

A global meat tax: from big data to a double dividend

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Abstract: The Food and Agriculture Organization of the United Nations (FAO) emphasizes the right of everyone to have access to safe, sufficient and nutritious food in its Rome Declaration. This article suggests how this noble FAO goal can be achieved. We suggest that a first step could be the introduction of a global meat tax, where the size of the negative externalities from meat production could be calculated based on foresight and big data. Applying the tool of a global meat tax will lead to a “double dividend” as negative externalities are reduced and at the same time huge tax revenues will be generated which could be used to make further steps in the direction of achieving the stated FAO goal in the Rome Declaration.

Keywords: climate change, environment, ethics, European Union (EU), food, Food and Agriculture Organisation (FAO), foresight, health, human health, meat consumption, negative externalities, poverty, World Trade Organization (WTO)

For many years, policy makers around the world have been trying to solve the puzzle of feeding nine billion people by 2050 while reducing greenhouse gas emissions along with water and land use (Chloupková 2012a).

In the year 2000, world leaders met and adopted the United Nations Millennium Declaration. In this context, eight Millennium Development Goals (MDGs) were set out, the first of which pledged to halve hunger and extreme poverty rates, reflecting the world’s commitment to improving the lives of billions of people.

On the positive side, since 1990/1992, over 216 million people have been rescued from a life of hunger (FAO 2016b). Furthermore, in view of eradicating hunger, malnutrition and poverty, FAO declared the year 2013 as the “International Year of Quinoa” (FAO 2013), and in the same vein, the year 2016 as the “International Year of Pulses” (FAO 2016).

In 2014, in the Rome Declaration, the heads of state and government at the World Food Summit reaffirmed “the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger” (FAO 2014).

In this paper, we suggest a first step in how to achieve this noble FAO goal as stated in the Rome Declaration. One option is to introduce a fat tax. In fact, Denmark has already attempted to tax meat (Vallgård et al. 2015). Given the fact that Denmark was the only country to implement this idea, this otherwise brilliant initiative had to be reversed as the burden was shouldered solely by the Danish state. In an inter-connected world, and in line with the European Union’s right to free movement, businesses from outside Denmark profited from this situation¹ Furthermore, from the literature available, it does not seem that the dimension of environmental and

¹In October 2011, Denmark introduced a fat tax on butter, milk, cheese, pizza, meat, oil and processed food if the item contained more than 2.3% saturated fat. However, in November 2012, the Danish Tax Ministry announced it would abolish the fat tax stating that it failed to change Danes’ eating habits, had encouraged cross-border trading, put Danish jobs at risk and had been a bureaucratic nightmare for producers and outlets. Mette Gjerskov, the Danish minister of food, agriculture and fisheries, stated that “the fat tax is one of the most criticized we had in a long time. Now we have to try to improve public health by other means.” Although the tax resulted in an additional \$216 million in revenue, it also led to numerous complaints from Danish retailers that their customers were taking their business to other countries, such as Sweden and Germany, to take advantage of their lower prices (Wikipedia 2016).

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natural resource damage was taken into consideration when designing the Danish tax on meat. Hence, any tax imposed on meat would have to be on a global level. A possible international institutional scheme of how to implement such a global meat tax has been outlined. As meat consumption is highest in the countries of the developed world, these countries will be affected the most.

Inspired by the Danish case, we first argue theoretically how meat taxation can help with achieving this goal, by creating a double dividend. Next, we illustrate how the tools of foresight and big data can establish the correct size of the meat tax, which would result in tax revenues for huge reinvestments. Discusses the cases of food, agriculture and climate, and outlines how such a global meat tax scheme could be set. Finally, a conclusion and perspectives are presented.

