Department Clinical Research and Veterinary Public Health
der Vetsuisse-Fakultät Universität Bern
(Leitung: Prof. Dr. T. Leeb)

Bundesamt für Veterinärwesen, Bern-Liebefeld
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med. vet. R. Hauser

Estimation of illegal imports and their contribution to the introduction of avian influenza virus into Switzerland

Inaugural-Dissertation

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Carmen Läubli
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Meinem „Zetzbugrosi“
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Inhaltsverzeichnis

Zusammenfassung

Illegale Importe von Tieren und tierischen Produkten können ein Risiko für die Einschleppung von Tierseuchen darstellen. Jüngstes Beispiel ist die Einschleppung von Infektiöser boviner Rhinotracheitis in den Kanton Jura im Jahr 2009. Es liegt in der Natur der Sache, dass wenig über Schmuggel-aktivitäten bekannt ist. Illegale Importe sind in dieser Arbeit definiert als alle nicht korrekt deklarierten Importe. An den Schweizer Grenzen werden durch die Grenzwachtleute und Zollbeamten Aufgriffe von geschmuggelten Waren und Tieren getätigt. Basierend auf den Daten von diesen Aufgriffen bezüglich Art des Produktes, Herkunft und Menge wurden die jährlichen illegalen Importe mittels Monte-Carlo-Simulationsmodellen geschätzt. Eine qualitative Risikoabschätzung zur Einschleppung von Aviärer Influenza durch diese geschätzten illegalen Importe wurde als Anwendungsbeispiel durchgeführt.

Mengenmässig am meisten werden Fleisch und Fleischwaren in die Schweiz geschmuggelt. Berechnet wurde ein Median von 2‘474 Tonnen Fleischwaren. Milch und Milchprodukte folgen mit 986 Tonnen vor den anderen tierischen Produkten mit 308 Tonnen. Andere tierische Produkte beinhalten vor allem Fisch und Fischprodukte, Honig, Pelze, Trophäen und diverse Souvenirs tierischen Ursprungs. Die Menge von illegal eingeführten Eiern wurde auf 51 Tonnen geschätzt, während jährlich schätzungsweise 30‘491 lebende Tiere in die Schweiz geschmuggelt werden. Alle diese Werte bezeichnen die Medianwerte. Die detaillierten Minimal- und Maximalwerte werden in der nachfolgenden Arbeit dargestellt.

Als wichtigste Einschleppungsroute wurde der private Strassenverkehr identifiziert. Die grösste Gefahr für die Einschleppung einer Tierseuche via illegale Importe geht – abhängig von der Epidemiologie des Krankheitserregers - einerseits von lebenden Tieren aus, andererseits von ungenügend gekochten Essensresten, die an Tiere verfüttert werden.

Das Risiko für die Einschleppung von Aviärer Influenza durch den Schmuggel von lebenden Vögeln wurde als klein eingeschätzt. Geschmuggeltes Geflügelfleisch trägt zu einem kleinen Einschleppungsrisiko in kommerzielle Geflügelbetrieben und Hinterhofgeflügelhaltungen bei, während dieses Risiko für andere Vogelhaltungen als vernachlässigbar eingestuft wird. Ebenso wird das Risiko für die Einschleppung des Aviären Influenza-Virus durch illegal importierte Eier und Federn als vernachlässigbar geschätzt.

Estimation of illegal imports and their contribution to the introduction of avian influenza virus into Switzerland

Carmen Läubli[1], Markus Zeller[2] and Ruth Hauser[1§]

[1]Swiss Federal Veterinary Office, Schwarzenburgstrasse 155, 3097 Bern-Liebefeld, Switzerland

[2]Swiss Federal Customs Administration, Monbijoustrasse 40, 3003 Bern, Switzerland

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Abstract

Background

Illegal imports of animals and animal products are considered to pose a risk for the introduction of avian influenza virus into Switzerland. Little is known about illegal activities. We assume that seizures made by the customs authorities at the Swiss borders represent product type, weight and origin of goods illegally imported into Switzerland. The aims of this study are first to estimate the annual illegal flow of all animal species and animal products and second to qualitatively assess the risk for the introduction of notifiable avian influenza viruses (NAIV) through those illegal imports into Switzerland.

Results

The median estimate of the total annual illegal flow of meat into Switzerland is 2,474 tonnes. A median estimate of 30,491 live animals was calculated, including pet animals, reptiles, amphibians and arthropods. The median flow of illegally imported eggs was 51 tonnes. The weight of smuggled milk and milk products was estimated to be 986 tonnes. Of other animal products 308 tonnes were calculated to be illegally imported.

The risk for the introduction of NAIV into any bird holding by illegal importations of live birds is considered to be low. Illegal imports of poultry meat and meat products pose a low risk for the introduction of NAIV into commercial and backyard poultry holdings whereas this risk is estimated to be negligible for other bird holdings. Illegally imported eggs and feathers are estimated to be a negligible risk for the introduction of NAI viruses into any holding type.

Conclusions

The most important entry route is considered to be by road traffic. Illegal imports of birds and their products contribute to a possible introduction of avian

influenza viruses into Switzerland. Beside border controls, information to travellers about dangers and risks linked to illegal imports of animals and animal products may help to reduce smuggling.

Background

It is the nature of illegal activities that little is known about them. At the borders goods are seized by custom authorities. We assume the seizures to represent the illegal imports concerning product type, origin and weight. Illegal import in this study is defined as an importation of live animals or animal products that does not follow the correct entry procedures by not being correctly declared at a Swiss Border Inspection Post (BIP). This definition includes consignments that were declared but not accompanied by correct certificates.

The aim of this study is to estimate the illegal flow of animals and animal products. The qualitative risk assessment for the introduction of avian influenza virus through illegal imports into Switzerland is an example for the use of the estimated amount of illegal imports of animals and animal products.

In risk assessments conducted by the Swiss Federal Veterinary Office (FVO), the risk for introduction of animal diseases through illegal imports could only be estimated with great difficulty [1]. In 2002 a study identified illegal meat imports as a risk for the introduction of foot and mouth disease, African swine fever, classical swine fever and swine vesicular disease into Great Britain [2, 3]. Switzerland is geographically situated in the middle of Western Europe, having a long border with the neighbouring countries and not many natural barriers. Many opportunities are given to smuggle animals and animal products into Switzerland.

Avian influenza viruses are highly contagious viral infections. An outbreak of avian influenza would be devastating for the Swiss poultry industry causing enormous economic losses as total flock destruction would be the implemented control measure. Depending on the virus strain circulating, NAIV can affect species of food producing birds as well as pet birds and wild birds. NAIV

infections can show the whole spectrum of pathogenicity, from low to high, depending on the host species as well as on the virus strain [4]. Furthermore, cases are described where a low pathogenic strain turned into a highly pathogenic one in chickens and turkeys after the introduction by wild birds [5]. British, German and Swiss risk assessments dealing with the introduction of avian influenza into the country identified migratory birds, legal and illegal imports as well as contaminated fomites as potential risks [1, 6, 7]. Contacts with infected birds are thought to be an important source of outbreaks in food producing birds. Therefore, illegal imports of birds and bird products could be a source for the introduction of NAIV into Switzerland.

Methods

Data: Seizures 2006

The primary data source were the penalty documents of all seizures made in the year 2006 by the border guards and the customs specialists at the Swiss borders. Data from hardcopies was recorded in a Microsoft Access database. The second data source was a Microsoft Access database based on Citrix used by the border veterinarians to record penalties they have issued. The data comprised the description, the tariff number, the weight and the origin of the seized product. In 2006 a total of 9,266 penalty documents concerning illegal imports of animals and animal products were recorded. Information about legal trade, passenger numbers at airports, road traffic and the control frequencies by the custom authorities was gathered and used to estimate the total annual flow of illegal imports of animals and animal products. Descriptive statistical analyses were performed using the statistics program NCSS 2004 (Kaysville, Utah, USA).

Estimation of the total annual illegal flow of animals and animal products into Switzerland

For each of the three main transport modes stochastic scenario tree models were developed. Thus, for freight, air passenger baggage and private road traffic the total annual flow of animals and animal products into Switzerland was established. Mail, train travellers baggage and pedestrians were not considered because of the small number of seizures made.

All models were structured in the following three steps:

- Estimation of the annual number of illegal importations into Switzerland.
- Estimation of the annual number of smuggled consignments by product type and region of origin.
- Estimation of the annual weight of illegal importations by product type and region of origin.

The estimation of the annual number of illegal imports had to be modelled separately for each transport mode because searches are conducted completely differently. Therefore, this step will be explained in detail and separately for every transport mode.

Estimation of the annual number of illegal importations into Switzerland by freight

In freight we assumed that smuggling only takes place together with declared consignments. Consignments have to be declared by an eight digit tariff code. A consignment can consist of different batches with different tariff codes resulting in many tariff code rows (TCR) per import declaration. These TCR are registered in the database “e-dec” of the Federal Customs Administration. They provided the input parameter for the estimation of the annual number of illegal imports in freight. Figure 1 shows the scenario tree and table 1 the input parameters for the estimation model of the number of illegal imports in freight.

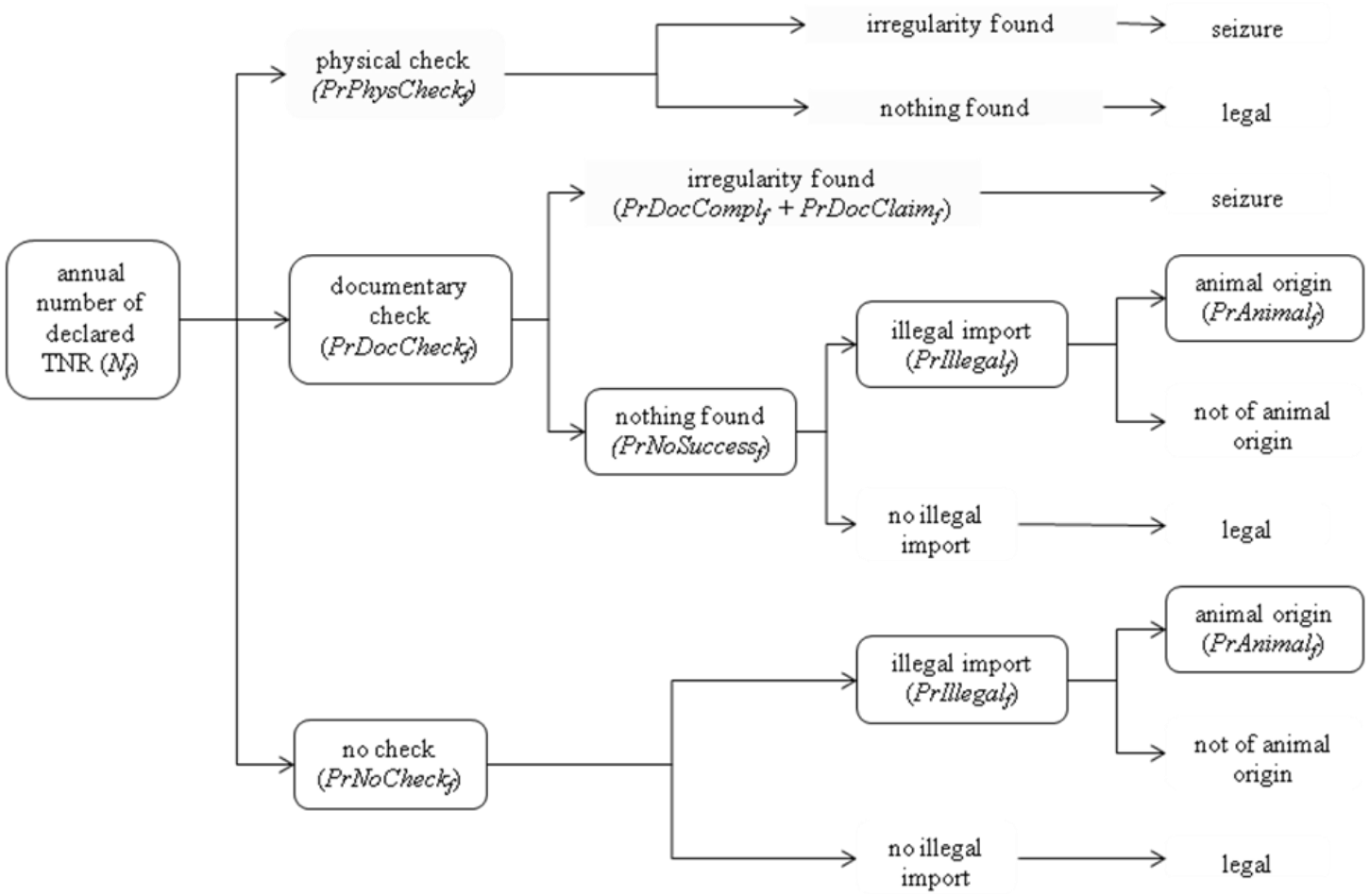

Figure 1 - Scenario tree freight

Scenario tree for the estimation of the annual number of illegally imported TCR by freight.

