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The Effect of Socio-Demographic Factors on Consumer Trends in the Czech Republic

Bachelor thesis

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Abstract

The thesis examines the potential effects of various socio-demographic determinants on consumer trends in the Czech market over the years 2009-2019. We use data from the agency Median, s.r.o., which has been researching consumer behavior since 1993. This work analyzes dependent categorical variables that define potential consumer trends and represent answers of respondents or households. We utilized an ordinal logistic regression for the analysis, which we subsequently tested by Brant's test. Statistically significant results from the models are similar to the results in previous studies. Specifically, during the years 2009–2019, the interest in recycling increases, people tend to buy organic food more often, and spending on Czech products decreases slightly (especially in 2018 and 2019), and people tend to spend more money on vacation. For example, the bachelor thesis shows that women have a greater tendency to buy organic products and Czech food than men and, at the same time, recycle more often than men. Furthermore, new variables are examined in regards to observed trends. Such variables are the number of persons employed in the household and the ABCDE classification. Overall, the main contributions of this thesis are Czech consumer preferences and trends over eleven years and detailed consumer cross-comparison according to several socio-demographic determinants.

Keywords

Global trends, consumer behavior, recycling, Czech product, bioproducts, traveling, Odered Logit regression, ABCDE classification

Abstrakt

Práce zkoumá potenciální vlivy různých socio-demografických determinantů na spotřebitelské trendy na českém trhu v rozmezí let 2009-2019. Používáme data od agentury Median, s.r.o., která provádí výzkum spotřebního chování již od roku 1993. V práci analyzujeme závislé kategorické proměnné, které reprezentující preference respondentů či domácností, a definují potenciální spotřebitelské trendy. Pro analýzu jsme použili ordinární logistickou regrese, které jsme následně otestovali Brantovým testem. Statisticky signifikantní výsledky v modelech se ztotožňují s výsledky v předchozích studiích. Konkrétně, během let 2009-2019 se zvyšuje zájem o recyklovaní, lidé častěji nakupují bio potraviny, mírně klesá zájem o české produkty (speciálně v letech 2018 a 2019) a populace utrácí více peněz za dovolenou. Bakalářská práce například ukazuje, že ženy mají větší tendenci kupovat bioprodukty a české potraviny než muži a zároveň recyklují častěji než muži. Nové proměnné, které dále zkoumáme ve vztahu ke sledovaným trendům, jsou počet zaměstnaných osob v domácnosti a ABCDE klasifikace. Celkově je tato práce výjimečná tím, že sleduje české spotřebitelské preference po dobu deseti let a detailněji zkoumá spotřebitelské trendy vzhledem k socio-demografickým údajům.

Klíčová slova

globalní trendy, spotřebitelské chovaní , recyklace, české výrobky, bioprodukty, cestování, ordinární logistická regrese, ABCDE česká národní socioekonomická klasifikace

Declaration of Authorship

I hereby proclaim that I wrote my bachelor thesis on my own under the leadership of my supervisor and that the references include all resources and literature I have used.

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Prague, 3 May 2021

Signature

Acknowledgment

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Bachelor's Thesis Proposal

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Proposed Topic:

The Effect of Socio-Demographic Factors on Consumer Trends in the Czech Republic

Preliminary scope of work:

Research question and motivation

The principal objective of the bachelor's thesis is to analyze effects of socio-demographic factors on consumer trends in the Czech republic over the period 2009—2019.
The study of consumer behavior consists of understanding consumers and their characteristics. We might initially think of approaching, observing, and interviewing consumers, however, we have to dig first into the larger picture. We need to identify relevant social, economic, and/or technological changes in the context in which consumers are immersed. The way people behave is undoubtedly impacted by their culture and time. (Sheth and Sisodia, 1999)
It is important for managers to identify trends in the market. A trend is an important change—in terms of economic, environmental, social, political, or technological factors—that is slowly formed and affects our behavior as consumers and how people perceive the world around them (Naisbitt, 1982).
There has been a huge change in consumers' spending over last decade. For example - consumers have developed increasing concerns about environmental problems, including polluted air, contaminated water, and adulterated food. These concerns have had an impact on consumption behavior due to the beliefs that non- ecological actions will harmfully affect consumers during their lives. People have changed food habits and moved to the consumption of renewable energy and energy- efficient appliances and transportation. Faith Popcorn (2015) named this trend Atmosfear. Consumers have developed increasing concerns technology innovation, which lead to a change in the world market. (Rajagopal Castano, Raquel,Flores Villalba, David R.2016)
In my bachelor's thesis I would like to uncover whether consumer trends in the Czech Republic are in line with the global trends and test how socio-demographic characteristics affect these trends in consumption. Existing research (Euromonitor) shows that preferences for traveling, bio-products, environment-friendly products and others differ by generation, region and also culture.

I will try to answer the following questions:
How have consumer trends changed in the Czech Republic over last years? What role do socio-demographic factors play in consumer trends? Can we see reasonable differences females and males? Can we see reasonable differences in consumer trends between households based on the **ABCDE - Czech national socio-economic classification –** is socio-economic classification what was derived from

ESOMAR socio-economic classification (ESOMAR Social Grade ,1997). It was modified to fit Czech conditions. We modified classes on the base of the index of the subsistence minimum. Index of the subsistence minimum is derived from the general income of the household of the respondent and the minimal life cost and index would be modified every year according to the consumer price index (inflation).

Contribution

Understanding consumers and their characteristics is important for seizing market opportunities. This does not refer to just understanding consumers as individuals, but also really getting down to understanding what social and cultural factors shape their motivations, perceptions and attitudes. (Castano et al. 2016)
The thesis aims to uncover consumer trends in the Czech Republic over the period 2009-2019 focusing mainly on the current global consumer trends (e.g. healthy life style, environment-friendly products, and traveling). The effect of socio-demographic characteristics of consumers on the trends will be analyzed.
Analysis of consumer trends is necessary for marketing strategies, which could be developed to serve different groups of consumers in diverse markets. The analysis will also uncover consumption patterns for different groups of consumers divided by age, socio-economic status, education, or region where they live.
I will use data from one of the leading market research agencies, MEDIAN s. r. o., with many years of experience in the area of market research, media and public opinion. The agency has been carrying out the highly extensive study about consumption - *Market & Media & Lifestyle (MML-TGI)* since 1996. Every year, about 15,000 respondents from the Czech Republic (aged 12-79 years) are interviewed within the survey. The sample is representative for the population of the Czech Republic, as the selection of the respondents is performed by the quota selection method.

Methodology

The data to be analyzed are the repeated cross-sectional data, because different respondents are interviewed every year. The dependent variable in our model would represent a consumer trend based on consumers' spending or preferences for consumption and lifestyle.
The dependent variables will be either *categorical* and will include statements about healthy life style, consumption of bio-products, Czech products, environment-friendly products, or preference for traveling.

Independent variables will include socio-demographic characteristics of consumers, which could affect the consumption – for example age, education, region, economic activity (that significantly determines the way of satisfying needs, size of family, employed people in household.
I would also use interactions of several variables to uncover marginal effects in different groups of consumers or ABCDE Czech national socioeconomic classification.
Dummy variables representing different years to see the time trend will be also included together with other regional macroeconomic factors, which may be relevant for consumption patterns.
Models with categorical dependent variable will be estimated by the ordered logit model or ordered probit model.

Outline

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Contents

Introduction

Today's modern world is established on specialized work and job diversification in society. Every person mainly focuses on their expertise, and various aspects of life, such as goods and services, can be either bought or rented. Nowadays, our civilization is heavily based on consumer behavior. Therefore, customers determine the demand on the market. Consumer preferences are constantly evolving and detecting such changes is crucial to gaining more attention. Furthermore, significant market changes can be defined as consumer trends.

The word "trend" has a long history. For its origin, we need to come back to Middle English and Old German. Its meaning was "to turn" or "to rotate". The sentence "to have a general tendency" was first recorded in 1863, when the word trend was revised. At the beginning of the twentieth century, the term gets more familiar to economists, mathematicians, and statisticians, who used it to describe upward or downward shifts on a graph or a created plot, which allow them to predict more long-term changes in a market or an economic sector. (Raymond, 2019)

To define consumer trends, we need to look at consumer behavior. The behavior can be investigated from a macro and micro point of view. In this thesis, we focus on both. Firstly, we define relevant consumer trends in the Czech Republic from 2009 to 2019, also addressing global trends in literature. Secondly, we focus on a micro point of view, which means we are interested in socio-demographic effects, and we concentrate on consumers or households as individuals.

Companies, businesses, and managers need to know actual consumer trends in the market. It is relevant for seizing market opportunities or segmentation of consumers in product categories. The thesis examines four potential consumer trends in the Czech Republic. First, we study whether in 2019 there are more buyers of bioproducts in the Czech market than in 2009. Second, we examine if there is a higher interest in purchasing Czech products than in 2009. Third, we analyze if the population of the Czech

republic tends to recycle more in 2019 than in 2009, and, last, if households spent more money on vacation during 2019 than in 2009. That could implicate that they travel more.

We will use data from the company Median s.r.o., one of the leading market research agencies in the Czech Republic, and run ordered logit regression to test these hypotheses. The main result of this thesis is to identify which socio-demographic factors are relevant to trends and how they affect them in the Czech market. Although the empirical studies in the Czech republic cover such topics to some extent, the published studies analyzed only a shorter period, mostly one year, and they focused only on one consumer trend. Hence, it makes this thesis innovative and unique.

This bachelor thesis is organized as follows. Chapter 1 introduces the theoretical background of this work. Chapter 2 describes a literature review on the topic of global trends and summarizes foreign and Czech studies about consumer trends and their socio-demographic determinants. Chapter 3 defines response variables for models and discusses which explanatory variables are further utilized in models. Chapter 4 introduces the methodology employed to analyze the data, describes the ordered logit regression and final models. Chapter 5 presents this bachelor thesis outcomes and compares results with other research from the literature review. The conclusion summarizes our findings and introduces ideas for future research.

1 Theoretical background

The first part of this work consists of two main chapters, which contain a theoretical background for subsequent research in the empirical part. The Chapter 1 provides a theoretical basis, which is necessary to define for an understanding of the topic. The Chapter 2 focuses on recent global trends in the world based on observation, literature review, and research.

1.1 Definition of terms

This chapter summarizes fundamental definitions and concepts for a proper understating of the topic. It is necessary to define the term trend. Furthermore, this section presents the basic concept of interpreting consumer behavior.

Firstly, what is the definition of a trend and why we measure it?

Definition 1 (Trend)**.** *A trend is a change – in terms of economical, environmental, social, political, or technological factors – that is slowly formed and affects our behavior as consumers and how people perceive the world around them. (Naisbitt, 1984)*

Definition 2 (Trend)**.** *Trends are impermanent cultural changes that indicate a trajectory of social influence. (Powers, 2019)*

For managers, it is necessary to identify trends in the market. When they are creating a business strategy for their company, they can take advantage of the knowledge of a market situation, and they can predict more specific consumer's behavior. Authors Ofek and Wathieu (2010) presented an idea that ignoring trends can allow rivals to transform the industry to their disadvantage.

We know that correlation between trends and consumer behavior exists. But to decide how big it is or which factors affect consumer trend is tricky. However, authors Ofek and Wathieu (2010) came with a plan based on Four-Step Process for addressing trends, that can help companies and businesses predict consumer behavior.

The first step is to identify trends that matter. The second step involves two completely distinct explorations. What important goals, beliefs, and perceptions are emerging among consumers? Moreover, we explore consumers and their behavior related to a product category. The third step is how essential aspects of the trend might relate to crucial elements of the consumption experiences in a category. The last step covers a development of a strategy from information found in the first, second, and third steps. Furthermore, how do we interpret consumer behavior?

Business and market strategy is based on consumer decision-making, which we can derived from people's reactions. For understanding consumer behavior from an individual point of view, we should look at their behavior in macro point of view. For example, it is meaningful to identify relevant social, economic, and technological changes and understanding global situation on market. Also, culture undoubtedly impacts the way how people behave.

On the other hand, the authors Payne and Frow (2005) believe in a micro point of view. It means that it is essential to first look at socio-demographic characteristics and focus on consumers or households as individuals.

Also, Koudelka (2006) categorized consumers behavior into four groups:

(a) rational thinking – based on the economic situation, without any emotion, social and psychical thinking,

(b) psychologist thinking – based on emotional and rationals thinking,

(c) sociological approach – attempt to explain consumer behavior based on the effects of the social environment,

(d) "black box" – which is divided by into 4P – product, place, price, propagation.

The consumer's black box is more or less a specific interaction of the consumer's predispositions to a particular action and purchase decisions. The black box method tracks marketing, sociological, psychological, and rational incentives that influence consumer's behavior, and it is a stage between a subject and a response. The focus on the black box method is crucial for identifying consumer trends since each of us and ours consumer behavior is in some way predictable.

A consumer determines the demand on the market. Therefore, it is essential to understand the process of their selection and their behavior. In the following Chapter 2, we introduce changes in consumer preferences on the market, which are a relevant to global trends.

2 Literature review

In this chapter, we summarize research focused on consumer trends. In the first Section 2.1, we introduce global trends which are relevant to this bachelor's thesis. Furthermore, we focus on the topic of how the socio-demographic characteristics affects consumer behavior and change trends. In Section 2.2 and Section 2.3, we focus on foreign and Czech studies, which analyze the impact of socio-demographics on consumers. In the last Section 2.4, we present the contributions of this bachelor's thesis.

2.1 Global trends in theory

Let us discuss which trends are relevant to this bachelor's thesis topic according to contemporary research.

The first trend we can name is **Going green** or, by FaithPopcorn (2015), **Atmosphere**. Environmental problems, including polluted air, dirty water, and others got worse during past years. Consumers are more concerned about ecology and want to support ecological companies, products, and services. However, in theory, consumers with low income or from developing countries, can not follow this trend since green products are, generally, more expensive. (Rajagopal et al., 2016)

From the decision-making point of view, the environmental problem is a secondary factor after satisfying primary criteria – effectiveness and reasonable price. Thus, being environmentally friendly is not enough to gain consumer loyalty; a green product also needs to have good quality and price. (Rajagopal et al., 2016)

The second trends is a **recycling trend**. Since the early 1990s, waste management has dramatically changed throughout the world. One of the most pervasive trends has been the increase in the recycling of waste in households. The increase is attributable to government policies aimed at reducing land-filled waste: curbside recycling programs, unit-pricing ("Pay-As-You-Throw"), and other programs (bag/tag programs, weight-based systems). (Degli and Marzetti, 2019)

Since demand for products from recycled materials has been growing, companies introduced more and more recyclable products. For example, the brand Samsung comes with an Origami Printer, an affordable laser printer with a case made entirely out of recycled cardboard. (Rajagopal et al., 2016)

The third trend presented by Hajkowicz (2015) is the **technological innovation**. Technology will continue to change the way people interact with each other and obtain information and make decisions. With technological innovation, we can observe globalization trends in traveling. Altogether, technology has a large impact on the growing tourism industry.
Organization for economic cooperation and development made research about international tourism. They found that international tourism has grown at an annual average rate of 7.1% since the 1950s and is expected to grow at an annual average rate of 4.3% through 2020 (OECD, 2002). World Trade Organization predicted that in 2020, tourist arrivals worldwide would be triple times more than in 1995. Today, we know that the prediction was underestimated. The United Nations World Tourism Organization – World Tourism Barometer monitors short-term tourism trends regularly. They estimate that there were, internationally, just 25 million tourist arrivals in 1950. In 2018, this number increased to 1.4 billion international arrivals per year. However, the Covid-19 pandemic significantly changes international tourism.

