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EXPLORING THE LINK BETWEEN DIET AND SUSTAINABILITY IN EUROPE: A FOCUS ON MEAT AND FISH CONSUMPTION

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Exploring the Link Between Diet and Sustainability in Europe: A Focus on Meat and Fish Consumption

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Abstract:
Global food production practices and consumption patterns have changed notably in the last few decades. Current dietary patterns are characterized by increased consumption of refined sugars as well as higher intakes of heavily-processed and animal-source foods, which results in higher obesity rates and increased prevalence of diet-related non-communicable diseases. Moreover, diets high in animal products are associated with a larger environmental burden. The aim of this paper is to examine the association between the consumption of meat and fish and economic and socio-demographic factors, different consumption habits and behaviours of individuals in five European countries. Using household-level data, descriptive analysis is presented and regressions using Heckman's standard sample selection model are conducted. The main reasons for not eating meat or fish are ethics, environment, taste and health. Our findings also suggest that though income results to be significant, its positive effect on meat and fish intake is rather small. Regarding fish, the price of groceries seems to have a significant negative impact while it does not affect the consumption of white meat. This indicates that if we want to lower the consumption of (especially red) meat, we should focus on other factors, such as gender, age, healthy habits and behavioural traits or values (especially factors that are part of the decisionmaking process during food purchases like price, taste, habit, family and appearance). Moreover, meat and fish intakes differ significantly among

analysed countries, hence, the policy recommendations should be based on a local context.

JEL: C34, C38, I15, O12, O13, Q56
Keywords: income, meat and fish consumption, animal protein, healthy and sustainable diet, behavioural analysis

1 Introduction

Global food production practices and consumption patterns have changed notably in the last few decades. On one hand, several health benefits, such as reductions in hunger, improved life expectancy, lower infant and child mortality rates, and decreased global poverty, have been achieved through improvements in production practices. On the other hand, due to increasing incomes, rapid urbanisation, and inadequate accessibility of nutritious foods current dietary patterns are characterized by increased consumption of refined sugars as well as higher intakes of heavily-processed and animal-source foods, which results in higher obesity rates and increased prevalence of diet-related non-communicable diseases (Willett et al. 2020). Institute for Health Metrics and Evaluation (IHME) estimated that globally, diets high in red meat were responsible for 896,000 deaths and for 23.9 million disability-adjusted life years (DALYs) in 2019 (IHME 2020). Reducing global meat consumption could alleviate adverse environmental and health effects of current food systems but it would require widespread dietary changes (Willett et al. 2020). Such shifts to sustainable diets depend on several socio-demographic, economic, and behavioural factors, which are to be assessed in this paper.

In this paper, we focus on the consumption of meat and fish with the aim to examine the associations between red meat, white meat and fish intake and economic and socio-demographic factors as well as different consumption habits and behaviours of individuals in five European countries - the Czech Republic, Latvia, Portugal, Spain and the United Kingdom[1]. For that, current trends and consumption habits are analysed, and the econometric analysis of cross-sectional data is conducted. Using household-level data from an original survey conducted in 2018 (Zverinova et al. 2020)[2], we are able to estimate the relationship between income, education, level of urbanization and certain types of behaviour and the quantity of meat (red and white) and fish in kilo-calories that a person consumes as well as protein intake from these food categories. This way, we expand the literature on animal consumption by conducting a thorough analysis of not only meat but also fish intake. Carrying this research out in the selected EU countries that differ economically, politically and culturally, provides a good basis for the overall picture of the EU, but it also enables us to study these countries individually. In addition to that, there is still not enough literature on the examination of meat and fish protein intake, hence, we aim to bridge this gap, too.

The paper is structured as follows: in section 2, we explain the theoretical background based on current literature, section 3 describes data and methods used in the analysis and the empirical model is explained. The results, both descriptive and from the regressions, are shown in section 4, while section 5 contains a discussion of our findings and concluding remarks.

[1] Countries were chosen because they differ in their political and socio-economic contexts as well as in consumption habits and climatic conditions, enabling us to have a broad European perspective.

[2] The objective of that study was to analyse current trends in consumption, travel and lifestyle of the inhabitants of five European countries as well as improve understanding of how lifestyles and behaviours might be changed to become healthier and more environmentally friendly while supporting health equity.

2 Literature review

Data from the Food and Agriculture Organization (FAO) clearly show that global meat consumption significantly increased in the past few decades, resulting in 342 million tonnes of meat consumed in 2018, which was a 47% increase compared to 2000 (FAO 2020). Given that, global meat production is estimated to double between 2000 and 2050, which is likely to have a negative impact on the environment (WRAP 2019) but it might also negatively influence consumers' health (Willett et al. 2020).

Many studies show that higher intake of red and processed meat is associated with an increased risk of cardiovascular diseases, stroke, type 2 diabetes (Abete et al. (2014), Chen et al. (2013) and Feskens et al. (2013)) and a linear association between red meat and total mortality was found (Pan et al. (2012), Sinha et al. (2009) and Etemadi et al. (2017)). Higher intakes of red meat during adolescence and early adult life were found to be correlated with an increased risk of breast cancer (Farvid et al. (2015) and Farvid et al. (2014)). Because of sufficient evidence related to colorectal and stomach cancer, International Agency for Research on Cancer classified processed red meat as "carcinogenic to humans" (a group 1 carcinogen). Unprocessed red meat was classified as "probably carcinogenic to humans" (a group 2A carcinogen) due to a positive association between its consumption and colorectal, pancreatic, and prostate cancer (Bouvard et al. 2015).

Focusing on animal and plant protein intake, Sokolowski et al. (2019) evaluated its relationship with overall diet quality. The results suggest that eating less than 70% of protein from animal sources might lead to a better score on the health eating index[3]. Springmann et al. (2016) estimated that global mortality could be reduced by 6-10% and food-related GHG emissions by 29-70% compared to a reference scenario in 2050 if a transition toward more plant-based diets which are in line with standard dietary guidelines took place. Estimated economic benefits from this dietary improvement might be 1-31 trillion US dollars (equivalent to 0.4–13% of global gross domestic product (GDP) in 2050). A systematic review by Nelson et al. (2016) supports findings by Springmann et al. (2016). They conclude that there is consistent evidence which shows that diets high in plant-based foods (vegetables, fruits, legumes, seeds, nuts, whole grains) and lower in animal-based foods (especially red meat), as well as lower in total energy, are associated with smaller negative environmental externalities and they were shown to be healthier. The report by Willett et al. (2020) indicates that vegan and vegetarian diets are associated with the largest reductions in GHG emissions, while vegetarian diets, in particular, are also associated with the greatest reductions in water use. Nevertheless, Springmann et al. (2016) highlight that current dietary practices, especially in developed countries, differ from recommended health-promoting dietary patterns, implying the necessity for a substantial change in this area.

Not only are current consumption trends a threat to human health, they are also contributing to environmental degradation. Land use changes, such as converting natural ecosystems to croplands and pastures, are one of the greatest factors influencing biodiversity loss, resulting in some species in danger of becoming extinct (Willett et al. 2020). Moreover, food production is responsible for almost 30% of global greenhouse gas (GHG) emissions (Vermeulen et al. 2012) and 70% of freshwater use (Merrey et al. 2007), while fresh and marine waters are likely to get polluted with agrochemicals (Tilman et al. 2001).

[3] Healthy eating index is measure of diet quality. It is often used to evaluate "how well a set of foods aligns with key recommendations of the Dietary Guidelines for Americans" (USDA 2020)).

That being said, the use and release of limiting resources from agriculture, such as nitrogen, phosphorus, and water; release of pesticides, and conversion of natural ecosystems to agricultural lands have a huge impact on ecosystems' functioning (Tilman et al. 2001). Out of all consumer products, specifically meat and meat products were estimated to account for 4–12% of the impact on global warming (Tukker and Jansen 2006).

There are studies from the EU countries that examined what affects meat (or animal product) consumption (Koch et al. (2021), Schmid et al. (2017) and Predanócyová et al. (2019)). A German study found that the main motives for meat consumption were good taste, usual habits, and the perception of meat as a healthy and satiable food (Koch et al. 2021). Schmid et al. (2017) found that overall meat consumption frequency among middle-aged and elderly people in Switzerland was predicted by language region, gender, household size, and BMI. Moreover, it was shown to be affected by respondents' opinions about the healthiness, taste, and safety of meat. Predanócyová et al. (2019) identified key factors affecting the consumption of meat and meat products from Slovak consumers' point of view. The most prominent reasons were price, taste, quality of meat, freshness, and country of origin. Though these studies examined what factors affect the consumption of meat or animal products within the EU, they tend to focus on one specific country or perform only descriptive analysis. Hence, we want to bridge this gap and bring new insights by conducting an econometric analysis on unique data from five EU countries.

3 Materials and methods

3.1 Data

The respective five EU countries were selected because of their different political, geographical and socio-economic contexts, which facilitates a more accurate representation of the broader European landscape. Only people aged between 18 and 65 were eligible to take part in the survey. Country subsamples are therefore representative of national populations aged 18 to 65 years with respect to gender, age, region, and education[4]. Social-psychological, sociological and economic approaches were combined to design the survey as well as analyse the data.

The Short-Form Food Frequency Questionnaire (SFFFQ), which is a standardized tool that has been validated against an extensive Food Frequency Questionnaire and a 24-hour diet recall for the UK (Cleghorn et al. 2016), was used to elicit respondents' eating patterns. We used the key structure as shown in the supplementary material of Cleghorn et al. (2016) study (which is primarily representative of the UK population). Small changes were made compared to the original version of Cleghorn et al. (2016)'s SFFFQ. Based on the feedback from the pre-survey, frequency questions (e.g. "How often do you eat at least one portion of [a food group X]?") were changed to ask directly about specific portions eaten (e.g. "How many portions of [a food group X] do you eat?"). These questions were accompanied by a picture showing what a typical portion of a specific food category might look like. The pre-survey also revealed that the participants had difficulties distinguishing between salads and vegetables, hence, these two categories were merged together. Because of the time constraints, three groups from the original SFFFQ were removed. More information on the survey methods and measures can be found in Zverinova et al. (2018).

[4]There was a slight deviance from quotas in some sample proportions, hence, weights were derived to make all analysed countries representative in terms of gender, age, region, and education.

After the pre-survey and pre-testing, which included language, translation and programming checks, the pilot survey was carried out in July 2018 (212-323 respondents by country) and the main wave followed shortly after. For the analysis, incomplete and test observations were excluded from the dataset. Table 1 shows the number of completed questionnaires (the pilot and the main wave summed up to "All completed") as well as the number of excluded observations ("Speeders") in each country. The overall number of completed questionnaires in the final sample was 10,346.

Table 1: The number of completed questionnaires (pilot + main wave) as well as the number of excluded observations ("Speeders") and the resulting final sample, where the "Speeders" are excluded.

