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Determinants of demand for farm dairy products

Bachelor thesis

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Abstract

This bachelor thesis aims to describe the demand for farm dairy products. Based on data gathered from two specific interconnected projects of one local farm, the analysis consists of a model for estimating own-price elasticity of the demand as well as models for determining characteristics of farm-food buyers. Using time series data and the OLS regression, the demand was estimated to be elastic for butter, curd, milk and inelastic for yoghurt. No significant relationship between sales of local products and general consumer trends in the Czech Republic was found.

Cross-sectional data containing 373 observations were employed in probit models to explore which factors significantly influence being a local farm food buyer and purchasing specific products. Results reveal that women living in Prague primarily buying local and organic food are the dominant group of customers. However, the effect of most other factors varies across estimated models.

JEL Classification	D12, D99, Q12
Keywords	consumer demand, elasticity, consumer behaviour, dairy, local products, alternative food networks
Title	Determinants of demand for farm dairy products

Abstrakt

Tato bakalářská práce se zabývá poptávkou po farmářských mléčných produktech. Na základě dat získaných ze dvou projektů lokální farmy byla provedena analýza vlastní cenové elasticity poptávky po mléčných farmářských výrobcích, a dále zkoumány charakteristiky zákazníků, kteří farmářské lokální potraviny nakupují. Použitím časové řady a OLS metody byla odhadnuta poptávka jako elastická pro máslo, mléko a tvaroh a jako neelastická pro jogurt. Porovnání se statistickými údaji neukázalo prokazatelnou souvislost mezi vývojem spotřebitelských trendů v České republice a prodeji farmářských mléčných výrobků.

Pro odhad faktorů, které významně ovlivňují nákup lokálních potravin, byla využita průřezová data obsahující 373 pozorování a probit model. Výsledky ukazují, že ženy žijící v Praze, nakupující především organické a lokální potraviny jsou hlavní skupinou zákazníků. Vliv ostatních faktorů se liší napříč odhadovanými modely.

Klasifikace JEL	D12, D99, Q12
Klíčová slova	spotřebitelská poptávka, elasticita, spotřebitelské chování, mléčné výrobky, lokální produkty
Název práce	Charakteristiky poptávky po farmářských mléčných výrobcích

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Acronyms

ADF Augmented Dickey-Fuller

AFNs Alternative Food Networks

AIDS Almost Ideal Demand System

AUC Area Under Curve

CZSO Czech Statistical Office

MLE Maximum Likelihood Estimation

MZF Mléko z farmy

NZF Nákup z farmy

OLS Ordinary Least Squares

VIF Variance Inflation Factor

Bachelor's Thesis Proposal

Author	Barbora Jakubová
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Proposed topic	Determinants of demand for farm dairy products

Motivation According to the Association of Small and Medium-Sized Enterprises and Crafts of the Czech Republic (Břeňová, 2016), people express high interest in the origin of food. 50% of Czechs buy regional products at least once a week and food represent 83% of regional products they buy (Friedlaenderová, 2018). They also believe in high quality. As consumers' concern for locally grown food rises, farmers and organisations are working on inventive ways to supply fresh and affordable local food to residents (Schmidt, Kolodinsky, DeSisto, Conte 2011). In the case of the Czech Republic, projects, that join farmers and makes an easier distribution, were created. The trend of local products was also reflected by supermarkets and food e-shops which try to attract consumers by special offers of farmer's goods.

Another point of view suggests (Chovítek, 2018), that consumers support local and organic food, only during answering in the surveys. However, their behaviour changes when the trade-off between these aspects and price arises. Their attitude towards buying regional products has not even been reflected in changes in their consumer basket. People spend monthly 101-500 Kč on average for regional food (Friedlaenderová, 2018).

The aim of this thesis is to explore the elasticity of demand for local farm products, specifically, for dairy products, the main segment where people care about the locality. Analysing data from specific farmer's e-shop we would like to estimate the evolution of demand behaviour and identify characteristics of purchasing consumers.

Expected Contribution Several studies have already been done, mainly concentrated on understanding the consumers of regional products via a qualitative point of view,

summarising interviews and questionnaires (Miškolci, 2017). In the thesis, we would like to utilise quantitative data, for estimating elasticities of demands in specific regions - mainly of Central Bohemia, Prague included. We will use the unique dataset described below.

