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THE FISCAL IMPACT OF AFRICAN SWINE FEVER INCIDENCE: A CASE STUDY OF THE CZECH REPUBLIC

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Abstract

African swine fever (ASF) is a viral disease of domestic pigs and wild boars of all breeds and ages similar to classical swine fever. In infected animals, it causes a wide range of clinical symptoms, and is characterized by a high, almost 100% lethality. Because of the potential transmission of infection from wild to domestic pigs, ASF has serious budgetary and economic consequences. The State Veterinary Administration announces Extraordinary Veterinary Measures and announces closed surveillance zones in which the movement of people, animals and agricultural products is restricted. At the same time, compensation is paid for a wild boar shot or a found dead that is tested for the presence of ASF. The first occurrence of ASF in wild boars in the Czech Republic was confirmed in 2017 and subsequently in 2018, a total of 230 boars. After a subsequent period without proven infection, the virus was recorded again in 2023. In this year, 3 300 clinical tests have been done and 59 occurrences of ASF were proven and more than EUR 965 thousand were paid out in compensations. In terms of compensation costs, ASF is one of the most most expensive disease after Avian influenza and Salmonellosis in poultry. Breed pigs on 232 farms were also continuously clinically tested, but the ASF virus was not proven in commercial farms. Due to the unfavorable disease situation especially in the surrounding countries and the free migration of animals, careful veterinary supervision is still required.

Keywords

African Svine Fever, Wild Boar, Domestic Pigs, Infectious Diseases, Costs

I. Introduction

African swine fever (ASF) is a viral disease of domestic and wild pigs of all breeds and ages similar to classical swine fever. In infected animals, it causes a wide range of clinical signs, depending on the virulence of the virus it can cause a peracute, acute, subacute or chronic form. *ASF* is characterized by high, almost 100% lethality. The original area of occurrence of *ASF* is sub-Saharan Africa. The natural reservoir of the virus in Africa is the warthog, the African brush hog and the forest pig (Hayes et al, 2021). Another reservoir of the virus and at the same time a carrier of the disease are large oval mites - ticks from the genus *Ornithodoros. ASF* is a reportable infection. *ASF* is not transferable to humans and does not exist (Halasa et al, 2016). The disease was introduced to the European Union from Asia. In 2007, *ASF* was confirmed in Georgia, and from there the infection gradually spread to Armenia, Russia, Azerbaijan, Ukraine, and Belarus and Moldova. In January 2014, the first case of *ASF* occurred in Lithuania, and this year the infection also spread to Latvia, Estonia and Poland. In the Baltic States (Estonia, Latvia and Lithuania) and Poland, *ASF* has not been eradicated in any of these countries so far (Cwynar et al, 2019). In the Baltic states, ASF covers practically the entire territory of these countries and occurs in both wild and domestic pigs (O´Neill, 2020).

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The disease can be spread through direct contact with an infected animal or the carcass of an animal that has died of *ASF*, as well as through raw or undercooked products and waste containing infected pork or contaminated materials, feed, litter, manure, vehicles, footwear, clothing and vectors. Recently, however, humans and their activities (international trade, travel) have become the greatest risk of long-distance spread (Bosch et al., 2016; Galindo et Alonso, 2017).

In 2023, *ASF* was reported to the European Animal Disease Information System (ADIS) from a total of 15 European countries, including 11 EU member states (Bulgaria, Czech Republic, Estonia, Italy, Lithuania, Latvia, Hungary, Germany, Poland, Romania and Slovakia) and Ukraine, Serbia, Moldova and North Macedonia. During 2023, compared to 2022, there was a significant reduction in the number of ASF outbreaks in domestic pig farms, as well as a significant reduction in the number of positive findings in wild pigs. In total, 536 *ASF* outbreaks in domestic pig farms were reported in 2023 (1 856 outbreaks in 2021) and 7 306 positive *ASF* findings in feral pigs; 12 036 cases in 2022 (ADIS, 2023).

The Czech Republic is among the countries that managed to cure animal farms from a number of diseases still occurring in other countries of Europe or the world. With the help of breeders and the consistent supervision of the State Veterinary Administration, the Czech Republic manages to maintain a good infection situation. Country statuses are granted by the European Commission and the World Organization for Animal Health (WOAH formerly OIE). Thanks to these statuses, animal breeders and traders today have favorable conditions for their business activities from the point of view of diseases, and thus lower financial costs (losses) in the fight against these diseases (SVA, 2023).

Not only animal health, but also the protection of animal well-being (welfare) has a long-standing historical basis in the Czech Republic and has recently become one of the main societal issues. It does not only concern the provision of the correct husbandry requirements for farm animals, but over time and with the development of society, it also began to be significantly addressed in the field of hobby breeding, in shelters for stray and abandoned animals, in circuses, in zoos and other facilities for animals (SVA, 2023).

The European Commission of the Czech Republic granted the status of a country officially free of the following diseases: *bovine tuberculosis, bovine brucellosis, bovine and caprine brucellosis, enzootic bovine leukosis, bluetongue, rabies, Aujeszky's disease* in domestic pigs, *infectious anemia of salmonids*, and *infectious bovine rhinotracheitis* (EC, 2023).