	All completed	"Speeders"	Final sample (excluding speeders)
Czech Republic	2,138	119	2,019
Latvia	1,928	146	1,782
Portugal	1,830	172	1,658
Spain	2,287	220	2,067
United Kingdom	3,017	197	2,820
Total	11,200	854	10,346

3.1.1 Meat and fish consumption

Data from the food consumption section of the questionnaire were used since we are interested in how many portions of white meat (whole and processed), red meat (whole and processed), white fish (in batter, other) and oily fish the respondents typically consume. They were asked to choose the frequency[5] that fits them the best. These variables are categorical but because the portion size of each food group as well as the frequency of consumption were known, we were able to calculate the intake of each food group in grams per day. Using *FRIDA food data* created by The National Food Institute at the Technical University of Denmark (DTU)[6], we obtained nutritional data necessary for estimations (information on calorie content and proteins per serving size for the respective food groups). Though there are other food composition sites (e.g. *What's In The Foods You Eat Search Tool* created by Agricultural Research Service of the US Department of Agriculture (USDA 2018)), we chose to use FRIDA because it best matches the European population we surveyed and the data requirements of the analysis.

The conversion to grams and kilocalories (kcal) allowed us to sum the intake of specific categories of meat and fish. New variables were created, which enabled the analysis of the consumption of red meat (RM), white meat (WM) and fish (F) in kcal/day as well as the analysis of protein intake from these food categories. Summary statistics for the overall intake of RM, WM and F expressed in kcal/day and from the protein intake of the same food groups are displayed in Table 2.

[5]The consumption frequencies for meat and fish were as follows: None, Less than one portion a month, Less than one portion a week, One portion per week, 2-3 portions per week, 4-6 portions per week, 7+ portions per week.

[6]DTU's National Food Institute aims to enhance public access to comprehensive information regarding the composition of foods consumed within Denmark and Europe (DTU 2023).

Table 2: Summary statistics for the consumption of red meat, white meat and fish (expressed in kcal/day).

				Overall intake			
	Unit	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Red meat	kcal/day	0	38	93	100	154	494
White meat	kcal/day	0	44	83	96	132	662
Fish	kcal/day	0	23	47	63	80	666
				Protein intake			
	Unit	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Red meat	kcal/day	0	12	30	32	46	148
White meat	kcal/day	0	18	34	39	53	259
Fish	kcal/day	0	9	19	26	34	270

Only people who eat meat or fish were asked to declare how often they do so for specific categories. Still, there are some respondents who choose not to consume red meat, white meat or fish. Not surprisingly, mean values for meat intake are generally higher than for fish intake.

Table 3: Mean intakes of red meat, white meat and fish by country.

	Unit	All	CZ	ES	LV	PT	UK
Overall intake (means)							
Red meat	kcal/day	100	93	90	131	102	90
White meat	kcal/day	96	80	102	87	118	95
Fish	kcal/day	63	38	86	46	89	61
Protein intake (means)							
Red meat	kcal/day	32	30	29	39	35	28
White meat	kcal/day	39	32	41	35	48	38
Fish	kcal/day	26	15	37	18	39	24
Relative protein intake from RM, WM and F(means)							
Red meat	%	32	32	33	30	34	31
White meat	%	40	40	40	40	41	40
Fish	%	42	40	43	40	44	40

Mean values for individual countries are available in Table 3 and Table B.4. Figure A.3 displays density plots for overall meat and fish consumption by country, which are expressed in kcal per day. It can be noted that meat intake is almost normally distributed with a slight right tail (the distribution is not as smooth for fish intake). Right tails can indicate that there is a small proportion of respondents who consume extremely large quantities of meat and fish. Besides that, we see a larger proportion of zero observations, especially in the case of fish consumption. Some zero observations are due to people not consuming red/white meat or not consuming fish but there are also cases when respondents perhaps could not find the right consumption frequency from the answers that were provided. Table B.5 shows the share of zeros in our dataset for red and white meat and fish. Overall, 3% of our respondents are vegetarians. Out of people who consume meat or fish in general, 3%, 3% and 6% stated they do not eat red meat, white meat and fish, respectively.

Using Food Balances data from FAO (2023), we compared our values with country averages for meat as well as fish and seafood supply, proteins and fats expressed in kcal/capita/day. Figure A.1 shows the evolution of meat (fish and seafood) supply, protein and fat supply in the last 60 years in analysed countries. There was a huge increase in the consumption of meat in Spain and Portugal while it has been stagnating in the UK. We can note that the average meat supply in 2018 was around 380 kcal/capita/day while the average meat intake provided by our respondents was roughly 200 kcal/capita/day. The reason might be that generally, data provided by FAO (2023) take the supply approach to approximate the consumption and they do not account for food waste. On the other hand, respondents tend to underestimate their consumption when filling in questionnaires (Schoeller 1990).

3.1.2 Explanatory variables

To explain changes in the consumption of meat and fish, several variables from the questionnaire were extracted. Firstly, the household's total net monthly income from all sources after tax and compulsory was used as the main economic variable. There were 12 intervals for monthly income our respondents could choose from. In addition to that, there were two more categories - "I do not know." and "I would prefer not to respond.". A numerical variable was created using the middle value of the respective interval. Missing observations were imputed using the mean value of the income conditional on a country. Because of the different currencies used in analysed countries, the income was converted to purchasing power standard (PPS) euros. The distribution of respondents' household income in specific countries (conditional on overall quartiles) can be seen in Figure A.4.

To control for potential biases, socio-demographic, health and environment-related variables such as gender, age, education, type of residence, unemployment, health status, smoking, body weight and behavioural factors were included in the model. Gender, age, education and type of residence are categorical variables. The distribution of these variables can be found in Table B.1. Unemployment, smoking, the perception on how healthy the respondent's diet is[7] and computed healthiness of their diet (based on respondents' food consumption values and "Wheel of Five" by Brink et al. (2019)) are dummy variables. Their overview can be found in Table B.2.

In the model, we include variables capturing certain attitudes, values and shopping behaviour. Dummies denoted as food factors (FF) tell us how important a certain FF (e.g. price, taste, convenience) is when purchasing grocery's[8] (summary statistics can be found in Table B.3). Then, we derived variables on biospheric[9] values (focus on nature and the environment), hedonic values (focus on pleasure and comfort), egoistic values (focus on protecting personal resources), altruistic values (focus on the welfare of other people) and security (focus on health, safety, harmony, and stability of society, of relationships,

[7]On a scale from 1 (very unhealthy) to 7 (very healthy), values higher than 4 were considered for perceived healthy diet.

[8]Respondents were asked the following question: "When buying food, what would you say are the most important factors that influence your choice?".

[9]For example, biospheric value orientation reflects how important people find the environment. The questionnaire included 3 items - preventing environmental pollution, respecting the earth, and protecting the environment - to measure the biospheric value. The respondents were asked to indicate on a 9-point scale ranging from 7 (of supreme importance) to 0 (not important) and -1 (opposed to my values) how important each of the items is as a guiding principle in their life.

and of self). Confirmatory factor analysis (CFA) was carried out to validate the selection and the coefficient of reliability was computed (Cronbach's $\alpha = 0.9$ indicated a reliable construct). Approximate fit indices indicated a good fit of the model and the root mean square error of approximation (0.061) was not far away from 0.05 suggesting a reasonable approximate fit. More information about the CFA model and its fit statistics can be found in Zverinova et al. (2020).

3.2 Methods and models

The quantity of food products consumed is one of the key variables and naturally, non-negative numbers are to be recorded (real positive numbers are observed when respondents purchase or consume certain food products, otherwise zeros are recorded). This means that the non-negative response variable, Y, has a (roughly) continuous distribution over strictly positive values, but $P(Y = 0) > 0$. We can denote Y as a corner solution outcome, where the corner, in this case, is at zero (Wooldridge 2013).

For those who do consume meat or fish, we observe the response over a certain range (because of a survey design). Given that, no consumption can be recorded (for example, because of the infrequency of the purchase of a product), meaning it is censored (from left by 0). Consequently, a larger share of zeros may be observed (either some people[10] choose not to consume a specific category - red meat, white meat or fish - or the frequency they consume the good was not offered) and we might face a sample selection problem, which has to be dealt with accordingly (Smutna and Scasny 2017).

3.2.1 Selection modelling

One of the well-known models that deals with censored data is a tobit model (also called a censored regression model), which was first introduced by Tobin (1958). It is a linear regression model where the dependent variable is either left- (having strictly positive values) or right-censored. Moreover, a tobit model assumes that the decision to purchase a (food) product is influenced by the same stochastic process, or in other words, the same regressors (Smutna and Scasny 2017). This assumption is likely to be violated in the case of food demand analysis. This can be solved by applying two specific processes, or else, by having two equations instead of just one. The food demand model can be then illustrated as follows:

$$Y_1^\star = X_1\beta_1 + \epsilon_1 \tag{1}$$

$$Y_2^\star = X_2\beta_2 + \epsilon_2 \tag{2}$$

$$Y_2 = \begin{cases} Y_2^\star & Y_1^\star > 0 \\ 0 & Y_1^\star \leq 0 \end{cases} \tag{3}$$

Equation 1, also called a participation equation, describes what factors (regressors X_1) influence the decision to purchase a product or not. Hence, $Y_1^\star$ is a dummy variable that indicates whether a product was purchased (1) or not (0). Equation 2, also called an outcome equation, aims to estimate what affects the quantity of a purchased good, which is depicted by the matrix of independent variables X_2. Lastly, ϵ_1 and ϵ_2 are disturbances and depending on a model they can or cannot be correlated[11].

[10] Non-vegetarians

[11] We assume that $\epsilon_1 \sim \mathcal{N}(0, \sigma_1^2)$ and $\epsilon_2 \sim \mathcal{N}(0, \sigma_2^2)$.

Oftentimes in consumer demand analysis, the assumption that the error terms are independent is too strong, hence, there are models that allow them to be correlated (Puhani 2000). In that case, Equation 3 is called the sample selection model. One of the most popular solutions for the sample selection problem was introduced by Heckman (1976). In the so-called Heckman's standard sample selection model, which is basically a generalized Tobit model, X_1 and X_2 may or may not be equal (Toomet and Henningsen 2008). Maximum likelihood (ML) method or two-step solution can be employed. Originally, Heckman (1976) suggested using a two-step solution since it was cheaper and less computationally demanding. This method is still used in empirical studies because its results are quite robust in certain cases and may allow for generalisations more easily compared to ML. However, the model may not converge. Nowadays, ML estimation is easy to perform and even though there might be instances when the model will not converge either, ML is recommended to be used for the estimation. The maximisation of the (log) likelihood function can be done through different algorithms, such as the Newton-Raphson (or ML/2step/BHHH) algorithm (Toomet and Henningsen 2008), which is used in this paper.

3.2.2 Empirical model

In our case, the dependent variable in the participation equation, which is a dummy variable $Y^{\star}_{dummy_j}$, is equal to 0 when a person does not consume a specific type of meat or fish j, where j = RM, WM, F, P.RM, P.WM, P.F[12]. If a positive consumption in the respective food category is recorded, $Y^{\star}_{dummy_j} = 1$. The dependent variable in the outcome equation is the logarithm of the amount of RM, WM or fish consumed (or proteins from RM, WM or F), denoted as $log(Y^{\star}_j)$ and expressed in kcal/day.