Description	Name	Value
Annual number of declared TCR	N_f	*RiskPert* (16,496,000; 20,620,000; 24,744,000)
Physical check performed	$PrPhysCheck_f$	RiskPert (52,188; 78,282; 104,376)/N_f
documentary check performed	$PrDocCheck_f$	RiskPert (3,702,011; 5,553,016; 7,404,021)/N_f
Proportion of TCR not searched at the BIP	$PrNoCheck_f$	1- $PrPhysCheck_f$- $PrDocCheck_f$
complaint after documentary check	$PrDocCompl_f$	(RiskPert (221,953; 332,929; 443,905)) / (N_f*$PrDocCheck_f$)
Claim after documentary check	$PrDocClaim_f$	(RiskPert (11,151; 16,726; 22,301)) / (N_f*$PrDocCheck_f$)
Documentary check was not successful	$PrNoSuccess_f$	1 - $PrDocCompl_f$ - $PrDocClaim_f$
Hiding illegal imports underneath legal imports	$PrIllegal_f$	RiskPert (0.0125; 0.025; 0.05)
Proportion illegally imported products are of animal origin	$PrAnimal_f$	RiskPert (0.03; 0.05; 0.08)

Table 1 - Input parameters : Freight

Input parameters for the stochastic simulation model to quantify the annual number of illegally imported tariff code rows (TCR) by freight.

Declared imports undergo with certain probabilities a documentary or physical check. The searches are conducted risk-based following risk analysis of the Federal Customs Administration, of every agency and the personal experiences of each customs specialist. Possible outcomes of searches are on the one hand claims or complaints, which were recorded, when nothing was found, nothing was recorded. Because of the risk based approach and the definition of illegal importations (e.g. not correct entry procedures), it was assumed by the experts that the rate of seizures from checked freight is higher than the proportion of illegal imports of all possible imports. Experts at the Federal Customs Administration were asked to estimate the probabilities that illegal importations

take place and that they are of animal origin. It was assumed that illegal importations are possible in consignments not checked as well as in cargo with only documents checked but revealing no irregularities.

The estimation of the annual number of illegal importations of animals and animal products in freight was calculated using Equation I:

$$nIllegal_f = N_f \times PrNoCheck_f \times PrIllegal_f \times PrAnimal_f + N_f \times PrDocCheck_f \times PrNoSuccess_f \times PrIllegal_f \times PrAnimal_f$$

where:

$nIllegal_f$	= Estimated annual number of illegally imported TCR of animals or animal products in freight
N_f	= Annual number of declared TCR
$PrNoCheck_f$	= Proportion of TCR not searched at the BIP
$PrIllegal_f$	= Proportion of incorrectly declared TCR of all TCR not physically checked
$PrAnimal_f$	= Proportion of TCR of animal origin of all TCR not correctly declared
$PrDocCheck_f$	= Proportion of TCR only document checked at the BIP
$PrNoSuccess_f$	= Proportion of document checked TCR not revealing any irregularities

Estimation of the annual number of illegal importations into Switzerland by air passengers

The number of travellers entering Switzerland at the airports of Zurich and Geneva in 2006 was received from the airport companies. Figure 2 shows the scenario tree and table 2 the input parameters for the estimation of illegal imports by air passengers.

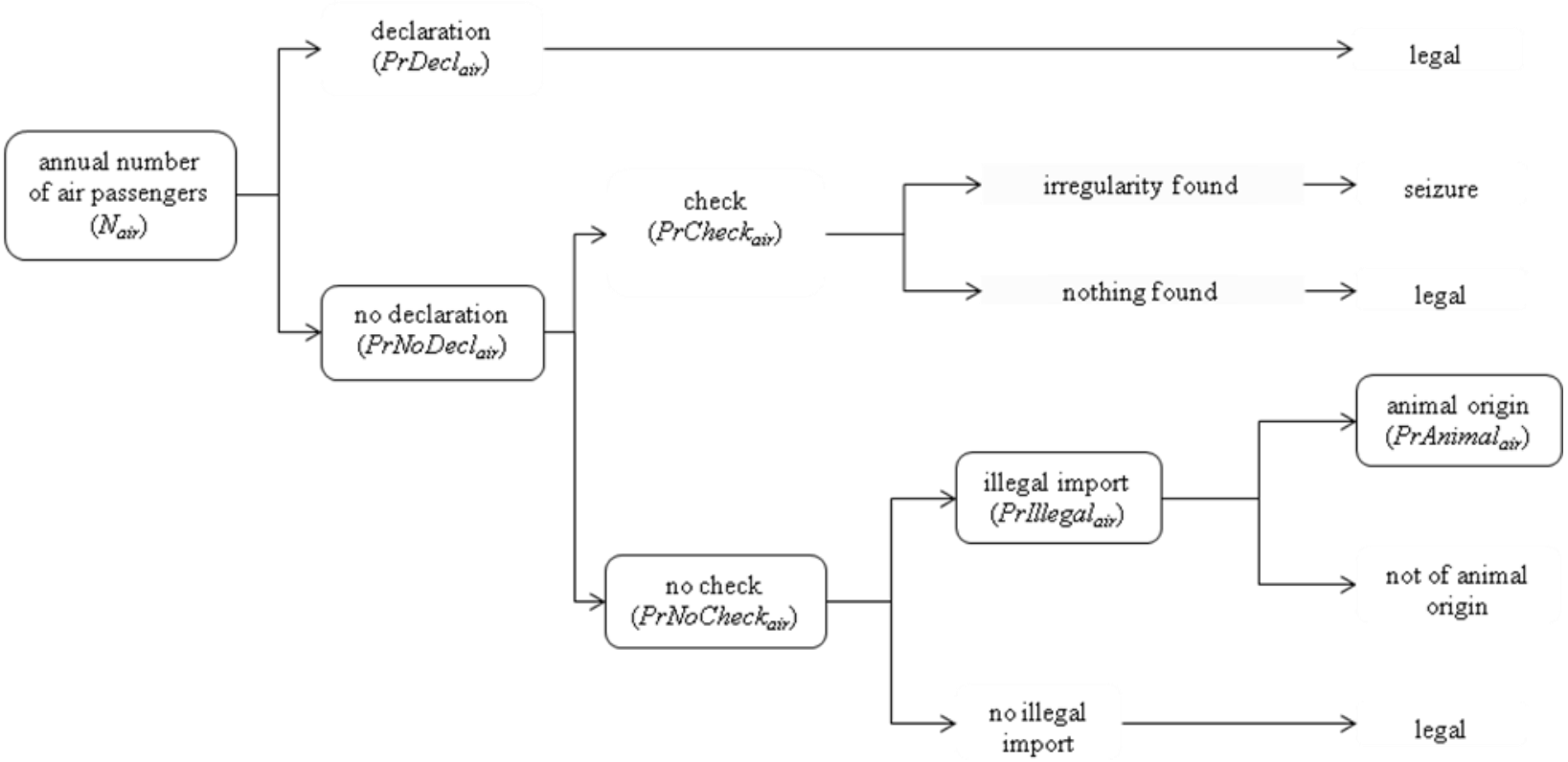

Figure 2 - Scenario tree air passengers

Scenario tree for the estimation of the annual number of illegal imports by air passengers.

Description	Name	Value
Annual number of air passengers	N_{air}	RiskPert (11,200,000; 14,910,697; 170,000,000)
Proportion of passengers declaring correctly	$PrDecl_{air}$	RiskPert (0.0019; 0.0024; 0.0036)
Proportion of passengers declaring nothing	$PrNoDecl_{air}$	1 – $PrDecl_{air}$
Check was performed	$PrCheck_{air}$	RiskPert (0.0060; 0.0123; 0.0255)
Check was not performed	$PrNoCheck_{air}$	1 - $PrCheck_{air}$
Probability that passenger imports not checked incorrectly declared items	$PrIllegal_{air}$	RiskPert (0.01; 0.02; 0.03)
Proportion of products found of animal origin	$PrAnimal_{air}$	RiskPert (0.08; 0.1; 0.15)

Table 2 - Input parameters: Air passengers

Input parameters for the stochastic simulation model to quantify the annual number of illegal importations by air passengers.

At airports, travellers have to declare goods they bring with them by choosing the red exit. Those people are thought to declare everything they carry. Passengers having nothing to declare choose the green exit. Most of them are not checked at all. Some are checked in the following way: one group of persons is only asked if they bring anything with them and where they come from. A second group is also asked and their baggage is superficially checked. The baggage of the third group is checked thoroughly. Neither the amount of negative searches nor the total number of searches conducted was documented. Expert opinion was gathered in order to estimate these frequencies. Customs officers were also asked to estimate the proportion of passengers taking animals or animal products illegally into Switzerland.

The estimation of the annual number of illegal importations of animals and animal products in the baggage of air passengers was calculated using Equation II:

$$nIllegal_{air} = N_{air} \times PrNoDecl_{air} \times PrNoCheck_{air} \times PrIllegal_{air} \times PrAnimal_{air}$$

where:

$nIllegal_{air}$	= Estimated annual number of illegal importations of animals or animal products in air passenger's baggage
N_{air}	= Annual number of passengers entering Switzerland by air
$PrNoDecl_{air}$	= Proportion of passengers entering Switzerland by air not declaring anything
$PrNoCheck_{air}$ not	= Proportion of passengers not declaring anything who are searched at the BIP
$PrIllegal_{air}$	= Proportion of incorrectly declared items of all passengers not checked
$PrAnimal_{air}$	= Proportion of items of animal origin of all incorrectly declared goods

Estimation of the annual number of illegal importations into Switzerland by private road traffic

The annual number of cars entering Switzerland was estimated based on a study of the Federal Office for Spatial Development [8]. Figure 3 shows the scenario tree and table 3 the input parameters for the estimation of illegal imports by road traffic.

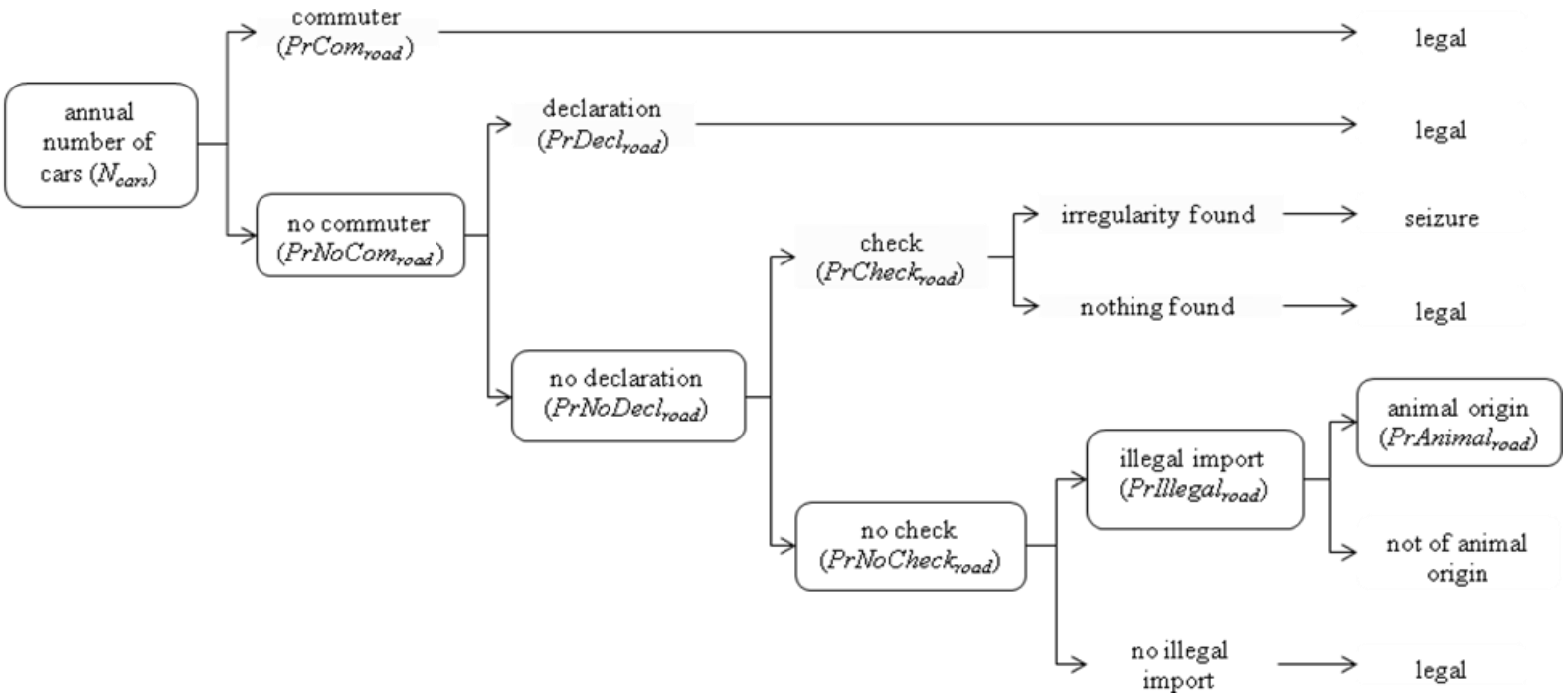

Figure 3 - Scenario tree private road traffic

Scenario tree for the estimation of the annual number of illegal imports by private road traffic.

