Trade patterns of Dutch poultry commodities and impact on trade restrictions following outbreaks of avian influenza

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Executive Summary

Introduction. The Netherlands is a major poultry exporting country and 2/3 of chicken meat and eggs produced in the Netherlands is exported to the other countries, which indicates that the Dutch poultry industry heavily depends on exports. Avian influenza causes a negative impact on the poultry industry not only by damaging animals but also by depriving the country's market access to the other countries. In case of an outbreak of AI in the Netherlands, EU countries suspend the importation of poultry commodities from movement restriction zones, while non-EU countries are allowed to impose stricter measures which can vary depending on the countries. Trade patterns of Dutch poultry products with the other countries and how they will be influenced by trade restrictions following outbreaks of AI have not been studied yet. Therefore, in this research, we studied the global trade patterns of Dutch poultry commodities and how trade restrictions affect them. This information will be beneficial for the Dutch poultry sector.

Methodology. The study comprised 3 parts.

- 1. Trade data analysis of Dutch poultry products with the other countries. For this purpose, we collected and analysed the trade data of poultry commodities of the Netherlands to clarify the trade flow of poultry products of the Netherlands with main trade partners;
- Analysis on the past HPAI/LPAI outbreaks. For this purpose we collected and researched the past avian influenza outbreaks to develop scenarios of the impacts on the poultry commodity exportation caused by trade restrictions in respect to the various level of HPAI outbreaks;
- 3. Scenario analysis. Based on the data collected in 2, we made several scenarios with different severity of outbreaks and of trade restrictions, and analysed them to reveal how large their impact would be on poultry trade and what products would be affected the most.

Results. Analysis on the trade flow clarified that most of the commodities are mainly exported to the EU and EFTA countries, particularly Germany, Belgium and UK. However, quite a large part of hatching eggs and egg albumin are exported to Russia and Japan, respectively. With regard to the import of poultry commodities, the most of the commodities are imported from the EU and EFTA countries except the poultry meat commodities, which significantly depend on Brazil and Thailand. Scenario analysis revealed that if a small outbreak would occur, the export of fresh poultry meat and poultry day-old chicks would be affected more significantly than the other commodities, but in case of a large outbreak, the export of breeding materials, especially hatching eggs, would decrease even more than the other commodities.

Discussion and Conclusions. We clarified the trade patterns of the poultry products of the Netherlands. Almost of the export of poultry meat products and egg products except egg

albumin are exported to the EU and EFTA countries, while a significant part of breeding materials are exported to non-EU/EFTA countries and the export of hatching eggs depends on Russia the most. This implies that hatching eggs are the most vulnerable to the trade restrictions following AI outbreaks. In the scenario analysis, we showed that in case of a small outbreak of HPAI, the export value of fresh poultry meat would be affected the most while in case of a large outbreak of HPAI, the export of breeding materials, especially hatching eggs would suffer the negative impacts most significantly because of the differences in trade restrictions for each scenario. However, depending on the affected places, these results can change considerably. In addition, In this analysis, we only focused of the movement restriction and the trade restrictions. However, for more precise scenario analysis, other factors such as the reduction in the poultry population and the consumers purchasing behaviour should also be taken into account. Furthermore, it is desirable that the Dutch government should prepare schemes enabling continued trade in large AI outbreaks.

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1. Introduction

1.1. Dutch Poultry production in the context of the international trade

The Netherlands is one of the leading countries in the world poultry production. According to FAOSTAT, which is a statistics database offered by Food and Agriculture Organizations of the United Nations (FAO), the total volume of the poultry production in the Netherlands is not so remarkable compared with other large poultry producing countries such as the USA, China and Brazil. Table 1 shows the ranking of the national production of poultry meat and shelled eggs and the Netherlands ranks as low as 30th and 22nd, respectively (UN FAO, n.d.). However, with respect to the production per capita, the Netherlands is comparable to other big producers, and especially for the poultry shelled egg production, the Netherlands is the biggest by far. These facts demonstrate how developed the Dutch poultry industry is. Obviously, not total amount of the products yielded in the Netherlands is consumed in the country itself, and about 2/3 of them are exported to the other countries (Dutch Poultry Centre, 2017). This makes the Netherlands one of the most outstanding countries in the trade of poultry products.

Tables 2 shows the ranking of the countries exporting poultry products, namely poultry meat, poultry shelled eggs, poultry hatching eggs, and day-old chicks of chicken. In each ranking, the Netherlands stands among the top 3. These facts show that Dutch poultry sector has larger markets outside the Netherlands, and if the Dutch poultry sector lose even a part of the markets for any reason, it might cause a significant negative impact on them.

	Poultry meat			Poultry shelled eggs									
Rank	Country	10 ⁶ t	kg/person*	Rank	Country	10 ⁶ t	kg/person*						
1	USA	21.5	66.8	1	China	32	22.8						
2	China	18.1	12.9	2	USA	6	18.6						
3	Brazil	14.5	69.7	3	India	4.6	3.5						
4	Russia	4.1	28.5	4	Mexico	2.7	21.1						
5	India	3.4	2.6	5	Japan	2.6	20.3						
6	Mexico	3.1	24.2	6	Brazil	2.5	12.0						
7	Japan	2.3	18.0	7	Russia	2.4	16.7						
8	Poland	2.3	60.5	8	Indonesia	1.8	6.9						
9	Indonesia	2.1	8.0	9	Iran	1.2	15.0						
10	Iran	2.1	26.3	10	Turkey	1.1	13.8						
30	Netherlands	1.1	64.7	22	Netherlands	0.7	41.2						

Table 1. Rankings of the national production of poultry meat and shelled eggs in 2016.

Source: FAOSTAT

*: Please note that this value is calculated by dividing the national production with the national population and does not mean the annual poultry meat or egg consumption per person.

Table 2. Rankings of the export of poultry products in 2016. HS code for these commodities is as follows. Fresh poultry meat: 0207; Fresh poultry shelled eggs: 040721 and 040729; Poultry hatching eggs: 040711 and 040719; day-old chicks of chicken: 010511.

	Fresh pou	ltry meat			Fresh poultr	y shelled eggs	
		Value				Value	
Rank	Reporter	(US 10 ⁶ \$)	Qty (10 ³)t	Rank	Reporter	(US 10 ⁶ \$)	Qty (10 ³)t
1	Brazil	6,128	4,056	1	Netherlands	518	395
2	USA	3,315	1,891	2	Turkey	248	276
3	Netherlands	2,486	1,366	3	Poland	197	217
4	Poland	1,850	968	4	Germany	156	129
5	Germany	1,001	483	5	China	118	78
6	France	949	433	6	Malaysia	103	95
7	Hong Kong	903	591	7	USA	98	82
8	Belgium	853	511	8	Belgium	72	60
9	Hungary	591	228	9	Ukraine	45	51
10	China	535	226	10	Spain	42	36

	Poultry hatc	hing eggs			Day-old chicks of chicken								
		Value			Value								
Rank	Reporter	(US 10 ⁶ \$)	Qty (10 ³)t	Rank	Reporter	(US 10 ⁶ \$)	Qty (10 ³)t						
1	USA	316	69	1	Netherlands	265	15						
2	Netherlands	196	54	2	USA	158	2						
3	France	122	18	3	UK	151	3						
4	Germany	121	25	4	Germany	120	3						
5	Belgium	84	25	5	France	79	4						
6	United Kingdom	69	6	6	Brazil	66	1						
7	Spain	66	45	7	Spain	61	1						
8	Canada	42	6	8	Hungary	57	3						
9	Brazil	42	9	9	Denmark	45	2						
10	Turkey	41	14	10	Poland	41	3						

Source: UN Comtrade Database

1.2. Livestock diseases and their impact on trade

Livestock diseases including avian influenza (AI) are a serious concern for the livestock industry as they do not only reduce yields by damaging animals, but also they may deprive a country of the market access of the livestock and livestock products to the other countries as they affects the countries sanitary status of livestock diseases. The World Organisation for Animal Health, which is normally referred as its historic acronym "OIE", is the intergovernmental organisation setting the trade standards regarding the animal diseases, and every year it revises a list of diseases which are highly concerned from the international trade view point, which is normally called the "OIE listed diseases" (World Organisation for Animal Health, 2018). If certain diseases of the OIE listed diseases such as highly pathogenic avian influenza (HPAI), foot and mouth disease (FMD), or classical swine fever (CSF), which we refer Highly Contagious Livestock Diseases (HCLD) in this thesis, would occur, normally the affected country would conduct series of control measures including movement restrictions

and the obligatory culling in order to contain the outbreak as well as maintain the trade from the free areas.

With regard to the European Union (EU), the European Commission (EC) sets directives for controlling the specific livestock diseases which stipulate what to do in peace time as well as in outbreaks, and every member country has to set its own contingency plans for the specific diseases based on the directives, and that is why the EU member countries can carry out harmonised measures at the EU level. In respect to AI,



Fig. 1. Restriction zones which are established in case of the outbreaks of HPAI and LPAI. The central red circle indicates the affected farm. (Left) Protection Zone (blue) and Surveillance Zone (black) in case of the outbreak of HPAI. (Right) Restricted Zone in case of the outbreak of LPAI.

the Council Directive 2005/94/EC of 20 December 2005 on Community measures for the control of avian influenza and repealing Directive 92/40/EEC (herein after referred as Directive 2005/94) is the legislative basis for the EU countries to fight against AI. Once AI is detected in a territory of an EU member country, the affected country has to cull immediately all the animals in the affected premises, and at the same time, the country should establish zones, in which several control measures are carried out, surrounding the affected premises. In case of an HPAI outbreak, the affected country would make Protection Zone (PZ) and Surveillance Zone (SZ), and in case of a low pathogenic avian influenza (LPAI) outbreak, the country would make Restricted Zone (RZ) (See Fig. 1). PZ is composed of the area with a radius of at least 3 km around the affected premises, and SZ is established outside the PZ with a radius of at least 10 km around the premises. RZ is set with a radius of at least 1 km around the affected establishment. In this thesis, we refer to these three zones as the "movement restriction zones". Table 3 summarises the major measures conducted in the movement restriction zones and their durations in force. As listed in the table, if a poultry farm would fall under the movement restriction zones, they cannot dispatch poultry or eggs in principle until the movement restriction zones will be lifted. Thus, by the effort of the affected country and the EU, poultry and poultry products sourced from the movement restriction zones are not able to be traded in national, EU and international markets unless at least 30 and 21 days have passed since the culling of animals and the disinfection of the affected farm(s) in case of outbreaks of HPAI and

LPAI, respectively. However, if another farm is found to be infected with AI in the movement restriction zones before they have been lifted, the duration will be extended and the size of the movement restriction zones can be expanded.

	HF	PAI	LPAI					
		Surveillance zone						
	Protection zone (3km)	(10km)	Restricted zone (1km)					
Main measures	Census of all the poultry holdings.	Census of all commercial poultry holdings.	Census of all commercial holdings.					
	Movement prohibition of poultry and poultry, eggs and carcass.	Movement prohibition of poultry and eggs within and to the outside the surveillance zone.	All movements of poultry and eggs within or into the RZ are subject to authorisation.					
	Additional surveillance of all poultry holdings.	Disinfection of vehicles related to poultry production.	Disinfection of vehicles related to poultry production.					
	All the poultry are brought inside.							
	Disinfection of vehicles related to poultry production.							
Duration	At least 21 days after the first cleansing and disinfection of the affected farm.	At least 30 days after the first cleansing and disinfection of the affected farm.	At least 21 days after the first cleansing and disinfection of the affected farm.					