The structural form of the outcome equation is the following:

$$log(Y^{\star}_j) = \gamma_{j0} + \mathbf{X}\gamma_{j1} + \mathbf{H}\gamma_{j2} + \mathbf{FF}\gamma_{j3} + \mathbf{V}\gamma_{j4} + \epsilon_{j2}$$

$$log(Y_j) = \begin{cases} log(Y^{\star}_j) & Y^{\star}_{dummy_j} > 0 \\ 0 & Y^{\star}_{dummy_j} \leq 0 \end{cases}$$

where vector $Y^{\star}_j$ represents the intake of food category j, where j = RM, WM, F, P.RM, P.WM and P.F; γ_{j0} is the intercept (scalar), $\gamma_{j1}, \cdots, \gamma_{j4}$ are estimates of the regression (vectors) and ϵ_{j2} is a vector of disturbances.

Dependent variables are explained by a set of socio-economic variables, represented in the matrix **X**, such as income (in thousands of PPS euros); gender, education, age, type of residence, country, and unemployment. Matrix **H** consists of health indicators (computed healthiness of diet[13], body weight and smoking). Lastly, we include variables on values and shopping behaviour. Matrix **FF** represents a range of considerations made by respondents during food purchase choices, encompassing aspects like price, taste, quality, habitual choices, family preferences, health concerns, production methods, appearance, safety, convenience, and origin, whereas specific values like altruism, biosphere conservation, hedonism, egocentrism, and security are included in **V**.

[12] RM = red meat, WM = white meat, F = fish, P.RM = proteins from red meat, P.WM = proteins from white meat, P.F = proteins from fish

[13] Smoking and computed healthiness of a diet are dummy variables. Weight is a continuous variable.

3.3 Hypotheses

Demand for food products is determined by our needs and the ability to satisfy them. In addition to nutritional factors, economic variables and demographic transitions have a major and often decisive significance (Kovljenic and Savic 2017). The effect of income is not always straightforward, though, and depends on the category of food as well as the development of the country being analysed (Muhammad et al. 2017).

We hypothesise that as people get wealthier, the amount of meat and fish in their diet increases. This is supported by a study showing that income is positively associated with demand for meat (Fransen 2011). There are other studies showing that income has an impact on the consumption of meat (Vranken et al. (2014), Malek et al. (2018)) but Stewart et al. (2021) found no significant difference in meat intake within the UK. Using a global dataset for 120 countries, Vranken et al. (2014) found that income is a key factor influencing meat consumption but their relationship does not have to be particularly linear. Vinnari et al. (2010) analysed meat consumption behaviour in Finnish households over 40 years. Their study revealed that besides non-meat consumption becoming more widespread, it has also become a middle-class phenomenon.

Preferences for meat and fish can change with respect to age, as well. We expect that older people have a tendency to eat more meat and fish in comparison to young adults. It was shown that gender has an influence on our dietary patterns (Gossard and York (2003), Vinnari et al. (2010)). Gossard and York (2003) found that it significantly affects the total amount of meat as well as the amount of beef consumed. Our hypothesis is that women have lower consumption of especially red meat compared to men. Besides gender race, ethnicity, location of residence (such as region and urban vs. non-urban areas) and social class were found to have an impact on the total amount of meat consumed (Gossard and York 2003). The effect of different levels of education on the consumption of meat and fish is also evaluated. It is likely that more educated respondents care more about the environment or their health, hence, they would eat moderate amounts of meat and fish (or they might decrease their consumption substantially).

In our model, we include variables for location of residence (town, countryside), country of origin (CZ, ES, LV, PT, UK), unemployment and specific health indicators that might affect the amount of meat and fish consumed (computed healthiness of a diet, body weight and smoking). Besides that, this paper analyses values and behaviour of the respondents and how these might affect the consumption of RM, WM or F by looking at eleven different food factors and five variables capturing certain values.

4 Results

4.1 Descriptive analysis

To analyze MF consumption better, we plotted the average consumption of specific meat and fish categories (Figure 1). This allows us to see that there is indeed a high consumption of meat (particularly, whole red and whole white meat) in Portugal. The highest intakes of processed red meat were identified in Latvia, where they eat a lot of red meat in general.

We also analysed why some people never consume meat or fish (Figure 2). Many respondents reply that it is unethical (31% in Latvia, 54-69% in the remaining countries), followed by it being environmentally unfriendly (32% in Latvia, 43-49% in the remaining countries). Other frequent reasons for not consuming meat or fish are health (14% in

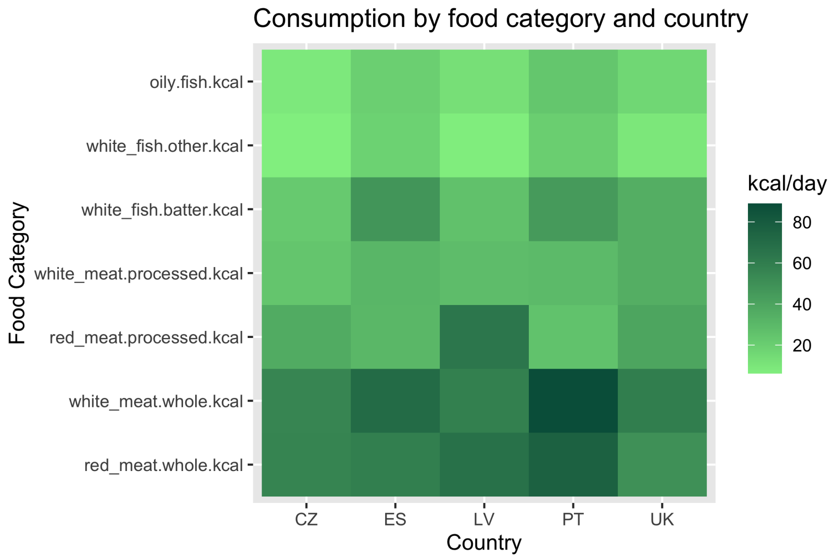

Figure 1: Heatmap of consumption by meat and fish food categories and by country.

Spain, 27-33% in the remaining countries) and taste (41% in the Czech Republic, 32% in the UK, 19% in Latvia, 18% in Spain, but only 5% in Portugal). Among "Other" reasons, respondents usually replied they were vegans or vegetarians, which might indicate that they consider it a lifestyle. Another common reason was animal welfare.

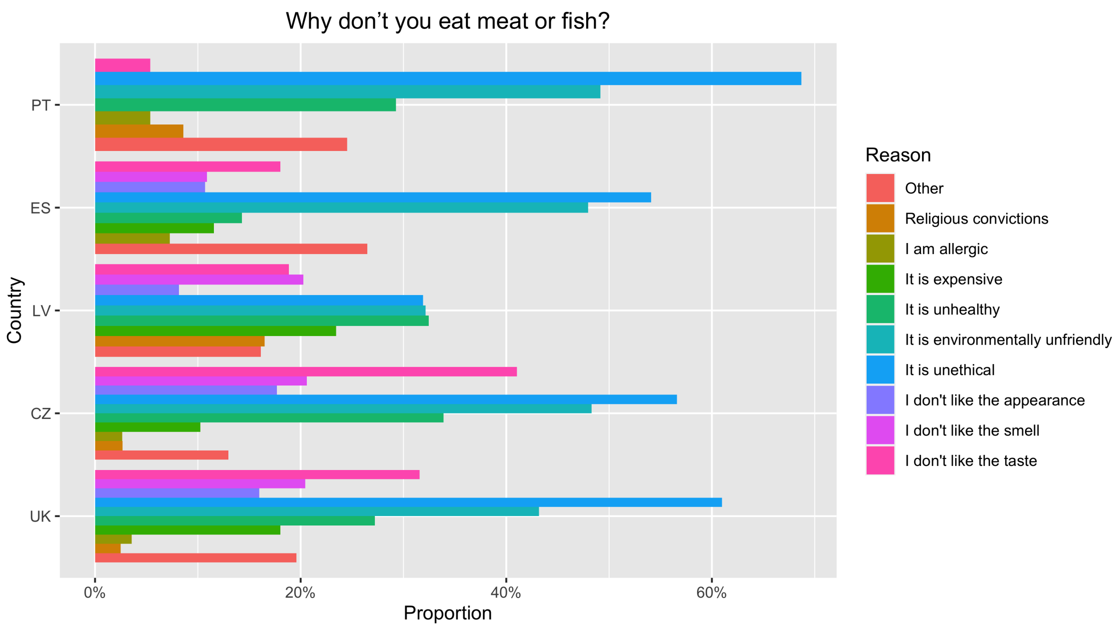

Figure 2: Reasons for not eating meat or fish in five European countries - United Kingdom (UK), Czech Republic (CZ), Latvia (LV), Spain (ES), Portugal (PT).

4.2 Regression results

The regression analysis was performed in R (R Core Team 2020) using the package sampleSelection created by Toomet and Henningsen (2008) and stargazer (Hlavac 2018).

We are interested in finding out what factors influence the amount of red meat, white meat and fish (and proteins coming from RM, WM and F) in a person's diet. Table 4[14] shows the results of the outcome equation from the Heckman selection model, while estimation results from the participation equation can be found in subsection B.1 (Table B.6). We conducted a sensitivity analysis, in which we expressed the calorie intake per kilogram of body weight (Table B.7).

On average, females tend to consume less RM and F (by 13% each) compared to males (10% lower intake for proteins from RM/F), however, the amount of WM is not statistically different. Interestingly, when looking at the per kilogram intakes, this association changes and females are actually likely to consume more WM or F per kg of body mass (by 17% and 8% respectively) and similar amounts of RM per kg of body mass as males. The amount of RM and WM decreases with age (especially for the oldest group). Compared to respondents aged 18-34, people in the age group 35-49 eat smaller amounts of WM, while the group of 50-65-year-olds has lower daily red and white meat intake (by 8.2% and 30%) but slightly higher fish intake (by 4%). After body weight normalization decreasing trends for RM and WM in older people are more pronounced and F/kg intake is also smaller than for younger people. The results show that there is no statistical difference between the level of education and daily RM or WM consumption, however, there seems to be a positive association between fish consumption and higher education (which is consistent for fish proteins and similar results are found after normalization).

From the economic perspective, income seems to play a role but the effect is quite small. The elasticity between income and the amount of RM, WM and F is positive, however, it is very inelastic. Increasing income by 10% was estimated to increase the amount of RM, WM and F by 0.6%, 0.4% and 0.4% respectively. We see very similar values for proteins (0.7%, 0.4% and 0.5%). Being unemployed does not have any influence on the daily RM or WM intake but it does have a small negative impact on the F intake (and F proteins).

The results indicate that there are also significant differences in the consumption of meat and fish (and proteins) among analyzed countries. Compared to the Czechs, all other countries are estimated to consume more of all the categories - RM, WM and F (same for proteins). In Latvia, they tend to consume around 35% more RM but have comparable WM consumption. On average, Portuguese people are likely to eat more RM, WM and F by 22%, 37% and 69% compared to Czechs. Similarly, Spaniards tend to consume 66% more fish.

