

GHENT UNIVERSITY

FACULTY OF VETERINARY MEDICINE

Academic year 2017-2018

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**Labour market and income of the veterinary profession in Belgium**

**A new structural approach**

by

Ashkan M.H. Joshghani

Promoters: Prof. dr. De Vliegher  
Prof. dr. ir. De Buysse

Research Report  
as part of the Master's Dissertation

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## EXECUTIVE SUMMARY

The focus of this dissertation is to examine the plethora on the labour market and income problem of veterinary practitioners. While this has often been the subject of lengthy discussion, there is a total dearth of actual hard, quantitative data to support this polemic.

This research dissertation is split into two main parts – demographic analysis of the total number of veterinary practitioners in Belgium, the Netherlands, France and Germany according to animal species and a comparative analysis between self-employed veterinarians and physicians.

The dominant challenge of this research was to collect data from different official institutions which were often difficult to access and needed to be pieced together in an overall picture. At the same time, the data were subjected to a strict qualitative analysis guided by the relevant official legislation.

One of the main results of this study is that it provides hard quantitative data supporting the often-quoted plethora of veterinarians on the Belgian labour market. It further also serves to highlight several other challenges faced by veterinary practitioners in general, and women in particular.

**Key words:** labour market - income – veterinary profession – veterinary practitioner

## **EXECUTIVE SUMMARY (Dutch version)**

Het doel van deze dissertatie is de plethora op de arbeidsmarkt van dierenartsen te onderzoeken, en de potentieel daarmee samenhangende problemen in verband met inkomen. Hoewel dit topic vaak onderwerp is van verhitte discussies, is er een nagenoeg totaal gebrek aan harde, kwantitatieve data om deze polemieken te ondersteunen.

Deze dissertatie is opgedeeld in twee delen: een demografische analyse van het totale aantal dierenartsen in België, Nederland, Frankrijk en Duitsland in verhouding tot de relevante diersoorten, en een vergelijkende analyse tussen zelfstandige dierenartsen en artsen.

De belangrijkste uitdaging voor deze studie was het verzamelen van data vergaard door verschillende officiële instanties. Deze gegevens waren vaak moeilijk toegankelijk en moesten samen gepuzzeld worden uit meerdere bronnen om een algemeen beeld te verkrijgen. Terzelfdertijd werden de gegevens onderworpen aan een stringente kwalitatieve analyse die geleid werd door de relevante wetgeving ter zake.

Een van de belangrijkste uitkomsten van dit onderzoek is dat het voor de eerste keer harde, kwantitatieve gegevens verschaft die de vaak genoemde plethora van dierenartsen op de Belgische arbeidsmarkt daadwerkelijk ondersteunen. Verder bracht dit werk ook meerdere andere problemen voor dierenartsen in het algemeen, en vrouwen in het bijzonder, aan het licht.

## INTRODUCTION

In the previous dissertation (M.H. Joshghani, 2016), we concluded that Belgium, relative to its size, has a considerably higher outflow of veterinary graduates entering the labour market than the neighbouring countries.

However, this finding alone, is insufficient to support the conclusion that there is a plethora of veterinary practitioners on the Belgian labour market.

Even though more than 90 % of the veterinary students graduate at Ghent University in one of the four specialisation tracks (equine medicine, ruminant medicine, companion animal medicine and medicine of pigs, poultry and rabbits), not every graduate will end up working as a veterinary practitioner in Belgium: some will start their clinical practice in other countries or even pursue other career opportunities beyond veterinary medicine (i.e. industry, education, research, public health, etc.).

While the phrase 'plethora of veterinary practitioners on the Belgian labour market' is constantly repeated, to this day, the actual veterinary supply in Belgium is still unknown. As this supposed oversupply remains a major topic of debate, it presently can be considered a moot point.

To define the veterinary supply to society, a dedicated model taking into account various factors and their interdependency needs to be developed; some of the main factors in play include trends in the number of active veterinary practitioners on the labour market according to the areas of practice (animal species), demographic trends (ageing), geographic trends (regional distribution and density), etc. Such methodology is already applied to human medicine by the Committee of Medical Supply Planning.

It is clear from this short list, which is far from exhaustive, that developing a model with this degree of sophistication and complexity is no small task; to this end, the establishment of a database of veterinary professionals (also known as a 'cadastre') will remain essential.

In 2015, the federal government initiated the development of a veterinary cadastre to identify the activities of veterinary practitioners according to their area of practice and region. This veterinary cadastre was intended to serve multiple purposes: to improve communication of health information through specific newsletters (by species and region); to evaluate the network for epidemiological surveillance of different animal species; and finally, to quantify the veterinary supply in Belgium and enabling policy accordingly.

Unfortunately, because registration was not mandatory, and veterinary practitioners themselves voluntarily had to input their data into the system, the cadastre ended up being incomplete, and hence, unreliable.

Nevertheless, it is surprising to see how little research has been conducted on this matter. The few studies related to this topic were all survey-based; consequently, the results were often dismissed as unrepresentative due to low response rates from veterinary practitioners. This research paper attempts to address these issues.

The first part focusses on the demographics and practice patterns of the veterinary practitioner's workforce in Belgium in comparison with the neighbouring Member states. A major question tackled in this part concerns the actual number (according to species) of veterinary practitioners on the Belgian Labour market. This information is then used to address the quandary of whether Belgium has a higher supply of veterinary practitioners as compared to neighbouring countries in relation to the numbers of animals and people.

The second part analyses data on the income of self-employed veterinarians. In addition, a comparison is made to their parallel medical peers, the physicians. Apart from establishing the earnings of veterinarians, income differences between physicians and veterinarians are reviewed in detail. In addition, the socially significant topic of income inequality between male and female practitioners in both professions is examined, and the income gap between both sexes is quantified. Finally, trends in the evolution of the number of physicians and veterinarians are documented.

To this day, an analysis of this kind has never been attempted before. This is probably in part due to the absence of readily available data required for such demographic analyses; in some cases, the necessary information even does not exist. This problem is further compounded by the fact that every country collects data for its own specific needs and purposes, making comparisons between countries a challenge. Consequently, a certain degree of interpretation of the various data is inevitable.

# RESEARCH REPORT

## 1. DEMOGRAPHIC ANALYSIS OF VETERINARY PRACTITIONERS

To perform a demographic analysis and quantify the number of veterinary practitioners (hereafter called “veterinarian”) according to the main areas of expertise (small animals, equine, bovine, poultry and swine), data was collected from different institutions officially linked to veterinarians.

In the following section, these institutions will be presented to better comprehend which data on veterinarians is collected by these sources.

### 1.1. QUALITATIVE ANALYSIS

#### 1.1.1. Framework of the veterinary profession in Belgium

##### 1.1.1.1. The Veterinary Board

Instituted by the law of 19 December 1950<sup>1</sup>, the Veterinary Board is a legal entity which ensures compliance with the Code of Practice by all its members. This Code, laid down by veterinarians and for veterinarians, establishes the principles and rules of conduct and responsibilities by the individual veterinarian with the purpose of guarding the credibility of the veterinary profession and maintain high-quality practice in veterinary medicine.

All veterinarians wishing to practice the profession in Belgium must register on the list of a regional council<sup>2</sup>. After receiving a specific order number, a yearly memberships fee is collected after the second year of graduation. Any transgression of the Code by a registered veterinary practitioner may lead to disciplinary action.

As mentioned in the previous dissertation (M.H. Joshghani, 2016), Belgium is divided into three linguistic communities: the Flemish *Community*, the French *Community* and the German-speaking *Community*<sup>3</sup>.

Eventually, Belgium has two Veterinary Boards: a Dutch-speaking Regional Council (*Dutch: Nederlandstalige Gewestelijke Raad van de Orde der Dierenartsen, NGROD*) and a French-speaking Regional Council (*French: Conseil Régional d’expression Française Ordre des Médecins Vétérinaires, CRFOMV*) of the Veterinary Boards for, respectively, the Flemish and French Community. Furthermore, veterinary medicine in Belgium is under the authority of the Minister of Agriculture.

Even though all the veterinary practitioners in Belgium are included on the list of a regional council, the database system and policy has not yet been developed to a sufficient degree of sophistication to allow the extraction of structured socio-demographic information of all their members.

The database lacks information regarding area of expertise of the veterinarians and is not able to differentiate between veterinary practitioners and non-practitioners (e.g. active in higher education) on the list.

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<sup>1</sup> art. 5 of the Act of 19 December 1950 on establishing the Veterinary Board

<sup>2</sup> art. 4 of the Act of 28 August 1991 on the practice of veterinary medicine

<sup>3</sup> art. 2 of the Coordinated Belgian Constitution of 17 February 1994

As mentioned earlier in the introduction concerning the cadastre, the Regional councils also subsequently made calls for action to their members to voluntarily provide this information; however, this initiative met again with a low response rate.

Therefore, to this day, it is not possible to perform a valid socio-demographic analysis solely based on the data collected by the Veterinary Board. Thus, an indirect approach is required to gain insight into this matter through assembling secondary sources of data.

#### **1.1.1.2. The Federation of Free and Intellectual Professions (*Dutch: Federatie van Vrije en Intellectuele Beroepen, FVIB*)**

Veterinary medicine is regarded as a liberal profession. However, the term 'liberal profession' has no universal definition. In 2001, the European Court of Justice (ECJ) described the nature of a liberal profession's activities to be,

*"of a marked intellectual character, require a high-level qualification and are usually subject to clear and strict professional regulation. In the exercise of such an activity, the personal element is of special importance and such exercise always involves a large measure of independence in the accomplishment of the professional activities."*<sup>4</sup>

According to Belgian law, a liberal profession is defined as follows,

*"any natural or legal person who exercises a professional activity of mostly intellectual services on an independent basis and under personal responsibility, who has previously followed the required training, who is subject to continuous education, who is subject to a disciplinary body which is fixed by law and who is not a merchant within the meaning of art. 1 of the Commercial Code."*<sup>5</sup>

While the second definition emphasizes the distinction from a merchant, both definitions highlight common concepts which describe the core principles of a liberal profession: professional qualification, independency, personal liability, intellectual service and professional regulation.

