the size of the internal market and the high growth rate of both domestic and foreign demand, given that the size of livestock is assumed to be constant, it is no longer surprising that the market would, in fact, absorb even more of the supply for bovines than it currently does, pushing up the respective prices. However, the ovine market is in a different position: with a much higher ratio of exported to locally processed animals (nearly 2.5 times that seen in bovines, see section 1.4, figures 88 and 89) and with a relatively low share of domestic consumption, even if a significant increase in demand is expected, the additional supply is still expected to produce a significant impact on the market.

- Ovines: price impact: -22.4%. In terms of producers' sales value (and not in terms of profit), that would mean a drop of aggregated sales value of live ovine animals of EUR 71.04m.
- Bovines: price impact: 2.41%. In terms of producers' sales value (and not in terms of profit), that would in fact lead to an increase of EUR 3.83m. The result may appear to be inconsistent with the economic logic, yet it is not: based on the strong growth in demand anticipated, the local and international market demand for bovines in 2021 would not only absorb the entire 2017 equivalent export supply but need even more supply to reach balance. This would lead to upward price pressure, albeit marginally, of between 2 to 3%. The result suggests that, in any case, if a shift in exports to the local market does not take place, a significant growth in local production of bovines would be necessary. Absent such supply growth, either an even larger price rise for bovine meat and meat products or significantly higher imports of such meat and products would be expected.

The difference between the estimated impact of cessation of live animals exports for bovines and ovines suggest a need to take a different, customized strategic approach when defining the policies in those two segments. For producers in the ovine sector, the safety buffer provided by current profit margins would be consumed as a result of live ovine exports cessation, meaning some of them would switch to a yearly loss. As a result, there would be a pronounced need to restructure business operations or to obtain local or public authorities' support for a while, until the market adapts to the new conditions.

The discussion above relates to the third scenario of the previous chapter. However, if we take into consideration a partial limitation of exports, as in scenarios 1 and 2 of the previous chapter, the impact on producers would be significantly reduced.

## Scenario B

In this scenario we have as well estimated, using econometric techniques, the response of ovine and bovine prices to an increase in supply. Higher supply of live animals would, naturally, lead to a decrease in prices. The coefficients for the respective responses were estimated to be -0.462 for bovines and -0.2 for ovines in the low elasticity version, which defines a weaker live animals price response to changes in supply. Using these coefficients and the data on the added supply coming from the live animals shifted from export to the local market the impact on producers' revenues was calculated. Just as in scenario A, in order to get the values that would be added to the supply of the live animal market in 2021, we estimated the trends for the domestic and export markets for ovines and bovines. Thus, starting with data from the 2010-2017 period, the value of exports of ovine and bovine meat was estimated: compared to 2017, an increase of 14.5% for bovine and 42.4% for ovine meat would be recorded in 2021. In terms of the domestic market, the average of the estimated growth rates for meat and meat products for ovines was 13.8%. For bovine meat and products the BMI Market Research growth rate estimate was used, leading to an increase in demand in 2021 of about 32.1% from 2017. The year of reference for local livestock output is 2017, and it was used as the basis for the 2021 calculations in a static version, without making an estimate of the volatility in livestock production. The years 2015-2017 showed a relatively stable level of local ovines and bovines heads (see charts in the introduction chapter), which supports the static hypothesis in ovine and bovine populations. In view of the size of the internal market and the high growth rate of both domestic and foreign demand, given that the size of livestock is assumed to be constant, it is no longer surprising that the market would, in fact, absorb even more of the supply for bovines than it currently does, pushing up the respective prices. However, the ovine market is in a different position: with a much higher ratio of exported to locally processed animals (nearly 2.5 times that seen in bovines, see section 1.4, figures 88 and 89) and with a relatively low share of domestic consumption, even if a significant increase in demand is expected, the additional supply is still expected to produce a significant impact on the market.

- Ovines: price impact: -5.04%. In terms of producers' sales value (and not in terms of profit), that would mean a drop of aggregated sales value of live ovine animals of EUR 15.98m.
- Bovines: price impact: 1.39%. In terms of producers' sales value (and not in terms of profit), that would in fact lead to an increase of EUR 2.21m. The result may appear to be inconsistent with the economic logic, yet it is not: based on the strong growth in demand anticipated, the local and international market demand for bovines in 2021 would not only absorb the entire 2017 equivalent export supply but need even more supply to reach balance. If supply does not change, prices would rise, albeit marginally, as a change of a little over 1% is relatively insignificant. The result suggests that, in any case, if a shift in exports to the local market does not take place, a significant growth in local production of bovines would be necessary. Absent such supply growth, we would expect either an even larger price rise for bovine meat and meat products or higher such imports.

In the estimates associated with scenario B, the impact values on aggregated sales are visibly lower. The result is to be expected, since lower elasticity levels were included in the coefficients used in calculations. Just as in scenario A, however, the differences between the ovine and bovine sector in terms of the estimated impact of cessation of live animals exports suggest a need to take a different strategic approach when defining the respective policies. For producers in the ovine sector, the safety buffer provided by current profit margins would be enough only for some of the producers, while



some of them would incur yearly losses as a result of live ovine exports cessation. In general, the situation would be manageable for the sector as a whole, although some producers may need to optimize business operations or to obtain local or public authorities' support for a while, until they adapt to the new market conditions.

The discussion above relates to the third scenario of the previous chapter. However, even with the new, lower values, of scenario B, if we take into consideration a partial limitation of exports, as in scenarios 1 and 2 of the previous chapter, the impact on producers would be furtherly reduced.

## 6. Recommendations

Romania is among the top 10 agricultural producers (cereals) in the EU, and in the top 3 European grain exporters. Romania is the largest global ovine exporter in 2017, and one of the largest bovine exporters in Europe. To the extent that the aim is for the local economy to develop, aiming at advancing to products of high added value, by offering products with a degree of further processing, the goal would be supported by the use of grains as raw materials for the production of live animals. Further processing by exporting refrigerated or frozen meat and meat products and by-products would provide additional momentum for the accumulation of value-added operations at local level, with a beneficial impact on Romania's economy.

### **Proposal: promotion, image, branding**

A more effective strategy for communication, marketing and branding is an important recommendation. The potential for creating value added by promotion should not be neglected. The proposal includes building a sectorial agricultural brand associated to the country, focusing on the main advantages of local supply, together with multi-channel promotion through a coherent strategy from a wide range of actors, ranging from industry associations and state institutions and bodies to the major market players and Romanian communities outside the country.

### **Proposals: meat**

In our view, there is an essential need to *develop new markets*, especially where purchasing power allows the export of high-quality, high-value products. There is also need for: *negotiation* in order to remove administrative and customs barriers and *support* for carriers providing cold chain transport services.

A proposal to be taken into consideration may seem a bold option but might prove an important catalyst for development: the creation of an association of processors and producers at a local level in a concentrated effort to develop a logistics operator that offers low-temperature storage facilities close to end-users in important destination countries.

The possibility of an EU-Japan trade agreement means a chance for the export of meat, especially quality, marbled bovine meat, from carefully controlled animals that would comply with destination quality standards, while at the same time developing and capitalizing on the ties between the two countries.

China is a growing, large volume market that could become more accessible in the context of the trade-related approach between the EU and China as a counterbalance to the recent US stance. Diversification of exports from current deliveries of frozen pork would provide access to a major market with potential for quantitative and qualitative growth.

Although Great Britain is surrounded by the uncertainty of trade relations with the EU after March 2019 and especially after the transitional period that could be agreed, it is an important market, relatively close geographically and with an important Romanian community, which could facilitate adoption and

spreading of products originating from Romania, including via major retail networks. Sheep meat products and even dairy and sheep cheese could eventually become interesting for the British consumer.

*Developing the local market* by ensuring a steady stream of meat to the distribution and retail network and improving and diversifying supply by introducing meat producing animal breeds adapted to local market requirements. One of the reasons for Romania importing EUR 3.5m in sheep meat in 2017 is precisely the seasonality of the local meat offer, along with the preference for certain breeds specializing in meat<sup>8</sup>.