The question we would like to answer is if there is any difference between regions. Next, we would like to focus on a comparison of demand for local food and general demand for dairy products and analyse their evolution in the time. The contribution might be discovering potential differences and exploring how these demands are interconnected and how local retailers (farmers) could rely on the trends that general demand faces.

Methodology We use two kinds of the dataset - one from a project that associates local farmers. More specifically, data from purchasing dairy products will be collected quarterly from 2016-2019, divided by regions. They will also be sorted to smaller categories depending on the type of dairy product. Data will be completed by qualitative information of consumers using questionnaires. The second dataset will be more general. We would like to use data of household consumption and average product price published by the Czech Statistical Office. Characteristics of consumers that are interested in local dairy products will be analysed via probit model, the demand elasticities (price and income elasticities and their evolution in time) will be estimated employing the panel data regression techniques.

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Chapter 1

Introduction

Approaches to food purchasing have changed in several ways during the past years. People change their preferences for both the places of shopping and the kind of products they buy. With the development of modern technologies, new ways of distributions were created. One of them is ordering food via the internet. The trend is constantly increasing from year to year - more people prefer using e-shops rather than going to the supermarket. According to a survey made by Ipsos for Acomware in the Czech Republic in 2019, one third of respondents buy foodstuff on the internet and 16% use e-shops every week. It was also estimated that sales in the e-shops contributed to the retail sales by 4% in 2019 (Kladivová, 2019). Increasing demand for these alternative ways of retail creates the potential to open new e-shops.

Another recent trend is the increasing interest of people in the origin of food and their effort to support local producers and farmers. A study conducted by Ipsos for the Association of Small and Medium-Sized Enterprises and Crafts of the Czech Republic confirms the trend that, besides shopping in supermarkets, customers look for local small shops. Even though three quarters of consumers purchase food in supermarkets, one third regularly buys at local butchers, bakeries or farmer's markets, and a half of customers buy something in small shops irregularly. An important finding is that four fifths of respondents believe that local produce has better taste and nutrition qualities (Břeňová, 2016).

This thesis aims to examine the above-mentioned trends in the case of two specific interconnected projects of one local farmer that produces dairy products. We will describe the trend from this perspective and scrutinise both the demand for farm dairy products and the characteristics of customers that express a positive attitude towards online and local food buying. To our current knowledge, this is one of the first studies that explores the demand for local food products in the Czech environment and analyses the combination of local and online buying.

Firstly, we will compare the development of sales of farm dairy products with the general development in the Czech Republic. Own-price elasticity of demand, i.e. the responsiveness of sales to price changes, will be estimated together with the influence of general consumer trends in the Czech Republic.

Secondly, we use data from an e-shop with local farm food complemented by data gained from a survey conducted among customers of this e-shop. We will describe the characteristics and preferences of people who express a positive attitude towards this alternative way of buying. We will also determine factors affecting the likelihood of purchase of local farm food from this e-shop.

The thesis is structured as follows: Chapter 2 focuses on the literature review and defines microeconomic terms connected to consumer demand relevant for our study. Subsequently it reviews empirical studies on food demand, briefly describes the dairy sector and the characteristics of the Czech consumer. The last section of the chapter is dedicated to the concept of alternative food networks (AFNs). Chapter 3 contains a description of the given data - first, the data used for estimating the demand over time, second the data from the e-shop and lastly data from the questionnaire. Chapter 4 deals with the methodology used for the estimation and describes the specific models. Results are presented in Chapter 5, and our findings are concluded in Chapter 6.

Chapter 2

Literature Review

The literature review is divided in the following way. Section 2.1 covers terms from microeconomic theory such as consumer, the main object of our study; demand and elasticity with a focus on demand for food, which is supported by empirical studies on estimation of elasticities in Section 2.2. Section 2.3 and Section 2.4 provide a brief description of a dairy sector and Czech consumer, respectively. Section 2.5 deals with the concept of alternative food networks to introduce research concerning alternative distribution channels.