TAXATION AND THE DOUBLE DIVIDEND

Market failure arises if the market does not take all production costs or benefits into account. Such an external effect (“externality”) is then imposed on others and society. An externality is a “cost or benefit not expressed in a market and therefore not internalised in buyers’ or sellers’ market decisions” (Hillman 2009). This means that an externality is in

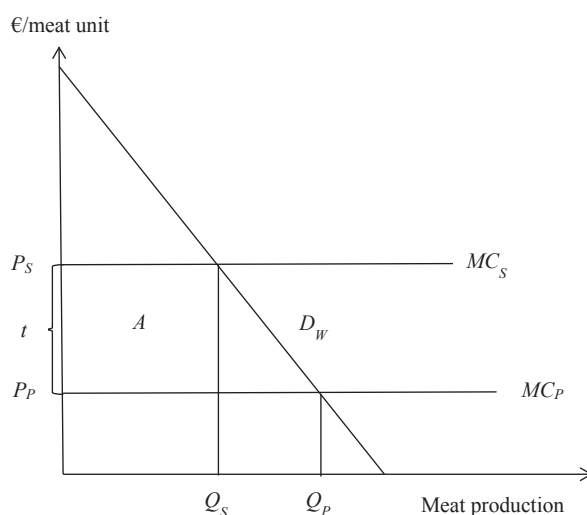


Figure 1. Meat production, negative externalities and taxation

existence “... whenever an individual’s production or consumption decision affects the production or consumption of others other than through the market prices” (Begg et al. 1984: 334).

Thus, a market failure occurs in the case of meat production, where a wide range of negative externalities can be identified such as climate change and its extreme weather patterns, damage to natural resources (meaning water, land, air), the spread of animal-borne diseases such as mad cow disease, foot and mouth disease, avian flu, as well as human conditions such as obesity and a whole range of health problems caused by overconsumption of meat and meat products. These externalities are to be borne not only by the individual itself, but by the whole of society and taxpayers.

Meat production involves an external diseconomy or external economy, when other affected parties are damaged from the externalities.² The meat producers are, however, not to blame for such negative externalities as they are unintentional: “Just as the invisible hand provides *unintended* social benefit through self-interested market decisions, people who create externalities likewise intend neither to harm nor to benefit others. *There is no goodwill intended from a positive externality and no malice intended from a negative externality*” (Hillman 2009).

In the world market for meat, there will be a demand curve, D_w , and a private marginal production cost curve, MC_p . The result is a market equilibrium with Q_p produced at the price of P_p as shown in Figure 1.

This private market equilibrium (Q_p, P_p) is, however, not optimal for overall society. The extra costs imposed on society from negative externalities have to be added to the normal production cost curve for meat in order to reflect the societal production cost curve. In this way, the negative externalities will be internalised in the cost production function of the meat producer. Imposing a tax t on each unit of meat produced will raise the private marginal production cost curve, MC_p , to MC_s , where also the negative externalities imposed on overall society are included. The optimal equilibrium for the world as a whole is therefore (Q_s, P_s). In this way, a double dividend is achieved: (i) meat production decreases from Q_p to Q_s and (ii) the total tax revenue will amount to area A .

²Tietenberg and Lewis (2012). This situation of fighting negative externalities worldwide corresponds to the case of CO₂ reduction where a global CO₂ tax or quota system may be considered too (Brandt and Svendsen 2014, 2016; Svendsen 1998).

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BIG DATA AND TAX REVENUE

Two crucial questions following from the theory depicted in Figure 1 are, of course, how to calculate the correct size of the tax t and how to invest the total tax revenue as represented by area A? To calculate the optimal meat tax t , we need to collect precise data, or at least to capture the appropriate magnitude, on the total value of the sum of negative externalities. Using foresight and big data could be one option.

In the context of the background outlined in earlier chapters, attaining the goals stated in the Rome Declaration might be rather tricky. If we were to advise governments (national, regional, local, and/or any other political initiatives) on what to do, we would suggest the use of big data as a tool for cracking the code of what goes wrong and to identify options of moving forward.

“Foresight is a systematic, participatory, future-intelligence-gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions. Research and innovation policies are based on (implicit or explicit) visions of the future of science, technology and society” (European Commission 2015a).