*What would be the options for producers, if they would cease exports?*

The ovine farmers have the option to:

- Shift some of the animals to the local market for consumption
- Focus on quality and move towards specialization, choosing between milk and meat, selecting the breeds accordingly. That would, in turn, support better export prices and higher volumes on the local and foreign markets
- Shift some of the previously exported animals to local slaughterhouses from where meat products would be exported, profiting from the Middle East and North Africa demand growth, where BMI sees a 27% growth in demand from 2017 to 2021. This action is needed, as the local market demand is not ready to absorb the increase in supply generated by the cessation of ovine exports.

The bovine farmers have the option to:

- Move towards specialized breeds. One way to optimize production would be to partially replace current breeds, over a transition period of 3 to 5 years, with those that local consumers shows an increasing preference for, such as, but not limited to the Angus varieties
- Shift the animals towards local slaughterhouses, part of the meat being offered to the local market, and the balance exported.

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<sup>8</sup> <https://www.zfcorporate.ro/retail-agrobusiness/romania-importa-carne-de-oaie-din-noua-zeelanda-de-la-17-500-de-kilometri-departare-desi-este-al-4-lea-cel-mai-mare-crescator-de-ovine-si-caprine-din-ue-17375460>

## **Byproducts: wool**

In order to benefit from wool, there is need for an aggregate and coherent policy, one that would lead to a massive qualitative reform of the sector. According to the information gathered from local reference firms, the interest and availability among yarn producers to use raw material from Romania is assessed at high levels, but only when the quality and price criteria are met. For this, there needs be, in our opinion, a diversified strategy, including:

- It is essential to inform and educate shepherds and sheep producers about the strict requirements of race, nourishment, care, cleanliness and temperature needed in order to take advantage of a valuable byproduct – and letting them know this will have a positive impact on their incomes
- Prepare the conditions for the appearance of at least one wool preprocessing center so that its later use by yarn producers can be easily integrated into existing flows
- Campaign to educate and inform the general public, in order to rebuild the brand of local products

## **Byproducts: hides**

Certain categories of leather products are already finding their way to European destinations, with Italy being often at the top of some product categories, while Germany dominates the saddle and harnessing equipment subgroup. Several options for further development might be:

- Strengthening current export destinations by increasing the number of trading partners in Italy and Germany, yet also
- Identifying new destination countries (if the current demands of firms in Germany and Italy are met, chances are products would fare well in other countries as well, such as France or the UK)
- Further development, by defining a set of brands for leather goods, footwear or equestrian equipment
- Running support programs for folk craftsmen or aiming to develop traditionally inspired design products to help rebuild the sheepskin industry

## **Byproducts: organs and other byproducts**

Except for certain products, such as bovine tongue (present in the online or brick-and-mortar offer of some retail chains) or sheep intestines (used in the preparation of sausages), sheep or cattle organs do not get much attention from producers or consumers. For segment development, it would be helpful to:

- Promote the health advantages of sheep and bovine organs.
- Enlarge the visibility of organs on the products and meat producers' own website, supporting a growth in popularity of organ consumption.
- Defining new products similar to some that are traditional in other countries, through product partnerships, offering products such as *haggis*, from Scotland, a sort of savory pudding that uses

among other ingredients, sheep organs. Thus, local consumers would be given the chance to diversify their diet<sup>9</sup>.

- Integration of some by-products into the pet food production chain, mainly for dogs and cats, including the possibility of exporting products of this category. The public authorities may support, through communication, events and possibly even moderate fiscal benefits, the option of using byproducts in the pet food industry, as the measure would reduce general nutrient waste. The potential for development in this area is, in our opinion, relatively high.
- Organic products are in the area of interest to local consumers, and the trend is favorable: some organic soaps imported in Romania use the bovine bile, considered a powerful anti-stain agent, along with other substances. The soaps could be produced locally, using locally sourced ingredients.

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<sup>9</sup> <http://www.meat-milk.ro/haggis-o-solutie-scotiana-pentru-sectorul-de-ready-meal-din-romania/>

## The Transition Period

Under the partial or gradual replacement of the total demand for live animals for export with demand for refrigerated or frozen meat and meat products, the total market demand in terms of heads of ovines and bovines would initially decrease, and even more so in the case of cessation of live animals exports. This would mean a period of relative over-production, limiting the growth of the farmers' businesses, and even making them incur losses when compared to the scenario of maintaining exported livestock volumes or that of full replacement or redirection of demand.

Profit margins are relatively low. On average, for the first 10 major ovine producers, the margin over the last 3 years (2015 – 2017) was 7.56% and 5.34% in the bovine sector, which means that farmers' tolerance for unfavorable price fluctuations is limited. A reconfiguration of export routes for meat and meat products as a result of and response to possible trade, legislative or logistical difficulties may induce further frictions.

Mixed farms are better positioned to cope with these economic pressures, as they have the possibility of additional compensation between the agricultural and livestock divisions. This is especially true for the groups that also own processing units. However, even large and integrated groups are not immune to distortion: shifting part of the production to meat production and locally marketed meat products, where a rapid substitution of export demand is not feasible, would mean a higher supply at local level, and thus pressure on the sales price. At the same time, this would be a benefit for the Romanian consumer. Balancing the two aspects in order to maintain economic equilibrium is not an easy nor easily quantifiable task.

Proposed paths:

- Specialization, offering products that are adapted to the market. One possibility is to identify the taste of the Romanian consumer and especially the trend in his or her preference. If an upward trend in demand or high levels of demand of a particular breed – which can possibly be a foreign breed - is noticed, offering locally that popular breed can represent an important opportunity. From the discussions with some producers, the interest in Angus beef is growing markedly, but other options need to be studied as well
- Increase in profit margins through consumer-friendly sales platforms, as well as the association of small producers for more bargaining power
- Information and awareness campaigns for local consumers
- Identifying new markets such as Japan, China, Hong Kong, taking note of the rapid evolution of global trade agreements. Researching and targeting better penetration of the destinations for which low-temperature logistics chains are available.

## 7. Conclusions

Romania is among the top 10 agricultural producers (grains) in the EU and among the top 3 European grain exporters. Romania also has the largest surface area among all EU countries cultivated with maize and the second largest are for growing soybeans (after Italy), the essential crops for animal feed. For each ovine that is sent for export, about 2 are slaughtered locally. For each exported bovine, about 3 are slaughtered locally. A shift from live animals export to those of refrigerated or frozen meat and meat products and by-products would create jobs in the local economy and provide additional momentum for the accumulation of value-added operations at local level, with a positive effect on Romania's economy.

The various scenarios examined have shown that, in the hypotheses presented, the lower the exports of live animals, ovines and bovines, the more jobs are created. The new jobs generated go from 2342 in scenario 1 to 3512 for the second scenario and 5311 for the third scenario. Jobs created locally would also contribute to the creation of other indirect jobs through the multiplier effect, while public finances would see revenue growth through direct and indirect taxation. Added value would increase and support GDP growth. The gross added value generated by the creation of the new jobs estimated in the third scenario is seen at EUR 46.26 million.

The estimated negative effects are observed only in the ovine sector. These could be mitigated even in the higher impact scenario by implementing at least some of our recommendations. In the absence of the implementation of any of the recommendations, in the relatively more severe scenario some ovine producers would suffer losses. The decrease in revenue is estimated, in this relatively more severe scenario, at EUR 71.04 million per year. Such loss of income could materialize, in the absence of any form of tax support, for about 2 to 3 years, before the market may get a chance to rebalance. In the relatively milder scenario, the losses in terms of revenue (and not profits) would be about EUR 15.98 million per year.