Among health indicators, smoking, body weight as well as computed healthiness of diet are significant. Respondents who smoke tend to eat more RM, WM and fish per day (ranging from 5% to 10%). Increasing body weight is associated with increases in red and white meat intake (and their protein consumption), though it is almost negligible (every one kg increase in body weight is likely to result in 0.3% (0.2%) increase in the amount of RM (WM)). The estimates are similar for corresponding protein intakes. Respondents with healthy diets are likely to consume less RM and WM (by 37% and 23%) and more fish (by 21%).

[14] The number of observations for these regressions is 10,070 (not including 276 vegetarians).

Table 4: Results for overall and protein intake of red meat (RM), white meat (WM) and fish (F) expressed in kcal/day, Heckman Sample Selection model.

	Overall intake			Protein intake		
	log(RM)	log(WM)	log(F)	log(P.RM)	log(P.WM)	log(P.F)
log(income)	0.058***	0.036***	0.042***	0.069***	0.037***	0.051***
	(0.012)	(0.011)	(0.012)	(0.013)	(0.011)	(0.011)
DK_income	0.038	0.007	−0.002	0.053*	0.010	0.001
	(0.026)	(0.025)	(0.025)	(0.028)	(0.025)	(0.025)
female	−0.132***	−0.0001	−0.130***	−0.098***	0.005	−0.099***
	(0.019)	(0.018)	(0.017)	(0.019)	(0.017)	(0.017)
edu (tertiary)	0.007	−0.020	0.066***	0.029	−0.016	0.092***
	(0.023)	(0.022)	(0.022)	(0.024)	(0.022)	(0.022)
edu (upper secondary)	0.033	−0.0004	0.027	0.048**	0.003	0.046**
	(0.022)	(0.020)	(0.020)	(0.022)	(0.020)	(0.020)
age (35-49)	−0.020	−0.139***	0.026	−0.008	−0.134***	0.035*
	(0.021)	(0.020)	(0.020)	(0.022)	(0.020)	(0.019)
age (50-65)	−0.084***	−0.296***	0.041*	−0.053**	−0.286***	0.051**
	(0.023)	(0.022)	(0.022)	(0.024)	(0.022)	(0.022)
town	0.011	0.065***	0.002	0.011	0.066***	0.005
	(0.020)	(0.019)	(0.019)	(0.021)	(0.019)	(0.019)
ES	0.131***	0.280***	0.661***	0.174***	0.283***	0.744***
	(0.031)	(0.029)	(0.029)	(0.032)	(0.029)	(0.029)
LV	0.347***	0.017	0.081***	0.295***	0.017	0.060**
	(0.030)	(0.028)	(0.028)	(0.031)	(0.028)	(0.028)
PT	0.217***	0.374***	0.687***	0.294***	0.381***	0.771***
	(0.032)	(0.030)	(0.030)	(0.034)	(0.030)	(0.030)
UK	0.160***	0.234***	0.374***	0.140***	0.233***	0.339***
	(0.029)	(0.027)	(0.027)	(0.030)	(0.027)	(0.027)
unemployed	−0.010	−0.019	−0.078***	−0.019	−0.022	−0.083***
	(0.032)	(0.030)	(0.030)	(0.033)	(0.030)	(0.030)
healthy diet	−0.370***	−0.230***	0.214***	−0.342***	−0.223***	0.279***
	(0.025)	(0.024)	(0.023)	(0.026)	(0.024)	(0.023)
body weight	0.003***	0.002***	−0.0001	0.003***	0.002***	0.00003
	(0.001)	(0.0005)	(0.0005)	(0.001)	(0.0005)	(0.0005)
smoking	0.101***	0.048***	0.078***	0.086***	0.044**	0.078***
	(0.019)	(0.018)	(0.018)	(0.020)	(0.018)	(0.018)
FF.price	0.047**	0.022	−0.097***	0.030	0.021	−0.116***
	(0.020)	(0.019)	(0.019)	(0.021)	(0.019)	(0.019)
FF.taste	0.080***	0.001	−0.019	0.071***	−0.0001	−0.028
	(0.018)	(0.017)	(0.017)	(0.019)	(0.017)	(0.017)
FF.quality	0.023	0.028	0.103***	0.046**	0.030	0.109***
	(0.021)	(0.020)	(0.020)	(0.022)	(0.019)	(0.019)
FF.habit	0.069***	0.013	−0.033*	0.070***	0.013	−0.040**
	(0.019)	(0.018)	(0.018)	(0.020)	(0.018)	(0.018)
FF.family	0.085***	0.042**	0.021	0.079***	0.040**	0.009
	(0.018)	(0.017)	(0.017)	(0.019)	(0.017)	(0.017)
FF.health	−0.076***	0.042**	0.094***	−0.058***	0.046**	0.126***
	(0.020)	(0.018)	(0.018)	(0.020)	(0.018)	(0.018)
FF.prod.methods	−0.021	−0.008	0.005	−0.017	−0.007	0.020
	(0.027)	(0.025)	(0.025)	(0.028)	(0.025)	(0.025)
FF.appearance	0.067***	0.030*	−0.019	0.080***	0.033*	−0.009
	(0.019)	(0.018)	(0.018)	(0.020)	(0.018)	(0.017)
FF.safety	0.014	0.020	0.073***	0.015	0.019	0.074***
	(0.022)	(0.021)	(0.020)	(0.023)	(0.021)	(0.020)
FF.convenience	−0.025	−0.005	−0.031	−0.037*	−0.006	−0.037*
	(0.020)	(0.019)	(0.019)	(0.021)	(0.019)	(0.019)
FF.origin	−0.026	−0.021	0.016	−0.022	−0.020	0.026
	(0.023)	(0.022)	(0.022)	(0.024)	(0.022)	(0.021)
altruistic	−0.024**	−0.003	0.007	−0.028***	−0.004	0.007
	(0.010)	(0.010)	(0.009)	(0.011)	(0.010)	(0.009)
biospheric	−0.002	−0.010	0.003	−0.001	−0.009	0.003
	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
egoistic	−0.019***	0.019***	0.054***	−0.024***	0.018***	0.050***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
hedonic	0.016*	0.011	−0.005	0.019*	0.011	−0.006
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)
security	0.040***	0.006	−0.035***	0.046***	0.007	−0.030***
	(0.011)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
Constant	3.830***	3.970***	3.428***	2.598***	3.047***	2.449***
	(0.069)	(0.065)	(0.068)	(0.072)	(0.065)	(0.067)
Observations	10,070	10,070	10,070	10,070	10,070	10,070
Log Likelihood	−12,662.180	−12,222.640	−12,905.580	−13,070.600	−12,198.780	−12,850.860
ρ	−0.951***	−0.906***	−0.056	−0.962***	−0.912***	−0.042
	(0.008)	(0.013)	(0.086)	(0.007)	(0.012)	(0.078)

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Analysing people's preferences with respect to RM consumption, those who value price, taste, habit, family and appearance of food a lot are likely to consume more red meat (by 5%, 8%, 7%, 9%, 7% respectively). On the other hand, those who value health are likely to eat lower amounts of RM. In the case of WM, there is a positive relationship with respect to family and health. For fish, there is a negative association with respect to price (and marginally habit). In contrast, those who value quality, health and safety tend to eat more fish. Surprisingly, egoists are likely to eat less RM but more WM and F and those who value security tend to eat more RM but less F. This is similar for proteins for the respective categories. Altruistic people tend to eat less RM.

5 Discussion

In this paper, we conducted both descriptive and econometric analyses of meat and fish consumption in five EU countries. After asking respondents how often they consume meat or fish, we were able to identify those who do not eat meat or fish at all. The most common reason for not eating meat or fish among the participants was ethics. Many of them said they do not eat MF because of environmental reasons, that they do not like the taste of MF or that it is unhealthy in their opinion (see Figure 2). Besides that, we examined the opinions on several meat-related issues. Almost 40% of the respondents think eating less meat can reduce human impacts on the environment, 25% do not agree with that statement and almost 30% of the respondents are neutral. The rest did not know or preferred not to answer (Figure A.5).

Although taxes are effective in changing behaviours (Jensen and Smed (2013), Mytton et al. (2012)), a low level of public acceptability of taxes complicates their implementation. A lower level of acceptability for the introduction of a meat tax has been found also in our survey. More than 45% oppose the introduction, 15% are neutral and 24% support this idea (Figure A.6). In the case of stopping meat subsidies, 34% are against it, 30% are in favour and almost 18% are neutral to this change in policy (Figure A.7).

Despite tax instruments being generally supported by the public far less, many economists argue that it is the most effective measure (OECD 2023). When it is already in place, it tends to have higher support, however, tax policies need to be designed well. Funke et al. (2022) suggest calling it a "levy" rather than a "tax" and reusing revenues effectively might ensure public support. Also, moderately high meat taxes might become more popular when combined with animal welfare standards, discounts on vegetarian meals, and information campaigns (Fesenfeld et al. 2020). They can become even more appealing when the tax revenues are used to support low-income households. As people are more sensitive to taxing meat, perhaps a change in subsidy structure (from meat products to plant-based products) could be the first policy instrument to consider.

Figure 1 shows that the average daily intake of specific meat and fish categories might vary between analysed countries. In order to properly address these and other differences, a regression analysis using Heckman selection method was carried out. This method is largely used when dealing with censored data, as is often the case in demand analysis for food products. We tested several models and by comparing goodness of fit measures (such as log-likelihood), we report the log-log model using the Maximum Likelihood method and Newton-Raphson algorithm.

Our results from participation equations suggest that gender is significant in terms of consuming red meat (fish) or not. Females are less likely to participate in the consumption of red meat or fish while there is no difference in the case of white meat. Goffman (1979) argues that men maximize and women minimize meat intake in their everyday life. Our results show that females are more likely to consume lower amounts of RM and F (similar to findings by Gossard and York (2003), Keller and Siegrist (2015) and Love and Sulikowski (2018), Koch et al. (2019)). However, after normalization of intake for body weight, the effect of gender changes - females tend to consume more white meat and fish per kilogram of body mass and similar amounts of red meat as males.

Research examining the frequency of meat consumption and education or age has been addressed in previous literature, too (Kirbiš et al. (2021), Koch et al. (2019)). In Germany, educational level, along with demographic factors such as gender and age, emerged as significant determinants of reduced meat consumption Koch et al. (2019). Similarly to their findings, our analysis shows that older people are more likely to consume meat or fish, but among those who do, the amount of RM and WM is significantly smaller than for young people. On the other hand, their consumption of fish is a bit larger compared to younger people. A study conducted in Slovenia revealed that educational level and socioeconomic status exert an influence on both the frequency of meat consumption and sustainable attitudes Kirbiš et al. (2021). In contrast to Kirbiš et al. (2021) and Koch et al. (2019), we do not find a significant relationship between education and meat consumption. Based on our results, tertiary education seems to have a positive impact only on fish consumption.