2.1 Microeconomic theory

2.1.1 Consumer

As already mentioned, the main focus of the thesis is on a consumer. A consumer is formally defined as an entity that acquires goods or services for direct use or ownership rather than for resale or use in production and manufacturing, as someone who is the final user of an item. Consumers are powerful in a market economy since the behaviour of producers in the marketplace is driven by consumers' economic choices. Understanding how consumers operate makes it easier for vendors to predict, which of their products will sell more and enables economists to get a better grasp of the shape of the overall economy.

To be able to analyse consumer's behaviour mathematically, we assume that consumer is rational. Rational consumers consider only possibilities that are avail-

able to them. So their decision making is based on all information they have, or which are worth to look up. As a result, they rank alternatives according to their preferences that satisfy assumptions of completeness, reflexivity and transitivity. Subsequently, they choose the option with the highest preference. Alternatively, rational consumers make decisions that maximise their utility (Varian, 2014).

Consumer behaviour and purchase or consumption are not subject only of an economic concern but also anthropological, psychological and of marketing. Several theories and models were developed for analysing consumer behaviour. For instance, Multi-Attribute Decision Making methods or the Subjected Expected Utility models are based on comparing product attributes by revealed preferences, maximising utility and assuming rationality of consumer. In contrast, the Theory of Planned Behaviour regards not only attitudes towards choice alternatives but also the effects of perceived social norms and behavioural control and incorporates demographic factors. It is one of the widely used models in the socio-psychological field to explain not only consumer's but generally human behaviour (Ajzen, 2015). Zepeda & Deal (2009) propose Alphabet Theory to understand consumer behaviour and habits in the context of local and organic food purchasing. The theory considers, besides consumer's values, beliefs and norms, also elements of consumer's demographics, information seeking and knowledge.

2.1.2 Demand curve and elasticity of demand

A demand curve traces the quantity of a good or service that is demanded at successively different prices. The law of demand states that when the price falls, the amount demanded rises. Two types of demand curves are distinguished - uncompensated Marshallian (named after Alfred Marshall) and compensated Hicksian (after John Richard Hicks). Marshallian demand curve expresses the optimal bundle for given prices (p) and income (m); the function of demand for a good i is expressed as: $x_i^*(p_1, ..., p_n, m) = x_i^*(p, m) = D_i(p, m)$. Hicksian demand function takes prices (p) and utility (u) as an argument, instead of income and is expressed as: $x_i^* = h_i(p, u)$.

The responsiveness of the quantity demanded to a change in particular factor is called elasticity. Compared to the slope of demand function that may also be

used as a measure of responsiveness, elasticity is a unit-free measure; its value is not dependent on the units of the factor or quantity (Varian, 2014). The theory distinguishes between own-price, cross-price and income elasticity that are defined using Marshallian demand in the following way:

Own-price elasticity of demand for the i-th good ($\epsilon^i_{p_i}$) is defined as the percentage change in the quantity demanded divided by the percentage change in the price :

$$\epsilon^i_{p_i} = \frac{\%\Delta x_i}{\%\Delta p_i} = \frac{\frac{\delta D_i(p,m)}{\delta p_i}}{\frac{D_i(p,m)}{p_i}} \tag{2.1}$$

Depending on the sign of the elasticity, goods are divided into Giffen and ordinary goods. For a Giffen good, the price elasticity is positive ($\epsilon^i_{p_i} > 0$), meaning that with an increase in price, the quantity demanded of that good also increases. Contrarily, the price elasticity of demand for an ordinary good is negative ($\epsilon^i_{p_i} < 0$), meaning that an increase in price leads to a decrease of quantity demanded of the good. The demand for an ordinary good is said to be:

- **elastic**, if an increase in price by 1 percent, leads to a decrease in the quantity demanded by more than 1 percent : $\epsilon^i_{p_i} < -1$,
- **inelastic**, if an increase in price by 1 percent, leads to a decrease in the quantity demanded by less than 1 percent:
  $0 > \epsilon^i_{p_i} > -1$,
- **unitary elastic**, if an increase in price by 1 percent, leads to a decrease in the quantity demanded by exactly 1 percent: $\epsilon^i_{p_i} = -1$.

