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2020   **Klára Hanusová**

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Health, Happiness and Consumption of Sugary Goods

Bachelor thesis

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Abstract

Numerous studies have examined socio-economic and demographic determinants of sugar consumption, happiness, and life satisfaction. However, little is still known about association between sugar consumption on one side and happiness (or life satisfaction), on the other side, in particular, if we control for other key factors such as health, dietary patterns, or even addictive behaviour that all potentially affect both sugar consumption and life satisfaction. This thesis fills this research gap. Individual-level data obtained from the INHERIT multi-country survey are used to analyse these determinants in five European countries, the Czech Republic, Latvia, Portugal, Spain, and the United Kingdom. The analysis is relying on several econometric models for count and limited dependent variable data, including negative binomial, logit, multinomial logit, and bivariate probit. We found that younger, respondents with children, and in particular males are eating more portions of sugary goods. Higher consumption of sugary goods is also correlated with eating more meat and smoking, and bad health status, gastrointestinal disease in particular, that is likely consequence of these health-adverse habits. Many of the explanatory variables which are positively associated with sugar consumption, tend to have opposite relationship with both happiness and life satisfaction. Higher income makes people more satisfied and happy, however, its effect on consumption of sugary goods is not significant or weakly negative and only in one country. We do not find, however, that sugar consumption and life satisfaction (or happiness) are associated one to the other either way. Despite the fact happiness and life satisfaction have been used in the literature interchangeably, the two measure different concepts of life quality. In our study we found the two are strongly and positively correlated and are associated with similar factors.

Keywords

Bibliografický záznam

Abstrakt

Existuje mnoho studijí, které zkoumají socio-ekonomické a demografické determinanty spotřeby cukru, štěstí a životní spokojenosti. Avšak o asociacích mezi spotřebou cukru na jedné straně a štěstím (životní spokojeností) na druhé, se toho ví málo, hlavně pokud je zároveň zkoumán i vlyv jiných důležitých faktorů jako je zdraví, stravovací návyky a v neposlední řadě i závislosti, které by potencionálně mohli mít efekt na spotřebu cukru i životní spokojenost. Tato práce vyplňuje danou mezeru ve výzkumu. Data zjišťované na úrovni jednotlivce, získána z INHERIT průzkumu vícero zemí jsou použita na analýzu determinantů v pěti evropských zemích, České republice, Lotyšsku, Portugalsku, Španělsku a Spojeném Království. Analýza se opíra o několik ekonometrických modelů, včetně negativního binomického, logit, multinomického logit a bivariate probit modelu. Zjistili jsme, že mladí lidé, lidé s dětmi a muži konzumují více porcí cukru. Vyšší konzumace cukru je korelována i s konzumací masa, kouřením, a špatným zdravotním stavem, obzvlášť s gastrointestinálními onemocněními, které jsou pravděpodobně výsledkem těchto zdraví nepříznivých návyků. Mnohé z vysvětlujících proměnných které mají pozitivní vztah ke konzumaci cukru mají ke štěstí a životní spokojenosti vztah opačného charakteru. Vyšší příjem činí lidi šťastnějšími a spokojenějšími, avšak jeho vlyv na spotřebu cukru není signifikantní, nebo má malý negativní efekt, a to pouze v případě jedné země. Asociace mezi spotřebou cukru a životní spokojeností (nebo štěstím) nebyla nalezena v žádném směru. I navzdory tomu, že jsou štěstí a životní spokojenost v literatuře často zaměňovány, obojí představuje různé koncepty měření kvality života. V této studii jsou štěstí a spokojenost silně pozitivně korelovány a je nalezena jejich asociace s podobnými faktory.

Klíčová slova

cukr; poptávka spotřebitelů; životní spokojenost; štěstí; zdraví; diety

Rozsah práce: 64 844 znaků (včetně mezer)

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague, May 5th 2020   Klára Hanusová

Acknowledgments

Acronyms

OLS   Ordinary Least Squares
SFFQ   Short-Form Food Frequency Questionnaire
SSBs   Sugar-Sweetened Beverages

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Bachelor's Thesis Proposal

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Notes: Please enter the information from the proposal to the Student Information System (SIS) and submit the proposal signed by yourself and by the supervisor to the Academic Director ("garant") of the undergraduate program.

Proposed Topic:

Health, happiness and consumption of sugary goods

Preliminary scope of work:

Research question and motivation

The main research question I intend to study is how the consumption of sugar is associated with life satisfaction, in particular with happiness.

There exists a considerable number of research papers analyzing determinants of happiness suggesting that there are various factors that have an influence on happiness. One of the first rigorous studies analysing the determinants of happiness is Easterlin (1973) who aimed at association between happiness and wealth (income). In his later research, Easterlin (2001) affirms that at a specific point in time lower income individuals are on average less happy than higher income individuals. Rečkova's master thesis (2018) also follows this stream of research.

In addition, income appears to have an effect on eating habits. Bowman (1999) observes that those with low income have higher tendencies to consumer large portions of food with added sugar than those with high income. Nonetheless, Colchero et al. (2015) show that low income households together with those who come from rural areas and households that live in municipalities with high levels of marginalization, exhibit more elastic demand for soft drinks and sugar sweetened beverages than their counterparts. And eating sugar, sweeteners or sugary beverages is positively associated with adverse health effects Popkin (2012). Moreover, Easterlin (2003) concludes that happiness is on average negatively affected by and unfavourable change in health in the long term.

There exists a large number of studies associating healthy eating habits with happiness. There is however a very limited number of research papers analysing the relation of happiness and the

consumption of unhealthy products such as sugar. I plan to cover this research gap in the proposed study by analysing the interlinkages among happiness, health status and a consumption of sugars, since happiness and a consumption of sugar are both related to health state. For instance, Malik et al. (2006) implies that there is an association between risk of an adverse gain in weight and a consumption of sugar-sweetened beverages. While a consumption of sugar tends to decrease the BMI (and hence overall healthstate), happiness and health are likely positively correlated. Consumption of sugar may then complement/ substitute satisfaction/ happiness.

Contribution
Although there is a vast number of research papers analyzing happiness and/or life satisfaction, the relation between happiness and sugar consumption has not been studied extensively yet. Positive or negative association between satisfaction/ happiness and consumption of sugars may mask (true) correlation between eating sugars and health state on one side and health state and happiness on the other side. Thus my intention is to analyse this relationship between sugar consumption and happiness that may help to explain consumers' behavior and lifestyle changes. Moreover, my results could help explaining possible outcomes of an implementation of a sugar tax to make lifestyle more healthy (and hopefully more happy) which is being broadly discussed among policy makers.

Methodology
I will be able to use individual-level data collected through an original survey conducted within the EU-funded H2020 project INHERIT in 2018 (Zvěřinová et al., 2018) that will be provided by my supervisor. Data for food consumption variables are collected through the Short-Form Food Frequency Questionnaire as proposed by Cleghorn et al. (2016) for indicating respondents' eating patterns. Happiness is measured by standard 10-point scale. Respondents provided self-reported data about their health status, including illnesses and BMI.
To conduct my research, I will propose a structural model that will enable to show the effects among eating unhealthy goods (sugars), health state (BMI) and life satisfaction/ happiness.
Firstly, I will analyze a consumption of confectionery, ice-cream and sugar-sweetened drinks and how it varies across different households by using OLS or count regression models (Poisson, negative binomial, and similar), depending on data structure. I will pay a special attention for controlling for the effect of income and health (measured by BMI) on the consumption of sugar.
Main objective of my study is to analyse the determinants of happiness. Since, happiness is measured as categorical variable, I will use then an Ordered logit model or MNL to analyse association between income, health, and consumption of unhealthy food on one side, and happiness on the other side.
Since analysis of the correlation between consumption of unhealthy food and health and the correlation between health and happiness sugars may require more complex modelling, I will discuss usage of these complex models (such as joint estimation or Structural Equation Models) in the literature review.

Outline
Abstract
1. Introduction
2. Literature review
   - measurement of happiness and life satisfaction
   - determinants of happiness, focusing on health and consumption of unhealthy food (lifestyle)
   - determinants of sugar consumption
   - complex modelling of happiness-food consumption-health
3. Methodology
   - econometric model(s)
   - data description
4. Results
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   - happiness and its determinants
5. Conclusion

List of academic literature:

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Contens

1 Introduction

Sugar intake is one of the most significant elements of eating patterns nowadays. Excessive consumption of food high in sugar, such as sugar-sweetened beverages (SSBs), candy, ice cream, and others have been linked to the deterioration of one's health. These negative impacts include for example weight gain and are associated with many diseases, such as diabetes. Weight gain then directly increases the Body Mass Index (BMI) scores. High scores in BMI are associated with obesity, an undesirable medical condition. An increase in the occurrence of obesity and overweight in society has been an ongoing trend for many years now. There exists a very extensive discussion among researchers about the main causes of this phenomenon. While possible explanations involve factors such as genetics, physical inactivity, overeating, and many others, excessive consumption of food high in sugar is also one of the determinants.

The problems resulting from high consumption of sugar have become apparent. The main consequence is the prevalence of overweight and obesity (see, e.g., Malik et al., 2006, for a review). The highest consumption of sugar is characteristic mostly for babies, children, and young adults, resulting from their high preferences for sweet taste (e.g. Bowman, 1999; Mennella and Bobowski, 2015). But these preferences are not the only determinants of sugar consumption. It has been found that there exist many factors that influence sugar intake, such as stress or present mood (e.g., Draanen et al, 2018; Khawaja et al, 2019). Current research shows that the effects of psychological factors on sugar consumption are not negligible and that these factors are affected by the resulting high scores of Body Mass Index (BMI) in return. Different BMI scores could then be associated with different levels of perceived happiness on one side and depression on the other side (e.g., Onyike et al., 2003; Datta and Mishra, 2019).

World Health Organization (2020) reports that in 2016 obesity increased three times since 1975. More specifically, the World Health Organization (2020) shows that in 2016, 39% of adults (18 years and older) worldwide were overweight and 13% of adults

worldwide were obese. Since sugar is likely to be one of the causes of weight gain and some diseases, there are attempts to reduce its consumption. [1]

A country's wealth and its population's well-being have been measured primarily by Gross Domestic Product (GDP) or Gross National Product (GNP) for a long time. However, happiness and life satisfaction, concepts that are now being discussed to a great extent, are getting more attention from both researchers and policymakers. A lot of research papers are trying to find the extent to which people's happiness and life satisfaction are affected by health, education, income, marital status, and many more (e.g., Easterlin, 2003).

Happiness, life satisfaction, and sugar consumption are all being studied extensively and draw the attention of economic research. In doing so, researchers aim to identify especially their main socio-demographic factors. Moreover, there is a limited number of research papers studying links between sugar consumption, happiness and life satisfaction altogether. Therefore the objective of this thesis it to study these relationships. In addition, explanatory variables concerning health status, addiction and dietary patterns are added to the modeling. Their effects on the three variables of interest are then observed.

The remainder of the paper is organized as follows. Chapter 2 reviews the literature, making its focus on conceptualization and measurement of happiness and life satisfaction, including their determinants. It also aims at health and unhealthy diet, determinants of sugar consumption. Lastly, econometric modeling approaches are discussed. Chapter 3 describes survey and sampling, econometric models, and data. Chapter 4 is dedicated to the results describing sugar consumption and zero sugar demand, including their determinants. It follows with the determinants of life satisfaction and happiness. The last chapter concludes and provides potential policy implications and research limitations.