Regarding economic variables, income resulted to be consistently significant for all analysed food categories (RM, WM, F, P.RM, P.WM, P.F), which is in line with findings from Vranken et al. (2014) or Malek et al. (2018). We can note a higher income elasticity for meat (especially red meat) than for fish (for intake as well as proteins). Income elasticity is generally higher for protein intake of RM, WM and F, which might indicate that with increasing income people would eat meat and fish containing more proteins (perhaps higher quality meat and fish). However, this positive income effect is rather negligible. We find that the perceived importance of the price of food products is also a key factor, particularly for fish (those who care about prices are estimated to consume almost 10% less fish but around 5% more RM).

As expected, unemployment is negatively linked to fish consumption, however, it does not really influence the consumption of red or white meat. Paying attention to prices in general when grocery shopping is also negatively associated with fish consumption but those respondents who do pay attention to prices are likely to consume more red meat. This can be explained partly by findings by Einhorn (2021). They argue that individuals residing in Western countries with lower socioeconomic status demonstrate a tendency to consume greater quantities of meat and opt for lower-priced meat products.

The amount of RM, WM and F (and their proteins) differs significantly among the five EU countries. Compared to the Czech Republic, we identified much higher daily fish intakes (and similarly white meat intakes) in Spain and Portugal. Regarding RM consumption, participants from all analysed countries have higher RM intakes compared to Czechia, with the most notable difference in Latvia (on average 35%). This highlights the importance to understand the local context and provide solutions according to the local needs and patterns.

Overall, our findings suggest that income might not be such a huge problem if we want to achieve lower meat consumption since its impact is quite small. The perceived importance of the price of food products, in general, does have a larger effect (especially on fish consumption) but we see that other factors, such as age, gender, healthy habits, behavioural traits and values can be more influential. For example, people who consider price, taste, habit, family or appearance a lot during their purchases consume more RM (only family importance has this positive, though smaller, effect on WM intake, too). In contrast, valuing health has a negative impact on RM consumption. This might suggest that if we want to lower RM consumption (due to environmental or health reasons), we need to make meat alternatives or plant-based products taste and appear better. Their price should be also attractive for consumers (or at least competitive) to motivate them to choose these alternatives (to RM especially) and make it more habitual for them. Authorities can help with smarter (healthier and more environmental-friendly) choices by either taxing "bad" foods or subsidizing "good" ones.

Limitations

One of the limitations of this study is that the amount of meat and fish consumed was calculated based on self-reported portions eaten. Common to many studies that attempt to validate dietary assessment, reference methods might not reflect true intake (Cleghorn et al. 2016). Some papers suggest that people tend to underestimate the amount of food they eat (Bedard et al. 2004). Given that, we used a validated SFFFQ by Cleghorn et al. (2016) so this problem should be minimized.

Additionally, we would have included some other factors in the analysis, however, we did not have those data from the questionnaire. In particular, prices of specific meat and fish products for that period could be used to derive price elasticities. Information on religion might be an interesting factor to examine with respect to meat and fish consumption. Also, more precise data on the health conditions of the respondents would provide even more accurate results.

6 Conclusion

There is still a lot of work to do when it comes to examining the sustainability of our diets while taking into account that diets need to be nutritious for each one of us. Intervention studies would help to reveal what is necessary to change in order to lower the negative environmental impact and improve the nutritional quality of our diets. Moreover, it would show what interventions prove to be efficient, which might be useful for policy-makers or other stakeholders in the (public) health sector.

Besides that, there is some emerging research in the application of willingness-to-pay analysis, which can assess the monetary value individuals place on alternative products to meat, including plant-based substitutes. It has been used to test a mix of meat alternatives (Bates et al. 2023), meat alternatives based on algae (Weinrich and Elshiewy 2019) or cultured meat (Rombach et al. 2022). While previous studies have contributed new insights, there is still a vast expanse of unexplored territory in understanding consumer preferences and behaviours regarding meat substitutes. Providing information on the impacts of animal products and their plant-based alternatives, economic and other associations can be derived. This could allow us to understand what prevents people from buying these alternatives. It would help policy-makers determine factors that are important for consumers in their decision-making and consequently, how to make these products more accessible if the aim is to reduce overall animal consumption, and as a consequence to decrease the negative environmental and health impacts.

Diet is only one cornerstone to overall well-being. A holistic approach needs to be considered, where the management of not only diet but also exercise and physical health, mental health, sleep and stress levels are all considered.

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References

Abete, I., Romaguera, D., Vieira, A. R., de Munain, A. L., and Norat, T. (2014). Association between total, processed, red and white meat consumption and all-cause, cvd and ihd mortality: a meta-analysis of cohort studies. *British Journal of Nutrition*, 112(5):762–775.

Bates, Z.-L., Mesler, R., Chernishenko, J., and MacInnis, C. (2023). Open to experiencing... meat alternatives? the hexaco personality model and willingness to try, buy and pay among omnivores. *Food Quality and Preference*, 107:104830.

Bedard, D., Shatenstein, B., and Nadon, S. (2004). Underreporting of energy intake from a self-administered food-frequency questionnaire completed by adults in montreal. *Public health nutrition*, 7:675–81.

Bouvard, V., Loomis, D., Guyton, K. Z., Grosse, Y., Ghissassi, F. E., Benbrahim-Tallaa, L., Guha, N., Mattock, H., and Straif, K. (2015). Carcinogenicity of consumption of red and processed meat. *The Lancet Oncology*, 16(16):1599–1600.

Brink, E., Rossum, C., Postma-Smeets, A., Stafleu, A., Wolvers, D., Dooren, C., Toxopeus, I., Buurma-Rethans, E., Geurts, M., and Ocke, M. (2019). Development of healthy and sustainable food-based dietary guidelines for the netherlands. *Public Health Nutrition*, 22.

Chen, G.-C., Lv, D.-B., Pang, Z., and Liu, Q.-F. (2013). Red and processed meat consumption and risk of stroke: a meta-analysis of prospective cohort studies. *European Journal of Clinical Nutrition*, 67(1):91–95.

Cleghorn, C., Harrison, R., Ransley, J., Wilkinson, S., Thomas, J., and Cade, J. (2016). Can a dietary quality score derived from a short-form ffq assess dietary quality in uk adult population surveys? *Public Health Nutrition*, -1:1–9.

DTU (2023). National food institute (technical university of denmark) frida fooddata.dk. `https://frida.fooddata.dk/?lang=en`. Online. Accessed 2023-06-25.

Einhorn, L. (2021). Meat consumption, classed?fleischkonsum und soziale ungleichheit: The socioeconomic underpinnings of dietary changewie sozioökonomische unterschiede unsere ernährungsgewohnheiten beeinflussen können. *Österreichische Zeitschrift für Soziologie*, 46.

Etemadi, A., Sinha, R., Ward, M., Graubard, B., Inoue-Choi, M., Dawsey, S., and Abnet, C. (2017). Mortality from different causes associated with meat, heme iron, nitrates, and nitrites in the nih-aarp diet and health study: Population based cohort study. *BMJ*, 357:j1957.

FAO (2020). World Food and Agriculture - Statistical Yearbook 2020. Technical report, FAO, Rome, Italy.

FAO (2023). FAOSTAT Datasets. `http://www.fao.org/faostat/en/#data`. Online. Accessed 2023-09-03.

Farvid, M. S., Cho, E., Chen, W. Y., Eliassen, A., and Willett, W. C. (2015). Adolescent meat intake and breast cancer risk. *International Journal of Cancer*, 136(8):1909–1920.

Farvid, M. S., Cho, E., Chen, W. Y., Eliassen, A. H., and Willett, W. C. (2014). Dietary protein sources in early adulthood and breast cancer incidence: prospective cohort study. *BMJ*, 348.

Fesenfeld, L., Wicki, M., Sun, Y., and Bernauer, T. (2020). Policy packaging can make food system transformation feasible. *Nature Food*, 1:173–182.

Feskens, E. J. M., Sluik, D., and van Woudenbergh, G. J. (2013). Meat Consumption, Diabetes, and Its Complications. *Current Diabetes Reports*, 13(2):298–306.

Fransen, E. (2011). Identifying the driving forces of global beef consumption: A Panel Data Analysis. Master's thesis, Wageningen University, Department of Social Sciences. unpublished thesis.

Funke, F., Mattauch, L., Bijgaart, I., Godfray, C., Hepburn, C., Klenert, D., Springmann, M., and Treich, N. (2022). Toward optimal meat pricing: Is it time to tax meat consumption? *Review of Environmental Economics and Policy*, 16:000–000.

Goffman, E. (1979). *Gender advertisements / Erving Goffman.* Harvard University Press Cambridge, Mass.

Gossard, M. and York, R. (2003). Social Structural Influences on Meat Consumption. *Human Ecology Review*, 10.

Heckman, J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. In *Annals of Economic and Social Measurement, Volume 5, number 4*, pages 475–492. National Bureau of Economic Research, Inc.

Hlavac, M. (2018). *stargazer: Well-Formatted Regression and Summary Statistics Tables.* Central European Labour Studies Institute (CELSI), Bratislava, Slovakia. R package version 5.2.2.

IHME (2020). Gbd 2019 cause and risk summary: Diet high in red meat — level 3 risk. `https://www.healthdata.org/results/gbd_summaries/2019`. Seattle, USA: IHME, University of Washington, Online. Accessed 2022-07-01.

Jensen, J. and Smed, S. (2013). The danish tax on saturated fat - short run effects on consumption, substitution patterns and consumer prices of fats. *Food Policy*, 42:18–31.

Keller, C. and Siegrist, M. (2015). Does personality influence eating styles and food choices? direct and indirect effects. *Appetite*, 84:128 – 138.

Kirbiš, A., Lamot, M., and Javornik, M. (2021). The role of education in sustainable dietary patterns in slovenia. *Sustainability*, 13:13036.

Koch, F., Heuer, T., Krems, C., and Claupein, E. (2019). Meat consumers and non-meat consumers in germany: A characterisation based on results of the german national nutrition survey ii. *Journal of nutritional science*, 8:e21.

Koch, F., Krems, C., Heuer, T., and Claupein, E. (2021). Attitudes, perceptions and behaviours regarding meat consumption in germany: results of the nemonit study. *Journal of Nutritional Science*, 10.

Kovljenic, M. and Savic, M. (2017). Factors influencing meat and fish consumption in Serbian households: Evidence from SILC database. *Ekonomika poljoprivrede*, 64:945–956.

Love, H. J. and Sulikowski, D. (2018). Of meat and men: Sex differences in implicit and explicit attitudes toward meat. *Frontiers in Psychology*, 9(APR).

Malek, L., Umberger, W., and Goddard, E. (2018). Is anti-consumption driving meat consumption changes in australia? *British Food Journal*, 121.

Merrey, D., Meinzen-Dick, R., Mollinga, P., and Karar, E. (2007). Water for food - water for life, comprehensive assessment of water management in agriculture. *Policy and Institutional Reform: the Art of the Possible*, pages 193–232.