Cross-price elasticity of demand compares the relationship between two goods and can be calculated as:

$$\epsilon^i_{p_j} = \frac{\%\Delta x_i}{\%\Delta p_j} = \frac{\frac{\delta D_i(p,m)}{\delta p_j}}{\frac{D_i(p,m)}{p_j}} \tag{2.2}$$

Thus, we can determine gross substitutes ($\epsilon^i_{p_j} > 0$) and gross complements ($\epsilon^i_{p_j} < 0$). Good i is said to be a gross substitute to a good j, if the quantity

demanded of good i increases as the price of good j grows. Good i is said to be a gross complement to a good j, if the demanded quantity of good i decreases as the price of good j rises.

Price elasticity is further divided into compensated and uncompensated, depending on whether Marshallian or Hicksian demand is used.

Income elasticity of demand for the i-th good (ϵ_m^i) expresses the responsiveness of the quantity demanded to a change in income:

$$\epsilon_m^i = \frac{\%\Delta x_i}{\%\Delta m} = \frac{\frac{\delta D_i(p,m)}{\delta m}}{\frac{D_i(p,m)}{m}} \tag{2.3}$$

The sign of income elasticity determines the kind of a good. Income elasticity of demand for an inferior good is negative ($\epsilon_m^i < 0$), an increase in income leads to a decrease in quantity demanded. Normal good's elasticity is positive ($\epsilon_m^i > 0$), an increase in income leads to an increase in the quantity demanded. Specifically, the value of income elasticity determines the demand to be elastic $\epsilon_m^i > 1$, then the good is called a luxury good; inelastic $0 < \epsilon_m^i < 1$, then the good is necessity. Other cases are unitary elastic demand $\epsilon_m^i = 1$, perfectly elastic $\epsilon_m^i = \infty$ and perfectly inelastic demand $\epsilon_m^i = 0$.

2.2 Estimation of demand for food

The elasticity of demand is one of the most important outcomes of the demand analysis. It is a useful tool when the fiscal or tax policy is made, it is convenient to know how to change the price of a good by a tax to get the desired quantity consumed. Similarly, elasticities of demand for food may be useful information helping with the identification of food price policies and protecting population health, not only in poor populations (Green *et al.*, 2013). An example might be a finding of Andreyeva *et al.* (2009), suggesting that taxation of sugar-sweetened beverages in the USA is worth to be a target for US public health policies and estimating that a 10% tax on soft drinks could lead to 8-10 % reduction in the purchase of these beverages. Cornelsen *et al.* (2015) add that increasing price

of sweets leads not only to decrease in their consumption but also to increase in demand for fruits and vegetables. Furthermore, a company knowing the elasticity of demand for its products can better determine a change in sales and revenue after a change in prices and design its pricing and promotional programs (Davis *et al.*, 2012).

Food demand can be estimated using a single equation or the system of equations known as the demand system. In single demand equation, the attention is paid on one given good. An example can be a linear equation in logarithmic form estimated by ordinary least squares method:

$$ln(q) = X\beta + u, \tag{2.4}$$

where both dependent and independent variables are in the form of natural logarithms. Prices, income and socio-demographic variables are usually employed as independent variables, and β coefficients are then directly interpreted as elasticities. This approach was used, for example, by Schrock (2010), and it will also be used in the empirical part of the present thesis, employing time series data. The main focus will be on the good's own-price elasticity.

In contrast, demand systems provide more complex analysis of demand satisfying microeconomic theory of consumer behaviour and interactions between different goods. The estimation is more demanding, but it is expected that it reflects reality better. The most frequently used model for estimating food demand is the Almost Ideal Demand System (AIDS), which was firstly proposed by Deaton and Muellbauer in 1980. The system of equations considers the allocation of total available budget into the expenditures for different goods as a function of total expenditure and prices (Green *et al.*, 2013). Other forms of demand systems are modifications of AIDS - QUAIDS (quadratic), LA/AIDS (linear approximation), censored AIDS or Rotterdam Demand System, CBS, NBR systems; or Linear Expenditure System.

The exact values of estimated elasticities differ depending on the methodology, period of research and the type of data (time series, household survey, retail scanner data) (Bouamra-Mechemache *et al.*, 2008). Generally, food demand tends to be rather inelastic, but the exact value varies across different types of food.