In the next section, we describe influence of socio-demographic variables on presented trends.

Socio-demographic factors

2.2 Foreign studies

Since the main topic of this thesis is covering consumer trends concerning organic products and food, first, let us focus on research of buyers and non-buyers of **organic products and food**. Foreign studies analyzed the profile of bio (organic) consumers and explained how socio-economic and demographic factors influencing willingness-to-pay for bioproducts.(Hughner et al., 2007; Jolly, 1991)

Haris et al. (2000) published that household size is correlated with total food expenditures. It is evident that the larger the household is, the more food is required to feed the consumers inside the house. However, the size of a household decreases the willingness to pay for organic products. The study from the author Jolly (1991) supports this hypothesis, that bigger families tent to buy less bioproducts than smaller families. He found that households have the highest willingness to pay for organic produce if there are two people with income higher than thirty-thousand dollars. In contrast to these findings, the income elasticity on demand for organic products is small and not statistically significant, even though there are some exceptions (Jolly, 1991). Most studies (e.g., Hughner et al. 2007) in the United States report that income is not a significant variable explaining organic product buyers' behavior. On the other side, Bonti-Ankomah and Yiridoe (2006) made studies in Canada showing a positive correlation between income and willingness to buy an organic product, up to some income level.

According to foreign studies, women are more likely to buy organic food than men. Boccaletti (2008) explains that females are more likely primary food shoppers for family and are probably more family-oriented and sensitive to environmental problems. Govindasamy and Italia (1997) and their team found that women are more educated about integrated pest management, hence, they incline to buy organic products more often than men.

Most studies (for example, Boccaletti 2008) present a negative relation-

ship between age and buying behavior of bioproducts. In only one research from the early 90s in the last century, Jolly (1991) found no correlation between mentioned variables.

In many cases for example, by Boccaletti (2008), the older respondents are, the lower the probability of buying organic food or rating organic food as "better" than conventional food is. A good explanation stems from the fact that older people seem to be less worried about cancer risks and, generally, about health and environmental risks. Authors Rajagopal et al. (2016) have another point of view. Older consumers prefer products that are local and have traditional values. Consumers who are 30 to 44 years old seek environmentally friendly products because they care about their children. Younger consumers support brands that echo their feelings about the environment and ethics.

Another aspect that affects purchase of organic food is the level of education. It may affect a decision in different ways. For example, a higher level of general knowledge about positive health and the environment has an impact on buying more organic products. However, it is also true that individuals with higher education levels may not perceive a current heath food problem because they may better understand the real risks associated with the environmental issues. Moreover, educated people are usually in a better position to understand the uncertainty around scientific information (Boccaletti, 2008). It is important to mention that other effects such as psychographic variables (Morris et al., 1993), environmental concerns (Clancy, 1991), and nutritional concerns increase willingness to pay for organic products.

Now, let us focus on research of tourism and **traveling trend**. The shift of trend from domestic traveling to international traveling was found in a study in Sweden. The author Frändberg and Vilhelmson (2011) showed an interesting fact. Men aged 15–24 traveled on average 1500 km less on long trips within the country in 2006 than in 1978. But number of international trips grew by 50% since 1978 in the group of people aged 15-24.

Eurostat (2018) publish research with focus on tourism trends in connec-

tion with age. They found that around 18% of the total number of European Union residents who were traveling in 2018 were aged 65 or over. For the population of people 15+, it was 24%. However, there were major differences between countries. In Sweden, the share of traveling people in the age group 65+ was equal to the share of this age group in the total population (24%). On the other hand, in Bulgaria, Croatia, Lithuania, and Romania, this age group resulted in less than 10% of that country's tourist population.

The empirical study of Reykjavik residents by Czepkiewicza et al. (2020) and his team describes the geographical trend of increasing international trips towards the city center, particularly among younger adults. He shows that high personal incomes have a positive effect on the number of international flights. University education also affects the number of flights positively. On the contrary, the number of children younger than seven years old affects it negatively.

Let us discuss socio-demographic factors correlated with **recycling**. Early studies found that the household income and size are the most important factors affecting the recycling of solid waste per household. (Richardson and Havlicek, 1978)

Hong et al. (1993) examine the role of price incentives in household recycling for Portland in Oregon. Altogether, household participation in recycling increases as the educational level rises. This follows an empirical study by Fiorillo (2013) that found that a low education level has a negative effect on recycling in households.

Fiorillo (2013) found from the model for household waste recycling, that the people of age between 51-60 tend to recycle more than other age groups. The significant relationship between the age of people and recycling also found the author Nixon and Saphores (2009). Research by Halvorsen (2008) presented that household income has a significant and positive effect on recycling behavior for all materials, except for food waste. However, the size of a household does not have any statistically significant effects on recycling.

2.3 Czech Republic

In the Czech Republic, we can find only a few research studies that focus on organic food consumption. This observation can be explained by the fact that the organic-food trend is relatively young in Czech market.

However, Ščastný et al. (2013) summarize the research conducted on this topic during the years 2006-2011.
There are interesting facts:

- Czech marketing studies have shown that organic purchasers have been more often college-educated people than people with primary education. (Marketing and Synergy, 2006)
- The proportion of organic food buyers has also been significantly larger among high school-educated people than in the general population. (Václavík, 2009)
- Women more regularly purchase organic food than men. Organic food has been purchased rather by larger households with three or more members than by households with one or two members. (Marketing and Synergy, 2006)
- Households with net income higher than 25,000 CZK purchased organic food more often. (Václavík, 2009)

It is important to note that not all observations of the socio-demographic data in the study are the same. For example, study by Jolly (1991) states that older people tend to purchase more bioproducts, but the study by Boccaletti (2008) refers that younger person tend to buy bioproducts more often.

According to Václavík (2009), we found different results in his studies from different years, especially about the place of residence of food buyers. During 2008, there is a small proportion (about 4%) of ordinary organic buyers in Prague. Only one year later, the proportion of organic buyers grew by 17% to 21% in Prague. We can also find differences between the studies about findings on the specific age category of ordinary buyers of

bioproducts. The bachelor's thesis by Seménková (2015) shows that a group of people in age between 36 to 53 years is most likely to buy organic food. But another empirical study by Nevečeřalová (2006) shows that the perfect age group for buying organic food is between 18 and 25 years.

Recycling in the Czech Republic has been growing over the past few years. Rybova (2019) found in her article six statistically significant variables that they have a positive effect on recycling: the average household size, the proportion of tertiary-educated inhabitants, the proportion of family houses, purchase power, the proportion of inhabitants employed in agriculture, and the sex ratio. The three most important significant socio-demographic variables (the average household size, education, and the percentage of family houses) were selected employing the linear regression analysis and further analyzed by geographically weighted regression.

There are only a few studies in the Czech republic focusing on travel trends. For example, authors Kamenický and Kučera (2004), who focused on the trends in tourism in the Czech Republic from 1994 to 2014, compare total money spent by Czech residents and foreign tourist. Nevertheless, no one, to the best of my knowledge, is analysing socio-demographic effects.

2.4 Summary and opportunity for research

This part briefly summarizes studies and research focusing on consumer trends and socio-demographic effects. It is important to mention that not all results regarding socio-demographic characteristics agree across empirical studies. Nevertheless, in my research, I found significant variables which are similar. More details are described in Chapter 5.

There is a relatively large gap in research comparing consumer trends with the region and the respondent's place of residence in Czech studies. Hence, studying consumer trends for such factors is one of the contributions of this thesis.

Moreover, in the Czech Republic, research about trends in population covers mainly the era of early 2000s. Also, studies are usually presented

from the dataset taken only in one year. On the contrary, this bachelor thesis is different since it works with the dataset covering the years 2009 to 2019.

Therefore, the contribution of this study is a more detailed and, at the same time, more complex view of consumer's behavior in the Czech republic. Furthermore, we compare global trends in consumer's behavior with trends in the Czech Republic, whether they coincide and where they differ. It is an opportunity to compare socio-demographic effects from literature with this thesis.

3 Data description

In this chapter, we concentrate on the empirical part of the thesis.

In the first Section 3.1, we present a structure of dataset, which is used to define consumer's trends, provided by the company Median s.r.o. Then, in Section 3.2, the dependent variables are described, followed by their summary. The last Section 3.3, including the analysis, leads to the selection of the final independent variables. This chapter is concluded by the definitions of the final dependent variables.

3.1 Dataset

We have used data from one of the leading market research agencies, MEDIAN s.r.o., with many years of experience in the area of market research, media, and public opinion. The agency has been carrying out the highly extensive study – Market & Media & Lifestyle (MML-TGI) – since 1996.

Every year, about 15,000 respondents from the Czech Republic (aged 12-79 years) are interviewed within the survey. The sample is representative on the population of the Czech Republic, as the selection of the respondents is performed by the quota selection method (see Appendix D, Table 21). Our final dataset includes about 111,500 respondents with appropriate households from 11 years. Their socio-demographic variables correspond to the quotas.

Interviewing

The research was conducted by personal interviews with the interviewer and respondent (face to face) in combination with an independent filling of the questionnaire by respondents (the questionnaire is available in both paper and online forms). Since 2012, there is a possibility of questioning the whole MML-TGI survey over the Internet. Questionnaires completed online represent approximately 40% of the total answers.

Data description

Dataset from MML-TGI (Market & Media & Lifestyle) is a study about consumption, including more than 3 000 brands and 300 types of services related to online activities and ratings of print media, radio, and television. This is complemented with detailed data about the respondent's lifestyle. Therefore we can consider MML-TGI as one of the most extensive studies about consumption on the Czech market.

MML-TGI is an extensive database, including around 15,000 questions and statements. Most of the questions focus on media brands.
The dataset is divided in four parts:

- personal data containing 57 entries about respondents and their households,
- media consumption including 45 TV stations, 91 radio stations, 204 print media titles and 138 Internet websites,
- consumer behavior with around 310 categories of products and services,
- lifestyle part with 620 questions regarding respondent's lifestyle.

There are two types of questions. The first type is about an individual's consumption, for example, **Have you used / drunk / eaten this product during the last 12 months?**. The second type represents household consumption, for example, **Do you ever buy this product?**.

Since this bachelor's thesis is mainly focused on consumer's or household's consumption, we use questions or statements connected to this topic. We also analyze questions and statements that are relevant to global trends (Section 2.1). Selected questions and variables are further described in the next Section 3.2.

3.2 Dependent Variables

For the purpose of this work, we chose four dependent variables that follow the consumer's trend mentioned in the literature review (Section 2).

This section shows that we can see a trend in each of the dependent variables from our dataset. Moreover, we can observe mainly an upward trend of dependent variables during the observed 11 years. In the next section, we measure if the trends are significant and which socio-demographic variables affect them.

The chosen dependent variables are:

- **Recycling** – represents statement *"I consciously try to recycle"*. Possible answers are: 1 = certainly not, 2 = rather not, 3 = neither yes or no, 4 = rather yes, 5 = certainly yes.

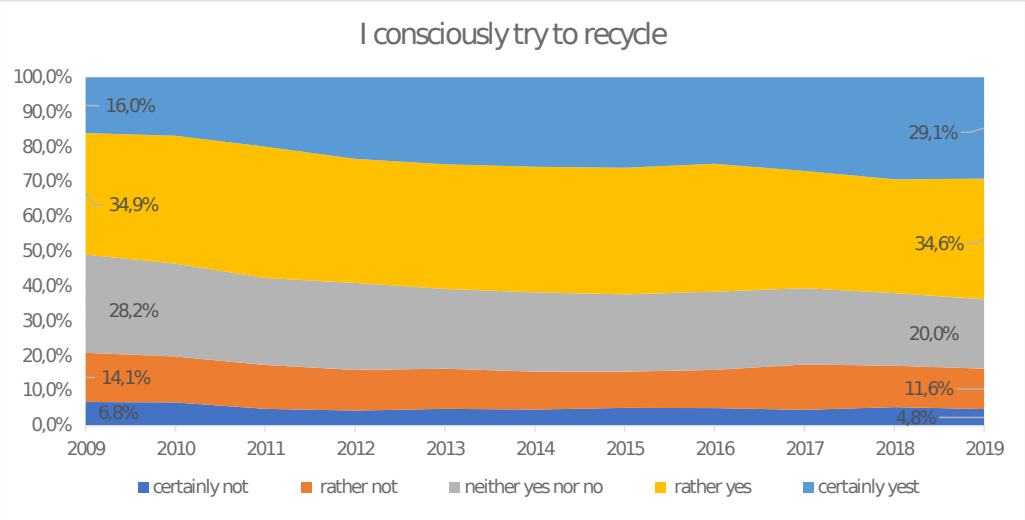

Figure 1: Recycling trend

From Figure 1, we see an upward trend in recycling. Since 2009, the answer *certainly yes* grew from 16% of the population percentage to 29.1% in 2019. The percentage of the answer *rather yes* stays constant during 11 years. On another side, we can see a decrease in percentages of answers *neither yes or no, rather no and certainly not*.

- **Czech products** – represents statement *"I buy Czech products whenever I can"*.

  Possible answers are: 1 = certainly not, 2 = rather not, 3 = neither yes or no, 4 = rather yes, 5 = certainly yes.

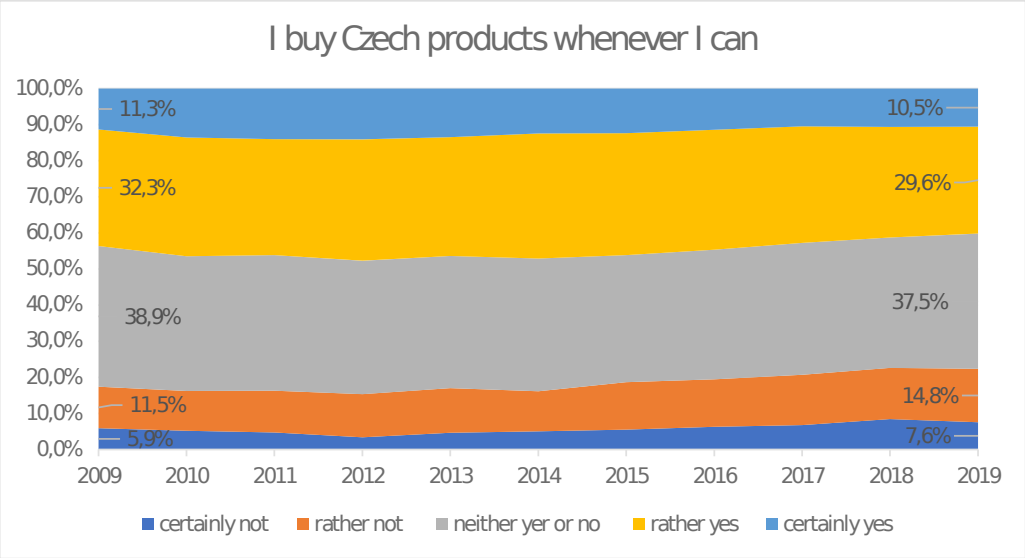

Figure 2: Czech product trend

From Figure 2, we observe a downward trend in the purchase of Czech products. Since 2009, the answer *certainly no* grew from 5.9% of the population to 7.6% in 2019 and *rather not* increased from 11.5% to 14.8% during 11 years. On the other hand, we can see a decrease in percentages of answers *neither yes or no, rather yes and certainly yes.*

- **Bio index** – is a variable, which is calculated from answers on five statements about buying organic food: *Do you eat organic or standard yogurts? Do you buy organic meat? Do you buy organic dairy products? Do you buy organic products? Do you buy organic fruits and vegetables?*

  Possible answers are : 1 = never, 2 = occasionally, 3 = always.