Given the current trends in the bovine meat market for export and local consumption, based on trend estimates and domain research, data show rising incomes for cattle breeders, amounting to EUR 2.21 million in the first scenario and EUR 3.83 million in the second (with a higher price response elasticity). Bovine producers should therefore produce more in order to satisfy the growing demand, even if the exports are partially redirected to the local market, which means that without such a change and without an adequate supply increase, local prices would increase in 2021.

Taking into consideration the data collected and their analysis carried out in this study, in a volatile environment both in terms of economic data and in terms of production, weather, global relations and regulatory framework, we can conclude that an option of strategic development of the local agriculture would have to take into account the shift towards high added-value products through further processing, through branding, along with the diversification of product offerings, and a series of other options for strategic local and international market development. The goal is to capture, for the local economy, resources that can be reinvested in development, technology, training, promotion at local and international level, with beneficial effects on Romania's economy and its long-term growth potential.

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## 9. Data

### 9.1 Statistical Data

<b>EFFECTIVELE DE ANIMALE EXISTENTE LA 1 DECEMBRIE 2017, PE TOTAL ȚARĂ</b>			
			- capete -
Denumirea indicatorilor	Total agricultură	din care:	
		Sector majoritar privat	din acesta: Exploatații agricole fără personalitate juridică
A	1	2	3
<b>TOTAL TARA</b>			
<b>EFFECTIVELE DE BOVINE</b>			
TAURINE SUB 1 AN – TOTAL	430149	428612	377015
- viței pentru sacrificare	128479	128244	122577
- alte taurine – total	301670	300368	254438
- masculi	82820	82361	60040
- femele	218850	218007	194398
TAURINE ÎNTRE 1 ȘI 2 ANI - TOTAL	247012	245877	220117
- masculi	59790	59464	53762
- femele	187222	186413	166355
- pentru sacrificare	16636	16595	11606
- altele	170586	169818	154749
TAURINE DE 2 ANI ȘI PESTE - TOTAL	1315148	1312035	1225914
- masculi	17188	17074	13631
- pentru reproducție	5702	5656	4825
- pentru sacrificare	7682	7615	5013
- pentru muncă	3804	3803	3793
- femele	1297960	1294961	1212283
- juninci	126105	125625	114285
- juninci pentru sacrificare	6421	6335	5264
- juninci pentru reproducție	119684	119290	109021
- vaci	1171855	1169336	1097998
- vaci pentru lapte	1160136	1157744	1089809
- alte vaci	11719	11592	8189
TAURINE TOTAL	1992309	1986524	1823046
BUBALINE TOTAL	18819	18430	17375
- bivolițe (femele pentru reproducție)	15027	14771	13986
- alte bubaline	3792	3659	3389
<b>BOVINE TOTAL</b>	<b>2011128</b>	<b>2004954</b>	<b>1840421</b>

Source: INS

Denumirea indicatorilor	Total agricultură	din care:	din care:
		Sector majoritar privat	din acesta:
			Exploatații agricole fără personalitate juridică
A	1	2	3
<b>TOTAL TARA</b>			
<b>EFFECTIVELE DE OVINE ȘI CAPRINE</b>			
<b>OVINE TOTAL</b>	9981859	9970502	9765312
Oi fătătoare și mioare montate - total	8453839	8445162	8366329
- oi pentru lapte și mioare montate	7649714	7642578	7581583
- alte oi și mioare	804125	802584	784746
Berbeci reproducători	245145	244806	237600
Alte ovine	1282875	1280534	1161383
<b>CAPRINE TOTAL</b>	1503270	1502213	1490284
Capre care au fătat deja și capre montate	1184159	1183469	1173969
- capre care au fătat deja	1040742	1040171	1032407
- capre montate pentru prima dată	143417	143298	141562
Alte caprine	319111	318744	316315
<b>OVINE ȘI CAPRINE TOTAL</b>	11485129	11472715	11255596
<b>EFFECTIVELE DE PĂSĂRI</b>			
<b>PĂSĂRI TOTAL</b>	73288712	73267108	44710216
din care: păsări ouătoare adulte	38312127	38290569	30487742
din care: găini ouătoare	34536093	34516462	27698508

Source: INS

## 9.2 Tests and econometric estimates

### Coefficient of elasticity for bovine prices

**Low elasticity. DBP dependent variable, DBQ, DPP, DCQ, DPQ, DP independent variables, yearly series**

Dependent Variable: DBP

Method: Least Squares

Date: 11/04/18 Time: 20:51

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 3.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.034689	0.021563	-1.608730	0.1251
DBQ	<b>-0.462433</b>	0.217949	-2.121747	0.0480
DPP	0.483796	0.101528	4.765135	0.0002
DCQ	0.814902	0.331158	2.460761	0.0242
DPQ	0.483152	0.271614	1.778819	0.0922
DP	-4.415086	2.721286	-1.622426	0.1221
R-squared	0.676409	Mean dependent var	-0.000808	
Adjusted R-squared	0.586523	S.D. dependent var	0.181759	
S.E. of regression	0.116875	Akaike info criterion	-1.243102	
Sum squared resid	0.245877	Schwarz criterion	-0.948589	
Log likelihood	20.91723	Hannan-Quinn criter.	-1.164968	
F-statistic	7.525164	Durbin-Watson stat	2.212632	
Prob(F-statistic)	0.000573	Wald F-statistic	8.289898	
Prob(Wald F-statistic)	0.000328			

# Stationarity of BP (bovine prices, yearly series)

Null Hypothesis: BP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.413366	0.0211
Test critical values:		
1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(BP)

Method: Least Squares

Date: 11/28/18 Time: 21:22

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BP(-1)	-0.789612	0.231329	-3.413366	0.0028
D(BP(-1))	0.334223	0.208324	1.604341	0.1243
C	4512.281	1324.770	3.406086	0.0028
R-squared	0.369903	Mean dependent var		34.35814
Adjusted R-squared	0.306893	S.D. dependent var		1049.310
S.E. of regression	873.5824	Akaike info criterion		16.50419
Sum squared resid	15262924	Schwarz criterion		16.65230
Log likelihood	-186.7982	Hannan-Quinn criter.		16.54144
F-statistic	5.870569	Durbin-Watson stat		1.667091
Prob(F-statistic)	0.009864			

# Stationarity of DBP (dlog(bovine prices), yearly series)

Null Hypothesis: DBP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.468014	0.0002
Test critical values:		
1% level	-3.769597	
5% level	-3.004861	
10% level	-2.642242	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DBP)

Method: Least Squares

Date: 11/28/18 Time: 21:23

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBP(-1)	-1.483656	0.271334	-5.468014	0.0000
D(DBP(-1))	0.491817	0.188177	2.613589	0.0171
C	-0.005068	0.034903	-0.145216	0.8861
R-squared	0.635613	Mean dependent var		-0.007125
Adjusted R-squared	0.597257	S.D. dependent var		0.257877
S.E. of regression	0.163654	Akaike info criterion		-0.656003
Sum squared resid	0.508869	Schwarz criterion		-0.507225
Log likelihood	10.21604	Hannan-Quinn criter.		-0.620956
F-statistic	16.57119	Durbin-Watson stat		2.016199
Prob(F-statistic)	0.000068			

# Stationarity of PP (pig prices, yearly series)

Null Hypothesis: PP has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.224948	0.2036
Test critical values:		
1% level	-3.769597	
5% level	-3.004861	
10% level	-2.642242	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PP)

Method: Least Squares

Date: 11/28/18 Time: 21:48

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.261484	0.117524	-2.224948	0.0391
D(PP(-1))	0.099928	0.160611	0.622176	0.5416
D(PP(-2))	-0.575253	0.159757	-3.600797	0.0020
C	1492.995	903.0893	1.653209	0.1156
R-squared	0.577543	Mean dependent var		-250.9651
Adjusted R-squared	0.507134	S.D. dependent var		1527.708
S.E. of regression	1072.519	Akaike info criterion		16.95637
Sum squared resid	20705344	Schwarz criterion		17.15474
Log likelihood	-182.5201	Hannan-Quinn criter.		17.00310
F-statistic	8.202637	Durbin-Watson stat		2.145217
Prob(F-statistic)	0.001188			