Muhammad, A., D'Souza, A., Meade, B., Micha, R., and Mozaffarian, D. (2017). How income and food prices influence global dietary intakes by age and sex: Evidence from 164 countries. *BMJ Global Health*, 2:e000184.

Mytton, O., Clarke, D., and Rayner, M. (2012). Taxing unhealthy food and drinks to improve health. *BMJ (Clinical research ed.)*, 344:e2931.

Nelson, M. E., Hamm, M. W., Hu, F. B., Abrams, S. A., and Griffin, T. S. (2016). Alignment of healthy dietary patterns and environmental sustainability: A systematic review. *Advances in Nutrition*, 7 6:1005–1025.

OECD (2023). *How Green is Household Behaviour?*

Pan, A., Sun, Q., Bernstein, A. M., Schulze, M. B., Manson, J. E., Stampfer, M. J., Willett, W. C., and Hu, F. B. (2012). Red Meat Consumption and Mortality: Results From 2 Prospective Cohort Studies. *Archives of Internal Medicine*, 172(7):555–563.

Predanócyová, K., Kubicová, , Kadekova, Z., and Košičiarová, I. (2019). Key factors affecting consumption of meat and meat products from perspective of slovak consumers. *Potravinarstvo Slovak Journal of Food Sciences*, 13:1001–1012.

Puhani, P. (2000). The heckman correction for sample selection and its critique. *Journal of Economic Surveys*, 14(1):53–68.

R Core Team (2020). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria.

Rombach, M., Dean, D., Vriesekoop, F., de Koning, W., Aguiar, L., Anderson, M., Mongondry, P., Oppong-Gyamfi, M., Urbano, B., Gómez-Luciano, C. A., Hao, W., Eastwick, E., Jiang, Z., and Boereboom, A. (2022). Is cultured meat a promising consumer alternative? exploring key factors determining consumer's willingness to try, buy and pay a premium for cultured meat. *Appetite*, 179:106307.

Schmid, A., Gille, D., Piccinali, P., Bütikofer, U., Chollet, M., Altintzoglou, T., Honkanen, P., Walther, B., and Stoffers, H. (2017). Factors predicting meat and meat products consumption among middle-aged and elderly people: Evidence from a consumer survey in switzerland. *Food Nutrition Research*, 61:1308111.

Schoeller, D. (1990). How accurate is self-reported dietary energy intake? *Nutrition reviews*, 48:373–9.

Sinha, R., Cross, A. J., Graubard, B. I., Leitzmann, M. F., and Schatzkin, A. (2009). Meat Intake and Mortality: A Prospective Study of Over Half a Million People. *Archives of Internal Medicine*, 169(6):562–571.

Smutna, S. and Scasny, M. (2017). Selectivity Problem in Demand Analysis: Single Equation Approach. Working Papers IES 2017/21, Charles University Prague, Faculty of Social Sciences, Institute of Economic Studies.

Sokolowski, C., Higgins, S., Vishwanathan, M., and Evans, E. (2019). The Relationship Between Animal and Plant Protein Intake and Overall Diet Quality in Young Adults. *Clinical Nutrition*, 39.

Springmann, M., Godfray, H. C. J., Rayner, M., and Scarborough, P. (2016). Analysis and valuation of the health and climate change cobenefits of dietary change. *Proceedings of the National Academy of Sciences*, 113(15):4146–4151.

Stewart, C., Piernas, C., Cook, B., and Jebb, S. (2021). Trends in uk meat consumption: analysis of data from years 1-11 (2008-09 to 2018-19) of the national diet and nutrition survey rolling programme. *The Lancet. Planetary health*, 5:e699–e708.

Tilman, D., Fargione, J., Wolff, B., D'antonio, C., Dobson, A., Howarth, R., Schindler, D., Schlesinger, W. H., Simberloff, D., and Swackhamer, D. (2001). Forecasting agriculturally driven global environmental change. *Science*, 292(5515):281–284.

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica*, 26(1):24–36.

Toomet, O. and Henningsen, A. (2008). Sample selection models in r: Package sampleselection. *Journal of Statistical Software*, 27(7):1–23.

Tukker, A. and Jansen, B. (2006). Environmental impacts of products: A detailed review of studies. *Journal of Industrial Ecology*, 10(3):159–182.

USDA (2018). USDA Food and Nutrient Database for Dietary Studies 2017-2018. Report, U.S. Department of Agriculture, Agricultural Research Service, Food Surveys Research Group.

USDA (2020). U.S. Department of Agriculture: Healthy Eating Index (HEI). `https://www.fns.usda.gov/healthy-eating-index-hei`. Online. Accessed 2021-04-29.

Vermeulen, S., Campbell, B. M., and Ingram, J. (2012). Climate change and food systems. *Annual Review of Environment and Resources*, 37:195–222.

Vinnari, M., Mustonen, P., and Räsänen, P. (2010). Tracking down trends in non-meat consumption in finnish households, 1966-2006. *BRITISH FOOD JOURNAL*, 112:836–852.

Vranken, L., Avermaete, T., Petalios, D., and Mathijs, E. (2014). Curbing global meat consumption: Emerging evidence of a second nutrition transition. *Environmental Science Policy*, 39:95–106.

Weinrich, R. and Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite*, 142:104353.

Willett, W., Rockstrom, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S. E., Srinath Reddy, K., Narain, S., Nishtar, S., and Murray, C. J. L. (2020). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Technical Report 10170, The Lancet.

Wooldridge, J. M. (2013). *Introductory Econometrics: A Modern Approach*, volume 5. Cengage Learning.

WRAP (2019). Food Futures: From Business as Usual to Business Unusual. Technical report, WRAP. Available online: http://www.wrap. org.uk/content/food-futures (accessed on 4 May 2021).

Zverinova, I., Máca, V., Ščasný, M., Strube, R., Marques, S., Dubová, D., Kryl, M., Craveiro, D., Taylor, T., Chiabai, A., and García de Jalón, S. (2020). How to achieve a healthier and more sustainable europe by 2040 according to the public? results of a five-country questionnaire survey. *International Journal of Environmental Research and Public Health*, 17:6071.

Zverinova, I., Scasny, M., and Maca, V. (2018). INHERIT: Barriers and Potential for Adopting Healthier, More Equitable and Environmentally Friendly Solutions Identified in a Five-Country Survey. Report, Charles University Environment Centre, Prague.

A Supplementary figures

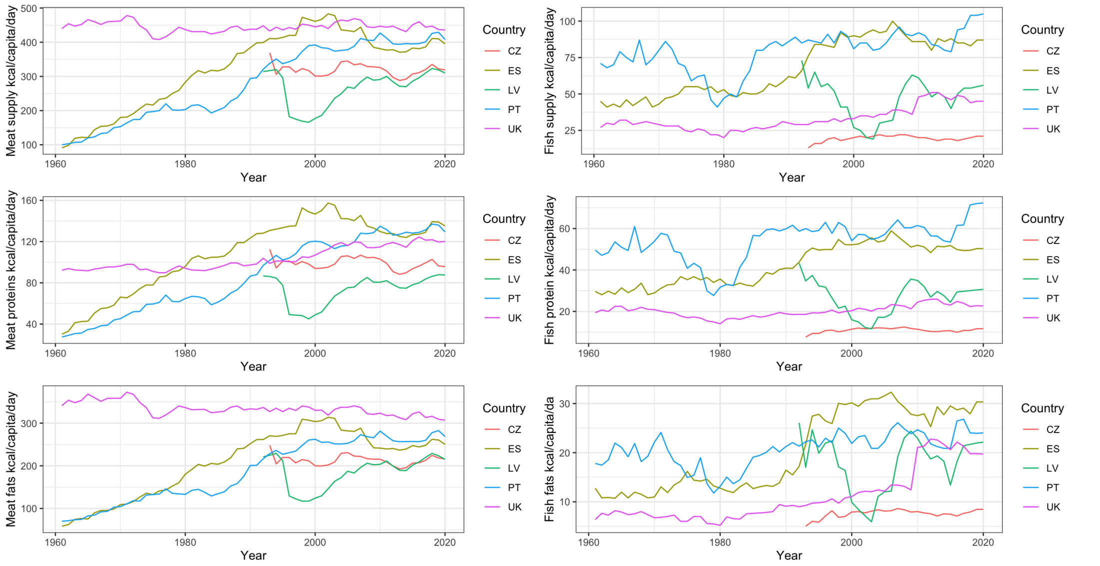

Figure A.1: Long-run trends in meat (left) and fish and seafood (right) supply (top), proteins (middle) and fats (bottom) expressed in kcal/capita/day by country from 1960 (if applicable) until 2020. Created by authors using data from FAO (2023) for five European countries - Czech Republic (CZ), Spain (ES), Latvia (LV), Portugal (PT), United Kingdom (UK).

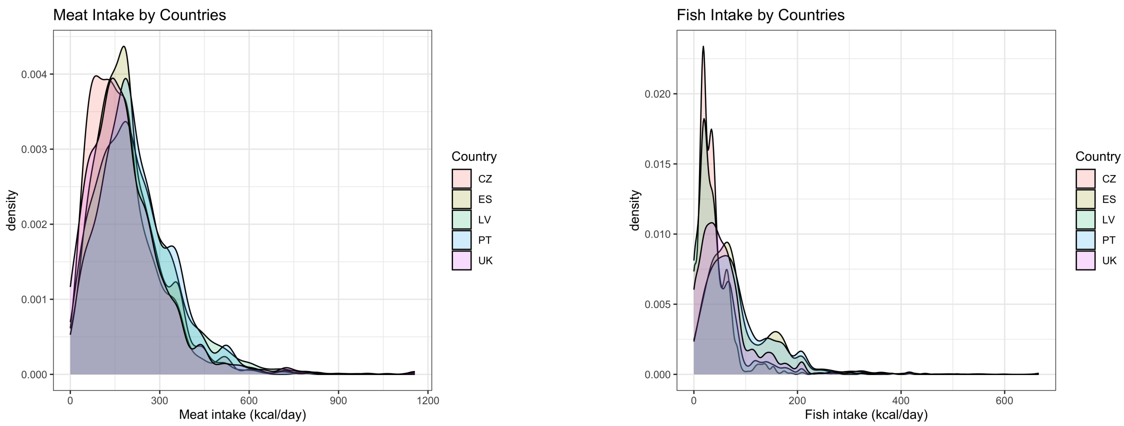

Figure A.3: Density plots of meat intake and fish intake by country.