Description	Name	Value
annual number of cars entering Switzerland	N_{cars}	RiskPert (114427500; 120450000; 126472500)
Number of commuters	$PrCom_{road}$	RiskPert (0.25; 0.26; 0.3)
Number of non- commuters	$PrNoCom_{road}$	1 - $PrCom_{road}$
Proportion of passengers declaring correctly	$PrDecl_{road}$	RiskUniform (0.005; 0.01)
Proportion of passengers not declaring anything	$PrNoDecl_{road}$	1 - $PrDecl_{road}$
Check was performed	$PrCheck_{road}$	RiskPert (0.005; 0.01; 0.03)
Check was not performed	$PrNoCheck_{road}$	1 - $PrCheck_{road}$
Proportion of incorrectly declared items	$PrIllegal_{road}$	RiskPert (0.001; 0.01; 0.02)
Proportion of items of animal origin of all incorrectly declared goods	$PrAnimal_{road}$	RiskPert (0.7; 0.8; 0.9)

Table 3 - Input parameters: Private road traffic

Input parameters for the stochastic simulation model to quantify the annual number of illegal importations by private road traffic.

Controls at BIP are based on car numbers and not on the number of individuals. Therefore the number of cars entering Switzerland was used as the basic input parameter and the authors calculated that seizures as well as illegal imports take place on car numbers. Customs officers assumed that commuters do not illegally import animals and animal products, because they do not want to have any problems at the BIP, wanting to get as fast as possible into Switzerland. People declaring goods are assumed to declare everything they transport. The rest of cars entering Switzerland are searched on a risk based approach. The goal of searches is not only to detect animals and animal products but also alcohol, tobacco, illegal immigrants and many other items. There is no documentation available concerning the search frequency, the success rate

(e.g. the proportion of undeclared goods found during searches) or the rate of searches not revealing any irregularities. These parameters had to be estimated by experts, as well as the proportion of illegal importations and the proportion of illegally imported animals and animal products.

The estimation of the annual number of illegal importations of animals and animal products by private road traffic was calculated using Equation III:

$$nIllegal_{road} = N_{cars} \times PrNoCom_{road} \times PrNoDecl_{road} \times PrNoCheck_{road} \times PrIllegal_{road} \times PrAnimal_{road}$$

where:

$nIllegal_{road}$	= Estimated annual number of illegal importations of animals or animal products by private road traffic
N_{cars}	= Annual number of cars entering Switzerland by road
$PrNoCom_{road}$	= Proportion of cars not transporting commuters of all the cars entering Switzerland
$PrNoDecl_{road}$	= Proportion of car drivers not declaring anything of all noncommuting travellers
$PrNoCheck_{road}$	= proportion of cars not searched at the BIP of the cars not declaring anything
$PrIllegal_{road}$	= Proportion of incorrectly declared items of all cars not checked
$PrAnimal_{road}$	= Proportion of items of animal origin of all incorrectly declared goods

Estimation of the annual number and the annual weight of smuggled consignment by product type and region of origin

For the descriptive statistics of the seizures and the estimation models, the consignments in trade were categorised in the same way as the seizures in traveller's traffic. The following product categories are used:

- meat and meat products
- milk and milk products
- eggs
- live animals
- other products of animal origin

The regions of origin are categorised according to the United Nations (UN): Western Europe, Northern Europe, Southern Europe, Eastern Europe, Africa, Asia, North America, South America, Oceania and unknown.

The contribution by product category and region to the total illegal importations is simulated based on the according number of seizures made of every possible combination of product and region. A first Poisson distribution is used on the number of seizures to simulate the variability of the data. The calculated annual number of illegal imports of one product from one specific region is then included into a second Poisson distribution, showing the uncertainty of the estimation. A proportion is then generated of each product- region combination and multiplied with the result of the first step of the model, the total annual number of illegal importation in one transport mode.

The volume of illegally imported animals and animal products is calculated by multiplying the number of illegal imports with a sample drawn from a weight distribution specific to every product category and transport mode. If there were less than 100 seizures available, a bootstrap sample was implemented and the population parameters to establish the weight distributions were derived. Data showed that truncated lognormal distributions were the best fit for the weights of

the animal products seized. To estimate the number of animals in a single import truncated Poisson distributions were used.

Weight estimation by product type and region of origin were modelled similarly for every transport mode using the corresponding input data.

The modelling software used was Microsoft Excel and Palisade @RISK (www.palisade.com). The simulations were run with 10,000 iterations each. Parameters influencing outputs most were identified evaluating the regression coefficients of each input value given in the @RISK output report.

Qualitative risk assessment

The risk assessment was performed qualitatively using the guidelines given in the World Organisation for Animal Health (OIE) *Terrestrial Animal Health Code* [9, 10]. Probabilities are assessed and described on a scale from negligible to high. The description of the probability categories is given in table 4.

Category	Interpretation
Negligible	Event is so rare that it does not merit consideration
Low	Event is rare but does occur
Medium	Event occurs regularly
High	Event occurs very often

Table 4 - Probability categories

Interpretation of the probability categories used in this qualitative risk assessment.

As the uncertainty of the relevant risks considered in this assessment is high throughout, it is not further discussed in this publication. Probability and

uncertainty categories are adopted from the EFSA [11]. We distinguished between three holding types: Commercial poultry holdings, backyard poultry holdings and other bird holdings. Commodities considered were live birds, poultry meat and poultry meat products, eggs and feathers.

Results

Description of the seizures of animals and animal products made in 2006

A total of 9,266 seizures were recorded. The main transport modes were freight (*n* = 220), air passenger baggage (*n* = 352) and private road traffic (*n* = 8,583). Seizures were also made in mails (*n* = 105), in train traveller baggage (*n* = 5) and one was recorded in a pedestrians luggage. Considering the transport modes of freight, air passenger's baggage, private road traffic and mail, 77.5% of the number of seizures of animals and animal products was meat, followed by milk and milk products (17%), other products of animal origin (3%), live animals (2%) and eggs (0.5%). The species was in 50 % of the seized meat not recorded and in 19 % of the cases it were mixed packages of which at least one species was known. The rest of the meat seizures were made up by beef (43%), pork (36%), poultry (12%), small ruminants (9%) and horse meat (0.3%). Other animal products consisted mainly of fish meat and caviar in 62% of the cases, leather and fur (10%) and trophies (10%). Feathers were found in 2% of the seizures of other animal products. Dogs contributed the most to the seizures of live animals (62%), followed by birds (12 %). Table 5 shows the species of the birds and their origin seized at the Swiss borders in 2006.

Species	Number of seizures	Total number of birds	Origin
Chicken	1	5	Portugal
Hazel grouses	1	2	Germany
Pheasants	1	5	unknown
Finches	2	5	Germany, unknown
Lanner falcon	1	1	Tunisia
Swan	1	1	France
Pigeons	5	61	Macedonia, Serbia, Germany, Netherlands, unknown
Budgerigars	6	14	Macedonia, Turkey, Russia, Spain, Germany, unknown
Parrots	4	8	Portugal, Guinea,Germany,France
TOTAL	22	102	

Table 5 - Seized birds

Details of the birds seized in 2006 at Swiss borders.

Despite the fact that of 81 % of all seizures the origin was not recorded, there were animal products and animals originating from 89 countries found by the custom authorities. The contribution of each region in every transport mode is shown in Figure 4.

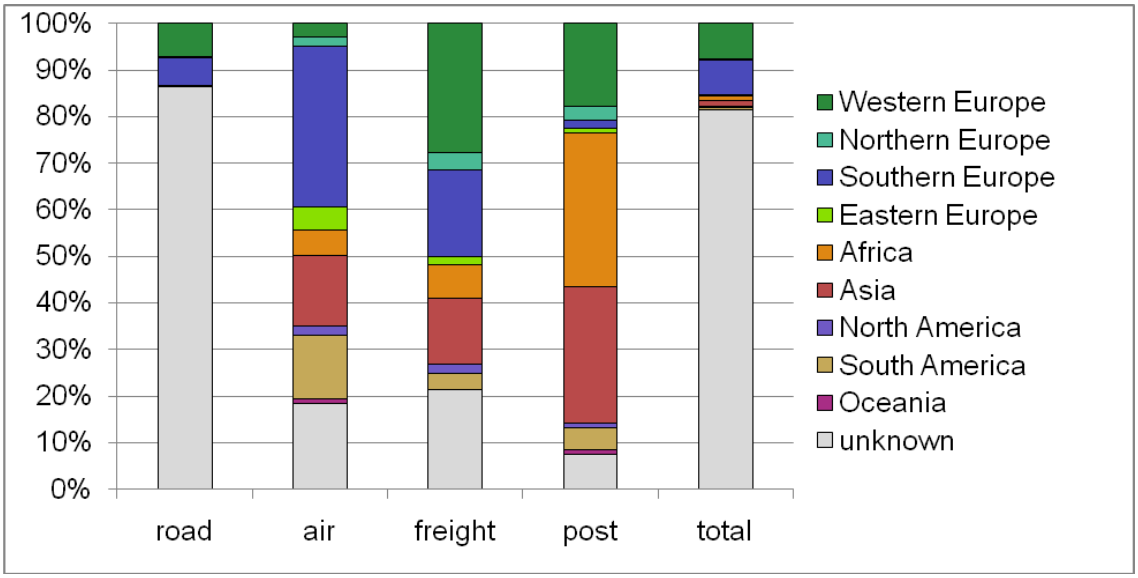

Figure 4 - Regions of origin

In private road traffic, the highest number of seizures was made. Even though the region of origin mostly was not recorded, it was assumed that most of the goods come from the surrounding countries.

The median weight of a single illegal importation in freight was 40 kg, ranging from the minimum of 0.4 kg up to the maximum of 41,600 kg. The median weight in road traffic was 3.5 kg (0.1 to 1,000 kg) and in air passenger's baggage, 5.1 kg (0.1 to 47 kg).

Estimated annual illegal flow of animals and animal products

The estimates of the annual number of illegal imports of animal origin in freight were on average 4,434, with a 90 % probability interval ranging from 1,184 to 11,512. The annual number of illegal importations in air passenger's baggage was estimated to be on average 29,725 (19,451 to 43,125) and in private road traffic the estimates were on average 700,947 (298,349 – 1,131,783).

The amount of illegally imported meat and meat products is estimated to be 2,474 tonnes. The estimate for the annual illegal flow of milk and milk products was 986 tonnes. The weight of illegally imported eggs is estimated to be 51

tonnes per year. 308 tonnes of other products of animal origin are illegally imported. The annual number of smuggled animals is estimated to be 30,491. All values are medians, and detailed results including minimum and maximum values for every product category and every transport mode are given in table 6.

Product	Transport mode	Annual estimated weight in tonnes/ number of animals		
		Minimum	*Median*	*Maximum*
Meat	*freight*	1	147	40,714
	air passengers	18	117	952
	road traffic	47	2,004	52,855
	total	241	2,474	53,076
Milk	*freight*	0	139	100,343
	air passengers	0	10	119
	road traffic	8	634	63,163
	total	34	986	103,007
Eggs	*freight*	0	38	4,953
	air passengers	0	1	46
	road traffic	0	6	241
	total	1	51	4,985
Other animal products	*freight*	0	98	32,594
	air passengers	1	30	398
	road traffic	0	64	14,155
	total	9	308	32,733
Animals	*freight*	190	4,917	55,398
	air passengers	148	1,778	23,156
	road traffic	1,461	21,414	163,093
	total	4,498	30,491	168,905

Table 6 - Results of the simulation model

Results of the estimation of the annually illegally imported weight of animal products in tonnes and estimation of the illegally imported number of animals.

Sensitivity analysis showed that the most influential parameter on the annual number of illegal imports for every model is the estimated proportion of illegal imports (e.g. $PrIllegal_f$, $PrIllegal_{air}$, $PrIllegal_{road}$). The annual illegal flow by product category and region was mostly influenced by the sampled value of the weight distribution which was multiplied by the annual number of illegal imports of the according combination of region and product.

Hazard Identification

Avian influenza viruses are influenza type A viruses and members of the family *Orthomyxoviridae*. Influenza A viruses are further divided into subtypes determined by the sixteen haemagglutinin (H1-H16) and nine neuraminidase (N1-N9) antigens. According to the OIE Terrestrial Animal Health Code notifiable avian influenza (NAI) is defined as an infection of poultry caused by any influenza A virus of the H5 or H7 subtypes or by any AI virus with an intravenous pathogenicity index greater than 1.2 [12]. NAI viruses can be further categorized according to their pathogenicity into highly pathogenic notifiable AI (HPNAI) and low pathogenic notifiable AI (LPNAI). Outbreaks in Italy, the Netherlands and Canada showed that LPNAI viruses are able to mutate into a highly pathogenic form [13-15]. In general, wild birds are known as reservoirs for AI viruses, mostly low pathogenic strains. They normally do not show any clinical signs. The currently circulating highly pathogenic H5N1 strain in Asia, Africa and Europe originating from south-east Asia seems to be virulent not only in poultry but also in some wild bird species.