Other liberal professions include other medical professions (e.g. physicians, dentists), legal consulting professions (e.g. notaries, lawyers) and technical professions (e.g. architects).

To enable a form of independency in their profession, a significant proportion of the liberal professionals practice under the employment status 'self-employed'. As defined by Belgian law, a self-employed person is:

*"a natural person who exercises a professional activity in Belgium without being attached to an employer by means of an employment contract or status."*<sup>6</sup>

For this reason, in the case of veterinary medicine in Belgium, self-employment among veterinarians is considered the standard on the labour market. Furthermore, the financial benefit for an employer to shift

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<sup>4</sup> ECJ 11 October 2001, Case 267/99, ECR 2001, I-7467 (Adam), para. 3

<sup>5</sup> art. 2 of the Act inserting Book XIV "market practices and consumer protection concerning practitioners of the liberal professions" into the Code of Economic Law and inserting the definitions specific to Book XIV and the law enforcement provisions specific to Book XIV, in the Books I and XV of the Code of Economic Law of 15 May 2014

<sup>6</sup> art. 3, §1 of the Royal Decree No 38 of 27 July 1967 on organizing social security for self-employed workers



the responsibility to self-employed veterinarians to pay their own social security contributions is also an important causal factor to this standard. Nonetheless, in the neighbouring Member States a considerable number of veterinarians practice as employees (hereafter called “salaried veterinarian”).

The Federation of Free and Intellectual Professions is an organization which collects and presents available statistical material concerning this target group, i.e. self-employed liberal professions. The data is sourced from the National Institute for the Social Security of the Self-employed (NISSE; *Dutch: Rijksinstituut voor de Sociale Verzekeringen der Zelfstandigen, French: Institut national d'Assurances sociales pour Travailleurs indépendants, RSVZ-INASTI*) and National Social Security Office (NSSO; *Dutch: Rijksdienst voor Sociale Zekerheid, RSZ*).

As a result, the proportion of veterinarians is well documented in the published data by the Federation of Free and Intellectual Professions.

#### **1.1.1.3. The Federal Public Service of Health, Food Chain Safety and Environment (*Dutch: Federale Overheidsdienst Volksgezondheid, Veiligheid van de Voedselketen en Leefmilieu*)**

Veterinarians who wish to cooperate in the implementation of legislative and regulatory provisions must first fulfill the conditions (e.g. registered at a Veterinary Board) and send a request. Then, an oath must be taken at the Federal Public Service (FPS) of Health, Food Chain Safety and Environment to be entitled as an ‘accredited veterinarian’<sup>7</sup>.

As it enables certain activities within the veterinary practice (e.g. rabies vaccination, epidemiological surveillance, etc.), the vast majority of veterinarians are also ‘accredited veterinarians’.

It has to be noted that accredited veterinarians can be active in a wide range of formal functions within the veterinary practice in which every function is defined differently by law. For instance, an ‘identifier’ (accredited veterinarian licensed for electronic identifications of Equidae), a ‘farm veterinarian’ (see below), etc.

Thus, the federal government has data on the number of accredited veterinarians in Belgium. The data should, however, be interpreted carefully.

First, after completing a training course, above-mentioned accreditation procedure and official request to the FPS, a veterinarian can become an identifier who is entitled to carry out the legislative procedure for electronic identification of Equidae (e.g. microchip implantation, etc.)<sup>8</sup>. The identifiers and Equidae are registered in a central database of the Belgian Confederation of the Horse (CBC-BCP), also known as ‘HorseID’<sup>9,10</sup>.

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<sup>7</sup> art. 4 of the Royal Decree of 20 November 2009 concerning the accreditation of veterinarians

<sup>8</sup> art. 10, 16 of the Royal Decree of 6 June 2005 on the identification and encoding of horses in a central database

<sup>9</sup> Ministerial Decree of 23 May 2006 designating the body responsible for managing the central database for the identification of horses

<sup>10</sup> art. 22 of the Royal Decree of 16 February 2016 on the identification and encoding of Equidae in a central database

However, an identifier is not necessarily only active as an equine veterinarian but can also be active in other animal sectors (e.g. small animals, bovine, etc.). In other words, the number of identifiers in Belgium gives no indication of veterinarians active in the equine sector.

Second, even though it is mandatory to notify the FPS veterinary services once a veterinarian wishes to cease their functions<sup>11</sup>, it is still questionable whether this requirement is fulfilled by every practitioner upon leaving the field; hence, it is debatable whether in reality the data registry only consists of active accredited veterinarians. In other words, it is unclear whether this system is effective in achieving consistent up-to-date data by solely relying on a voluntarily communication by the veterinarian.

#### **1.1.1.4. The Federal Agency for the Safety of the Food Chain (*Dutch: Federaal Agentschap voor de veiligheid van de voedselketen, FAVV*)**

The Federal Agency for the Safety of the Food Chain (FASFC) is a federal executive agency with the objective of preserving the safety and the quality of the food chain with a view to protect the health of humans, animals and plants<sup>12</sup>.

FASFC has a computerized database for animal identification and registration at farm level, also known as 'SANITEL/SANITRACE'<sup>13</sup>. This system aims to centralize and monitor all information of animals in herds (e.g. cattle, poultry, pigs), geographical location and responsible animal holder (i.e. farmer registration) to ensure the traceability of each individual animal (for cattle) or group of animals (pigs, poultry or small ruminants) from farm to slaughterhouse.

With an eye on epidemiological surveillance, each livestock farmer in cattle, poultry and/or pig is obliged to conclude an agreement with an accredited veterinarian for each animal species. By law, the selected accredited veterinarian is then designated the 'farm veterinarian' of the farm and will carry out official tasks commissioned by the federal government.

An accredited veterinarian can conclude multiple agreements with different farms, up to a maximum of 100 agreements per species<sup>14,15</sup>.

Every agreement between animal holder and farm veterinarian is registered in the database SANITEL/SANITRACE. This system provides a way to indirectly quantify the number of veterinarians active in the cattle, poultry and pig sector in Belgium.

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<sup>11</sup> art. 7 of the Royal Decree of 20 November 2009 concerning the accreditation of veterinarians

<sup>12</sup> art. 4 of the Law of 4 February 2000 establishing the Federal Agency for the Safety of the Food Chain

<sup>13</sup> art. 17 of the Animal health law of 24 March 1987

<sup>14</sup> art. 2 of the Royal Decree of 15 February 1995 laying down specific measures for the epidemiological surveillance and prevention of notifiable porcine diseases

<sup>15</sup> art. 2 of the Royal Decree of 28 February 1999 laying down specific measures for the epidemiological surveillance and prevention of notifiable bovine diseases

## **1.1.2. Framework of the veterinary profession in the Netherlands**

### **1.1.2.1. The Central Information Point for Healthcare Professions (*Dutch: Agentschap Centraal Informatiepunt Beroepen Gezondheidszorg, Agentschap CIBG*)**

Contrary to Belgium, the Netherlands has no Veterinary Board. Instead, these tasks are carried out by the CIBG for the official registration, while the independent Veterinary Disciplinary Board (*Dutch: Veterinair Tuchtcollege, VTC*) is responsible for the disciplinary enforcement on behalf of the Ministry of Agriculture, Nature and Food Quality (*Dutch: Ministerie van Landbouw, Natuur en Voedselkwaliteit, LNV*)<sup>16</sup>.

To be allowed to practice veterinary medicine in the Netherlands, a veterinary practitioner is obliged to be registered in the Register of veterinary medical practitioners<sup>17,18,19</sup>.

The CIBG is an executive agency within the Ministry of Health, Welfare and Sports which manages the register and issues permits based on the appropriate qualifications<sup>20</sup>.

In accordance with the law, if a veterinarian has ended their veterinary activities, their registration at the CIBG should also be terminated<sup>21</sup>. Through a link between the register and Municipal Basic administration, a section of the data is automatically updated (e.g. morbidity). On the other hand, regarding business information, the responsibility lies with the veterinarian to notify the CIBG.

Recently, concern has been expressed by the government about the fact that changes are often inadequately communicated to the CIBG<sup>22</sup>. As the system is based on a one-time registration, the register has become outdated over the years (e.g. retired, incapacitated, abroad, unemployed).

The Royal Veterinary Association of the Netherlands (RVAN) annually publishes an overview of veterinarians which provides the possibility to somehow update the governmental register through their database. Therefore, the responsible ministry commissioned the establishment of a one-time agreement between CIBG and RVAN (see following section) for a data transfer of the registered veterinarians at the RVAN<sup>18</sup>.

### **1.1.2.2. The Royal Veterinary Association of the Netherlands (*Dutch: Koninklijke Nederlandse Maatschappij voor Diergeneeskunde, KNMvD*)**

The Royal Veterinary Association of the Netherlands (RVAN) is the professional organization for veterinarians in the Netherlands.