From the World Organization for Animal Health, the Czech Republic obtained the status of a country free of *foot-and-mouth disease, African horse sickness, plague of small ruminants, classical swine fever, rinderpest*, and for *bovine spongiform encephalopathy*, the Czech Republic achieved the highest possible status of negligible risk. Unfortunately, seven years ago *ASF* has occurred on the north of the Czech territory (WOAH, 2023; SVA, 2023).

A total of 36 peer-reviewed articles were found, in English, which presented their own economic analysis (Vienna et al, 2020).

Knowledge about the economic consequences of *ASF* can better inform effective allocation of resources for disease prevention and potential response (Dixon et al, 2019). Economic analyses have been carried out in regions around the world since at least the late 1970s; however, there has yet to be a rigorous meta-analysis or review of either the economic literature for *ASF* in more than 10 years. Knight-Jones and Rushton (2013) provide an extensive table of existing cost–benefit analysis studies of control and eradication programs as a part of their original economic analysis (Knight-Jones et Rushton, 2013). However, the paper does not specifically function as a scoping or systematic literature review. Bennett and IJpelaar (2005) also carried out a review of 34 endemic diseases to Great Britain where they outlined new developments in economic analysis and updated disease cost estimates (Hess, 2019); however, they did not report a table of all findings and briefly summarize results with no mention of *ASF* (Bennett et IJpelaar, 2005). While acknowledging that many

economic evaluations of non-zoonotic animal disease programs have been carried out on an ad hoc basis, Perry and Grace (2009) conclude that the varying diseases, methodologies and results make it difficult to draw general conclusions or compare diseases (Perry et Grace, 2009). It should also be noted that most of these studies have been carried out in developed countries and those from developing counties rarely consider the differential impact on the poor (Perry et Grace, 2009).

African Swine Fever – the current status in the Czech Republic

On June 26, 2017, the first occurrence of *ASF* in the wild pig population was confirmed in the Czech Republic. Investigations carried out at the State Veterinary Institutes in cities Olomouc and Jihlava proved infection in two pieces of dead wild pigs found on 21 and 22 June in the cadastral territory of Priluka near Zlín in the Zlín Region. Timely capture of *ASF* was made possible by comprehensive monitoring, within the framework of which since 2014 all found dead wild pigs have been investigated for *ASF* throughout the Czech Republic.

Immediately after the confirmation of this dangerous disease, in accordance with the legislation of the Czech Republic and the EU, the State Veterinary Administration (SVA) issued extraordinary veterinary measures (EVM) aimed at preventing the spread of *ASF* in the wild pig population and, in particular, to prevent the introduction of *ASF* into domestic pig farms, its gradual suppression and final eradication. The so-called infested area (IA) was defined and measures were established in this area. The entire district of Zlín (1 033 km^2) was designated as an IA, the so-called high-risk area was defined within the IA.

In addition to the immediate delimitation of the IA on a sufficiently large area, among the essential measures taken were the regulation of hunting (including its complete ban in the IA in the initial phase of the spread of *ASF* and cooperation with the Police of the Czech Republic in a later phase), a ban on feeding and limiting the baiting of wild pigs, the regulation of intensive searches and removal of wild boar carcasses, restriction of wild boar migration from and to the protected area (using electric and odor fences and leaving part of the unharvested crops as a food source), demarcation of the area with intensive hunting around the protected area and, of course, continued intensive monitoring of *ASF* throughout the Czech Republic. All wild boars caught in the IA and in the intensive hunting area, as well as all dead wild boars found, were examined at the *ASF* and disposed of under strict biosecurity conditions.

At the same time, breeders of domestic pigs in the IA were ordered to carry out an inventory of all categories of pigs kept on the farm, and the rules of biological safety of farms were established, in particular the prevention of contact between domestic pigs and wild pigs, the use of disinfectants at the entrances to the farm, reporting of deaths and sick pigs suspected of *ASF*, control of all movements of pigs, obligation to report domestic slaughter of pigs. Inspections focused on compliance with biosecurity principles were implemented in pig holdings; in the infested area, they also included taking samples for laboratory examination for *ASF* in accordance with the legislation. A ban on feeding kitchen waste to domestic pigs was issued throughout the Czech Republic.

By consistently applying the measures taken, it was possible to prevent the spread of *ASF* infection in the wild pig population and the introduction of *ASF* into domestic pig farms.

II. Material and methods

The issue of costs associated with the occurrence and suppression of infectious diseases of wild and farm animals in general stands on the edge of their legal regulation and economic impact on public budgets. This also applies to the current incidence of *ASF* in the Czech Republic. The main method used was therefore the assessment of legislation, i.e. legal acts, decrees and implementing regulations, and their application to the occurrence of *ASF* in the Czech territory. Furthermore, the relevant EU legislation was analyzed and compared with the relevant legislation of the Czech Republic.