Infected live birds are a potential source of NAIV, especially if they are in the incubation period or not showing clinical signs. The majority of live birds seized in Switzerland in 2006 were pigeons (table 5). Studies showed that isolation of H5N1 from experimentally infected pigeons is possible but transmission to contact birds has not occurred [16, 17].

NAIV can be detected in fresh meat of infected birds. If the meat is fed untreated to poultry there may be sufficient virus present to infect them [18]. HPNAI viruses were reported to be present on the surface of and in the contents of eggs laid by infected hens, posing a potential risk for the spread of the virus [19]. During processing, poultry products are usually subjected to heat treatment. Temperatures above 60-65°C lead to viral inactivation within five minutes. Feathers could be contaminated with infective faeces or other body fluids [20].

Release assessment

NAI viruses could be introduced into Switzerland without being detected. The entry routes for illegal importations are by road, air or train, in freight traffic as well as in tourist traffic. Another possibility is items and animals sent by post and courier. In freight the main reason for illegally importing goods or declaring wrongly is thought to be to circumvent customs duties. Many persons must get involved to organize illegal importations in freight traffic. This fact raises the risk for smugglers to be detected.

People travelling to neighbouring countries for shopping probably do not want to pay the customs duties and do not declare their goods. Holiday travellers can be grossly divided into two groups: One group are migrants and seasonal workers visiting their relatives and bringing back to Switzerland their specialities. Other holiday travellers import souvenirs as well as specialities of the country they visited. In rare cases they bring live animals with them. Birds protected by CITES and other birds not allowed for legal import because of sanitary reasons can only be introduced into Switzerland by smuggling.

An average of 3,669 birds are estimated to be smuggled into Switzerland annually. Illegal imports are not quarantined and dying or sick birds are not taken to a veterinarian.

A median of 24,088 illegal imports of poultry meat into Switzerland was calculated, leading to the amount of 139 tonnes smuggled per year. The

production and processing of poultry products would not always have been controlled as well as legal imports would have been. By mail mainly canned poultry meat gets imported. Because of its treatment, it poses no risk of introduction of NAIV into Switzerland. Furthermore almost all postings from Asia and Africa are controlled. (Personal Communication)

The annual number of illegal egg importations was estimated to be 3,142 with a weight of 51 tonnes. In backyard poultry holdings it is common to feed egg shells to the poultry. If they are not heat treated, NAIV could be transmitted to them. Feathers are brought into Switzerland illegally 483 times. They are assumed not to pose a risk for the introduction of NAIV into any holding type, as they are mostly heat treated.

A medium probability for the release of NAI viruses into other bird holdings is likely to occur from smuggled live birds. NAI viruses are also thought to be released with a medium probability in backyard poultry holdings by smuggled meat and meat products. The other release pathways by live birds and poultry are assessed to have low probabilities. Eggs have a low probability of releasing NAIV into backyard poultry holdings. The probabilities of all other release pathways are negligible. Table 7 shows all possibilities of releases and their probabilities of occurrence.

Commodity	Holding type	Probability Release	Probability Exposure	Consequences		Risk estimation
				HPAI	*LPAI*	
Live birds	*Commercial*	Low	Low	High	Medium	Low
	Backyard	Low	Medium	Low	Low	Low
	Other	Medium	High	Low	Low	Low
Meat and meat products	*Commercial*	Low	Low	High	Medium	Low
	Backyard	Medium	Medium	Low	Low	Low
	Other	Low	Low	Low	Low	Negligible
Eggs	*Commercial*	Negligible	-	-	-	Negligible
	Backyard	Low	Low	Low	Negligible	Negligible
	Other	Negligible	-	-	-	Negligible
Feathers	*Commercial*	Negligible	-	-	-	Negligible
	Backyard	Negligible	-	-	-	Negligible
	Other	Negligible	-	-	-	Negligible

Table 7 - Risk assessment

Results of the qualitative risk assessment. Release probabilities estimated to be negligible were not considered further in the assessment.

Exposure assessment

It is unlikely that illegally imported birds have direct contact with commercial poultry, as biosecurity measures are implemented. Contacts with backyard poultry and other birds are possible and a direct or indirect transmission of NAI viruses could occur. Because commercial holdings are not linked to private backyard poultry holdings and because of the biosecurity measures implemented, the probability of the introduction of NAIV via small holdings into commercial holdings is considered to be low. If the smuggled birds are dead upon arrival or die shortly afterwards they might not be disposed of safely [21].

Wild animals could feed on the carcasses, become infected and probably transmit the disease to birds.

Poultry meat scraps could infect birds if fed uncooked to them. But as most of the smuggled poultry meat is intended for personal use, it generally will be cooked and the virus will be inactivated. Exposure to NAIV in backyard poultry holdings from smuggled live birds and poultry meat and meat products carries a medium probability. All other possibilities of exposure are assessed as low probability. Table 7 shows all pathways of exposure and their estimated probabilities.

Consequence assessment

As consequences are different considering HPNAI or LPNAI, they were evaluated separately. The consequences of an outbreak of HPNAI in commercial poultry holdings are severe as control measures (e.g. flock destruction) are extensive and expensive. The consequences of an outbreak of LPNAI are considered to be medium in commercial poultry holdings and low in other holding types. The consequence estimation of all holding types and commodities is shown in table 7.

Risk estimation

The risks of the introduction of NAIV into any holding type by illegal importations of live birds are considered to be low. Illegal imports of poultry meat and meat products pose a low risk for the introduction of NAIV into commercial and backyard poultry holdings whereas this risk is estimated to be negligible for other bird holdings. Illegally imported eggs and feathers are estimated to be a negligible risk for the introduction of NAIV into any holding type. An overview of the risk estimation is given in table 7.

Discussion

Experts assumed that proportions of seized animals and animal products correspond to the proportions of smuggled goods and animals. The information about product types and origin of the seized goods was gained by collecting data on the seizures of just one year, which made it impossible to consider variability between years. The results of the extrapolation models are difficult to interpret as many input parameters are very uncertain (e.g. at the Swiss borders no control frequencies are documented and no information was available about how many controls did not reveal any irregularities). Therefore, these parameters had to be estimated by experts leading to wide uncertainty ranges. The estimation of the annual flow in tonnes is appropriate if considering the median estimate, however, the range is extremely broad, putting estimates in a high level of uncertainty. The reason is the simplification of the simulation by multiplying the annual number of illegal imports with one sample drawn from the weight distribution per iteration.

Effects of the disease awareness by travellers, customs officers and farmers were not considered in the models.

LPNAI is circulating in many countries and can therefore be introduced from anywhere. HPNAI H5N1 occurs at the time of this study in Asia, Africa and infrequently in Europe. Therefore the risk for the introduction of HPNAI from North and South America as well as from Oceania is at the moment of this study negligible.

The most important entry route is considered to be by road as there is a long border not constantly under surveillance. Therefore, people smuggling birds and their products with premeditation would choose this entry route because the risk of detection is lower than in the other entry routes described in this study. Safety checks and the constant observation by customs officers at the airports prevent large scale smuggling. Political decisions have big impacts on control frequencies at Swiss borders.

Considering the population, the annual illegal flow of meat and meat products into Great Britain, estimated by Wooldridge, Hartnett et al in 2002 was in the same magnitude as the results of this study. The situation in Switzerland as a land-locked country is different compared to an island like Great Britain. The British study assessed the risks of introduction concerning foot and mouth disease, African swine fever, classical swine fever and swine vesicular disease. The epidemiology of avian influenza is different regarding the susceptible population and the commodities containing virus.

This study showed that many people travelling are not aware of the risks linked to illegal importation of animals and animal products. It is important to inform people before travelling that they are not allowed to import animals and animal products from third countries. A possible tool could be to show a short film sequence on every flight to a third country. The prevention of exposure is most effectively done by implementing biosecurity measures in poultry holdings. Farmers and seasonal workers must be informed about risks linked to illegally imported animals and animal products as well as about the risks of feeding uncooked scraps. Further research is needed on the exposure pathways which could be different for illegal activities compared to legal ones.

Conclusions

Illegal imports of animals and animal products contribute to a possible introduction of avian influenza into Switzerland. As the most important entry route is considered to be by road, border controls are one possibility to help prevent smuggling but even more important is to inform people about the dangers and risks linked to illegal imports, especially of live animals. An

improvement in the estimation of illegal imports could be reached by more detailed record keeping by customs officers concerning their controls as well as the seized items. It is almost impossible to compare data between different countries as data records and data quality and also country specific factors (e.g. landscape, length of borderlines, natural barriers, political decisions) differ greatly and need in depth knowledge.

Authors' contributions

CL, RH and MZ contributed to the design of the study and interpreted the results. CL and MZ collected the data; CL devised the scenario tree models, analyzed the results and drafted the manuscript. RH supervised the study. All authors read and approved the final manuscript.

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Dokumentation für AnwenderInnen der Hochrechnungsmodelle für die Schätzung der illegalen Importe tierischer Herkunft

Einleitung

Hochgerechnet werden die Daten des Handelswarenverkehrs (HV) sowie des Reiseverkehrs (RV). Beim Reiseverkehr wurden zwei Modelle erarbeitet, eines für die Hochrechnung im Luftverkehr und eines für den Strassenverkehr. Im Luftverkehr werden nur die beiden Flughäfen Zürich und Genf berücksichtigt, da für den Flughafen Basel und die kleineren Flugplätze zu wenig Daten zur Verfügung stehen, um eine vernünftige Schätzung machen zu können.

Der Postverkehr wird ebenfalls nicht berücksichtigt, da

- zu wenig Grundlagendaten betreffend Herkunft und Anzahl der Sendungen vorhanden sind (n=106).
- die Kontrollfrequenzen nicht bekannt sind.
- die Verzollung und Kontrolle der Postsendungen komplett anders ist als im Jahr 2006 (neu ist die Post zugelassener Empfänger).

Somit ist im Postverkehr mit den Daten, die zur Verfügung stehen, keine adäquate Schätzung möglich. Ebenso wurden zu wenig Aufgriffe von Bahnreisenden (n=5) und Fussgängern (n=1) erfasst um eine Schätzung zu machen.

Technische Aspekte

Die Modelldateien können unter folgenden Pfaden gefunden respektive bei Ruth Hauser, Monitoring, BVET, angefordert werden:

- Modell HV Endversion:

  Q:\BVET_0_REGISTRATUR\4-Monitoring\45-Forschungsprojekte\45.08_Illegaler Import Fleisch (cla)\Ergebnisse\Daten Modell HV\Modell HV Endversion und Resultate

- Modell RV air Endversion:

  Q:\BVET_0_REGISTRATUR\4-Monitoring\45-Forschungsprojekte\45.08_Illegaler Import Fleisch (cla)\Ergebnisse\Daten Modell RV_Luft\Modell RV air Endversion und Resultate

- Modell RV road Endversion:

  Q:\BVET_0_REGISTRATUR\4-Monitoring\45-Forschungsprojekte\45.08_Illegaler Import Fleisch (cla)\Ergebnisse\Daten Modell RV_Strasse\Modell RV road Endversion und Resultate

Alle Modelle basieren auf Excel und @RISK [1].

Abkürzungen

AFR	Afrika
ASIA	Asien
EEU	Osteuropa
HV	Handelswarenverkehr
NAM	Nordamerika
NEU	Nordeuropa
OZE	Ozeanien
RV	Reiseverkehr
SAM	Südamerika
SEU	Südeuropa
TN	Tarifnummer
TNZ	Tarifnummernzeilen
UNB	Unbekannt
VA	Verkehrsart
WEU	Westeuropa

Daten

Datenerfassung

Es wurden:

- schätzungsweise 50‘000 Dossiers und Strafbescheide des Jahres 2006 gesichtet.
- 10‘289 Datensätze in einer Access-Datenbank erfasst.
- 9‘267 Datensätze ausgewertet.

Bei den 1‘022 Datensätzen, die nicht ausgewertet wurden, handelt es sich um Speiseöle, die pflanzlichen Ursprungs sind, und um Kleider und Schuhe, bei welchen unklar war, ob es sich um tierische Produkte handelt.

Als illegaler Import wurden alle Importe von Tieren und tierischen Produkten definiert, die nicht korrekt an der Schweizer Grenze deklariert wurden.