Table 3. Measures to be conducted after the confirmation of HPAI /LPAI

On the other hand, according to the article 2-1 of the Sanitary and Phytosanitary agreement (SPS agreement) of the World Trade Organization (WTO), every country has the right to take SPS measures for the protection of human, animal or plant life or health as long as they are scientifically justifiable, and the import restrictions can be taken if necessary. The extent of the import restrictions can range from a movement restriction zone, a single province to the entire country, depending on the partner countries, diseases and outbreaks. For example, if HPAI would occur in a country called A, a partner country called B would suspend the importation of poultry and poultry products from the entire territory of A, while another country called C would suspend the import only from the affected region of A, which is called "regionalisation" or "zoning" (World Organisation for Animal Health, 2017-b). If diseases like HPAI, FMD, or CSF would occur in the Netherlands, the other EU member countries in principle do not suspend the import of livestock and livestock products except those from the movement restriction zones. On the other hand, the non-EU countries are allowed to take stricter import measures including import restrictions of livestock and livestock products from the entire territory of the Netherlands or from affected provinces. Therefore, in case of

outbreaks of HCLD in the Netherlands, if there would be many countries imposing import restrictions on the entire country or a wide area of the country, the export of livestock and livestock products could be disrupted considerably because the significant part of them could be a surplus in the national or EU market. In this regard, Hop *et al* (2014) studied the trade patterns of live pigs between the Netherlands and the other EU countries, and how it would be disrupted by the outbreak of CSF. With respect to poultry, if AI would occur in the Netherlands, similar measures as above would be imposed on poultry and poultry products by the other countries. However, the trade patterns of Dutch poultry and poultry products and how it would be influenced by the trade restrictions by the other countries have not been studied yet. Thus, in this research, we studied quantitatively the global trade pattern of Dutch poultry commodities and how the trade restrictions affect them. This would provide a valuable insight for Dutch poultry sector.

1.3. Study objectives

The main objective of this research is to study the impact of the trade restrictions following outbreaks of AI. In order to answer this main question, the following questions were studied:

1. To what countries and how much amount are Dutch poultry commodities exported? The aim of this question is to grasp the actual situation of the net-basis Dutch poultry exportation in context of the EU and non-EU countries. Regarding this question, we will focus on the exportation of the three different commodities: poultry meat products, egg products and breeding materials.

2. How were the past outbreaks of AI like, and to what extent did importing countries impose trade restrictions on them? The aim of this question is to develop possible scenarios of the impacts on the exportation of the poultry commodities caused by the trade restrictions in respect to the various level of AI outbreaks.

3. To what extent can be the impact of the outbreaks of AI on the trade of Dutch poultry commodities? The aim of this question is to analyse how much amount of the export of the poultry would reduce in each scenario, and how it would be solved or mitigated.

2. Methodology

2.1. Trade data analysis

We collected the data of the Dutch poultry trade from 2002 to 2017, using Eurostat (<u>http://ec.europa.eu/eurostat</u>) offered by the EC. At first, we considered that Eurostat, UN comtrade (<u>https://comtrade.un.org/</u>), CBS (<u>https://www.cbs.nl/</u>), or FAOSTAT (<u>www.fao.org/faostat/</u>) would be the choice for the data source we would use, and we selected Eurostat because of the following reasons:

- Eurostat is the primary data source for the statistics of EU member countries. Therefore we thought that Eurostat is more precise than UN comtrade and FAOSTAT.
- Eurostat offers the data of statistics of long period, while CBS offers the data only from 2008. This is the reason why we did not choose CBS, even though its data is thought to be the most correct for the Dutch trade among these four databases.

We adopted Combined Nomenclature (CN) of Harmonized Commodity Description and Coding Systems (HS) for classifying the goods in Eurostat, and used the codes listed in the Table 4 for the purpose of the data collection with regard to the Dutch poultry products trade. Please note that as the HS code is reviewed every 5 years, commodities can be classified into different codes depending on the years. For example, until 2011, the fresh shelled eggs and the cooked or preserved shelled eggs were classified into the same code 04070030 without regard to the poultry species. However, in 2012, the revised HS code (HS 2012 edition) came into force and the fresh shelled eggs and the cooked or preserved shelled eggs and the cooked or preserved shelled eggs were divided fresh eggs of domestic fowls), 04072910 (Shelled fresh eggs of poultry other than domestic fowls), and 04079010 (Poultry eggs, in shell, preserved or cooked).

Based on the trade data obtained, we analysed how much volume and value of poultry products were exported from the Netherlands to the EU and EFTA countries (Norway, Iceland, Liechtenstein and Switzerland) and the non-EU/EFTA countries in the period of 2002 to 2017, and how much the Netherlands imported the poultry products from these countries in the same period as well. Then, we identified which countries are the major partners for the Netherlands regarding the trade of poultry products. The reason why we regarded the EU and EFTA countries as the same cluster is because Norway, Iceland and Liechtenstein compose a single market with EU called European Economic Area (EEA), and Switzerland has agreed on a common veterinary policy with EU (Swiss Federal Food Safety and Veterinary Office, n.d.). Therefore, we considered the veterinary policies of these countries are harmonised with EU with regard to the trade of poultry products.

The way for classifying a country as a major trade partner is:

- 1) Calculating the mean export and import volume and value of the last 5 years (2013-2017), 10 years (2008-2017) and 15 years (2003-2017) for each country and each commodity. With regard to the export of fresh poultry meat to Russia, Russia has suspended the importation of the certain EU agricultural commodities including fresh poultry meat which falls under the category of CN 0207 since 2014 (European Commission, n.d.-a) because of the so-called "Crimean crisis". Therefore, we used the mean of the data of 2009-2013, 2004-2013 and 2002-2013 for Russia as the references to the mean of the 5 years 10 years, and 15 years' of the other countries.
- 2) If the mean export or import volume or value of a commodity of a certain country is equal to or larger than 5% in at least one in the three different periods compared with those of total, the country is classified as one of the major trade partner for that commodity.

Table 4. List of the HS codes used for the data collection.

Poultry	y meat		
•	Fresh poultry meat	0207:	Meat and edible offal, of the poultry of heading 0105, fresh, chilled or frozen.
•	Processed poultry meat	16022010:	Preparations of goose or duck liver (Valid since 2008).
	1 5	16022011:	Preparations of goose or duck liver, containing equal to or larger than 75% by weight of fatty livers (Valid until 2007).
		16022019:	Preparations of goose or duck liver which do not fall under 16022011 (Valid until 2007).
		160231:	Prepared or preserved meat of turkeys.
		160232:	Prepared or preserved meat of domestic chickens.
		160239:	Prepared of preserved meat of other poultry.
Eggs		•	
•	Fresh, cooked or preserved	04070030	Poultry eggs, in shell, fresh, preserved or cooked (Valid until 2011).
	eggs, in shell		
•	Shelled fresh eggs	040721:	Shelled fresh eggs of domestic fowls (Valid since 2012).
		04072910:	Shelled fresh eggs of poultry other than domestic fowls (Valid since 2012).
•	Cooked or preserved eggs, in	04079010:	Poultry eggs, in shell, preserved or cooked (Valid since 2012).
	shell		
•	Eggs not in shell	0408:	Birds' eggs, not in shell, and egg yolks, fresh, dried, cooked.
•	Egg albumin	350211:	Egg albumin, dried.
		350219:	Egg albumin, other than dried.
Breedi	ng materials		
•	Hatching eggs	04070011:	Turkey or goose eggs for hatching (Valid until 2011).
		04070019:	Poultry eggs for hatching (Excluding turkey or goose) (Valid until 2011).
		040711:	Fertilised eggs of domestic fowls for incubation (Valid since 2012).
		04071911:	Fertilised eggs of domestic turkeys or domestic geese for incubation (Valid since 2012).
		04071919:	Fertilised poultry eggs for incubation other than domestic fowls, turkeys and geese (Valid since 2012).
•	Day-old chicks	010511:	Live domestic fowls weighing equal to or smaller than 185g.
		010512:	Live domestic turkeys weighing equal to or smaller than 185g.
		010513:	Live domestic ducks weighing equal to or smaller than 185g (Valid since 2012).
		010514:	Live domestic geese weighing equal to or smaller than 185g (Valid since 2012).
		010515:	Live domestic guinea fowls weighing equal to or smaller than 185g (Valid since 2012).
		010519:	Live domestic ducks, geese and guinea fowls weighing equal to or smaller than 185g (Valid until 2011).

2.2. Outbreak history of HPAI and LPAI in the Netherlands

Information regarding the past outbreaks of AI including LPAI in the Netherlands was obtained mainly from the OIE World Animal Health Information System (WAHIS) (World Organisation for Animal Health, n.d.) and the web page of the Standing Committee on Plants, Animals, Food and Feed (SCoPAFF) of the EC (European Commission, n.d.-b). All member countries of the OIE are obliged to notify the outbreaks of the OIE listed diseases including HPAI and LPAI immediately to the OIE, and after that, they have to continue to report the courses of the outbreaks until the outbreaks are resolved. Therefore, you can get the brief outline of each outbreak in WAHIS. SCoPAFF is the organisation which gives opinions and advise to the EC regarding food and feed safety, animal health and welfare, and plant health. In the monthly meetings of SCoPAFF about animal health and welfare, current outbreaks of HCLD in the member countries are available in its webpage. Further, we researched scientific and news articles, and press releases by governmental and intergovernmental organisations.

2.3. Scenario analysis

Based on the data of the past AI outbreaks obtained in 2.2., we developed four different outbreak scenarios depending on the severity of the outbreak and the strictness of the import restrictions by the non-EU countries. Then, we analysed these scenarios regarding how they would affect the poultry trade.

3. Results

3.1. Trade data analysis

Table 5 is the total value of the trade of Dutch poultry products with EU/EFTA and non-EU/EFTA countries. This table shows that for the Dutch poultry sector, poultry meat products are the most important commodities, followed by egg products and breeding materials. Table 6 shows major countries importing 5% or more of total Dutch poultry products exported in volume or value at least one in the mean of the last 5 years, 10 years or 15 years period. On the contrary, Table 7 shows the countries whose export amount or value of poultry products to the Netherlands accounts for 5% or more of the total import volume or value of poultry products of the Netherlands at least one in the mean of the last 5 years, 10 years or 15 years. Figures of the detailed import and export data of poultry products with major trade partners are in the Appendix I and II.

Table5. Mean trade value of the poultry products of the Netherlands in the last five years (2013-2017). The
values and percentages in italic indicate how much value of each commodity is exported to or imported
from EU&EFTA and non-EU/EFTA countries.