If our vision is a global society supplied with nutritious food and a healthy planet, the use of the right tool(s), such as big data to analyse all data – not just a subset of it – is needed. The end result is better decisions achieved in a fraction of the time (SAS 2013).

Gigabytes, terabytes and petabytes of data are churned out daily by operational/transactional systems, imported from databases and propagated through analysis and reporting. But that is only the tip of the data iceberg. By some estimates, this structured (numerical) data represents only about 10% of the information in an organisation. As much as 90% of data is actually unstructured data – freeform text, images, audio and video. This unstructured data comes from websites, correspondence, contact centre records, social media, blogs, claims, customer complaints and any number of other sources. It is contained in document repositories, emails, PowerPoint presentations, spreadsheets, PDFs, XML documents, SharePoint sites, website interactions, social media

sites and texting channels such as SMS and IM. It is everywhere, and it is growing fast (SAS 2013).

In other words: “The sheer volume of data resources available to us causes a scarcity of human attention” (SAS 2013). From the technological viewpoint, for unstructured data (particularly unstructured text), this is where text analytics comes in. Text analytics identifies and extracts the relevant information and interprets, mines and structures it to reveal patterns, sentiments and relationships within and amongst documents.

Big data is defined less by volume – which is a constantly moving target – than by the ever-increasing variety, complexity, velocity and variability of the data. Yet text, video and other unstructured media require different architectures and technologies for analysis. It is hard to imagine any forward-looking activity that is not considering big data. This might mean that data management strategies would have to be re-thought.

The use of big data does not imply any hypothesis, *per se*, but rather a reading into the data collected. In this way, new patterns usually emerge. Given the age we are living in, big data is abundant, and can be collected on several levels and platforms, for example: Facebook postings (many people like to share what they had for breakfast, lunch or dinner, and many of them take pictures of the food they cook or purchase in canteens and restaurants), tweets, published new recipes (do they contain meat, are they healthy?), menus at canteens, restaurants³, food served at schools, hospitals, airplanes and airports⁴, the content of advertisements, the proportion of supermarkets dedicated to meat as opposed to fruit, vegetable, pulses, rice, etc.

NUTRITIOUS FOOD, AGRICULTURE, CLIMATE AND FORESIGHT

Nutrition in the global world

An additional element outlined by the FAO is that “Improving nutrition, and ensuring everyone has access to a healthy diet, is not the responsibility of

³In the context of providing inspiration for non-meat alternatives, we can mention Prague, which has the world’s highest density of vegan restaurants (<https://www.expats.cz/prague/article/weekly-czech-news/prague-ranks-among-worlds-most-vegan-friendly-cities/>, accessed Oct 18, 2016).

⁴Given what is outlined below, namely that the meat sector emits more GHG than all forms of transport, it would be an interesting scientific task to actually calculate what is more polluting: the meat served on the airplane or the airplane journey itself.

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the individual alone. Nutrition is a public issue that must be addressed primarily by governments in collaboration with other stakeholders, including civil society, the private sector and academia” (FAO 2014). Europe is now following suit (A Food Policy for Europe 2016).

We, the authors, live in the developed world. Nonetheless, when we have to rely on food supplied by means others than our own kitchens, for example, when attending catered events, restaurants and canteens, we experience the strong desire that this laudably forward-looking FAO initiative will become a reality for all soon. Unfortunately, these days, even in so called “developed” countries, people have limited access to nutritious food, as too much meat and processed food is being offered for consumption.

The fundamental question to ask here is: Can the FAO goal be achieved in a world which perceives animal protein, especially meat, as the supreme food option? Although there are many who are conscious of their own health as well as that of planet Earth, by attempting to limit their meat consumption, they are often marginalised and victimised due to the non-existence and/or limited choice of nutritious non-meat alternatives.