Die Aufgriffe wurden in die folgenden Produktkategorien eingeteilt:

- TN1: Fleisch und geniessbare Schlachtnebenprodukte von Rind, Kalb, Schwein, Schaf, Ziege, Pferd, Esel, Maultier oder Maulesel, frisch, gekühlt oder gefroren.
- TN2: Fleisch und geniessbare Schlachtnebenprodukte von Rind, Kalb, Schwein, Schaf, Ziege, Pferd, Esel, Maultier oder Maulesel, (konservierend) gesalzen, getrocknet oder geräuchert; Fleisch und geniessbare Schlachtnebenprodukte von Hausgeflügel aller Art; Würste und ähnliche Erzeugnisse aus Fleisch, geniessbaren Schlachtneben-produkten oder Blut; Fleischzubereitungen und Fleischkonserven.
- Milch- und Milchprodukte (TN3 und TN4)
- Eier (TN5)
- lebende Tiere
- andere tierische Produkte

Die Ursprungsregionen wurden gemäss der Länderliste der Vereinten Nationen eingeteilt in Westeuropa, Nordeuropa, Südeuropa, Osteuropa, Afrika, Asien, Nordamerika, Südamerika, Ozeanien und unbekannt (keine Erfassung des Ursprungslandes an der Grenze) [2].

Hochrechnungsmodelle

Struktur der Modelle

Jedes der drei Modelle HV, RV Luftverkehr und RV Strassenverkehr wird in die folgenden drei Teile strukturiert:

- Schätzung der jährlichen Anzahl illegaler Importe.
    - Verteilung der geschätzten illegalen Importe auf die Ursprungsregionen und die Produktkategorien.
    - Schätzung der Mengen der geschmuggelten Produkte in kg respektive der Anzahl der illegal importierten Tiere.

Tabellenblätter

1. Data

Das Tabellenblatt **Data** enthält die gesammelten Daten für die Eruierung der Inputparameter für den ersten Teil des Modells (Schätzung der jährlichen illegalen Importe).

2. Inputs Nr illegal

Im Tabellenblatt **Inputs Nr illegal** werden die Verteilungswerte berechnet, die dann ins Modell einfliessen. Bei neuen Erkenntnissen können hier die aktualisierten Werte für die Unsicherheitsverteilungen eingegeben werden.

3. Tree Nr illegal

Das Tabellenblatt **tree nr illegal** beinhaltet den Szenariobaum und die Berechnung für die Schätzung der Anzahl der jährlichen illegalen Importe respektive TNZ von Tieren und tierischen Produkten in die Schweiz über die oben genannten Kanäle.

4. Prod_distr_poisson

Das Tabellenblatt **prod_distr_poisson** enthält die verschiedenen Schritte für die Verteilung der illegalen Importe auf die verschiedenen Produktkategorien und Ursprungsregionen. Als Grundlage dienen die Aufgriffe aus dem Jahr 2006.

5. Menge_Anderes

Im Tabellenblatt **Menge_Anderes** wird die jährliche Menge in kg geschätzt, die von anderen tierischen Produkten eingeführt wird. Zu anderen tierischen Produkten zählen: Fischfleisch, Kaviar, Bushmeat, Wildfleisch (Reh, Hirsch, Wildschwein, Gemse, Steinbock, Hase), Trophäen, unbehandelte Tierhäute, etc.

6. Menge_Eier, Menge_Milch; Menge_TN1 und Menge_TN2

In den Tabellenblättern **Menge_Eier , Menge_Milch; Menge_TN1; und Menge_TN2** werden die jährlichen Mengen in kg geschätzt, die von den entsprechenden Produkten in die Schweiz geschmuggelt werden.

7. Menge_Fleisch

Die Menge an Fleisch in kg ist die summierte Menge der Tarifnummern eins und zwei jeder Ursprungsregion. Dazu werden die entsprechenden Mengen aus den Tabellenblättern **Menge_TN1** und **Menge_TN2** addiert.

8. Anzahl_Tiere

Die Anzahl der Tiere pro Ursprungsregion, die illegal pro Jahr in die Schweiz eingeführt werden, wird simuliert.

Details der einzelnen Modelle

1. Modell Handelswarenverkehr

1.1. Tabellenblatt Data

Beim Handelswarenverkehr konnten Informationen zu den jährlich eingeführten TNZ und Kontrollen einerseits von allen Zollstellen, andererseits zusätzliche detailliertere Angaben von der Zollstelle Chiasso eingeholt werden (Abbildung 1). Alle diese Informationen sind in dieser Tabelle zusammengefasst. Pro Deklaration können mehrere TNZ aufgeführt werden. Da als Grundlage der Hochrechnung die TNZ dienen, muss die Anzahl Deklarationen auf die Anzahl deklarierter TNZ umgerechnet werden (Abbildung 2).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1																
2	**Zusammenstellung Daten**		**Alle ZK**								**nur Chiasso**					
3	**Parameter/Jahr**		**2005**		**Differenz 2005-2006**		**2006**		**2007**		**1. Halbjahr 2006**		**1. Halbjahr 2007**		**1. Halbjahr 2008**	
4	***Abkürzung Beschreibung***	***Beschreibung***	*absolut*	*relativ*	*absolut*	*relativ zu 2006*	*absolut*	*relativ*	*absolut*	*relativ*	*absolut*	*relativ*	*absolut*	*relativ*	*absolut*	*relativ*
5	NrTNZ	Anzahl deklarierte Tarifnummernzeilen	19180000		1440000	0.06983511	20620000		21940000		99414		169285		172082	
6	Pphys	Anzahl/Anteil materielle Kontrollen an NrTNZ	90590	0.00472315	12308	0.15722644	78282	0.00379641			846	0.00850987	1227	0.00724813	1079	0.00627027
7	Pdoc	Anzahl/Anteil formelle Kontrollen an NrTNZ	6395535	0.33344812	842519	0.15172278	5553016	0.26930242	5064000	0.2308113	24195	0.24337618	28536	0.1685678	26223	0.15238665
8	pnocheck	Anzahl/Anteil an NrTNZ keine Kontrollen	12693875	0.66182873	2294827	0.15310378	14988702	0.72690116			74373	0.74811395	139522	0.82418407	144780	0.84134308
9	p1	complaints physical check: Anteil Beanstandungen an Materiellen Kontrollen)	22864	0.25238989	3793	0.19888836	19071	0.24361922			148	0.1749409	228	0.18581907	258	0.23911029
10	p2	claims physical check: Anteil Strafverfahren an materiellen Kontrollen)	4004	0.04419914	271	0.06339181	4275	0.05461026			34	0.04018913	51	0.04156479	50	0.0463392
11	p3	physical check in progress: Anteil an materiellen Kontrollen wo Strafverfahren noch nicht abgeschlossen									66	0.07801418	156	0.12713936	43	0.03985171
12	pphysno	(1'-p1'-p2'-p3)														
13	p4	(Complaints document check)	528729	0.08267158	195800	0.58811338	332929	0.05995463			1326	0.05480471	2146	0.07520325	1111	0.04236739
14	p5	(Claims document Check)	11897	0.0018602	4829	0.28871218	16726	0.00301206			24	0.00099194	67	0.00234791	41	0.00156351
15	pdocno	(1'-p4'-p5)														
16	NdeclAnimal										15776		18083		13834	
17	PphysAnimal										62		133		38	
18	PdocAnimal=pa3										3506	0.22223631	4650	0.2571476	3006	0.21729073
19	pa1										9	0.14516129	16	0.12030075	5	0.13157895
20	pa2										1	0.01612903	3	0.02255639	6	0.15789474
21																

Daten aller Zollstellen

Daten aus Chiasso

Abbildung 1 - Tabellenblatt Data HV

Zusammenstellung der für das Modell benötigten Daten aller Zollstellen sowie der detaillierteren Angaben der Zollstelle Chiasso.

30									
31	**Korrektur Deklaration/Tarifnummernzeilen**								
32									
33	NrTNZ	Anzahl Tarifnummernzeilen pro Jahr	19180000				20620000		21940000
34	NrDecl	Anzahl Deklarationen pro Jahr	12569573				11831028		11462000
35	TNZ/Deklaration		1.52590705				1.74287475		1.91415111
36									
37	Straffälle Materielle Revisionen	Deklarationen	2624				2453		
38	p2	TNZ	4004				4275		
39									
40	Straffälle formelle Revisionen	Deklarationen	7797				9597		
41	p5	TNZ	11897				16726		
42									

Abbildung 2 - Tabellenblatt Data HV

Die Anzahl der Deklarationen wird basierend auf den Daten von Chiasso auf die Anzahl Tarifnummernzeilen umgerechnet.

1.2. Tabellenblatt Inputs Nr illegal

In dieser Tabelle können die Eingabeparameter verändert werden. Die Verteilungsparameter wurden mittels der vorhandenen Daten und Expertenmeinungen festgelegt. Bei neuen Erkenntnissen können diese Verteilungen angepasst werden. In jeder Iteration fliessen die Werte der Spalte *Distribution value* ins Modell ein (Abbildung 3).

	A	B	C	D	E	F	G	H	I
1	***INPUTS regarding probabilities and proportions of the amount of illegal imports***								
2									
3							**Distribution parameters**		
4	**Limb**	**Description**	**Branch**	**Name**	**Distribution value**	**Name of Distribution**	**min**	**most likely**	**max**
5	Declared tariff number rows per year	annual tariff number rows in freight traffic		NrTNZ	22492989	*RiskPert(G5;H5;I5)*	1.6E+07	20620000	2.5E+07
6	Control Category	physical check		Pphys	0.003188438	RiskPert(G6;H6;I6)/NrTNZ	52188	78282	104376
7		document check		Pdoc	0.208333314	RiskPert(G7;H7;I7)/NrTNZ	3702011	5553016	7404021
8		no check		1-pphys-pdoc	0.788478247	1-Pphys-Pdoc			
9	Physical Check successful (PhysChPos)	Physical check was successful (= irregularity was found)	complaints	p1	0.279653807	(RiskPert(G9;H9;I9))/(NrTNZ*Pphys)	12714	19071	25428
10			claims	p2	0.058003077	(RiskPert(G10;H10;I10))/(NrTNZ*Pphys)	2850	4275	5700
11			No	1-p1-p2	0.662343117	1-p_1-p_2			
12	Document Check successful (DocChPos)	Document check was successful (= irregularity was found)	complaints	p4	0.086431019	(RiskPert(G12;H12;I12))/(NrTNZ*Pdoc)	221953	332929	443905
13			claims	p5	0.003906683	(RiskPert(G13;H13;I13))/(NrTNZ*Pdoc)	11151	16726	22301
14			No	1-p4-p5	0.909662298	1-p_4-p_5			
15	Illegal Import	Hiding illegal imports underneath legal imports	Yes	pi	0.015106522	*RiskPert(G15;H15;I15)*	0.001	0.005	0.03
16			No	1-pi	0.984893478	*1-pi*			
17	Product Category Physical Check	Products found are of animal origin	Complaints: yes	pa1	*0.112912255*	*RiskUniform(G18;I18)*	0.01		0.14516
18			Complaints: No	1-pa1	*0.887087745*	*1-pa1*			
19			Claims: yes	pa2	*0.019230283*	*RiskPert(G20;H20;I20)*	0.01	0.016129	0.15789
20			Claims: No	1-pa2	*0.980769717*	*1-pa2*			
21	Product Category Document Check	Products found are of animal origin	Complaints: yes	pa3	*0.173373492*	*RiskPert(G22;H22;I22)*	0.01	0.222236	0.3
22			Complaints: No	1-pa3	*0.826626508*	*1-pa3*			
23	Product Category illegal imports	illegally imported products are of animal origin	yes	pai	*0.021488634*	*RiskPert(G23;H23;I23)*	0.01	0.03	0.05
24			no	1-pai	*0.978511366*	*1-pai*			
25									

Abbildung 3 - Tabellenblatt Inputs Nr illegal HV

Die Werte die in jeder Iteration in das Modell einfliessen, werden in der Spalte E (*Distribution value*) berechnet.

1.3. Tabellenblatt Tree Nr illegal

In diesem Tabellenblatt wird die jährliche Anzahl an illegal importierten TNZ berechnet. Da angenommen wurde dass illegale Importe sowohl in nicht kontrollierten als auch in Sendungen vorkommen können, bei welchen ausschliesslich die Dokumente angeschaut wurden, müssen diese beiden Werte addiert werden. Dies geschieht in der Zelle L22 (rot eingerahmt). Dieser Wert fliesst dann in die weitere Modellrechnung ein (Abbildung 4).