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<sup>16</sup> § 5 of the Animal Act of 19 May 2011 on an integral framework for rules of kept animals and related subjects (*Dutch: Wet dieren*)

<sup>17</sup> art.10 of the Act of 21 March 1990 on the practice of veterinary medicine

<sup>18</sup> art. 4.3 of the Animal Act of 19 May 2011 on an integral framework for rules of kept animals and related subjects (*Dutch: Wet dieren*)

<sup>19</sup> art. 4.1 of the Decision of 16 April 2014 on the rules concerning veterinary medicine (*Dutch: Besluit Diergeneeskundigen*)

<sup>20</sup> art. 10 of the Decision of the Minister of Economic Affairs of 16 December 2014 on the granting of a mandate and authorization to the director of the Agency Central Information Point for Healthcare Professions (CIBG) regarding matters related to admission, registration and cancellation of the exercise of veterinary medicine

<sup>21</sup> art. 4.2, 4.6 of the Decision of 16 April 2014 on the rules concerning veterinary medicine (*Dutch: Besluit Diergeneeskundigen*)

<sup>22</sup> Letter by Kalis A.A.W (CIBG) concerning the Register of veterinary medical practitioners to the Collective Practicing Veterinarians (CPD) on 30 March 2017

As with any professional organization, it aims to support veterinary medicine in the broadest sense, as well as to ensure the honor and interests of the profession. In addition, the Code of Practice, similarly to that of Belgium, is laid down by the RVAN. While membership of RVAN is voluntary, approximately 70% of veterinarians in the Netherlands are RVAN-members.

#### **1.1.2.3. The Guaranteed Veterinarian Foundation (Dutch: *Stichting Geborgde Dierenarts, SGD*)**

The Guaranteed Veterinarian Foundation (SGD) is an independent organization for guaranteeing the quality of veterinary services provided by veterinary practitioners active in livestock, i.e. cattle (dairy and beef), veal calves, pigs and poultry.

In 2008, a covenant regarding antimicrobial resistance (AMR) in livestock laid down the basis for the organization through the foundation of the Taskforce Antibiotic Resistance<sup>23</sup>. Aiming to promote a responsible use of antibiotics and reduction of AMR in livestock, a framework was established between the veterinarian and farmer.

Ultimately, in 2014, a new regulation was introduced by the Ministry of Agriculture, Nature and Food Quality. Under this regulation, all veterinary antimicrobials were brought under a strict measure known as the “UDD” (Dutch: *Uitsluitend Door Dierenarts*), meaning all veterinary antibiotics must be administered by veterinarians only and after a clinical diagnosis<sup>24</sup>.

However, mandatory requirements are imposed which permit a farmer to administer and store antimicrobials. These requirements include: the one-on-one agreement with a veterinarian, the central registration of prescribed antimicrobials and the introduction of a farm health and treatment plan. In this case, the one-on-one relation is considered the cornerstone for achieving a responsible antimicrobial use<sup>25,26,27</sup>.

As the sector requires a veterinarian to comply with the quality system, the vast majority of veterinary practitioners active in livestock are known to the SGD, since they are entitled as a ‘guaranteed veterinarian’.

As a result, the SGD has accurate data available on the number of veterinary practitioners active in cattle, veal calves, pigs and poultry. However, it should be noted that a veterinarian can be registered as a “guaranteed veterinarian’ for several animal species.

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<sup>23</sup> Covenant of 3 December 2008 to reduce antibiotic resistance in livestock farming in the Netherlands under the authority of the Ministry of Agriculture, Nature and Food Quality (Dutch: *Ministerie van Landbouw, Natuur en Voedselkwaliteit, LNV*)

<sup>24</sup> Regulation of the State Secretary for Economic Affairs of 15 August 2013, no. WJZ/13031524, amending the Regulation on veterinary medicines concerning the use of antibiotics by animal keepers

<sup>25</sup> art 1.28 of the Animal Keepers Decree of 15 September 2015 (Dutch: *Besluit houders van dieren*)

<sup>26</sup> art. 5.13, 5.14 of the Veterinarians Regulation of 1 January 2017 (Dutch: *Regeling diergeneeskundigen*)

<sup>27</sup> art. 5.8 of the Veterinarians Decree of 1 January 2018 (Dutch: *Besluit diergeneeskundigen*)

#### **1.1.2.4. The Pension Fund Foundation for Veterinarians (*Dutch: Stichting Pensioenfonds voor Dierenartsen, SPD*)**

In the Netherlands, the participation in the pension fund system is mandatory for every veterinary practitioner who is as an employee or self-employed in a Dutch established veterinary practice, was still under the age of 60 on 31 December 2006 and has not yet reached 65 years of age<sup>28,29</sup>.

The Pension Fund Foundation for Veterinarians (SPD) is entitled to the implementation of regulations enabling a lifetime basic pension (supplementary to the basic state pension, also known as the General Old Age Pensions Act, AOW) for veterinarians and possible relatives<sup>30</sup>.

As this legislation specifically targets the population of veterinary practitioners, it enables the collection of accurate data at the SPD on the total number of veterinarians practicing in the Netherlands. The area of practice, however, is evidently not known as this information has no relevance to the SPD.

According to Dutch law, a mandatory professional pension scheme is intended for mainly self-employed professionals<sup>31</sup>. Therefore, to maintain a mandatory pension scheme for all veterinary practitioners, a minimum ratio of 55 % of self-employed veterinarians is required. Otherwise, it will lead to a partial withdrawal in which the pension scheme will only be mandatory for self-employed veterinarians, excluding salaried veterinarians<sup>32</sup>.

As mentioned earlier, a considerable number of veterinarians practice as employees in the Netherlands, in fact exceeding the number of self-employed veterinarians. Ultimately, an exception has been made for existing professional pension funds, including SPD, not to withdraw the obligation solely based on the minimum ratio of 55% for self-employed professionals in the profession. However, the ratio requirement is still in place for new professional pension funds.

Nevertheless, the SPD monitors and still provides the proportion of self-employed vs salaried veterinarians in the Netherlands through an annual report.

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<sup>28</sup> Amendment of 26 February 2008 of Minister of Social Affairs and Employment on the obligation to participate in an occupation pension scheme

<sup>29</sup> art. 5 of the Mandatory Participation in a Pension Scheme for Professional Groups Act of 6 October 2005 (*Dutch: Wet verplichte beroepspensioenregeling, Wvb*)

<sup>30</sup> Law of 31 May of 1956 on general old-age insurance scheme (*Dutch: Algemene Ouderdomswet, AOW*)

<sup>31</sup> art. 20 of the Mandatory Participation in a Pension Scheme for Professional Groups Act of 6 October 2005 (*Dutch: Wet verplichte beroepspensioenregeling, Wvb*)

<sup>32</sup> Decision of 5 March 2015 of the State Secretary for Social Affairs and Employment amending the obligation to participate in the occupational pension scheme for veterinarians

### 1.1.3. Framework of the veterinary profession in France

#### 1.1.3.1. The National Order of Veterinarians (*French: l'Ordre National des Vétérinaires*)

In France, veterinary medicine is regulated by the Ministry of Agriculture<sup>33</sup>. The framework of the veterinary profession in France is comparable to that of Belgium. The National Order of Veterinarians is in charge to ensure compliance with the Code of Practice of the veterinary profession<sup>34</sup>. The French veterinary order is organized with twelve regional councils and one national council.

To be licensed to practice veterinary medicine and surgery in France, all veterinarians must first register at a regional council of the Order of Veterinarians which resides in their administrative residence<sup>35,36</sup>.

In France, according to the Code of Practice, veterinarians are obliged to provide all the information required for the exercise of the missions declared and requested by the veterinary order<sup>37</sup>. In other words, through a central database, socio-demographic data can be collected from all the veterinarians in France, even including their area of expertise. If the information is not given, a disciplinary action can be executed by the regional council.

The National Order of Veterinarians uses this data to annually publish a 'demographic atlas of the veterinary profession' (*French: Atlas démographique de la profession vétérinaire*) which enables a better understanding on the socio-demographic evolution of the veterinary profession.

### 1.1.4. Framework of the veterinary profession in Germany

#### 1.1.4.1. The Federal Veterinary Chamber (*German: Bundestierärztekammer, BTK*)

In the Federal Republic of Germany, consisting of sixteen Federal States (*Länder*), the veterinary professional law is regulated by seventeen State veterinary chambers (*Landestierärztekammer*). The Federal veterinary chamber (*Bundestierärztekammer, BTK*) is an umbrella organization of the State Veterinary Chambers organized as an association.

As in other countries, a veterinarian must be officially registered in Germany, based on the federal Veterinary Act (*Bundestierärzteordnung, BTÄO*)<sup>38</sup>. A temporary permit may be granted in individual cases. Each veterinarian must register with one of the seventeen veterinary chambers in which s/he practices his/her profession and is subject to their professional regulations. As an example, for the Federal State of Lower Saxony, these regulations are issued based on the health profession laws of the Federal States<sup>39</sup>.

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<sup>33</sup> art. 241-17 of the decree of 10 April 2017 on the reform of the Order of Veterinarians

<sup>34</sup> art. 242-1 of the ordinance of 31 July 2015 on the reform of the Order of Veterinarians

<sup>35</sup> art. 241-1 of 16 July 2013 on various provisions for adapting to European Union law in the field of sustainable development

<sup>36</sup> Decree of 16 March 2017 fixing the ordinal regions and the disciplinary districts of the Order of Veterinarians

<sup>37</sup> art. R242-33 XIX of the Decree No. 2015-289 of 13 March 2015 amending the veterinary Code of Practice and various provisions related to the veterinary professional practice

<sup>38</sup> art. 2 of the federal regulations for veterinarians of 20 November 1981, BGBl. I p.1193 (*German: Bundestierärzteordnung, BTÄO*)

<sup>39</sup> art. 4 of the Chamber law for the healthcare professions (HKG) of 8 December 2000 (Nds. GVBl. p. 301), last amended by the Act of 15 September 2016 (Nds. GVBl. p. 192)

The BTK is a registered association which acts as a coordination and advice center for all state veterinary chambers<sup>40</sup>. It currently still operates a central veterinary database at the Saxon State veterinary chamber. For this purpose, the BTK publishes annual statistics on the professional practice of veterinarians in Germany. The statistics are based on questionnaires from the state veterinary chambers, i.e. on the information provided by the veterinarians<sup>41</sup>. These statistics also contain information on the successfully completed specialization, which is examined and granted by the state veterinary chambers.