In addition, as outlined by foresight studies, a big problem is arising: As countries such as China⁵, India and Brazil are getting richer, meat consumption, which is perceived as a luxury and as a symbol of status, is increasing markedly among their populations (European Parliament 2009). This is also reconfirmed by the FAO: “As poor countries become more prosperous, they acquire some of the benefits along with some of the problems of industrialized nations. These include obesity.” Sources report that during the last 40 years, the global number of obese people rose from 105 million in 1975 to 614 million in 2014 (MF Dnes 2016).

FAO: The cost of a poor diet: “The underweight and overweight share high levels of sickness and disability, shortened life spans and reduced productivity. Obesity increases the risk of chronic diseases such as diabetes, hypertension, heart disease, stroke, gall bladder disease and a number of cancers.”

In other words, escaping from poverty might mean reducing chronic hunger, but, on the other hand, it may also lead to a worse nutritional basis than what was the *status quo* under poverty, as traditional diets featuring grains, potatoes, pulses and vegetables are giving way to meals high in fat, meat and industrially prepared meals high in sugar and other additives. In the words of the FAO: “And as food companies watch incomes rise in the developing world, they are setting their sights on new markets. From Mexico to Morocco, the same foods that jeopardize health in wealthy countries are now tempting poor ones.”

Yet, it is scientifically proven that the developed world is abusing the consumption of animal-derived protein, especially of meat, to the detriment of the climate as well as their own health. In terms of human health, the average European citizen is consuming three-times more meat than is medically advisable. In the USA, this statistic is even more striking, as the average US citizen consumes four-times more meat than is medically advisable. The European Parliament (2009) has stated that: “Based on nutritional requirements, the scientific consensus strongly indicates that the developed world appears to be overconsuming meat products.”

From the point of view of governments that are conscious of their countries’ medical expenditures, and of the use of taxpayers’ contributions, meat overconsumption is having devastating consequences due to the high occurrence of diseases such as diabetes, cardiovascular diseases, obesity, etc. (European Parliament 2009).

The alarming cost of meat consumption

Unfortunately, the negative externalities associated with meat consumption, in terms of damage to the environment, natural resources and climate, are not limited only to people consuming meat, but affect everybody irrespectively of whether that individual consumes meat or not. Unless immediate changes are implemented, many future generations will suffer as a result of the carelessness of this current generation. The following figures speak for themselves:

⁵Data from the period 1990–2003 provide examples of this trend. In 1990, Japan consumed an average of 37 kg of meat per capita. Growth in meat consumption over this period was slow, and Japanese meat consumption levelled off at 43 kg per capita in 2000, remaining at this level to 2003. During the same period, Chinese meat consumption more than doubled from 25 kg per capita in 1990 to 54 kg per capita in 2003 (European Parliament 2009). Yet, from a medical point of view, the appropriate amount of meat for an average person should not exceed 28 kg/year.

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On average, seven tonnes of water are needed to create the feed required for 1 kg of meat⁶ (European Parliament 2009). Among all meats, poultry emerges as the least water-intensive, with between 2390 and 3900 L of embedded water in each kg of poultry meat. The actual water requirements for livestock production are considerably higher, as drinking water alone accounts for 65% of the animals' body weight. Water requirement estimations for the production of 1 kg of beef come to around 15 000–20 000 L (European Parliament 2009; Smolin and Grosvenor 2010).

The embedded water in plant-based food is significantly lower, with between 100 and 5000 L in each kg of product (European Parliament 2009). In other words, meat consumption will exacerbate the scarcity of water resources already felt by many parts of the world.

Worldwide food production is responsible for 31% of total greenhouse gas (GHG) emission. Livestock's share of total emissions from agriculture is at 80%, with cattle, sheep and pig production being the main contributors (Chloupková 2009). The global livestock industry emits more GHG than all forms of transport (European Parliament 2009). Hence, reducing meat consumption has a much more palpable impact than buying any food produced locally.