	Export		Import	Balance		
	Value (€1,000)	%/Total	Value (€1,000)	%/Total	Value (€1,000)	
Fresh poultry meat	2,059,194	56%	644,864	40%	1,414,330	
EU&EFTA	1,789,967	87%	514,951	80%	1,275,017	
Non-EU/EFTA	269,226	13%	129,913	20%	139,313	
Processed poultry meat	513,988	14%	591,464	37%	-77,476	
EU&EFTA	487,735	95%	231,815	39%	255,920	
Non-EU/EFTA	26,253	5%	359,649	61%	-333,395	
Poultry hatching eggs	140,753	4%	67,427	4%	73,327	
EU&EFTA	65,238	46%	64,230	95%	1,008	
Non-EU/EFTA	75,515	54%	3,197	5%	72,318	
Poultry day-old chicks	188,994	5%	76,785	5%	112,209	
EU&EFTA	126,086	67%	76,584	100%	49,502	
Non-EU/EFTA	62,908	33%	200	0%	62,707	
Shelled eggs	444,661	12%	180,922	11%	263,740	
EU&EFTA	402,496	91%	180,655	100%	221,841	
Non-EU/EFTA	42,166	9%	267	0%	41,899	
Eggs not in shell	243,678	7%	34,836	2%	208,842	
EU&EFTA	224,860	92%	34,567	99%	190,293	
Non-EU/EFTA	18,818	8%	269	1%	18,549	
Egg albumin	87,399	2%	11,923	1%	75,476	
EU&EFTA	48,110	55%	11,874	100%	36,236	
Non-EU/EFTA	<i>39,289</i>	45%	49	0%	39,240	
Total	3,678,667	100%	1,608,220	100%	2,070,447	
EU&EFTA	3,144,492	85%	1,114,676	69%	2,029,816	
Non-EU/EFTA	534,174	15%	493,543	31%	40,631	

Table 6 List of the major importing countries of Dutch poultry products. These countries imports 5% or more of total Dutch poultry products in volume(above) or value (below) at least one in the mean of the last 5 years (2013-2017), 10 years (2008-2017) or 15 years (2003-2017) period. **Volume**

Volume																					
		Fresh m	eat	Pro	cessed r	neat	Ha	tching e	ggs	Day	v-old ch	icks	Sh	elled eg	ggs	Eggs not-in-shell			Egg albumin		
	5y	10y	15y	5у	10y	15y	5у	10y	15y	5y	9у	11y	5y	10y	15y	5y	10y	15y	5y	10y	15y
Germany	X	Х	Х	х	х	х	Х	х	х	х	х	Х	Х	Х	х	х	Х	Х	х	х	X
Belgium	Х	х	Х	х	Х	х	х	х	х	Х	Х	Х	Х	Х	х	х	х	Х	Х	х	Х
UK	х	х	Х	х	х	х	х	х	х							х	х	Х	х	х	Х
France	Х	Х	Х	х	х	х			х							х	х	Х	х	х	Х
Italy				х									Х	Х					Х		
Denmark				х													х	Х		х	Х
Russia							х	х	х												
South Africa	Х																				
Libya								х	х												
Switzerland													Х								
Japan																			Х	х	Х
USA																					

Value

value													-								
		Fresh m	eat	Pro	cessed 1	neat	Ha	tching e	ggs	Day	y-old ch	1cks	Sh	nelled eg	ggs	Egg	s not-in-	-shell	Eg	gg albur	nın
	5у	10y	15y	5у	10y	15y	5у	10y	15y	5у	10y	15y	5у	10y	15y	5у	10y	15y	5y	10y	15y
Germany	х	х	Х	х	х	х	х	х	х	х	х	х	х	Х	х	х	Х	х	х	Х	х
Belgium	х	х	Х	х	х	х	х	х	Х	х	х	х	х	Х	х	х	Х	х		Х	Х
UK	х	Х	Х	Х	х	х	х	х	Х	х	х					х	Х	х	х	Х	Х
France	х	х	х	х	х	х										х	х	х			
Italy				Х																	
Denmark				Х	х																
Ireland	х	х	Х																		
Poland												Х									
Russia							х	х	х	х	х	х									
South Africa																					
Libya								х	Х												
Switzerland													Х					х			
Japan																			х	Х	Х
USA																			х		

Table 7. List of the major exporting countries of poultry products to the Netherlands. The volume or value of the poultry products these countries export to the Netherlands accounts for 5% or more of the total volume or value of the import of the Netherlands at least one in the mean of the 5 years (2013-2017), 10 years (2008-2017) or 15 years (2003-2017) period. **Volume**

Volume																					
	F	resh me	eat	Pro	cessed 1	meat	Ha	tching e	eggs	Day	y-old cl	nicks	Sh	nelled eg	ggs	Eggs not-in-shell			Egg albumin		
	5y	10y	15y	5у	10y	15y	5y	10y	15y	5y	9y	11y	5у	10y	15y	5y	10y	15y	5y -	10y	15y
Germany	Х	Х	х	х	Х	х	х	х	Х	х	х	Х	Х	Х	х	х	х	Х	х	Х	X
Belgium	Х	Х	х	Х	Х	х	Х	х	Х	х	х	Х	Х	Х	х	х	х	Х			
UK	Х	Х	х	х	х		х	х	х	х	х	Х						х			
Poland	Х	Х	х										х	х	х				х	х	Х
France							х	х	х	х	х	Х	х	х	х	х	х	х			
Italy																					Х
Spain																х	х	х	х	х	Х
Austria																			х		
Denmark										х	х	Х									
Brazil	Х	Х	х	Х	Х	х															
Thailand				х	Х	х															
China				x																	

Value

	Fresh meat		Processed meat		Hatching eggs		Day-old chicks		Shelled eggs		gs	Eggs	not-in-	shell	Eg	g albur	nin				
	5у	10y	15y	5y	10y	15y	5у	10y	15y	5у	9у	11y	5y	10y	15y	5у	10y	15y	5y	10y	15y
Germany	х	х	х	х	х	х	х	х	Х	х	х	х	х	х	х	х	х	х	х	х	х
Belgium	х	х	х	х	х	х	х	х	Х	х	х	х	х	х	х	х	х	х			х
UK	х	х	х	х	х	х	х	х	Х	х	х	х						х			
Poland	х	х	х										х	х	х				х	х	х
France	х	х	х				х	х	Х				х	х	х	х	х	х			
Italy																					х
Spain														х	х	х	х	х	х	х	х
Austria																			х		
Sweden																			х	х	х
Denmark										х	х	х					х	х			
Brazil	х	х	х	х	х	х															
Thailand				х	х	х															
China				х																	
USA								х	х												

Fig. 2 shows the net trade flow of fresh poultry meat of the Netherlands with the major trade partners. The figures of the other commodities are in Appendix III. Table 8 to the table 11 summarise the net trade flow of all the poultry commodities. The values in these figures are the mean value of the last five years (2013-2017) except the export value of fresh poultry meat to Russia, which is the mean value of 2009-2013. The colour of the countries indicates how strict the trade restrictions imposed by these countries are in case of Scenario 1 and 2 in the scenario analysis (which will be discussed in the section 3.3.). We omitted the trade flow with the Oceanian countries because the trade volume and value of the poultry commodities with them are far smaller than those with the other countries.

For the Netherlands, the EU and EFTA countries, especially Germany, Belgium, UK, France, and Italy are the most important trade partners. In respect to the processed poultry meat, shelled eggs and egg not in shell, about 95% of exported Dutch products are consumed in the EU and EFTA countries both in volume and in value. For fresh poultry meat, about 75% of the total export volume is exported to the countries in the EU and EFTA, but in value, that exported to the EU and EFTA countries amounts to about 90%. This is because the Netherlands exports premium chicken cuts such as fillet to the EU and EFTA countries, while it exports lower value cuts such as wing and thigh meat to the other countries, based on the different taste preferences (van Horne, 2017).

The export of poultry breeding materials and egg albumin shows different patterns compared with the commodities mentioned above. For breeding materials, especially hatching eggs, Russia is the most important buyer of Dutch commodities, whose import volume and value amount to about 40% of the total export of Dutch hatching eggs. In addition, with regard to day-old chicks, the export volume of the Netherlands to Russia is only 3% of the total export of Dutch day-old chicks, but the equivalent export value to Russia is 8%. This indicates that Russia imports expensive day-old chicks such as GP or GGP more than EU and EFTA countries do. The major importer of Dutch egg albumin is Japan, which imports about 10% and 30% of the total export of Dutch egg albumin in volume and in value, respectively. The export value of the egg albumin is quite small compared with the other poultry commodities. Therefore, we did not include Japan as an individual country in the figures of the net trade flow.

In respect to the import of poultry commodities, breeding materials and egg commodities are mainly imported from the EU countries such as Germany, Belgium and the UK, but for fresh and processed poultry meat products, Brazil, Thailand and Ukraine play significant roles for supplying these commodities to the Netherlands as well as the other EU countries above.

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Fig.2 Net trade flows of fresh poultry meat of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017) except the export value to Russia, which is the mean value of 2009-2013. The broken line circumscribing the centre indicates the countries belonging to the EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.

The total volume and va	arue exclude	mose of th	lie Oceanian c	Junuties and	countries n	iot specified.						
	Fre	esh chicken	meat (Unit: vol	ume (1,000 t),	, value(millio	on €))	Processed chicken meat (Unit: volume(1,000 t), value(million €))					
	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.
Germany	330	107	223	465	107	358	42	22	20	151	64	87
Belgium	98	79	19	146	118	28	12	17	-5	45	68	-23
UK	189	96	93	595	41	554	26	15	11	89	55	34
France	119	13	106	226	35	191	9	5	4	39	17	22
Italy	12	5	7	18	7	11	7	1	6	23	5	18
Other EU+EFTA	170	66	104	342	127	215	37	6	31	142	23	119
Russia	34*	0	34	25*	0	25	0	0	0	0	0	0
Other non-EU/EFTA Europe	22	19	33	14	35	-21	0	1	-1	1	2	-1
Africa	185	0	185	161	0	161	3	0	3	7	0	7
Asia	100	4	96	87	9	78	4	44	-40	13	153	-140
North America	1	0	1	1	0	1	0	0	0	1	0	1
South America	0	43	-43	0	85	-85	0	71	-71	0	210	-210
Total	1260	432	828	2080	564	1516	140	182	-42	511	597	-86

Table 8. Summary of the net trade flow of fresh poultry meat (left) and processed poultry meat (right) of NL with trade partners. The values of export volume and value are the mean of the last 5 years (2013-2017)"E" stands for "Export" and "I" stands for "Import". Net export volume and value indicate balance of export minus import. The total volume and value exclude those of the Oceanian countries and countries not specified.

*: Russia does not import fresh poultry meat since 2014, and we used the data of the mean of 2009-2013 for Russia.

Table 9. Summary of the net trade flow of the poultry hatching eggs (left) and poultry day-old chicks (right) of the Netherlands with major trade partners. "E" stands for "Export" and "I" stands for "Import". Net export volume and value indicate balance of export minus import. The total volume and value exclude those of the Oceanian countries and countries not specified.

		Hatching eggs (Unit: volume(100 t), value(million €))					Day-old chicks (Unit: volume(100 t), value(million €))					
	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.
Germany	52	88	-36	16	28	-12	83	16	67	80	30	50
Belgium	88	46	42	26	14	12	11	5	6	16	6	10
UK	26	28	-2	10	10	0	4	6	-2	12	15	-3
France	16	12	4	5	4	1	1	3	-2	2	2	0
Italy	3	2	1	1	1	0	1	0	1	1	0	1
Other EU+EFTA	25	29	-4	9	9	0	7	9	-2	15	24	-9
Russia	148	0	148	57	0	57	3	0	3	16	0	16
Other non-EU/EFTA Europe	3	0	3	3	0	3	1	0	1	5	0	5
Africa	12	0	12	4	0	4	5	0	5	15	0	15
Asia	20	0	20	7	0	7	7	0	7	25	0	25
North America	3	8	-5	1	3	-2	0	0	0	0	0	0
South America	1	0	1	0	0	0	0	0	0	1	0	1
Total	397	213	184	139	69	70	123	39	84	188	77	111

Table 10. Summary of the net trade flow of the poultry shelled eggs (left) and poultry eggs not in shell (right) of the Netherlands with major trade partners. "E" stands for
"Export" and "I" stands for "Import". Net export volume and value indicates balance of export minus import. The total volume and value exclude those of the Oceanian
countries and countries not specified.

	She	elled egg (Ur	nit: volume(2	1,000 t), valu	ue(million €))	Eggs not in shell (Unit: volume(1,000 t), value(million €))					
	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.
Germany	252	71	181	320	73	247	47	7	40	90	9	81
Belgium	31	46	-15	33	39	-6	13	7	6	21	11	10
UK	5	2	3	6	2	4	31	0	31	64	1	63
France	9	15	-6	9	13	-4	10	2	8	17	5	12
Italy	18	2	16	18	2	16	3	0	3	4	1	3
Other EU+EFTA	33	56	-23	38	53	-15	18	4	14	40	7	33
Russia	0	0	0	0	0	0	0	0	0	0	0	0
Other non-EU/EFTA Europe	0	0	0	0	0	0	0	0	0	0	0	0
Africa	11	0	11	11	0	11	0	0	0	0	0	0
Asia	6	0	6	7	0	7	1	0	1	3	0	3
North America	0	0	0	0	0	0	1	0	1	4	0	4
South America	0	0	0	0	0	0	0	0	0	0	0	0
Total	365	192	173	442	182	260	124	20	104	243	34	209

Table 11. Summary of the net trade flow of the egg albumin of the Netherlands with major trade partners. "E" stands for "Export" and "I" stands for "Import". Net export volume and value indicates balance of export minus import. The total volume and value exclude those of the Oceanian countries and countries not specified.