In closing, it must be noted that both in France and Germany, any changes in the activities of the veterinarian must be reported to the chamber. However, this is probably not always the case.

## 1.2. RESULTS

The objective of this section is to analyse the available data from Belgium and the surrounding Member States, namely The Netherlands, Germany and France at the following three levels:

- a. Comparison of the total number of individual veterinarians
- b. Comparison of the total number of veterinarians according to their activity in the five main professional areas (small animal, equine, bovine, poultry and pig)
- c. Comparison of the number of veterinarians in relation to the number of animals, livestock farms and population

### 1.2.1. Belgium

Based on the qualitative analysis discussed in the previous section, it was decided to use raw data provided by three organisations: the Flemish and Walloon Veterinary Boards, the Federation of Free and Intellectual Professions (FVIB), and the Federal Agency for the Safety of the Food Chain (FASFC).

According to the Veterinary Boards, a total of **3 472** members are registered on the list of the Dutch-speaking Regional Council (NGROD) and **2 460** on the list of the French-speaking Regional Council (CFROMV). However, the format of the raw data of both Veterinary Boards differs substantially, which complicates the ability to extract information useful for comparative purposes.

For the NGROD, all the members with the status 'unsubscribed' and 'non-practising' were excluded, after which a total of **3 039** active members remained on the list. The differentiation according to their area of activity is unknown. For this reason, these data could not be used in the demographic analysis.

For the CFROMV, the area of activity of a fraction of their members is known. A total of **869** was only active in small animals, whereas **185** members were listed as only practising with 'large animals', which probably is meant to include both livestock and equines. A further **345** members was reported to be active in a mixed practice. Only the number of members active in small animals was used in the analysis (Figure 1), because the FASFC data are both more accurate and detailed for the livestock sector.

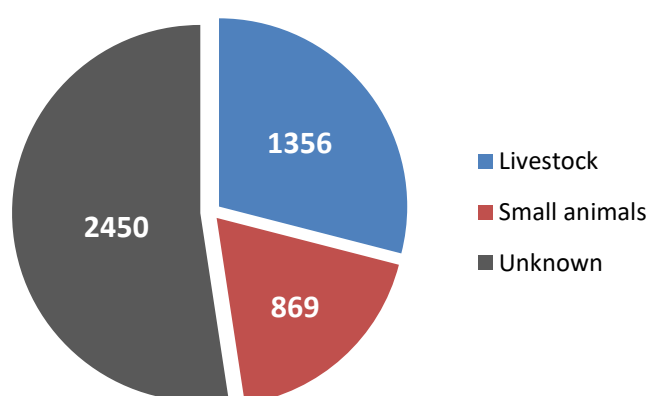
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<sup>40</sup> art. 1, 2 on the statute of the Federal Chamber of Veterinarian's association of the German Veterinary Chambers e.V (in force since 1 September 2003, last amended on 15 September 2017)

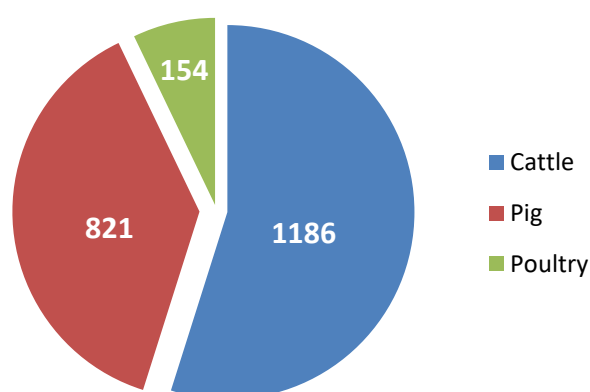
<sup>41</sup> Statistics of the veterinary profession in the Federal Republic of Germany on behalf of the Federal Veterinary Chamber (<https://www.bundestieraerztekammer.de/btk/statistik/>)

The 'SANITEL/SANITRACE' data provided by the FASFC indicate that a total of **2 161** veterinarians is active in cattle, pig and poultry. However, a veterinarian can have agreements for multiple animal species and as a result may be counted several times across various sectors. After exclusion of these multiple counts of single individuals, a total of **1 356** individual veterinarians practicing in livestock remained (Figure 1).

Data from the FVIB (2017) show a total of **4 675** self-employed veterinarians active on the labour market (Figure 1). As mentioned earlier, self-employment among veterinarians is considered the standard on the Belgian labour market. Consequently, this number can be considered a valid representation of the entire population of veterinary practitioners in Belgium.



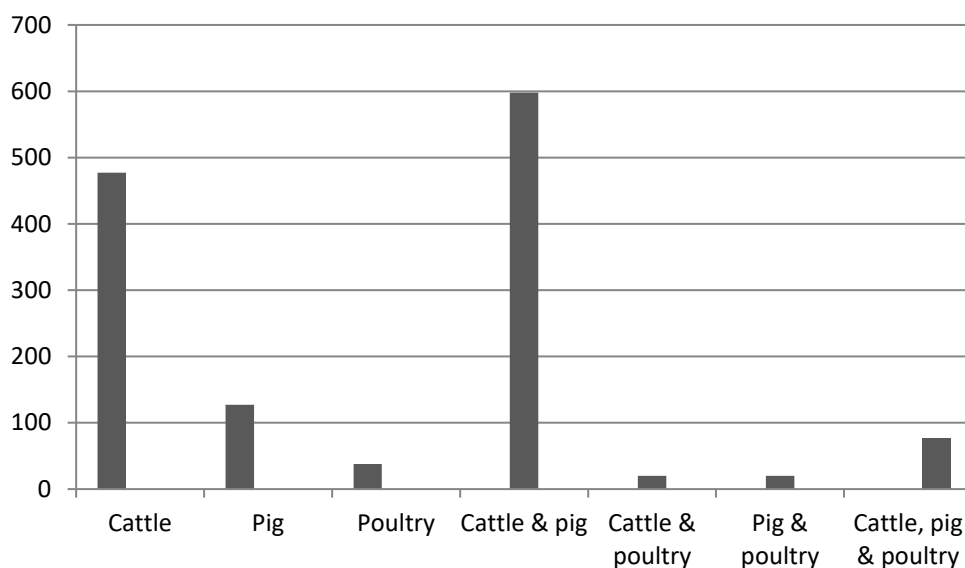
**Figure 1** - Numbers of individual veterinarians in 2016, Belgium.



**Figure 2** - Number of veterinarians active in livestock in 2016, Belgium.



An overview of the number of veterinarians active in livestock is provided in Figure 2, while the detailed distribution of the number of veterinarians active in livestock across the sectors is shown in Figure 3. For Belgium, a substantial fraction is active in both cattle and pig



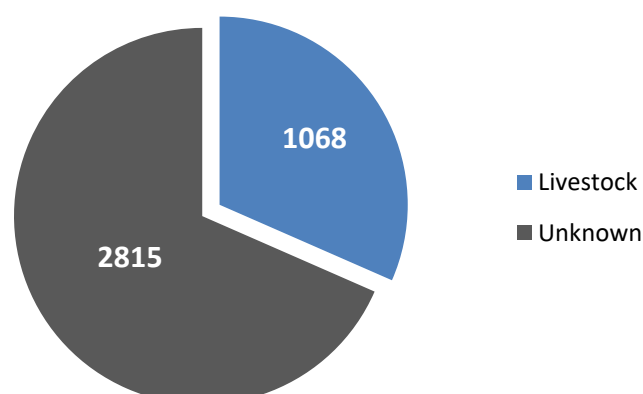
**Figure 3** - Detailed activity of veterinarians active in livestock in 2016, Belgium.

### 1.2.2. The Netherlands

As the most reliable sources for the Netherlands, data from the Pension Fund Foundation for Veterinarians (SPD) and the Guaranteed Veterinarian Foundation (SGD) were used in the demographic analysis.

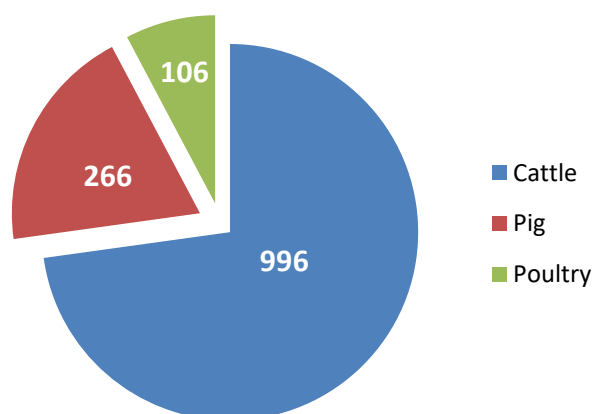
A total of **3 883** veterinary practitioners was present in the Netherlands in 2017 (Figure 4) according to the SPD (2017). This is the most accurate source since, as mentioned earlier, it is mandatory for every veterinary practitioner in the Netherlands to participate in the pension fund system. It was decided to use 2017 statistics for the Netherlands, because the most reliable official data on animals and livestock farms available (CBS, 2017) are for that year; these data are relevant for the third level of the demographic study (see below).