# Stationarity of DPP (dlog(pig prices), yearly series)

Null Hypothesis: DPP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.340801	0.0000
Test critical values:		
1% level	-3.769597	
5% level	-3.004861	
10% level	-2.642242	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPP)

Method: Least Squares

Date: 11/28/18 Time: 21:48

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPP(-1)	-1.752982	0.238800	-7.340801	0.0000
D(DPP(-1))	0.707555	0.166045	4.261215	0.0004
C	-0.055790	0.033189	-1.680967	0.1091
R-squared	0.746996	Mean dependent var		0.002522
Adjusted R-squared	0.720365	S.D. dependent var		0.285567
S.E. of regression	0.151010	Akaike info criterion		-0.816822
Sum squared resid	0.433275	Schwarz criterion		-0.668043
Log likelihood	11.98504	Hannan-Quinn criter.		-0.781774
F-statistic	28.04888	Durbin-Watson stat		2.058271
Prob(F-statistic)	0.000002			

# Stationarity of CQ (chicken quantities, yearly series)

Null Hypothesis: CQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.819172	0.7954
Test critical values:		
1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(CQ)

Method: Least Squares

Date: 11/28/18 Time: 21:49

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CQ(-1)	-0.113790	0.138909	-0.819172	0.4215
C	41372.24	44570.01	0.928253	0.3633

R-squared	0.029599	Mean dependent var	5252.349
Adjusted R-squared	-0.014510	S.D. dependent var	31625.75
S.E. of regression	31854.37	Akaike info criterion	23.65539
Sum squared resid	2.23E+10	Schwarz criterion	23.75356
Log likelihood	-281.8647	Hannan-Quinn criter.	23.68144
F-statistic	0.671043	Durbin-Watson stat	2.197160
Prob(F-statistic)	0.421474		



# Stationarity of DCQ (dlog(chicken quantities), yearly series)

Null Hypothesis: DCQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.357947	0.0000
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DCQ)

Method: Least Squares

Date: 11/28/18 Time: 21:50

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DCQ(-1)	-1.255224	0.197426	-6.357947	0.0000
C	0.025225	0.019963	1.263607	0.2202
R-squared	0.658111	Mean dependent var		0.007174
Adjusted R-squared	0.641831	S.D. dependent var		0.158346
S.E. of regression	0.094766	Akaike info criterion		-1.791874
Sum squared resid	0.188592	Schwarz criterion		-1.693135
Log likelihood	22.60655	Hannan-Quinn criter.		-1.767041
F-statistic	40.42349	Durbin-Watson stat		1.993478
Prob(F-statistic)	0.000003			

# Stationarity of PQ (pig quantities, yearly series)

Null Hypothesis: PQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.433144	0.1438
Test critical values: 1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PQ)

Method: Least Squares

Date: 11/28/18 Time: 21:52

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PQ(-1)	-0.225981	0.092876	-2.433144	0.0236
C	106530.7	49370.46	2.157783	0.0421
R-squared	0.212040	Mean dependent var		-11030.36
Adjusted R-squared	0.176223	S.D. dependent var		54767.85
S.E. of regression	49708.47	Akaike info criterion		24.54539
Sum squared resid	5.44E+10	Schwarz criterion		24.64356
Log likelihood	-292.5447	Hannan-Quinn criter.		24.57144
F-statistic	5.920192	Durbin-Watson stat		2.582294
Prob(F-statistic)	0.023552			

# Stationarity of DPQ (dlog(pig quantities), yearly series)

Null Hypothesis: DPQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.642226	0.0000
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPQ)

Method: Least Squares

Date: 11/28/18 Time: 21:52

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPQ(-1)	-1.352849	0.203674	-6.642226	0.0000
C	-0.025797	0.023176	-1.113051	0.2783
R-squared	0.677514	Mean dependent var		-0.001159
Adjusted R-squared	0.662158	S.D. dependent var		0.188764
S.E. of regression	0.109717	Akaike info criterion		-1.498876
Sum squared resid	0.252796	Schwarz criterion		-1.400138
Log likelihood	19.23708	Hannan-Quinn criter.		-1.474044
F-statistic	44.11917	Durbin-Watson stat		2.026503
Prob(F-statistic)	0.000001			

# Stationarity of BQ (bovine quantities, yearly series)

Null Hypothesis: BQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.302073	0.1793
Test critical values:		
1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(BQ)

Method: Least Squares

Date: 11/28/18 Time: 21:54

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BQ(-1)	-0.230708	0.100217	-2.302073	0.0312
C	31186.95	16560.07	1.883262	0.0730

R-squared	0.194126	Mean dependent var	-5882.551
Adjusted R-squared	0.157495	S.D. dependent var	20629.96
S.E. of regression	18935.84	Akaike info criterion	22.61516
Sum squared resid	7.89E+09	Schwarz criterion	22.71333
Log likelihood	-269.3819	Hannan-Quinn criter.	22.64120
F-statistic	5.299541	Durbin-Watson stat	2.398235
Prob(F-statistic)	0.031172		

# Stationarity of DBQ (dlog(bovine quantities), yearly series)

Null Hypothesis: DBQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.533301	0.0002
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DBQ)

Method: Least Squares

Date: 11/28/18 Time: 21:53

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBQ(-1)	-1.181505	0.213526	-5.533301	0.0000
C	-0.042852	0.027105	-1.581005	0.1288

R-squared	0.593161	Mean dependent var	-0.003076
Adjusted R-squared	0.573787	S.D. dependent var	0.191980
S.E. of regression	0.125334	Akaike info criterion	-1.232731
Sum squared resid	0.329880	Schwarz criterion	-1.133993
Log likelihood	16.17641	Hannan-Quinn criter.	-1.207899
F-statistic	30.61742	Durbin-Watson stat	1.827263
Prob(F-statistic)	0.000017		

# Stationarity of P (population, yearly series)

Null Hypothesis: P has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.672553	0.8355
Test critical values: 1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(P)

Method: Least Squares

Date: 11/28/18 Time: 21:55

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P(-1)	-0.027677	0.041152	-0.672553	0.5082
C	455483.0	872899.1	0.521805	0.6070

R-squared	0.020146	Mean dependent var	-130591.0
Adjusted R-squared	-0.024393	S.D. dependent var	246099.3
S.E. of regression	249082.7	Akaike info criterion	27.76861
Sum squared resid	1.36E+12	Schwarz criterion	27.86678
Log likelihood	-331.2234	Hannan-Quinn criter.	27.79466
F-statistic	0.452327	Durbin-Watson stat	1.882624
Prob(F-statistic)	0.508235		

# Stationarity of DP (dlog(population), yearly series)

Null Hypothesis: DP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.394960	0.0023
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DP)

Method: Least Squares

Date: 11/28/18 Time: 21:55

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DP(-1)	-0.954346	0.217146	-4.394960	0.0003
C	-0.006096	0.002870	-2.123829	0.0457

R-squared	0.479111	Mean dependent var	-0.000198
Adjusted R-squared	0.454307	S.D. dependent var	0.016471
S.E. of regression	0.012167	Akaike info criterion	-5.897199
Sum squared resid	0.003109	Schwarz criterion	-5.798460
Log likelihood	69.81779	Hannan-Quinn criter.	-5.872366
F-statistic	19.31567	Durbin-Watson stat	2.010205
Prob(F-statistic)	0.000253		

## Coefficient of elasticity for bovine prices

### High elasticity. DBPD11, DBQS11MOD, DPPD11 endogenous variables used in VAR, Monthly series

Series have been adjusted for seasonal effects, hence the D11 and S11 designations. Method used is TRAMO/SEATS. MOD signifies that major outliers left have been replaced by the average of neighboring values.