A concurrent method of economic evaluation was an in-depth analysis of statistical data related to the costs of *ASF* eradication in the Czech Republic; this information was provided by the Ministry of

Agriculture of the Czech Republic (Saksún, 2023). Subsequently, the data was related to individual items of cost compensation in the application of EVM, as stipulated by the Veterinary Act.

In the case of *ASF*, the total costs according to the Veterinary Act included the costs of monitoring the infectious situation, serological and virological examinations, the costs of setting up and guarding protective zones, surveillance zones and other limited zones and compliance with the measures during the specified period of observation before the end of emergency veterinary measures.

Compensations and reimbursements for shot and found pieces of wild pigs and their carcasses were calculated in three areas:

- IA directly in the area of occurrence of the shot pig or its carcass,
- in the closed zone I (CZ I) and subsequently also
- in the closed zone II (CZ II).

SVA defined CZ I within a radius of 3 km from the focus of the *ASF* infection, so it has an area of approximately 30 km^2. CZ II is then defined within a radius of 10 km from the outbreak, so it has an area of approximately 314 km^2.

The main component of costs is financial compensation paid in connection with the shooting of wild pigs by members of the Hunting Association of the Czech Republic, as well as compensation paid for dead and found carcasses of wild pigs cumulatively in IA, CZ I and CZ II.

The analysis presented in this article covers the period from the beginning of 2017, when the first occurrence of *ASF* was confirmed in the Czech Republic, until the end of 2023. The content and method of the work follow on from previous articles by the authors, which were devoted to this issue and were already published (Pospisil, 2022).

III. Results

The first occurrence of *ASF* was recorded at the end of June 2017. A total of 205 positive cases of *ASF* in wild pigs were diagnosed from 26 June 2017 to 31 December 2017, of which 191 cases were found dead and 14 cases were shot wild pigs. All positive cases were detected only in a small part of the IA region.

Favorable developments continued in 2018. By consistently applying the prescribed veterinary measures, it was possible to keep the *ASF* infection in the same territory without further spread. Based on the results of the monitoring and the favorable development of the epidemiological situation, the infested area was reduced from 1 February 2018. The result of the SVA's cooperation with hunters and the police of the Czech Republic in hunting wild pigs in the infested area was the reduction of the number of wild pigs in this area to a minimum. During 2018, the number of caught and found dead wild pigs decreased, but the number of positive cases decreased significantly. For the entire year 2018, only 25 positive cases of *ASF* in wild pigs were diagnosed, of which 21 cases were found dead and 4 cases were shot. The last positive case in a shot wild pig was detected on February 8, 2018, and in dead wild pig found on April 15, 2018 - but in this case it was a 5-6 month old carcass, which means that the infection and death already occurred at the end of 2017 or at the beginning of 2018. All other examinations as part of the ongoing intensive monitoring of both wild pigs and domestic pig farms were negative.

The favorable development of the situation continued in 2019 as well. Intensive monitoring of *ASF* continued both in wild pigs (all found dead wild pigs in the entire territory of the Czech Republic, all wild pigs caught in IA and areas with intensive hunting) and in domestic pigs (all litters, suspected dead pigs, mass deaths of pigs). In all cases, the examination for *ASF* was negative. On the basis of the area-wide monitoring of *ASF* and its results, all areas of the Czech Republic were exempted from Part I and Part II of the Annex to Commission Implementation Decision 2014/709/EU by the European Commission's implementing decision (EU) 2019/404 of 12 March 2019. With this decision, the EC officially recognized that the Czech Republic has successfully completed

the eradication of *ASF* on its territory and continues to be considered an *ASF*-free member state. Subsequently, the World Organization for Animal Health-OIE restored the status of a country free of *ASF* on 19 April 2019 by publishing the self-declaration of the Czech Republic on the WOAH website (WOAH, 2019). In connection with the completion of the eradication of *ASF* in the Czech Republic on March 14, 2019, the SVA canceled the infested area and the area with intensive fishing and with it the measures that applied to them. Thus, only some measures valid for the entire territory of the Czech Republic remained in force.

After more than 4 years, the reappearance of *ASF* in the Czech Republic was proven in December 2022. For the entire year 2023, SVA recorded 59 positive cases of *ASF* in the wild pig population. The same infection was also confirmed in an individual caught in Ceskolipsko. The last confirmed dead piece was found in the cadastral territory of the municipality of Visnova. This is the first positive finding since mid-August 2023. Although the Czech Republic was successful in suppressing and eradicating *ASF*, the risk of its possible reintroduction to Czech territory continues

As of October 3, 2023, the SVA amended the EVM for the suppression of *ASF* valid for the CZ I. Hunters will be able to move animals caught in the CZ I outside this zone without a veterinary certificate. The change should bring a slight simplification of the hunters' agenda and slightly reduce their costs for issuing veterinary certificates during the move.