The number of veterinarians active in livestock (i.e. cattle, veal calves, pigs and poultry) was extracted from the online database of the SGD (2018). In May 2018, **851** veterinarians were registered as a 'guaranteed veterinarian' for cattle, **145** for veal, **266** for pig and **106** for poultry which makes for a total of **1 368** veterinarians active in livestock.



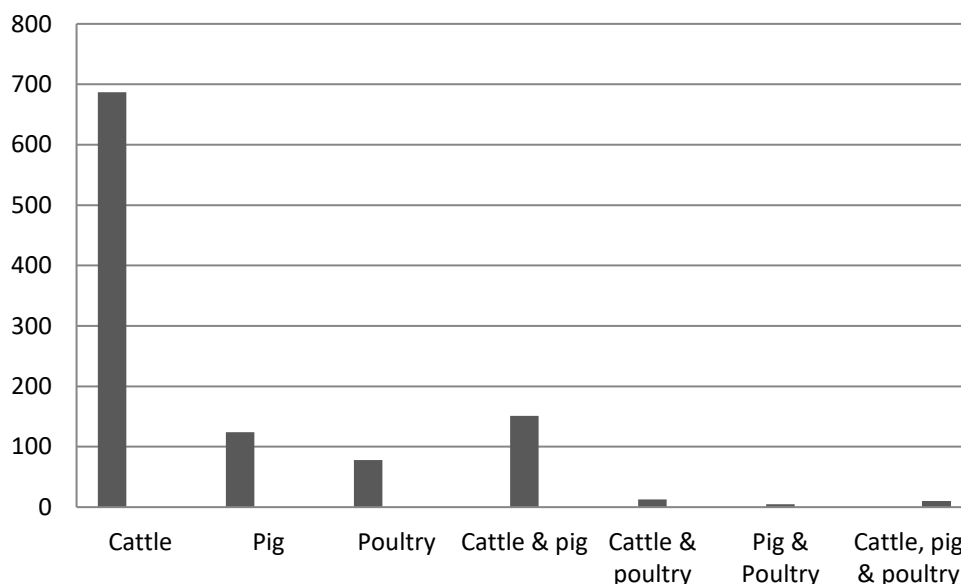
**Figure 4** - Numbers of individual veterinarians in 2017, the Netherlands.

Since a veterinarian may be registered as a guaranteed veterinarian for several animal species, it was decided to exclude multiple counts and calculate the exact number of individual veterinarians active in livestock, as was done in the previous paragraph for Belgium. While the year 2016 was used as a reference for all other comparisons made in this section, the online SGD database unfortunately does not allow extraction of this information for past years; consequently, for the Netherlands, the 2018 database had to be used out of necessity instead. After exclusion of multiple counts, a total of **1 068** individual veterinarians practicing in livestock remained for the year 2018 (Figure 4).



**Figure 5** - Number of veterinarians active in livestock in 2018, the Netherlands.

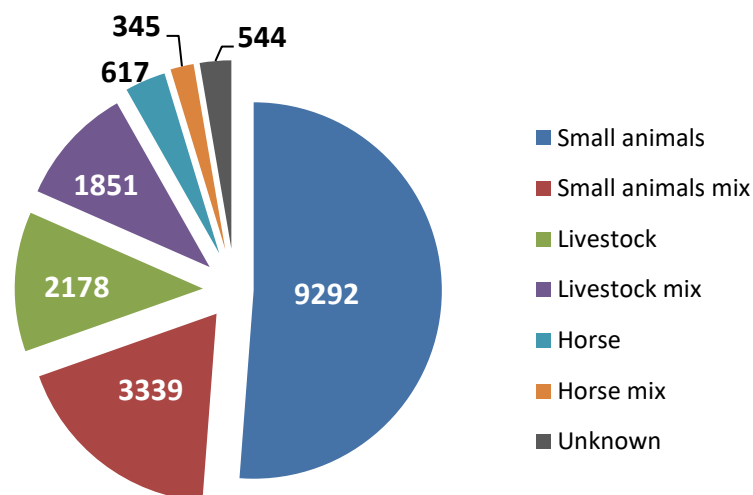
In contrast to Belgium, the clear majority of veterinarians in the Netherlands are mainly specialized in cattle, as shown in Figures 5 and 6.



**Figure 6** – Detailed distribution of veterinarians active in livestock in 2018, the Netherlands.

### 1.2.3. France

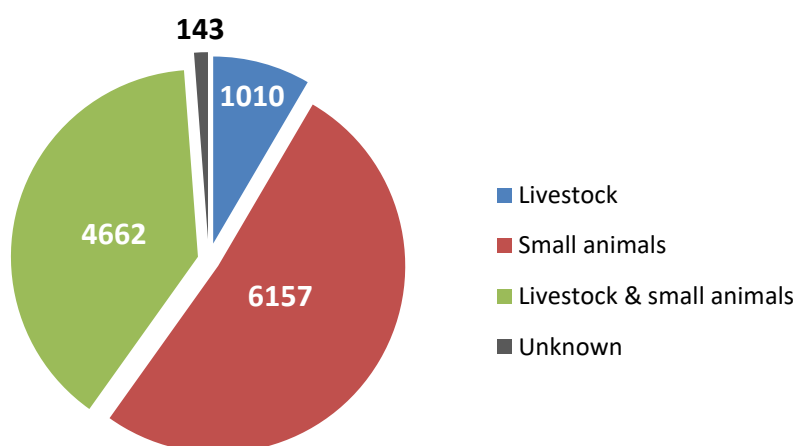
The '*Atlas démographique de la profession vétérinaire 2017*' of the Ordre National des Vétérinaires (2017) shows a total of **18 149** veterinarians active in 2016. In the case of France, the area of activity of the veterinary population is explicitly known in detail; it is differentiated into seven sectors: small animals, small animals mix, livestock, livestock mix, equine, equine mix and unknown (Figure 7).



**Figure 7** - Detailed activity of the total veterinary population in 2016, France.

### 1.2.4. Germany

Data from the Federal Veterinary Chamber show a total number of **11 972** veterinarians active in 2016. Their activity is divided into three sectors, which differ from those used in France, i.e. livestock, small animals and the mix of livestock and small animals. However, when the figures provided for these three sectors are added up, there is a discrepancy of 143 veterinarians less as compared to the total number; these were placed in the category 'unknown' for the demographic analysis (Figure 8).



**Figure 8** - Detailed activity of the total veterinary population in 2016, Germany.

### 1.2.5. Comparisons between Belgium and neighbouring countries

In the following section, a series of comparisons is made to gain more insight into the supply of veterinarians in each country in relation to the relevant labour market of that country, by determining the ratio between a relevant animal group and the number of veterinarians active in that specific sector. Afterwards, the ratios are compared to each other in which the lowest ratio is underlined.

In general, data from 2016 are used (Statbel, 2016; Graph Agri, 2017; Destatis, 2016; Destatis, 2017) with the exception for the Netherlands, where data from 2017 (CBS, 2017) is used for the comparisons in Tables 1- 4, as mentioned earlier due to the better quality of the data on companies and animals for that year. For Tables 5-6, it was possible to use valid data from 2016 for all countries. In the case of France, the most recent Graph Agri (2017) figures for poultry farms date back to 2013; however, a slightly more recent source (Volaille Française, 2014) provides data for 2014, which were used here.

**Table 1 – Ratio livestock - veterinarians active in cattle, pig and poultry for Belgium and the Netherlands.**

	Veterinarians			Livestock			Ratio		
	cattle	pig	poultry	cattle	pig	poultry	cattle	pig	poultry
Belgium	1 186	821	154	2 503 140	6 178 980	43 222 978	<u>2 111</u>	<u>7 526</u>	<u>280 669</u>
The Netherlands	1 006	275	109	4 096 110	12 400 699	105 184 440	4 072	45 093	964 995

**Table 2 – Ratio farms - veterinarians active in cattle, pig and poultry for Belgium and the Netherlands.**

	Veterinarians			Farms			Ratio		
	cattle	pig	poultry	cattle	pig	poultry	cattle	pig	poultry
Belgium	1 186	821	154	20 391	4 528	2 107	<u>17</u>	<u>6</u>	<u>14</u>
The Netherlands	1 006	275	109	26 260	4 301	1 920	26	16	18

**Table 3 – Ratio livestock - veterinarians active in livestock for Belgium, the Netherlands, France and Germany.**

	Veterinarians		Livestock			Ratio
			cattle	pig	poultry	
Belgium	1 356		2 503 140	6 178 980	43 222 978	<u>38 278,096</u>
The Netherlands	1 068		4 096 110	12 400 699	105 184 440	113 934,754
France	4 138		19 372 291	12 739 688	240 859 000	65 966,887
Germany	5 663		12 466 586	27 376 100	827 500 000	153 159,577

**Table 4 – Ratio farms - veterinarians active in livestock for Belgium, the Netherlands, France and Germany.**

Veterinarians		Farms			Ratio
		cattle	pig	poultry	
Belgium	1 356	20 391	4 528	2 107	<b>19,931</b>
The Netherlands	1 068	26 260	4 301	1 920	30,412
France	4 138	177 000	17 900	14 000	50,843
Germany	5 663	147 094	24 400	47 203	38,619

The sector 'small animals' is often considered to be the most saturated area of activity within the veterinary profession. In addition, it is also the track in which most of the students graduate (M.H. Joshghani, 2016). Unfortunately, no data are available on the number of veterinarians active in small animals. It is, however, unlikely that there are major differences in the percentage of veterinarians working in small animals between Belgium and neighbouring countries. Therefore, the entire veterinarian population, for which accurate data are available for all relevant countries, can be considered a proxy for the number active in small animals. Because the number of small animals per country was derived from an industry source (Fediaf, 2016; IVH, 2016), the reliability of these numbers is unknown. Therefore, the ratio between the total human population for 2016 (Worldometers, 2018) and the total number of veterinarians per country was also determined, as the former can be considered a proxy for the number of pets. Tables 5 and 6 show the results of these calculations, providing an indication of the situation of the labour market for veterinarians active in small animals in Belgium and the surrounding states.

