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Economic effects of African swine fever at Hungarian and European level

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A B S T R A C T

Examining the pig sector in Europe, it can be said that the emergence of African swine fever (ASF) has a major impact on the sector. In connection with this, the aim of this article was to highlight the trends of the Hungarian pig sector, as well as the sales prices of Germany for a more accurate analysis, to give a comprehensive picture of how the Hungarian market trends developed with the appearance of ASF.
For this, a three-year cycle was analyzed using different timeline analysis methods. After evaluating this, it was confirmed that compared to the period before the outbreak of the epidemic in Hungary, market fluctuations increased, and in the trends of weekly sales prices per kilogram, the predictability decreased.
Based on this, it can be concluded that in such a globalized and price-tracking sector, it is a serious lesson for Hungary that due to its small size and low degree of integration, it is much more disadvantaged during crisis situations than other larger pig-keeping countries. All participants in the sector need to learn from this situation and, together with the policy, change the situation in Hungary as soon as possible, by raising the vertical integration of the sector.

1. Introduction

Nowadays, the world pig sector can be said to have grown into a comprehensive system due to globalization and various market effects, which is significantly influenced by various political, natural or social factors. These include market regulation measures introduced between major pig-keeping countries, or even changes in consumption patterns. In the present study, I would like to highlight the animal health determinants, including the economic effects of African swine fever (ASF), at European and Hungarian levels.

It can be concluded that the effect and infectivity of the virus are not unknown to the pig sector. However, compared to previous typically territorially isolated cases, there has been a steady spread since the 2007 outbreak in Georgia. Production cycles in the pig sector are typically considered to be longer, so contamination of a farm or even a country can be a significant economic factor, as re-production or exemptions can take years. In addition, an important factor is that an outbreak in a major pig-holding country can even reshape the world market, a good example for this, is China, which is currently emerging with huge import needs due to its infection. As a result of this demand, potential exporting countries typically respond with a rapid realignment of supply, which is reflected in changes in sales prices.

Based on the above factors, the study covers Hungarian market players and one of its leading integrations, as well as Germany, one of the leading pig markets in Europe.

Based on this, it becomes comparable what changes in sales prices cause the appearance of the epidemic, and how this can be managed in terms of successful management.

The main question of the study is thus how the spread and European appearance of ASF had an impact on the sales price of pigs, how certain reports of infection influenced its development. On the

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other hand, what fluctuations were shown before and after the Hungarian appearance in the given time interval, and how this affected the market.

2. Literature review

The virus was discovered and isolated as early as 1910 as a separate disease. By 1957, they had been expelled from Africa and reported cases in Portugal, but they were able to be resolved relatively quickly. (Viñuela, 1985) was rediscovered in 1960, but at that time it could not be eradicated, so it was discovered in Spain in several European pig-keeping countries. The virus disappeared again in 1990 due to processing regulations introduced over the years. The current epidemic broke out in 2007 in Georgia and brought to Europe. Since its announcement there, ASF has, unlike before, grown into a large-scale epidemic that continues to appear in both domestic and wild boar herds. (GOGIN et.al., 2012) Subsequently, the virus was also discovered in the southern part of Russia, a fact that was significant because the concentration of pigs in this region is particularly high and the Ukrainian-Kazakhstan border is also close. The virus has caused significant economic damage to Russian pig farming over the course of a few years. (Sánchez-Cordón et.al., 2018) Based on its investigations, it can be said that the ASF epidemic in Russia caused more than $ 276 million in damage to the sector in 2011. The virus also spread further west, with Poland being one of these countries. Polish pig farming has never been as endangered as it is today (starting in February 2014) as a result of the spread of African swine fever. (PESJAK et.al., 2014). The epidemic has been present in the country ever since, so significant stocks have had to be eradicated recently, which has adversely affected the sector from an economic point of view. This was also supported by the article (TER BEEK, 2019), as the extermination of 8000 individual pig farms in that year has been unprecedented since the outbreak of the present epidemic. Among the infected countries, it is worth highlighting the Czech Republic, where the virus that appeared in the wild boar herd has been isolated and eradicated. There, according to an article by one of the leading professional portals, the last positive case was recorded in a wild boar in February 2018. It is an important fact that with the help of proper demarcation, all cases were discovered within a radius of 89 kilometers and it has now been reached that no positively detectable case can be found in the country (PIG PROGRESS, 2019)