		Shelled egg (Unit: volume(100 t), value(million €))										
	E. vol.	I. vol.	Net E. vol.	E. val.	I. val.	Net E. val.						
Germany	30	5	25	12	1	11						
Belgium	21	1	20	3	0	3						
UK	17	1	16	9	0	9						
France	23	1	22	4	0	4						
Italy	0	2	-2	3	2	1						
Other EU+EFTA	96	100	-4	20	10	10						
Russia	0	0	0	0	0	0						
Other non-EU/EFTA Europe	0	0	0	0	0	0						
Africa	0	0	0	0	0	0						
Asia	33	0	33	28	0	28						
North America	3	0	3	4	0	4						
South America	0	0	0	0	0	0						
Total	223	110	113	83	13	70						

3.2. Outbreak history of HPAI and LPAI in the Netherlands

Fig. 3 shows the AI outbreak history in the Netherlands from 2000 to 2017. The Netherlands had been free from HPAI and LPAI for more than 75 years since the first outbreak recorded on 1924. In 2003, however, a huge outbreak of H7N7 HPAI attacked its most densely populated poultry areas (Gelderse Vallei) and then the infection spread to Limburg, which is another densely populated area bordering to Germany and Belgium and 43 outbreaks were confirmed in this province. Finally, in the entire country, 255 flocks became infected in total, and 1255 commercial flocks and 17,421 flocks of hobbyists, which accounted for 30 million birds, were culled (Elbers, et al., 2004; Stegeman, et al., 2004), The duration of the movement restriction zones lasted about 6 and 4 months for Gelderse Vallei and Limburg, respectively (EC DG SANCO, 2003) . 2/3 out of the 30 million birds were destroyed for preemptive culling purposes. As a result, the number of poultry and poultry farms in the Netherlands significantly dropped compared with that of the previous year (Fig. 4). The direct costs including veterinary costs and compensation costs for culled animals amounted to 250 million euros, and indirect costs such as lower prices and the loss of international market access was estimated to be even higher than the direct costs (Meuwissen, et al., 2006).



Fig 3. AI outbreak history in the Netherlands. Blue and red bars indicate HPAI and LPAI outbreaks in poultry, respectively, while green bars indicate HPAI cases confirmed in wild birds.





Fig. 4. Chicken population (upper) and the number of chicken farms (bottom) in the Netherlands since 2000 to 2016. Data about the number of parents of layer hens are available from 2005

Since then, the Netherlands had been free from AI for seven years until LPAI was detected in Noord-Brabant in 2010. Table 11 shows the AI outbreaks which occurred in the Netherlands from 2010 to 2017. In all the outbreaks, the movement restriction zones were

lifted in around one month except the case in Flevoland in 2016 where a large movement restriction zone was made due to several outbreaks observed in a small area in that province and it required about 2 months until the entire zone became lifted.

		-							
Voor	Year Mth Type		Location	Animals	1 4 000	2km	10km	Date of	Date when
 rear	IVITU	туре	LOCATION	culled	TRUU	ЗКШ	TOKUU	Confirmation	zones lifted
 2010	May	LPAI	Noord-Brabant*1	28,000		22		16/May	7/Jun
2011	Mar	LPAI	Zeeland ^{*1}	127,500	0	0		25/Mar	19/Apr
	May	LPAI	Gelderland*1	8,800	14	56		12/May	3/Jun
	Jun	LPAI	Flevoland*1	47,000	0	0		24/Jun	19/Jul
	_	LPAI	Flevoland*1	7,000	0	0		27/Jun	19/Jul
2012	Mar	LPAI	Limburg*1	44,500	2	21		17/Mar	10/Apr
 	Aug	LPAI	Utrecht*1	31,870	0	0		10/Aug	4/Sep
2013	Mar	LPAI	Gelderland	80,152	3			12/Mar	5/Apr
		LPAI	Flevoland	23,500	0			19/Mar	10/Apr
	May	LPAI	Utrecht	10,750	11			1/Jun	24/Jun
	Jul	LPAI	Friesland	9,043	0			2/Aug	27/Aug* ²
	Nov	LPAI	Groningen	9,301	0			30/Nov	23/Dec* ²
 	Dec	LPAI	Groningen	11,698	1			10/Dec	2/Jan* ²
2014	Feb	LPAI	Flevoland	40,237	0			27/Feb	22/Mar
	Nov	HPAI	Utrecht	150,000			13	16/Nov	19/Dec
		HPAI	Zuid-Holland	43,000	0	0	0	20/Nov	19/Dec
		HPAI	Overijssel	10,000			26	21/Nov	21/Dec
		HPAI	Overijssel* ³	14,600				21/Nov	21/Dec
		HPAI	Zuid-Holland	28,000			3	30/Nov	31/Dec
2015	Mar	LPAI	Gelderland	26,573	17			12/Mar	3/Apr
		LPAI	Friesland	22,273	1			26/Mar	17/Apr
	Apr	LPAI	Noord-Brabant	12,000	1			3/Apr	20/May
2016	Nov	HPAI	Flevoland* ⁴	10,000	5* ⁴	3	35	26/Nov	28/Dec
		HPAI	Flevoland	8,409	0	1	31	2/Dec	30/Dec
		HPAI	Flevoland	15,421	0	4	32	2/Dec	31/Dec
		HPAI	Friesland	62,899	0		12	13/Dec	13/Jan
		HPAI	Flevoland	13,989	1* ⁴	1	29	17/Dec	18/Jan
		HPAI	Friesland	28,941		1	15	17/Dec	19/Jan
		HPAI	Gelderland	48,082	3* ⁴	5	22	21/Dec	20/Jan
		HPAI	Zuid-Holland	6,594		2	7	22/Dec	22/Jan
 		HPAI	Zuid-Holland	27,000	1*4	1	1	25/Dec	26/Jan
2017	Oct	LPAI	Zeeland	41,504	0			13/Oct	4/Nov
	Dec	HPAI	Flevoland	15.985		4	27	8/Dec	9/Jan

Table 11. Summary of the HPAI/LPAI outbreaks from 2010-2017

*1: Until 2013, in case of LPAI outbreaks, at first 3km restricted zone was set, and after the screening of all the poultry establishments inside the zone was found to be negative (which was done almost in a week), the zone was reduced to be 1km.

*2: Estimated by the author.

*3: This outbreak occurred inside the 1km radius of the previous outbreak in Overrijssel.

*4: These premises were also depopulated for the purpose of pre-emptive culling.

3.3. Scenario analysis

Based on the data of the past outbreaks, we developed 4 different scenarios depending on the severity of the outbreaks and strictness of the import restrictions: Scenario 1 is the case where relatively a mild outbreak would occur and import restrictions by the non-EU/EFTA countries are not strict. Scenario 2 is the case where several outbreaks would be observed, but the strictness of the import restrictions is the same level as Scenario 1, but the duration of the restrictions are longer than that of Scenario 1. Scenario 3 is the case where a number of outbreaks are found and stricter import restrictions are imposed compared with Scenario 1 and 2. Finally, Scenario 4 is the worse case of the Scenario 3 and has the longer duration of the import restrictions. For Scenario 1 and 2, we used the data of the outbreak in Flevoland in 2017 and that of the outbreaks in the several provinces in 2016, respectively, whereas with regard to Scenario 3 and 4, we chose the outbreaks in 2003 and made different (optimistic and conservative) assumptions for the duration of the trade restrictions by the non-EU countries. In the actual case of the HPAI outbreak in 2003, almost all the poultry inside the movement restriction zones were depopulated, most of which are for pre-emptive culling purposes, but in this scenario analysis, we did not consider the decrease in the number of poultry and only focused on the impact of the movement and trade restrictions.

Table 12 shows the parameters for the scenario analysis illustrating how many and what types of farms there were in the movement restriction zones and the provinces for each scenario, which is based on the actual cases of the HPAI outbreaks as explained above. Table 13 shows the poultry population in the whole country in 2002 and 2016. As the data of the poultry population in 2017 is not yet available, we used that of 2016 instead for Scenario 1. In addition, we used the poultry population data in 2002 for Scenario 3 and 4 because the poultry population data in 2003 was collected after the 2003 HPAI epidemic. With regard to the number of farms in the movement restriction zones for 2003 HPAI outbreak, we estimated that about 70% of layer and layer parent farms and 50% of broiler and broiler parent farms in Gelderland were located in the Gelderse Vallei, and 60% of poultry farms of Limburg were located in the movement restriction zone established in that province according to experts' opinions. The values of the duration of the trade restrictions imposed by the non-EU countries were estimated based on the following assumption: In principle, the WTO member countries have to set trade policies regarding animal health based on the international standard set by the OIE, which is called the OIE Terrestrial/Aquatic Animal Health Code. According to the chapter of AI of the OIE Terrestrial Health Code (World Organisation for Animal Health, 2017-a), once AI is detected in a country, the disease free status of that country can be regained 3 months after culling animals, and cleansing and disinfection of the affected establishments. Therefore, theoretically, the duration of the trade restrictions by non-EU countries lasts at least 3 months, and in fact, the duration of the import restrictions of poultry and poultry products by the non-EU countries ranges from 3 month to 2 years (EC DG TRADE, 2018). Taking these facts into consideration, we assumed that for Scenario 1, the duration would be the minimum, that is 3 months. For the Scenario 2, where the disease spread to 4 different provinces, we

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					N	Number of far	ms in provin	ce
Scenario	Duration of outbreaks	Duration of the movement restriction zones	# of farms in movement restriction zones	Duration of non-EU's restrictions	Layer	Broiler	Layer parent	Broiler Parent
1	1 month	1 month	31(12:13:2:4)	3 months	30 ^{*2}	32 ^{*2}	5	9
2	2 months	Flevoland-A : 1 month	38(15:16:3:5)	6 months	30	32	5	9
		Flevoland-B : 1 month	30(12:13:2:3)		п	"	"	"
		Friesland: 1 month	28(7:16:1:4)		29	66	3	16
		Gelderland: 1month	27(18:5:1:3)		330	97	19	56
		Zuid-Holland: 1month	11(5:5:0:0)		12	12	1	1
3	6 months	Gelderse Vallei: 6 months	593(456:75:20:42)	9 months	651 ^{*3}	151 ^{*3}	29 ^{*3*4}	84 ^{*3}
		Limburg: 4 months	254(149:83:5:17)		248 ^{*3}	138 ^{*3}	8*3*4	28 ^{*3}
4	11	п	п	12 months	"	"	"	"

Table 12. Parameters for the scenario analysis. Numbers inside the bracket next to the number of the farms indicates "(# of layer farms : # of broiler farms : # of broiler farms)" in the movement restriction zones.

*2: As of 8 Jun., 2018, the data for 2017 is not yet available and instead we used the data of 2016.

*3: We used the data of 2002, as the data of 2003 was collected after the outbreak.

*4: Until 2004 the data regarding layer parents were not available, we used those of 2005.

Table 13. Number of the Dutch poultry farms in 2002 and 2016.

		Number of farms in the Netherlands										
Year	Layer	Broiler	Turkey	Ducks	Layer parent	Broiler Parent						
2002	1,880	1,096	37	97	100^{*}	418						
2016	1,017	629	112	56	68	283						

*: Until 2004 the data regarding layer parents were not available, we used those of 2005.

assumed longer period, 6 months. In respect to the Scenario 3 and 4, the duration is likely to be much longer than the Scenario 1 and 2, and in Scenario 3 we made an optimistic assumption that the duration would be 9 months, while for Scenario 4, we were more conservative and we assumed that the duration would be 1 year. In this scenario analysis, we did not assume that the duration would vary depending on the countries, which actually does in the reality.