  Since we are interested in the organic (bio) products trend, we put together five statements about organic food. Each statement focuses on a specific food group, such as meat, vegetables, or fruits. We need to take into account that the difference between the answer "never" and "occasionally" is not the same as the difference between "occasionally" and

"always". Hence, when we created the bio index (Table 1), we realized that it is better to have five groups of answers for better graduation. We summed values of 5 answers (1 = never, 2 = occasionally, 3 = always) and re-coded the summed value in the following way as described in the table below.

Sum	**New value**	**New explanation**
5	1	never
6	2	occasionally
7	2	occasionally
8	3	regularly
9	3	regularly
10	3	regularly
11	4	almost every time
12	4	almost every time
13	5	always
14	5	always
15	5	always

Table 1: Bio index

We have created this new value and explanation to preserve the meaning of the answer. For example, when the sum is equal to five, it means the consumers never really buy organic food. Furthermore, when the sum is equal to six, consumers at least once answered "occasionally" to the questions regarding bio products. It could mean that respondents in one household buy organic meat quite regularly, but each respondent buys it only occasionally. Therefore, the sum equals to six is placed in a different category.

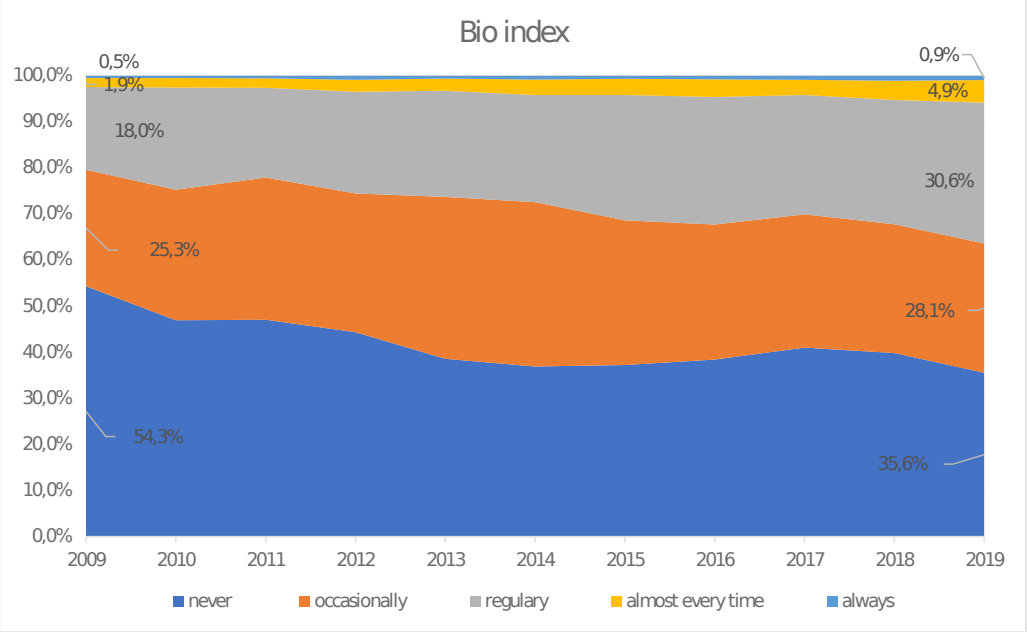

Figure 3: Bio index trend

From Figure 3, we see an upward trend in purchasing organic and bio food. Since 2009, the percentage of people that answered *never* decreased from 54.3% to 35.6%. And the proportional percentage of people buying organic food *regularly* has grown from 18% in 2009 to 30.6% in 2019.

- **Traveling** – is a variable representing answers to the question: *How much do you plan to spend on your vacation?* Possible answers are:

  1 = 5 000 CZK and less,

  2 = 5,001 - 10,000 CZK,

  3 = 10,001 - 20,000 CZK,

  4 = 20,001 - 30,000 CZK,

  5 = 30,001 - 50,000 CZK,

  6 = 50,001 - 75,000 CZK,

  7 = 75,001 - 100,000 CZK,

  8 = 100,001 CZK and more.

  The value represents total spending of a whole family (the question is answered only once per household).

We can see an upward trend of this variable in Figure 4. The bar plot shows total average spending on vacation by a household without inflation rate[1]. For spending comparison, we use base year 2009. In 2009, the average spending on vacation was 18,454 CZK. During 2019, the household's average spend was 28,041 CZK.

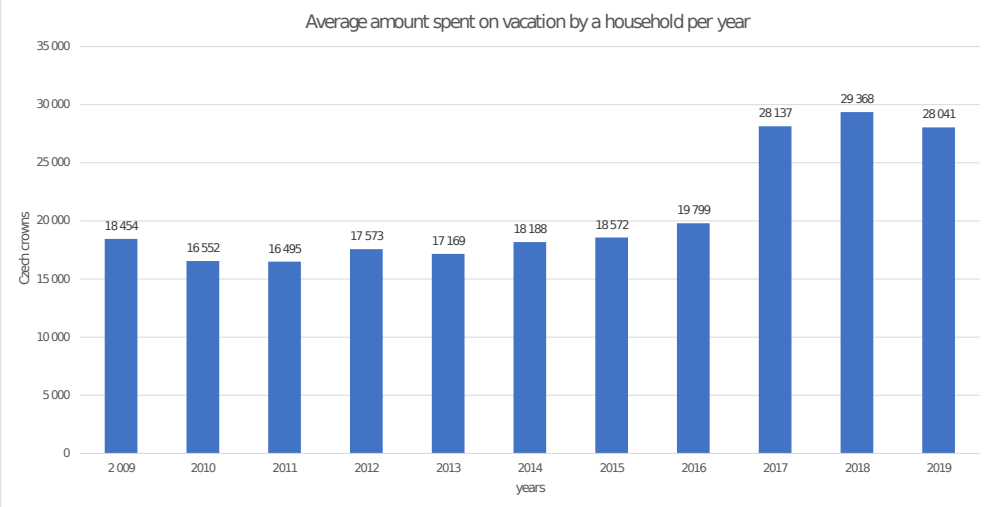

Figure 4: Average amount spent on vacation by a household per year

[1] *https : //www.czso.cz/csu/czso/inflationrate*

3.3 Independent variables

This section introduces independent variables for final statistical cross-comparison models.

In this study, we measure the effect of socio-demographic determinants. Explanatory variables are selected from the personal part of MML data, which is focused on respondents and their households. The process of collecting relevant independent variables followed the studies described in Section 2.2 and Section 2.3.

The final dataset utilized for statistical models consists of ten possible explanatory variables:

- **Year** – a variable representing a time of year when the survey took place. It is a categorical variable with possible answers between 2009 to 2019. Each year, there are around 15,000 representative respondents that answered the survey. Nevertheless, in my final dataset, there are only around 10,000 respondents per year because some respondents have missing answers for explanatory variables.

- **Age** – represents a numerical variable age of respondents from 12 to 79 years.

- **Gender** – is categorical variable. It has two values:
  0 = male, 1 = female.

- **Education** – a variable representing the highest level of education degree achieved by a respondent. It is a categorical variable with possible answers:
  1 = without education,
  2 = primary education,
  3 = high school education without a final degree,
  4 = high school education with a degree,
  5 = degree from a specialized school,
  6 = bachelor's university degree,
  7 = master's university degree / scientific preparation.

- **Income** – represents the income of a household. Respondents answered the question: *In which group would the monthly household income fit?* Therefore, it is a categorical variable with possible answers:
  1 = 4,000 CZK and less,
  2 = 4,001 - 6,000 CZK,
  3 = 6,001 - 8,000 CZK ,
  4 = 8,001 - 10,000 CZK,
  5 = 10,001 - 12,500 CZK,
  6 = 12,501 - 19,000 CZK,
  7 = 19,001 - 19,500 CZK,
  8 = 19,501 - 20,000 CZK,
  9 = 20,001 - 25,000 CZK,
  10 = 25,001 - 30,000 CZK,
  11 = 30,001 - 40,000 CZK,
  12 = 40,001 - 50,000 CZK,
  13 = 50,001 - 75,000 CZK,
  14 = 75,001 - 100,000 CZK,
  15 = 100,001 CZK and more.

- **Count income** – represents the number of economically active members in a household. It is numerical variable ranging from 1 to 8 persons.

- **Count p** – represents answers to the question: *How many persons live in your family/household?* Possible values are from 1 to 5 persons.

- **Region** – represents a district of a household. It is a categorical variable having possible values:
  1 = South Bohemia district, 8 = Pardubice district,
  2 = South Moravia district, 9 = Plzeň district,
  3 = Karlovy Vary district, 10 = Prague district,
  4 = Hradec Králové district, 11 = Central Bohemia district,
  5 = Liberec district, 12 = Ústí nad Labem district,
  6 = Moravia-Silesian district, 13 = Vysočina district,
  7 = Olomouc district, 14 = Zlín district.

- **Size of city** – represents the size of a city, town, or a village where a household is located. It is a categorical variable with five categories:

  1 = 1000 residents and less,

  2 = 1,000 - 4,999 residents,

  3 = 5,000 - 19,999 residents,

  4 = 20,000 - 99,999 residents,

  5 = 100,000 residents and more.

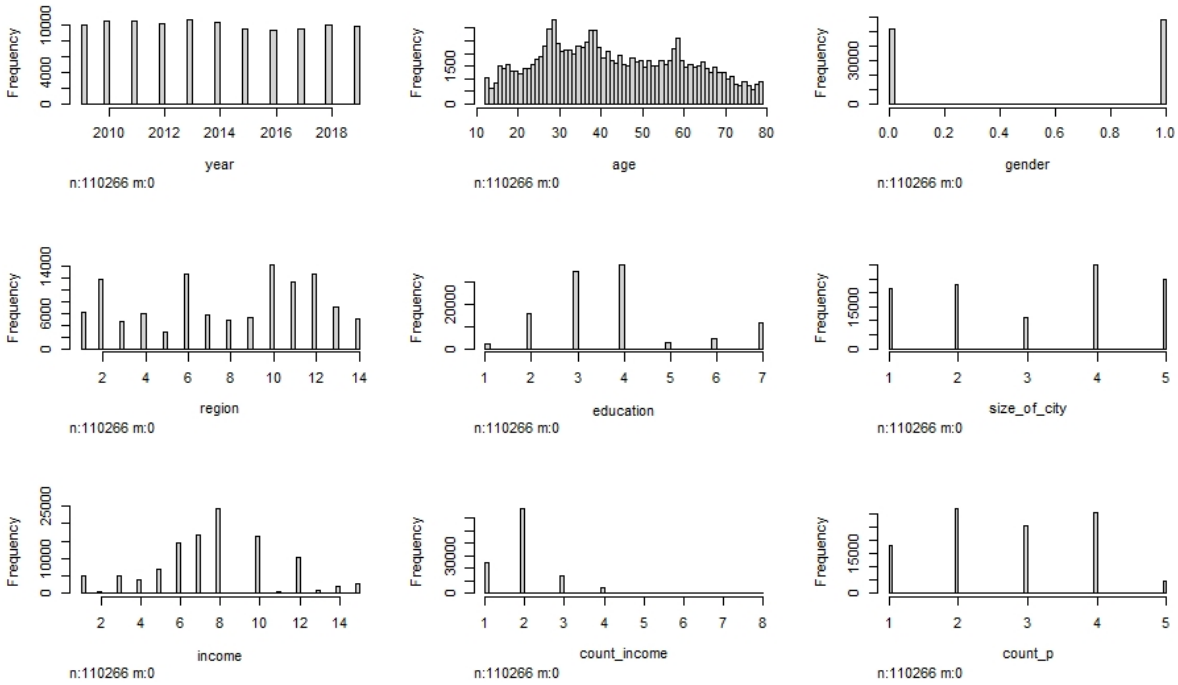

Figure 5: Histograms of selected independent variables

In Figure 5 Most of ours independent variables are categorical, except age, count p, and count income. We created histograms for each independent variables, see Figure 5. On the x-axis, we have all categories describing each variable and the y-axis representing category's frequency of respondent/households for each variable.

- **ABCDE Classification** – it is a socio-economic classification that was derived from the European Society for Opinion and Marketing Research classification. The classification of a household (together with all persons in the given household) has one of the values: "A – the highest", "B", "C1", "C2", "D", "E1", "E", "E3 – the lowest". Classes differ from the original scale because they were adjusted according to the income of households in the Czech Republic.

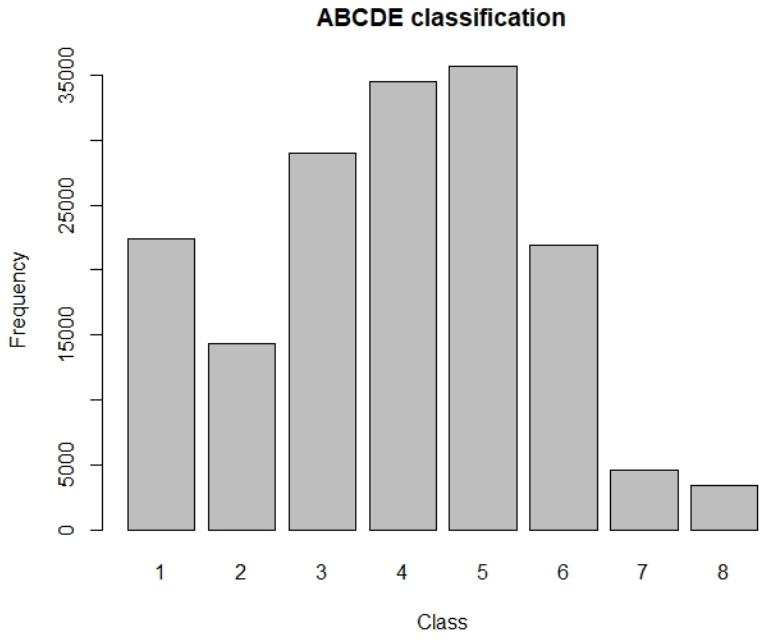

Figure 6: Histogram of the ABCDE classification variable

There are many differences, especially in some professions, in socio-economic levels between the Czech Republic and other European countries. The classification was adapted to Czech conditions with the index of the subsistence minimum. Index of the subsistence minimum is derived from the household's general income and the minimal life costs (minimal life costs = 2,877 CZK). Specifically, the index of the subsistence minimum is calculated as $2,877 \cdot n + 2,719$, where n is the number of people in the household and 2,719 is a constant. Numbers 2,719 and 2,877 are modified every year according to the consumer price index (inflation).

The ABCDE classification dividing households into the eight groups is based on the following variables:

- Job of the person with the highest income (i.e. the head of household).
- The highest completed education of the person with the highest income (i.e. the head of household).

Figure 6 shows the distribution of households into eight classes in our dataset. And ABCDE classes are described in more detail below:

Class	#	**Explanation**
A	1	**Top managers and professionals with the highest completed education** • Managers with the highest completed education from the category "top manager" to the level of "middle management" with responsibility of a larger department.
B	2	**Middle management** • Managers from the category "top manager" to "middle manager" with lower completed education and coordinating less employees. • Manager with a middle leading competency.
C1	3	**Not manually working employees with a high level of completed education** • Not manually working persons with a high level of completed education • Skilled manual workers with high level of completed education • Owners of small companies, private entrepreneur owning small companies

C2	4	**Skilled workers, not manually working employees** • Not manually working persons (supervisors, foremen, technicians) with lower completed education • Skilled manually working persons with lower completed education • Owners of small companies, private entrepreneurs owning small companies with lower completed education.
D	5	**Skilled and unqualified manual workers and managers, or not manually working persons with low completed education.** • Not manually working persons (supervisors, foremen, technicians) with a low level of completed education. • Managers, private entrepreneur owning small companies with a low level of completed education. Skilled and unqualified manual workers with a low level of education.
E1	6	Low educated persons working out of office in not manual work and small private entrepreneurs.
E2	7	Skilled manual workers and small owners of the companies, out of office not manually working persons with the lowest level of completed education.
E3	8	Unqualified manual workers, farmers who finished the lowest level of education.