After the initial small-scale impact, it can be said that the event that greatly affected the world market occurred in August 2018. Subsequently, however, the virus spread rapidly among a small number of pig farms with small numbers of animals. On August 3, 2018, China reported the first case of infection in Shenyang City, northeastern China. By 8 October, a total of 33 cases of African swine fever had been reported from eight provinces. (WANG et.al., 2018) After the eruption, a significant food industry disruption occurred in the country, due to a huge drop in the market compared to forecasts, which was caused by other animal protein sources (eg chicken, duck and other meat products). cannot be offset. According to studies, African swine fever currently affects 150-200 million pigs, with an expected 30% loss on the order of 30% higher than the US annual meat output and equal to the annual production of the European Union. (MCCRACKEN et al., 2019) In addition to stock loss, there have also been measurable changes in consumption patterns. It can be stated that both processing and consumption decreased by 10-15% in the first months of 2019. Currently, the selling price of pork is lower, which indicates that supply and demand are in balance, with the result that consumption is falling by an average of 10-15%. (PAN, 2019) An important measure in September last year was that the US and China reduced their protective tariffs, as confirmed by the article below. Referring to economist Dermot Hayes, it can be said that China's counter-duties surpassed $ 8 in the price of each pig sold for a year. In contrast, our competitors face only a 12% tariff on Chinese exports (GLOBAL MEAT NEWS, 2019). According to current sources, China's pig population fell by 41.1% over the same period last year. China is the world's largest pork market in the world, importing 2 million tons of pork in 2018, accounting for 20% of global trade. The ASF epidemic is expected to significantly reduce production in 2019, which could mean a drop of up to 13 million tonnes. To offset this, China will increase total pig imports by 30% this year (IAGETTI, 2019)

In addition to China, in 2018, the virus was also discovered in Western Europe. One of the reports with a significant impact occurred in September 2018, when the disease was discovered in Belgium. The Belgian Food Safety Authority, FASFC, confirmed that a positive sample was found in 2 feral

pigs near the village of Étalle (HOUGHTON, 2018). With regard to intra-European meat trade, there are still barriers to achieving higher sales prices. The impetus came mainly from exports to China, where demand remains high. (THE PIG SITE, 2019)

In the light of the above, significant market changes took place in Hungary as well after the outbreak of the infection. Despite the information and animal health restrictions, the pathogen officially appeared in Hungary on April 21, 2018. Territorially, next to Gyöngyös, 200 km from the Ukrainian border, this is important because there is significant transit traffic in this region. (Náhlik et al., 2018) Following the announcement, export restrictions were introduced in Hungary. As a result, live pig exports fell measurably compared to 2017 volumes. On the other hand, it is an interesting fact that in the summer months of 2018, a decrease in sales prices was observed, however, this trend changed by 2019. "The price explosion of live pigs in April is being followed extremely slowly by changes in consumer prices. In the case of cod, we see a shift first. In August, shrimp cost 9% more and pork legs 13% more in stores than in December 2018. " (ÉDER, 2019). There are several factors that can be observed in the price increase, which can be related to European exports, among others. On the other hand, changes in raw material prices are also important influencers.

From the above-mentioned trends, it can be concluded that the pig sector faces and faces significant challenges both globally and in Hungarian level. The ASF virus is expected to require the eradication of additional swine herds worldwide. From China's point of view, achieving the right supply requires a huge increase in imports, which is already showing its suction effect on the European market. The Hungarian pig sector must also adapt to this market environment, from which it can profit significantly with appropriate decisions. The necessary steps and possibilities are discussed in the further parts of the study.

3. Methodology

The compilation of the data set related to this article was preceded by extensive research work, the aim of which was to cover the widest possible spectrum of data and to make it as comparable as possible.