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[1] The prevalence of high sugar intake in the world has led many countries to adopt some measures to decrease the consumption of sugar-sweetened food and beverages. One of the instruments to do so is a sugar tax. Within Europe, there exist few countries that have adopted the sugar tax on soda beverages. A list of those countries includes Norway, Portugal, Lithuania, Ireland, the UK, and others.

2   Literature Review

2.1 Measurement of Happiness and Life Satisfaction

While happiness is more likely to refer to one's emotional state, and life satisfaction to content with one's life, these two words are often used to a certain extent interchangeably among scientists. For instance, Veenhoven (1991) understands happiness as a "*degree to which an individual judges the overall quality of his life favorably.*" and concludes *„As such, happiness can also be called life-satisfaction."* (Veenhoven, 1991) Nonetheless, the true meaning of happiness and life satisfaction still remains a philosophical question.

Happiness is a relatively new topic broadly discussed by many researchers of social sciences. Its concept brings together knowledge from philosophy, psychology, economics, and others. Barrow (1980) offers his thoughts on a subject of happiness. He understands happiness as a broad concept and a degree word. He explains that a universal set of material things or personal traits that would lead to ultimate happiness are non-existent. Moreover, Barrow suggests that only beings with consciousness can experience a state of happiness while emphasizing that *"There is no suggestion here, that the happy man must be conscious that he is happy…*" (Barrow, 1980).

In the field of economics, the researchers are interested in determining the correlation and possibly even uncovering causation between various factors, happiness, and/or life satisfaction. One of the first economists to focus their research on happiness and life satisfaction is Richard Easterlin. There are many factors with an ability to influence happiness and life satisfaction of people. Easterlin (2003) discusses health, marital status, income, aspiration and adaptation, and their influence on happiness. The author extensively studies especially income and its influence on both happiness and life satisfaction. As a result, Easterlin (1995; 2001; 2003; 2004) and Easterlin et al. (2010) explain that even though people with higher income are on average happier than those with lower income, an increase in income of all does not necessarily induce an increase in happiness of all. According to the author, people generally judge their well-being based

on a comparison of both their objective and subjective situation, and this comparison is substantially influenced by the average level of living of the society as a whole. Income, in relation to the Easterlin paradox, is one of the most discussed factors influencing happiness. In an attempt to explain the relationship between income and happiness, Fanning and O'Neill (2019) find that in countries with continuously rising income, there is an increase in happiness, while its decrease is observed in countries where income is constant. Similarly, Veenhoven (1991) observes a simultaneous decrease in the correlation between the level of happiness and relative income of individuals, with an increase in the gross national product and concludes that *"...wealth is subject to a law of diminishing happiness returns*." (Veenhoven, 1991) Throughout many years economists have succeeded to find additional variables that affect people's happiness in terms of income. This stream of research is also followed by Rečková's master thesis. Rečková (2017) shows that the relationship between material prosperity and happiness is likely to change with age, while noting the existence of other factors, such as having a friend, which has a considerable impact on the level of happiness.

Research on life satisfaction brings very similar results. Chen (2001) observes that life satisfaction is likely to be affected when change in socio-demographic factors, level of income, and structure of household occurs. Some researchers uncovered the importance of marital status. Evans and Kelley (2004) find a causal relationship between being married and life satisfaction in comparison to other forms of marital status. The authors find that life satisfaction might decrease as a result of being merely in a long-lasting cohabitation. In terms of education, Salinas-Jiménez et al. (2010) find that it increases the level of life satisfaction, more so, if there are fewer people who attained a given level of education. Within conducting research to point out the differences in life satisfaction between various regions, Pittau et al. (2009) state that being unemployed adversely alters life satisfaction, even in regions where unemployment occurs with a higher frequency.

The levels of happiness and life satisfaction are self-reported. There exists extensive research proposing various scales of happiness and life satisfaction measurement, mostly following a Likert scale designed by Likert (1932). Several scales based on the number of items are introduced for instance by Diener et al. (1985) who propose Satisfaction with Life Scale, Lyubomirsky and Lepper (1999), who introduce a

Subjective Happiness Scale and Hills and Argyle (2002) who present Oxford Happiness Questionnaire. Another approach is a measurement of self-reported happiness and life satisfaction based solely on one item scale. This 11-point method is used by many scientists nowadays and "*is viable in large-scale research projects and community surveys as well as in cross-cultural comparisons.*" (Abdel-Khalek, 2006)

Other methods used for gathering data on self-reported happiness and life satisfaction include for example Experience Sampling Method, the Day Reconstruction Method, the U-index, Brain Imaging method approaches, and other kinds proposed by various scientists.

2.2 Determinants of Happiness, Focusing on Health and Consumption of Unhealthy Food (Lifestyle)

Income is not the only potential determinant of happiness that is being studied. There exist many factors that may influence the level of happiness substantially. One of the key predictors, which is also a focus of this thesis, is health. Apart from previously discussed income changes, Eastlerin (2003) also takes health state into consideration and suggests that the occurrence of an adverse change to one's health conditions results in a lasting decrease in happiness. The author points out that the decrease in the level of happiness tends to be greater in the initial state than in the long run. Easterlin (2003) concludes, that there occurs to be, some, but not a complete adaptation to deteriorating health in terms of the level of happiness and that this adaptation is influenced by one's personality traits and other characteristics. The importance of personality traits appears to be clear for it has an influence over the perception of an individual's reality. Weimann et al. (2015) comment on this psychological factor and say that people who get higher scores in neuroticism, or introversion tend to be less satisfied.

There exists an association between happiness and health state, but it is also important how health is measured. It might be through an objective measure of diagnosis or self-perception. Cornelisse-Vermaat et al. (2006) observe the perception of one's health and how various life circumstances such as marital status or cohabitation, house ownership, and balanced working hours exercise positive influence over health

perception. On contrary, in the sample of Italian respondents Sabatini (2014) did not find varying results of perceived health based on education and job. In terms of factors such as age, sex and education, Pinto et al. (2016) did not find any correlation with the life satisfaction of elderly people. However, number of diseases, frailty, depression, cognitive status and self-rated health status were found to be strongly correlated with the life satisfaction of this group. Graham et al. (2017) conclude in their study of Chinese people that highly educated individuals, individuals living in urban areas, those suffering from chronic diseases or frequent minor illnesses report more mental health problems.

Among many indicators of health, the body mass index (BMI) is also given some attention in this thesis. Extremely low or high BMI scores are understood to indicate an adverse change in the health state of an individual. A research conducted by Datta and Mishra (2019) among young adults suggests that a level of happiness varies across different BMI scores. This stream of research can be followed and the use of BMI as an indicator of the respondents' health can be considered to be a relevant approach. BMI scores may be determined mainly by food consumption habits, however, Cornelisse-Vermaat et al. (2006) show that age and the level of education also affect BMI substantially. Moreover, there exist associations between BMI and some economic factors. For instance, Egger et al. (2012) find a positive correlation between BMI and GDP.

While BMI seems to be an objective evaluation of health, and consequently have an effect on the level of happiness and life satisfaction, society also plays a major role in a self-perception of individuals. Pinhey (1997) discovers that people characterized as obese who, in addition, live in societies where obesity is considered to be a common physical trait, report being more happy, than those who live in societies where obesity is not ordinary. This finding is then probably coherent with the fact that people tend to compare themselves to others. In relation to mental health, Onyike et al. (2003) find an association between obesity and depression, indicating the dependence of depression on the severity of obesity. Thus there is a necessity of further research, for high BMI scores might have an influence on happiness and life satisfaction.

2.3 Determinants of Sugar Consumption

As pointed out in the previous section, eating patterns are not the sole determinant correlated with a weight increase. Therefore, various characteristics of individuals who consume a high quantity of sugary food are being examined. In terms of age, ethnicity and income, Bowman (1999) confirms that children, African Americans and low-income households are more likely to have a diet consisting of high sugar intakes. Moreover, he observes that individuals exercising such eating patterns have lower intakes of important micronutrients such as Vitamin A, Magnesium and others. Similarly, Draanen et al. (2018) indicate non-white male respondents with lower levels of education and income to be the main consumers of SSBs. Moreover, a positive association between allostatic load and the consumption of SSBs among young adults is found in their study. Sugar consumption determinants may exist in terms of financial support offered to low-income households. According to Twarog et al. (2020), children from low-income families that are found to be eligible for nutritional assistance are more likely to consume SSBs and, in addition, are more inclined to be obese in comparison to those eligible children who choose not to consume SSBs. To find a solution to the prevalence of obesity and other health issues connected with high sugar intake, much of the research is focused also on identifying main causes of people's self-reported preferences for the consumption of food rich in sugar. Since younger people tend to lead unhealthy lifestyles, many scientists focus their research on this group. Khawaja et al. (2019) surveyed university undergraduate students between ages 18-26. Based on the results, only 19% of the respondents had a high degree of knowledge on the consumption of sugar, while 81,2% had only a low degree of knowledge. Moreover, 77% of the respondents indicated a positive relationship towards the consumption of sugar. Khawaja et al. (2019) show that based on their survey of university students, around half of the respondents consider appetite and/or taste, current mood, stress, attitudes, beliefs and knowledge to influence their consumption of sugary goods. These observations might indicate an association between sugar consumption and self-reported happiness. It shows that the consumption of food high in sugar can be an important part of the econometric model trying to explain the determinants of happiness.

The prevalence of obesity is an undesirable phenomenon occurring in society. An increasing number of health issues can have a negative impact not only on happiness or

life satisfaction but also on the economy. Links between high BMI and sugar intake have been pointed out in previous sections. Policymakers then clearly have an incentive to reduce the excessive consumption of sugary food. Implementation of various policies, can too, affect the sugar intake of individuals and households. One of the means to reach such a goal is an adoption of a sugar tax. Such taxation generates a higher price of the food of interest. In general, the expected outcome is a fall in the demand for sugary food. One approach of addressing possible outcomes of a sugar tax introduction is to determine the elasticity of the demand for sugary food. Due to Mexico being one of the countries with the highest levels of obesity and diabetes in the world, and very high consumption of SSBs, Colchero et al. (2015) did a research on the price elasticity for soft drinks and SSBs. They conclude that the implementation of sugar tax might reduce the consumption of soft drinks and SSBs, especially, among low-income households. Other possible outcomes have been predicted by many researchers. Through the use of simulation for the sample of the New York population, Ruff and Zhen (2015) predict a decrease in obesity in the horizon of 10 years. Similarly, Val Castelló and Casasnovas (2020) examine outcomes of the introduction of the sugar tax in the region of Catalonia and show a decrease in the sales of SSB, while pointing out that this decrease was most substantial in regions with high levels of obesity.

Researchers are aware of various aspects of sugar consumption. Policies concerning a necessary education on excessive sugar intake might have important implications. Grummon et al. (2019) discuss an implementation of a national SSB health warning policy, which they presume to (under certain assumptions) lead to a gradual decrease in the average BMI and obesity by reducing calorie intake.

The extent to which a sugar tax or educational policies will be effective needs to be further examined. It is very likely that people's preferences are not solely based on their knowledge and price of sugary food. Taking into account an ability of sugar to possess some reinforcing value, Flack et al. (2019) conducted a study in which they conclude that the relative reinforcing value of sugar increases by 33% after limiting the intake of food rich in sugar for one week. Therefore it makes sense to study the links between sugar consumption and happiness, for it could be uncovered as one of the determinants of the effectiveness of various policies concerning sugar intake.