For the outbreaks in Flevoland in Scenario 2, we made the first 3 outbreaks (see Table 11) into one outbreak because the RZ/SZ for these outbreaks were almost overlapping (We call this outbreak "Flevoland-1"). For the value of the farms inside the movement restriction zone, we used the values of the first outbreak in Flevoland. Even though there were a small overlapping between the movement restriction zones established for these 3 outbreaks and for the fourth outbreak in Flevoland (We call this fourth outbreak "Flevoland-2"), we considered the movement restriction zones for Flevoland-1 and Flevoland-2 as completely different for convenience sake. For the outbreaks of Friesland and Zuid-Holland, there were 2 outbreaks for each. In these outbreaks, the duration of the implementation of the movement restriction zones was 1 month for all the outbreaks and they did not have any overlapping, so we made 2 outbreaks in each province together by summing up the number of the farms inside the movement restriction zones for the purpose of convenience.

Table 14 lists the level of trade restrictions which are assumed to be imposed by the trade partners for each scenario. The table specifies from which part of the Netherlands the trade partners would suspend the import of poultry commodities. The rationale behind the assumptions of the level of trade restrictions is explained in Appendix IV. The colours of the countries and regions in the Fig. 2 and the figures in Appendix III indicate the level of trade restrictions by those countries: red indicates trade restrictions on the whole country of the Netherlands and orange and green indicate trade restrictions only on the affected provinces and the movement restriction zones, respectively.

Based on these parameters and assumptions, we did an analysis how much the export volume and value of poultry commodities would decrease in each scenarios. The way to calculate is explained as follows with the example of the fresh meat in Scenario 2:

For the export of fresh meat to the EU and EFTA countries, the export from the broiler farms located in the movement restriction zones in Flevoland-1, Flevoland-2, Friesland, Gelderland and Zuid-Holland, whose numbers are 16, 13, 16, 5, and 5 respectively, is suspended for 1 month. In 2016, there were 629 broiler farms in the Netherlands. Therefore, theoretically, the annual export volume and value to the EU and EFTA countries would decrease to:

		Scenario 1 and 2		Scenario 3 and 4				
	- Day-old chicks	- Fresh meat	- Processed meat	- Day-old chicks	- Fresh meat	- Processed meat		
	- Hatching Eggs	- Shelled eggs	- Eggs not in shell	- Hatching eggs	- Shelled eggs	- Eggs not in shell		
			- Egg albumin			- Egg albumin		
EU and EFTA countries	PZ/SZ	PZ/SZ	No restriction	PZ/SZ	PZ/SZ	No restriction		
Other non-EU/EFTA Europe	Whole country	Whole country	No restriction	Whole country	Whole country	No restriction		
Russia	PZ/SZ	Whole country	No restriction	Whole country	Whole country	No restriction		
Asia	Affected province	Affected province	No restriction	Whole country	Whole country	No restriction		
Africa	Whole country	Whole country	No restriction	Whole country	Whole country	No restriction		
North America	Affected province	Affected province	No restriction	Whole country	Whole country	No restriction		
South America	Whole country	Whole country	No restriction	Whole country	Whole country	No restriction		

Table 14. Level of the trade restrictions which are assumed to be imposed by the trade partner countries.

Table 15. Summary of the results of the scenario analysis. Unit for the volume and value is 1,000 t and 1,000 euros, respectively. Scenario 1 and 2 are based on the HPAI outbreak in Flevoland in 2017 and HPAI outbreaks in several provinces in 2016, respectively. Scenario 3 and 4 are based on the huge outbreak in 2003, with different assumption about the duration of the trade restriction by the non-EU countries.

				% vs		% vs		% vs		% vs
		Normal*	Scenario 1	normal	Scenario 2	normal	Scenario 3	normal	Scenario 4	normal
Frach most	Vol.(t)	1,260	1,197	95.0%	1,116	88.6%	949	75.3%	863	68.5%
Fresh meat	Val.(€)	2,081,273	2,026,991	97.4%	1,953,552	93.9%	1,758,309	84.5%	1,686,187	81.0%
Processed	Vol.(t)	142	142	99.8%	141	99.3%	133	94.1%	133	94.1%
meat	Val.(€)	512,480	511,597	99.8%	508,746	99.3%	482,009	94.1%	482,009	94.1%
Hatching ages	Vol.(t)	35	34	98.6%	33	96.2%	19	56.0%	15	42.4%
Hatching eggs	Val.(€)	121,820	120,078	98.6%	116,975	96.0%	64,703	53.1%	46,914	38.5%
	Vol.(t)	12	12	98.5%	12	96.1%	10	83.6%	10	80.3%
Day-old Chicks	Val.(€)	188,946	183,265	97.0%	173,758	92.0%	133,109	70.4%	117,630	62.3%
	Vol.(t)	365	362	99.1%	356	97.5%	301	82.4%	297	81.2%
Shelled eggs	Val.(€)	443,646	440,294	99.2%	433,706	97.8%	367,043	82.7%	362,445	81.7%
Eggs not in	Vol.(t)	124	123	99.9%	123	99.5%	105	85.2%	105	85.2%
shell	Val.(€)	242,856	242,617	99.9%	241,721	99.5%	206,987	85.2%	206,987	85.2%
Egg albumin	Vol.(t)	24	24	99.9%	24	99.5%	20	85.2%	20	85.2%
	Val.(€)	82,510	82,429	99.9%	82,125	99.5%	70,324	85.2%	70,324	85.2%

*1: The export volume and value to the Oceanian countries and countries not specified are excluded from the volume and value of Normal.

$$(1 - \frac{16 + 13 + 16 + 5 + 5}{629} \times \frac{1}{12}) \times 100 = 99.3\%.$$

On the other hand, the non-EU/EFTA countries are assumed to impose stricter trade restrictions. The duration of the trade restrictions by the non-EU/EFTA countries is assumed to last for 6 months for Scenario 2. Asian and North American countries would be likely to impose trade restrictions only on the affected provinces in Scenario 2. In the affected provinces, namely Flevoland, Friesland, Gelderland and Zuid-Holland, there are 32, 66, 97 and 12 broiler farms, respectively. Therefore annual export volume and value to the Asian and North American countries would decrease to:

$$(1 - \frac{32+66+97+12}{629} \times \frac{6}{12}) \times 100 = 83.5\%.$$

With respect to the other non-EU/EFTA countries except the Asian and North American countries, they are assumed to impose import restrictions on the whole country of the Netherlands, and the annual export value to these countries would decrease to:

$$(1 - \frac{629}{629} \times \frac{6}{12}) \times 100 = 50\%$$

For the products with processing such as processed meat and eggs not in shell, we did not assume any restrictions by the non-EU countries. However, poultry meat and eggs sourced from the movement restriction zones are not available for the production of processed products, practically they are in a same situation as the cases under the EU-level restriction. Summary and the detailed data of the results of the scenario analysis are in table 15 and in Appendix V, respectively.

In Scenario 1, in most of the commodities, the reduction in the export volume and value is small and except fresh poultry meat and poultry day-old chicks, they maintained more than 98% of the value and volume of the normal state. However, export volume of the fresh poultry meat and export value of day-old chicks were less than 98%. In Scenario 2, the export volume and value reduced more for all the commodities compared with Scenario 1, and still fresh poultry meat and day-old chicks are the commodities which were affected the most because the level of trade restriction has not changed from Scenario 1. In Scenario 3, the export volume and value reduced more significantly compared with Scenario 1 and 2, and needless to say, in Scenario 4, the reduction was the largest. Both in Scenario 3 and 4. hatching eggs suffered the negative impact most significantly. The reduction in the export value and volume of processed products such as processed meat did not change between Scenario 3 and 4.

4. Discussion and Conclusions

In this research, we clarified the trade flows of the poultry products from the Netherlands to the other countries and those from the other countries to the Netherlands as well. Among the three types of the commodities, the export of egg products are likely to be the most stable against the import restrictions due to HPAI outbreaks. This is because more than about 95% of poultry shelled eggs and poultry eggs not in shell are exported to the EU and EFTA countries, especially Germany, and the export volume and value of egg albumin are quite small and not likely to fall under the import restrictions following AI outbreaks. The export of fresh poultry meat depends on the non-EU countries more than that of egg products do, but the expensive parts of chicken meat are normally traded with the other EU and EFTA countries. Therefore, in value, about 90% of Dutch exported fresh poultry meat are exported to the EU and EFTA countries. Therefore, the export of poultry fresh meat is also regarded as quite strong against the trade restriction by non-EU countries. On the other hand, we found that poultry breeding materials depend on the non-EU/EFTA countries far more than the other commodities, and that in particular, more than 40% of Dutch poultry hatching eggs are exported to Russia. Therefore, these commodities are likely to be the most vulnerable to import restrictions following the AI outbreaks among all the commodities.

In the scenario analysis, we estimated how the export volume and value of the Dutch poultry commodities would decrease in each Scenario. In Scenario 1 and 2, the decrease in the export volume of fresh poultry meat was the most remarkable, followed by the export value of day-old chicks. On the other hand, the reduction in export volume and value of poultry hatching eggs was much smaller than that of fresh poultry meat and day-old chicks even though hatching eggs depend on the non-EU/EFTA countries most considerably. This is because almost all the part of the hatching eggs exported to non-EU/EFTA countries are dispatched to Russia, which impose EU-level restrictions in Scenario 1 and 2. Therefore, in these scenarios, practically about 90% of the exported Dutch hatching eggs are exported to EU and EFTA countries. On the other hand, about 25% of the export volume of fresh poultry meat and 20% of the export value of the poultry day-old chicks depend on the African and Asian countries. Therefore, these products would be affected more than hatching eggs in Scenario 1 and 2. In Scenario 3 and 4, as all the non-EU/EFTA countries including Russia impose trade restrictions on fresh products and breeding materials sourced from any part of the Netherlands, the export of hatching eggs would decrease most significantly among all the commodities. This is consistent with the trade patterns explained above. In addition, there was quite a difference between the export volume and value of processed meat products and processed egg products in Scenario 3 and 4. This is because in these scenarios, quite a large proportion of the layer farms in the Netherlands were assumed to fall under the movement

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restrictions compared with the broiler farms. Therefore, the volume of eggs available for the production of processed egg products were assumed to be more insufficient than the volume of raw meat available for the production of processed meat products.

These results, however, could be quite different if outbreaks would occur in different provinces from those in the scenario analysis. This is because in the Netherlands, the composition of the poultry industry varies a lot depending on the provinces. For example, in the Netherlands, Gelderse Vallei and Limburg are the major densely populated poultry areas, but the ratio between layer farms and broiler farms are quite different between these provinces: 4:1 and 2:1, respectively. Hence, the commodities affected by the trade restrictions can vary considerably depending on the location of the outbreaks, and therefore, for this type of analysis, grasping correct data about the composition of poultry industry is crucial for the accurate estimation.

For the scenario analysis, we focused only on the reduction in the export of poultry products caused by the movement restrictions based on the EU directive 2005/94 and the import restrictions imposed by non-EU/EFTA countries following the outbreak of AI. However, in actual situations, other several factors would affect the trade and they should also be taken into account for the better estimation. With regard to the HPAI outbreak 2003, obviously the reduction in the poultry population due to the massive culling of poultry was the main cause of the decrease in exports. In addition, if an outbreak would occur, poultry industry would be tend to shift their production from fresh products to processed products to considerable extent in order to maintain the market access to the non-EU countries. This is also the case for the 2003 HPAI outbreak (see Fig. A3 and A4 in the Appendix I). In that year, the export volume and value of processed meat products and eggs not in shell increased even though those of fresh products and breeding materials dropped significantly. Consumer's buying behaviour is also an important factor affecting the trade. It is reported that during the HPAI outbreak in Italy, consumers tended to reluctant to buy fresh and frozen chicken meat for fear of getting infection (Beach, Kuchler, Leibtag, & Zhen, 2008). Annual growth or reduction in the poultry industry should be taken into consideration as well.