Vector Autoregression Estimates

Date: 11/05/18 Time: 00:24

Sample (adjusted): 2015M01 2017M12

Included observations: 36 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	DBPD11	DBQS11MOD	DPPD11
DBPD11(-1)	-1.240396 (0.89690) [-1.38298]	2.805398 (2.44044) [ 1.14954]	-2.468702 (1.80160) [-1.37028]
DBPD11(-2)	0.346537 (0.39426) [ 0.87897]	-0.209868 (1.07276) [-0.19563]	-0.655294 (0.79194) [-0.82746]
DBPD11(-3)	0.781677 (0.57815) [ 1.35204]	-1.810421 (1.57311) [-1.15085]	1.004484 (1.16132) [ 0.86495]
DBPD11(-4)	-0.372076 (0.44859) [-0.82944]	-0.294171 (1.22059) [-0.24101]	-1.432164 (0.90107) [-1.58940]
DBPD11(-5)	0.423985 (0.47208) [ 0.89812]	-1.596388 (1.28451) [-1.24280]	-0.762289 (0.94826) [-0.80388]
DBPD11(-6)	0.305100 (0.38309) [ 0.79641]	0.571105 (1.04239) [ 0.54788]	1.497440 (0.76952) [ 1.94594]
DBPD11(-7)	-0.586306 (0.47304) [-1.23946]	1.248948 (1.28711) [ 0.97035]	-1.121055 (0.95018) [-1.17983]
DBPD11(-8)	0.076053 (0.50147) [ 0.15166]	-0.432095 (1.36448) [-0.31667]	-0.808722 (1.00730) [-0.80286]
DBPD11(-9)	0.351064 (0.44788) [ 0.78383]	0.099519 (1.21867) [ 0.08166]	1.076709 (0.89966) [ 1.19680]
DBPD11(-10)	-0.797754 (0.46602) [-1.71183]	0.322167 (1.26803) [ 0.25407]	-1.444107 (0.93610) [-1.54269]
DBPD11(-11)	-0.552345 (0.70644) [-0.78187]	0.154199 (1.92219) [ 0.08022]	-1.576062 (1.41901) [-1.11068]



DBQS11MOD(-1)	0.089879 (0.18604) [ 0.48311]	0.091404 (0.50622) [ 0.18056]	-0.140274 (0.37370) [-0.37536]
DBQS11MOD(-2)	0.489901 (0.27627) [ 1.77327]	-0.619154 (0.75172) [-0.82365]	0.761647 (0.55494) [ 1.37249]
DBQS11MOD(-3)	-0.192309 (0.15782) [-1.21854]	0.408497 (0.42942) [ 0.95127]	-0.163980 (0.31701) [-0.51727]
DBQS11MOD(-4)	0.272507 (0.15326) [ 1.77804]	-0.626557 (0.41702) [-1.50246]	0.018491 (0.30786) [ 0.06006]
DBQS11MOD(-5)	0.117097 (0.18100) [ 0.64693]	-0.322587 (0.49250) [-0.65499]	0.363055 (0.36358) [ 0.99856]
DBQS11MOD(-6)	-0.003849 (0.13946) [-0.02760]	0.231048 (0.37947) [ 0.60887]	0.025393 (0.28014) [ 0.09064]
DBQS11MOD(-7)	-0.180651 (0.14649) [-1.23316]	0.548105 (0.39861) [ 1.37506]	-0.276456 (0.29426) [-0.93949]
DBQS11MOD(-8)	0.433728 (0.21928) [ 1.97799]	-1.185010 (0.59665) [-1.98611]	0.254753 (0.44046) [ 0.57838]
DBQS11MOD(-9)	0.073303 (0.16870) [ 0.43452]	0.393279 (0.45902) [ 0.85678]	0.692057 (0.33886) [ 2.04229]
DBQS11MOD(-10)	-0.112223 (0.20848) [-0.53830]	0.273654 (0.56725) [ 0.48242]	-0.206299 (0.41876) [-0.49264]
DBQS11MOD(-11)	-0.170116 (0.20606) [-0.82558]	0.474857 (0.56067) [ 0.84694]	0.120503 (0.41390) [ 0.29114]
DPPD11(-1)	0.638540 (0.30679) [ 2.08133]	-1.772892 (0.83478) [-2.12379]	1.360994 (0.61625) [ 2.20849]
DPPD11(-2)	-0.477377 (0.23899) [-1.99749]	1.026507 (0.65028) [ 1.57856]	-0.568898 (0.48005) [-1.18507]
DPPD11(-3)	0.338682 (0.24773) [ 1.36714]	-0.682577 (0.67407) [-1.01263]	-0.152414 (0.49761) [-0.30629]
DPPD11(-4)	0.373636 (0.28218) [ 1.32409]	0.394449 (0.76781) [ 0.51373]	1.468899 (0.56682) [ 2.59148]

DPPD11(-5)	-0.443561 (0.24474) [-1.81236]	0.940737 (0.66594) [ 1.41265]	-0.319479 (0.49161) [-0.64986]
DPPD11(-6)	-0.411781 (0.36102) [-1.14059]	0.351284 (0.98233) [ 0.35760]	-0.781211 (0.72519) [-1.07726]
DPPD11(-7)	0.190490 (0.20052) [ 0.94996]	-0.015856 (0.54562) [-0.02906]	0.383672 (0.40279) [ 0.95253]
DPPD11(-8)	0.120161 (0.28971) [ 0.41476]	0.217200 (0.78829) [ 0.27553]	0.558345 (0.58193) [ 0.95946]
DPPD11(-9)	-0.439070 (0.26309) [-1.66888]	0.689849 (0.71587) [ 0.96366]	-0.638138 (0.52847) [-1.20752]
DPPD11(-10)	-0.002835 (0.29161) [-0.00972]	0.341437 (0.79345) [ 0.43032]	-3.83E-05 (0.58575) [-6.5e-05]
DPPD11(-11)	0.229312 (0.24881) [ 0.92162]	-0.301463 (0.67701) [-0.44528]	0.415393 (0.49979) [ 0.83114]
R-squared	0.940685	0.890197	0.935631
Adj. R-squared	0.307988	-0.281030	0.249023
Sum sq. resids	0.000487	0.003608	0.001966
S.E. equation	0.012745	0.034679	0.025601
F-statistic	1.486785	0.760055	1.362687
Log likelihood	150.7001	114.6646	125.5907
Akaike AIC	-6.538893	-4.536921	-5.143928
Schwarz SC	-5.087334	-3.085362	-3.692369
Mean dependent	0.002724	0.008798	0.002307
S.D. dependent	0.015321	0.030640	0.029542
Determinant resid covariance (dof adj.)	2.54E-11		
Determinant resid covariance	1.47E-14		
Log likelihood	420.0948		
Akaike information criterion	-17.83860		
Schwarz criterion	-13.48393		
Number of coefficients	99		

# Stationarity of BP (bovine prices, monthly series)

Null Hypothesis: BP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.858841	0.3484
Test critical values: 1% level	-3.577723	
5% level	-2.925169	
10% level	-2.600658	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(BP)

Method: Least Squares

Date: 11/28/18 Time: 22:11

Sample (adjusted): 2014M02 2017M12

Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BP(-1)	-0.157342	0.084645	-1.858841	0.0696
C	994.4942	525.8176	1.891329	0.0650
R-squared	0.071309	Mean dependent var		17.61336
Adjusted R-squared	0.050671	S.D. dependent var		121.8973
S.E. of regression	118.7688	Akaike info criterion		12.43386
Sum squared resid	634771.1	Schwarz criterion		12.51259
Log likelihood	-290.1956	Hannan-Quinn criter.		12.46348
F-statistic	3.455291	Durbin-Watson stat		2.017410
Prob(F-statistic)	0.069597			

Stationarity of DBPD11 (dlog(bovine prices seasonally adjusted), monthly series)

Null Hypothesis: DBPD11 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.940271	0.0000
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DBPD11)