The source of the basic data was provided on the one hand by the AKI PAIR system, which covers the entire Hungarian free market system, in terms of average sales prices of live pigs, slaughterhouse meat types or even the prices of feed materials. It also provides information on E-base average prices for pigs arriving at slaughterhouses in major foreign markets.

On the integration side, the data were obtained from one of Hungary's leading producer groups. The given Cooperative can be said to be a key player in the domestic pig sector, in addition, the market model keeps in mind efficiency and annual or even longer-term balanced income, predictable average pricing, which is an important criterion for producers.

From this comprehensive database 3 markets were analyzed in this case. On the part of AKI, the German ZMP (central) price, the line forming the weekly average of the Hungarian free market was taken into account. These average prices can be said to be given by the group of pigs arriving at the slaughterhouse in commercial class 'E'. In the case of the Cooperative, the sales price of the capital pigs was included in the analysis in this case also the average price of the commercial categories "E" (55.0-59.9% lean meat) was calculated due to the exact comparability.

In the case of setting the time interval, the interval between the 1st week of 2018 and the 5th week of 2021 was determined, as thus all market trends (including today's market conditions) could be assessed from the domestic appearance of African swine fever.

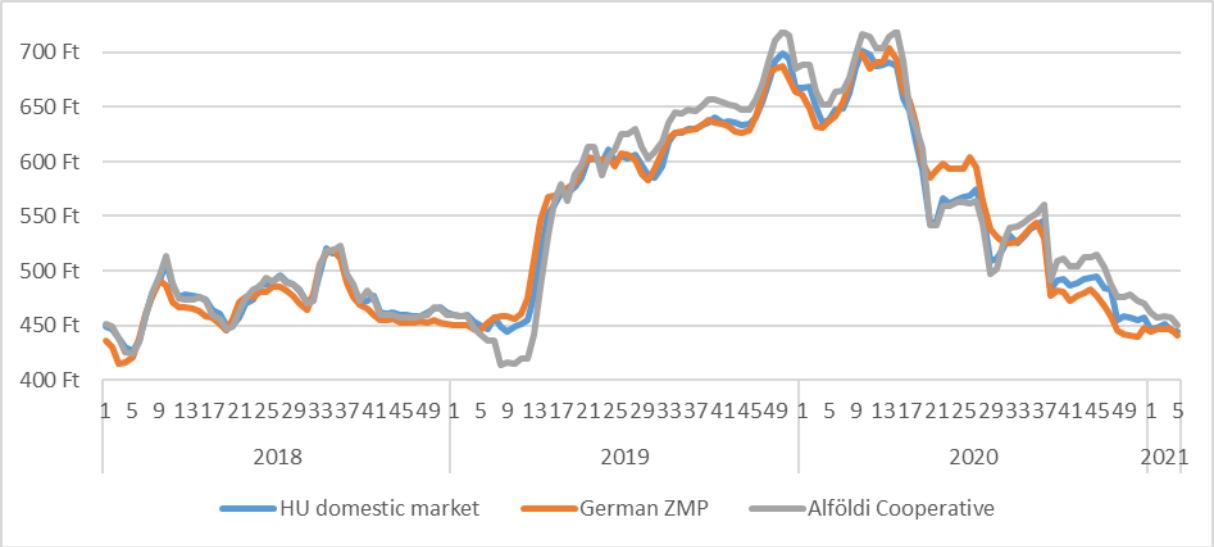

Figure 1: Development of sales prices covering the period (2018 - 2021) in the given markets (HUF / kg)

The prices, as mentioned in the weekly period, are included in the database they were evaluated with Microsoft Excel. Examining the curves 3 sections were separated, to which I fitted separate trend lines. Subsequently, it was possible to draw further conclusions using simple statistical indicators such as variance, standard deviation and coefficient of variation.