If the export volume of a certain poultry commodity would decrease, theoretically the import volume of that commodity should decrease as well because the surplus caused by the reduction in the export has to be compensated by the reduction in the import. This phenomenon seems to have occurred in the series of HPAI outbreak in 2016 with regard to fresh products and breeding materials. However, if the scale of the outbreaks is devastating like the huge outbreak in 2003, the national production would decrease tremendously and the

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country have to increase the import of poultry commodities in order to cover the national consumption.

As we shown, if serious outbreaks of AI would occur in the Netherlands, the export of breeding materials would suffer the negative impacts far more than the other commodities; therefore, it is crucial for the Dutch breeding sector to mitigate the impacts of the import restrictions caused due to large outbreaks. One of the schemes which can reduce the impacts of the trade restrictions is the regionalisation. This scheme has already been enforced for the export of certain products for some trade partners such as Russia and Hong Kong. Thus, it is desirable to increase the number of the countries adopting the regionalisation and to expand the level of the outbreaks to which this scheme can be applied.

Another measure which can enable the Dutch poultry sector to export breeding materials to the non-EU countries even in case of outbreaks is Compartmentalisation (World Organisation for Animal Health, 2017-a; World Organisation for Animal Health, 2017-b). According to the definition of the OIE, Compartmentalisation is the concept that establishes an animal subpopulation contained in one or more establishments under a common biosecurity management system with a distinct health status with respect to a specific disease or specific diseases. This concept was officially published by OIE in 2004, and in 2009, European Commission issued the regulation called Commission Regulation (EC) No 616/2009, in order to facilitate the implementation of the compartmentalisation in the EU member countries. The USA has also started the operation of approving compartment facilities in their territory in 2015. In the EU, the UK is the most advanced in implementing this scheme and already agreed on the export conditions with Japan and South Africa stipulating continued exports of day-old chicks from the approved facilities even in case of outbreaks of avian influenza. In the Netherlands, one hatchery which distribute hatching eggs for pharmaceutical purposes has already obtained a compartment status (Boender, et al., 2014). Normally, breeding farms and hatcheries are managed in strict hygienic and operational conditions. Therefore, the requirements for obtaining the compartment status do not seem difficult for the Dutch breeding poultry sector to fulfil. Thus, it is desirable that the Dutch government should promote the implementation of the compartmentalisation while they try to negotiate with the trade partners on the import conditions stipulating the continued trade from the registered compartment facilities.

For the Dutch poultry sector, the UK is one of the most important customer. As of June 2018, there is an ongoing discussion whether the UK would remain in the single market or not after Brexit. If the UK would withdraw from the single market, and as a result they have veterinary policies which are not harmonised with those of EU, the Dutch poultry industry might

lose an important trade partner in case of a future HPAI outbreak. Thus, it is needed for the Dutch veterinary authorities to be prepared for negotiating with the UK for setting import conditions mitigating the impact of the disease outbreak on the poultry trade.

In conclusion,

- About 95% and 90% of the export of Dutch egg products and meat products in value are dispatched to the EU and EFTA countries and Germany, Belgium and the UK are the most important customers for the Netherlands. On the other hand quite a large part of breeding materials are exported to non-EU/EFTA countries and in particular, the most important buyer of Dutch hatching eggs is Russia.
- Scenario analysis showed in small HPAI outbreaks, fresh poultry meat and poultry dayold chicks would be affected the most. On the other hand, in large outbreaks, the export of hatching eggs would suffer the negative impact most significantly. However, depending on the affected places, these results could change considerably.
- For more precise scenario analysis, factors such as the reduction in the poultry population in the Netherlands caused by culling, consumers purchasing behaviour influenced by the outbreak, and annual growth or reduction of the industry should also be taken into account.
- Export of breeding materials heavily depends on the non-EU/EFTA countries, especially the export of hatching eggs to Russia. Therefore, it is important for Dutch poultry sector to prepare a scheme such as Compartmentalisation which enables continued exports even in large AI outbreaks.
- The UK, one of the largest importer of the Netherlands, may withdraw from the single market due to Brexit and a scheme for continued trade of poultry commodities should be established between the UK as well.

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Appendix I. Export volume and value of the Dutch poultry products to the EU and EFTA countries and the non-EU/EFTA countries, and the major importer countries of Dutch poultry products.

Fig. A1. Volume of the exported fresh poultry meat. (Above) bars indicate the volume (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners.




Fig. A2. Value of the exported fresh poultry meat. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.





Fig. A3. Volume of the exported processed poultry meat. (Above) bars indicate volume (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners.





Fig. A4. Value of the exported processed poultry meat export. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.





Fig. A5. Volume of the exported poultry hatching eggs. (Above) bars indicate amount (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners. Note that until 2008 reporting the volume was not obligatory for EU countries and data in certain years are missing and graph was made only from 2009.





Fig. A6. Value of the exported poultry hatching eggs. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.





Fig. A7. Volume of the exported poultry day-old chicks. (Above) bars indicate volume (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners. Note that until 2008 reporting the amount was not obligatory for EU countries and data in certain years are missing and graph was made only from 2009.





Fig. A8. Value of the exported poultry day-old chicks. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below)Value of the exported products to major trade partners.





Fig. A9. volume of the exported poultry shelled eggs. (Above) bars indicate amount (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners. Note that data 2008 reporting the amount was not obligatory for EU countries and the data for 2008 is missing and graph was made only from 2009.

*: the volume in 2012 was estimated value by the author. There are some outliers in volume of the monthly data. Therefore, I removed them and instead, add the mean of the other monthly volumes.





Fig. A10. Value of the exported poultry shelled eggs. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.





Fig. A11. Volume of the exported eggs not-in-shell. (Above) bars indicate volume (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners.





Fig. A12. Value of the exported eggs not-in-shell. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.





Fig. A13. Volume of the exported egg albumin. (Above) bars indicate volume (tonnes) of the exported products. Lines indicate the proportion of the exported products against the total volume. (Below) Volume of the exported products to major trade partners.





Fig. A14. Value of the exported egg albumin. (Above) bars indicate value (\in) of the exported products. Lines indicate the proportion of the exported products against the total value. (Below) Value of the exported products to major trade partners.

500,000 100% 450,000 90% 400,000 80% 350,000 70% 300,000 60% 250,000 50% 200,000 40% 150,000 30% 100,000 20% 50,000 10% 0 0% 15 02 03 04 05 06 07 08 09 10 11 12 13 14 16 17 EU+EFTA volume non-EU/EFTA volume •EU+EFTA % non-EU/EFTA % 160,000 140,000 120,000 100,000 80,000 60,000 40,000 20,000 0 14 UK 02 04 05 06 07 08 09 10 11 12 13 15 16 17 03 Belgium Germany France Italy Russia • Other non-EU/EFTA Europe • Other EU+EFTA Africa North America South America Asia

Appendix II. Import volume and value of poultry products by the Netherlands from the EU/EFTA and the non-EU/EFTA countries, and the major exporter countries of poultry products to the Netherlands.

Fig. A15. Volume of the imported fresh poultry meat. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners.





Fig. A16. Value of the imported fresh poultry meat. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A17. Volume of the imported processed poultry meat. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners.





Fig. A18. Value of the imported processed poultry meat. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A19. Volume of the imported poultry hatching eggs. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners. Note that until 2008 reporting the volume was not obligatory for EU countries and data in certain years are missing and graph was made only from 2009.





Fig. A20. Value of the imported poultry hatching eggs. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A21. Volume of the imported poultry day-old chicks. (Above) bars indicate amount (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners. Note that until 2008 reporting the volume was not obligatory for EU countries and data in certain years are missing and graph was made only from 2009.





Fig. A22. Value of the imported poultry day-old chicks. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A23. Volume of the imported poultry shelled eggs. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners. Note that until 2008 reporting the volume was not obligatory for EU countries and data in certain years are missing and graph was made only from 2009.





Fig. A24. Value of the imported poultry shelled eggs. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A25. volume of the imported eggs not-in-shell. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners.





Fig. A26. Value of the imported eggs not-in-shell. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.





Fig. A27. Volume of the imported egg albumin. (Above) bars indicate volume (tonnes) of the imported products. Lines indicate the proportion of the imported products against the total volume. (Below) Volume of the imported products to the Netherlands from major trade partners.





Fig. A28. Value of the imported egg albumin. (Above) bars indicate value (\in) of the imported products. Lines indicate the proportion of the imported products against the total value. (Below) Value of the imported products to the Netherlands from major trade partners.

Appendix III. Net trade flow of poultry commodities of the Netherlands with the major trade partners (Except fresh poultry meat). The values are the mean of the 5 years in 2013-2017. The colour of country/region indicates the strictness of the import restriction imposed by that country in Scenario 1 (Red: Import suspension on the entire country; Orange: Import suspension on the affected province; Green: Import suspension on PZ/SZ) in the section 3.3.



Fig. A29. Net trade flows of the processed poultry meat of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.



Fig.A30. Net trade flows of the poultry hatching eggs of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.



Fig.A31. Net trade flows of the poultry day-old chicks of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3..



Fig.A32. Net trade flows of the poultry shelled eggs of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.



Fig.A33. Net trade flows of the poultry eggs not in shell of the Netherlands with major trade partner countries and regions. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.



Fig.A34. Net trade flows of the egg albumin of the Netherlands with major trade partner countries and region. The values are the mean value of the last five years (2013-2017). The broken line circumscribing the centre indicates the countries belonging to EU or EFTA. As the UK is scheduled to withdraw from the EU, it is separated by the dotted line. The colour of a country/region indicates the strictness of the import restrictions imposed by that country in Scenario 1 (Red: Import restrictions on the entire country; Orange: Import restrictions on the affected provinces; Green: Import restrictions on the movement restriction zones) in the section 3.3.

Appendix IV. Rationale behind the assumption on the trade restrictions imposed by the non-EU/EFTA trade partners.

Russia

Russian poultry industry heavily depends on the supply of poultry breeding materials by the Netherlands and in case of relatively small outbreaks, they would impose trade restriction only on the movement restriction zones in order to maintain a continued supply. However, in case of large outbreaks, they are assumed to strengthen the measures and impose import ban on the whole country. For the other poultry commodities, Russia is assumed to impose trade restrictions on whole country regardless of the scale of the outbreak.

Other non-EU/EFTA European countries

With regard to the non-EU/EFTA European countries Except Russia, some countries such as Serbia (EC DG TRADE, 2018), Macedonia and Bosnia are known to have already introduced regionalisation concept for Dutch poultry commodities, but major importer including Ukraine and Georgia have not yet adopted the regionalisation policy on Dutch poultry commodities. Therefore, we assume that these countries impose whole country ban regardless of the magnitude of the outbreak.

African countries

Only Tunisia is known to have adopted the regionalisation policy in case of AI outbreaks in EU (EC DG TRADE, 2018). However, main trade partners of Dutch poultry commodities such as South Africa and Benin have not adopted the regionalisation. Therefore, we assumed that all the African countries impose trade restriction on the whole country regardless of the magnitude of the outbreak.

Asian countries

Regarding the fresh commodities, Hong Kong and the Philippines are major clients of Dutch poultry products, and for breeding products, Saudi Arabia, UAE and Thailand are the most important trade partners in Asia. Except Thailand, these countries already applied the regionalisation on Dutch poultry commodities (EC DG TRADE, 2018). Therefore, we assume that Asian countries as a whole adopt the regionalisation on Dutch poultry products in small outbreaks. However In case of huge outbreaks, we assume that they would impose import restrictions on the whole country.

North American Countries

EU and the USA have already agreed on continued exportation of poultry products from nonaffected area to the USA in case of outbreaks (Swayne, Hill, & Clifford, 2017). Canada and Mexico have already applied the regionalisation policy for Dutch poultry products (EC DG TRADE, 2018). However In case of huge outbreaks, we assume that they would impose import restrictions on the whole country.