Method: Least Squares

Date: 11/28/18 Time: 22:11

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBPD11(-1)	-1.199802	0.151103	-7.940271	0.0000
C	0.003401	0.002292	1.483863	0.1450
R-squared	0.588969	Mean dependent var		0.000516
Adjusted R-squared	0.579627	S.D. dependent var		0.023673
S.E. of regression	0.015349	Akaike info criterion		-5.473063
Sum squared resid	0.010366	Schwarz criterion		-5.393557
Log likelihood	127.8805	Hannan-Quinn criter.		-5.443280
F-statistic	63.04790	Durbin-Watson stat		1.887398
Prob(F-statistic)	0.000000			

# Stationarity of BQ (bovine quantities, monthly series)

Null Hypothesis: BQ has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.130563	0.0000
Test critical values: 1% level	-3.584743	
5% level	-2.928142	
10% level	-2.602225	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(BQ)

Method: Least Squares

Date: 11/28/18 Time: 22:12

Sample (adjusted): 2014M04 2017M12

Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BQ(-1)	-1.054597	0.172023	-6.130563	0.0000
D(BQ(-1))	0.505664	0.139355	3.628611	0.0008
D(BQ(-2))	0.410236	0.138334	2.965544	0.0050
C	10080.63	1645.793	6.125090	0.0000
R-squared	0.481748	Mean dependent var		106.3333
Adjusted R-squared	0.443828	S.D. dependent var		2298.553
S.E. of regression	1714.191	Akaike info criterion		17.81596
Sum squared resid	1.20E+08	Schwarz criterion		17.97655
Log likelihood	-396.8591	Hannan-Quinn criter.		17.87583
F-statistic	12.70405	Durbin-Watson stat		1.968067
Prob(F-statistic)	0.000005			

Stationarity of DBQS11MOD (dlog(bovine quantities seasonally adjusted, outliers replaced with average of neighbors), monthly series)

Null Hypothesis: DBQS11MOD has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.699775	0.0000
Test critical values:		
1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DBQS11MOD)

Method: Least Squares

Date: 11/28/18 Time: 22:12

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBQS11MOD(-1)	-0.850683	0.149248	-5.699775	0.0000
C	0.010196	0.005401	1.887850	0.0657

R-squared	0.424742	Mean dependent var	-0.000138
Adjusted R-squared	0.411668	S.D. dependent var	0.044983
S.E. of regression	0.034503	Akaike info criterion	-3.853025
Sum squared resid	0.052381	Schwarz criterion	-3.773519
Log likelihood	90.61959	Hannan-Quinn criter.	-3.823242
F-statistic	32.48743	Durbin-Watson stat	2.027561
Prob(F-statistic)	0.000001		

# Stationarity of PP (pig prices, monthly series)

Null Hypothesis: PP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.363888	0.1574
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PP)

Method: Least Squares

Date: 11/28/18 Time: 22:13

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.133213	0.056353	-2.363888	0.0227
D(PP(-1))	0.483942	0.128731	3.759338	0.0005
C	775.9332	326.6064	2.375744	0.0220

R-squared	0.280746	Mean dependent var	3.433043
Adjusted R-squared	0.247293	S.D. dependent var	226.1383
S.E. of regression	196.1947	Akaike info criterion	13.45909
Sum squared resid	1655171.	Schwarz criterion	13.57834
Log likelihood	-306.5590	Hannan-Quinn criter.	13.50376
F-statistic	8.392100	Durbin-Watson stat	2.037830
Prob(F-statistic)	0.000837		

Stationarity of DPPD11 (dlog(pig prices seasonally adjusted), monthly series)

Null Hypothesis: DPPD11 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.260984	0.0000
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPPD11)

Method: Least Squares

Date: 11/28/18 Time: 22:13

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPPD11(-1)	-0.893885	0.142771	-6.260984	0.0000
C	0.000254	0.004314	0.058876	0.9533
R-squared	0.471153	Mean dependent var		0.002042
Adjusted R-squared	0.459134	S.D. dependent var		0.039699
S.E. of regression	0.029196	Akaike info criterion		-4.187071
Sum squared resid	0.037506	Schwarz criterion		-4.107564
Log likelihood	98.30262	Hannan-Quinn criter.		-4.157287
F-statistic	39.19992	Durbin-Watson stat		2.070602
Prob(F-statistic)	0.000000			



## Coefficient of elasticity for ovine prices

### Low elasticity. DOP, DOQ, DPP endogenous variables used in VAR, Yearly series

Vector Autoregression Estimates

Date: 11/04/18 Time: 23:02

Sample: 2000 2017

Included observations: 18

Standard errors in ( ) & t-statistics in [ ]

	DOP	DOQ	DPP
DOP(-1)	0.207837 (0.38217) [ 0.54384]	0.472639 (0.29958) [ 1.57768]	0.041461 (0.21707) [ 0.19101]
DOP(-2)	0.081037 (0.37538) [ 0.21588]	0.332603 (0.29426) [ 1.13031]	0.019334 (0.21321) [ 0.09068]
DOQ(-1)	-0.197736 (0.45337) [-0.43615]	-0.508279 (0.35539) [-1.43019]	0.150666 (0.25751) [ 0.58510]
DOQ(-2)	-0.218280 (0.43357) [-0.50345]	-0.390339 (0.33987) [-1.14849]	-0.080074 (0.24626) [-0.32516]
DPP(-1)	0.088287 (0.26990) [ 0.32711]	-0.100087 (0.21158) [-0.47306]	-0.072176 (0.15330) [-0.47081]
DPP(-2)	-0.124126 (0.27415) [-0.45277]	-0.039065 (0.21490) [-0.18178]	-0.782124 (0.15571) [-5.02289]
C	0.008433 (0.04441) [ 0.18990]	0.036682 (0.03481) [ 1.05377]	-0.028807 (0.02522) [-1.14210]
R-squared	0.085901	0.317452	0.803858
Adj. R-squared	-0.058431	0.209682	0.772888
Sum sq. resids	0.361482	0.222127	0.116617
S.E. equation	0.097533	0.076455	0.055397
F-statistic	0.595162	2.945627	25.95623
Log likelihood	44.69240	55.64910	70.14707
Akaike AIC	-1.675218	-2.162182	-2.806536
Schwarz SC	-1.394181	-1.881146	-2.525500
Mean dependent	0.000683	0.008579	0.001915
S.D. dependent	0.094806	0.086656	0.116268
Determinant resid covariance (dof adj.)		4.07E-06	
Determinant resid covariance		2.45E-06	
Log likelihood		99.14145	
Akaike information criterion		-3.472953	
Schwarz criterion		-2.629844	
Number of coefficients		21	

# Stationarity of OP (ovine prices, yearly series)

Null Hypothesis: OP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.154852	0.2266
Test critical values:		
1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(OP)

Method: Least Squares

Date: 11/27/18 Time: 20:53

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OP(-1)	-0.348543	0.161748	-2.154852	0.0424
C	2487.987	1172.774	2.121455	0.0454

R-squared	0.174279	Mean dependent var	0.183213
Adjusted R-squared	0.136746	S.D. dependent var	1086.996
S.E. of regression	1009.944	Akaike info criterion	16.75283
Sum squared resid	22439704	Schwarz criterion	16.85100
Log likelihood	-199.0340	Hannan-Quinn criter.	16.77888
F-statistic	4.643388	Durbin-Watson stat	1.827541
Prob(F-statistic)	0.042383		

# Stationarity of DOP (dlog(ovine prices), yearly series)

Null Hypothesis: DOP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.717220	0.0011
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DOP)

Method: Least Squares

Date: 11/27/18 Time: 20:51

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOP(-1)	-1.013565	0.214865	-4.717220	0.0001
C	-0.006161	0.033389	-0.184523	0.8554
R-squared	0.514475	Mean dependent var		-0.009105
Adjusted R-squared	0.491355	S.D. dependent var		0.224484
S.E. of regression	0.160101	Akaike info criterion		-0.743086
Sum squared resid	0.538277	Schwarz criterion		-0.644347
Log likelihood	10.54549	Hannan-Quinn criter.		-0.718253
F-statistic	22.25216	Durbin-Watson stat		1.973747
Prob(F-statistic)	0.000117			