2.4 Complex Modeling of Happiness-Food Consumption-Health

Many theories were used for analyzing or explaining consumption patterns with or without linking these patterns to health status and/or happiness and life satisfaction. A decision to consume a certain food is generally a subject of choice. Very often, discrete choice analysis is used to explain this selection between various alternatives. In doing so, mostly used are theories of stated preferences collecting data based on hypothetical scenarios or revealed preferences based on actual (revealed) behavior. Relying on a conditional good, intentions can be studied. Behavior is then often observed through the Theory of Planned Behavior proposed by Ajzen (1985). The author states that *"Intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior."* (Ajzen, 1991)

Data collected on the happiness or life satisfaction of people are self-reported, thus it has been a subject of interest to identify their appropriate interpretation. There exist several theories explaining happiness and life satisfaction, suggesting ways of how to approach them. A very widely used method was proposed by Michalos (1985), who examines 7 hypotheses based on which people are inclined to evaluate their life and consequently introduces Multiple Discrepancies Theory. This theory attempts to explain self-reported well-being, happiness and life satisfaction with one's life as a whole and separate areas of it as well. Consequently *"happiness and satisfaction are functions of perceived gaps of what one has and wants, relevant others have, the best one has had in the past, expected to have 3 years ago, expects to have after 5 years, deserves and needs*." (Michalos, 1985)

In terms of econometric modeling of sugar intake in relation to mood, stress and other mental constructs, various methods have been used by economists. When modeling an effect of sadness or guilt on consumption of sugar, Lefebvre et al. (2019) use a logistic regression model in case of binary outcomes. In addition, a discriminant analysis is conducted in order to address a question of whether snack preferences and sugar cravings

represent two different constructs. Furthermore, Draanen et al. (2018) estimate the effects of sugar consumption on allostatic load, and its components by using negative binomial regression and Poisson regression together with logistic regression, respectively. Other econometric models are widely used as well. Those might include ordinary least squares (OLS) estimation, or ordered probit, as used by Graham et al. (2017) in their study of happiness and health of the Chinese population. Categories of the dependent variable may not always have a natural ordering. Kwak and Clayton-Matthews (2002) explain that in those cases, OLS is not an appropriate model and multinomial logistic regression is one of the favorable models that should be used instead. When measuring happiness and life satisfaction as categorical variables with no natural ordering, Serban-Oprescu et al. (2019) use multinomial logistic regression in their research of subjective well-being.

Samples are drawn from certain populations. Consequently, the representativeness of the samples needs to be accounted for. To address this issue, Onyike et al. (2003), Graham et al. (2017), and Draanen et al. (2018) among many other scientists incorporate weights into their modeling.

While following the econometric techniques of the researchers who use Poisson regression, negative binomial regression, OLS or multinomial logistic regression would be efficient, additional potential methods should be discussed. The research of this thesis could be subject to the extension of structural equation modeling. Lei and Wu (2007) comprehensively explain and evaluate this method.

3   Methodology

In this chapter, I first describe the survey and sampling techniques. Then, I specify econometric models and reasons for their application based on data characteristics and lastly, I describe the dataset, its components and procedures in the data preparation.

3.1 Survey and Sampling

All the data used in this research are obtained from the INHERIT survey conducted by Zvěřinová et al. (2018). The researchers prepared their own questionnaire, following their comprehensive pre-survey and literature review. Samples were taken from population of the Czech Republic, Portugal, the United Kingdom, Spain and Latvia. The respondents differed in age, gender, education and region. On obstacle in form of a deviation from few quotas appeared and consequently weights were derived by the researchers in order to account for the representativeness of the subsamples of each country. In this thesis, weights are incorporated into the modeling and each sample is given the same weight.

The data collected are self-reported and gathered through Computer Assisted Web Interviewing and Computer Assisted Self Interviewing methods. Only responses where respondents gave their consent to participate in the survey were taken into consideration. Each respondent was also given specific instructions on how to participate in the survey. Moreover, it was stressed out to the respondents at the beginning of the survey and throughout sections containing sensible questions that all of the reported answers were strictly anonymous.

The questionnaire contains many sections and those used in this thesis include quota questions, socio-demographic information, dietary patterns, and health-related questions.

Data concerning the eating patterns, which are used in this thesis, were gathered through discrete choice experiments. Short-Form Food Frequency Questionnaire (SFFFQ) proposed by Cleghorn et al. (2016) where respondents were asked about

portions of food eaten, was used for gathering information on dietary patterns. The respondents were asked how many portions of a certain food they consume per week (or per day in case of fruit and vegetables) and were shown a picture of the food of interest. Variables obtained from the SFFFQ concerned portions of sugar, meat, fish, fruit and vegetables, and pulses.

Both life satisfaction and happiness were measured by a standard 11-point scale. Respondents were given a chance to choose on a scale from 0 to 10, where 0 stood for extremely dissatisfied/ unhappy and 10 for extremely satisfied/ happy. They were also given an option not to answer or report not knowing their level of life satisfaction/ happiness. The questions they were asked were: „All things considered, how satisfied are you with your life as a whole nowadays?", and „Taking all things together, how happy would you say you are?"

Income was recorded as „net monthly income from all sources after tax and compulsory deductions", in the national currency of each respondent. There were 12 categories to choose from in the survey and an option not to answer. Information on gender, town size, education, marital and employment status and smoking was obtained in a similar manner, by providing respondents with specific categories.

Health-related data were collected by asking respondents whether they have been ever diagnosed with certain illnesses. The possible answers were „yes", „no", or „I would prefer not to answer/ I don't know".

Respondents were asked to self-report their height (without shoes) and weight (without shoes and clothes). In case any respondents preferred not to answer the question, they were also given an option not to respond. Consequently, BMI scores were obtained as follows:

$$BMI = \frac{weight}{height^2},$$

where weight is in kilograms kg and height is in meters m.

3.2 Econometric Models

The data analysis concerning the purposes of this thesis is conducted by using STATA software. It consists of analytical parts addressing sugar consumption and its determinants, zero sugar consumption and its determinants and determinants of life satisfaction and happiness. Moreover, in each part of the analysis, there are post-estimation tests used in order to test for simple or composite (non) linear hypotheses concerning the statistical significance of the variables.

Due to the data characteristics and model specification, it is necessary to identify reference groups of some of the independent variables. In the case of variables with more than 2 categories, the chosen reference groups include specifically Latvia, primary and lower secondary education, students and other employment status, cohabitation and civil partnership, and non-smokers.

3.2.1 Determinants of Sugar Consumption

Measured sugar intake can be labeled as a count variable, for the survey includes portions of sugar consumed by the respondents per week. Consequently, the use of a count model for the analysis is well reasoned. Based on the results of descriptive statistics from the first part, the negative binomial regression (see, e.g., Hilbe, 2011, for a review) is chosen as an appropriate model. The sugar variable satisfies the assumptions for the use of this model. The dependent variable is a count variable with over-dispersed distribution, therefore an application of Poisson regression would have been inappropriate. Moreover, zero-inflated negative binomial regression was ruled out, for I was not dealing with an excessive number of zeros.

The range of the dependent variable is between 0 and 126 portions per week. For this reason, OLS regression was also recognized, in order to consider approaching sugar consumption as a continuous variable. All of the orinary least squares assumptions were not met, therefore a use of this model was also disregarded.

The negative binomial model is then proposed as follows:

$$y_i = \beta_0 + \beta_i X + v_i \, ,$$

where the dependent variable y stands for portions of sugar eaten per week and X is a list of independent variables, consisting of socio-demographic factors, health-related variables and variables indicating dietary patterns, v represents an error term and i is the i-th observation. An exact list of the variables is discussed in the Data Description section of the Methodology Chapter.

3.2.2 Determinants of Zero Sugar Consumption

Overall, 12,08% of respondents self-reported a sugar consumption of 0 portions per week. Consequently, I pay special attention to finding determinants of such behavior.

Whether one does or does not consume zero portions of sugar per week is a binary outcome. I introduce a dummy variable describing zero sugar consumption, where number one is assigned to having zero sugar consumption, and number zero is assigned otherwise. Moreover, because the necessary assumptions are met, I use a logistic regression (see, e.g., Long, 2001, for a review) for this analysis. Zero portions of sugar represent a dependent variable and the list of independent variables is the same as in the previous case.

3.2.3 Determinants of Life Satisfaction and Happiness

This part of the analysis is focused on life satisfaction and happiness and their determinants. The outcomes were originally divided into categories from 0 to 10. Therefore the use of the ordered logit model was initially considered, although based on statistical tests, the parallel slopes assumption was violated. Multinomial logistic regression (see, e.g., Long, 2001, for a review) relaxes this assumption.

An obstacle encountered during the estimation was a lack of responses for several categories, where the responses consisted of less than 5%. Consequently, an estimation could not be undertaken, because of an occurrence of too many singular matrixes. In an attempt to resolve this problem, the categories of life satisfaction needed to be rescaled.

The resulting scale consists of three points from 1 to 3 and can be seen in Table A2 (Appendix A). The second category is chosen as a base group for purposes of the interpretation. The aim is to explain what contributes to lower and/ or higher levels of life satisfaction and/ or happiness.

Both models for life satisfaction and happiness are proposed as follows:

$$y_i = \beta_0 + \beta_i X + v_i ,$$

where y stands for life satisfaction or happiness, X stands for socio-demographic variables, health-related variables and dietary patterns, v is the error term and i is the i-th observation. The composition of the independent variables is described in the Data Description section of the Methodology Chapter.

In order to test for consistency of the results I present dummy variables for both life satisfaction and happiness, obtained by further rescaling of the 3-point scale. I first approach the dummy variables with the use of univariate logistic regressions. Nonetheless, since life satisfaction and happiness are highly correlated, the bivariate probit model is more appropriate.

3.3 Data Description

The dataset contains 10 346 observations represented by completed interviews with respondents, sampled from the target population. Responses of the speeders and incomplete observations are not included. The observations are obtained from samples of populations of 5 countries – the Czech Republic, Portugal, the United Kingdom, Spain and Latvia. In total, the number of observations for the Czech Republic was 2 019, for Portugal 1 658, for the UK 2 820, for Spain 2 067, and for Latvia 1 782.

One of the variables that is a focus of this thesis are portions of food high in sugar consumed by the respondents per week. I understand confectionery, ice cream and SSBs to satisfy the characteristics of that type of food. Consequently, those are all included in a single variable.

The descriptive statistics which are to be found in Table A1 (Appendix A) show that the highest average sugar consumption can be observed in the UK with a standard deviation of 11,45, while it is the lowest in Portugal with a standard deviation of 9,72. There is a zero sugar consumption in each of the countries of at least 10% and the highest number of portions exceeds 100 in majority of the countries.

Happiness are used as a continuous variable measured by a standard 11-point scale in the sugar consumption modeling (Happiness is first divided into three dummy variables in order to allow for more flexibility. Their significance is not found, thus I approach this variable as a continuous one.). Throughout modeling for both happiness and life satisfaction, these dependent variables are treated as categorical, measured by a 3-point and 2-point scales. Reasons for choosing different scales are discussed in the Econometric Models section of Methodology Chapter and a comparison of the 3 different scales is to be seen in Table A2 (Appendix A).

The average levels of both life satisfaction and happiness do not differ dramatically across countries as can be seen from Table A1 (Appendix A). Nonetheless, they are the highest in the Czech Republic and lowest in the UK. The most common responses in the case of happiness include reporting of level 8. It is the same in the case of life satisfaction in most of the countries. Moreover, there exist people in all of the countries, who are both extremely dissatisfied/unhappy and extremely satisfied/happy.