(BROWN, 1998) The coefficient of variation can be considered a useful statistical coefficient, as it allows the comparison of variables without scale effects, in a form without dimension. A result in excess of 30% in value proves to us that the data are either erroneous or out of control in the experiment. Furthermore, in the present study, it is important to interpret the 10% limit, which indicates homogeneity. 4. Results and discussion

The above summarizing figure 1 could be divided into 3 sections for more accurate evaluation. The first phase covers the timeline from week 1 of 2018 to week 12 of 2019, where the impact of the period before the outbreak of African swine fever and the market changes following the notification can be assessed. The second phase took place between the 13th week of 2019 and the 15th week of 2020, here the longer-term effects of the emergence of domestic ASF could be traced, and the effects of significant world market disturbances could also be observed in this phase. The last section presents the period between the 16th week of 2020 and the 5th week of 2021, here some markets are already experiencing an adjustment but later it will be proved that the market disturbances still exist here.

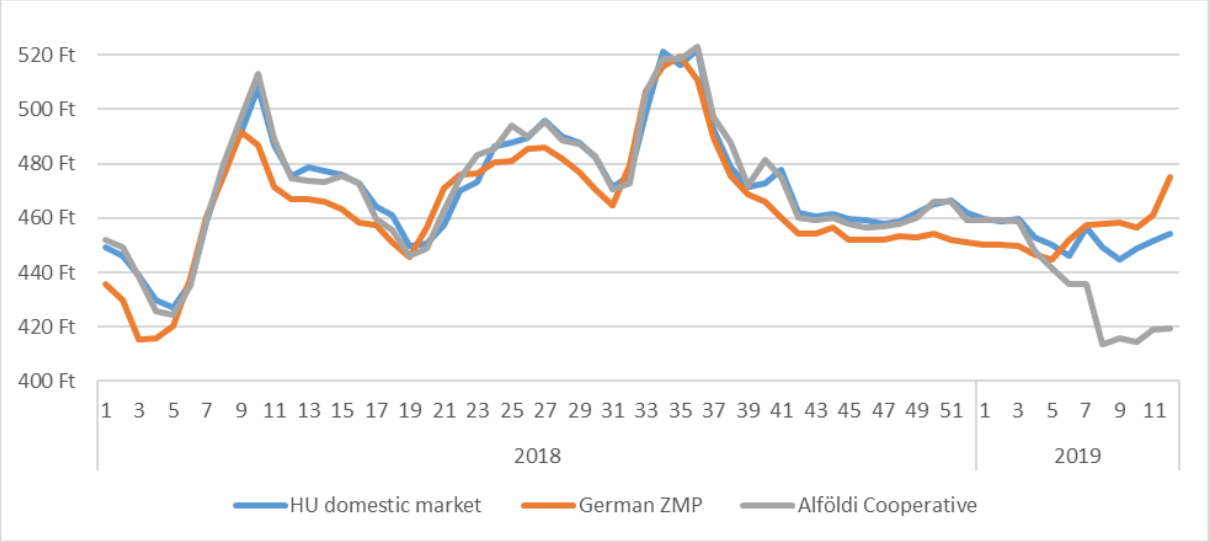

Figure 2: Development of weekly average prices in the examined markets between the 1st week of 2018 and the 12th week of 2019

Table 1: Statistical indicators for the first phase

	HU domestic market	German ZMP	Alföldi Cooperative
Standard deviation	20.43	20.90	26.04
Mean	468.42	463.42	465.50
Coefficient of variation	4.36	4.51	5.59
Variance	417.26	436.97	678.26

Table 2: The result of the trend analysis of the first stage

	HU domestic market	German ZMP	Alföldi Cooperative
R^2	0.013	0.017	0.0879
Trend function	y = -0.1267x + 472.53	y = 0.0456x + 461.94	y = -0.4146x + 478.97

Looking at the first section it is clear that we get a relatively balanced curve based on the data. However the fluctuations in it can already be linked to the Hungarian appearance of ASF.

It can be stated that, taking into account the developments in the world market and Romania, the Hungarian slaughterhouses concluded their contracts from the beginning of 2018 by stipulating a 1-month moratorium in case of the domestic appearance of ASF. This fact also had some effect on the initial data, and then the usual market trend can be observed, which supports the demand-increasing effect of the summer period, however, on April 21. 2018, the infection was discovered in a dead wild boar in Heves county. The immediate effect of this can be clearly seen in the figure with a significant decrease in the curve from the given week 16 to week 19 and the said moratorium also came into force.