# Stationarity of OQ (ovine quantities, yearly series)

Null Hypothesis: OQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.073382	0.2562
Test critical values: 1% level	-3.737853	
5% level	-2.991878	
10% level	-2.635542	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(OQ)

Method: Least Squares

Date: 11/27/18 Time: 20:58

Sample (adjusted): 1994 2017

Included observations: 24 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OQ(-1)	-0.270827	0.130621	-2.073382	0.0500
C	16299.36	8107.628	2.010373	0.0568
R-squared	0.163464	Mean dependent var		-256.7972
Adjusted R-squared	0.125439	S.D. dependent var		7356.109
S.E. of regression	6879.283	Akaike info criterion		20.59007
Sum squared resid	1.04E+09	Schwarz criterion		20.68824
Log likelihood	-245.0809	Hannan-Quinn criter.		20.61612
F-statistic	4.298913	Durbin-Watson stat		1.575889
Prob(F-statistic)	0.050050			

Stationarity of DOQ (dlog(ovine quantities), yearly series)

Null Hypothesis: DOQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.531206	0.0017
Test critical values: 1% level	-3.752946	
5% level	-2.998064	
10% level	-2.638752	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DOQ)

Method: Least Squares

Date: 11/27/18 Time: 20:59

Sample (adjusted): 1995 2017

Included observations: 23 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOQ(-1)	-0.966146	0.213221	-4.531206	0.0002
C	0.002598	0.027437	0.094705	0.9254
R-squared	0.494364	Mean dependent var		0.006546
Adjusted R-squared	0.470286	S.D. dependent var		0.180700
S.E. of regression	0.131516	Akaike info criterion		-1.136428
Sum squared resid	0.363228	Schwarz criterion		-1.037689
Log likelihood	15.06892	Hannan-Quinn criter.		-1.111596
F-statistic	20.53183	Durbin-Watson stat		2.030978
Prob(F-statistic)	0.000183			

# Stationarity of PP (pig prices, yearly series)

Null Hypothesis: PP has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-2.224948	0.2036
Test critical values:		
1% level	-3.769597	
5% level	-3.004861	
10% level	-2.642242	

\*Mackinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PP)

Method: Least Squares

Date: 11/27/18 Time: 21:01

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PP(-1)	-0.261484	0.117524	-2.224948	0.0391
D(PP(-1))	0.099928	0.160611	0.622176	0.5416
D(PP(-2))	-0.575253	0.159757	-3.600797	0.0020
C	1492.995	903.0893	1.653209	0.1156
R-squared	0.577543	Mean dependent var	-250.9651	
Adjusted R-squared	0.507134	S.D. dependent var	1527.708	
S.E. of regression	1072.519	Akaike info criterion	16.95637	
Sum squared resid	20705344	Schwarz criterion	17.15474	
Log likelihood	-182.5201	Hannan-Quinn criter.	17.00310	
F-statistic	8.202637	Durbin-Watson stat	2.145217	
Prob(F-statistic)	0.001188			

Stationarity of DPP (dlog(pig prices), yearly series)

Null Hypothesis: DPP has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=5)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-7.340801	0.0000
Test critical values: 1% level	-3.769597	
5% level	-3.004861	
10% level	-2.642242	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPP)

Method: Least Squares

Date: 11/27/18 Time: 21:01

Sample (adjusted): 1996 2017

Included observations: 22 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPP(-1)	-1.752982	0.238800	-7.340801	0.0000
D(DPP(-1))	0.707555	0.166045	4.261215	0.0004
C	-0.055790	0.033189	-1.680967	0.1091
R-squared	0.746996	Mean dependent var		0.002522
Adjusted R-squared	0.720365	S.D. dependent var		0.285567
S.E. of regression	0.151010	Akaike info criterion		-0.816822
Sum squared resid	0.433275	Schwarz criterion		-0.668043
Log likelihood	11.98504	Hannan-Quinn criter.		-0.781774
F-statistic	28.04888	Durbin-Watson stat		2.058271
Prob(F-statistic)	0.000002			

## Coefficient of elasticity for ovine prices

**High elasticity. DOQ, DPQ, DPSP independent variables in LS regression, DOP the dependent variable, Monthly series**

Series have been adjusted for seasonal effects, hence the S11 designations. Method used is TRAMO/SEATS. MOD signifies that major outliers left have been replaced by the average of neighboring values.

Dependent Variable: DOPS11

Method: Least Squares

Date: 11/04/18 Time: 23:43

Sample (adjusted): 2014M02 2017M12

Included observations: 47 after adjustments

HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001861	0.002832	-0.657212	0.5145
DOQS11MOD	<b>-0.889536</b>	0.391733	-2.270768	0.0282
DPQS11	-0.071711	0.021951	-3.266824	0.0021
DPSPS11	0.087883	0.075950	1.157118	0.2536
R-squared	0.150020	Mean dependent var	-0.004418	
Adjusted R-squared	0.090719	S.D. dependent var	0.027063	
S.E. of regression	0.025806	Akaike info criterion	-4.395164	
Sum squared resid	0.028636	Schwarz criterion	-4.237705	
Log likelihood	107.2864	Hannan-Quinn criter.	-4.335911	
F-statistic	2.529809	Durbin-Watson stat	2.892769	
Prob(F-statistic)	0.069739	Wald F-statistic	5.118926	
Prob(Wald F-statistic)	0.004071			



# Stationarity of OP (ovine prices, monthly series)

Null Hypothesis: OP has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.279253	0.0001
Test critical values:		
1% level	-3.592462	
5% level	-2.931404	
10% level	-2.603944	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(OP)

Method: Least Squares

Date: 11/27/18 Time: 21:23

Sample (adjusted): 2014M06 2017M12

Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OP(-1)	-0.856153	0.162173	-5.279253	0.0000
D(OP(-1))	0.469115	0.150126	3.124805	0.0035
D(OP(-2))	0.408342	0.148423	2.751207	0.0091
D(OP(-3))	0.334167	0.135290	2.470006	0.0182
D(OP(-4))	0.438165	0.134747	3.251762	0.0024
C	5629.334	1113.714	5.054560	0.0000
R-squared	0.434571	Mean dependent var	-123.4713	
Adjusted R-squared	0.358161	S.D. dependent var	1877.516	
S.E. of regression	1504.169	Akaike info criterion	17.59866	
Sum squared resid	83713407	Schwarz criterion	17.84441	
Log likelihood	-372.3711	Hannan-Quinn criter.	17.68928	
F-statistic	5.687397	Durbin-Watson stat	2.087817	
Prob(F-statistic)	0.000547			

Stationarity of DOPS11 (dlog(ovine prices), monthly series)

Null Hypothesis: DOPS11 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-11.60101	0.0000
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DOPS11)

Method: Least Squares

Date: 11/27/18 Time: 21:24

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOPS11(-1)	-1.507080	0.129909	-11.60101	0.0000
C	-0.006599	0.003563	-1.852084	0.0707
R-squared	0.753617	Mean dependent var		0.000134
Adjusted R-squared	0.748017	S.D. dependent var		0.047497
S.E. of regression	0.023843	Akaike info criterion		-4.592173
Sum squared resid	0.025013	Schwarz criterion		-4.512667
Log likelihood	107.6200	Hannan-Quinn criter.		-4.562390
F-statistic	134.5834	Durbin-Watson stat		2.287624
Prob(F-statistic)	0.000000			

# Stationarity of OQ (ovine quantities, monthly series)

Null Hypothesis: OQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.218341	0.0000
Test critical values: 1% level	-3.577723	
5% level	-2.925169	
10% level	-2.600658	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(OQ)