Correlations of independent variables

To determine which variables should be included in the final model, I performed a small statistical analysis.

Firstly, correlations between individual variables have been investigated. The correlation coefficient of variable X1 and variable X2 is calculated as follows.

$$Corr(X_1, X_2) = \frac{Cov(X_1, X_2)}{\sqrt{Var(X_1)Var(X_2)}}$$

The correlation coefficient measures a linear dependency between two variables and always ranges from -1 to 1. The problem in regression models could cause multicollinearity when two dependent variables are strongly correlated.

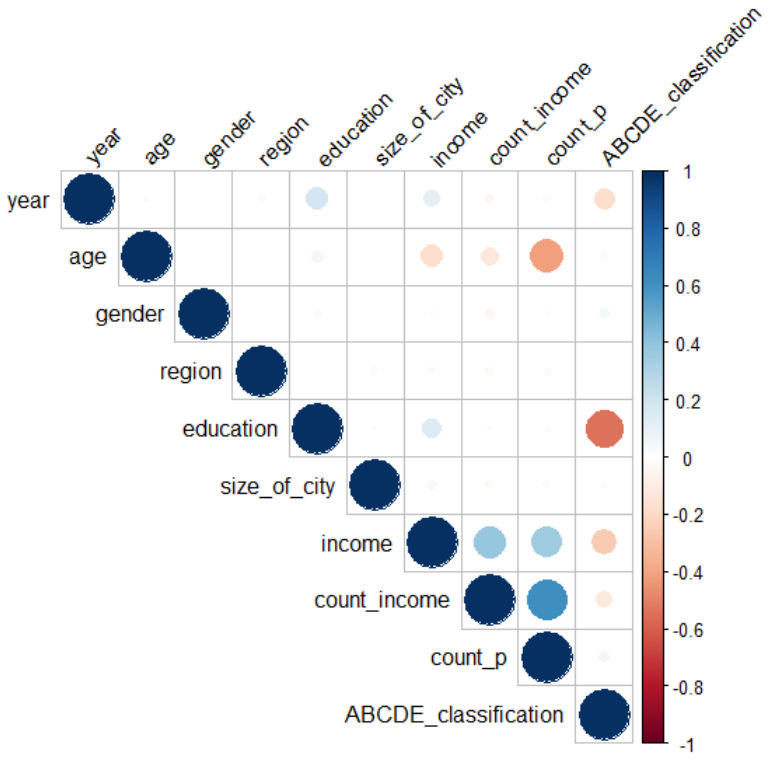

Figure 7: Correlation matrix

From Figure 7, we can see that a higher absolute value (higher than the commonly used value 0.7) of a correlation is only between the pair *education* and *ABCDE classification*. The variables correspond because the ABCDE classification is mainly based on education and income variables. Therefore, to avoid multicollinearity in a model, we work only with one of these variables each time. For that reason, I decided to make two types of models. In the first model, we have education and income variables, and in the second model, these variables we replaced with ABCDE classification. Another higher correlation is observed between variables *count p* and *count income*. They correspond thanks to the fact that in households with more people, there are, generally, more employed people. The absolute correlation value between *count p* and *count income* is equal to 0.64. Nevertheless, absolute correlations of discussed variables are not higher than 0.7. Hence, I kept both variables in my final model.

4 Methodology

In this chapter, the theory of empirical part is introduced as well as final statistical models. Firstly, in Section 4.1, we describe the theory behind the econometric models and why we decided to work with the ordered logit model. Moreover, we confirm assumptions that are necessary to check to ensure that the model is valid and all prerequisites were fulfilled. In the second Section 4.2, we propose the final models for response and explanatory variables described in the previous Chapter 3.

4.1 Ordered logit model

Ordered response models are designed for multinomial data. In such models a response variable is characterized by more than two categorical outcomes. To statistically support observed trends, ordered logit and probit models were selected. These two models are similar, but they differ in the cumulative distribution function. The ordered logit model utilize the logistic distribution, and the ordered probit model employ the standard normal distribution. We have used an ordered logit model since the results of both models are comparable (see Appendix B, Table 11, Table 12, and Table 13). Furthermore, the coefficients of the logistic regression model can be interpreted in terms of the odds ratio. The odds ratio is the ratio of the odds of an event occurring in one group to its odds occurring in another group. These groups might be for example men and women.

We used the ordered logit model and we assigned each outcome value as a ranking scale. For example, our dependent variables Recycling, Czech products, and Bio index are ordered response variables having values from 1 (the lowest value) to 5 (the highest value) and dependent variable Traveling is an ordered response variable that can have values from a set {1, 2, ..., 8}. Nevertheless, the rating itself has only an ordinal meaning. For example, we can not say that the difference between values four and two is twice as important as the difference between values one and two.

According to Wooldridge (2010), ordered logit model can be derived from a latent variable model as:
Let y be an ordered response having values from a set {1, 2, ..., J} for some known integer J and assume that a latent variable y* is determined by

$$\mathrm{y}^* = x\beta + \epsilon$$

where x is a 1 × K vector of explanatory variables that may or may not contain a constant depending on the particular model to be estimated, β is a K × 1 vector of parameters, and ϵ is a mean zero random error term.
Let $\alpha_1 < \alpha_2 < ... < \alpha_{J-1}$be threshold parameters (unknown parameters) that determine the observed outcome as follows:

$$\begin{aligned} \mathrm{y} = 1 \qquad & if \;\; y^* \leq \alpha_1 \\ \mathrm{y} = 2 \qquad & if \;\; \alpha_1 < y^* \leq \alpha_2 \\ & \vdots \\ \mathrm{y} = J \qquad & if \;\; \alpha_{j-1} < y^* \end{aligned}$$

Given $F(\cdot)$ which is the logistic cumulative distribution function for the error term, we can compute each response probability:

$$\begin{aligned} \mathrm{P}(y = 1|x) &= P(y^* \leq \alpha_1|x) = P(x\beta + \epsilon \leq \alpha_1|x) = F(\alpha_1 - x\beta) \\ \mathrm{P}(y = 2|x) &= P(\alpha_1 < y^* \leq \alpha_2|x) = F(\alpha_2 - x\beta) - F(\alpha_1 - x\beta) \\ &\vdots \\ \mathrm{P}(y = J|x) &= P(\alpha_{J-1} < y^*|x) = 1 - F(\alpha_{J-1} - x\beta) \end{aligned}$$

where $F(z) = e^z/(1 + e^z)$.

The marginal effect of an increase in a regressor x_r on the probability of selecting alternative j is:

$$\partial \mathrm{p}_j / \partial x_r = (F'(\alpha_{j-1} - x\beta) - F'(\alpha_j - x\beta))\beta_r$$

Marginal effects interpretation is following. Each unit increase in the independent variable increases/decreases the probability of selecting alternative j by the marginal effect expressed as a percent.

The parameters α and β can be estimated by Maximum likelihood estimation (MLE). For each i the log-likelihood function is:

$$\mathcal{L}_i(\alpha, \beta) = 1(y = 1)log(F(\alpha_1 - x\beta)) + 1(y = 2)log(F(\alpha_2 - x\beta) - F(\alpha_1 - x\beta))$$
$$+ ...1(y = 5)log(1 - F(\alpha_4 - x\beta))$$

The assumptions of the ordered logistic regression are as follow and are verified in order:

- The dependent variable are ordered. – Already checked in Section 3.2
- One or more of the independent variables are either continuous, categorical or ordinal. – Already checked in Section 3.3
- No multicollinearity. – Discussed in Section 3.3
- Proportional odds. – We used Brant test on every model (further described in Chapter 5)

In the following section, we apply theoretical regression models on variables from my final dataset.

4.2 Proposed models

Firstly, a simple model for each dependent variable is constructed to run a regression to make sure that findings are consistent with the results of the previous literature. The models are described by following equations:

$$\begin{aligned} \mathrm{y}_{it} = \beta_0 + \beta_1 \sum_{j=1}^{j=11} \gamma_j Year_j + \beta_2 Gender_{it} + \beta_3 age_{it} + \beta_4 \sum_{l=1}^{l=14} \delta_l Region_l \\ + \beta_5 \textstyle\sum_{k=1}^{k=7} \epsilon_k Education_k + \beta_6 \sum_{n=1}^{n=5} \kappa Sizeofcity_n \\ + \beta_7 \textstyle\sum_{m=1}^{m=15} \zeta_m Income_m + \beta_8 Countincome_{it} + \beta_9 Countp_{it} + u_{it} \end{aligned}$$

A similar model with variable y_{it} is constructed for each response variable **Recycling, Czech products, and Bio index**, using the same explanatory variables.

$$\begin{aligned} \mathrm{T}raveling_{it} = \beta_0 + \beta_1 \sum_{j=1}^{j=11} \gamma_j Year_j + \beta_2 Gender_{it} + \beta_3 age_{it} + \beta_4 \sum_{l=1}^{l=14} \delta_l Region_l \\ + \beta_5 \textstyle\sum_{k=1}^{k=7} \epsilon_k Education_k + \beta_6 \sum_{n=1}^{n=5} \kappa Sizeofcity_n \\ + \beta_8 Countincome_{it} + \beta_9 Countp_{it} + u_{it} \end{aligned}$$

Secondly, we constructed a model for households with variables year and ABCDE classification. We do not include other variables from the dataset. Since correlation is high between income, education, and ABCDE classification, and interpretation of others variables would be similar as in the first proposed models. Also, these models aims to define the relationship of the explanatory variable ABCDE classification with response variables representing trends. The models are described by following equations:

$$\mathrm{y}_{it}^{1} = \beta_0 + \beta_1 \sum_{j=1}^{j=11} \gamma_j Year_j + \beta_2 \sum_{l=1}^{l=8} \delta_l ABCDEclassification_l + u_{it}$$

A similar model with variable y_{it}^{1} is constructed for each response variable **Recycling, Czech products, Bio index, and Traveling**, using the same explanatory variables.

In models where Recycling, Czech products, and Bio index are response variables output values of models are from a set {1, ..., 5}. And for the Traveling response variable values are from a set {1, ..., 8} . β_0 is an intercept, β_J are the coefficients corresponding to all the explanatory variables described in Section 3.3, and u is an error term.

5 Results

In this chapter, we summarize the results of the models. We found no difference in marginal effects when comparing the ordered probit and logit model with the dependent variable recycling (Appendix B, Table 11). Moreover, both models identify similar significant variables. We decided to use only the ordered logit model because of of the interpretation based on logit odds ratios. The odds ratio is the ratio of the odds of an event occurring in one group to its odds occurring in another group. These groups might be for example men and women. We apply marginal effects obtained from the ordered logit regression to quantify the magnitude of the significant effects.

5.1 Recycling

We summarize the most crucial points of the recycling trend, which we concluded from Model 1 (Table 3):

- There is a significant upward trend of recycling from 2009 to 2019.
- Females tend to recycle more than males.
- Respondents with the highest education level tend to recycle more than respondents with lower education levels.
- Households in cities with 100,000 residents and more tend to recycle less than households from smaller cities.
- Families with more members recycle more than smaller families.
- Residents of Prague are more likely to recycle than residents of South Bohemia and from other districts of the Czech republic.

Detailed interpretation of model First, let us interpret explanatory variables representing the recycling trend in Model 1 (Table 3). Most of them are statistically significant on the 99% confidence interval. Only variables region6 and region14, which represent Moravia-Silesian and Zlín districts, are not significant even on the 90% confidence interval (for marginal effects see Appendix B, Table 12).

Time

Next, we can conclude that variables indicating time (the **year** variable) have a positive coefficient each time. Holding other variables fixed in our model, except variable year2019, the odds of recycling in the year 2019 over odds of recycling in 2009 is $\exp(0.359) = 1.4318$. In terms of percent change, year 2019 has higher odds about 43% than the odds of recycling in 2009.

Since we are interested in recycling during the past 11 years, we look at the marginal effects of variable year2019 (Appendix B, Table 12). The year 2019 is associated with respondents being 1.4% less likely to answer "certainly not" on a statement "I consciously try to recycle", about 3% less likely to respond "rather not", 3.9% less likely to answer "neither yes or no", but about 1.5% more likely to answer "rather yes", and 6.8% more likely to respond "certainly yes".

Gender

The second variable, **gender1**, representing females, has a positive coefficient, which means that females tend to recycle more often than males. According to marginal effects (see Appendix B, Table 12), females are about 5% more likely to answer "certainly yes", 2% more likely to respond "rather yes", 3.1% less likely to answer "neither yes or no", 2.7% less likely to answer "rather no", and approximately 1.5% less likely to answer "certainly no".

Age

The variable indicating **age** has a positive coefficient. This means that older people are more likely to recycle waste. However, this variable has a really small coefficient and marginal effects are inconspicuous. Thus, from this analysis we cannot confirm influence of the age variable on the recycling trend. Nevertheless, since the histogram distribution graph of the age variable is, typically, concave, I tried to test the squared value of the age variable as well, but model did not show any significant differences.

Education

Variables indicating a level of **education** have a positive coefficient except for education2, representing respondents only with primary education.

Respondents with the highest education level, which represents a master's degree/scientific preparation, are 2.3% less likely to respond on recycling "certainly no", 5% less likely to answer "rather no", 7% less likely "neither yes or no", 1.7% more likely say "rather yes", and 12.6% more likely to answer "certainly yes". We can say that respondents with the highest education level tend to recycle more than respondents with the lowest education level from marginal effects of the model. It is similar to what Fiorillo (2013) found about education in his study.

City size

On the other hand, variables representing the **size of the city** have positive coefficients until size reaches the highest level – 100,000 residents and more. The results imply that people in small towns tend to recycle more than people from the biggest cities.

Income of household

The **income** variable has a negative coefficient for all values. For comparing group result we look at Table 12(Appendix B) with marginal effects of Model 1. When we compare the level of income between 4,000 to 6,000 CZK with income 100,001 CZK and more, we can notice differences. Households with lower-income levels are about 17.4% more likely to answer "certainly no or rather no", about 6% more likely to respond "neither yes or no", but about 23.4% less likely to answer "rather yes or certainly yes".

On the other hand, households with high-income levels are about 5.1% more likely to answer "rather or certainly no", about 3.1% more likely to respond "neither yes or no", and 8.2% less likely to answer "certainly or rather yes".

Employed people in a household

Also, the variable **count income**, which represents the number of employed people in households, has a negative coefficient. That means, according to our findings, that a household with fewer employed people recycles more often.

Number of people in a household

But variable **count p**, representing the size of household, has a positive coefficient, which leads to the conclusion that bigger families tend to recycle more often than small families.

Districts in the Czech Republic

The variables **region** representing districts in the Czech republic have significant coefficients except for region6 and region14 values, representing Moravia-Silesian and Zlín district, that are not significant even on 95% confidence interval. From Table 12, we see that region10 (Prague) has the highest probability for answering "yes". Residents of Prague are about 13.9% more likely to answer "certainly or ranter yes", 6.7% less likely to answer "neither yes or no", and 7.2% less likely to responds" certainly or rather no", comparing to base district - region1 (South Bohemia).