Another major leap in the curve is caused by the fact that on August 3. 2018, China announced the emergence of the infection in several provinces, which caused significant stock cuts, thus reshaping world market demand trends. Figure 2 above also illustrates the price changes of this period well.

Looking at Table 1-2 it can be clearly seen that the fluctuations of the average price values can be considered relatively stable during this period the coefficient of variation is also around 5%, which shows a homogeneous time series at this stage of the study. The value of R^2 also proves to us that, based on the trend analysis a steady increase in steady fluctuations can be observed in the data of the first stage.

However, based on previous studies, it is important to examine why the results obtained in the case of the Cooperative are so compared to other markets. This may be answered by the fact of the embargo mentioned earlier, after which a price reduction was applied in the contracts of its largest slaughterhouse partners in order to reduce the loss. This factor also played a significant role in terms of revenue and market homogeneity.

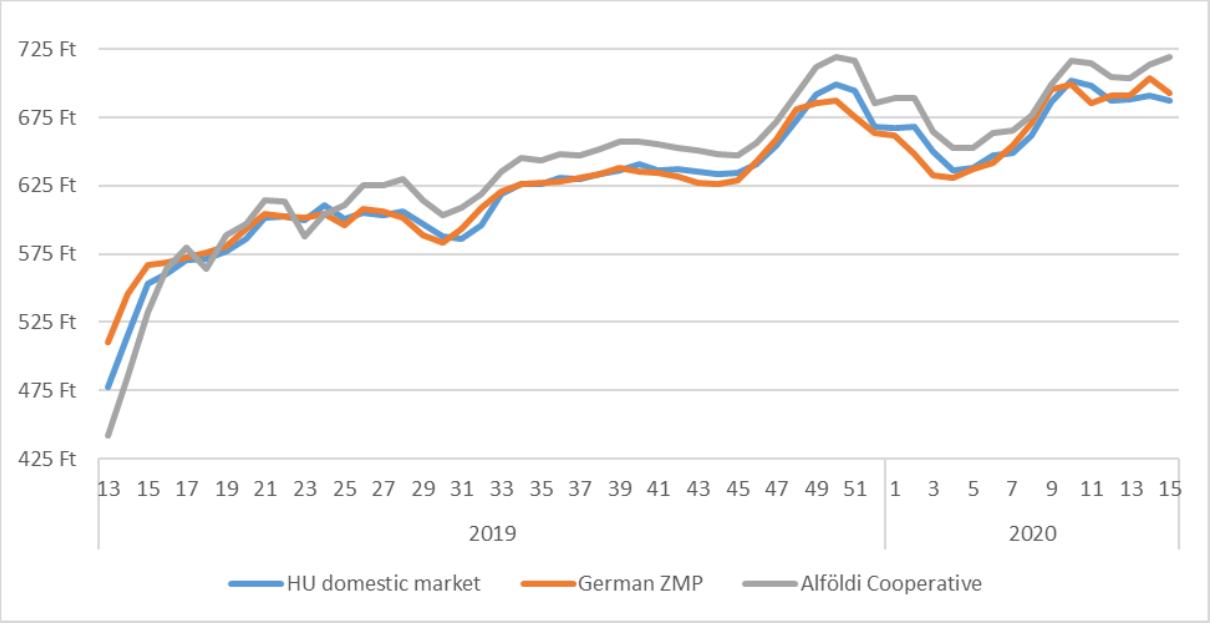

Figure 3: Development of weekly average prices in the examined markets between the 12th week of 2019 and the 15th week of 2020

Table 3: Statistical indicators for the second phase

	HU domestic market	German ZMP	Alföldi Cooperative
Standard deviation	47.04	42.40	56.47
Mean	629.31	629.76	642.40
Coefficient of variation	7.48	6.73	8.79
Variance	2213.02	1798.07	3189.03