Method: Least Squares

Date: 11/27/18 Time: 21:18

Sample (adjusted): 2014M02 2017M12

Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OQ(-1)	-0.916922	0.147454	-6.218341	0.0000
C	6372.461	1440.315	4.424353	0.0001
R-squared	0.462158	Mean dependent var		110.4681
Adjusted R-squared	0.450206	S.D. dependent var		9521.109
S.E. of regression	7059.718	Akaike info criterion		20.60382
Sum squared resid	2.24E+09	Schwarz criterion		20.68255
Log likelihood	-482.1898	Hannan-Quinn criter.		20.63345
F-statistic	38.66776	Durbin-Watson stat		1.975653
Prob(F-statistic)	0.000000			

# Stationarity of DOQ (dlog(ovine quantities), monthly series)

Null Hypothesis: DOQ has a unit root

Exogenous: Constant

Lag Length: 9 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.975896	0.0002
Test critical values: 1% level	-3.621023	
5% level	-2.943427	
10% level	-2.610263	

\*MacKinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DOQ)

Method: Least Squares

Date: 11/27/18 Time: 21:19

Sample (adjusted): 2014M12 2017M12

Included observations: 37 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOQ(-1)	-5.931327	1.192012	-4.975896	0.0000
D(DOQ(-1))	4.528560	1.123630	4.030294	0.0004
D(DOQ(-2))	3.885377	1.055855	3.679841	0.0011
D(DOQ(-3))	3.202712	0.944408	3.391238	0.0022
D(DOQ(-4))	2.741585	0.810996	3.380516	0.0023
D(DOQ(-5))	2.125303	0.662903	3.206054	0.0035
D(DOQ(-6))	1.753346	0.515785	3.399376	0.0022
D(DOQ(-7))	1.216510	0.356226	3.414993	0.0021
D(DOQ(-8))	0.931763	0.230215	4.047362	0.0004
D(DOQ(-9))	0.589176	0.151692	3.884031	0.0006
C	0.031776	0.096748	0.328440	0.7452
R-squared	0.825591	Mean dependent var		0.015543
Adjusted R-squared	0.758511	S.D. dependent var		1.192631
S.E. of regression	0.586078	Akaike info criterion		2.011044
Sum squared resid	8.930659	Schwarz criterion		2.489965
Log likelihood	-26.20431	Hannan-Quinn criter.		2.179886
F-statistic	12.30749	Durbin-Watson stat		3.121372
Prob(F-statistic)	0.000000			

Stationarity of DOQS11MOD (dlog(ovine quantities, seasonally adjusted, outliers adjusted), monthly series)

Null Hypothesis: DOQS11MOD has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-8.475142	0.0000
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(DOQS11MOD)  
 Method: Least Squares  
 Date: 11/27/18 Time: 21:29  
 Sample (adjusted): 2014M03 2017M12  
 Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DOQS11MOD(-1)	-1.235798	0.145814	-8.475142	0.0000
C	0.003720	0.001221	3.046929	0.0039
R-squared	0.620126	Mean dependent var		7.20E-05
Adjusted R-squared	0.611493	S.D. dependent var		0.012433
S.E. of regression	0.007750	Akaike info criterion		-6.839810
Sum squared resid	0.002643	Schwarz criterion		-6.760304
Log likelihood	159.3156	Hannan-Quinn criter.		-6.810027
F-statistic	71.82803	Durbin-Watson stat		2.140234
Prob(F-statistic)	0.000000			

# Stationarity of PSP (chicken prices, monthly series)

Null Hypothesis: PSP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.017841	0.0404
Test critical values: 1% level	-3.577723	
5% level	-2.925169	
10% level	-2.600658	

\*Mackinnon (1996) one-sided p-values.

## Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PSP)

Method: Least Squares

Date: 11/27/18 Time: 21:14

Sample (adjusted): 2014M02 2017M12

Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PSP(-1)	-0.325687	0.107920	-3.017841	0.0042
C	1394.888	459.8840	3.033129	0.0040
R-squared	0.168320	Mean dependent var		10.02370
Adjusted R-squared	0.149838	S.D. dependent var		224.4313
S.E. of regression	206.9351	Akaike info criterion		13.54431
Sum squared resid	1926995.	Schwarz criterion		13.62304
Log likelihood	-316.2912	Hannan-Quinn criter.		13.57393
F-statistic	9.107362	Durbin-Watson stat		1.841123
Prob(F-statistic)	0.004181			

Stationarity of DPSP (dlog(chicken prices), monthly series)

Null Hypothesis: DPSP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.823080	0.0000
Test critical values:		
1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPSP)

Method: Least Squares

Date: 11/27/18 Time: 21:13

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPSP(-1)	-1.028278	0.150706	-6.823080	0.0000
C	0.002256	0.007490	0.301206	0.7647
R-squared	0.514104	Mean dependent var		1.67E-05
Adjusted R-squared	0.503061	S.D. dependent var		0.071989
S.E. of regression	0.050747	Akaike info criterion		-3.081404
Sum squared resid	0.113314	Schwarz criterion		-3.001898
Log likelihood	72.87230	Hannan-Quinn criter.		-3.051621
F-statistic	46.55443	Durbin-Watson stat		1.966187
Prob(F-statistic)	0.000000			

Stationarity of DPSPS11 (dlog(chicken prices, seasonally adjusted), monthly series)

Null Hypothesis: DPSPS11 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.823080	0.0000
Test critical values:		
1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPSPS11)

Method: Least Squares

Date: 11/27/18 Time: 21:31

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPSPS11(-1)	-1.028278	0.150706	-6.823080	0.0000
C	0.002256	0.007490	0.301206	0.7647
R-squared	0.514104	Mean dependent var		1.67E-05
Adjusted R-squared	0.503061	S.D. dependent var		0.071989
S.E. of regression	0.050747	Akaike info criterion		-3.081404
Sum squared resid	0.113314	Schwarz criterion		-3.001898
Log likelihood	72.87230	Hannan-Quinn criter.		-3.051621
F-statistic	46.55443	Durbin-Watson stat		1.966187
Prob(F-statistic)	0.000000			



Stationarity of PQ (pig quantities, monthly series)

Null Hypothesis: PQ has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.947811	0.0000
Test critical values:		
1% level	-3.577723	
5% level	-2.925169	
10% level	-2.600658	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PQ)

Method: Least Squares

Date: 11/27/18 Time: 21:33

Sample (adjusted): 2014M02 2017M12

Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PQ(-1)	-1.076549	0.180999	-5.947811	0.0000
C	41448.20	7522.068	5.510214	0.0000
R-squared	0.440135	Mean dependent var		2188.298
Adjusted R-squared	0.427693	S.D. dependent var		32689.17
S.E. of regression	24729.67	Akaike info criterion		23.11102
Sum squared resid	2.75E+10	Schwarz criterion		23.18975
Log likelihood	-541.1089	Hannan-Quinn criter.		23.14064
F-statistic	35.37646	Durbin-Watson stat		1.699466
Prob(F-statistic)	0.000000			

Stationarity of DPQS11 (dlog(pig quantities), seasonally adjusted, monthly series)

Null Hypothesis: DPQS11 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-9.461849	0.0000
Test critical values: 1% level	-3.581152	
5% level	-2.926622	
10% level	-2.601424	

\*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(DPQS11)

Method: Least Squares

Date: 11/27/18 Time: 21:33

Sample (adjusted): 2014M03 2017M12

Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DPQS11(-1)	-1.335617	0.141158	-9.461849	0.0000
C	0.002067	0.012694	0.162811	0.8714
R-squared	0.670478	Mean dependent var		-0.001485
Adjusted R-squared	0.662988	S.D. dependent var		0.148242
S.E. of regression	0.086058	Akaike info criterion		-2.025078
Sum squared resid	0.325865	Schwarz criterion		-1.945572
Log likelihood	48.57680	Hannan-Quinn criter.		-1.995295
F-statistic	89.52659	Durbin-Watson stat		2.154337
Prob(F-statistic)	0.000000			