	I	J	K	L
1				
2				
3	uct	Limb		Annual Nr of illegally and legally imported Tariff Number Rows
4	Prop	Outcome	Probability	
5	0.11291226	Negative	0.000100679	2265
6	0.88708774	Negative	0.00079098	17791
7	0.01923028	Negative (Seizures)	3.55643E-06	80
8	0.98076972	Negative	0.000181383	4080
9		Negative	0.00211184	47502
10	0.17337349	Negative	0.003121843	70220
11	0.82662651	Negative	0.014884618	334800
12	0.17337349	Negative (Seizure)	0.000141107	3174
13	0.82662651	Negative	0.000672785	15133
14	0.02148863	Positive Doc Check	6.15194E-05	1384
15	0.97851137	Negative	0.002801362	63011
16		Negative	0.18665008	4198318
17	0.02148863	Positive No Check	0.000255955	5757
18	0.97851137	Negative	0.011655209	262160
19		Negative	0.776567083	17467315
20		Total	1	22492990
21				
22	Total illegale Importe tierisch		0.000317474	7141
23				
24				

Abbildung 4 - Tabellenblatt Tree Nr illegal HV

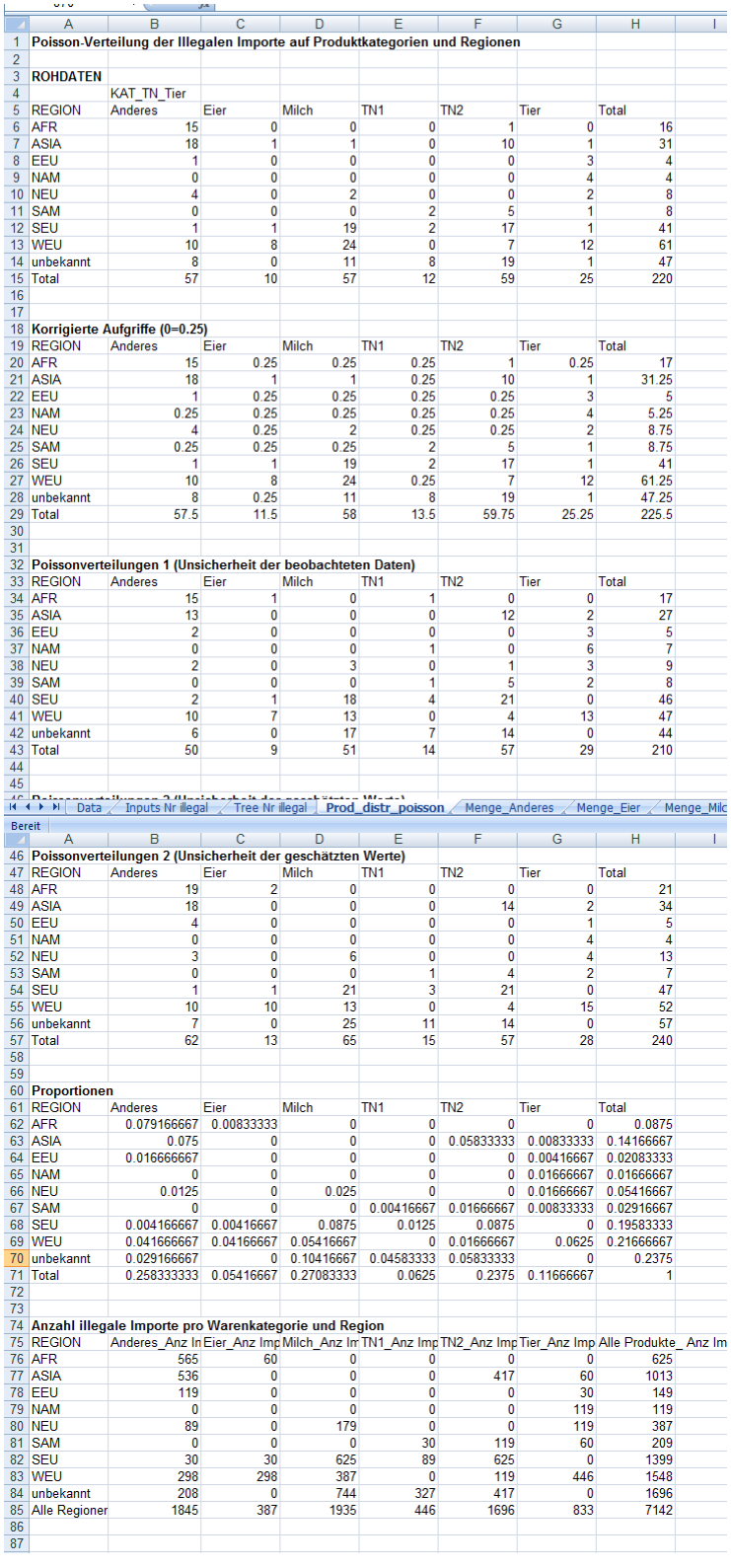
Die Anzahl der illegal eingeführten TNZ wird in der Zelle L22 (rot eingerahmt) berechnet.

1.4. Tabellenblatt Prod_distr_poisson

In diesem Tabellenblatt wird der zweite Schritt der Modellrechnung vollzogen. Hierzu werden die Daten der Aufgriffe verwendet. Die Verteilung der Aufgriffe innerhalb der Verkehrsart auf die verschiedenen Produktkategorien und

Ursprungsregionen wird als Grundlage verwendet. Entsprechend dieser Verteilung erfolgt die Aufteilung der im Tabellenblatt Tree Nr illegal ermittelten Anzahl illegaler Importe. Der oberste Abschnitt zeigt die erfassten Daten des Jahres 2006. Da es Kombinationen von Produkten und Ursprungsregionen gibt, die im Jahr 2006 nicht aufgegriffen wurden, gibt es Werte, die 0 sind. Es kann jedoch nicht ausgeschlossen werden, dass trotzdem illegale Importe solcher Kombinationen stattfinden. Deshalb werden diese Werte auf 0.25 korrigiert, da anschliessend mit zwei nachgeschaltenen Poissonverteilungen die Unsicherheit der Daten dargestellt wird und bei einem Wert von 0 diese Möglichkeiten ausgeschlossen wären.

Die erste Poissonverteilung schätzt die Variabilität der beobachteten Daten, während die 2. Poissonverteilung die Unsicherheit der geschätzten Werte veranschaulicht. Aus diesen Werten werden dann Proportionen gebildet. Diese Proportionen für jede Produkt-Regionskombination werden anschliessend mit der Anzahl illegal importierten TNZ multipliziert und ergeben somit die Anzahl illegal importierter TNZ pro Produkt und Region (Abbildung 5).



Poisson-Verteilung der Illegalen Importe auf Produktkategorien und Regionen

ROHDATEN

	KAT_TN_Tier						
REGION	Anderes	Eier	Milch	TN1	TN2	Tier	Total
AFR	15	0	0	0	1	0	16
ASIA	18	1	1	0	10	1	31
EEU	1	0	0	0	0	3	4
NAM	0	0	0	0	0	4	4
NEU	4	0	2	0	0	2	8
SAM	0	0	0	2	5	1	8
SEU	1	1	19	2	17	1	41
WEU	10	8	24	0	7	12	61
unbekannt	8	0	11	8	19	1	47
Total	57	10	57	12	59	25	220

Korrigierte Aufgriffe (0=0.25)

REGION	Anderes	Eier	Milch	TN1	TN2	Tier	Total
AFR	15	0.25	0.25	0.25	1	0.25	17
ASIA	18	1	1	0.25	10	1	31.25
EEU	1	0.25	0.25	0.25	0.25	3	5
NAM	0.25	0.25	0.25	0.25	0.25	4	5.25
NEU	4	0.25	2	0.25	0.25	2	8.75
SAM	0.25	0.25	0.25	2	5	1	8.75
SEU	1	1	19	2	17	1	41
WEU	10	8	24	0.25	7	12	61.25
unbekannt	8	0.25	11	8	19	1	47.25
Total	57.5	11.5	58	13.5	59.75	25.25	225.5

Poissonverteilungen 1 (Unsicherheit der beobachteten Daten)

REGION	Anderes	Eier	Milch	TN1	TN2	Tier	Total
AFR	15	1	0	1	0	0	17
ASIA	13	0	0	0	12	2	27
EEU	2	0	0	0	0	3	5
NAM	0	0	0	1	0	6	7
NEU	2	0	3	0	1	3	9
SAM	0	0	0	1	5	2	8
SEU	2	1	18	4	21	0	46
WEU	10	7	13	0	4	13	47
unbekannt	6	0	17	7	14	0	44
Total	50	9	51	14	57	29	210

Data | Inputs Nr illegal | Tree Nr illegal | Prod_distr_poisson | Menge_Anderes | Menge_Eier | Menge_Milc

Bereit

Poissonverteilungen 2 (Unsicherheit der geschätzten Werte)

REGION	Anderes	Eier	Milch	TN1	TN2	Tier	Total
AFR	19	2	0	0	0	0	21
ASIA	18	0	0	0	14	2	34
EEU	4	0	0	0	0	1	5
NAM	0	0	0	0	0	4	4
NEU	3	0	6	0	0	4	13
SAM	0	0	0	1	4	2	7
SEU	1	1	21	3	21	0	47
WEU	10	10	13	0	4	15	52
unbekannt	7	0	25	11	14	0	57
Total	62	13	65	15	57	28	240

Proportionen

REGION	Anderes	Eier	Milch	TN1	TN2	Tier	Total
AFR	0.079166667	0.00833333	0	0	0	0	0.0875
ASIA	0.075	0	0	0	0.05833333	0.00833333	0.14166667
EEU	0.016666667	0	0	0	0	0.00416667	0.02083333
NAM	0	0	0	0	0	0.01666667	0.01666667
NEU	0.0125	0	0.025	0	0	0.01666667	0.05416667
SAM	0	0	0	0.00416667	0.01666667	0.00833333	0.02916667
SEU	0.004166667	0.00416667	0.0875	0.0125	0.0875	0	0.19583333
WEU	0.041666667	0.04166667	0.05416667	0	0.01666667	0.0625	0.21666667
unbekannt	0.029166667	0	0.10416667	0.04583333	0.05833333	0	0.2375
Total	0.258333333	0.05416667	0.27083333	0.0625	0.2375	0.11666667	1

Anzahl illegale Importe pro Warenkategorie und Region

REGION	Anderes_Anz In	Eier_Anz Imp	Milch_Anz Im	TN1_Anz Imp	TN2_Anz Imp	Tier_Anz Imp	Alle Produkte_ Anz Im
AFR	565	60	0	0	0	0	625
ASIA	536	0	0	0	417	60	1013
EEU	119	0	0	0	0	30	149
NAM	0	0	0	0	0	119	119
NEU	89	0	179	0	0	119	387
SAM	0	0	0	30	119	60	209
SEU	30	30	625	89	625	0	1399
WEU	298	298	387	0	119	446	1548
unbekannt	208	0	744	327	417	0	1696
Alle Regioner	1845	387	1935	446	1696	833	7142

Daten der Aufgriffe im Jahr 2006

Korrektur der Werte 0.0

1. Poissonverteilung

2. Poissonverteilung

Proportionen jeder Produkt-/Herkunftsregionskombination

Die Proportionen wurden mit dem simulierten Wert der Anzahl illegaler Importe multipliziert

Abbildung 5 - Tabellenblatt Prod_distr_poisson HV

Mittels Poissonverteilungen werden Variabilität und Unsicherheit der Daten modelliert.

1.5. Tabellenblätter Mengen der tierischen Produkte

Konnten bei weniger als 100 Aufgriffen Mengenangaben erfasst werden (vor allem bei HV und RV Luftverkehr), wird ein Bootstrap Sample Verfahren angewendet, aus welchem Mittelwert und Standardabweichung errechnet werden, die für die Defintition der Lognormalverteilung dienen. Um „unmögliche“ Extremwerte zu vermeiden werden gestutzte (truncated) Lognormalverteilungen verwendet. Diese Grenzwerte werden aus dem kleinsten Wert grösser als 0.0 und dem grössten realistischen Wert gebildet. Die verwendeten Werte werden in schwarzer Schrift, die restlichen in grau dargestellt.

Die *simulierte Menge* bezeichnet die Menge, die pro illegalen Import von diesem Produkt geschmuggelt wird. In der Tabelle wird für jede Ursprungsregion die gesamte Menge simuliert, die pro Jahr geschmuggelt wird, indem die Anzahl illegaler Importe der entsprechenden Produktkategorie und Herkunftsregion aus dem Tabellenblatt **Prod_distr_poisson** eingefügt wird und mit der simulierten Menge multipliziert wird (Abbildung 6).

	Data	Bootstrap Sample		Populationsparameter							
Anderes:	1.4	65.5									
	2	14.65		**mean (μ)**	312.4862745						
	3	75		**median**	56						
	3.5	56		**Standard deviatior**	786.1113758						
	3.6	425									
	4	8		**Simulierte Menge**	23.60262577		RiskLognorm(F4;F6;RiskTruncate(0.1;40000))				
	4	4.3									
	4.3	80		**HV**							
	4.4	65.5		**REGION**	**Anz. Illegale Impc**	**Menge (kg)**	**Minimum**	**2.5% Percen**	**5% Percentil**	**Median**	**Mean**
	5.7	4		AFR_Anderes	338	7978	124	425	1063	23283	82950
	7.2	100		ASIA_Anderes	863	20369	559	735	1133	30184	97671
	7.7	15		EEU_Anderes	0	0	0	0	0	75	6589
	8	0		NAM_Anderes	0	0	0	0	0	0	1868
	8	84		NEU_Anderes	263	6207	0	0	0	5760	26184
	9	37		SAM_Anderes	0	0	0	0	0	0	282
	10	200		SEU_Anderes	0	0	0	0	0	0	3933
	13.6	834.7		WEU_Anderes	225	5311	186	631	696	14991	55998
	14.65	4		UNB_Anderes	526	12415	103	461	696	11902	43871
	15	5.7		Total_Anderes		52280	1262	2620	4245	95971	319345
	15.5	15.5									

Abbildung 6 - Tabellenblätter Mengen HV

Berechnung der jährlich geschmuggelten Mengen von tierischen Produkten. Für jede Produktkategorie wurde ein separates Tabellenblatt mit analogem Aufbau erstellt.