The announcement of the move and the move itself will only be possible after receiving a satisfactory result of the laboratory examination of the caught piece for *ASF*. The notification can be used for all legal ways of using wild boar, i.e. both for the hunter's and his household's own consumption, and for delivery to a retail store or catering establishment. On the contrary, it cannot be used in the case of delivery to a processing facility outside the CZ I (restaurant or purchase). In this case, a veterinary certificate will still be required. In the case of movements within the CZ I, there is no need for a notification or a veterinary certificate, with the exception of delivery to a game plant. It should be emphasized that venison delivered to venison plants, including venison buyouts, must come exclusively from registered or approved and registered establishments in the long term. Meat from wild pigs that have been stored in domestic conditions cannot be added to them.

Closed zones I – II of areas with ASF occurrence

Areas with the risk of *ASF* virus occurrence are divided into CZ I to II, and in each of them there are restrictions on the handling of caught black game, its meat (venison) and products from this meat.

In closed zones (i.e. also within the zone), a general prohibition applies to the movement of all products originating from wild pigs. Legislation allows the Regional or Central SVA to grant the following exceptions to this prohibition:

- zone II may not leave wild boars caught here or their unprocessed meat,
- the direct sale of caught pigs and their meat by the hunter to the final consumer is also prohibited here,
- only venison from hunted black game that has been tested for *ASF* with a satisfactory result can be used for human consumption, namely:
    - from CZ I, unprocessed game from black game or products from it, produced by normal technological procedures, may be placed on the market, but game and products may not leave the territory of the Czech Republic,
    - CZ II and outside – unprocessed venison from black game can only be used for private consumption in the household of a hunter or an authorized hunting participant in the territory of the closed zone in which the pig was caught,
    - from CZ II and outside, only meat products produced by special processing methods that ensure the mitigation of the risk of *ASF* transmission by these products can be taken out. Such processing must take place in an approved and designated establishment and the products can then be marketed throughout the EU,

- it is possible to export from the Czech Republic only meat products produced by specially designated processing methods that ensure the mitigation of the risk of transmission of *ASF* by these products. Such processing must take place in an approved and designated business.

Costs related to ASF occurrence

For the whole year, *ASF* was detected in 59 wild pigs. The SVA immediately after the confirmation defined the IA and ordered the EVM to prevent the spread of the disease. CZ I was defined around the zone of infection on 20 January 2023 within a radius of 3 km, and a week later it was extended to CZ II, i.e. within a radius of 10 km around the proven infection.

The following tables show an overview of the incidence of ASF in 2023 in zones IA, CZ I and CZ II: examined and positive wild pigs. The right column cumulatively and sequentially loads the cases during the year as they were registered. Zones CZ I and CZ II are reported together, but are divided into wild pigs found dead (Table 2) and wild pigs shot (Table 3) by members of the Hunting association of the Czech Republic. Due to the relatively high number of occurrences, cases are reported monthly as positive *ASF* incidence occured.

Table 1 Number of wild pigs found dead in IA in 2023

	Number of dead/killed wild pigs found according to the examinations carried out SVA: Frydland and Ceskolipsko			
	Virology Epl 402		Serology Epl 412	
2023	Examined/*Positive*	Cumulative/*Positive*	Examined/*Positive*	Cumulative/*Positive*
January	-	2/*2*	-	1/*0*
May	1/*0*	3/*2*	-	1/*0*
June	-	3/*2*	-	1/*0*
∑	***3/2***		***1/0***	

Source: SVA; 2023

The relatively small number of found dead wild pigs is caused by their registration directly in IA, which means directly in the very small area focus of ASF infection.

Table 2 Number of wild pigs found dead in CZ I and CZ II in 2023

	Number of found dead wild pigs according to the following EVM SVA: Frydland and Ceska Lipa			
	Virology Epl 405 and 406		Serology Epl 415 and 416	
2023	Examined/*Positive*	Cumulative/*Positive*	Examined/*Positive*	Cumulative/*Positive*
March	-	7/*6*	-	1/*0*
April	3/*2*	10/*8*	-	1/*0*
May	7/*7*	17/*15*	6/*0*	7/*0*
June	29/*22*	46/*37*	10/*0*	17/*0*
July	5/*2*	51/*39*	7/*0*	24/*0*
August	9/*2*	60/*41*	5/*0*	29/*0*
Septemb.	10/*1*	70/*42*	8/*1*	37/*1*
October	7/*0*	77/*42*	6/*0*	43/*1*
Novemb.	4/*0*	81/*42*	3/*0*	46/*1*
Decemb.	2/*0*	83/*42*	1/*0*	47/*1*
∑	***83/42***		***47/1***	

Source: SVA; 2023

The above table shows that *ASF* infection was detected in 35 % of dead found wild pigs. Due to overpopulation and subsequent damage to agricultural production and also the imminent danger of collision with cars, as well as to prevent and eradicate the occurrence of *ASF*, the shooting of wild pigs is permitted in the Czech Republic all year round. The following table shows the number of *ASF* positive wild pigs hunted and shot.