Testing

In the hypothesis model, we are using following variables: year, age, gender, education, region, size of city, income, count income, and count p. We need to check whether they are jointly significant. We utilized the likelihood ratio test. First, we estimated the model with a constant only and ran the lrtest to test the hypothesis.

In such the case, for the null hypothesis we set parameters year = 0, age = 0, gender = 0, education = 0, region = 0, size of city = 0, income = 0, count income = 0, and count p = 0. In other words, we observe if they are insignificant. For this hypothesis, we obtained test statistics equal to 6151.5, and the p-value is almost 0, much below than 5% threshold. Therefore, we have to reject the null hypothesis that those nine variables are jointly insignificant. Hence, they are jointly significant.

Brant test is to test the parallel regression assumption. It tests the primary assumption of the order logit model that we fulfill a proportional odds assumption. In our model, the output p-value of the omnibus test says that we cannot reject the null hypothesis. Therefore odds assumption met, and we can use the ordered logit model.

Table 3: Model 1 and Model 2

	Dependent variable:	
	recycling	czech_product
	(Model 1)	(Model 2)
year2010	0.070*** (0.025)	0.105*** (0.025)
year2011	0.229*** (0.025)	0.109*** (0.025)
year2012	0.247*** (0.025)	0.134*** (0.026)
year2013	0.297*** (0.025)	0.075*** (0.025)
year2014	0.345*** (0.025)	0.066*** (0.026)
year2015	0.366*** (0.026)	−0.001 (0.026)
year2016	0.312*** (0.026)	−0.055** (0.027)
year2017	0.294*** (0.026)	−0.141*** (0.026)
year2018	0.356*** (0.026)	−0.218*** (0.026)
year2019	0.359*** (0.026)	−0.257*** (0.027)
gender1	0.298*** (0.011)	0.304*** (0.011)
age	0.006*** (0.0004)	0.017*** (0.0004)
region2	0.348*** (0.029)	0.126*** (0.029)
region3	−0.227*** (0.035)	0.177*** (0.036)
region4	−0.232*** (0.033)	−0.063* (0.033)
region5	0.565*** (0.041)	0.414*** (0.040)
region6	0.024 (0.029)	0.088*** (0.029)
region7	0.436*** (0.033)	0.116*** (0.032)
region8	0.094*** (0.034)	0.287*** (0.035)
region9	0.174*** (0.034)	0.042 (0.034)
region10	0.611*** (0.036)	0.075** (0.036)
region11	−0.219*** (0.029)	−0.077*** (0.029)
region12	−0.225*** (0.028)	−0.266*** (0.028)
region13	0.154*** (0.031)	0.130*** (0.032)
region14	0.031 (0.034)	0.015 (0.034)

education2	−0.065* (0.039)	−0.144*** (0.040)
education3	0.066* (0.039)	0.004 (0.040)
education4	0.291*** (0.038)	0.097** (0.039)
education5	0.579*** (0.052)	0.388*** (0.053)
education6	0.575*** (0.046)	0.160*** (0.046)
education7	0.637*** (0.041)	0.187*** (0.042)
size_of_city1,000 - 4,999	0.128*** (0.021)	0.062*** (0.021)
size_of_city5,000 - 19,999	0.057*** (0.020)	−0.083*** (0.021)
size_of_city20,000 - 99,999	0.069*** (0.020)	−0.276*** (0.020)
size_of_city100,000 +	−0.626*** (0.029)	−0.207*** (0.029)
income4,001 - 6,000	−0.957*** (0.146)	0.755*** (0.146)
income6,001 - 8,000	−0.756*** (0.116)	0.851*** (0.117)
income8,001 - 10,000	−0.565*** (0.100)	0.780*** (0.101)
income10,001 - 12,500	−0.594*** (0.097)	0.700*** (0.098)
income12,501 - 19,000	−0.548*** (0.097)	0.729*** (0.098)
income19,001 - 19,500	−0.531*** (0.098)	0.825*** (0.098)
income19,501 - 20,000	−0.523*** (0.096)	0.811*** (0.097)
income20,001 - 25,000	−0.451*** (0.095)	0.794*** (0.095)
income25,001 - 30,000	−0.389*** (0.095)	0.813*** (0.095)
income30,001 - 40,000	−0.353*** (0.094)	0.801*** (0.095)
income40,001 - 50,000	−0.338*** (0.095)	0.732*** (0.096)
income50,001 - 75,000	−0.281*** (0.096)	0.764*** (0.097)
income75,001 - 100,000	−0.333*** (0.103)	0.701*** (0.103)
income100,001+	−0.239** (0.122)	0.730*** (0.122)
count_income	−0.079*** (0.011)	−0.005 (0.011)
count_p	0.027*** (0.007)	0.025*** (0.007)
Observations	111,529	111,529

Note: Standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01

5.2 Czech products

We summarize the most crucial points of the purchase of Czech products, which we concluded from Model 2 (Table 3):

- There is a significant downward trend in purchasing Czech products from 2015 to 2019.
- Females tend to purchase Czech products more than males.
- Respondents with the highest education level tend to purchase Czech products more often than respondents with lower education levels.
- Households in a town with 1,000 to 4,999 residents tend to purchase Czech products more often than households from bigger cities.
- Residents of Liberec district are more likely to purchase Czech products than residents from other districts of the Czech republic.

Detailed interpretation of model

First, let us interpret explanatory variables representing the purchase of Czech products in Model 2 (Table 3). Most of them are statistically significant on the 99% confidence interval. Only variables year2015, region9 (Plzeň district), region14 (Zlín district), and count income are not significant even on the 90% confidence interval.

Time

We can conclude the variables indicating time (the **year** variable) have positive coefficients until the year2015. From the year 2016, we see significant negative coefficients. Having other variables fixed in our model, except variable year2019, the odds of purchasing Czech products in 2019 over the odds of purchasing Czech products in 2009 are $\exp(-0.257) = 0.773$. In terms of percent change, the year 2019 has lower odds, about 23 %, than the odds of purchasing Czech products in 2009.

Gender

The second variable, **gender1**, representing females, has a positive coefficient, which means that females tend to purchase Czech products more

often than males. Holding other variables fixed in our model, except variable gender1, the odds of females purchasing Czech products over odds of males purchasing Czech products is exp(0.304) = 1.355. In terms of percentage change, a female has higher odds, approximately 36% that males purchase Czech products.

Age

Variable indicating **age** has positive coefficient. However, this variable has a really small coefficient and marginal effects are inconspicuous.

Education

Values indicating a level of **education** have a positive coefficients except for the value education2, representing respondents only with primary education. Respondents with the highest education level, which represents a master's degree/doctorate practice, are 2.6% less likely to respond to purchase of Czech products "certainly or rather no", 2% less likely to "neither yes or no", and 4.6% more likely to say "certainly or rather yes" (Appendix B, Table14) . We can say that respondents with the highest education level tend to purchase Czech products more often than respondents with the lowest education level.

City size

On the other hand, variables representing the **size of the city** have negative coefficients, excepted a town with 1,000 to 4,999 residents.

Income of household

All variables representing **income** level have positive coefficients. However, marginal effects and values of coefficients are similar for every level of income. Therefore, we do not see differences in levels of household income in regards to purchases of Czech products.

Number of people in a household

Variable **count p** has a positive coefficient. However, this variable has a really small coefficient, and marginal effects are inconspicuous.

Districts in the Czech Republic

The variable **region** representing districts in the Czech republic have significant coefficients except for the region9, and region14 values, representing Plzeň and Zlín district, which are not significant even on 95% confidence interval. From Table 14, we see that region5 (Liberec district) has the highest probability for answering "yes". Residents of Liberec district are about 10.3% more likely to answer "certainly or rather yes", 5.1% less likely to answer "neither yes or no", and 5.2% less likely to respond "certainly or rather no".

Testing

We need to check whether variable in Model 2 are jointly significant. We used the likelihood ratio test. First, we estimated the model with a constant only and ran the lrtest to test the hypothesis. For this hypothesis, we obtained test statistics equal to 671.19, and the p-value is almost 0, much below than 5% threshold. Therefore, we have to reject the null hypothesis that those nine variables are jointly insignificant. Hence, they are jointly significant.

We employed the Brant test is to test the parallel regression assumption. It tests the primary assumption of the order logit model that we fulfill a proportional odds assumption. In our model, the output p-value of the omnibus test says that we cannot reject the null hypothesis. Therefore odds assumption met, and we can use the ordered logit model.

5.3 Bio index

We summarize the most crucial points of recycling trend, which we concluded from Model 3 (Table 4):

- There is a significant upward trend of purchasing bio products between 2009 to 2019.
- Females tend to purchase bioproducts more often than males.
- Respondents with the highest education level tend to purchase bioproducts more than respondents with lower education levels.
- Households in cities with 100,000 residents and more tend to buy bioproducts less than households from smaller cities.
- Residents of Karlovy vary district are more likely to purchase bioproducts than residents from other districts of the Czech republic.

Detailed interpretation of model

First, let us interpret explanatory variables representing the purchase of bioproducts in Model 3 (Table 4). Most of them are statistically significant on the 99% confidence interval. Only variables region4 (Hradec Králové district), region5 (Liberec district), region6 (Moravia-Silesian district), region8 (Pardubice district), region9 (Plzeň district), and income variables between 6,001 - 19,500 are not significant even on the 90% confidence interval.

Time

Next, we can conclude that variables indicating time (the **year** variable) have positive coefficients. Having other variables fixed in our model, except variable year2019, the odds of purchasing bioproducts in 2019 over odds of purchasing bio in 2009 are $\exp(0.550) = 1.773$. In terms of percent change, the year 2019 has higher odds, about 77%, than the odds of purchasing bioproducts in 2009. When we look at marginal effects for the variable year2019, we say that in 2019 respondents are 12.5% less likely to answer that "never" buy bioproducts, 0.7% more likely answer to "occasionally", 9.7%

more likely to answer that bioproducts buy "regularly", 1.7% more likely to answer "almost every time", and 0.4% more likely to answer "always" than in 2009 (for marginal effects, see Appendix B, Table 15).

Gender

The second variable, **gender1**, representing females, has a positive coefficient, which means that females tend to purchase bioproducts more often than males. It is similar to what Ščastný et al. (2013) found in their study. Holding other variables fixed in our model, except variable gender1, the odds of female purchase bio products over the odds of male purchase bio products is $\exp(0.406) = 1.501$. In terms of percent change, female has about 50% higher odds than males in regards to bioproducts purchases.

Age

Variable indicating **age** has a negative coefficient. According to results, older respondents tend to buy bioproduct more often than younger respondents. Thus, from this analysis we cannot confirm influence of the age variable on the recycling trend.

Education

Variables indicating a level of **education** have positive coefficients. Respondents with the highest education level, which represents a master's degree/doctorate practice, are 23.4% less likely to respond to buying bioproducts "never", 2% less likely to state "occasionally", 20% more likely to say that they buy bioproduct "regularly", 4.3% more likely to say "almost every time", and 1% more likely to say "always" (for marginal effects, see Appendix B, Table 15). We can say that respondents with the highest education level tend to purchase bioproducts more often than respondents with the lowest education level. Outcomes are similar to what Ščastný et al. (2013) found in their study.

City size

On the other hand, variables representing the **size of the city** have positive coefficients, excepted cities with 100,000 residents and more has negative coefficients.

Income of household

Not all variables representing **income** level have significant positive coefficients. However, the marginal effect of significant levels has notable marginal effects see Appendix B, Table 15. The households with the highest income level (100,001 CZK and more) is about 25.7% less likely to answer " never" on buying bioproducts, in comparison to respondents of the lowest income level, about 6.3% less likely to answer "occasionally", but 24% more likely to answer that they buy bioproducts "regularly", 6.5% more likely to respond "almost every time" and 1.6% more likely answer "always". Hence, we can say that households with higher income levels tend to buy bioproducts more often than with lower income levels. It is similar to what Václavík (2009) found in his study.

Employed people in a household

Variable **count income** has a negative coefficient, which contrasts with the variable income since we found that people with higher income level of households tends to buy more bioproducts. Nevertheless, households with the higher number of employed persons tend to buy less of bioproducts.

Number of people in a household

Variable **count p**, representing the size of the household, has a positive coefficient. Which leads to conclusion that biggers families tend to purchase bioproducts more than smaller households.

Districts in the Czech Republic

The variables **region** is representing districts in the Czech republic. From marginal effects, Appendix B Table 15, we see that region3 (Karlovy vary district) has the highest probability for answering "always", "almost every time" and "regularly". Specifically, there are about 8.8% less likely to answer "never", 0.8% more likely answer "occasionally", about 6.6% more likely answer "regularly", 1.1% more likely answer "almost every time", and 0.3% more likely answer "almost every time".

Testing

We need to check the jointly significant of variables in Model 3. We used the likelihood ratio test. First, we estimated the model with a constant only and ran the lrtest to test the hypothesis.

In such the case, for the null hypothesis we set parameters year = 0, age = 0, gender = 0, education = 0, region = 0, size of city = 0, income = 0, count income = 0, and count p = 0. In other words, we observe if they are insignificant. For this hypothesis, we obtained test statistics equal to 4017.8, and the p-value is almost 0, much below than 5% threshold. Therefore, we have to reject the null hypothesis that those nine variables are jointly insignificant. Hence, they are jointly significant.

The Brant test is to test the parallel regression assumption. It tests the primary assumption of the order logit model that we fulfill a proportional odds assumption. In our model, the output p-value of the omnibus test says that we cannot reject the null hypothesis. Therefore odds assumption met, and we can use the ordered logit model.

Table 4: Model 3

	Dependent variable:
	bio_index
year2010	0.264*** (0.027)
year2011	0.187*** (0.027)
year2012	0.278*** (0.027)
year2013	0.455*** (0.027)
year2014	0.483*** (0.027)
year2015	0.540*** (0.028)
year2016	0.539*** (0.028)
year2017	0.360*** (0.028)
year2018	0.400*** (0.028)
year2019	0.550*** (0.028)
gender1	0.406*** (0.011)
age	−0.008*** (0.0004)
region2	0.067** (0.030)
region3	0.381*** (0.037)
region4	−0.040 (0.034)
region5	−0.014 (0.043)
region6	−0.003 (0.030)
region7	0.250*** (0.034)
region8	0.057 (0.036)
region9	0.026 (0.036)
region10	0.269*** (0.037)
region11	−0.148*** (0.030)
region12	−0.163*** (0.029)
region13	−0.374*** (0.033)
region14	0.086** (0.036)
education2	0.390*** (0.044)

education3	0.549*** (0.043)
education4	0.815*** (0.042)
education5	0.967*** (0.056)
education6	1.175*** (0.049)
education7	1.122*** (0.045)
size_of_city1,000 - 4,999	0.134*** (0.022)
size_of_city5,000 - 19,999	0.328*** (0.022)
size_of_city20,000 - 99,999	0.230*** (0.021)
size_of_city100,000 +	−0.248*** (0.030)
income4,001 - 6,000	−0.360** (0.156)
income6,001 - 8,000	−0.010 (0.120)
income8,001 - 10,000	−0.080 (0.103)
income10,001 - 12,500	−0.050 (0.099)
income12,501 - 19,000	−0.025 (0.099)
income19,001 - 19,500	0.092 (0.100)
income19,501 - 20,000	0.175* (0.098)
income20,001 - 25,000	0.295*** (0.097)
income25,001 - 30,000	0.424*** (0.096)
income30,001 - 40,000	0.563*** (0.096)
income40,001 - 50,000	0.645*** (0.097)
income50,001 - 75,000	0.814*** (0.098)
income75,001 - 100,000	1.065*** (0.105)
income100,001+	1.365*** (0.126)
count_income	−0.183*** (0.011)
count_p	0.061*** (0.007)
Observations	111,529

Note: Standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01

5.4 Traveling trend

I did not include inflation in this model because respondents fill in answers to vacation spending not in absolute values but they select only from relatively wide intervals (e.g., 75,001 - 100,000 CZK). For this reason, it would be difficult to estimate the impact of inflation on the absolute value. Therefore, in this thesis, the traveling trend could be a little overestimated. But, due to wide intervals, inflation should not significantly affect the main results. Nevertheless, in the future, it is possible to improve this model and adjust it with respect to inflation to make the results more accurate.