1.6. Tabellenblatt Anzahl_Tiere

Die Anzahl der im Handelswarenverkehr pro illegalem Import geschmuggelten Tiere wird mittels einer gestutzten (truncated) Poissonverteilung ermittelt. Anschliessend erfolgt die Hochrechnung mittels Multiplikation mit den entsprechenden Anzahlen illegalen Importen pro Ursprungsregion (Abbildung 7).

	Data	Bootstrap Sample		Populationsparameter									
Tiere:Anzahl:	1	2		mean (μ)	17.7727273								
	1	1		median	2								
	1	2		Standard deviation (σ)	34.4396391								
	1	100											
	1	85		Simulierte Anzahl Tiere	11			RiskPoisson(11;RiskTruncate(0.5;200))					
	1	85		HV									
	1	85		REGION	Anz Aufgriffe	AnzTiere	Minimum	2.5% Percen	5% Percentil	Median	Mean	95% Percent	97.5% Perce
	1	2		AFR_Tier	0	0	0	0	0	0	46	304	477
	2	2		ASIA_Tier	25	275	0	0	0	0	204	990	1194
	2	2		EEU_Tier	101	1111	0	0	0	495	760	2145	3360
	2	1		NAM_Tier	201	2211	0	0	0	609	913	2616	3600
	2	1		NEU_Tier	0	0	0	0	0	273	500	1245	2794
	2	1		SAM_Tier	101	1111	0	0	0	0	317	1210	2490
	2	2		SEU_Tier	50	550	0	0	0	0	241	1100	1422
	2	1		WEU_Tier	327	3597	221	350	396	2080	2994	8173	8853
	3	1		UNB_Tier	101	1111	0	0	0	0	209	880	1400
	5	1		Total_Tier	906	9966	#NV	#NV	#NV	#NV	#NV	#NV	#NV
	5	1											
	12	1											
	29	1											
	85	12											
	100	2											
	9200												

Abbildung 7 - Tabellenblatt Anzahl Tiere HV

Dieses Tabellenblatt dient der Berechnung der jährlich geschmuggelten Anzahl lebender Tiere.

2. Modell Reiseverkehr Luft

2.1. Tabellenblatt Data

Die Informationen über die Zahlen der jährlich einreisenden Passagiere wurden bei den Flughafenbetreibern von Genf und Zürich eingeholt. Die Kontrolltätigkeit der Zollfachleute an den Flughäfen wurde vor Ort erörtert und entsprechende Kontrollfrequenzen in Interviews mit den Experten ermittelt (Abbildung 8).

	A	B	C	D	E	F	G	H	I	J	K
1	**Travellers traffic Airport Zurich**										
2											
3	**Berechnungen**								**RELATIV**		
4			**min**	**most likely**	**max**				min	most likely	max
5	**NrPaxZH**	annual nr passengers entering Switzerland by Airport Zurich	7'200'000	9'957'669	11'000'000						
6	**NrPaxGE**	annual nr passengers entering Switzerland by Airport Ge	4'000'000	4'953'028	6'000'000						
7	**NrPax**	annual nr of passengers entering Switzerland	11'200'000	14'910'697	17'000'000						
8	**Pdecl**	amount of passengers declaring correctly (Benutzer roter Durchgang)	32'000	36'000	40'000				0.00188235	0.00241437	0.00357143
9	**Pcheck**	Control Frequency	**Annahme Minimum**	**Expertenmeinung Pfaf**	**Annahme Maximum**	**Anz Kontrollen/d**			**Anz Kontrollen/a**		
10	Anzahl Zollmitarbeitende/Tag		4	5	6	Min	most likely	max	Min	most likely	max
11	Totalrevisionen/Mitarbeiter/d		5	10	15	280	500	780	102'200	182'500	284'700
12	Teilrevisionen/Mitarbeiter/d		5	10	15				0.0060231	0.01226916	0.02551075
13	Oberflächliche Kontrollen/Mitarbeiter/d		60	80	100						
14	**Pcompl**	Complaints: Items are destroyed by the Border Post but without claim of the passenger	2000	2200	2600				0.00702494	0.01205479	0.02544031
15	**Pclaim**	Claims: Cases in which passenger gets claimed	2000	2150	2300				0.00702494	0.01178082	0.02250489
16	**Pillegal**	Probability that not checked passengers import items illegally	0.01	0.02	0.03				0.01	0.02	0.03
17	**Panimal**	Probability of an illegally imported item to be of animal origin	0.08	0.1	0.15				0.08	0.1	0.15
18											
19											

Abbildung 8 - Tabellenblatt Data RV Luft

Zusammenstellung der Daten im Reiseverkehr Luft, die als Grundlage für die Berechnung der Anzahl illegalen Importe dienen.

2.2. Tabellenblatt Inputs Nr illegal

In dieser Tabelle können die Eingabeparameter verändert werden. Die Verteilungsparameter wurden mittels der vorhandenen Daten und Expertenmeinungen festgelegt. Bei neuen Erkenntnissen können diese Verteilungen angepasst werden. In jeder Iteration fliessen die Werte der Spalte *Distribution value* ins Modell ein (Abbildung 9).

	A	B	C	D	E	F	G	H	I
1	***INPUTS regarding probabilities and proportions of the amount of illegal imports***								
2									
3									
4	**Limb**	**Description**	**Branch**	**Name**	**Distribution value**	**Name of Distribution**	**Distribution parameters**		
5							**min**	**most likely**	**max**
6	NrPax	annual nr of air passengers		NrPax	14033107	*RiskPert*	11'200'000	14'910'697	17'000'000
7	Declaration	annual nr pf passengers declaring correctly	yes	Pdecl	0.002473	*RiskPert*	0.001882353	0.00241437	0.00357143
8		declaring nothing	no	1-Pdecl	0.997527				
9	Check performed	Check was performed	yes	Pcheck	0.018424	*RiskPert(G9;H9;I9)*	0.006023102	0.01226916	0.02551075
10			no	1-Pcheck	0.981576				
11	Check successful	Check was successful (= irregularity was found)	complaints	Pcompl	0.013518	*RiskPert(G11;H11;I11)*	0.007024939	0.01205479	0.02544031
12			claims	Pclaim	0.010830	*RiskPert(G12;H12;I12)*	0.007024939	0.01178082	0.02250489
13			No	1-Pcompl-Pclaim	0.975652				
14	Illegal Import	Probability that not checked passengers import items illegally	Yes	Pillegal	0.022489	*RiskPert(G14;H14;I14)*	0.01	0.02	0.03
15			No	1-Pillegal	0.977511				
16	Product Category	Products found are of animal origin	Yes	Panimal	0.112706	*RiskPert(G16;H16;I16)*	0.08	0.1	0.15
17			No	1-Panimal	0.887294				
18									

Abbildung 9 - Tabellenblatt Inputs Nr illegal RV Luft

Die Werte die in jeder Iteration in das Modell einfliessen, werden in der Spalte E (*Distribution value*) berechnet.

2.3. Tabellenblatt Tree Nr illegal

In diesem Tabellenblatt wird die jährliche Anzahl illegaler Importe berechnet. Diese Zahl in der Zelle N9 wird für die weiteren Berechnungen verwendet (Abbildung 10).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1				Tree for extrapolation of annual number of illegal imports into Switzerlan										
2	NrPax	Declaration		Check performed		Check successful		Illegal Import		animal product		Limb		Annual I
3		Branch	Prop	Branch	Prop	Branch	Prop	Branch	Prop	Branch	Prop	Outcome	Probability	
4	1.4E+07	yes	0.00247	n.a.		n.a.		n.a.		n.a.		negative	0.00247	34705
5		no	0.99753	yes	0.01842	complaint	0.01352	n.a.		yes	1	negative	0.00025	3486
6						claims	0.01083	n.a.		yes	0.11271	negative (	2.2E-05	315
7										no	0.88729	negative	0.00018	2478
8						no	0.97565			n.a.		negative	0.01793	251634
9				no	0.98158	n.a.		pi	0.02249	pai	0.11271	positive	0.00248	34827
10										no	0.88729	negative	0.01954	274181
11								no	0.97751	n.a.		negative	0.95713	1E+07

Abbildung 10 - Tabellenblatt Tree Nr illegal RV Luft

Die Anzahl der illegalen Importe wird in der Zelle N9 (rot eingerahmt) berechnet.

2.4. Restliche Tabellenblätter des Modells Reiseverkehr Luft

Die restlichen Tabellenblätter sind analog dem Modell HV aufgebaut und werden in gleicher Art und Weise gerechnet.

3. Modell Reiseverkehr Strasse

3.1. Tabellenblatt Data

Die Angaben zur Anzahl der einreisenden Personenwagen stammen aus der Studie Alpen-und grenzquerender Personenverkehr 2001 von Dörnenburg et al [3]. Die Kontrolltätigkeit der Grenzwachtleute wurde an verschiedenen Grenzübergängen vor Ort erörtert und entsprechende Kontrollfrequenzen in Interviews mit den Experten ermittelt (Abbildung 11).

	Name	Beschreibung	Minimum	Most likely	Maximum
6	**NrCars**	annual nr of cars entering Switzerland	114'427'500	120'450'000	126'472'500
7	**NrCommuters**	percentage of commuters entering Switzerland every year	0.25	0.26	0.3
8	**Decl**	percentage of travellers declaring goods correctly	0.005		0.01
9	**Check**	Control Frequency	0.005	0.01	0.03
10	**Complaints**	percentage of people not declaring goods correctly (small amounts)	0.01	0.02	0.1
11	**Claims**	percentage of people not declaring goods correctly (big amounts)	0.005	0.01	0.02
12	**Illegal**	Probability that not checked passengers import items illegally	0.001	0.01	0.02
13	**animal**	Probability of an illegally imported item to be of animal origin	0.7	0.8	0.9

Abbildung 11 - Tabellenblatt Data RV Strasse

Zusammenstellung der Daten im Reiseverkehr Strasse, die als Grundlage für die Berechnung der Anzahl illegalen Importe dienen.

3.2. Tabellenblatt Inputs Nr illegal

In dieser Tabelle können die Eingabeparameter verändert werden. Die Verteilungsparameter wurden mittels der vorhandenen Daten und Expertenmeinungen festgelegt. Bei neuen Erkenntnissen können diese Verteilungen angepasst werden. In jeder Iteration fliessen die Werte der Spalte „Distribution value“ ins Modell ein (Abbildung 12).

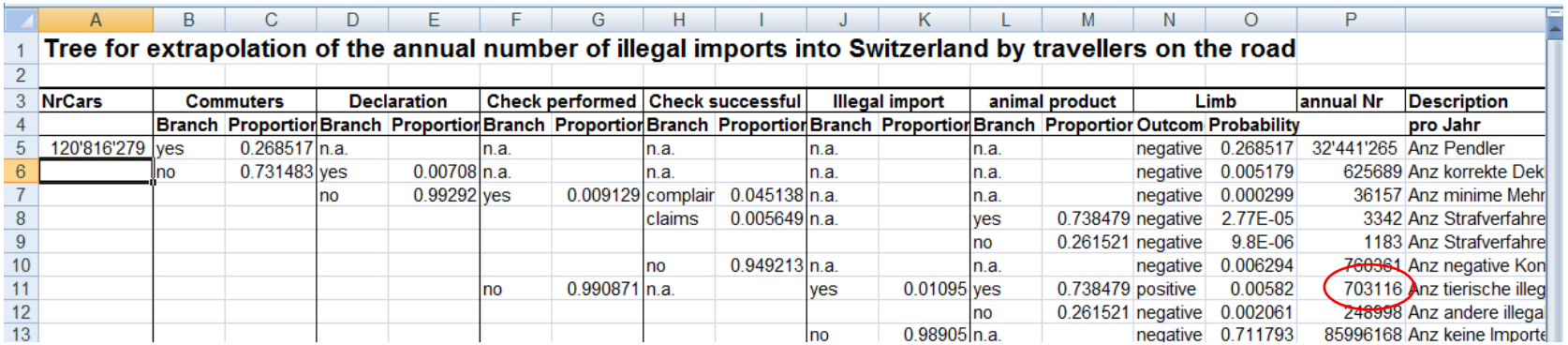
	A	B	C	D	E	F	G	H	I
1	**INPUTS regarding probabilities and proportions of the amount of illegal imports in road travellers**								
2									
3									
4	**Limb**	**Description**	**Branch**	**Name**	**Distribution value**	**Name of Distribution**	**Distribution Parameters**		
5							**minimum**	**most likely**	**maximum**
6	NrCars	annual nr of cars entering Switzerland		NrCars	122783642.6	*RiskPert(G6;H6;I6)*	114427500	120450000	126472500
7	NrCommuters	Amount of commuters	yes	NrCommuter	0.278080852	*RiskPert(G7;H7;I7)*	0.25	0.26	0.3
8			no	1-NrCommuter	0.721919148	*1-NrCommuter*			
9	Declaration	annual nr of passengers declaring correctly	yes	Pdecl	0.005377534	*RiskUniform(G9;I9)*	0.005		0.01
10			no	1-Pdecl	0.994622466	*1-Pdecl*			
11	Check performed	Check was performed	yes	Pcheck	0.011041884	*RiskPert(G11;H11;I11)*	0.005	0.01	0.03
12			no	1-Pcheck	0.988958116	*1-Pcheck*			
13	Check successful	Check was successful (= irregularity was found)	complaints	Pcomplaint	0.024713218	*RiskPert(G13;H13;I13)*	0.01	0.02	0.1
14			claims	Pclaim	0.00667631	*RiskPert(G14;H14;I14)*	0.005	0.01	0.02
15			no	1-Pcomplaint-Pclaim	0.968610472	*1-Pcomplaint-Pclaim*			
16	Illegal import	Probability that not checked passengers	yes	Pillegal	0.014058092	*RiskPert(G16;H16;I16)*	0.001	0.01	0.02
17			no	1-Pillegal	0.985941908	*1-Pillegal*			
18	Product category	Products found are of animal origin	yes	Panimal	0.854666664	*RiskPert(G18;H18;I18)*	0.7	0.8	0.9
19			no	1-Panimal	0.145333336	*1-Panimal*			

Abbildung 12 - Tabellenblatt Inputs Nr illegal RV Strasse

Die Werte die in jeder Iteration in das Modell einfliessen, werden in der Spalte E (*Distribution value*) berechnet.