Table 3 Number of wild pigs shot CZ I and CZ II in 2023

Date	Number of shot wild pigs SVA: Frydland and Ceska Lipa			
	Virology Epl 505 and 406		Serology Epl 515 and 516	
2023	Examined/*Positive*	Cumulative/*Positive*	Examined/*Positive*	Cumulative/*Positive*
March	-	80/*1*	-	1/*1*
April	28/*0*	108/*1*	-	1/*1*
May	28/*0*	136/*1*	-	1/*1*
June	17/*2*	153/*3*	1/*0*	2/*1*
July	27/*0*	180/*3*	-	2/*1*
August	65/*4*	245/*7*	2/*2*	3/*2*
Septemb.	80/*1*	325/*8*	3/*1*	6/*3*
October	83/*1*	408/*9*	1/*1*	7/*4*
Novemb.	75/*1*	483/*10*	-	7/*4*
Decemb.	74/*0*	558/*10*	-	7/*4*
∑	**558/*10***		**7/*4***	

Source: SVA; 2023

This table shows that *ASF* infection was detected in 2,5 % of shot wild pigs. The generally lower incidence of the *ASF* virus is probably caused by the fact that wild pigs were not shot intentionally for *ASF* eradication, but also for other reasons. It is generally about the regulation of the population of wild pigs, the protection of agricultural crops, but also for meat by members of regional hunting associations.

The following table shows the amount of compensation paid for a wild pig shot or found dead in individual months in CZ II and CZ I.

Table 4 Financial compensations for shot and found dead wild pigs in 2023 (EUR thousand)

Date	CZ II shot pigs	CZ I shot pigs	CZ II dead pigs	CZ I dead pigs
March	2.1	1.7	0.5	0.3
April	6.6	6.5	0.7	0.3
May	9.4	10.6	2.4	0.4
June	11.3	16.5	4.5	0.4
July	12.2	23.9	7.7	1.0
August	15.0	41.2	11.2	2.2
September	32.4	106.5	22.2	6.7
October	28.7	105.9	20.9	7.7
November	37.6	100.1	18.8	7.3
December	34,6	94,8	17.7	7.0
∑	189.9	507.7	106.6	33.3
∑ all pigs 2023 CZ II + CZ I		**837.5**		

Source: SVA; 2023

Compensation paid for wild pig shot or found dead changed during the outbreak of *ASF* in the Czech Republic. Although the first occurrence of *ASF* appeared in the Czech Republic already in 2017, compensation for wild pigs shot or found dead was paid from 1 January 2023. At the time of the first occurrence the compensation was EUR 120 for one wild pig, subsequently the amount was reduced to EUR 40. Finally the amout was set at EUR 80 from September 13, 2023 and is valid until today. This is also the main reason why the amounts of compensation paid fluctuate over time, as shown in Table 4.

The analysis in this article begins in 2017, when the first occurrence of *ASF* in wild pigs was recorded in the Czech Republic. A total of 205 cases were proven in 2017 (191 found dead and 14 shot). Subsequently, 25 cases were proven in 2018 (21 dead pigs and 4 shot pigs). This was a period when the compensations paid amounted to EUR 120 per one wild pig, so the total compensations in these two years amounted to EUR 27 600.

The primary and priority reason for eradicating *ASF* disease is to protect domestic pigs both in small breedings and on large farms. The following table shows the number of domestic pigs examined for *ASF* in the whole Czech Republic since the outbreak of the disease in 2017.

Table 5 Number of domestic pigs and number of farms examined on ASF

Number of domestic pigs and farms of all sizes examined on ASF			
Dead domestic pigs/ *Positive*	Aborted pigs/ *Positive*	Total examined/ *Positive*	Number of examined farms/ *Positive*
1 665/*0*	**962/*0***	**2 627/*0***	**232/*0***

Source: SVA; 2023

As can be seen from the research results above, *ASF* is a disease occurring in the Czech Republic only in wild pigs. Domestic pig farms are *ASF*-free. The adopted provisions of the EVM have so far effectively prevented the spread of *ASF* to commercial and domestic farms of all sizes.

From 2017 to the end of 2023, approximately 3 300 *ASF* tests were carried out both in wild and domestic pigs, i.e. over 23 100 tests in total for the entire monitored period. Tests are usually supplied in sets of 100 pieces and according to the current price lists, commonly used sets cost around EUR 500, i.e. one test costs around EUR 5. The material costs for the conducted testing for the monitored period thus reached the amount of approximately EUR 115 500.

The last group of costs is associated with the sanitation and cleaning-up of found dead pigs, creation of a collection point, as well as the payment of compensation from hunting grounds for the days when hunting was prohibited. The total compensation provided amounted to EUR 12 600 at the end of 2023.

The total direct costs associated with testing, containment, eradication and sanitation of pigs in an *ASF* outbreak from the first outbreak to the end of 2023 amounted to EUR 965 600. This amount consists of all related costs for which compensation can be drawn according to the Veterinary Act. According to the provisions of § 67 et seq. of the Veterinary Act, these are generally costs associated with diagnostics, mitigation and prevention, as well as costs associated with the payment of compensation to livestock breeders and, finally, costs associated with the disposal of dead animals in slaughterhouses.