Following the stream of research discussed in the literature review, there are socio-demographic factors considered in this thesis. Those include household income, age, gender, education, number of adult household members, number of children living in the household, marital status and employment status. Furthermore, their representativeness can be found in Tables A3-A9 (Appendix A).

The countries do not share the same currency, therefore an average value of household income was calculated for each of the categories and a method of purchasing power parity was used for the purposes of comparison. Due to the approach to the data cleaning, I introduce a dummy variable – missing household income, to account for the possibility that the respondents who did not indicate their household income had

systematically different behavior. A high number of survey participants from Portugal, the UK and Spain belong to the second tercile, while respondents from the Czech Republic and Latvia mostly reported having a third tercile level of household income.

All of the respondents are at least 18 years of age and a maximum of 65 years of age. The respondents indicated being between 31-45 years old with the highest frequency. Slightly fewer people are between 46 and 59 years of age and almost a quarter of them is less than 31. In the modeling for sugar consumption, age is introduced as a categorical variable with 4 categories. In the rest of the modeling, age is approached as a continuous variable and is incorporated also in the quadratic form, for a better specification.

Gender is associated with both various propensity to consume food high in sugar and levels of happiness. The last category describing „other" gender consists of less than 0,28% and is placed in the reference group together with the female gender due to its low variation.

Education is divided into 3 categories. It is categorized into primary & lower secondary, upper secondary, and tertiary levels of education. The primary and lower secondary is attained with the highest frequency in the Czech Republic, Portugal and Spain. On contrary, tertiary education is attained with the highest frequency only in the UK.

The presence of children in the household might result in the significance of the total number of household members. Consequently, two variables are introduced in order to distinguish between the presence of adults and children in households respectively. Moreover, the number of adults ranges between 1 and 7 members (in the case of the Czech Republic between 1 and 6) and the average number of members is 2 in all of the countries. The number of children present in the household ranges between 0 and 6, with 0 being the most frequent number reported. The next two answers with a high frequency are 1 and 2 children, although due to the huge number of zero responses, there is on average less than 1 child present in the household in all of the countries.

Due to the low variation of certain responses, I use clustering for variables concerning marital and employment status. Marital status refers to current legal marital status of the respondent. I intend to observe the effects of being married, single, and being separated in terms of dealing with a partner loss in any sense (being separated after being married or in a civil partnership, divorced, dissolved civil partnership, widowed, or having civil partner died). Employment status refers to current legal employment status of the respondent. I observe the effects of being employed in any sense (full-time, part-time, being self-employed), at home (looking after home full-time or being on maternity/paternity or parental leave), unemployed, retired, and unable to work due to sickness or disability. In terms of the responses, at least 42% of respondents reported being married and the majority of the respondents indicated being employed full-time in all of the countries.

Both height and weight were recorded in the units of measurement characteristic for the country of origin of each respondent. For this reason, the observations are converted to centimeters for height and kilograms for weight, whenever it is necessary. Table A10 (Appendix A) provides an overview of the distribution of certain BMI categories. Moreover, descriptive statistics suggest, that the respondents were on average, of normal weight. Scores characterizing normal weight occur with the highest frequency, in each country, except for the Czech Republic.

The mentioned illnesses consist of cardiovascular disease, cancer, food intolerance or allergy, diabetes, stomach or other gastrointestinal diseases, hypertension, and other chronic diseases. Clustering is used for cancer and other chronic diseases. Suffering from hypertension, stomach or other gastrointestinal disease or other chronic diseases occur as positive responses with the highest frequencies. The frequencies of all diseases can be seen in Table A11 (Appendix A).

Lastly, dietary patterns in terms of portions of meat, fish, fruit and vegetables, and pulses consumed are also considered. Clearly, at least 4 portions of meat and 1 portion of fruits and vegetables are eaten on average in all of the countries, while consumption of fish and pulses barely equals to 1 in certain cases. Nonetheless, there exists both zero and very high consumption of all food categories in all of the countries. Descriptive statistics of each can be found in Table A13 (Appendix A).

The data preparation also required extensive cleaning due to the presence of missing values under certain observations, or due to untruthful responses that would be unfeasible. STATA was used for the detection of such observations. The software does not use incomplete observations for the modeling. For these reasons, several observations are excluded from the models.

4 Results

This chapter discusses all the results from the regressions. Detailed output from each model is listed in Tables A14-A20 in the Appendix A.

4.1 Sugar Consumption and Its Determinants

In general, there exist cultural, socio-economic, political and many other differences between countries. In terms of the expected sugar consumption, the differences appear also in between certain countries of my interest. Compared to Latvia, the expected sugar consumption is different only for Portugal, the UK and Spain. Based on the descriptive statistics, the average sugar consumption is the lowest in Portugal, moreover, it follows that the expected sugar consumption is lower by almost a quarter compared to Latvia. On contrary, it is approximately 17% higher in both the UK and Spain. Lastly, potential statistical differences between the Czech Republic, the UK and Spain are also addressed, although the results imply, that there are no statistical differences in the expected sugar consumption between these countries.

The level of household income might affect consumption of certain goods. Among the five countries of my interest, the significance of income is found in Spain. More specifically, the level of household income is associated with lower expected sugar consumption in this country. The results indicate, that the expected sugar consumption of wealthy people is a few times lower than the expected sugar consumption of the poorer ones. As income increases to approximately 3 371€ a relationship between the expected sugar consumption and household income becomes negative in Spain.

Many researchers state that children and young people tend to consume more sugar. The results of this thesis seem to be consistent with such conclusions. People between 18 and 30 years are found to be associated with higher expected sugar consumption of almost 29% in comparison to the reference group. Moreover, there is a statistical difference between the sugar consumption of this, and any other age group. Compared to people who are at least 60 years old, higher sugar consumption is observed also in the case of the remaining two age groups.

What is usually uncovered by researchers, is a higher sugar consumption associated with the female gender compared to males. The analysis, in this case, shows that males have higher expected sugar consumption in comparison to the reference group.

Education results in being a highly significant indicator of expected sugar consumption. In comparison to the lowest education level, both upper secondary and tertiary levels of education are associated with lower expected sugar consumption by almost 15% and 22% respectively. Moreover, the two higher levels of education are statistically different from each other. Altogether, these results imply that there exist statistical differences between any two levels of education in terms of the expected sugar consumption. The lower expected sugar consumption is associated with each higher level of education.

Living arrangements might also have an impact on various life circumstances, including dietary patterns. As the number of children living in the household increases, so does the expected sugar consumption. Moreover, at the 10% significance level an increase in the number of adults present in the household also exercises a positive effect on the expected sugar consumption. Lastly, being at home in terms of employment status is associated with higher sugar consumption of almost 13% respectively.

BMI was calculated in the effort to indicate whether there is an association between a change in the BMI score and the expected sugar consumption. Such a relationship is not uncovered, however, there is an indication, that people who refused to report their weight and/or height have statistically different sugar consumption compared to the people who provided this information. Moreover, these respondents have a higher expected sugar consumption by almost 20%.

A diagnosis of certain diseases may lead to a change in one's lifestyle. On contrary, a certain lifestyle, including dietary patterns, may eventually lead to the development of some disease. In terms of diseases, those which result in having a statistically significant association with the expected sugar consumption are cardiovascular disease, cancer or other chronic diseases, gastrointestinal or other stomach disease, and hypertension. The effects are between 6% and 11% in the case of each disease. The first three diseases imply

a positive relationship with the expected sugar consumption. On contrary, being treated for hypertension is associated with a decrease in the expected sugar consumption.

Based on the topic of this thesis, special attention is paid to suffering from diabetes on the country-specific level. While there is no indication of the association between suffering from diabetes and the expected sugar consumption in the case of the Czech Republic and Spain, the results are significant for Portugal, the UK and Latvia. Being from Latvia and suffering from diabetes decreases sugar consumption by almost 41%. Compared to Latvia, being from Portugal and, in addition, suffering from diabetes lowers the expected sugar consumption even further, by almost by a half. The opposite effect is observed in the case of the UK. People suffering from diabetes, are expected to consume altogether at least 50% more sugar in comparison to people from Latvia.

Interesting results are obtained for smoking status. A choice to smoke, which is mostly a habit might have an adverse effect on one's health. There might be then an indication of similar attitudes towards other habits which tend to lead to a deterioration of health. Consistent with this intuition, the results show that compared to non-smokers, people who smoke have a higher expected sugar consumption. Nonetheless, a shift in attitudes might occur. Interestingly, compared to being a non-smoker, people who used to smoke have a lower expected sugar consumption.

In general, there might be an association between consumption of various food categories. In this thesis, such associations are uncovered in case of the meat and pulses consumption and the expected sugar consumption. While each additional portion of pulses increases the expected sugar consumption by slightly more than 1%, the effect of an additional portion of meat is somewhat higher and equal to more than 6%. Consequently, both represent complements to the unhealthy eating pattern that is sugar consumption.

4.2 Determinants of Zero Sugar Consumption

The statistical differences between countries are not evident, except for Portugal and Latvia. Being from Portugal increases the likelihood of consuming no sugar by almost 36% compared to Latvia.

Results obtained for age categories remain quite consistent with the existing research. Being between 18 and 30 years old compared to the reference group makes consuming no sugar less likely by more than 38%. Similar results are observed in the case of the age category of 31-45 years of age. Moreover, there does not appear to be a statistical difference between these two age categories.

Consistent with results for overall sugar consumption, living arrangements are significant indicators of zero sugar consumption. They are important in such a way, that as both the number of adults and children increases, the likelihood of having zero sugar consumption decreases.

There might be underlying reasons, perhaps a character of the disability or sickness, influencing portions of sugar eaten by those people. Based on the results, people who are unable to work due to these reasons, have a considerable increase in the likelihood of consuming no sugar in comparison to the reference group.

While cancer or other chronic diseases are not significant indicators in the overall expected sugar consumption, it is statistically significant in the modeling for zero sugar consumption. Being diagnosed with cancer or other chronic disease decreases the likelihood of consuming no sugar by almost 20%. Moreover, the likelihood is considerably decreased in the case of people from Latvia, who are diagnosed with diabetes.

The intuition behind the negative association between being a former smoker and the expected sugar consumption described in the previous section can be followed even in the case of zero sugar consumption. The results indicate, that compared to being a non-smoker, people who used to smoke have a higher likelihood of consuming no sugar.

In terms of dietary patterns, meat and fruit and vegetable consumption resulted in being highly statistically significant. As a complement, an increase in meat consumption

makes having zero sugar intake to be less likely. On contrary, fruit and vegetable consumption appears to act as a substitute and consequently increases the likelihood of having zero sugar consumption.

4.3 Determinants of Life Satisfaction and Happiness

I discuss the results of multinomial logistic regression concerning life satisfaction and happiness. Even though the two represent different constructs, both describe people's well-being in a certain way. Consequently, mainly variables that are observed as having an effect on both the level of life satisfaction and happiness are mentioned.

Being satisfied/ happy represents a base group. Therefore, in general, the interpretation is whether a unit change in certain independent variables affects the likelihood of being very or less satisfied/ happy, compared to the base group. Only results that appear to be robust are discussed. The robustness is supported by both univariate logit and bivariate probit models.