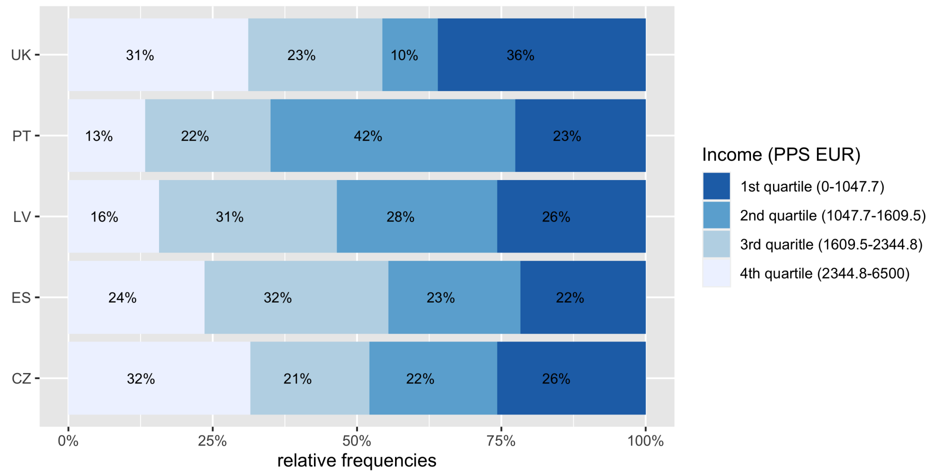

Figure A.4: Respondents' household income (adjusted by purchasing parity to PPS euros).

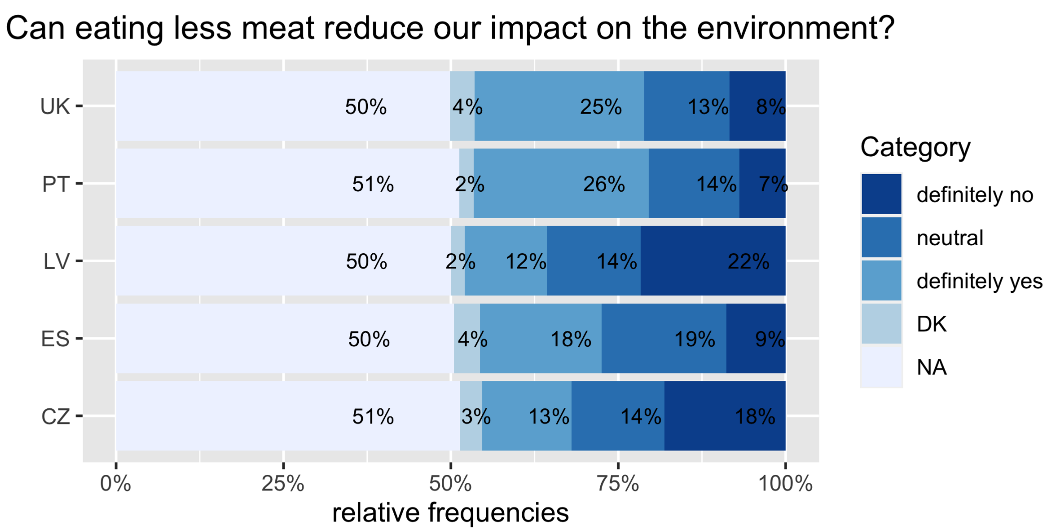

Figure A.5: Respondents' opinion on meat impact on the environment those who did not reply denoted as "NA"). "DK" stands for "did not know" or "did not want to answer".

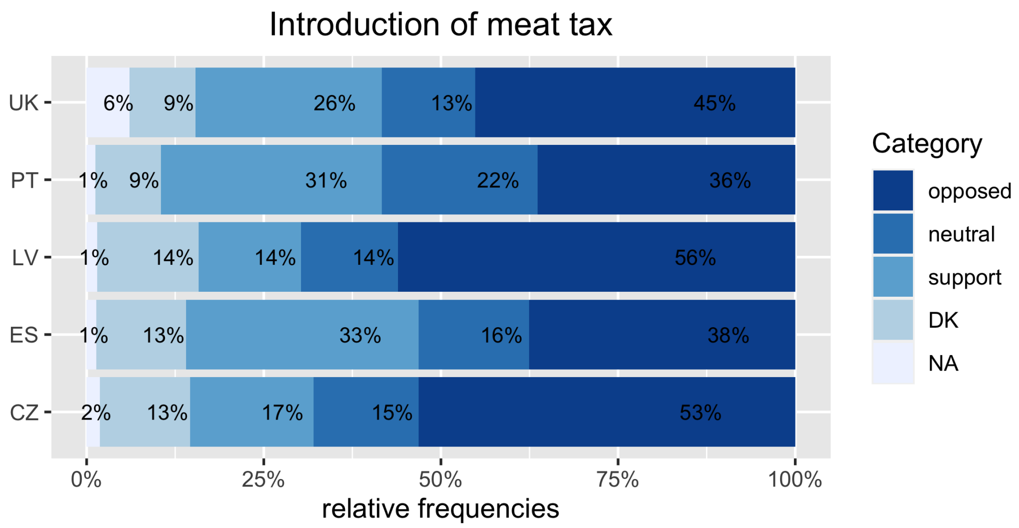

Figure A.6: Respondents' opinion on meat tax (those who did not reply denoted as "NA"). "DK" stands for "did not know" or "did not want to answer".

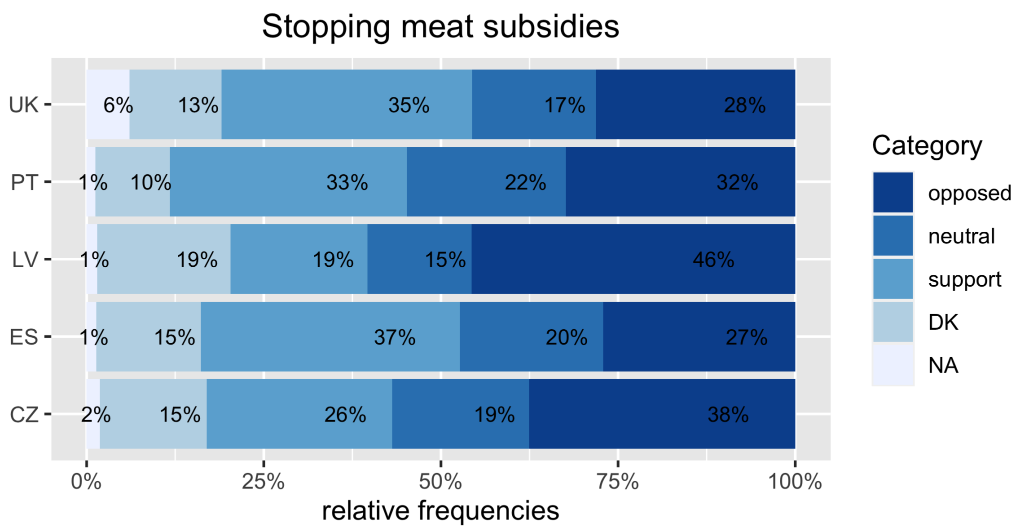

Figure A.7: Respondents' opinion on meat subsidies (those who did not reply denoted as "NA"). "DK" stands for "did not know" or "did not want to answer".

B Supplementary tables

Table B.1: Distribution of gender, age, education and type of residence in the Czech Republic (CZ), Spain (ES), Latvia (LV), Portugal (PT) and the United Kingdom (UK) expressed in percentages.

	CZ	ES	LV	PT	UK
Gender					
Female	51	50	54	47	54
Age					
18-34 yrs	31	30	33	36	35
35-49 yrs	38	42	35	40	34
50-65 yrs	31	28	32	24	31
Education					
Primary & lower secondary	43	39	9	38	21
Upper secondary	37	27	58	34	39
Tertiary	20	34	33	28	40
Residence					
Town + City	62	87	69	77	79

Table B.2: Summary statistics for dummy variables expressed in percentages.

	All	CZ	ES	LV	PT	UK
Unemployed	8	3	16	6	11	6
Smoking	28	33	35	28	26	19
Healthy diet (perceived)	19	9	27	12	22	21
Healthy diet (computed)	15	7	19	6	19	20

Note: Respondents' perceived healthiness of their diet is determined based on a scale ranging from 1 (very unhealthy) to 7 (very healthy). In this context, a perceived healthy diet corresponds to responses with values greater than 4. The computed healthiness of their diet is established by analyzing respondents' food consumption patterns in alignment with the "Wheel of Five" by Brink et al. (2019)).

Table B.3: Summary statistics for food factors (FFs) dummy variables expressed in percentages.

	CZ	ES	LV	PT	UK
FF.price	77	65	84	85	74
FF.taste	61	52	60	28	75
FF.quality	73	75	73	80	71
FF.habit	45	28	35	28	23
FF.family	38	39	37	47	31
FF.health	30	41	29	47	29
FF.production.methods	9	16	14	18	16
FF.appearance	69	52	62	60	42
FF.safety	14	30	27	33	20
FF.convenience	26	22	25	15	32
FF.origin.country	29	15	23	18	11

Table B.4: Mean intakes of red meat, white meat and fish per kg of body mass by country.

	Unit	All	CZ	ES	LV	PT	UK
Overall intake per kg of body mass (means)							
Red meat	kcal/kg/day	1.44	1.19	1.57	1.77	1.46	1.27
White meat	kcal/kg/day	1.37	1.04	1.59	1.18	1.70	1.35
Fish	kcal/kg/day	0.92	0.48	1.33	0.60	1.30	0.90
Protein intake per kg of body mass (means)							
Red meat	kcal/kg/day	0.46	0.38	0.50	0.54	0.50	0.40
White meat	kcal/kg/day	0.55	0.42	0.64	0.48	0.69	0.54
Fish	kcal/kg/day	0.39	0.19	0.57	0.24	0.58	0.36

Table B.5: Percentage of vegetarians and share of zero consumption of specific meat and fish by country.

	Unit	All	CZ	ES	LV	PT	UK
Vegetarians	%	3	2	1	2	1	6
Red meat	%	3	1	2	2	2	5
White meat	%	3	2	2	3	1	5
Fish	%	6	6	3	8	2	8

B.1 Supplementary regressions from Sample Selection model

Table B.6: Results for the participation equation from the Heckman Sample Selection model for red meat (RM), white meat (WM) and fish (F) intake and RM, WM and F proteins in kcal/day.