We summarize the most crucial points of traveling trend, which we concluded from Model 4 (Table 5):

- There is a significant downward trend in spending money on traveling from 2010 to 2016, but from 2018 to 2019 we observe a significant upward trend in spending money on traveling.
- Women tend to spend less money on traveling than men.
- Respondents with the highest education level tend to spend more money on traveling than respondents with lower education levels.
- Households from bigger cities tend to spend more money on traveling than households from smaller towns.

Detailed interpretation of model

First, let us interpret explanatory variables representing the traveling trend in Model 4 (Table 5). Most of them are statistically significant on the 99% confidence interval. Only variables year2017, region3 (Karlovy Vary district), region6 (Moravia-Silesian district), region9 (Plzeň district), the size of city 1,000 - 4,999 residents, and the size of city 20,000 - 99,999, are not significant even on the 90% confidence interval.

For this dependent variable, we did not use independent variable **income**. The reason is self explanatory. We detected a correlation between the traveling and income variables. When we run the model with the income variable, we had two problems. First, we needed to omit many observations, and

second, there is a strong relationship between income and traveling, which shifts our results. Therefore, we decide not to include the income variable in the model with the traveling dependent variable.

Year

Next, we can conclude that variables indicating time (the **year** variable) have negative coefficients, but the year 2018 and 2019 has a positive coefficient. Holding other variables fixed in our model, except the variable year2019, the odds of spending money on traveling in 2019 over the odds of spending money on traveling in 2009 are $\exp(0.243) = 1.275$. In terms of percent change, the year 2019 has about 27.5% higher odds of spending money on traveling than the odds in 2009.

Gender

The second variable, **gender1**, representing women, has a negative coefficient, which means that women tend to spent less money on traveling than men. Holding other variables fixed in our model, except the variable gender1, the odds of women spending money on traveling over the odds of men spending money on traveling is $\exp(-0.175) = 0.839$. In terms of percent change, women has approximately about 16% lower odds of spending money on traveling than the odds of men.

Education

Variable values indicating the level of **education** have positive coefficients, except education2, which is representing primary education. Respondents with the highest education level, which represents a master's degree/doctorate practice, are 26.4% less likely to spend up to "20,000 CZK" on traveling, 22.7% more likely to spend "20,001 - 75,000 CZK" on traveling, and 3.8 % more likely to spend "75,001 and more CZK" on traveling (for marginal effects, see Appendix B, Table 16). We can say that respondents with the highest education level tend to spend more money on traveling than respondents with the lowest education level. Observations are similar to those found in the study by Czepkiewicza et al. (2020).

City size

Also, variables representing the **size of the city** have positive coefficients, especially cities with the size of 100,001 and more residents.

Employed people in a household

The variable **count income** has a negative coefficient. But marginal effects are inconspicuous.

Number of people in a household

The variable **count p**, representing the size of a household, has a positive coefficient. Which is similar to what Czepkiewicza et al. (2020) published.

Districts in the Czech Republic

The variables **region** represents districts in the Czech republic. From Table 14, we see that households in the region10 (Prague) are 7% less likely to spend up to "20,000 CZK" on traveling , 6.3% more likely to spend "20,001 - 75,000 CZK" on traveling, and 0.7 % more likely spend " 75,001 and more CZK" on traveling.

Testing

We need to check whether variables in Model 4 are jointly significant. We employed the likelihood ratio test. First, we estimated the model with a constant only and ran the lrtest to test the hypothesis.

In such the case, for the null hypothesis we set parameters year = 0, age = 0, gender = 0, education = 0, region = 0, size of city = 0, count income = 0, and count p = 0. In other words, we observe if they are insignificant. For this hypothesis, we obtained test statistics equal to 4764, and the p-value is almost 0, much below than 5% threshold. Therefore, we have to reject the null hypothesis that those eight variables are jointly insignificant. Hence, they are jointly significant.

The Brant test is to test the parallel regression assumption. It tests the primary assumption of the order logit model that we fulfill a proportional odds assumption. In our model, the output p-value of the omnibus test says that we cannot reject the null hypothesis. Therefore odds assumption met, and we can use the ordered logit model.

Table 5: Model 4

	Dependent variable:
	traveling
year2010	-0.132^{***} (0.040)
year2011	-0.159^{***} (0.039)
year2012	-0.192^{***} (0.039)
year2013	-0.322^{***} (0.039)
year2014	-0.238^{***} (0.038)
year2015	-0.153^{***} (0.038)
year2016	-0.107^{***} (0.038)
year2017	0.037 (0.039)
year2018	0.231^{***} (0.038)
year2019	0.243^{***} (0.038)
gender1	-0.175^{***} (0.016)
age	0.002^{***} (0.001)
region2	-0.360^{***} (0.042)
region3	-0.073 (0.052)
region4	-0.102^{**} (0.050)
region5	0.195^{***} (0.059)
region6	0.062 (0.042)
region7	-0.377^{***} (0.048)
region8	-0.213^{***} (0.051)
region9	-0.006 (0.050)
region10	0.287^{***} (0.051)
region11	0.100^{**} (0.043)
region12	0.126^{***} (0.043)
region13	-0.223^{***} (0.048)
region14	-0.161^{***} (0.049)
education2	-0.174^{**} (0.075)

education3	0.239*** (0.073)
education4	0.633*** (0.072)
education5	0.691*** (0.084)
education6	0.747*** (0.078)
education7	1.083*** (0.075)
size_of_city1,000 - 4,999	0.002 (0.032)
size_of_city5,000 - 19,999	0.123*** (0.031)
size_of_city20,000 - 99,999	0.022 (0.031)
size_of_city100,000 +	0.290*** (0.040)
count_income	−0.044*** (0.013)
count_p	0.238*** (0.009)
Observations	52,135

Note: Standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01

5.5 Models with ABCDE classification

Recycling as dependent variable

In Model 5 (Table 6) we have all statistical significant variables on 99% confidence interval. We see that all variables **ABCDE classification** representing households defined based on classification (Section 3.3) have a negative coefficient.The classes are defined from the highest to lowest class. We compare the lowest-level and highest-level classes of variable ABCDE classification. The model shows that households in class "E3" are 15.4% more likely to be in a group that answers "certainly or rather no" , about 5.7% more like respond " neither yes or no" and 21.2% less likely answer "certainly or rather yes" (For marginal effects see Table 17 in Appendix C). This implicates that households in lower levels in ABCDE classification are less likely to recycle than households in higher levels.

Czech products as dependent variable

In Model 6 (Table 6) we have all statistical significant variables on 99% confidence interval, except of year2015 and ABCDEclassificationC1, which are not significant. We see that all variables **ABCDE classification** representing households defined based on classification (Section 3.3) have a negative coefficient, except class "B". The classes are defined from the highest to lowest class. We compare the lowest-level and highest-level classes of variable ABCDE classification. The model shows that households in class "E3" are 28.3% more likely to be in a group that answers "certainly no", about 11.1% less likely respond "rather no", 14.8% less likely answer "neither yes or no", and 2.3% less likely answer "certainly or rather yes" (For marginal effects see Table 18 in Appendix C).

This implicates that households in lower levels in ABCDE classification are less likely to purchase Czech products than households in higher levels.

Table 6: Model 5 and Model 6

	Dependent variable:	
	recycling	czech_product
	(Model 5)	(Model 6)
year2010	0.062** (0.025)	0.111*** (0.025)
year2011	0.225*** (0.025)	0.105*** (0.025)
year2012	0.306*** (0.025)	0.153*** (0.025)
year2013	0.369*** (0.025)	0.081*** (0.025)
year2014	0.393*** (0.025)	0.092*** (0.025)
year2015	0.391*** (0.026)	0.017 (0.026)
year2016	0.356*** (0.026)	−0.036 (0.026)
year2017	0.349*** (0.026)	−0.123*** (0.026)
year2018	0.408*** (0.026)	−0.206*** (0.026)
year2019	0.430*** (0.026)	−0.228*** (0.026)
ABCDE_classificationB	−0.079*** (0.023)	0.112*** (0.023)
ABCDE_classificationC1	−0.272*** (0.019)	−0.010 (0.019)
ABCDE_classificationC2	−0.404*** (0.018)	−0.065*** (0.018)
ABCDE_classificationD	−0.468*** (0.018)	−0.102*** (0.018)
ABCDE_classificationE1	−0.534*** (0.023)	−0.157*** (0.023)
ABCDE_classificationE2	−0.620*** (0.037)	−0.134*** (0.037)
ABCDE_classificationE3	−0.857*** (0.054)	−0.398*** (0.054)
Observations	111,529	111,529
Note:Standard errors in parentheses		*p<0.1; **p<0.05; ***p<0.01

Bio index as dependent variable

In Model 7 (Table 7) we have all statistical significant variables on 99% confidence interval. We see that all variables **ABCDE classification** representing households defined based on classification (Section 3.3) have a neg-

ative coefficient.The classes are defined from the highest to lowest class. We compare the lowest-level and highest-level classes of variable ABCDE classification. The model shows that households in class "E3" are 28.3% more likely to answer on question about buying bioproducts that they "never" buy them, about 11.1% less likely respond "occasionally" and 14.8% less likely answer "regularly", 1.9% less likely to answer "almost every time", and 0.4% less likely to answer "always" (For marginal effects see Table 19 in Appendix C).

This implicates that households in lower levels in ABCDE classification are less likely to buy bioproducts than households in higher levels.

Traveling as dependent variable

In Model 8 (Table 6) we have all statistical significant variables on 99% confidence interval, except of year2017 which is significant but on 90% confidence interval. We see that all variables **ABCDE classification** representing households defined based on classification (Section 3.3) have a negative coefficients. The classes are defined from the highest to lowest class. We compare the lowest-level and highest-level classes of variable ABCDE classification. The model shows that households in class "E3" are 44.2% more likely to spend "10 000 CZK and less" on traveling , 42.1% less likely to spend "10 001 - 75 000 CZK " on traveling, and about 2.1% less likely to spend "75 001 CZK and more" on traveling.(For marginal effects see Table 18 in Appendix C).

This implicates that households in lower levels in ABCDE classification are spend less money on traveling that households in higher levels.

Testing we tested if models, Model 5 , Model 6, Model 7 and Model 8, are jointly significant and brant test for correct proportional odds assumptions. We found that we have in all models reject null hypotheses since p value is almost 0. Hence, variables inside models are jointly significant parameters and Brant test is correct, it means that we can not reject null hypothesis and we can use this ordered logit model.

Table 7: Model 7 and Model 8

	Dependent variable:	
	bio_index	traveling
	(Model 7)	(Model 8)
year2010	0.283*** (0.027)	−0.142*** (0.040)
year2011	0.223*** (0.027)	−0.130*** (0.039)
year2012	0.389*** (0.027)	−0.109*** (0.039)
year2013	0.575*** (0.026)	−0.252*** (0.038)
year2014	0.605*** (0.026)	−0.154*** (0.037)
year2015	0.670*** (0.027)	−0.096** (0.038)
year2016	0.684*** (0.027)	−0.087** (0.038)
year2017	0.539*** (0.027)	0.065* (0.038)
year2018	0.606*** (0.027)	0.229*** (0.038)
year2019	0.767*** (0.027)	0.209*** (0.037)
ABCDE_classificationB	−0.277*** (0.023)	−0.482*** (0.029)
ABCDE_classificationC1	−0.346*** (0.019)	−0.538*** (0.024)
ABCDE_classificationC2	−0.482*** (0.018)	−0.732*** (0.024)
ABCDE_classificationD	−0.617*** (0.019)	−1.128*** (0.026)
ABCDE_classificationE1	−0.732*** (0.024)	−1.310*** (0.037)
ABCDE_classificationE2	−0.910*** (0.039)	−1.704*** (0.069)
ABCDE_classificationE3	−1.175*** (0.058)	−1.928*** (0.114)
Observations	111,529	52,135

Note:Standard errors in parentheses *p<0.1; **p<0.05; ***p<0.01

Conclusion

This study is the first one that analyzes the effect of socio-demographic factors on consumer trends in the Czech Republic from 2009 to 2019. Contemporary studies were, usually, published from a dataset taken only in one year.

The main focus of this work is to test the hypothesis that there are significant consumer trends from 2009 to 2019 and the hypothesis that socio-demographic determinants affect these trends. Such trends can be helpful for marketing businesses or companies that need to segment consumers on the market. We took advantage of data from Median s.r.o., one of the leading market research agencies in the Czech Republic, and run ordered logit regression to test these hypotheses.

This study provides four trends that are relevant to consumers in the Czech Republic over 11 years. We learned that we have a significant upward trend in waste recycling in the Czech Republic, a downward trend in purchasing Czech products in recent years, a rising trend in buying bioproducts, and a rising trend in traveling. The last trend is mainly evident in consumers spending more money on vacation in 2018 and 2019 than in 2009. The findings of this thesis are, usually, in line with the literature.

This thesis also discusses the connection between socio-demographic determinants and response variables. A trend, response variable always depends on education, gender, age, size of the household resident place, number of people in a household, ABCDE classification, and districts in the Czech Republic. Study shows that women tend to recycle and purchase Czech and bioproducts more often than men. On the other hand, men spend more money on traveling. Higher education has a significant effect on all of the trend variables. The size of the place of residents of households has surprising results. Residents from the biggest cities tend to spend more money on vacation but tend to recycle less and purchase Czech and bioproducts less than residents from smaller cities or towns. Also, bigger families with more members tend to recycle, buy more Czech and bioproducts and spend more

money on vacations. Outcomes determined by districts were completely different each time and showed contradictory findings. In the work, we tested the ABCDE classification of households and how they differ in each trend. For this variable, we constructed a separate model to avoid multicollinearity.

Altogether, the main contributions of the thesis are the complex analysis of determinants of trend variables and the complex analysis of consumers during 11 years. The overall results support the hypotheses.

Future research has an opportunity to compare this research with consumer behavior in the year 2020 and coming years. Since the Covid pandemic changes the consumer market, therefore, it would be interesting to see how trends change. Also, further research could unveil other trends for further analysis.