A country with the lowest average levels of both life satisfaction and happiness is the UK. On contrary, the highest levels are attributed to the Czech Republic. Compared to the reference group, being from the UK decreases the likelihood of being satisfied and happy by more than 38%, and decreases the likelihood of being very satisfied and happy by more than 24%. Within the first category, there is no statistical difference in the level of life satisfaction and happiness between the UK and the Czech Republic. Nonetheless, there is a statistical difference between these two countries within the third category. Moreover, countries that are highly statistically different between each other in any category, are the Czech Republic and Spain, and the UK and Portugal.

As already broadly discussed by many researchers, income is associated with different levels of life satisfaction and happiness in this thesis as well. An increase in the household income increases the likelihood of being satisfied and happy by more than 22% and increases the likelihood of being very satisfied and happy by more than 16% and 13%, respectively. Moreover, there is a statistical difference between those who did report their level of income and those who did not in the first category only.

Age is another concept that tends to be highly correlated with various levels of life satisfaction and happiness. In this thesis, the results imply that as people get older, the likelihood of being less satisfied and happy increases, although this effect diminishes with increasing age. It then follows, that it is less likely to be very satisfied and happy. Moreover, this effect gets stronger as age increases.

An extensive debate exists on the importance of education. Upper secondary level of education does not appear to be a robust indicator of life satisfaction and happiness, although having attained a tertiary level of education is found to increase the likelihood of being satisfied and happy by more than 40% in both cases. Moreover, it also makes being happier to be less likely by approximately 14%. These results are based on the comparison to the lowest education category. Statistical differences between the two higher levels of education are present in all categories within the modeling for life satisfaction only.

Interestingly, a number of people in the household seems to have an effect on the levels of both life satisfaction and happiness. In terms of living arrangements, with an increase in the number of adults, the likelihood of being satisfied and happy decreases by 11% and 8% respectively. Although, these results should be interpreted with caution, for there might be many underlying reasons for such an outcome.

Whether one works or not due to various reasons might greatly affect the lifestyle and consequently determine how satisfied or happy one is. Interestingly, there are no statistical differences between any two kinds of employment status within the third category of both life satisfaction and happiness. Within the first category, the differences are also not found to be existent between being employed, at home or retired. Similarly, being unemployed and unable to work due to sickness or disability do not appear to differ between each other. However, in comparison to the reference group, both decrease the likelihood of being satisfied and happy. While being unemployed decreases this likelihood by approximately 60%, the other category of employment status makes it less likely by approximately 42% and 49%, respectively. Moreover, compared to any other kind of employment status, being unemployed or unable to work highly differ.

Consequently, it then seems that an adverse change to the legal employment status has a considerable negative effect on one's life satisfaction and happiness.

Marital status is also given some attention by researchers and its influence is considered in this thesis as well. All kinds of marital status are statistically significant compared to the reference group. Moreover, almost all differ between each other throughout the modeling. The only exception is a lack of statistical difference between being separated and single within the first category. Being married in comparison to the reference group increases the likelihood of being satisfied and happy by approximately 18%. It has an even bigger positive effect of approximately 30% on the likelihood of being very satisfied and happy. While being in a formal marriage seems to have a positive effect on life satisfaction and happiness, it appears to be the opposite case for being single. Compared to the reference group, being single decreases the likelihood of being satisfied and happy by more than 30%. It also decreases the likelihood of being very satisfied and happy by more than 14% and 27% respectively. Also, compared to the reference group, being separated decreases the likelihood of being satisfied and happy by more than 30% in both cases. These results then seem to be consistent with those of Evans and Kelley (2004) mentioned in the Literature Review Chapter.

Beyond a certain level, an increase in the BMI score indicates an adverse change in health. Consequently, an effect of BMI scores is observed as a health indicator and the results show that an increase in the BMI score is found to decrease the likelihood of being both very satisfied and happy. Although, this effect amounts to only less than 2%.

To continue, the influence of health status in terms of formally diagnosed diseases is also observed. Two diseases that resulted in having a significant effect on the level of life satisfaction and happiness are cardiovascular disease and stomach or other gastrointestinal diseases. Suffering from the first one makes reporting lower levels of life satisfaction almost 13% more likely and reporting higher levels almost 19% less likely. Similarly, suffering from this disease decreases the likelihood of being very happy by almost 15%. Similar effects are found in the case of stomach or other gastrointestinal diseases. It decreases the likelihood of being very satisfied by almost 22% and the likelihood of being very happy by more than 17%. Moreover, it decreases the likelihood of being happy by more than 14%.

Many people adopt the habit of smoking. For this reason, an association between smoking status, and life satisfaction and happiness is briefly addressed. Compared to non-smokers, being a smoker affects different levels of life satisfaction and happiness. People who smoke are more than 32% less likely to report being satisfied and almost 21% less likely to be happy. Moreover, it makes approximately 12% and 7% less likely to be very satisfied and happy, respectively.

This thesis intended to address a potential influence of sugar consumption on the level of life satisfaction and/ or happiness. There is no indication of any relationship, however, a significance of other food categories is found.

Interesting results are obtained for fish consumption. Its significance is found in the case of Portugal, the UK and Spain, although the test for robustness is passed only by the last two countries. An additional portion of fish increases the likelihood of being very satisfied and happy by approximately 7% in the UK. Moreover, the results indicate, that with 4 portions of fish eaten per week, people from the UK start being more likely to report higher levels of life satisfaction. A similar conclusion can be made in case of happiness, as at least 6 portions of fish are eaten. In Spain, an additional portion of fish decreases the likelihood of being less satisfied and increases the likelihood of being very satisfied. Moreover, once more than 3 fish are eaten per week, Spanish people start being more likely to be more satisfied. In addition, as more than 4 fish per week are eaten in Spain, people also start reporting higher levels of happiness.

Lastly, there is an indication of fruit and vegetable consumption having an effect on the perceived life satisfaction and happiness. An additional portion of fruit or vegetables consumed per day increases the likelihood of being very satisfied and happy by more than 4% and 2%, respectively.

5 Conclusion

A standard approach to studying happiness and life satisfaction is mainly through an identification of their socio-demographic or health determinants. Similarly, there tends to be an effort to uncover the characteristics of those who consume higher amounts of sugar. There is an indication, that there exist factors which are predictors of all, happiness, life satisfaction, and sugar consumption. Nonetheless, to my knowledge, relationships between happiness and life satisfaction on one side and sugar consumption on the other, have been given very little attention by the researchers. Consequently, I aimed to fill this gap in research. I proposed models, where I first attempted to find an association between (zero) sugar consumption and happiness. Then, I constructed two separate models in order to find a relationship between happiness and life satisfaction, and sugar consumption in return. Moreover, in addition to socio-demographic factors, I added BMI scores, diseases, addictions in terms of smoking, and dietary patterns into all of the models. Therefore this thesis does not explain only relationships between happiness, life satisfaction, and sugar consumption. It also attempts to identify further predictors of these variables of interest.

The data were obtained through the INHERIT questionnaire survey from representative samples. The analysis was undertaken for 5 European countries, differing in political, socio-economic, climate and cultural characteristics. Logit and negative binomial model were used for the identification of the determinants of (zero) sugar consumption. An analysis of determinants of life satisfaction and happiness was undertaken through the use of the multinomial logit and bivariate probit model.

An association between sugar consumption and happiness was not found. Similarly, sugar did not result in being a significant predictor of either happiness or life satisfaction. Nonetheless, several factors were found to be associated with all, sugar consumption, happiness and life satisfaction. Variables that resulted in having a positive relationship with sugar consumption, were mostly negatively associated with happiness and life satisfaction, and vice-versa. Consequently, there is an indication that people who consume more sugar tend to be less happy and less satisfied. Nonetheless, these results should be interpreted with caution, due to a potential bias.

An implementation of health-related factors to the modeling brought interesting results. People with higher BMI scores do not tend to be very happy and satisfied and

tend to consume more sugar. Similarly, those who suffer from stomach, gastrointestinal disease, or were diagnosed with cancer or other chronic disease are less likely to be happy and satisfied and, in addition, were found to have a positive relationship towards sugar consumption.

Two things could be concluded based on controlling for addictions in terms of smoking. First, those who used to smoke, but chose to stop tend to consume less sugar than non-smokers, which implies a shift in attitudes towards adverse habits altogether. Second, smokers have a positive relationship towards sugar consumption, and are likely to be unhappy and dissatisfied.

Three food categories resulted in being important predictors of happiness, life satisfaction, and/ or sugar consumption. First, the results show that people who consume a lot of fruit and vegetables are likely to be very happy and satisfied and also do not tend to consume sugar at all. Second, in two countries – the UK and Spain higher consumption of fish makes it likely that people are very happy and satisfied. Third, excessive consumption of meat acts as a complement to an unhealthy diet in terms of high sugar consumption. Moreover, those who eat meat tend to consume at least some sugar per week.

Significant results were found also in terms of socio-demographic variables. It was found that people who have attained a tertiary level of education tend to be happy and satisfied, and consume considerably less sugar compared to those of lower education categories. Next, it was observed that people who live with children consume more sugar. Moreover, living with a lot of adult members makes being unhappy and dissatisfied more likely. Nonetheless, married people tend to be very happy and satisfied and are not very likely to consume any sugar. On contrary, single people were found to be less happy and satisfied and consume more sugar. Lastly, being unemployed due to sickness or other disability decreases the likelihood of being happy and satisfied. Interestingly, these people are extremely unlikely to consume any sugar.

There exist a few limitations to this thesis. Firstly, cross-sectional data were used for this analysis and therefore the research was limited to the analysis of data at one point in time. It was not possible to account, for example, for a possible adaption to adverse changes to one's health which may, in result, alter the perception of life satisfaction and happiness as discussed by Easterlin (2003). Secondly, income refers to a household

income and there is no information on individual levels of income in terms of households which consist of more than 1 member. Moreover, information on the price of sugar was not available, which might have been an important predictor of (zero) sugar consumption. Third, the thesis is limited to the interpretation of observed associations between variables only. It does not uncover causal effects. Lastly, there is a room for the use of more advanced techniques such as structural equation modeling. The advantage lies within the possibility to choose a variable of interest as a mediator. Consequently, sugar consumption could then better explain both happiness and life satisfaction, and vice versa.

Even despite the limitations, the results may have important implications. Sugar consumption tends to decrease with each higher level of education. There might be several underlying reasons for such results. Nonetheless, in addition to a sugar-tax introduction, there should be an incentive for the policymakers to attempt reducing sugar consumption through the adoption of various health warning policies as discussed by Grummon et al. (2019).

Based on the estimated results, there might be certain topics suitable for further research. While income does not seem to affect sugar consumption in majority of the countries of my interest, its importance in Spain is substantial and should be further examined. It also appears that a decision to stop smoking is followed by a decrease in sugar consumption. Consequently, addressing possible underlying reasons, such shifts in behavior should be addressed. Lastly, fish consumption in several countries with access to the sea should be subject to research based on its association with higher levels of life satisfaction and happiness.