Table 4: Results of the second stage trend analysis

	HU domestic market	German ZMP	Alföldi Cooperative
R^2	0.8013	0.8284	0.7585

Trend function	y = 2.6285x + 555.72	y = 2.409x + 562.31	y = 3.0698x + 556.44

Examining Section 2 of the timeline it is clear that market trends show a significant change. Here, the value of all indicators is more prominent than that of the previous period. However, the value of the coefficient of variation still shows a homogeneous level, increasing to 7-8% compared to the previous value of around 5%. The value of R^2 also shows a significant upward trend, which may be due to the fact that the loss of stock in the Chinese market is gaining ground on the world market due to the increasing number of infected areas appearing there. This effect also indirectly affected Hungary, as well as the values of the German market.

In this case too the question arises as to why the Cooperative's indicators are developing as described above. There are several explanations for this. On the one hand the loss-minimizing effect can still be observed in the contracts of large Hungarian slaughterhouses which is also reflected in the price deduction here. It should be noted that the free market is less confronted with this factor due to its shorter-term contracts. On the other hand, as evidenced by the average price line, the cooperative increased its export activity in the previous year, but at that stage it reached a volume that is measurable in its revenues.

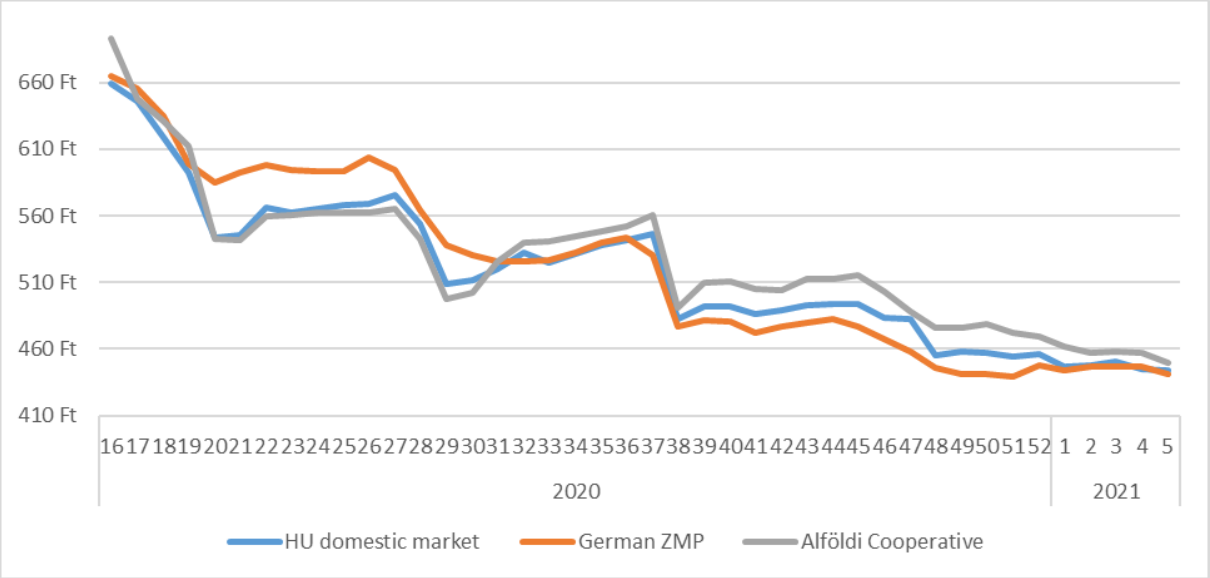

Figure 4: Development of weekly average prices in the examined markets between the 16th week of 2020 and the 5th week of 2021

Table 5: Statistical indicators for the third section

	HU domestic market	German ZMP	Alföldi Cooperative
Standard deviation	55.15	67.19	53.33
Mean	517.25	520.44	526.29
Coefficient of variation	10.66	12.91	10.13
Variance	3041.32	4514.18	2843.30

Table 6: Results of the third stage trend analysis

	HU domestic market	German ZMP	Alföldi Cooperative

R^2	0.864	0.9228	0.7653
Trend function	y = -4.1785x + 607.09	y = -5.2611x + 633.55	y = -3.8028x + 608.05

In the case of the third stage it can be said that its examination revealed tendencies that were almost non-existent in the time series analyzes of the pig sector so far. An example of this is the value of the coefficient of variation, which is above the homogeneous value of 10% for the whole period. In addition, it reaches almost 13% in the German market. These are also supported by the trend analysis as for all functions the parameter b_1 was negative which shows a significant decrease for us.