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Appendix A

Table 8: Summary of studies of bio products buyers and their socio-demographic effect

Variable	**Correlation**	**Study of bio products**
size of household	negative	Haris et al. (2000) Jolly (1991)
size of household	positive	Václavík (2009)
income	negative	Jolly (1991)
income	none	Hughner et al. (2007)
income	positive	Bonti-Ankomah and Yiridoe (2006) Václavík (2009)
gender = women	positive	Boccaletti (2008) Govindasamy and Italia (1997) Ščastný et al. (2013) Václavík (2009)
education	positive	Jolly (1991) Ščastný et al. (2013) Václavík (2009)
age	positive	Jolly (1991) Václavík (2009)
age	negative	Boccaletti (2008)

Table 9: Summary of studies of recycling per person and their socio-demographic effect

Variable	**Correlation**	**Study of recycling**
size of household	none	Fiorillo (2013)
size of household	positive	Rybova (2019)
income	positive	Halvorsen (2008)
education	positive	Rybova (2019) Fiorillo (2013)
age	positive/ negative	Nixon and Saphores (2009) Fiorillo (2013)

Table 10: Summary of studies of traveling trend and their socio-demographic effect

Variable	**Correlation**	**Study of international traveling**
household with children lower that 7 years	negative	Czepkiewicza et al. (2020)
house in city center	positive	Czepkiewicza et al. (2020)
education	positive	Czepkiewicza et al. (2020) Eurostat (2018)
age	positive/ negative	Eurostat (2018)

Appendix B

Table 11: Ordered Logit and Probit model

	Dependent variable:	
	recycling	
	ordered logistic	*ordered probit*
	(1)	(2)
year2010	0.070*** (0.025)	0.034** (0.015)
year2011	0.229*** (0.025)	0.137*** (0.015)
year2012	0.247*** (0.025)	0.151*** (0.015)
year2013	0.297*** (0.025)	0.175*** (0.015)
year2014	0.345*** (0.025)	0.202*** (0.015)
year2015	0.366*** (0.026)	0.211*** (0.015)
year2016	0.312*** (0.026)	0.178*** (0.015)
year2017	0.294*** (0.026)	0.173*** (0.015)
year2018	0.356*** (0.026)	0.201*** (0.015)
year2019	0.359*** (0.026)	0.203*** (0.015)
gender1	0.298*** (0.011)	0.175*** (0.006)
age	0.006*** (0.0004)	0.003*** (0.0002)
region2	0.348*** (0.029)	0.191*** (0.017)
region3	−0.227*** (0.035)	−0.140*** (0.020)
region4	−0.232*** (0.033)	−0.135*** (0.019)
region5	0.565*** (0.041)	0.335*** (0.024)
region6	0.024 (0.029)	0.005 (0.017)
region7	0.436*** (0.033)	0.268*** (0.019)
region8	0.094*** (0.034)	0.051** (0.020)
region9	0.174*** (0.034)	0.106*** (0.020)

region10	0.611*** (0.036)	0.353*** (0.021)
region11	−0.219*** (0.029)	−0.136*** (0.017)
region12	−0.225*** (0.028)	−0.144*** (0.016)
region13	0.154*** (0.031)	0.078*** (0.018)
region14	0.031 (0.034)	0.028 (0.020)
education2	−0.065* (0.039)	−0.034 (0.023)
education3	0.066* (0.039)	0.041* (0.023)
education4	0.291*** (0.038)	0.171*** (0.022)
education5	0.579*** (0.052)	0.338*** (0.031)
education6	0.575*** (0.046)	0.330*** (0.027)
education7	0.637*** (0.041)	0.373*** (0.024)
size_of_city1,000 - 4,999	0.128*** (0.021)	0.072*** (0.012)
size_of_city5,000 - 19,999	0.057*** (0.020)	0.028** (0.012)
size_of_city20,000 - 99,999	0.069*** (0.020)	0.027** (0.012)
size_of_city100,000 +	−0.626*** (0.029)	−0.371*** (0.017)
income4,001 - 6,000	−0.957*** (0.146)	−0.559*** (0.084)
income6,001 - 8,000	−0.756*** (0.116)	−0.443*** (0.066)
income8,001 - 10,000	−0.565*** (0.100)	−0.323*** (0.057)
income10,001 - 12,500	−0.594*** (0.097)	−0.336*** (0.056)
income12,501 - 19,000	−0.548*** (0.097)	−0.306*** (0.056)
income19,001 - 19,500	−0.531*** (0.098)	−0.301*** (0.056)
income19,501 - 20,000	−0.523*** (0.096)	−0.287*** (0.055)
income20,001 - 25,000	−0.451*** (0.095)	−0.245*** (0.054)
income25,001 - 30,000	−0.389*** (0.095)	−0.203*** (0.054)
income30,001 - 40,000	−0.353*** (0.094)	−0.180*** (0.054)
income40,001 - 50,000	−0.338*** (0.095)	−0.167*** (0.055)
income50,001 - 75,000	−0.281*** (0.096)	−0.133** (0.055)
income75,001 - 100,000	−0.333*** (0.103)	−0.162*** (0.059)
income100,001+	−0.239** (0.122)	−0.101 (0.071)
count_income	−0.079*** (0.011)	−0.050*** (0.006)
count_p	0.027*** (0.007)	0.015*** (0.004)

Table 12: Marginal effects of Recycling using ordered logit model

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.003	-0.006	-0.007	0.004	0.013
year2011	-0.010	-0.020	-0.025	0.012	0.042
year2012	-0.010	-0.021	-0.027	0.012	0.046
year2013	-0.012	-0.025	-0.032	0.014	0.055
year2014	-0.014	-0.029	-0.037	0.015	0.065
year2015	-0.015	-0.031	-0.040	0.016	0.070
year2016	-0.013	-0.026	-0.034	0.014	0.059
year2017	-0.012	-0.025	-0.032	0.014	0.055
year2018	-0.014	-0.030	-0.039	0.015	0.067
year2019	-0.014	-0.030	-0.039	0.015	0.068
gender1	-0.014	-0.027	-0.031	0.020	0.052
age	0.000	-0.001	-0.001	0.000	0.001
region2	-0.014	-0.029	-0.038	0.016	0.066
region3	0.011	0.022	0.022	-0.018	-0.038
region4	0.012	0.022	0.023	-0.018	-0.038
region5	-0.020	-0.044	-0.062	0.014	0.113
region6	-0.001	-0.002	-0.003	0.002	0.004
region7	-0.017	-0.036	-0.048	0.016	0.085
region8	-0.004	-0.008	-0.010	0.006	0.017
region9	-0.007	-0.015	-0.019	0.009	0.032
region10	-0.023	-0.049	-0.067	0.019	0.120
region11	0.011	0.021	0.022	-0.017	-0.037
region12	0.011	0.022	0.022	-0.017	-0.038
region13	-0.007	-0.014	-0.016	0.009	0.028
region14	-0.001	-0.003	-0.003	0.002	0.005
education2	0.003	0.006	0.007	-0.004	-0.011
education3	-0.003	-0.006	-0.007	0.004	0.012
education4	-0.013	-0.026	-0.031	0.017	0.052
education5	-0.021	-0.045	-0.064	0.013	0.116
education6	-0.021	-0.045	-0.063	0.014	0.115
education7	-0.023	-0.050	-0.070	0.017	0.126
size_of_city1 000 - 4 999	-0.006	-0.011	-0.014	0.008	0.023
size_of_city5 000 - 19 999	-0.003	-0.005	-0.006	0.004	0.010
size_of_city20 000 - 99 999	-0.003	-0.006	-0.007	0.004	0.012
size_of_city100 000 +	0.034	0.063	0.057	-0.055	-0.099
income4 001 - 6.000	0.068	0.106	0.060	-0.108	-0.126
income6 001 - 8.000	0.049	0.082	0.056	-0.080	-0.106
income8 001 - 10.000	0.033	0.059	0.048	-0.055	-0.085
income10 001 - 12.500	0.035	0.062	0.050	-0.058	-0.089
income12.501 - 19.000	0.032	0.057	0.047	-0.052	-0.083
income19.001 - 19.500	0.031	0.055	0.046	-0.050	-0.081
income19.501 - 20.000	0.030	0.054	0.046	-0.049	-0.081
income20.001 - 25.000	0.024	0.045	0.042	-0.039	-0.072
income25.001 - 30.000	0.020	0.038	0.037	-0.032	-0.063
income30.001 - 40.000	0.018	0.034	0.034	-0.028	-0.059
income40.001 - 50.000	0.017	0.033	0.033	-0.027	-0.056
income50.001 - 75.000	0.014	0.027	0.027	-0.023	-0.046
income75.001 - 100.000	0.018	0.033	0.031	-0.029	-0.053
income100.001+	0.012	0.023	0.023	-0.019	-0.039
count_income	0.004	0.007	0.008	-0.005	-0.014
count_p	-0.001	-0.003	-0.003	0.002	0.005

Table 13: Marginal effects of Recycling using ordered probit model

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.003	-0.005	-0.005	0.003	0.010
year2011	-0.012	-0.020	-0.020	0.009	0.043
year2012	-0.013	-0.022	-0.022	0.010	0.048
year2013	-0.015	-0.025	-0.026	0.011	0.056
year2014	-0.017	-0.029	-0.030	0.012	0.065
year2015	-0.018	-0.030	-0.032	0.012	0.068
year2016	-0.015	-0.026	-0.027	0.011	0.057
year2017	-0.015	-0.025	-0.026	0.011	0.055
year2018	-0.017	-0.029	-0.030	0.012	0.065
year2019	-0.017	-0.029	-0.031	0.012	0.065
gender1	-0.017	-0.026	-0.024	0.015	0.053
age	0.000	0.000	0.000	0.000	0.001
region2	-0.016	-0.028	-0.029	0.011	0.061
region3	0.015	0.022	0.018	-0.015	-0.040
region4	0.015	0.021	0.018	-0.014	-0.039
region5	-0.025	-0.045	-0.053	0.011	0.112
region6	0.000	-0.001	-0.001	0.000	0.002
region7	-0.021	-0.037	-0.041	0.012	0.088
region8	-0.005	-0.008	-0.007	0.004	0.016
region9	-0.009	-0.015	-0.015	0.007	0.033
region10	-0.028	-0.049	-0.055	0.014	0.117
region11	0.015	0.021	0.018	-0.014	-0.040
region12	0.015	0.022	0.019	-0.015	-0.042
region13	-0.007	-0.012	-0.011	0.006	0.024
region14	-0.003	-0.004	-0.004	0.002	0.009
education2	0.003	0.005	0.005	-0.003	-0.010
education3	-0.004	-0.006	-0.006	0.003	0.013
education4	-0.016	-0.025	-0.024	0.013	0.053
education5	-0.025	-0.046	-0.053	0.010	0.114
education6	-0.025	-0.045	-0.052	0.011	0.110
education7	-0.028	-0.051	-0.058	0.013	0.124
size_of_city1 000 - 4 999	-0.007	-0.011	-0.010	0.006	0.022
size_of_city5 000 - 19 999	-0.003	-0.004	-0.004	0.002	0.008
size_of_city20 000 - 99 999	-0.003	-0.004	-0.004	0.002	0.008
size_of_city100 000 +	0.043	0.058	0.044	-0.043	-0.103
income4 001 - 6.000	0.084	0.089	0.046	-0.087	-0.133
income6 001 - 8.000	0.061	0.071	0.043	-0.064	-0.111
income8 001 - 10.000	0.040	0.051	0.036	-0.042	-0.086
income10 001 - 12.500	0.042	0.053	0.038	-0.043	-0.090
income12.501 - 19.000	0.037	0.049	0.035	-0.038	-0.083
income19.001 - 19.500	0.037	0.048	0.035	-0.038	-0.081
income19.501 - 20.000	0.034	0.045	0.034	-0.035	-0.079
income20.001 - 25.000	0.028	0.038	0.030	-0.027	-0.069
income25.001 - 30.000	0.022	0.031	0.026	-0.021	-0.058
income30.001 - 40.000	0.019	0.028	0.024	-0.018	-0.052
income40.001 - 50.000	0.018	0.026	0.022	-0.017	-0.048
income50.001 - 75.000	0.014	0.020	0.017	-0.013	-0.039
income75.001 - 100.000	0.018	0.025	0.021	-0.018	-0.046
income100.001+	0.011	0.016	0.013	-0.010	-0.029
count_income	0.005	0.008	0.007	-0.004	-0.015
count_p	-0.002	-0.002	-0.002	0.001	0.005

Table 14: Marginal effect of Czech products

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.005	-0.010	-0.011	0.015	0.011
year2011	-0.005	-0.010	-0.012	0.015	0.011
year2012	-0.006	-0.012	-0.015	0.019	0.014
year2013	-0.004	-0.007	-0.008	0.011	0.008
year2014	-0.003	-0.006	-0.007	0.010	0.007
year2015	0.000	0.000	0.000	0.000	0.000
year2016	0.003	0.005	0.005	-0.008	-0.006
year2017	0.007	0.014	0.013	-0.021	-0.014
year2018	0.012	0.021	0.020	-0.032	-0.021
year2019	0.014	0.025	0.023	-0.038	-0.024
gender1	-0.015	-0.029	-0.031	0.044	0.031
age	-0.001	-0.002	-0.002	0.003	0.002
region2	-0.006	-0.012	-0.014	0.018	0.013
region3	-0.008	-0.016	-0.020	0.025	0.019
region4	0.003	0.006	0.006	-0.009	-0.006
region5	-0.017	-0.035	-0.051	0.054	0.049
region6	-0.004	-0.008	-0.009	0.013	0.009
region7	-0.006	-0.011	-0.013	0.016	0.012
region8	-0.013	-0.025	-0.034	0.039	0.032
region9	-0.002	-0.004	-0.004	0.006	0.004
region10	-0.004	-0.007	-0.008	0.011	0.008
region11	0.004	0.007	0.008	-0.011	-0.008
region12	0.015	0.026	0.024	-0.040	-0.025
region13	-0.006	-0.012	-0.014	0.018	0.014
region14	-0.001	-0.001	-0.002	0.002	0.002
education2	0.008	0.014	0.014	-0.021	-0.014
education3	0.000	0.000	0.000	0.001	0.000
education4	-0.005	-0.009	-0.010	0.014	0.010
education5	-0.017	-0.033	-0.047	0.051	0.046
education6	-0.008	-0.014	-0.018	0.022	0.017
education7	-0.009	-0.017	-0.021	0.026	0.020
size_of_city1 000 - 4 999	-0.003	-0.006	-0.007	0.009	0.006
size_of_city5 000 - 19 999	0.004	0.008	0.008	-0.012	-0.008
size_of_city20 000 - 99 999	0.015	0.027	0.026	-0.041	-0.027
size_of_city100 000 +	0.011	0.020	0.020	-0.031	-0.020
income4 001 - 6.000	-0.027	-0.057	-0.101	0.084	0.102
income6 001 - 8.000	-0.030	-0.062	-0.115	0.090	0.118
income8 001 - 10.000	-0.028	-0.059	-0.104	0.087	0.105
income10 001 - 12.500	-0.027	-0.055	-0.091	0.082	0.091
income12.501 - 19.000	-0.028	-0.057	-0.096	0.085	0.095
income19.001 - 19.500	-0.030	-0.062	-0.110	0.091	0.112
income19.501 - 20.000	-0.030	-0.062	-0.107	0.092	0.108
income20.001 - 25.000	-0.031	-0.063	-0.102	0.095	0.101
income25.001 - 30.000	-0.032	-0.065	-0.103	0.098	0.103
income30.001 - 40.000	-0.033	-0.066	-0.098	0.100	0.097
income40.001 - 50.000	-0.030	-0.059	-0.092	0.090	0.091
income50.001 - 75.000	-0.029	-0.060	-0.099	0.090	0.098
income75.001 - 100.000	-0.026	-0.054	-0.093	0.081	0.092
income100.001+	-0.027	-0.056	-0.097	0.082	0.097
count_income	0.000	0.000	0.000	-0.001	0.000
count_p	-0.001	-0.002	-0.003	0.004	0.003

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Table 15: Marginal effect of Bioproducts