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Appendix A: Tables

Table A1: Descriptive Statistics of Sugar Sonsumption, Life Satisfaction and Happiness

		Mean	St. Dev.	Variance	Median	Mode	Min	Max	Zero outcome (%)
All	**Sugar**	7,67	10,55	111,36	4	1	0	126	12,08
	Life Satisfaction	6,64	2,11	4,44	7	8	0	10	1,16
	Happiness	6,84	2,08	4,34	7	8	0	10	0,85
CZ	**Sugar**	7,74	11,03	121,72	4	1	0	95	13,08
	Life Satisfaction	6,84	2,13	4,54	7	8	0	10	0,71
	Happiness	7,09	2,12	4,51	7	8	0	10	0,45
PT	**Sugar**	6,15	9,72	94,54	4	1	0	126	14,90
	Life Satisfaction	6,79	9,72	94,54	7	8	0	10	0,37
	Happiness	6,85	1,94	3,77	7	8	0	10	0,55
UK	**Sugar**	8,36	11,45	131,08	5	3	0	126	11,56
	Life Satisfaction	6,44	2,28	5,19	7	7	0	10	1,70
	Happiness	6,60	2,21	4,90	7	8	0	10	1,18
ES	**Sugar**	8,03	9,61	92,44	5	0	0	109	10,74
	Life Satisfaction	6,68	2,08	4,31	7	8	0	10	1,34
	Happiness	6,93	2,00	3,99	7	8	0	10	0,89

Table A1: Descriptive Statistics of Sugar Consumption, Life Satisfaction and Happiness (cont.)

		Mean	St. Dev.	Variance	Median	Mode	Min	Max	Zero Outcome (%)
LV	**Sugar**	7,52	10,16	103,17	5	1	0	126	10,72
	Life Satisfaction	6,55	2,03	4,10	7	7	0	10	1,32
	Happiness	6,80	2,00	4,04	7	8	0	10	0,98

Table A2: Scales For Measurement of Life Satisfaction and Happiness

11-point scale	3-point scale	2-point scale	Label
0 1 2 3 4 5	1	0	Less satisfied/ happy
6 7	2		Satisfied/ happy
8 9 10	3	1	Very satisfied/ happy

Table A3: Income - Terciles

	1st tercile (%)	2nd tercile (%)	3rd tercile (%)
All	27,94	36,60	35,46
CZ	32,06	31,89	36,05
PT	24,73	41,27	33,99
UK	27,08	37,50	35,42
ES	23,89	39,79	36,32
LV	32,93	31,93	35,14

Table A4: Age Categories

	18-30 years (%)	31-45 years (%)	46-59 years (%)	60-65 years (%)
All	23,86	33,23	30,81	10,60
CZ	24,02	38,19	54,38	11,94
PT	28,29	36,85	27,56	7,30
UK	23,09	33,16	29,18	14,57
ES	19,84	40,40	32,46	7,31
LV	25,48	29,80	35,02	9,71

Table A5: Gender

	Male (%)	Female (%)	Other (%)
All	48,60	51,29	0,12
CZ	49,18	50,82	-
PT	52,96	46,98	0,06
UK	46,21	53,62	0,18
ES	50,17	49,78	0,05
LV	45,85	53,87	0,28

Table A6: Attained Levels of Education

	Primary and Lower Secondary (%)	Upper Secondary (%)	Tertiary (%)
All	29,57	38,56	31,88
CZ	43,04	36,60	20,36
PT	37,70	33,84	28,47
UK	21,10	39,18	39,72
ES	38,80	27,09	34,11
LV	9,43	57,46	33,11

Table A7: Average Number of Household Members

	Average number of adults living in the household including the respondent.	Average number of children living in the household
All	2,18	0,58
CZ	2,21	0,59
PT	2,40	0,57
UK	2,11	0,51
ES	2,40	0,64
LV	2,27	0,62

Table A8: Marital Status

	Married (%)	In Civil Partnership (%)	Separated after being married or in a civil partnership (%)	Divorced / dissolved civil partnership (%)
All	42,03	4,65	1,37	7,98
CZ	42,41	0,50	0,90	11,79
PT	38,30	16,62	1,59	7,45
UK	40,55	2,55	1,33	6,33
ES	47,35	6,29	1,23	5,89
LV	45,88	0	2,12	10,12

Table A8: Marital Status (cont.)

	Widowed/ Civil partner died (%)	Single (%)	Cohabitation without being married (%)
All	1,43	25,11	15,60
CZ	0,85	16,78	26,77
PT	1,04	28,83	6,17
UK	1,37	34,51	13,37
ES	1,03	26,47	11,74
LV	3,24	17,12	21,53

Table A9: Employment Status

	Employed Full-time (%)	Employed Part-time (%)	Self-employed (%)	Student (%)	Looking After the Home Full-time (%)
All	52,42	10,57	7,97	7,83	4,52
CZ	57,60	7,43	7,18	8,47	1,19
PT	58,38	9,11	9,71	11,04	2,96
UK	42,13	14,65	7,59	6,56	7,02
Es	48,33	11,80	6,43	6,05	5,81
LV	62,01	7,63	9,65	8,19	4,32

Table A9: Employment status (cont.)

	On maternity/paternity or parental leave (%)	Retired (%)	Unemployed (%)	Unable to work due to sickness or disability (%)	Other (%)
All	2,45	6,73	8,07	5,10	0,93
CZ	8,96	6,74	2,72	7,97	0,84
PT	0,36	5,31	11,10	1,87	1,21
UK	0,46	9,33	5,96	7,87	0,85
ES	0,15	5,03	15,67	2,42	0,82
LV	2,81	5,89	5,84	3,59	1,01

Table A10: BMI Scores

	Average BMI score	Underweight (%)	Normal Weight (%)	Overweight (%)	Obesity (%)
All	23,04	2,75	38,16	28,48	18,02
CZ	25,37	2,48	31,70	32,49	26,35
PT	22,57	2,53	41,80	29,92	13,69
UK	21,03	3,12	37,87	22,66	16,21
ES	23,20	2,85	43,11	30,00	14,32
LV	23,82	2,58	36,81	30,08	19,75

Table A11: Diseases

	Cardiovascular Disease (%)	Cancer (%)	Diabetes (%)	Food Intollerance or Allergy (%)
All	6,61	3,10	6,42	10,61
CZ	7,88	2,97	8,12	12,23
PT	6,57	3,08	4,70	11,88
UK	4,22	3,87	6,70	9,11
ES	3,82	2,23	5,95	9,05
LV	12,23	3,09	6,17	11,78

Table A11: Diseases (cont.)

	Stomach or Other Gastrointestinal Disease (%)	Other Chronic Disease (%)	Hypertension (%)
All	15,73	14,47	14,81
CZ	20,75	15,35	22,14
PT	14,78	14,84	14,66
UK	9,57	9,96	12,27
ES	15,00	10,64	11,32
LV	21,49	24,69	14,70

Table A12: Smoking

	Smoker (%)	Former Smoker (%)	Non Smoker (%)
All	27,76	25,35	45,92
CZ	33,18	26,65	39,43
PT	25,75	22,98	50,54
UK	19,33	25,25	54,61
ES	35,17	26,08	38,03
LV	28,23	25,42	44,39

Table A13: Descriptive Statistics of Dietary Patterns

		Mean	St. Dev.	Variance	Mode	Median	Min	Max
All	**Meat**	5,41	3,92	15,38	4	5	0	32
	Fish	1,98	2,41	5,79	0	1	0	24
	Fruit and vegetables	2,82	2,54	6,43	1	2	0	12
	Pulses	1,44	2,93	8,58	0	1	0	42
CZ	**Meat**	4,80	3,57	12,73	4	4	0	32
	Fish	0,88	1,31	1,71	0	0	0	15
	Fruit and vegetables	2,47	2,36	5,55	1	2	0	12
	Pulses	0,63	1,45	2,10	0	0	0	25
PT	**Meat**	6,22	3,92	15,40	5	6	0	32
	Fish	3,21	2,83	8,00	2	3	0	24
	Fruit and vegetables	2,65	2,20	4,82	1	2	0	12
	Pulses	2,04	3,56	12,70	0	1	0	42
UK	**Meat**	4,90	4,02	16,14	4	4	0	32
	Fish	1,80	2,33	5,42	0	1	0	24
	Fruit and vegetables	3,43	2,93	8,58	1	3	0	12
	Pulses	1,82	3,70	13,62	0	1	0	42
ES	**Meat**	5,38	3,46	12,01	5	5	0	24
	Fish	2,96	2,50	6,26	2	2	0	18
	Fruit and vegetables	2,54	2,15	4,64	1	2	0	12
	Pulses	1,85	2,58	6,66	1	1	0	42

Table A13: Descriptive Statistics of Dietary Patterns (cont.)

		Mean	St. Dev	Variance	Median	Mode	Min	Max
LV	**Meat**	6,21	4,36	19,00	4	6	0	32
	Fish	1,20	1,97	3,86	0	1	0	24
	Fruit and vegetables	2,77	2,60	6,73	1	2	0	12
	Pulses	0,72	2,08	4,33	0	0	0	42

Table A14: Determinants of Sugar Consumption

Dependent Variable: Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cz	0,067 (0,0777)	
pt	-0,2412 (0,0835)	**
uk	0,1636 (0,0656)	*
es	0,1763 (0,0711)	*
income (CZ)	0,0128 (0,0288)	
income (ES)	-0,0523 (0,023)	*
income (PT)	-0,0222 (0,038)	
income (UK)	0,0017 (0,0175)	
income (LV)	0,0236 (0,0326)	
missing income	-0,0564 (0,0497)	
age 18-30	0,2863 (0,0629)	***
age 31-45	0,1786 (0,0583)	**
age 46-59	0,0921 (0,0532)	.
male	0,0563 (0,0284)	*

Table A14: Determinants of Sugar Consumption (cont.)

Dependent Variable: Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
tertiary education	-0,2171 (0,0386)	***
secondary education	-0,1478 (0,0356)	***
adults	0,0276 (0,0155)	.
children	0,0843 (0,0168)	***
employed	0,0309 (0,0548)	
at home	0,1252 (0,0713)	.
retired	0,0545 (0,0793)	
unemployed	0,039 (0,0669)	
unable to work	-0,002 (0,0813)	
married	-0,0443 (0,0368)	
separated	0,0411 (0,0566)	
single	0,0547 (0,0387)	
happiness	-0,0081 (0,0071)	
BMI	0,0037 (0,0025)	

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Table A14: Determinants of Sugar Consumption (cont.)

Dependent Variable: Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
missing BMI	0,2008 (0,0809)	*
cardiovascular	0,1046 (0,0581)	.
cancer & chronic	0,0605 (0,0354)	.
diabetes (CZ)	0,0127 (0,1427)	
diabetes (PT)	-0,4725 (0,1638)	**
diabetes (UK)	0,3359 (0,1065)	**
diabetes (ES)	-0,1189 (0,1446)	
diabetes (LV)	-0,409 (0,1405)	**
food intollerance	-0,0006 (0,0425)	
gastrointestinal	0,0863 (0,037)	*
hypertension	-0,1089 (0,0426)	*
smoker	0,0837 (0,0333)	*
former smoker	-0,1141 (0,033)	**
Fish	0,0034 (0,0062)	

Table A14: Determinants of Sugar Consumption (cont.)

Dependent Variable: Sugar Consumption		
	Estimated Coefficients **(Robust Std. Errors)**	**Significance**
Meat	0,0607 (0,0035)	***
Fruit	-0,002 (0,0066)	
Pulses	0,0109 (0,0047)	*
_cons	1,3225 (0,1412)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of observations = 10 151

Wald chi2(45) = 908,93

Prob > chi2 = 0,000

Pseudo R2 = 0,0195

alpha = 1,0402 (0,0201)

Table A15: Determinants of Zero Sugar Consumption

Dependent Variable: Zero Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cz	0,1375 (0,1912)	
pt	-0,1123 (0,1963)	
uk	0,4378 (0,1966)	*
es	-0,0762 (0,1698)	
income (CZ)	-0,0625 (0,0743)	
income (ES)	-0,0029 (0,0652)	
income (PT)	0,0121 (0,0848)	
income (UK)	-0,0604 (0,0491)	
income (LV)	-0,0783 (0,1057)	
missing income	-0,0221 (0,1237)	
age 18-30	-0,3718 (0,1494)	*
age 31-45	-0,283 (0,1345)	*
age 46-59	-0,0273 (0,117)	
male	-0,1054 (0,0706)	

Table A15: Determinants of Zero Sugar Consumption (cont.)