It can be said about this period that the year 2020 started very well as the prices of capital pigs were over HUF 500 / live kg, the demand was particularly strong. Restrictions imposed due to the COVID-19 epidemic interrupted this process. By the 20th week, capital pig prices had fallen to HUF 410 / kg live, but the biggest problem was that the number of slaughterings had fallen drastically due to the outage of the HORECA sector.

In the summer months, the situation slowly returned to normal, the market reached equilibrium, the price of 420-430 HUF / kg of live pigs was realized. However, in September 2020, Germany reported ASF infection in the wild boar herd. Following the notification, German exports to the Far East were restricted. As a result, prices began to fall across Europe. By the 38th week it was close to 390 HUF / live kg, then in the 48th week it reached its lowest point (this time fell in the 4th week before Christmas) to 360 HUF / kg, which did not change until the end of the year. This trend continued in early 2021.

It can be considered an important fact that in the test results and values mentioned in the previous sections, the cooperative achieved an advantage in the given case. This is due to the fact that the previously mentioned export strategy showed its impact on this year so the impact of the world market and the decrease in demand for the coronavirus epidemic also became somewhat offset.

The above findings are supported by previous studies. They all found that as a result of the ASF infection, the costs of some producers increased, on the one hand, which is relevant to us, that their incomes decreased, and on the other hand, they became less predictable. (FASINA et al., 2011)

Based on the given study, it is worthwhile to analyze the effects of ASF from several aspects in the future, either to examine several markets or the relationship of different actors within a given market in relation to the infection. In addition, over time, with the expansion of the amount of data, it will be possible to include even more accurate measurements, as well as new test methods.

4. Conclusion and Recommendations

From the above it was concluded that the domestic market was significantly affected by the domestic appearance of the ASF epidemic. As from the producer's point of view, in addition to the decrease in demand, the transformation of market channels also caused sales difficulties. The reason for this was that several market participants also served the Far Eastern demand, which became inaccessible with the domestic appearance of ASF, on the other hand, leading European producers in several cases drained their accumulated stocks on the Hungarian market, which caused further market disturbances.

Examining the impact of ASF from the point of view of processors it can be stated that the management of major slaughterhouses in Hungary was greatly endangered by higher risk-taking, which was reduced by price deductions and corresponding contracts.

Based on these it can be concluded that the domestic impact of the ASF epidemic is clearly measurable in the examination of sales prices, be it free market participants or a horizontal integration. In addition, the last section of the time series under study also shows how exposed Germany, as one of the leading pig-keeping countries in Europe, is to the effects of the epidemic, which then collapses in price-following markets.

Furthermore, it is worth highlighting at the cooperative with a well-thought-out strategy how to reduce market disturbances in its own activities. As presented, the identified export market potential for the final stage indicators was a significant improvement over the other two markets, both in terms of the higher average sales price they achieved and in terms of time series homogeneity.

In conclusion, I would certainly like to emphasize that the study has once again demonstrated the impact of full globalization on the world's pig sector. This is supported by the fact that a pandemic affects all pig-holding regions of the world to some degree. A serious lesson for Hungary is that due to the size of its production and the low degree of integration, it finds itself in a much more disadvantaged situation during crisis situations than other larger and more developed pig-keeping countries. All actors in the sector need to learn from this situation and, together with the policy, change the situation in Hungary as soon as possible, ie raise the vertical integration of the sector to the level of Europe's model countries (eg Spain).

The above has been confirmed by several studies, which have found that ASF is currently the main threat in the European pig sector. This can only be offset if a comprehensive regulation eliminates the infection from Europe, as has been the case in the past. (JURADO et al., 2018)

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