**Table 5 – Ratio small animals – total numbers of veterinarians in Belgium, the Netherlands, France and Germany.**

Veterinarians		Small animals		Ratio
		Dog	Cat	
Belgium	4 675	1 315 000	2 020 000	<b>713,369</b>
The Netherlands	3 786	1 568 048	2 587 280	1 097,551
France	18 149	7 337 000	13 480 000	1 147,005
Germany	11 972	8 600 000	13 400 000	1 837,621

**Table 6 – Ratio population – total numbers of veterinarians in Belgium, the Netherlands, France and Germany.**

	<b>Veterinarians</b>	<b>Population</b>	<b>Ratio</b>
Belgium	4 675	11 358 379	<b><u>2 429,600</u></b>
The Netherlands	3 786	16 987 330	4 486,881
France	18 149	64 720 690	3 566,075
Germany	11 972	81 914 672	6 842,188

As the previous tables show, regardless of whatever measure is used, Belgium consistently exhibits a proportionately significantly higher number of veterinarians than any of the neighbouring countries.

## 2. COMPARATIVE ANALYSIS OF SELF-EMPLOYED VETERINARIANS AND PHYSICIANS

In Belgium, every self-employed professional is mandated to pay social security contributions, which are determined as a percentage calculated from their annual net fiscal income<sup>42</sup>. Therefore, a self-employed professional must register at a Social Security Fund for the Self-employed which collects the social security contributions and provides information on obligations and regulations to its members<sup>43</sup>.

The National Institute for the Social Security of the Self-employed (NISSE) is a federal government service tasked with supervising the social rights and obligations of self-employed professionals, including countering non-compliance and social fraud<sup>44,45</sup>.

A total of eleven accredited Social Security Funds for the Self-employed manage the social security scheme in Belgium under the authority of NISSE. Consequently, NISSE has statistical data of all self-employed professionals in Belgium.

In the following part, based on official raw data from the NISSE, a thorough statistical analysis will be presented on the number, as well as the professional gross income of self-employed veterinarians from the years 1995 to 2014. As a reference, the analysis will include equivalent data for physicians.

The objective of the research is to examine the general trend over the years and to explore whether significant discrepancies are present in the comparison between veterinarians and physicians.

### 2.1. METHODS

#### 2.1.1. Dataset

The raw data, for each profession, are composed of different datasets for each year. The different datasets have been integrated to form one dataset consisting of the following five variables: *income bracket*, *sex*, *profession*, *year* and *number*.

The variable *income bracket* is a categorical variable in which income is aggregated into different brackets varying in range. According to the value of the income, professionals are sorted into a specific income bracket (e.g., an income of 2700 is binned in the [2500-5000] bracket, whereas an income of 2200000 is binned in the [2000000-2250000] bracket). Regrettably, we did not have access to individual income figures.

The variable *sex* is a categorical variable consisting of two levels, namely male and female.

The variable *profession* is also a categorical variable with two levels, namely veterinarian and physician.

The variable *year* is, strictly speaking, a categorical variable. In our analysis, it was treated as a continuous variable since the research question relates to a general trend over the years rather than a

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<sup>42</sup> art. 11 of the Royal Decree no. 38 of 27 July 1967 on organizing social security for self-employed workers

<sup>43</sup> art. 10 of the Royal Decree no. 38 of 27 July 1967 on organizing social security for self-employed workers

<sup>44</sup> art. 21 of the Royal Decree no. 38 of 27 July 1967 on organizing social security for self-employed workers

<sup>45</sup> Law of 21 December 1970 establishing a National Institute for the Social Security of the Self-employed

comparison between two specific years. The variable 'year' consists of 19 levels, ranging from the year 1995 to 2014.

The last variable *number* is a discrete numerical variable which represents the number of professionals who share a certain combination of values (e.g. number of male physicians in the income bracket 5000-7500 euro in 2014).

## **2.1.2. Analysis**

### **2.1.2.1. Data preparation**

Upon further inspection of the dataset, we noticed three difficulties regarding the *income bracket* variable. The following measures were applied to address these difficulties before proceeding to the statistical modelling.

First, the highest income bracket has no upper limit. To avoid inclusion of outliers this income bracket was excluded from the dataset.

Second, the lowest income bracket is equal to the value 0. This income bracket represents the starter professionals who have not yet generated any income at the fixed count on 31 December of each year. As the relevance of this income bracket to the research question is questionable, it has also been excluded.

Third, the remaining income brackets are variable in length. This difficulty was addressed by taking the centre point of each income bracket and multiplying it by the number of professionals in that income bracket. Then, the resulting value for each income bracket was summed up and divided by the total number of professionals in a specific year. This method enables us to aggregate the data into an estimate of a *mean income* for each year. It is, however, inevitable that there is a margin of error in this estimate, as the distribution within each income bracket is not known.

Surprisingly, visual inspection of the *mean income* variable uncovered a sudden (unusual) peak in 2000, regardless of gender or profession. This may be due to the introduction of broader income brackets in 2001, in which the upper limit was increased by 1 000 000 EUR for the physicians and 500 000 EUR for the veterinarians. Notably, less than 1 % of the population of physicians and veterinarians can be found in those broad income brackets. The problem was tackled by only considering income brackets included in each year. Therefore, it was decided to only consider data from the year 2001 onwards. The resulting dataset was screened for outliers, none of which were found.

Finally, in 2003, a legislative change came into effect, causing 'assisting spouses' to be counted among the self-employed veterinarians<sup>46</sup>. Since it is difficult to isolate the impact of this event on our analysis, we further restricted our dataset to the year 2003 and later.

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<sup>46</sup> art. 11 of the Programme Law of 24 December 2002



### 2.1.2.2. Statistical modelling

Following the data preparation phase, a statistical model was sought that best describes our data. Such a model can be used to draw conclusions with respect to the impact of different factors, as well as their interaction. Analysis of the final dataset was approached as follows.

The *mean income* variable (see previous section for its definition) was analyzed using a generalized linear model with a Gaussian link function, using the R package 'lme4' (Bates et al., 2014). The *number* variable (see previous section for its definition) represents count data. As such, it was analyzed using a generalized linear model with a Poisson link function<sup>47</sup>. Statistical modeling consisted of a few steps.

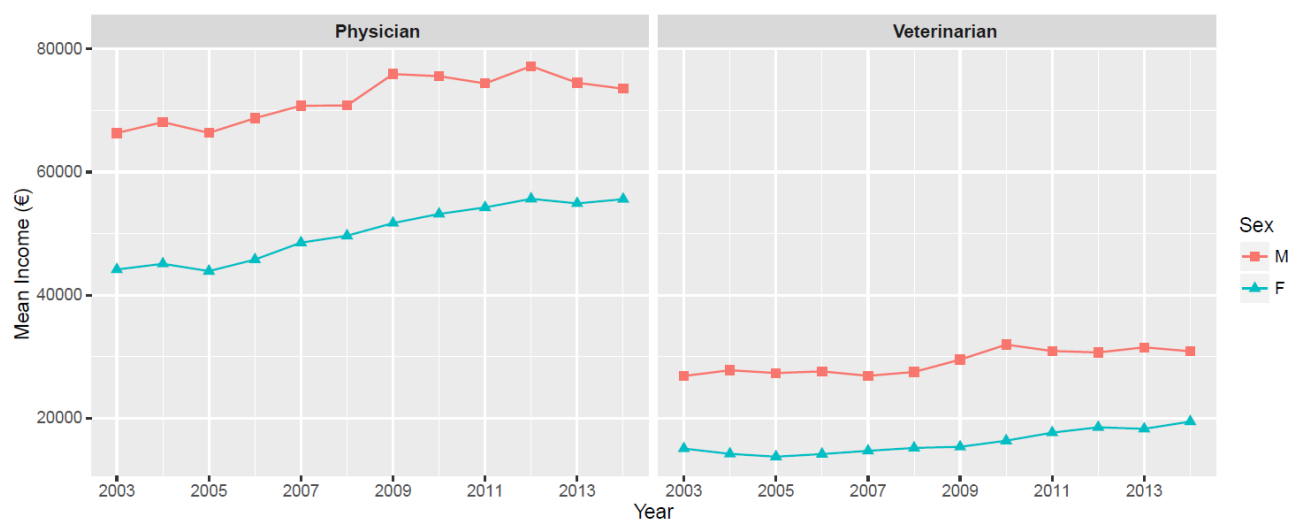
First, all relevant predictors and their interactions are entered into the model. These included main effects for the variables *year*, *profession*, and *sex*, as well as all two-way interaction effects, and finally the three-way interaction effect.

Second, the most parsimonious model that significantly fits the data is established. This is achieved by systematically restricting the full model, comparing goodness of fit using likelihood ratio tests.

Finally, the variance table of the final model is analyzed.

## 2.2. RESULTS

### 2.2.1. Mean income



**Figure 9** - Mean income between physicians and veterinarians from 2003 to 2014.

The most parsimonious model that described the *mean income* data, which was obtained following the steps described above, included an intercept, all main effects, and two interaction effects<sup>48</sup>.

<sup>47</sup> No evidence was found for over dispersion.