Dependent Variable: Zero Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
tertiary education	0,092 (0,0917)	
secondary education	0,0363 (0,0824)	
adults	-0,1006 (0,0402)	*
children	-0,1649 (0,0498)	**
employed	-0,0006 (0,1267)	
at home	-0,0877 (0,1667)	
retired	-0,0839 (0,1798)	
unemployed	0,2031 (0,1568)	
unable to work	0,4347 (0,1618)	**
married	0,1638 (0,0943)	.
separated	0,1768 (0,1217)	
single	-0,0566 (0,1036)	
happiness	-0,0132 (0,0169)	
BMI	0,0068 (0,0063)	

Table A15: Determinants of Zero Sugar Consumption (cont.)

Dependent Variable: Zero Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
missing BMI	0,1852 (0,196)	
cardiovascular	-0,0339 (0,1326)	
cancer & chronic	-0,2371 (0,0928)	*
diabetes (CZ)	0,295 (0,221)	
diabetes (PT)	0,1522 (0,336)	
diabetes (UK)	-0,1588 (0,2581)	
diabetes (ES)	0,3116 (0,2717)	
diabetes (LV)	0,611 (0,2704)	*
food intollerance	0,0657 (0,1087)	
gastrointestinal	-0,0704 (0,0924)	
hypertension	0,0207 (0,099)	
smoker	0,1194 (0,0835)	
former smoker	0,2231 (0,0794)	**

Table A15: Determinants of Zero Sugar Consumption (cont.)

Dependent Variable: Zero Sugar Consumption		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
Fish	-0,0002 (0,0182)	
Meat	-0,1269 (0,0124)	***
Fruit	0,0504 (0,0128)	***
Pulses	0,0131 (0,0108)	
_cons	-1,3502 (0,3446)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of observations = 10 151

Wald chi2(45) = 353,77

Prob > chi2 = 0,000

Pseudo R2 = 0,0568

Table A16: Determinants of Life Satisfaction

	First Category		Third Category	
Dependent Variable: Life Satisfaction (3-point scale) **Base Group: Second Category**				
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
cz	0,3344 (0,1142)	**	0,4245 (0,1023)	***
pt	0,0161 (0,1397)		0,0496 (0,1206)	
uk	0,4175 (0,1078)	***	-0,273 (0,1011)	**
es	0,0349 (0,1282)		-0,2052 (0,1148)	.
income (EUR)	-0,2501 (0,0365)	***	0,1664 (0,0256)	***
missing income	-0,5102 (0,1027)	***	0,1681 (0,0888)	.
age	0,0471 (0,0169)	**	-0,0547 (0,015)	***
age2	-0,0005 (0,0002)	*	0,0007 (0,0002)	***
male	0,1102 (0,0592)	.	0,0816 (0,0526)	
tertiary education	-0,4046 (0,0806)	***	-0,074 (0,0692)	
secondary education	-0,1546 (0,0699)	*	-0,1891 (0,0651)	**
adults	0,1161 (0,0316)	***	-0,0407 (0,03)	

Table A16: Determinants of Life Satisfaction (cont.)

Dependent Variable: Life Satisfaction (3-point scale)				
Base Group: Second Category				
	First Category		**Third Category**	
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
children	0,044 (0,038)		0,0631 (0,0323)	.
employed	-0,2125 (0,108)	*	0,116 (0,1015)	
at home	-0,1282 (0,1407)		0,1452 (0,1286)	
retired	-0,1313 (0,1628)		0,2281 (0,1457)	
unemployed	0,6268 (0,13)	***	-0,0095 (0,1365)	
unable to work	0,4138 (0,1486)	**	0,0334 (0,1592)	
married	-0,177 (0,0807)	*	0,3354 (0,0686)	***
separated	0,311 (0,1049)	**	0,0647 (0,1019)	
single	0,3006 (0,0822)	***	-0,144 (0,0769)	.
BMI	0,0072 (0,0051)		-0,0177 (0,0051)	**
missing BMI	0,3775 (0,1624)	*	-0,2706 (0,1544)	.
diabates (CZ)	0,0406 (0,2255)		-0,3023 (0,2119)	

Table A16: Determinants of Life Satisfaction (cont.)

Dependent Variable: Life Satisfaction (3-point scale)				
Base Group: Second Category				
	First Category		**Third Category**	
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
diabetes (PT)	0,3996 (0,2835)		-0,9313 (0,3374)	**
diabetes (UK)	-0,1766 (0,2151)		0,154 (0,1883)	
diabetes (ES)	-0,2752 (0,2763)		-0,1876 (0,2259)	
diabetes (LV)	-0,0056 (0,2537)		-0,0912 (0,259)	
cardiovascular	0,1668 (0,1144)		-0,1248 (0,1123)	
canccer & chronic	0,1267 (0,0759)	.	-0,187 (0,0719)	**
food intollerance	0,231 (0,0907)	*	-0,0448 (0,0835)	
gastrointestinal	0,102 (0,081)		-0,2192 (0,0746)	**
hypertension	0,016 (0,0901)		0,0108 (0,0811)	
smoker	0,3244 (0,0683)	***	-0,1185 (0,062)	.
former smoker	-0,0095 (0,0714)		-0,0694 (0,0614)	
fish (CZ)	-0,0392 (0,0537)		0,0193 (0,0388)	

Table A16: Determinants of Life Satisfaction (cont.)

	First Category		Third Category	
Dependent Variable: Life Satisfaction (3-point scale)				
Base Group: Second Category				
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
fish (PT)	-0,072 (0,0335)	*	0,0211 (0,021)	
fish (UK)	-0,021 (0,0292)		0,0712 (0,0225)	**
fish (ES)	-0,0485 (0,0284)	.	0,079 (0,0208)	***
fish (LV)	-0,0182 (0,0369)		0,0064 (0,0289)	
Meat	-0,012 (0,0079)		0,0081 (0,0068)	
Fruit	-0,0034 (0,0123)		0,0402 (0,0103)	***
Pulses	-0,0187 (0,0133)		0,0083 (0,0087)	
Sugar	0,0054 (0,0028)	.	0,0012 (0,0025)	
_cons	-1,46 (0,3632)	***	0,9722 (0,3278)	**

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of Observations = 10 110

Wald chi2(88)= 1173,34

Prob. > chi2 = 0,0000

Pseudo R2 = 0,0696

Table A17: Determinants of Happiness

	First Category		Third Catgeory	
Dependent Variable: Happiness (3-point scale)				
Base Group: Second Category				
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
cz	0,1872 (0,119)		0,2224 (0,1008)	*
pt	-0,0255 (0,1426)		-0,0804 (0,1205)	
uk	0,2495 (0,1128)	*	-0,3819 (0,0989)	***
es	-0,1601 (0,1354)		-0,281 (0,1133)	*
income (EUR)	-0,2204 (0,0369)	***	0,1339 (0,0253)	***
missing income	-0,4847 (0,1058)	***	0,174 (0,0879)	*
age	0,0334 (0,0175)	.	-0,0541 (0,0148)	***
age2	-0,0004 (0,0002)	.	0,0007 (0,0002)	***
male	0,035 (0,0613)		-0,042 (0,052)	
tertiary education	-0,435 (0,0836)	***	-0,1478 (0,0686)	*
secondary education	-0,1376 (0,0725)	.	-0,1186 (0,0646)	.
adults	0,0875 (0,0325)	**	-0,0452 (0,0297)	

Table A17: Determinants of Happiness (cont.)

Dependent Variable: Happiness (3-point scale)				
Base Group: Second Category				
	First Category		**Third Catgeory**	
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
children	0,0389 (0,0399)		0,0737 (0,0314)	*
employed	-0,0455 (0,1084)		0,2288 (0,0978)	*
at home	0,057 (0,1451)		0,2556 (0,1241)	*
retired	0,0081 (0,1668)		0,2389 (0,1435)	.
unemployed	0,5903 (0,1304)	***	0,107 (0,1275)	
unable to work	0,4847 (0,1486)	**	0,1085 (0,1503)	
married	-0,1889 (0,0841)	*	0,2949 (0,0678)	***
separated	0,337 (0,1086)	**	0,0051 (0,0994)	
single	0,3339 (0,0846)	***	-0,2741 (0,0756)	***
BMI	0,0067 (0,0054)		-0,0126 (0,005)	*
missing BMI	0,3859 (0,1698)	*	-0,1399 (0,1505)	
diabates (CZ)	0,1977 (0,236)		-0,0434 (0,2085)	

Table A17: Determinants of Happiness (cont.)

	First Category		Third Catgeory	
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
Dependent Variable: Happiness (3-point scale) **Base Group: Second Category**				
diabetes (PT)	0,6231 (0,3009)	*	-0,5518 (0,3204)	.
diabetes (UK)	0,2731 (0,2255)		0,3974 (0,1988)	*
diabetes (ES)	-0,2606 (0,2837)		-0,2151 (0,2219)	
diabetes (LV)	0,2882 (0,2625)		-0,0997 (0,2595)	
cardiovascular	-0,0141 (0,118)		-0,4009 (0,1085)	***
canccer & chronic	0,0872 (0,0786)		-0,142 (0,07)	*
food intollerance	0,1477 (0,0945)		-0,0036 (0,0818)	
gastrointestinal	0,1455 (0,0842)	.	-0,174 (0,0728)	*
hypertension	0,0503 (0,0946)		0,0928 (0,0801)	
smoker	0,2061 (0,0707)	**	-0,0701 (0,0611)	
former smoker	-0,051 (0,0739)		-0,0586 (0,0611)	
fish (CZ)	-0,0973 (0,0594)		-0,0024 (0,0375)	

Table A17: Determinants of Happiness (cont.)

Dependent Variable: Happiness (3-point scale)

Base Group: Second Category

	First Category		Third Catgeory	
	Estimated Coefficients (Robust Std. Errors)	**Significance**	**Estimated Coefficients (Robust Std. Errors)**	**Significance**
fish (PT)	-0,0753 (0,0323)	*	-0,0147 (0,0215)	
fish (UK)	0,0035 (0,0296)		0,0664 (0,0228)	**
fish (ES)	-0,0362 (0,0305)		0,0691 (0,0213)	**
fish (LV)	-0,0502 (0,04)		-0,0106 (0,0289)	
Meat	-0,008 (0,0082)		0,0098 (0,0068)	
Fruit	-0,0327 (0,0131)	*	0,0212 (0,0102)	*
Pulses	-0,0089 (0,0136)		0,0175 (0,0091)	.
Sugar	0,0023 (0,0029)		0,0001 (0,0025)	
_cons	-0,9796 (0,3783)	**	1,2579 (0,3251)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of Observations = 10 151

Wald chi2(88)= 1060,38

Prob. > chi2 = 0,0000

Pseudo R2 = 0,0609

Table A18: Determinants of Life Satisfaction and Happiness

Dependent Variables: Life Satisfcation and Happiness (binary)				
	Life Satisfaction		**Happiness**	
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
cz	0,0997 (0,0569)	.	0,0468 (0,0566)	
pt	0,1047 (0,0677)		0,0389 (0,0668)	
uk	-0,2645 (0,0551)	***	-0,2631 (0,0549)	***
es	-0,1121 (0,0637)	.	-0,093 (0,0638)	
income (EUR)	0,1953 (0,016)	***	0,1451 (0,0159)	***
missing income	0,3574 (0,0502)	***	0,2718 (0,0499)	***
age	-0,0363 (0,0084)	***	-0,0418 (0,0084)	***
age2	0,0004 (0,0001)	***	0,0005 (0,0001)	***
male	-0,0243 (0,0293)		-0,0274 (0,0294)	
tertiary education	0,2024 (0,0392)	***	0,1811 (0,0394)	***
secondary education	0,0272 (0,0349)		0,0495 (0,0351)	
adults	-0,0795 (0,0162)	***	-0,0677 (0,016)	***
children	0,0056 (0,0183)		0,0325 (0,0185)	.