South American countries

Peru and Chile are known to have adopted the regionalisation on Dutch poultry products in case of outbreaks of HPAI (EC DG TRADE, 2018). However, the volume of the poultry products which these two countries import is quite low, and in the South American region, Brazil play a key role of supplying poultry products. Therefore, we assume that South American countries imposed trade restrictions on the whole country in any case of HPAI outbreaks.

Appendix V. Detailed results of the scenario analysis.

Table A1. Results of the scenario analysis on fresh poultry meat. **Volume (t)**

	% vs			% vs		% vs	% vs			% vs
	Normal	Total	Scenario 1A	Normal	Scenario1B	Normal	Scenario 2A	Normal	Scenario 2B	Normal
Total	1,260,281	100%	1,197,115	95.0%	1,116,273	88.6%	948,564	75.3%	862,841	68.5%
Germany	330,183	26%	329,615	99.8%	327,777	99.3%	310,551	94.1%	310,551	94.1%
Belgium	98,144	8%	97,975	99.8%	97,429	99.3%	92,308	94.1%	92,308	94.1%
UK	188,535	15%	188,210	99.8%	187,161	99.3%	177,325	94.1%	177,325	94.1%
France	118,898	9%	118,694	99.8%	118,032	99.3%	111,829	94.1%	111,829	94.1%
Italy	11,516	1%	11,496	99.8%	11,432	99.3%	10,831	94.1%	10,831	94.1%
Other EU+EFTA	170,111	13%	169,818	99.8%	168,872	99.3%	159,997	94.1%	159,997	94.1%
Other Non-EU/EFTA										
Europe	22,047	2%	16,535	75.0%	11,023	50.0%	5,512	25.0%	0	0.0%
Russia	34,298	3%	25,724	75.0%	17,149	50.0%	8,575	25.0%	0	0.0%
Asia	100,405	8%	99,128	98.7%	83,884	83.5%	25,101	25.0%	0	0.0%
Africa	184,726	15%	138,545	75.0%	92,363	50.0%	46,182	25.0%	0	0.0%
North America	1,320	0%	1,303	98.7%	1,102	83.5%	330	25.0%	0	0.0%
South America	98	0%	74	75.0%	49	50.0%	25	25.0%	0	0.0%

Value (€)

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1A	Normal	Scenario1B	Normal	Scenario 2A	Normal	Scenario 2B	Normal
Total	2,081,273,136	100%	2,026,991,480	97.4%	1,953,552,128	93.9%	1,758,309,183	84.5%	1,686,186,680	81.0%
Germany	465,165,000	22%	464,363,841	99.8%	461,775,483	99.3%	437,506,923	94.1%	437,506,923	94.1%
Belgium	146,021,225	7%	145,769,731	99.8%	144,957,212	99.3%	137,339,002	94.1%	137,339,002	94.1%
UK	594,657,376	29%	593,633,191	99.8%	590,324,287	99.3%	559,299,858	94.1%	559,299,858	94.1%
France	225,984,843	11%	225,595,627	99.8%	224,338,160	99.3%	212,548,093	94.1%	212,548,093	94.1%
Italy	18,462,524	1%	18,430,725	99.8%	18,327,993	99.3%	17,364,767	94.1%	17,364,767	94.1%
Other EU+EFTA	342,492,154	16%	341,902,276	99.8%	339,996,517	99.3%	322,128,037	94.1%	322,128,037	94.1%
Other Non-EU/EFTA										
Europe	14,484,472	1%	10,863,354	75.0%	7,242,236	50.0%	3,621,118	25.0%	0	0.0%
Russia	24,729,219	1%	18,546,914	75.0%	12,364,609	50.0%	6,182,305	25.0%	0	0.0%
Asia	86,943,391	4%	85,837,593	98.7%	72,637,126	83.5%	21,735,848	25.0%	0	0.0%
Africa	160,943,427	8%	120,707,570	75.0%	80,471,714	50.0%	40,235,857	25.0%	0	0.0%
North America	1,258,117	0%	1,242,116	98.7%	1,051,098	83.5%	314,529	25.0%	0	0.0%
South America	131,389	0%	98,542	75.0%	65,695	50.0%	32,847	25.0%	0	0.0%
Table A2. Results of the scenario analysis on processed poultry meat **Volume (t)**

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1A	Normal	Scenario1B	Normal	Scenario 2A	Normal	Scenario 2B	Normal
Total	141,921	100%	141,676	99.8%	140,886	99.3%	133,482	94.1%	133,482	94.1%
Germany	42,209	30%	42,137	99.8%	41,902	99.3%	39,700	94.1%	39,700	94.1%
Belgium	12,323	9%	12,302	99.8%	12,233	99.3%	11,590	94.1%	11,590	94.1%
UK	26,126	18%	26,081	99.8%	25,935	99.3%	24,572	94.1%	24,572	94.1%
France	9,319	7%	9,303	99.8%	9,252	99.3%	8,765	94.1%	8,765	94.1%
Italy	6,787	5%	6,776	99.8%	6,738	99.3%	6,384	94.1%	6,384	94.1%
Other EU+EFTA	37,212	26%	37,148	99.8%	36,941	99.3%	35,000	94.1%	35,000	94.1%
Other Non-EU/EFTA										
Europe	939	1%	938	99.8%	932	99.3%	883	94.1%	883	94.1%
Russia	0	0%	0	99.8%	0	99.3%	0	94.1%	0	94.1%
Asia	4,219	3%	4,212	99.8%	4,188	99.3%	3,968	94.1%	3,968	94.1%
Africa	2,550	2%	2,545	99.8%	2,531	99.3%	2,398	94.1%	2,398	94.1%
North America	202	0%	202	99.8%	201	99.3%	190	94.1%	190	94.1%
South America	33.02	0%	33	99.8%	33	99.3%	31	94.1%	31	94.1%

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1A	Normal	Scenario1B	Normal	Scenario 2A	Normal	Scenario 2B	Normal
Total	512,480,027	100%	511,597,378	99.8%	508,745,740	99.3%	482,008,663	94.1%	482,008,663	94.1%
Germany	151,380,113	30%	151,119,389	99.8%	150,277,052	99.3%	142,379,258	94.1%	142,379,258	94.1%
Belgium	44,630,053	9%	44,553,187	99.8%	44,304,848	99.3%	41,976,411	94.1%	41,976,411	94.1%
UK	88,746,457	17%	88,593,608	99.8%	88,099,788	99.3%	83,469,713	94.1%	83,469,713	94.1%
France	38,952,184	8%	38,885,096	99.8%	38,668,351	99.3%	36,636,140	94.1%	36,636,140	94.1%
Italy	23,381,365	5%	23,341,095	99.8%	23,210,992	99.3%	21,991,141	94.1%	21,991,141	94.1%
Other EU+EFTA	142,321,189	28%	142,076,068	99.8%	141,284,138	99.3%	133,858,965	94.1%	133,858,965	94.1%
Other Non-EU/EFTA										
Europe	2,222,814	0%	2,218,986	99.8%	2,206,617	99.3%	2,090,649	94.1%	2,090,649	94.1%
Russia	1,155	0%	1,153	99.8%	1,146	99.3%	1,086	94.1%	1,086	94.1%
Asia	13,315,238	3%	13,292,305	99.8%	13,218,214	99.3%	12,523,532	94.1%	12,523,532	94.1%
Africa	6,682,849	1%	6,671,339	99.8%	6,634,153	99.3%	6,285,496	94.1%	6,285,496	94.1%
North America	739,050	0%	737,778	99.8%	733,665	99.3%	695,107	94.1%	695,107	94.1%
South America	107559.8	0%	107,375	99.8%	106,776	99.3%	101,164	94.1%	101,164	94.1%

Table A3. Results of the scenario analysis on poultry hatching eggs **Volume (t)**

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	34,506	100%	34,035	98.6%	33,180	96.2%	19,310	56.0%	14,635	42.4%
Germany	5,163	15%	5,156	99.9%	5,136	99.5%	4,781	92.6%	4,781	92.6%
Belgium	8,832	26%	8,820	99.9%	8,786	99.5%	8,179	92.6%	8,179	92.6%
UK	2,590	8%	2,586	99.9%	2,577	99.5%	2,398	92.6%	2,398	92.6%
France	1,579	5%	1,576	99.9%	1,570	99.5%	1,462	92.6%	1,462	92.6%
Italy	321	1%	320	99.9%	319	99.5%	297	92.6%	297	92.6%
Other EU+EFTA	2,483	7%	2,479	99.9%	2,470	99.5%	2,299	92.6%	2,299	92.6%
Other Non-EU/EFTA										
Europe	347	1%	260	75.0%	173	50.0%	87	25.0%	0	0.0%
Russia	14,804	43%	14,783	99.9%	14,727	99.5%	3,701	25.0%	0	0.0%
Asia	1,963	6%	1,944	99.0%	1,656	84.3%	491	25.0%	0	0.0%
Africa	1,211	4%	908	75.0%	606	50.0%	303	25.0%	0	0.0%
North America	316	1%	313	99.0%	267	84.3%	79	25.0%	0	0.0%
South America	60	0%	45	75.0%	30	50.0%	15	25.0%	0	0.0%

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	121,820,325	100%	120,078,350	98.6%	116,975,028	96.0%	64,703,064	53.1%	46,913,705	38.5%
Germany	16,402,538	13%	16,379,172	99.9%	16,316,865	99.5%	15,188,708	92.6%	15,188,708	92.6%
Belgium	25,951,246	21%	25,914,278	99.9%	25,815,698	99.5%	24,030,787	92.6%	24,030,787	92.6%
UK	9,712,631	8%	9,698,796	99.9%	9,661,900	99.5%	8,993,871	92.6%	8,993,871	92.6%
France	4,931,757	4%	4,924,732	99.9%	4,905,998	99.5%	4,566,794	92.6%	4,566,794	92.6%
Italy	778,781	1%	777,672	99.9%	774,714	99.5%	721,150	92.6%	721,150	92.6%
Other EU+EFTA	9,288,474	8%	9,275,243	99.9%	9,239,959	99.5%	8,601,103	92.6%	8,601,103	92.6%
Other Non-EU/EFTA										
Europe	1,270,078	1%	952,558	75.0%	635039	50.0%	317,519	25.0%	0	0.0%
Russia	57,040,710	47%	56,959,455	99.9%	56,742,776	99.5%	14,260,177	25.0%	0	0.0%
Asia	7,002,132	6%	6,932,311	99.0%	5,904,932	84.3%	1,750,533	25.0%	0	0.0%
Africa	4,419,895	4%	3,314,922	75.0%	2,209,948	50.0%	1,104,974	25.0%	0	0.0%
North America	1,082,868	1%	1,072,070	99.0%	913,188	84.3%	270,717	25.0%	0	0.0%
South America	341,753	0%	256,314	75.0%	170,876	50.0%	85,438	25.0%	0	0.0%

Table A4. Results of the scenario analysis on poultry day-old chicks. **Volume (t)**

	% vs Normal Total Scona			% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	12,363	100%	12,180	98.5%	11,880	96.1%	10,340	83.6%	9,930	80.3%
Germany	8,288	67%	8,276	99.9%	8,245	99.5%	7,675	92.6%	7,675	92.6%
Belgium	1,130	9%	1,129	99.9%	1,125	99.5%	1,047	92.6%	1,047	92.6%
UK	440	4%	439	99.9%	437	99.5%	407	92.6%	407	92.6%
France	84	1%	84	99.9%	83	99.5%	78	92.6%	78	92.6%
Italy	77	1%	77	99.9%	77	99.5%	71	92.6%	71	92.6%
Other EU+EFTA	704	6%	703	99.9%	700	99.5%	652	92.6%	652	92.6%
Other Non-EU/EFTA										
Europe	113	1%	85	75.0%	56	50.0%	28	25.0%	0	0.0%
Russia	329	3%	329	99.9%	327	99.5%	82	25.0%	0	0.0%
Asia	662	5%	656	99.0%	559	84.3%	166	25.0%	0	0.0%
Africa	505	4%	378	75.0%	252	50.0%	126	25.0%	0	0.0%
North America	9	0%	9	99.0%	7	84.3%	2	25.0%	0	0.0%
South America	21	0%	16	75.0%	11	50.0%	5	25.0%	0	0.0%