Assuming production methods and yield trends remain stable, producing the quantity of meat that would be required to feed the global population based on Western eating patterns would impose the following burdens: 33% of global arable land would be required only to produce the feed for the animal sector; 58% of the world's surface would have to be sacrificed as pastureland and about 18% of oil production would be required as an input in the animal husbandry. To illustrate, 7–10 kg of cereal feed is required to produce a single kilogram of beef (Chloupková 2009). In other words, 2 ha of land can feed either one meat eater, 14 vegetarians or 50 vegans (Smolin and Grosvenor 2010).

Given the pronounced difference clearly outlined by Smolin and Grosvenor (2010), 200 000 litres of water are needed to produce 1 kg of beef, while “only” 2000 litres of water are needed to produce 1 kg of

soy. This, together with the other factors outlined above, demonstrates that given the currently available scientific knowledge, it is more effective, from economic, ecological as well as health perspectives, to feed the majority of the global population mostly with plant-derived food as opposed to animal-derived food.

This reality was also voiced during the Danish meat tax debate, by taking into perspective individual human health issues: “As it is today, it is much cheaper to live healthily than unhealthily, and if you believe that you can regulate the behaviours of the Danes by using taxes and excises ... we have reached a limit” (Vallgård et al. 2015).

Voices of high-political leaders on this issue are clear: “Obesity and overconsumption of meat are serious problems in the developed part of the world. These phenomena are not only unhealthy; they are also related to the climate change and other environmental challenges, like water and air pollution. Consumers have the right being informed about the consequences of their decisions. The challenges we are facing in the 21st Century are huge, so all the options to address them should be taken into account, including the market policy measurers analysed by the authors.” (Janez Potočnik 2016)⁷

Behavioural change as a possible solutions

The issues outlined above are well understood by the European Parliament, which on 29 September 2015 released a manifesto calling for healthier, plant-based food options, in order to solve the crises affecting both our planet as well as human health. This initiative was driven by the democratically elected members of the European Parliament and enjoyed cross-party support. As a part of this initiative, several hundred delicious and nutritionally balanced lunch meals were made from the vegan, gluten-free leftovers collected from Brussels supermarkets and distributed in front of European Parliament to staff members and passers-by⁸.

The farmer is not the culprit in this global problem. Yet, unless this inconsiderate human behaviour, which is exacerbating the speed and volume of climate

⁶Although it should be noted that such water is not actually ‘lost’ as it, in part at least, will return to the aquifer it is drawn from.

⁷In personal communication with Janez Potočnik, former EU Commissioner for Research and Science (2004–2010) and the Environment (2010–2014), and current chairman of the Forum for the Future of Agriculture and of the Rise (Rural Investment Support for Europe) Foundation.

⁸One of the authors was a witness to this initiative.

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change and impinging on scarce natural resources, is shifted by 180 degrees, humanity is going to have to deal with a very major disaster in the very near future.

Ethically speaking, it is the role of the developed countries to pioneer this change of human behaviour by radically limiting their meat consumption. This would not only help the developed countries, their populations and their economies *per se*, but it would also help the developing countries, whose meat and animal protein production is not (yet) at breaking point (European Parliament 2009). Furthermore, although they are growing rapidly, the GHG emissions of the developing countries do not yet exceed the world average (Huffington Post 2013).

Hence, a pioneering initiative by developing countries, including the European Union, to limit their meat consumption and bring it down to the level of developing countries, would be the best gift that the developed world could give to developing countries. Furthermore, this gift represents a win-win scenario for all parties, and, in its long-term impact, can out-rank any developing aid that is being given to the developing countries.

It is the farmers and the agricultural sector who are suffering tremendously from climate change and the unpredictable weather patterns and weather extremities. Farmers all over the world never know in advance whether their farm will be hit by too much rain or drought, and/or if the annual harvest will be destroyed altogether. The ripple effect of this is that under different scenarios different pests and/or different diseases spread (CZELO 2013, 2014).