For the purposes of calculating the total costs associated with the occurrence of ASF, the costs associated with financial compensations for shot and found dead wild pigs are taken into account, as shown in table no. 4, namely EUR 837 500. Another expense was the expenses associated with testing wild and domestic pigs for ASF disease. For the monitored period, the amounts reached EUR 115 500, as indicated above under table number 5. And finally, the last group of costs is associated with the sanitation, management and security of the collection site, as well as the payment of hunting compensation for the days when hunting was prohibited, when the total compensation provided amounted to EUR 12 600. The total considered and calculated costs thus reached the mentioned EUR 965 600.

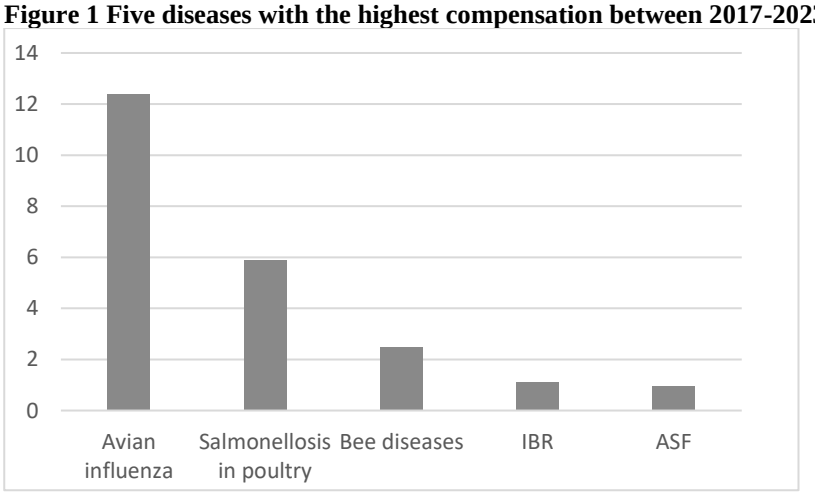
IV. Conclusion

EVMs are generally ordered when a dangerous disease occurs or threatens to spread and when animal products, water or feed are found to be unhealthy or suspected to be unhealthy. They are also applied if there is a risk of the introduction of the causative agents of animal diseases and diseases transmissible from animals to humans or the introduction of harmful feed.

Between 2017 and 2023, EVM was declared in the event of the occurrence of a total of 11 diseases, with some of the diseases occurring in the Czech Republic every year and some only in selected years. The total compensation for applied EVM in the Czech Republic for the entire period reached the amount of EUR 28.4 million.

The following figure shows the five most expensive diseases for which the compensation reached the highest level.

Figure 1 Five diseases with the highest compensation between 2017-2023 (EUR mil.)



Source: own processing

The highest compensations of EUR 12.4 million were paid for the eradication of *Avian influenza*, mainly due to its high incidence in 2021 and 2022. The second most costly disease is *Salmonellosis in poultry*, which occurs annually in Czech farms and for which the amount of compensation reached EUR 5.9 million. Diseases of bees also occur every year, the total compensation of which in the monitored period reached EUR 2.5 million. It is followed by *Infectious Bovinne Rhinotracheitis (IBR)* with a compensation amount of EUR 1.1 million and *ASF* with compensations of EUR 0.96 million.

V. Discussion

At various times, *ASF* has occurred in all major and minor world economies. The range of volume significant costs or losses presented for *ASF* was from USD 649 000 to USD 94 539 870 which represent the average annual pig production loss from an outbreak in Nigeria (Fasina et al., 2012) and the total economic loss value of swine de-populated from an outbreak in Spain (Bech-Nielsen et al., 1993), respectively. The range of costs and/orlosses was from USD 58 338 to USD 585 762 061 which represent the total direct annual production loss from an outbreak in Australia (Garner et al., 2001) and the maximum median epidemic cost (based on infected herd) of an outbreak in Denmark (Boklund et al., 2009), respectively. Finally, the range of costs and/or losses presented for *ASF* was between USD 8 300 000 and USD 84 584 000 in 2019 which represent total average economic loss per herd from an outbreak in Ethiopia (Jemberu et al., 2019) and the maximum, median total national loss in agricultural surplus from an outbreak in California in the United States (Carpenter et al., 2019), respectively. These ranges highlight the fact that geospatial information and scale are paramount to compare studies and since that was not uniform, it is nearly impossible to make generalizations about which of these diseases is the most costly. The economic scoping review affirmed that an outbreak of any of these diseases is expensive an tha the economic impact of each disease is driven by a number of factors, including loca-tion o outbreak (Hop et al., 2016; Mahul et Durand, 2000; Pendell et al., 2007), trade implications (Babalobi et al., 2007a; Countryman et Hagerman, 2017; Mangen et al., 2004) and consumer reaction (Blake et al., 2003; Thompson et al., 2002). The results of the review also implied that disease management and control practices heavily contribute to the economic impact of the disease (Boklund et al., 2009; Schoenbaum et Disney, 2003). Comparing across studies, analyses were often partial in terms of total impact evaluation (micro and macroeconomic), therefore not capturing the full burden on the economy.