	% vs Normal Total Sce			% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	188,945,713	100%	183,264,552	97.0%	173,757,877	92.0%	133,108,932	70.4%	117,630,208	62.3%
Germany	80,454,416	43%	80,339,809	99.9%	80,034,189	99.5%	74,500,582	92.6%	74,500,582	92.6%
Belgium	16,337,588	9%	16,314,315	99.9%	16,252,254	99.5%	15,128,564	92.6%	15,128,564	92.6%
UK	11,982,399	6%	11,965,330	99.9%	11,919,813	99.5%	11,095,671	92.6%	11,095,671	92.6%
France	1,850,435	1%	1,847,799	99.9%	1,840,770	99.5%	1,713,498	92.6%	1,713,498	92.6%
Italy	1,323,499	1%	1,321,613	99.9%	1,316,586	99.5%	1,225,556	92.6%	1,225,556	92.6%
Other EU+EFTA	15,082,478	8%	15,060,993	99.9%	15,003,700	99.5%	13,966,336	92.6%	13,966,336	92.6%
Other Non-EU/EFTA										
Europe	4,890,974	3%	3,668,230	75.0%	2,445,487	50.0%	1,222,743	25.0%	0	0.0%
Russia	15,520,354	8%	15,498,245	99.9%	15,439,288	99.5%	3,880,088	25.0%	0	0.0%
Asia	25,331,420	13%	25,078,827	99.0%	21,362,109	84.3%	6,332,855	25.0%	0	0.0%
Africa	15,347,699	8%	11,510,774	75.0%	7,673,849	50.0%	3,836,925	25.0%	0	0.0%
North America	167,800	0%	166,127	99.0%	141,506	84.3%	41,950	25.0%	0	0.0%
South America	656,653	0%	492,490	75.0%	328,327	50.0%	164,163	25.0%	0	0.0%

Table A5. Results of the scenario analysis on poultry shelled eggs.

Volume (t)

	% vs			% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	365,429	100%	362,294	99.1%	356,339	97.5%	301,118	82.4%	296,826	81.2%
Germany	252,275	69%	252,027	99.9%	251,097	99.5%	215,015	85.2%	215,015	85.2%
Belgium	30,766	8%	30,736	99.9%	30,622	99.5%	26,222	85.2%	26,222	85.2%
UK	5,162	1%	5,157	99.9%	5,138	99.5%	4,399	85.2%	4,399	85.2%
France	9,175	3%	9,166	99.9%	9,133	99.5%	7,820	85.2%	7,820	85.2%
Italy	18,066	5%	18,048	99.9%	17,981	99.5%	15,397	85.2%	15,397	85.2%
Other EU+EFTA	32,820	9%	32,787	99.9%	32,666	99.5%	27,972	85.2%	27,972	85.2%
Other Non-EU/EFTA										
Europe	7	0%	5	75.0%	4	50.0%	2	25.0%	0	0.0%
Russia	26	0%	19	75.0%	13	50.0%	6	25.0%	0	0.0%
Asia	6,069	2%	6,024	99.3%	4,134	68.1%	1,517	25.0%	0	0.0%
Africa	10,956	3%	8,217	75.0%	5,478	50.0%	2,739	25.0%	0	0.0%
North America	108	0%	108	99.3%	74	68.1%	27	25.0%	0	0.0%
South America	0	0%	0	N/A	0	N/A	0	N/A	0	N/A

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	443,646,002	100%	440,293,753	99.2%	433,706,313	97.8%	367,043,277	82.7%	362,444,937	81.7%
Germany	320,780,148	72%	320,464,730	99.9%	319,281,912	99.5%	273,402,512	85.2%	273,402,512	85.2%
Belgium	33,439,778	8%	33,406,897	99.9%	33,283,594	99.5%	28,500,888	85.2%	28,500,888	85.2%
UK	5,966,145	1%	5,960,278	99.9%	5,938,279	99.5%	5,084,975	85.2%	5,084,975	85.2%
France	9,389,768	2%	9,380,535	99.9%	9,345,912	99.5%	8,002,946	85.2%	8,002,946	85.2%
Italy	17,812,059	4%	17,794,545	99.9%	17,728,866	99.5%	15,181,306	85.2%	15,181,306	85.2%
Other EU+EFTA	37,864,744	9%	37,827,513	99.9%	37,687,893	99.5%	32,272,310	85.2%	32,272,310	85.2%
Other Non-EU/EFTA										
Europe	9,848	0%	7,386	75.0%	4,924	50.0%	2,462	25.0%	0	0.0%
Russia	29,687	0%	22,265	75.0%	14,844	50.0%	7,422	25.0%	0	0.0%
Asia	6,741,618	2%	6,691,901	99.3%	4,592,660	68.1%	1,685,405	25.0%	0	0.0%
Africa	11,494,547	3%	8,620,910	75.0%	5,747,273	50.0%	2,873,637	25.0%	0	0.0%
North America	117,661	0%	116,793	99.3%	80,155	68.1%	29,415	25.0%	0	0.0%
South America	0	0%	0	N/A	0	N/A	0	N/A	0	N/A

Table A6. Results of the scenario analysis on eggs not in shell. **Volume (t)**

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	123,620	100%	123,498	99.9%	123,042	99.5%	105,362	85.2%	105,362	85.2%
Germany	47,140	38%	47,093	99.9%	46,920	99.5%	40,177	85.2%	40,177	85.2%
Belgium	12,973	10%	12,960	99.9%	12,912	99.5%	11,057	85.2%	11,057	85.2%
UK	30,532	25%	30,502	99.9%	30,389	99.5%	26,022	85.2%	26,022	85.2%
France	9,718	8%	9,708	99.9%	9,673	99.5%	8,283	85.2%	8,283	85.2%
Italy	2,576	2%	2,573	99.9%	2,564	99.5%	2,195	85.2%	2,195	85.2%
Other EU+EFTA	18,373	15%	18,355	99.9%	18,288	99.5%	15,660	85.2%	15,660	85.2%
Other Non-EU/EFTA										
Europe	4	0%	4	99.9%	4	99.5%	4	85.2%	4	85.2%
Russia	0	0%	0	N/A	0	N/A	0	N/A	0	N/A
Asia	1,107	1%	1,106	99.9%	1,102	99.5%	943	85.2%	943	85.2%
Africa	232	0%	232	99.9%	231	99.5%	198	85.2%	198	85.2%
North America	960	1%	959	99.9%	955	99.5%	818	85.2%	818	85.2%
South America	5	0%	5	99.9%	5	99.5%	4	85.2%	4	85.2%

	% vs			% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	242,855,578	100%	242,616,782	99.9%	241,721,297	99.5%	206,987,015	85.2%	206,987,015	85.2%
Germany	90,302,859	37%	90,214,066	99.9%	89,881,091	99.5%	76,965,575	85.2%	76,965,575	85.2%
UK	63,946,051	26%	63,883,174	99.9%	63,647,385	99.5%	54,501,537	85.2%	54,501,537	85.2%
Belgium	20,833,495	9%	20,813,010	99.9%	20,736,190	99.5%	17,756,491	85.2%	17,756,491	85.2%
France	17,122,307	7%	17,105,471	99.9%	17,042,336	99.5%	14,593,427	85.2%	14,593,427	85.2%
Italy	4,208,757	2%	4,204,619	99.9%	4,189,100	99.5%	3,587,145	85.2%	3,587,145	85.2%
Other EU+EFTA	39,502,497	16%	39,463,655	99.9%	39,317,996	99.5%	33,668,174	85.2%	33,668,174	85.2%
Other Non-EU/EFTA										
Europe	15,524	0%	15,508	99.9%	15,451	99.5%	13,231	85.2%	13,231	85.2%
Russia	4	0%	4	99.9%	4	99.5%	3	85.2%	3	85.2%
Asia	2,681,693	1%	2,679,056	99.9%	2,669,168	99.5%	2,285,620	85.2%	2,285,620	85.2%
Africa	474,330	0%	473,864	99.9%	472,115	99.5%	404,274	85.2%	404,274	85.2%
North America	3,749,034	2%	3,745,347	99.9%	3,731,523	99.5%	3,195,320	85.2%	3,195,320	85.2%
South America	19,028	0%	19,009	99.9%	18,939	99.5%	16,217	85.2%	16,217	85.2%

Table A7. Results of the scenario analysis on egg albumin. **Volume (t)**

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	23,991	100%	23,968	99.9%	23,879	99.5%	20,448	85.2%	20,448	85.2%
Germany	3,009	13%	3,007	99.9%	2,995	99.5%	2,565	85.2%	2,565	85.2%
Belgium	2,123	9%	2,121	99.9%	2,113	99.5%	1,810	85.2%	1,810	85.2%
UK	1,710	7%	1,708	99.9%	1,702	99.5%	1,458	85.2%	1,458	85.2%
France	2,274	9%	2,271	99.9%	2,263	99.5%	1,938	85.2%	1,938	85.2%
Italy	1,594	7%	1,592	99.9%	1,587	99.5%	1,359	85.2%	1,359	85.2%
Other EU+EFTA	9,613	40%	9,604	99.9%	9,568	99.5%	8,193	85.2%	8,193	85.2%
Other Non-EU/EFTA										
Europe	8	0%	8	99.9%	8	99.5%	7	85.2%	7	85.2%
Russia	2	0%	2	99.9%	2	99.5%	2	85.2%	2	85.2%
Asia	3,302	14%	3,299	99.9%	3,287	99.5%	2,814	85.2%	2,814	85.2%
Africa	20	0%	20	99.9%	20	99.5%	17	85.2%	17	85.2%
North America	336	1%	336	99.9%	335	99.5%	287	85.2%	287	85.2%
South America	0	0%	0	99.9%	0	99.5%	0	85.2%	0	85.2%

		% vs		% vs		% vs		% vs		% vs
	Normal	Total	Scenario 1	Normal	Scenario 2	Normal	Scenario 3	Normal	Scenario 4	Normal
Total	82,509,876	100%	82,428,746	99.9%	82,124,506	99.5%	70,323,577	85.2%	70,323,577	85.2%
Germany	11,809,206	14%	11,797,594	99.9%	11,754,050	99.5%	10,065,045	85.2%	10,065,045	85.2%
Belgium	2,633,092	3%	2,630,503	99.9%	2,620,794	99.5%	2,244,197	85.2%	2,244,197	85.2%
UK	9,171,656	11%	9,162,638	99.9%	9,128,819	99.5%	7,817,048	85.2%	7,817,048	85.2%
France	4,041,566	5%	4,037,592	99.9%	4,022,690	99.5%	3,444,647	85.2%	3,444,647	85.2%
Italy	2,785,110	3%	2,782,371	99.9%	2,772,101	99.5%	2,373,763	85.2%	2,373,763	85.2%
Other EU+EFTA	19,532,162	24%	19,512,956	99.9%	19,440,935	99.5%	16,647,359	85.2%	16,647,359	85.2%
Other Non-EU/EFTA										
Europe	82,632	0%	82,551	99.9%	82,246	99.5%	70,427	85.2%	70,427	85.2%
Russia	2,354	0%	2,351	99.9%	2,343	99.5%	2,006	85.2%	2,006	85.2%
Asia	27,874,090	34%	27,846,681	99.9%	27,743,901	99.5%	23,757,225	85.2%	23,757,225	85.2%
Africa	178,893	0%	178,717	99.9%	178,057	99.5%	152,471	85.2%	152,471	85.2%
North America	4,398,972	5%	4,394,646	99.9%	4,378,426	99.5%	3,749,266	85.2%	3,749,266	85.2%
South America	144	0%	144	99.9%	144	99.5%	123	85.2%	123	85.2%