	Overall intake			Protein intake		
	RM$_{dummy}$	WM$_{dummy}$	F$_{dummy}$	RM$_{dummy}$	WM$_{dummy}$	F$_{dummy}$
log(income)	0.010	−0.007	0.071**	−0.005	−0.011	0.071**
	(0.033)	(0.033)	(0.028)	(0.031)	(0.033)	(0.028)
DK_income	0.011	−0.062	−0.105*	−0.005	−0.065	−0.105*
	(0.066)	(0.071)	(0.062)	(0.064)	(0.070)	(0.062)
female	−0.119**	−0.023	−0.114**	−0.116**	−0.023	−0.114**
	(0.051)	(0.051)	(0.047)	(0.050)	(0.051)	(0.047)
edu (tertiary)	−0.028	−0.097	0.256***	−0.042	−0.092	0.257***
	(0.063)	(0.065)	(0.061)	(0.061)	(0.064)	(0.061)
edu (upper secondary)	−0.009	−0.012	0.122**	−0.019	−0.005	0.122**
	(0.062)	(0.063)	(0.053)	(0.061)	(0.062)	(0.053)
age (35-49)	−0.043	−0.038	0.204***	−0.043	−0.039	0.204***
	(0.055)	(0.061)	(0.051)	(0.053)	(0.060)	(0.051)
age (50-65)	0.069	−0.110*	0.294***	0.038	−0.110*	0.294***
	(0.064)	(0.064)	(0.058)	(0.062)	(0.063)	(0.058)
town	−0.047	0.024	0.091*	−0.052	0.022	0.091*
	(0.056)	(0.055)	(0.048)	(0.055)	(0.055)	(0.048)
ES	−0.242**	0.022	0.319***	−0.291***	0.011	0.319***
	(0.099)	(0.095)	(0.085)	(0.095)	(0.094)	(0.085)
LV	−0.268***	0.033	−0.205***	−0.235**	0.031	−0.206***
	(0.096)	(0.086)	(0.070)	(0.092)	(0.085)	(0.070)
PT	−0.173*	0.100	0.345***	−0.188*	0.087	0.344***
	(0.103)	(0.107)	(0.092)	(0.099)	(0.106)	(0.092)
UK	−0.429***	−0.205***	−0.240***	−0.391***	−0.213***	−0.240***
	(0.087)	(0.079)	(0.070)	(0.085)	(0.079)	(0.070)
unemployed	−0.101	−0.005	−0.141*	−0.074	−0.006	−0.140*
	(0.079)	(0.087)	(0.077)	(0.077)	(0.086)	(0.077)
healthy diet	−0.270***	−0.375***	0.752***	−0.215***	−0.363***	0.752***
	(0.058)	(0.062)	(0.111)	(0.057)	(0.061)	(0.111)
body weight	0.003**	0.001	0.001	0.003**	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
smoking	0.008	0.051	−0.129***	−0.007	0.047	−0.128***
	(0.056)	(0.055)	(0.047)	(0.054)	(0.055)	(0.047)
FF.price	0.046	−0.011	−0.035	0.038	−0.011	−0.034
	(0.054)	(0.055)	(0.054)	(0.052)	(0.055)	(0.054)
FF.taste	−0.032	0.052	−0.051	−0.039	0.049	−0.051
	(0.051)	(0.052)	(0.047)	(0.049)	(0.052)	(0.047)
FF.quality	0.082	0.084	0.148***	0.057	0.081	0.149***
	(0.055)	(0.057)	(0.048)	(0.054)	(0.057)	(0.048)
FF.habit	−0.093*	0.038	−0.016	−0.101**	0.040	−0.016
	(0.053)	(0.057)	(0.048)	(0.051)	(0.057)	(0.048)
FF.family	0.123**	0.058	0.113**	0.094*	0.056	0.113**
	(0.053)	(0.054)	(0.047)	(0.052)	(0.054)	(0.047)
FF.health	−0.035	−0.029	0.054	−0.035	−0.030	0.054
	(0.051)	(0.056)	(0.053)	(0.049)	(0.056)	(0.053)
FF.production.methods	−0.162***	−0.200***	0.216**	−0.144**	−0.198***	0.216**
	(0.062)	(0.067)	(0.084)	(0.060)	(0.067)	(0.084)
FF.appearance	−0.014	0.031	0.112**	−0.031	0.027	0.112**
	(0.051)	(0.054)	(0.049)	(0.050)	(0.054)	(0.049)
FF.safety	−0.036	0.074	0.014	−0.033	0.074	0.014
	(0.057)	(0.063)	(0.061)	(0.055)	(0.063)	(0.061)
FF.convenience	−0.007	0.014	−0.015	0.004	0.010	−0.015
	(0.056)	(0.059)	(0.051)	(0.055)	(0.059)	(0.051)
FF.origin	0.044	−0.004	0.067	0.051	−0.001	0.067
	(0.065)	(0.064)	(0.067)	(0.063)	(0.064)	(0.067)
altruistic	0.012	0.004	−0.013	0.019	0.004	−0.013
	(0.026)	(0.027)	(0.025)	(0.026)	(0.027)	(0.025)
biospheric	−0.075***	−0.056**	0.019	−0.067***	−0.055**	0.019
	(0.023)	(0.025)	(0.022)	(0.023)	(0.025)	(0.022)
egoistic	0.036*	0.045**	0.029	0.038**	0.044**	0.029
	(0.019)	(0.020)	(0.018)	(0.019)	(0.020)	(0.018)
hedonic	0.036	0.005	−0.014	0.028	0.006	−0.014
	(0.024)	(0.025)	(0.023)	(0.023)	(0.025)	(0.023)
security	0.013	0.035	0.047*	−0.001	0.033	0.047*
	(0.030)	(0.029)	(0.026)	(0.029)	(0.029)	(0.026)
Constant	1.910***	1.712***	0.774***	1.997***	1.729***	0.773***
	(0.184)	(0.189)	(0.163)	(0.179)	(0.188)	(0.163)
Observations	10,070	10,070	10,070	10,070	10,070	10,070
Log Likelihood	−12,662.2	−12,222.6	−12,905.6	−13,070.6	−12,198.8	−12,850.9
ρ	−0.951***	−0.906***	−0.056	−0.962***	−0.912***	−0.042
	(0.008)	(0.013)	(0.086)	(0.007)	(0.012)	(0.078)

Note: Robust SE *p<0.1; **p<0.05; ***p<0.01

Table B.7: Results for overall and protein intake of red meat (RM), white meat (WM) and fish (F) expressed in kcal/day per kilogram of body weight, Heckman Sample Selection model.

	Overall intake			Protein intake		
	log(RM/kg)	log(WM/kg)	log(F/kg)	log(P.RM/kg)	log(P.WM/kg)	log(P.F/kg)
log(income)	0.069***	0.042***	0.045***	0.080***	0.042***	0.054***
	(0.013)	(0.012)	(0.013)	(0.013)	(0.012)	(0.013)
DK_income	0.062**	0.060**	0.018	0.082***	0.063**	0.027
	(0.029)	(0.028)	(0.028)	(0.030)	(0.028)	(0.028)
female	−0.004	0.174***	0.080***	0.029	0.179***	0.106***
	(0.018)	(0.017)	(0.018)	(0.019)	(0.017)	(0.018)
edu (tertiary)	−0.001	−0.021	0.085***	0.018	−0.017	0.108***
	(0.024)	(0.023)	(0.024)	(0.025)	(0.023)	(0.023)
edu (upper secondary)	0.025	0.001	0.031	0.039*	0.003	0.049**
	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)
age (35-49)	−0.091***	−0.218***	−0.055***	−0.078***	−0.214***	−0.046**
	(0.021)	(0.021)	(0.021)	(0.022)	(0.020)	(0.021)
age (50-65)	−0.186***	−0.414***	−0.062***	−0.154***	−0.405***	−0.052**
	(0.023)	(0.022)	(0.023)	(0.024)	(0.022)	(0.023)
town	0.0004	0.066***	0.005	−0.002	0.067***	0.007
	(0.021)	(0.020)	(0.021)	(0.022)	(0.020)	(0.020)
ES	0.211***	0.374***	0.778***	0.259***	0.376***	0.863***
	(0.031)	(0.030)	(0.031)	(0.032)	(0.030)	(0.030)
LV	0.366***	0.018	0.073**	0.314***	0.019	0.051*
	(0.030)	(0.029)	(0.030)	(0.031)	(0.029)	(0.030)
PT	0.300***	0.461***	0.793***	0.379***	0.468***	0.880***
	(0.032)	(0.031)	(0.032)	(0.034)	(0.031)	(0.032)
UK	0.161***	0.283***	0.432***	0.138***	0.283***	0.396***
	(0.032)	(0.029)	(0.030)	(0.033)	(0.029)	(0.029)
unemployed	−0.034	−0.025	−0.076**	−0.041	−0.027	−0.085***
	(0.033)	(0.032)	(0.033)	(0.034)	(0.032)	(0.032)
healthy diet	−0.393***	−0.209***	0.232***	−0.371***	−0.202***	0.296***
	(0.027)	(0.025)	(0.025)	(0.028)	(0.025)	(0.025)
smoking	0.130***	0.058***	0.096***	0.114***	0.055***	0.093***
	(0.020)	(0.019)	(0.019)	(0.020)	(0.019)	(0.019)
FF.price	0.034	0.010	−0.099***	0.019	0.009	−0.114***
	(0.021)	(0.021)	(0.021)	(0.022)	(0.020)	(0.021)
FF.taste	0.084***	−0.007	−0.013	0.074***	−0.008	−0.021
	(0.019)	(0.018)	(0.018)	(0.020)	(0.018)	(0.018)
FF.quality	0.050**	0.040*	0.110***	0.075***	0.041**	0.114***
	(0.022)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)
FF.habit	0.057***	0.011	−0.040**	0.059***	0.011	−0.046**
	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)	(0.019)
FF.family	0.103***	0.033*	0.013	0.099***	0.031*	0.0003
	(0.019)	(0.018)	(0.018)	(0.019)	(0.018)	(0.018)
FF.health	−0.087***	0.047**	0.093***	−0.069***	0.050***	0.126***
	(0.020)	(0.019)	(0.020)	(0.021)	(0.019)	(0.019)
FF.prod.methods	−0.051*	−0.001	0.040	−0.048*	0.00004	0.058**
	(0.028)	(0.027)	(0.027)	(0.029)	(0.027)	(0.026)
FF.appearance	0.063***	0.029	−0.031	0.077***	0.032*	−0.021
	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)	(0.019)
FF.safety	0.011	0.017	0.063***	0.013	0.016	0.064***
	(0.022)	(0.022)	(0.022)	(0.023)	(0.022)	(0.022)
FF.convenience	−0.035*	−0.017	−0.038*	−0.044**	−0.018	−0.045**
	(0.021)	(0.020)	(0.021)	(0.022)	(0.020)	(0.021)
FF.origin	−0.026	−0.032	0.002	−0.021	−0.031	0.013
	(0.024)	(0.023)	(0.023)	(0.025)	(0.023)	(0.023)
altruistic	−0.025**	−0.008	0.005	−0.028***	−0.008	0.005
	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
biospheric	−0.009	−0.005	0.008	−0.009	−0.005	0.008
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)
egoistic	−0.014*	0.022***	0.054***	−0.018**	0.021***	0.048***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
hedonic	0.018**	0.011	−0.005	0.021**	0.011	−0.006
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)
security	0.044***	0.005	−0.034***	0.050***	0.006	−0.027**
	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)	(0.011)
Constant	−0.373***	−0.270***	−1.025***	−1.609***	−1.187***	−1.991***
	(0.057)	(0.055)	(0.060)	(0.059)	(0.055)	(0.059)
Observations	9,248	9,245	9,289	9,248	9,245	9,289
Log Likelihood	−11,960.5	−11,508.3	−12,240.8	−12,330.4	−11,491.1	−12,173.1
ρ	−0.020	−0.677***	−0.081	−0.019	−0.684***	−0.064
	(0.156)	(0.043)	(0.080)	(0.153)	(0.041)	(0.075)

Note: Robust SE — *p<0.1; **p<0.05; ***p<0.01

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