<sup>48</sup> In the data, the levels of the *year* variable cannot be considered independent. Individuals reporting income in 2001, for instance, are unlikely to report strongly diverging income in 2002 or 2003. As such, the analyses were run with an additional correction (Newey-West correction). This did not considerably alter the significance of the factors and interactions. As such, the initial model was upheld.

The interaction between *profession* and *year* was included in the model, as was the interaction between *profession* and *sex*. The ANOVA table is shown in Table 7.

<b>Table 7 – ANOVA table full model for mean income data.</b>				
	$\beta$	se	z value	p
(Intercept)	-2086738,697	166198,269	-12,556	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian)	1148087,159	235039,846	4,885	<b>&lt; 0,001</b>
<i>sex</i> (F)	-21655,456	571,295	-37,906	<b>&lt; 0,001</b>
<i>year</i>	1074,727	82,747	12,988	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>sex</i> (F)	8587,195	807,934	10,629	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>year</i>	-592,888	117,022	-5,066	<b>&lt; 0,001</b>

*Note: All factors evaluated with significance level of  $\alpha = 0.05$ . Significant p-values in **boldface**.*

As all predictive variables are involved in significant interaction effects, the main effects cannot be interpreted on their own. To gain in-depth understanding of the interaction between *profession* and *sex*, an additional model was fit, omitting both effects containing the *year* variable (Table 8). This was done because the large offset of the values of the *year* variable (starting in 2003) made interpretation of certain regression coefficients cumbersome (notably of the *profession* variable).

<b>Table 8 – ANOVA table restricted model for mean income data (profession x sex interaction).</b>				
	$\beta$	se	z value	p
(Intercept)	71850,594	952,458	75,437	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian)	-42728,483	1346,978	-31,722	<b>&lt; 0,001</b>
<i>sex</i> (F)	-21655,456	1346,978	-16,077	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>sex</i> (F)	8587,195	1904,915	4,508	<b>&lt; 0,001</b>

*Note: All factors evaluated with significance level of  $\alpha = 0.05$ . Significant p-values in **boldface**.*

The model suggests that (1) veterinarians earn significantly less than their physician counterparts, as evidenced by the significant negative regression coefficient, (2) women earn significantly less than men, indicated by the significant negative regression coefficient, and (3) the *mean income* gap between men and women is smaller for veterinarians. Figure 9 illustrates these findings. It is worth noting, however, that the gap between men and women is proportionally larger, due to the lower base wages veterinarians receive (see Table 9 for illustration). In other words, while there is a vastly larger absolute wage gap (in euros) for physicians, it is larger for veterinarians from a relative perspective (in percentages).

Table 9 – Mean income differences per sex.			
Profession	Sex	Mean income (€)	Increase (%)
physician	female	50195.14	
	male	71850.59	143.143
veterinarian	female	16053.85	
	male	29122.11	181.403

The second interaction effect, between *profession* and *year* (Table 7), suggests that the *mean income* evolves differently over the years, depending on whether the professional is a veterinarian or a physician. More explicitly, our model suggests that, over the years, both physicians and veterinarians see a steady increase in mean income, as the regression coefficient for *year* is positive and significant. In our model, the interaction of *year* with *profession* indicates that the wages for physicians increase at a faster rate. This is made evident by the significant negative regression coefficient for *year* x *profession* (veterinarian), indicating a *mean income* growth penalty on the model for veterinarians. In addition, and perhaps more interestingly, the data also indicates a proportionally larger increase for physicians, compared to their base wages (Table 10). This indicates that mean income grows faster for physicians, both in absolute terms and in relative terms.

Table 10 – Mean income evolution over time.			
Profession	Year	Mean income (€)	Increase (%)
physician	2003	59220.610	
	2014	66153.900	11.708
veterinarian	2003	23580.136	
	2014	25924.370	9.942

### 2.2.2. Number

For the *number* data, the same approach was repeated, albeit with a different statistical model (as discussed in section 1.2.2.2 Statistical Modelling<sup>49</sup>). The full model shows a significant three-way interaction effect (*profession* x *sex* x *year*, see Table 11). As such, it was considered the most parsimonious model, and was not further restricted. The three-way interaction suggests that the number of professionals evolved differently over time, depending on both the profession and the sex of the individual.

To reduce the complexity involved in interpreting a three-way interaction effect, the dataset was divided into two parts, based on the *profession* variable. Separate models were refitted to these data.

<sup>49</sup> Contrary to the model used for the mean income data (Gaussian link function), the regression coefficients

**Table 11 – ANOVA table full model for number data**

	$\beta$	se	z value	p
(Intercept)	34,032	1,301	26,164	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian)	-20,573	3,689	-5,577	<b>&lt; 0,001</b>
<i>sex</i> (F)	-33,510	2,050	-16,347	<b>&lt; 0,001</b>
<i>year</i>	-0,012	0,001	-18,689	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>sex</i> (F)	-35,121	5,635	-6,233	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>year</i>	0,009	0,002	5,047	<b>&lt; 0,001</b>
<i>sex</i> (F) x <i>year</i>	0,016	0,001	16,155	<b>&lt; 0,001</b>
<i>profession</i> (veterinarian) x <i>sex</i> (F) x <i>year</i>	0,018	0,003	6,255	<b>&lt; 0,001</b>

*Note: All factors evaluated with significance level of  $\alpha = 0.05$ . Significant p-values in **boldface**.*

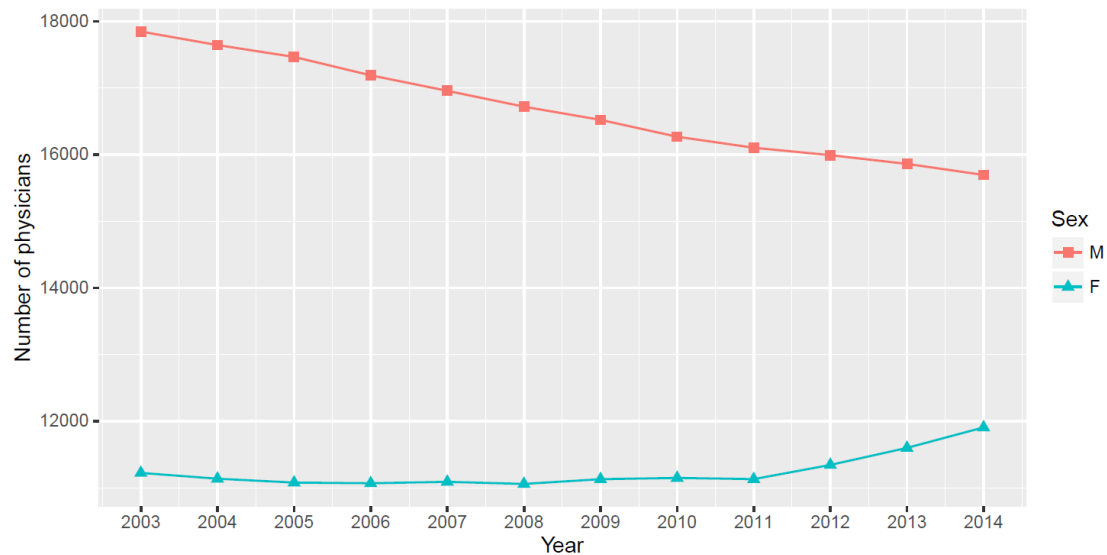
The model describing the **physician** data contained two main effects, and a significant interaction effect (see Table 12). The main effect for sex suggests that, on average over all the years where data was recorded, there were less female than male physicians. The main effect for *year* reveals that the number of physicians, averaged over male and female, decreases over time.

**Table 12 – ANOVA table full model for number data (physicians).**

	$\beta$	se	z value	p
(Intercept)	34,032	1,301	26,164	<b>&lt; 0,001</b>
<i>sex</i> (F)	-33,510	2,050	-16,347	<b>&lt; 0,001</b>
<i>year</i>	-0,012	0,001	-18,689	<b>&lt; 0,001</b>
<i>sex</i> (F) x <i>year</i>	0,016	0,001	16,155	<b>&lt; 0,001</b>

*Note: All factors evaluated with significance level of  $\alpha = 0.05$ . Significant p-values in **boldface**.*

Most importantly, however, the interaction effect suggests that the number difference between men and women is decreasing as time goes on. In other words, it appears the male dominance in the physician profession is steadily eroding (see Figure 10 for illustration).



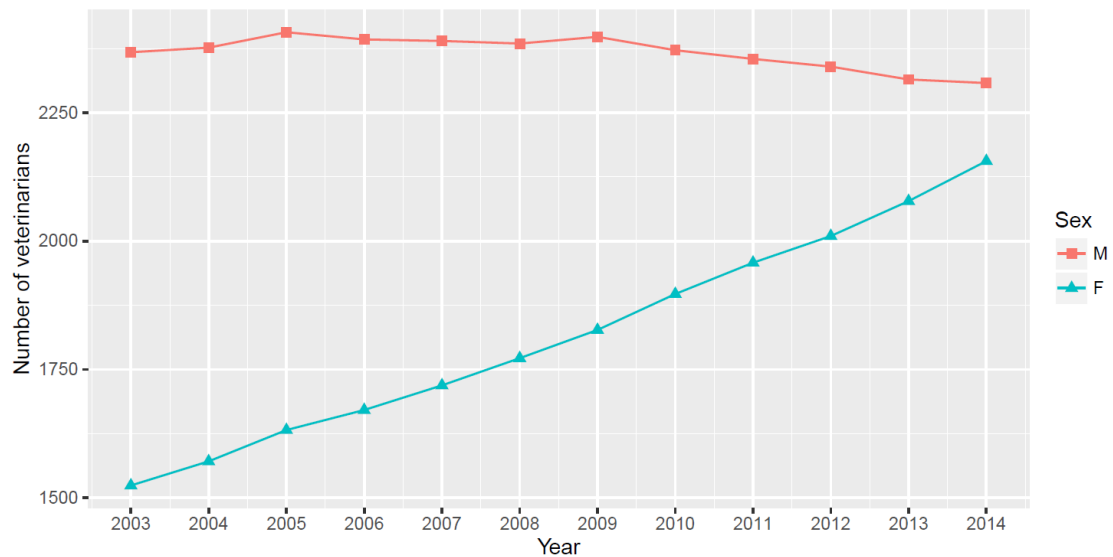
**Figure 10** - Evolution of the total number of physicians from 2003 to 2014.