The latest large outbreak of *ASF* was reported in China, the world's biggest producer and consumer of pork, in August 2018 and has killed millions of pigs (NBS, 2020). The number of pigs slaughtered and the total pig herd in China were about 700 million and 450 million head per year, respectively. The officially released data on culling and deaths caused by the *ASF* accounts for less than 0.2% of the yearly number of slaughtered (healthy) pigs (MAG, 2020).

The real estimatioan might be that 43.5 million pigs died either due to *ASF* virus infection, being culled to stamp out the virus or as a consequence of other *ASF*-related impacts during the first year of the *ASF* outbreaks, accounting for 6.3 % of the total number of pigs slaughtered in 2018 (that is 693.8 million). The total economic direct loss caused by the *ASF* outbreak is estimated to be about USD 111.2 billion, amounting to 0.78 % of China's gross domestic product in 2019 (Shibing et al., 2021).

The total indirect economic losses to producers in all sectors of the Chinese economy (149 sectors) are estimated to have been USD 14.5 billion. Across the different provinces in China, this varies from USD 2.2 billion in Guangdong province to USD 1.4 million in Qinghai province (Chiang et Sun, 2019). The average indirect economic losses of producers per province were USD 467.8 million and 18 provinces suffered losses of between USD 100 and USD 900 million. The provinces with high economic losses for producers are mainly located in the eastern coastal, central and southern parts of China (Shibing et al, 2021).

The 2019 *ASF* outbreaks in Vietnam imposed considerable impacts on the pig sector in Vietnam, resulting in the death or culling of nearly six million pigs, or more than 20 % of the country's pig

population. The outbreak caused severe direct and indirect economic losses among farmers, particularly medium and large farmers whose livelihoods are largely derived from pig production. The adverse impacts of the *ASF* outbreak were not restricted to the pig sector but also extended to other related sectors of the economy. The outbreaks led to a significant loss of jobs in the pig sector and the relevant sectors, estimated as up to 247 000 jobs while total losses in the pig sector reached EUR 380 million and in the processing and food industry EUR 245 millioin (Nguyen-Thi et al, 2021).

In September 2019, East-Timor, where pigs are kept by more than 70 % of households, became the eleventh Asian country to report *ASF*. The pig keeping sector consists of around 142 000 (72 %) households in the country. In most rural communities, at least 75 % of households raise pigs. For families, replacing a pig comes at significant cost. The value of the national herd is more than USD 160 million. This implies a per pig-keeping-household value of more than USD 1000 (Smith et al, 2019).

In Africa, the economic cost of *ASF* had been estimated at EUR 13.1 million in Benin between 2014 and 2018 (Ohouko et al., 2020). The cost of an epidemic in Nigeria in 2001, just due to the high mortality (91 %) in 306 farms, was EUR 85.5 million (Babalobi et al., 2007b). An epidemic in 219 households in Tanzania has reached EUR 41.1 (Kivumbi et al., 2021).

The ASF virus has been detected among wild pigs in all states bordering the Czech Republic. In Poland, *ASF* has been escalating and spreading to new areas since 2018, while in 2021 and 2022, *ASF* occurred in the west of Poland in the area close to the border with the Czech Republic. In 2023, cases of *ASF* in wild pigs and outbreaks of infection in domestic pig farms are reported from Poland. In 2018, the *ASF* outbreaks in domestic pig *ASF* included 25 395 pigs, in 2019 it included 35 360 pigs, and in 2020 it included 56 210 pigs. As for the pork trade, the confirmation of the *ASF* virus in Poland has resulted in many non-EU countries (Russia, Belarus, Ukraine, Kazakhstan, China, Japan, South Korea, Taiwan, Singapore, Azerbaijan and Georgia) banning the import of pork products from Poland. This has caused difficulties in exports and the need to diversify outlets. All of these activities generate costs. In total, in the years from 2014 to 2020, the costs of *ASF* virus control in Poland amounted to over EUR 97.6 million (Szymanska et Dziwulaki, 2022).

In Germany, *ASF* has been present since 2020. The first cases of *ASF* were confirmed in feral pigs in areas adjacent to localities with *ASF* occurrence in Poland. Currently, *ASF* in wild boars occurs in three federal states: Saxony, Brandenburg, Mecklenburg-Vorpommern. In the Federal Republic of Saxony, the infection in the wild boar population is slowly spreading inland. At the end of February 2023, 1 outbreak of *ASF* was confirmed in Germany in a farm of domestic pigs (a small farm with 11 pigs) in the district of Cottbuz in the Federal Republic of Brandenburg (Richter et al, 2023). The costs associated with the eradication and the payment of compensation for the shot pieces reached the above-mentioned federal states EUR 12.3 million.