Plant breeding is one of the innovation and technology options that will allow the development of plant varieties tolerating a broader range of extremities, such as varieties resistant to pests and diseases and tolerant to environmental stress (Chloupek 2000). For this purpose, the revenues captured could be used towards research and innovation, such as plant breeding, and/or used towards insurance for farmers, as, due to damage to the planet, weather extremities and storms, etc., are expected to increase in frequency.

Another option would be to put in place a higher tax for meat and to incentivise the consumption of plant-based food by lowering their taxes. What would speak for this option is the fact that most citizens across the world are already used to the fact that they pay more taxes for unhealthy products (hard alcohol, cigarettes, etc.) compare to their other supermarket purchases. It should be, therefore, easy to put meat in the same (or a similar) category with the unhealthy

items. To offset the grocery basket purchase, it would be wise to use a lower tax bracket for plant-based food.

Yet another way to approach such a complex situation would be to introduce a tax on GHG as an alternative to a meat or fat tax. This could present a more practical alternative to the meat tax, as it would not seem to target the farm level *per se*. However, to offset the full range of the negative externalities caused by meat (over)consumption, alongside the GHG emission taxes, it would be necessary to introduce also water tax, soil tax, etc. This could result in a heavy bureaucratic load. Also, the underlying message aimed at the broad population: “Eating less meat is good for you and good for the planet” would be lost in the “translation” of too many different taxes, none of which would mention the word “meat”.

The overarching objective of altering tax brackets for meat *vis-à-vis* plant-based food is to induce a behavioural change. The authors are of the opinion that another path to consider with the aim of reducing meat consumption would be global guidelines on meat consumption as suggested below.

A worldwide guideline could define a standard meal as plant-based food. The guideline should capture the essence of the necessity that meals containing meat should be in a minority compared to plant-based meals and/or meals not containing meat. These guidelines could be applicable in food outlets/canteens at airports, parliaments, governments, international institutions, schools, universities, prisons, etc.

Undoubtedly, this would be a profoundly ethical step towards improving the global health of the world’s population as well as the well-being of the planet itself.

Possible scenario for implementing a global tax system

Any new tax system which would come into effect would have to be holistically thought through to treat the current problem of meat overconsumption, and also to avoid any new market distortion, as happened in Denmark with the noble attempt to introduce a fat tax. For that reasons, the authors would prefer to concentrate on a meat tax, rather than a fat tax, to avoid penalising the consumption of healthy oils, such as olive oil, avocados, nuts, seeds, etc., that are necessities in any nutritious, and especially plant-based, diet. Although we outline that different meats, and certainly different parts of meat, different ages

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of the slaughtered animals, etc., present different negative externalities, the authors would recommend the use of one single meat tax; otherwise the system becomes too complex and would require a voluminous administrative support to determine the origin of all the different sorts of meats.

A worldwide solution is an absolute necessity. For this purpose, a new international platform could be created, or an already existing international platform could be used. Two possible platforms could be the World Trade Organization (WTO) and/or United Nations (UN).

If the WTO scheme should be taken, then “piggy-backing” on the already existing Sanitary and Phytosanitary (SPS) Measures Agreement, part of which, *inter alia*, requires animals to be slaughtered at certified processing points, may represent a smooth and effective choice. It may be therefore the most logical place to implement such a levy.

Other aspects

Food waste is another important subject to which not enough attention is being paid (Chloupková 2012; Council of the European Union 2016). Similar to meat, food waste also creates externalities, which then place a burden on many market actors. However, for reasons of simplicity this article deals only with the issue of meat.

CONCLUSION AND PERSPECTIVES

The main issue that we tackled in this article was how to go about realising the noble FAO goal as stated in the Rome Declaration. We argued that one important solution answer could be to introduce a global meat tax that incorporates the negative externalities in the private marginal production cost curves. Policy makers should not be discouraged by the abolishment of the Danish meat tax for the reasons outlined in the previous chapters, namely: Denmark acted unilaterally, and the environmental damage caused by the meat consumption did not seem to be taken into account.