Table A18: Determinants of Life Satisfaction and Happiness (cont.)

Dependent Variables: Life Satisfcation and Happiness (binary)				
	Life Satisfaction		Happiness	
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
employed	0,1134 (0,0533)	*	0,1552 (0,0535)	**
at home	0,11 (0,0687)		0,0829 (0,069)	
retired	0,1133 (0,0802)		0,141 (0,0802)	.
unemployed	-0,3694 (0,0674)	***	-0,26 (0,0665)	***
unable to work	-0,2294 (0,0758)	**	-0,2023 (0,075)	**
married	0,2201 (0,0388)	***	0,2106 (0,0391)	***
separated	-0,1382 (0,0533)	**	-0,1827 (0,0532)	**
single	-0,2282 (0,0411)	***	-0,3334 (0,0409)	***
BMI	-0,009 (0,0026)	**	-0,0056 (0,0027)	*
missing BMI	-0,2865 (0,0818)	***	-0,2362 (0,0837)	**
diabates (CZ)	-0,1849 (0,1122)	.	-0,3191 (0,1103)	**
diabetes (PT)	-0,3896 (0,1623)	*	-0,2639 (0,1596)	.

Table A18: Determinants of Life Satisfaction and Happiness (cont.)

Dependent Variables: Life Satisfcation and Happiness (binary)				
	Life Satisfaction		Happiness	
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
diabetes (UK)	0,2122 (0,1039)	*	0,1563 (0,1105)	
diabetes (ES)	-0,0428 (0,1294)		0,0121 (0,1318)	
diabetes (LV)	-0,0586 (0,139)		-0,1622 (0,1349)	
cardiovascular	-0,0995 (0,0581)	.	-0,1561 (0,0579)	**
canccer & chronic	-0,1392 (0,0387)	***	-0,1045 (0,0385)	**
food intollerance	-0,0708 (0,0455)		-0,0514 (0,0452)	
gastrointestinal	-0,1339 (0,0414)	**	-0,1409 (0,0411)	**
hypertension	-0,0177 (0,0445)		0,0239 (0,045)	
smoker	-0,1805 (0,034)	***	-0,1251 (0,034)	***
former smoker	-0,0473 (0,0347)		0,009 (0,0349)	
fish (CZ)	0,0111 (0,0244)		0,0311 (0,0254)	
fish (PT)	0,0226 (0,0136)	.	0,0112 (0,0132)	

Table A18: Determinants of Life Satisfaction and Happiness (cont.)

Dependent Variables: Life Satisfcation and Happiness (binary)				
	Life Satisfaction		Happiness	
	Estimated Coefficients (Robust Std. Errors)	Significance	Estimated Coefficients (Robust Std. Errors)	Significance
fish (UK)	0,0293 (0,0135)	*	0,0318 (0,0131)	*
fish (ES)	0,0537 (0,0125)	***	0,0487 (0,0127)	***
fish (LV)	0,0306 (0,0173)	.	0,0117 (0,0169)	
Meat	0,0089 (0,0038)	*	0,004 (0,0038)	
Fruit	0,0206 (0,0059)	**	0,0229 (0,0061)	***
Pulses	0,0068 (0,0053)		0,0059 (0,0056)	
Sugar	-0,001 (0,0014)		0,0002 (0,0014)	
_cons	0,9175 (0,1793)	***	1,0775 (0,1796)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of Observations = 10 052

Wald chi2(88)= 1206,59

Prob. > chi2 = 0,0000

rho: 0,9004 (0,0054)   chi2(1) = 2706.74   Prob. > chi2 = 0,0000

Table A19: Determinants of Life Satisfaction

Dependent Variable: Life Satisfaction (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cz	0,1493 (0,093)	
pt	0,1819 (0,1123)	
uk	-0,4491 (0,0909)	***
es	-0,1976 (0,1053)	.
income (EUR)	0,3329 (0,0278)	***
missing income	0,5981 (0,0826)	***
age	-0,0619 (0,0138)	***
age2	0,0007 (0,0002)	***
male	-0,0464 (0,0484)	
tertiary education	0,3387 (0,0647)	***
secondary education	0,034 (0,0573)	
adults	-0,1347 (0,0268)	***
children	0,0112 (0,0305)	
employed	0,1724 (0,0879)	*

Table A19: Determinants of Life Satisfaction (cont.)

Dependent Variable: Life Satisfaction (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
at home	0,1758 (0,114)	
retired	0,1558 (0,1303)	
unemployed	-0,5913 (0,1101)	***
unable to work	-0,3753 (0,1249)	**
married	0,3698 (0,0643)	***
separated	-0,2177 (0,0863)	*
single	-0,3648 (0,0679)	***
BMI	-0,0146 (0,0043)	**
missing BMI	-0,4564 (0,1346)	**
diabates (CZ)	-0,3114 (0,184)	.
diabetes (PT)	-0,6132 (0,2593)	*
diabetes (UK)	0,3542 (0,1702)	*
diabetes (ES)	-0,0525 (0,2234)	
diabetes (LV)	-0,0953 (0,2218)	

Table A19: Determinants of Life Satisfaction (cont.)

Dependent Variable: Life Satisfaction (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cardiovascular	-0,1578 (0,0971)	
canccer & chronic	-0,2376 (0,0638)	***
food intollerance	-0,1202 (0,0754)	
gastrointestinal	-0,2112 (0,068)	**
hypertension	-0,031 (0,0738)	
smoker	-0,3026 (0,0558)	***
former smoker	-0,0821 (0,0576)	
fish (CZ)	0,0191 (0,0408)	
fish (PT)	0,0335 (0,0236)	
fish (UK)	0,051 (0,0235)	*
fish (ES)	0,0917 (0,0215)	***
fish (LV)	0,0538 (0,0306)	.
Meat	0,015 (0,0064)	*
Fruit	0,0325 (0,0099)	**

Table A19: Determinants of Life Satisfaction (cont.)

Dependent Variable: Life Satisfaction (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
Pulses	0,0124 (0,0094)	
Sugar	-0,0022 (0,0023)	
_cons	1,548 (0,2975)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of Observations = 10 110

Wald chi2(44)= 951,58

Prob. > chi2 = 0,0000

Pseudo R2 = 0.0886

Table A20: Determinants of Happiness

Dependent Variable: Happiness (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cz	0,055 (0,0935)	
pt	0,0587 (0,1121)	
uk	-0,4523 (0,0909)	***
es	-0,1688 (0,1062)	
income (EUR)	0,246 (0,0271)	***
missing income	0,4555 (0,0821)	***
age	-0,0656 (0,0139)	***
age2	0,0008 (0,0002)	***
male	-0,0534 (0,0486)	
tertiary education	0,2916 (0,065)	***
secondary education	0,0589 (0,0577)	
adults	-0,1138 (0,0265)	***
children	0,0588 (0,031)	.
employed	0,2294 (0,0866)	**

Table A20: Determinants of Happiness (cont.)

Dependent Variable: Happiness (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
at home	0,1138 (0,1135)	
retired	0,1995 (0,1305)	
unemployed	-0,4247 (0,1068)	***
unable to work	-0,3546 (0,1215)	**
married	0,3428 (0,0652)	***
separated	-0,3056 (0,0863)	***
single	-0,5427 (0,0677)	***
BMI	-0,0092 (0,0044)	*
missing BMI	-0,3762 (0,1362)	**
diabates (CZ)	-0,5159 (0,1816)	**
diabetes (PT)	-0,4168 (0,2594)	
diabetes (UK)	0,2366 (0,1748)	
diabetes (ES)	0,0538 (0,2281)	
diabetes (LV)	-0,2868 (0,2138)	

Table A20: Determinants of Happiness (cont.)

Dependent Variable: Happiness (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
cardiovascular	-0,2426 (0,0966)	*
canccer & chronic	-0,1707 (0,0636)	**
food intollerance	-0,0834 (0,0751)	
gastrointestinal	-0,2213 (0,0675)	**
hypertension	0,0538 (0,0747)	
smoker	-0,2055 (0,0559)	***
former smoker	0,0197 (0,058)	
fish (CZ)	0,0571 (0,0434)	
fish (PT)	0,0166 (0,023)	
fish (UK)	0,0553 (0,023)	*
fish (ES)	0,0836 (0,0221)	***
fish (LV)	0,0213 (0,0302)	
Meat	0,0077 (0,0064)	
Fruit	0,0391 (0,0102)	***

Table A20: Determinants of Happiness (cont.)

Dependent Variable: Happiness (binary)		
	Estimated Coefficients (Robust Std. Errors)	**Significance**
Pulses	0,01 (0,0096)	
Sugar	0,0007 (0,0023)	
_cons	1,7326 (0,2993)	***

p-value: 0,000 " *** " 0,001 " ** " 0,01 " * " 0,05 "." 0,1 " " 1

Number of Observations = 10 151

Wald chi2(44)= 872,05

Prob. > chi2 = 0,0000

Pseudo R2 = 0,0798

Appendix B: Explanatory Variables

Table B1: Description of the Explanatory Variables

Variable	Description
cz	Being from the Czech Republic
pt	Being from Portugal
uk	Being from the United Kingdom
es	Being from Spain
income	Income of the household after an application of purchasing power parity
missing income	Unreported income
income (CZ)	Household income of the Czech respondents
age	Age of the respondent
age2	Age squared of the respondent
age 18-30	Being between 18 and 30 years old
male	Male gender
tertiary education	Having attained tertiary level of education
secondary education	Having attained upper secondary level education
adults	Number of adults living in a household including the respondent
children	Number of children present in the household
employed	Being employed Full-time/Part-time or Self-employed
athome	Taking care of home full-time or being on maternity/paternity or parental leave
retired	Being retired
unemployed	Being unemployed

Table B1: Description of the Explanatory Variables (cont.)

Variable	Description
unable to work	Being unable to work due to sickness or other disability
married	Being married
separated	Being separated after being married or in a civil partnership or divorced / dissolved civil partnership or widowed/ civil partner died
single	Being single
bmi	BMI score
happiness	Level of happiness measured on an 11-point scale
cardiovascular	Suffering from cardiovascular disease
cancer & chronic	Suffering from cancer or other chronic disease
diabetes	Suffering from diabetes
diabetes (CZ)	Suffering from diabetes and being from the Czech republic
food intollerance	Having food intollerance or allergy
gastrointestinal	Suffering from stomach or other gastrointestinal disease
hypertension	Being treated for hypertension
smoker	Being a smoker
former smoker	Being a former smoker
Fish	Portions of fish consumed per week
fish (CZ)	Portions of fish eaten per week by Czech respondents
Meat	Portions of meat consumed per week
Fruit	Portions of fruit and vegetables consumed per day
Pulses	Portions of pulses consumed per week
Sugar	Portions of sugar consumed per week