In Slovakia, the first positive findings of *ASF* were recorded in July 2019 in domestic pigs in the Trebisov district. Subsequently, the first case of *ASF* in a wild boar was confirmed in August 2019. This was a wild boar that was caught in an area where *ASF* occurs in domestic pigs (Trebisov district) and which showed behavioral changes suspicious for *ASF* before the capture. In Slovakia, ASF in wild pigs is gradually spreading, especially in the eastern, central and southern parts of the country. In 2023, no outbreak in domestic pig farms has been confirmed so far (Schmidt et al, 2021). Losses caused by the occurrence of *ASF* in Slovakia reached the end of 2023 EUR 0,6 million.

Bulgaria and Romania have mid-term difficult infectious situation, currently almost the entire territory of these countries is affected, including some large-scale pig farms with 20-40 thousand reared pigs (Zani et al, 2019). The first outbreak of *ASF* occured in 2017 in Romania and one year later in 2018 in Bulgaria. In Romania 15 200 professional and non-professional farms have been compensated. The total value of the compensations paid by the end of 2021 was EUR 102.5 thousand (Martin et al, 2021).Veterinary measures implemented early on and subsequently followed mainly in Bulgaria managed to stabilize the situation and prevent further large-scale spread of the disease.

At the beginning of 2022, the first case of *ASF* (genotype II) was confirmed in mainland Italy (in Sardinia, *ASF* has been endemic since the 70s - genotype I) in the Piedmont region and then in the Liguria region. Italy immediately took measures to prevent the spread of *ASF* to other areas. Despite the measures taken, another case was confirmed in early May in a wild boar near Rome in the Lazio region. During 2022, Italy managed to limit the contagion to only the three regions mentioned above. In 2023, *ASF* spread in Italy to other areas in the south of the country – to the touristic regions of Calabria and Campania (Franzoni et al, 2020).

In 2023, *ASF* was confirmed in wild and domestic pigs in Greece near the border with Bulgaria. In the past (2020), one outbreak of *ASF* in domestic pigs was confirmed in Greece, which the Greeks successfully eradicated. For this reason, the costs associated with the occurrence of *ASF* in Greece are relatively low, which is unique in the area of Southern and Southeastern Europe (Brellou et al, 2022).

In June 2023, the first ever occurrence of *ASF* was confirmed in Croatia and Bosnia and Herzegovina. In particular, the situation of the spread of *ASF* in Croatia, both in farms with domestic pigs and in the population of wild pigs, is very unfavorable and serious. Despite the measures taken, there is a rapid and uncontrollable spread of *ASF* in Croatia, especially in farms with domestic pigs. From the above information, it follows that despite all measures taken immediately, this dangerous disease has not yet been eradicated and, on the contrary, it is gradually spreading to other areas. As the occurrence of *ASF* is quite current here and the infection is spreading, it is difficult to estimate the economic impact on breeding and compensations right now (Avilez et al, 2023).

African swine fever is a viral disease of domestic and wild pigs of all breeds and ages similar to classical swine fever. In infected animals, it causes a wide range of clinical signs, depending on the virulence of the virus it can cause a peracute, acute, subacute or chronic form. *ASF* is characterized by high, almost 100% lethality.

In the Czech Republic, on 26 June 2017, the first occurrence of *ASF* in the population of wild pigs was confirmed. By the end of 2023, *ASF* was detected in 59 wild pigs. Immediately afterwards, the SVA delineated CZ I within a radius of 3 km from the center of the infection and CZ II within a radius of 10 km and introduced strict SVM there, which was aimed at preventing the spread of the infection and its apparent eradication.

In parallel with these measures, compensation was paid to members of hunting associations in the attacked areas and to the finders of dead wild pigs. The current amount of compensation paid is EUR 80 for both shot and found dead wild boar. From 2017 to the end of 2023, approximately 3 300 *ASF* tests were carried out both in wild and domestic pigs, i.e. over 23 100 tests in total for the entire monitored period.

In 2007, there were 205 cases of *ASF*, 25 cases in 2018, and 59 cases in 2023. All positive findings were in wild boars. In the mentioned period, 232 farms breeding domestic pigs were also tested, all with negative results, so *ASF* does not currently occur in commercial farms in the Czech Republic. The total direct costs associated with testing, containment, eradication and sanitation of pigs in an *ASF* outbreak from the first outbreak to the end of 2023 amounted to EUR 965 600.

Between the monitored years 2007 and 2023, EVMs were also applied to the occurrence of other diseases of farm and wild animals. From the point of view of the compensations paid out, the incidence of *Avian influenza* and *Salmonellosis in polutry* was the most fiscally demanding (EUR 12.4 million and 5.9 million respectively).

In 2023, *ASF* was reported to the European Animal Disease Information System (ADIS) from a total of 15 European countries, including 11 EU member states (Bulgaria, Czech Republic, Estonia, Italy, Lithuania, Latvia, Hungary, Germany, Poland, Romania and Slovakia) and Ukraine, Serbia, Moldova and North Macedonia. During the last two years, there has been a significant reduction in the number of *ASF* outbreaks in domestic pig farms, as well as a significant reduction in the number of positive

findings in wild pigs. Nevertheless, and precisely for this reason, the prudential activity of the SVA is still in place.

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