The appropriate size of the meat tax should be calculated based on the holistic use of foresight and big data. As a result, a double dividend occurs where

meat production will drop to the optimal level and tax revenue will be generated at the same time. How the tax revenue generated should be invested is a political decision that calls for international negotiations. There are a whole range of possibilities such as development aid, disaster funds, climate change, research and new technology, etc.

The authors are of the opinion that the revenue collected should be solely used for the farmers already hugely disadvantaged by the adverse effects of climate change; be it for the purpose of lowering land tax, for their insurance funds or, investments in research and innovation such as breeding new plant varieties resistant to a broad range of extreme weather etc.

In perspective, Dr Rajendra Pachauri, chair of the United Nations Intergovernmental Panel on Climate Change, which in 2007 was awarded a joint share of the Nobel Peace Prize, has suggested that people should reduce their meat consumption to help combat climate change⁹.

Furthermore, the EFFLA Policy Brief “European Bioeconomy Challenges: Food security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research” addressed to the Commissioner for Research and Innovation, as well as the European Parliament’s Science and Technology Options Assessment’s study “Implications of Global Trends in Eating Habits for Climate Change, Health and Natural Resources”, are both calling for a reduction in the consumption of meat and the cutting down of food waste. This is in order to reduce the occurrence of obesity and other related diseases, and the abuse of natural resources with respect to the scarcity of water and land and in order to curb CO₂ emissions (European Commission 2015b; European Parliament 2009).

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REFERENCES

A Food Policy for Europe (2016): The New Mansholt Letter. Available at <https://mansholt.atavist.com/newletter#chapter-1072466> (accessed May 28, 2016).

⁹During a meeting in the European Parliament witnessed by one of the authors.