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.062	0.008	0.045	0.007	0.002
year2011	-0.044	0.006	0.032	0.005	0.001
year2012	-0.065	0.008	0.048	0.008	0.002
year2013	-0.104	0.009	0.080	0.013	0.003
year2014	-0.111	0.008	0.085	0.014	0.003
year2015	-0.123	0.007	0.095	0.017	0.004
year2016	-0.122	0.007	0.095	0.017	0.004
year2017	-0.084	0.009	0.062	0.010	0.002
year2018	-0.093	0.009	0.070	0.012	0.003
year2019	-0.125	0.007	0.097	0.017	0.004
gender1	-0.098	0.019	0.067	0.010	0.002
age	0.002	0.000	-0.001	0.000	0.000
region2	-0.016	0.003	0.011	0.002	0.000
region3	-0.088	0.008	0.066	0.011	0.003
region4	0.010	-0.002	-0.006	-0.001	0.000
region5	0.003	-0.001	-0.002	0.000	0.000
region6	0.001	0.000	-0.001	0.000	0.000
region7	-0.059	0.007	0.043	0.007	0.002
region8	-0.014	0.002	0.010	0.001	0.000
region9	-0.006	0.001	0.004	0.001	0.000
region10	-0.063	0.008	0.046	0.007	0.002
region11	0.036	-0.008	-0.024	-0.003	-0.001
region12	0.040	-0.009	-0.026	-0.004	-0.001
region13	0.092	-0.025	-0.058	-0.008	-0.002
region14	-0.021	0.003	0.014	0.002	0.000
education2	-0.091	0.010	0.067	0.011	0.002
education3	-0.129	0.017	0.094	0.015	0.003
education4	-0.189	0.021	0.139	0.023	0.005
education5	-0.201	-0.020	0.175	0.037	0.009
education6	-0.236	-0.036	0.211	0.049	0.012
education7	-0.234	-0.020	0.201	0.043	0.010
size_of_city1 000 - 4 999	-0.032	0.005	0.022	0.003	0.001
size_of_city5 000 - 19 999	-0.077	0.011	0.056	0.009	0.002
size_of_city20 000 - 99 999	-0.055	0.009	0.039	0.006	0.001
size_of_city100 000 +	0.060	-0.014	-0.040	-0.006	-0.001
income4 001 - 6.000	0.089	-0.024	-0.055	-0.008	-0.002
income6 001 - 8.000	0.002	0.000	-0.002	0.000	0.000
income8 001 - 10.000	0.019	-0.004	-0.013	-0.002	0.000
income10 001 - 12.500	0.012	-0.002	-0.008	-0.001	0.000
income12.501 - 19.000	0.006	-0.001	-0.004	-0.001	0.000
income19.001 - 19.500	-0.022	0.004	0.015	0.002	0.001
income19.501 - 20.000	-0.041	0.006	0.030	0.005	0.001
income20.001 - 25.000	-0.069	0.009	0.051	0.008	0.002
income25.001 - 30.000	-0.099	0.010	0.073	0.012	0.003
income30.001 - 40.000	-0.130	0.013	0.097	0.016	0.004
income40.001 - 50.000	-0.146	0.008	0.114	0.020	0.005
income50.001 - 75.000	-0.178	-0.002	0.146	0.028	0.006
income75.001 - 100.000	-0.216	-0.029	0.192	0.043	0.010
income100.001+	-0.257	-0.063	0.240	0.065	0.016
count_income	0.044	-0.008	-0.030	-0.005	-0.001
count_p	-0.015	0.003	0.010	0.002	0.000

Table 16: Marginal effect of Traveling dependent variable

	effect.1	effect.2	effect.3	effect.4	effect.5	effect.6	effect.7	effect.8
year2010	0.014	0.015	0.002	-0.011	-0.013	-0.005	-0.002	-0.001
year2011	0.017	0.018	0.002	-0.013	-0.015	-0.006	-0.002	-0.001
year2012	0.021	0.022	0.002	-0.016	-0.019	-0.007	-0.003	-0.002
year2013	0.037	0.037	0.001	-0.027	-0.030	-0.011	-0.004	-0.003
year2014	0.027	0.027	0.002	-0.020	-0.023	-0.008	-0.003	-0.002
year2015	0.017	0.018	0.002	-0.013	-0.015	-0.006	-0.002	-0.001
year2016	0.011	0.012	0.002	-0.009	-0.010	-0.004	-0.001	-0.001
year2017	-0.004	-0.004	-0.001	0.003	0.004	0.001	0.001	0.000
year2018	-0.022	-0.027	-0.007	0.017	0.024	0.009	0.004	0.002
year2019	-0.023	-0.028	-0.008	0.018	0.025	0.010	0.004	0.002
gender1	0.018	0.020	0.004	-0.014	-0.018	-0.007	-0.003	-0.002
age	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
region2	0.041	0.041	0.001	-0.030	-0.034	-0.012	-0.005	-0.003
region3	0.008	0.008	0.001	-0.006	-0.007	-0.003	-0.001	-0.001
region4	0.011	0.012	0.002	-0.008	-0.010	-0.004	-0.001	-0.001
region5	-0.019	-0.023	-0.006	0.014	0.020	0.008	0.003	0.002
region6	-0.006	-0.007	-0.001	0.005	0.006	0.002	0.001	0.001
region7	0.044	0.043	0.000	-0.032	-0.035	-0.012	-0.005	-0.003
region8	0.024	0.024	0.002	-0.018	-0.020	-0.007	-0.003	-0.002
region9	0.001	0.001	0.000	-0.001	-0.001	0.000	0.000	0.000
region10	-0.028	-0.033	-0.009	0.021	0.030	0.012	0.004	0.003
region11	-0.010	-0.012	-0.003	0.008	0.010	0.004	0.001	0.001
region12	-0.013	-0.015	-0.003	0.010	0.013	0.005	0.002	0.001
region13	0.025	0.026	0.002	-0.019	-0.021	-0.008	-0.003	-0.002
region14	0.018	0.019	0.002	-0.013	-0.016	-0.006	-0.002	-0.001
education2	0.019	0.020	0.002	-0.014	-0.017	-0.006	-0.002	-0.001
education3	-0.024	-0.028	-0.007	0.018	0.024	0.009	0.004	0.002
education4	-0.063	-0.072	-0.018	0.047	0.065	0.026	0.010	0.006
education5	-0.056	-0.076	-0.039	0.038	0.076	0.034	0.013	0.009
education6	-0.060	-0.082	-0.042	0.041	0.082	0.037	0.015	0.010
education7	-0.085	-0.116	-0.063	0.053	0.118	0.056	0.023	0.015
size_of_city1 000 - 4 999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
size_of_city5 000 - 19 999	-0.012	-0.014	-0.003	0.009	0.012	0.005	0.002	0.001
size_of_city20 000 - 99 999	-0.002	-0.003	0.000	0.002	0.002	0.001	0.000	0.000
size_of_city100 000 +	-0.028	-0.033	-0.009	0.022	0.030	0.012	0.004	0.003
count_income	0.005	0.005	0.001	-0.004	-0.004	-0.002	-0.001	0.000
count_p	-0.025	-0.028	-0.005	0.019	0.024	0.009	0.003	0.002

Appendix C

Table 17: Marginal effect of Recycling model with ABCDE classification

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.003	-0.006	-0.006	0.004	0.011
year2011	-0.010	-0.020	-0.024	0.011	0.042
year2012	-0.013	-0.026	-0.032	0.013	0.058
year2013	-0.016	-0.031	-0.039	0.015	0.071
year2014	-0.016	-0.033	-0.042	0.015	0.076
year2015	-0.016	-0.033	-0.041	0.015	0.076
year2016	-0.015	-0.030	-0.038	0.014	0.069
year2017	-0.015	-0.030	-0.037	0.014	0.067
year2018	-0.017	-0.034	-0.043	0.015	0.079
year2019	-0.018	-0.036	-0.046	0.015	0.084
ABCDE_classificationB	0.004	0.007	0.008	-0.005	-0.014
ABCDE_classificationC1	0.014	0.026	0.026	-0.020	-0.046
ABCDE_classificationC2	0.021	0.039	0.038	-0.031	-0.068
ABCDE_classificationD	0.025	0.046	0.043	-0.037	-0.078
ABCDE_classificationE1	0.031	0.055	0.046	-0.048	-0.084
ABCDE_classificationE2	0.039	0.065	0.049	-0.060	-0.094
ABCDE_classificationE3	0.060	0.094	0.057	-0.091	-0.120

Table 18: Marginal effect of Czech products model with ABCDE classification

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.006	-0.010	-0.011	0.015	0.012
year2011	-0.005	-0.010	-0.011	0.014	0.012
year2012	-0.008	-0.014	-0.016	0.021	0.017
year2013	-0.004	-0.008	-0.008	0.011	0.009
year2014	-0.005	-0.009	-0.009	0.013	0.010
year2015	-0.001	-0.002	-0.002	0.002	0.002
year2016	0.002	0.003	0.003	-0.005	-0.004
year2017	0.007	0.012	0.011	-0.018	-0.013
year2018	0.012	0.021	0.018	-0.030	-0.021
year2019	0.013	0.023	0.020	-0.033	-0.023
ABCDE_classificationB	-0.006	-0.010	-0.012	0.015	0.012
ABCDE_classificationC1	0.001	0.001	0.001	-0.001	-0.001
ABCDE_classificationC2	0.003	0.006	0.006	-0.009	-0.007
ABCDE_classificationD	0.006	0.010	0.010	-0.014	-0.011
ABCDE_classificationE1	0.009	0.015	0.014	-0.023	-0.016
ABCDE_classificationE2	0.008	0.013	0.012	-0.019	-0.014
ABCDE_classificationE3	0.025	0.041	0.028	-0.059	-0.037

Table 19: Marginal effect of Bio index model with ABCDE classification

	effect.1	effect.2	effect.3	effect.4	effect.5
year2010	-0.067	0.007	0.049	0.009	0.002
year2011	-0.053	0.007	0.038	0.007	0.001
year2012	-0.091	0.008	0.068	0.012	0.003
year2013	-0.131	0.006	0.101	0.019	0.004
year2014	-0.137	0.005	0.107	0.021	0.005
year2015	-0.150	0.002	0.119	0.024	0.006
year2016	-0.153	0.002	0.122	0.024	0.006
year2017	-0.123	0.006	0.095	0.018	0.004
year2018	-0.137	0.004	0.107	0.021	0.005
year2019	-0.170	-0.002	0.137	0.028	0.007
ABCDE_classificationB	0.068	-0.016	-0.044	-0.007	-0.002
ABCDE_classificationC1	0.085	-0.019	-0.055	-0.008	-0.002
ABCDE_classificationC2	0.118	-0.028	-0.076	-0.012	-0.003
ABCDE_classificationD	0.152	-0.039	-0.095	-0.014	-0.003
ABCDE_classificationE1	0.181	-0.056	-0.106	-0.015	-0.003
ABCDE_classificationE2	0.224	-0.079	-0.124	-0.017	-0.004
ABCDE_classificationE3	0.283	-0.111	-0.148	-0.019	-0.004

Table 20: Marginal effect of Traveling model with ABCDE classification

	effect.1	effect.2	effect.3	effect.4	effect.5	effect.6	effect.7	effect.8
year2010	0.016	0.016	0.002	-0.011	-0.014	-0.005	-0.002	-0.001
year2011	0.014	0.015	0.002	-0.010	-0.013	-0.005	-0.002	-0.001
year2012	0.012	0.013	0.002	-0.009	-0.011	-0.004	-0.002	-0.001
year2013	0.029	0.029	0.002	-0.021	-0.024	-0.009	-0.003	-0.002
year2014	0.017	0.018	0.002	-0.012	-0.015	-0.006	-0.002	-0.001
year2015	0.010	0.011	0.001	-0.008	-0.009	-0.004	-0.001	-0.001
year2016	0.010	0.010	0.001	-0.007	-0.009	-0.003	-0.001	-0.001
year2017	-0.007	-0.008	-0.002	0.005	0.007	0.003	0.001	0.001
year2018	-0.023	-0.026	-0.007	0.016	0.024	0.010	0.004	0.002
year2019	-0.021	-0.024	-0.006	0.015	0.022	0.009	0.003	0.002
ABCDE_classificationB	0.059	0.053	-0.002	-0.040	-0.044	-0.016	-0.006	-0.004
ABCDE_classificationC1	0.064	0.060	0.000	-0.044	-0.050	-0.018	-0.007	-0.004
ABCDE_classificationC2	0.090	0.080	-0.003	-0.061	-0.067	-0.024	-0.009	-0.006
ABCDE_classificationD	0.158	0.110	-0.028	-0.094	-0.093	-0.033	-0.012	-0.008
ABCDE_classificationE1	0.207	0.108	-0.058	-0.109	-0.096	-0.033	-0.012	-0.007
ABCDE_classificationE2	0.306	0.095	-0.104	-0.134	-0.108	-0.035	-0.013	-0.008
ABCDE_classificationE3	0.363	0.079	-0.127	-0.145	-0.113	-0.036	-0.013	-0.008

Appendix D

Table 21: Data set from Median s.r.o. representing quotas in Czech population

Class	Teoretical frequency		Selective samle		Weighted sample	
	Thousand	%	Thousand	%	Thousand	%
Sex						
Men	4363	49,6	4 182	47,6	4 363	49,6
Women	4431	50,4	4 612	52,4	4 431	50,4
Education						
Primary	1396	15,9	1 208	13,7	1 369	15,6
High school w/o graduation	2884	32,8	2 329	26,5	2 852	32,4
High school with graduation	2903	33,0	3 557	40,5	2 958	33,6
University	1610	18,3	1 699	19,3	1 615	18,4
Age						
12-19 years	746	8,5	649	7,4	712	8,1
20-29 years	1239	14,1	1 549	17,6	1 290	14,7
30-39 years	1579	18,0	1 986	22,6	1 609	18,3
40-49 years	1627	18,5	1 538	17,5	1 662	18,9
50-59 years	1326	15,1	1 271	14,4	1 315	14,9
60-69 years	1403	16,0	1 095	12,5	1 371	15,6
70-79 years	873	9,9	706	8,0	835	9,5
Size of residence site						
up to 999 inhabitants	1500	17,1	551	6,3	1 398	15,9
1 000 – 4 999 inhabitants	1923	21,9	1 756	20,0	1 930	21,9
5 000 – 19 999 inhabitants	1615	18,4	2 168	24,7	1 635	18,6
20 000 – 99 999 inhabitants	1823	20,7	2 529	28,8	1 879	21,4
100 000+ inhabitants	1933	22,0	1 789	20,3	1 952	22,2
Number of household members						
1 person	1265	14,4	1 233	14,0	1 261	14,3
2 persons	2432	27,7	2 606	29,6	2 473	28,1
3 persons	2015	22,9	2 120	24,1	2 004	22,8
4 persons	2049	23,3	2 414	27,5	2 078	23,6
5 and more	1032	11,7	421	4,8	978	11,1
District						
Prague	1059	12,0	973	11,1	1 065	12,1
Central Bohemia	1098	12,5	1 306	14,8	1 171	13,3
South Bohemia	531	6,0	574	6,5	536	6,1
Plzeň district	483	5,5	391	4,4	467	5,3
Karlovy Vary district	250	2,8	335	3,8	232	2,6
Ústí nad Labem district	688	7,8	974	11,1	701	8,0
Liberec district	366	4,2	251	2,8	367	4,2
Hradec Králové district	457	5,2	468	5,3	447	5,1
Pardubice district	429	4,9	319	3,6	405	4,6
Vysočina district	424	4,8	584	6,6	412	4,7
South Moravia district	977	11,1	901	10,2	973	11,1
Olomouc district	528	6,0	464	5,3	530	6,0
Zlín district	487	5,5	367	4,2	466	5,3
Moravia-Silesian district	1017	11,6	888	10,1	1 024	11,6