The model fit to the *veterinarian* data shows a significant main effect for sex, and a significant interaction effect (see Table 13). The regression coefficient for sex suggests that there are significantly less women than men in the veterinarian profession. Again, the regression coefficient for the interaction effect suggests that this difference is decreasing, comparable to what was observed for physicians. Visual inspection of the data suggests that, while the decreasing number gap between male and female physicians can likely be attributed to both a decrease in male physicians and an increase in female physicians (Figure 10), the respective decreasing gap for veterinarians is due to the rapid increase in female practitioners (Figure 11).

**Table 13 – ANOVA table full model for number data (veterinarians).**

	$\beta$	se	z value	p
(Intercept)	13,459	3,452	3,899	<b>&lt; 0,001</b>
sex(F)	-68,630	5,249	-13,075	<b>&lt; 0,001</b>
year	-0,003	0,002	-1,648	0,099
sex(F) x year	0,034	0,003	13,025	<b>&lt; 0,001</b>

*Note: All factors evaluated with significance level of  $\alpha = 0.05$ . Significant p-values in **boldface**.*



**Figure 11** - Evolution of the total number of veterinarians from 2003 to 2014.

As seen in Table 14, the evolution of the total number of physicians and veterinarians over time shows an opposite trend: while there is a ca 5 % decline in the number of physicians between 2003 to 2014, the number of veterinarians increased by almost 15 %.

Table 14 – Total number evolution over time.			
Profession	Year	Total number	Difference (%)
physician	2003	29 070	
	2014	27 601	-5.053
veterinarian	2003	3 892	
	2014	4 464	14.697

This difference is related to the *numerus clausus*, which is applied to medicine and dentistry, but not to veterinary medicine in Belgium, as discussed in the previous dissertation by M.H. Joshghani (2016).

### 3. DISCUSSION AND CONCLUSION

As discussed earlier in the demographic analysis, presently, the main area of activity of the large majority of veterinary practitioners remains unknown. When compared to neighbouring countries, the collection of data useful for demographic analysis is considerably more complicated in Belgium, as the relevant information unfortunately is far less accessible, and needs to be pieced together using multiple, often deficient, sources.

Several causes lie at the root of this problem:

First, every organization registers different kinds of data, lacking any kind of overarching unified approach in data collection or common database system.

Second, the response rate for the voluntary registration of detailed activities by veterinarians with their respective Boards is low, and hence unrepresentative of the veterinary society at large.

Third, available data are often outdated, because of the unreliable link between veterinarians and their official organisations. Data provided by the Boards has the advantage that, through the collection of mandatory yearly membership fees, it represents a reliable indicator of the total number of active veterinarians. Unfortunately, detailed areas of activity for their members remain unrecorded, precluding detailed per-sector analyses. The FOD database is less useful, because it is only based on a one-time recognition of a veterinary member; hence, retired and deceased members often remain on the FOD list, making it an unreliable resource for any kind of demographic analysis.

Since the Boards are the central professional organisations with a capacity to collect comprehensive, detailed data, they lie at the core of a solution to this problem. When a veterinarian has retired from the veterinary profession, then the s/he will no longer pay a yearly membership fee to the Veterinary Board, providing the Boards with an up-to-date image of active and retired veterinarians. If, once the order number has been switched to inactive, this information should be passed on to the FOD, this would allow the FOD in turn to update their database and change the status of the veterinarian from the list of accredited veterinarians from active to passive. It is therefore suggested that a data link between both Veterinary Boards and the FOD is established.

Another measure would involve making it mandatory for every member to provide yearly updated information on their activities, as is already the case in France and Germany. This would allow all relevant data to be kept accurate and complete on a year-to-year basis.

The results of the demographic analysis show that, by any measure, Belgium comparatively always has the largest supply of veterinarians by a large margin. This provides a clear indication of the genuine existence of a plethora of veterinarians on the Belgian labour market as compared to our neighbouring countries.

This study presents the first objective, quantitative data to support this oft-made assertion.

It is generally considered that the plethora on the labour market has a cascade effect, resulting in increased geographical competition between veterinary practitioners, leading to concomitant tariff

conflicts, which in turn lead to low salaries, and, ultimately, the early termination of careers of new entrants to the field.

Although saturation of the labour market no doubt is a factor responsible for this cascade of negative knock-on effects, the actual picture is more complicated, and various other factors also need to be taken into consideration to fully explain and understand the myriads of problems encountered by veterinarians on the Belgian labour market.

The status of the veterinary practice as a free profession also has an important impact on the functioning of the labour market, allowing each veterinarian to freely set their own tariffs for their professional services. This situation contrasts to that of physicians, where all tariffs in the public sector are strictly regulated through their direct link with the social security system.

In the past, the Veterinary Board tried to address this problem by compiling a tariff list detailing mandatory minimum tariffs for veterinary practitioners. Non-compliance with these minimum tariffs would result in disciplinary action by the Board. However, this initiative led to the Board being convicted in court for an infraction of Belgian<sup>50</sup> and European<sup>51</sup> anti-cartel legislation. Legal decision nr. 2007-I/O-19 of 21 August 2007 was phrased as follows:

*“By fixing and distributing minimum tariffs (or generally applicable tariffs), a restrictive competitive practice is established which leads to or results in considerably obstructing, limiting or falsifying the competition on the relevant Belgian market or an important part thereof.”*

Consequently, imposition of a minimum tariff list is regarded as illegal since it violates Article 2 of WBEM and Article 81 of the EU convention, because it is considered to pose a potentially negative influence on free trade between EU member states.

Surprisingly, in Germany there does exist the so-called ‘Tierärztegebührenordnung (GOT)’, which is a scale of fees for veterinarians. The GOT imposes mandatory fixed minimum tariffs for veterinary practices, which all veterinarians are obliged to follow<sup>52</sup>. The tariff list also includes suggested maximum tariffs, but these are not mandatory and individual practitioners can choose to charge higher fees for their services.

The stated aim of the GOT is (Bundestierärztekammer, 2017):

*“The scale of fees for veterinarians is a federal regulation that is intended to ensure transparency and protect animal owners from overreaching. At the same time, however, it should also ensure adequate remuneration for veterinarians so that they can meet the quality standards of livestock farmers, e.g.*

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<sup>50</sup> Art. 2 of the Law of the Protection of Economic Competition, coordinated on 15 September 2006 (Dutch: *Wet tot bescherming van de economische mededinging*, WBEM)

<sup>51</sup> Art. 81 of the Council Regulation (EC) No. 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down of the Treaty [2003] OJ L1/1. Regulation 1/2003

<sup>52</sup> Tierärztliche Gebührenordnung, Bundesministerium der Justiz und für Verbraucherschutz, Tierärztegebührenordnung GOT Stand 30. Veterinary scales of fees 2008



*through training and investment. Competition between veterinarians should be based primarily on performance rather than price”*

So, while a similar initiative in Belgium, aimed at ensuring fair competition between veterinarians and adequate remuneration for their services, was struck down by the courts, similar regulations do exist unchallenged in Germany. Because one of the reasons for striking down the Belgian tariff list was a conflict with European legislation, apparently a similar argument does not hold – or was not used – in the case of Germany. The reasons for this are currently unclear and present an avenue for further research.

For the income analysis, only the income officially reported to the RSVZ was included. As an obvious consequence, any potential ‘black’ income, i.e. unaccounted and untaxed monetary transactions, is not included. Since the contribution from this underground economy is by its very nature undocumented and hence very difficult to quantify, the real income situation may be somewhat at variance with the officially reported data. These effects may, however be considered to be fairly minor: a livestock keeper has little incentive to complete a ‘black’ transaction with a veterinarian, as this would preclude the keeper from deducting any expenses from his own taxes. This picture of course changes if we consider the possibility of livestock keepers also using unofficial earnings to conclude transactions, but a detailed treatment of this very complicated topic would be a dissertation subject in its own right and falls far outside the scope of this work.

The results show a very pronounced income gap between men and women, both in veterinarians and in physicians. This huge gender inequality gap, which has very clear and significant social implications, should be a target for further study, e.g. is it caused by naked income differences, or does it result from a discrepancy in working hours? While in absolute terms, the gender income gap is smaller in veterinarians than in physicians, it is greater in relative terms.

Veterinarians on average earn considerably less than physicians. While both professions exhibit a rise over time in their income, this increase is considerably more pronounced for physicians, exacerbating the existing gap between both groups of health professionals.

The numerical analysis shows that the number of physicians is declining over time. The profession is male-dominated, but this dominance is diminishing over time. This decreased male dominance results both from a greater inflow of women, and a decline in the number of male practitioners. The overall reduction in the number of physicians can likely be linked to the *numerus clausus* system (M.H. Joshghani, 2016), which limits the inflow of new medical students.

While the total numbers of veterinarians are mildly increasing, this increase over time is statistically insignificant. However, the share of women practicing as veterinarians shows a sharp increase year-over-year. As a consequence, the male dominance in the veterinary profession is quickly being erased.

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