<https://doi.org/10.17221/270/2016-AGRICECON>

- Begg D., Fischer S., Dornbusch R. (1984): *Economics*. McGraw-Hill, London.
- Brandt U.S., Svendsen G.T. (2014): A global CO₂ tax for sustainable development? *Journal of Sustainable Development*, 7: 85–93.
- Brandt U.S., Svendsen G.T. (2016): *The Politics of Persuasion: Should Lobbying be Regulated in the EU?* Edward Elgar Publishing Cheltenham.
- Burgelman J.-C., Chloupková J., Wobbe W. (2014): Foresight in support of European research and innovation policies: The European Commission is preparing the funding of grand societal challenges. *European Journal of Futures Research*, 2: 55.
- Chloupek O. (2000): Genetická diverzita, šlechtění a semenářství. *Academia*, Czech Republic.
- Chloupková J. (2009): Improvements in growth and sustainability through technology and interdisciplinary Incentives; a chapter in the EU Policy Challenges 2009–2019. A report to the President of the European Parliament, June 2009. Available at http://www.europarl.europa.eu/former_ep_presidents/president-buzek/ressource/static/files/special/EU_Policy_Challenges_2009-19_-_Full_Text.pdf (accessed Jan 17, 2016).
- Chloupková J. (2012a): Contrary to popular belief, conventional crops are also faced with health concerns. *Europe's World*, Autumn 2012. Available at <http://europesworld.org/2012/10/01/contrary-to-popular-belief-conventional-crops-are-also-faced-with-health-concerns/#.VpLnYxUrLIU>
- Chloupková J. (2012b): Potraviny do popelnic nepatří. Interview with Franz Fischler, European Commissioner for Agriculture 1995–2004). *Zemědělec*. Available at <http://zemedelec.cz/potraviny-do-popelnic-nepatri/>
- Council of the European Union (2016): Food losses and food waste – Council conclusions. Available at <http://data.consilium.europa.eu/doc/document/ST-10730-2016-INIT/en/pdf> (accessed July 11, 2016).
- CZELO (Czech Liaison Office for Research and Innovation) (2013), in cooperation with Permanent Representation of the Czech Republic to the European Union Conference, Agricultural Research and Food Security – Outlook to Horizon 2020 and beyond; Czech contribution to common European effort; moderated by Jarka Chloupková, June 2013. Available at http://www.czelo.cz/files/dokums_raw/Food_security_conference_05_June_2013_Brussels_Agenda.pdf
- CZELO (Czech Liaison Office for Research and Innovation) (2014), in cooperation with Permanent Representation of the Czech Republic to the European Union Conference, Water Research for Agriculture – Sustainable Resources of water in Europe; moderated by Jarka Chloupková, June 2014. Available at http://www.mzv.cz/file/1187504/WATER_RESEARCH_FOR_AGRICULTURE_half_day_conference_10_June_2014_Brussels_UPDATE.pdf
- European Commission (2015a): FOR-LEARN: Support to mutual learning between Foresight managers, practitioners, users and stakeholders of policy-making organisations in Europe. Available at <http://forlearn.jrc.ec.europa.eu/index.htm> (accessed Nov 16, 2015).
- European Commission (2015b): *European Bioeconomy Challenges: Food security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research*. European Forum on Forward Looking Activities – EFFLA Policy Brief No. 3. Available at https://ec.europa.eu/research/innovation-union/pdf/expert-groups/effla-reports/effla_pb3_-_european_bioeconomy_challenges.pdf (accessed Nov 16, 2015).
- European Parliament (2009): Implications of Global Trends in Eating Habits for Climate Change, Health and Natural Resources Study (IP/A/STOA/IC/2008-180). Science and Technology Options Assessment (S T O A). Available at [http://www.europarl.europa.eu/RegData/etudes/etudes/join/2009/424735/IPOL-JOIN_ET\(2009\)424735_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/etudes/join/2009/424735/IPOL-JOIN_ET(2009)424735_EN.pdf) (accessed Nov 16, 2015).
- FAO (2013): International Year of Quinoa. Available at <http://www.fao.org/quinoa-2013/en/> (accessed Dec 24, 2015).
- FAO (2014): Rome Declaration on World Food Security. Available at <http://www.fao.org/docrep/003/w3613e/w3613e00.htm> (accessed Dec 25, 2015).
- FAO (2016a): International Year of Pulses. Available at <http://www.fao.org/pulses-2016/en/> (accessed April 2, 2016).
- FAO (2016b): The Nutrition Transition and Obesity. Available at <http://www.fao.org/FOCUS/E/obesity/obes2.htm> (accessed Jan 10, 2016).
- Hillman A.L. (2009): *Public Finance and Public Policy. Responsibilities and Limitations of Government*. Cambridge University Press, Cambridge.
- Huffington Post (2013): Developing Countries' Carbon Emissions Will Vastly Outpace Developed Nations, U.S. EIA Says, Sept 24, 2013. Available at http://www.huffingtonpost.com/2013/07/25/carbon-emissions-developing-countries_n_3651513.html (accessed Oct 8, 2016).
- MF Dnes (2016): Počet oběžných vzrostl za 40 let na šestinásobek. April 2–3, 2016.
- SAS (2013): From Big Data to Meaningful Information. Conclusions paper. Available at https://www.sas.com/content/dam/SAS/en_us/doc/conclusionpaper1/from-big-data-to-meaningful-information-106328.pdf (accessed Jan 17, 2017).

<https://doi.org/10.17221/270/2016-AGRICECON>

Smolin L.A., Grosvenor M.B. (2010): *Nutrition: Science and Applications*, Wiley.

Svendsen G.T. (1998): A general model for CO₂ regulation: the case of Denmark. *Energy Policy*, 26: 33–44.

Tietenberg T., Lewis L. (2012): *Environmental and Natural Resource Economics*. 8th Ed. Pearson International.

Vallgård S., Holm L., Jensen J.D. (2015): The Danish tax on saturated fat: why it did not survive. *European Journal of Clinical Nutrition*, 69: 223–226.

WTO (2016): *Understanding the WTO Agreement on Sanitary and Phytosanitary Measures*. Available at https://www.wto.org/english/tratop_e/sps_e/spsund_e.htm (accessed Oct 8, 2016).

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