The magnitude of the elasticity also depends on the availability and closeness of substitute foods, the necessity of food and the time period. Green *et al.* (2013) conducted a complex meta-analysis of food prices and food demand at the global level and provided the comparison between different income groups within the same country. They conclude that dietary staple food tends to have smaller elasticity than animal source food, the pastry or confectionery. Moreover, estimates differ across individual countries or income groups. Lower price elasticity for all food tends to be estimated in high-income countries, compared to the low-income ones, because food expenditure represents a smaller share of income. Hence, they are less sensitive to a price change. The same holds for high-income households within countries.

2.2.1 Empirical studies on food demand

We focus on studies concerning (1) milk or dairy products, (2) the comparison of organic or local and conventional food or (3) food demand in the Czech Republic, as these studies are relevant for our empirical part.

Dairy products & milk

The own-price elasticity of demand for milk is generally estimated to be inelastic since milk is considered to be one of the fundamental foodstuffs and a necessity. The difference emerges when specific types of dairy (conventional, organic, lactose-free) are taken into account. The demand elasticity for milk is one of the most studied among demands for food. Some research takes dairy products as one group in the whole demand system, while other distinguishes between groups of dairy products (Bouamra-Mechemache *et al.*, 2008) or different fat contents of milk (Andreyeva *et al.*, 2009). Davis *et al.* (2012) suggest that information of elasticity is useful not only for retailers but also for milk processors. For example, when the demand for low-fat milk increases, it is necessary to find a way how to process the surplus of fat. Milk producer can extend the production to other dairy products - butter, ice cream.

Together with demand elasticities, research deals with factors affecting milk consumption. Milk is preferred by households with children and retired people,

partly because of its nutrition values. However, health programmes promoting the reduction of fat in people's diet lead to a preference for low-fat milk (Davis *et al.*, 2012). Education and the level of income positively influence milk consumption (Vargová & Jamrich, 2018). As income increases, households tend to switch from conventional to organic, from private-label conventional milk to branded-label one (Chen *et al.*, 2018).

Organic food

Even though dairy products that will be analysed in the present thesis are not organic; studies dealing with the demand for organic food was reviewed. Since some similarities can be found between the concepts of local, farm and organic products; their findings will be useful for further comparison with our results.

Bunte *et al.* (2007) compared consumer purchasing decisions and demand for organic food, based on an experiment in Dutch supermarkets. Using AIDS model, demand for organic food was found out to be sensitive to price, the absolute value of own-price elasticity for all investigated products exceeded 1, except for eggs. An experiment of lowering the price gap between organic and non-organic revealed that some organic products (milk, mushrooms, pork, potatoes and rice) became less sensitive to price change and demand inelastic. They suggest that rising sales of organic products can be reached by reducing their prices, but when the drop is too significant, sales declines as demand becomes insensitive to price changes.

Schrock (2010) investigated the relationship between organic and conventional milk by two-step analysis concerning German panel data. First, determinants influencing the probability of organic milk purchase are estimated, finding that the primary organic milk consumer is well educated, wealthy and without children living in the household. The second step was the estimation of the demand for organic milk. The author notes that the majority of previous research estimated the demand for organic food to be highly elastic compared to the conventional. Still, she admits that the market with organic food and consumer preferences change and more options are available so that the difference can be smaller. Her finding supports it, own-price elasticity for organic milk ranges between -0.22 and -0.66, depending on different retail formats, which implies that price campaigns

are not a convenient tool to enhance the quantity demanded. Furthermore, based on the observation of groups of non-buyers, the occasional buyers and committed buyers of organic food, Schröck (2012) concludes that demand for organic milk is less elastic for the latest group. Once consumers decide to buy organics, they become less sensitive to price change.

Food demand in the Czech Republic

The limited number of studies that have examined food demand concerning Czech data exist. In many cases, food is taken only as one group of commodities within the whole spectrum to explore household demand.