3.3. Tabellenblatt Tree Nr illegal

In diesem Tabellenblatt wird die jährliche Anzahl an illegalen Importen im RV Strasse berechnet. Diese Zahl in der Zelle P11 wird für die weiteren Berechnungen verwendet (Abbildung 13).



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
1	**Tree for extrapolation of the annual number of illegal imports into Switzerland by travellers on the road**																
2																	
3	**NrCars**	**Commuters**		**Declaration**		**Check performed**		**Check successful**		**Illegal import**		**animal product**		**Limb**		**annual Nr**	**Description**
4		**Branch**	**Proportior**	**Branch**	**Proportior**	**Branch**	**Proportior**	**Branch**	**Proportior**	**Branch**	**Proportior**	**Branch**	**Proportior**	**Outcom**	**Probability**		**pro Jahr**
5	120'816'279	yes	0.268517	n.a.		n.a.		n.a.		n.a.		n.a.		negative	0.268517	32'441'265	Anz Pendler
6		no	0.731483	yes	0.00708	n.a.		n.a.		n.a.		n.a.		negative	0.005179	625689	Anz korrekte Dek
7				no	0.99292	yes	0.009129	complair	0.045138	n.a.		n.a.		negative	0.000299	36157	Anz minime Mehr
8								claims	0.005649	n.a.		yes	0.738479	negative	2.77E-05	3342	Anz Strafverfahre
9												no	0.261521	negative	9.8E-06	1183	Anz Strafverfahre
10								no	0.949213	n.a.		n.a.		negative	0.006294	760361	Anz negative Kon
11						no	0.990871	n.a.		yes	0.01095	yes	0.738479	positive	0.00582	703116	Anz tierische illeg
12												no	0.261521	negative	0.002061	248998	Anz andere illega
13										no	0.98905	n.a.		negative	0.711793	85996168	Anz keine Importe

Abbildung 13 - Tabellenblatt Tree Nr illegal RV Strasse

Die Anzahl der illegalen Importe wird in der Zelle P11 (rot eingerahmt) berechnet.

3.4. Restliche Tabellenblätter des Modells Reiseverkehr Strasse

Die restlichen Tabellenblätter sind analog dem Modell HV aufgebaut und werden in gleicher Art und Weise gerechnet.

Zusammenfassung der Resultate aller drei Modelle

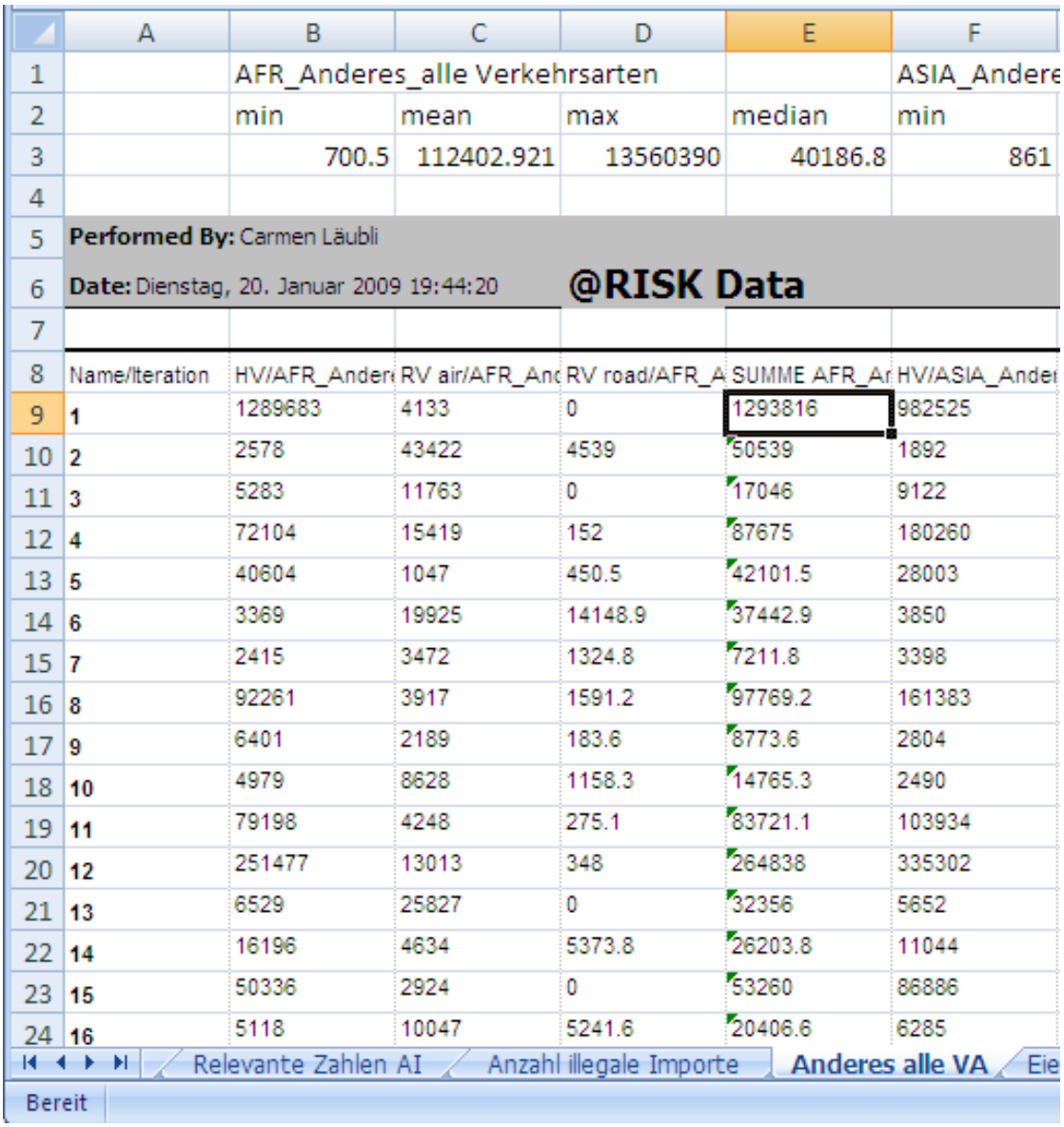
Die drei Modelle werden einzeln gerechnet, da die Rechenleistung eines PC nicht genügt um alle Modelle in einem Schritt zu rechnen (Dauer der Berechnung pro Modell ca. 10 bis 15 Minuten). Deswegen müssen anschliessend die Endresultate aller 10‘000 Iterationen inklusive der Perzentile in einer separaten Excel Tabelle (Name der Datei: *Resultate Simulation 20-1-09*) berechnet werden. Hierzu werden die Resultate pro Iteration von allen drei Modellen addiert.

Folgende Tabellenblätter wurden erstellt:

Tabellenblatt	**Erklärung**
Alle Daten_HV_RV air *Alle Daten RV road*	@Risk Daten der Iterationen aller Modelle. Diese Daten werden für die Berechnung der Gesamtmenge verwendet.
Statistik HV, Statistik RV air *Statistik RV road*	@Risk Output Results. Diese Daten werden nicht weiterverwendet.
Anderes_alle VA; Eier_alle VA; Milch_alle VA; TN1_alle VA; TN2_alle VA; Fleisch_alle VA; und *Tiere_alle VA*	In diesen Tabellenblättern werden für jedes Produkt die Summen der Mengen der illegalen Importe der drei Verkehrsarten pro Herkunftsregion sowie die Gesamtmenge berechnet. Diese Mengen sind in der 3. Zeile ersichtlich.

Anzahl illegale Importe	In diesem Tabellenblatt wird die jährliche Anzahl der illegalen Importe aus allen drei Modellen berechnet.
Übersicht Resultate *relevante Zahlen AI*	Zusammenfassungen der relevanten Zahlen für die Risikoabschätzung und die Publikation.

Beispiel: Für die Menge Anderes aus der Region AFR werden im Tabellenblatt „Anderes alle VA“ die Werte der 1. Iteration aus dem Modell Handelswarenverkehr (Zelle B9), Reiseverkehr Luft (Zelle C9) und Reiseverkehr Strasse (Zelle D9) addiert. Die Summe dieser Werte wird in der Zelle E9 berechnet (Abbildung 14). Entsprechend werden für jede Iteration die entsprechenden Mengen addiert, d.h. jede Zeile entspricht einer Iteration. Diese Summen dienen anschliessend der Berechnung von Minimum, Maximum, Mittelwert und Median der Gesamtmengen der illegalen Importe pro Herkunftsland. Analog erfolgt die Berechnung für jede Herkunftsregion und die Gesamtmenge aus allen Regionen.



	A	B	C	D	E	F
1		AFR_Anderes_alle Verkehrsarten				ASIA_Andere
2		min	mean	max	median	min
3		700.5	112402.921	13560390	40186.8	861
4						
5	**Performed By:** Carmen Läubli					
6	**Date:** Dienstag, 20. Januar 2009 19:44:20			**@RISK Data**		
7						
8	Name/Iteration	HV/AFR_Ander	RV air/AFR_Anc	RV road/AFR_A	SUMME AFR_Ar	HV/ASIA_Ander
9	1	1289683	4133	0	1293816	982525
10	2	2578	43422	4539	50539	1892
11	3	5283	11763	0	17046	9122
12	4	72104	15419	152	87675	180260
13	5	40604	1047	450.5	42101.5	28003
14	6	3369	19925	14148.9	37442.9	3850
15	7	2415	3472	1324.8	7211.8	3398
16	8	92261	3917	1591.2	97769.2	161383
17	9	6401	2189	183.6	8773.6	2804
18	10	4979	8628	1158.3	14765.3	2490
19	11	79198	4248	275.1	83721.1	103934
20	12	251477	13013	348	264838	335302
21	13	6529	25827	0	32356	5652
22	14	16196	4634	5373.8	26203.8	11044
23	15	50336	2924	0	53260	86886
24	16	5118	10047	5241.6	20406.6	6285

Relevante Zahlen AI | Anzahl illegale Importe | **Anderes alle VA** | Eie

Bereit

Abbildung 14 - Berechnung der Gesamtmenge der illegalen Importe aller Verkehrsarten

Interpretation der Resultate

Die Resultate müssen mit grösster Vorsicht interpretiert werden. Die Definition des illegalen Imports muss bei der Interpretation der Resultate berücksichtigt werden. Illegaler Import wurde definiert als nicht korrekte Deklaration. Dies hat zur Folge, dass auch Importe als illegal erfasst werden, die nicht per se illegal sind und bei korrekter Deklaration durchaus in die Schweiz eingeführt werden dürfen.

Das Verzollungs- und Kontrollsystem der Schweizer Zollbehörden ist infolge politischen Entscheiden und laufender Anpassungen an die Bestimmungen des EU-Raums ständigen Veränderungen unterworfen. Deshalb sollte sich jede Anwenderin dieser Modelle eingehend mit dem schweizerischen Zollsystem auseinandersetzen.

Referenzen

1. Murray N: Import Risk Analysis: Animals and Animal Products. *New Zealand Ministry of Agriculture and Forestry;* January 2002.

2. http://unstats.un.org/unsd/methods/m49/m49regin.htm

3. Dörnenburg K, Kooijman G, Hitz P: Alpen- und grenzquerender Personenverkehr 2001. *Federal Office for Spatial Development* 2003.