Janský (2014) used QUAIDS to examine elasticities of demand for different groups and analyse their changes in quantity demanded and in tax revenue after a change of VAT. Food and energy performed the lowest income and cross-price elasticity; thus, with taxation reform quantity remains nearly the same. Additionally, he highlights that the estimated tax revenue differs when behavioural responses are taken into account; consumers accommodate to the new situation and change the type of commodities they buy. The difference is estimated to be 28%.

Dybczak *et al.* (2014) treat food similarly during estimation of consumer demand and subsequent examination of the impact of regulated prices on commodity groups such as energy, postal services, TV and radio fees or health care.

Brosig (1998) carried out one of the first studies concerning individual food groups and estimated elasticities using data from 1991-1996 and examined the period short-after the Velvet revolution and transition of the Czech economy.

Janda *et al.* (2000) analyse demand for imported food using two-stage AIDS with time trend, which should capture demographic changes and dividing food into four subgroups: meat, carbohydrates, fruit and vegetables and milk and sweets. Moreover, they mention the exogeneity of prices, since the Czech Republic is a small economy, it does not influence world prices. It was estimated that all products were normal goods, with positive group expenditure elasticities, in most cases indicating imported good as luxury goods. Vegetables and fruit exhibit the lowest own-price elasticity.

Crawford *et al.* (2003) applied the concept of unit value to estimate demand of Czech households, meaning that missing explicit information about the price of commodities was computed as a proportion of expenditure and quantity of a good. In the QUAIDS model, they also employ characteristics of a household such as the age of a head of household, education or occupation; and even ownership of durable goods - phone, car, washing machine. Elasticities were estimated for eight categories - meat, dairy, starches, sweets, vegetables and fruit, alcohol, clothes. However, own-price elasticity for dairy products was not significant.

The category of dairy products and eggs was also concerned in more recent work; the study of Smutná (2016). Based on budget survey data of Czech households from 2013, dividing food into 11 subcategories, the author deals with the problem of selectivity - the problem in demand estimation when households report zero consumption. Comparing different models and estimators, QUAIDS with Shonkwiler and Yen's treatment resulted as the most suitable for the given data; estimated own-price elasticities are all negative, the demand for the majority of subcategories is inelastic except vegetables and non-alcoholic beverages.

The following table summarises reviewed studies on demand for food.

Table 2.1: Own-price elasticities estimated in mentioned studies

Author	Period	Country	Category	Own price elast.
Bouamra-Mechemache *et al.* (2008)	1952-2003	EU	Dairy	-0.57
Andreyeva *et al.* (2009)	1938-2007	USA	Dairy	-0.65
Davis *et al.* (2012)	2007	USA	Whole milk	-1.48
Vargová & Jamrich (2018)	2006-2012	Slovakia	Whole milk	-1.42
Schrock (2010)	2004-2007	Germany	Organic milk	-0.22 - -0.66
Jonas & Roosen (2008)	2000-2003	Germany	Organic milk	-10.17
Chen *et al.* (2018)	2012	USA	Organic milk	-2.436
Janský (2014)	2001-2011	Czech Republic	Food	-0.311
Dybczak *et al.* (2014)	2001-2008	Czech Republic	Food	-0.679
Brosig (1998)	1991-1996	Czech Republic	Dairy	-0.32
			Milk	-1.07
Janda *et al.* (2000)	1993-1997	Czech Republic	Dairy	-0.85
		(compensated)	Milk	-0.97
			Milk products	-0.73
Crawford *et al.* (2003)	1991-1992	Czech Republic	Dairy	-0.062
Smutná (2016)	2013	Czech Republic	Dairy&eggs	-0.995

2.3 Dairy sector

Since our analysis is dedicated to dairy products, it is worth to mention shortly, what influences the Czech dairy market. The dairy sector is affected by several factors, including the situation on the European market. Milk production takes place in all EU countries and represents a dominant proportion of the value of EU agricultural output; it is the second biggest agricultural sector in terms of output value after the vegetable and horizontal plant sector and before cereals in the EU. One hundred fifty-five million tonnes of milk is approximately produced each year. Germany, France, the UK, the Netherlands, Poland, Italy and Ireland are the leading producers of cow milk, all together they make three quarters of total EU production. The Czech Republic is ranked thirteenth (Augere-Granier, 2018).

Within the Common Agricultural Policy, the European Union adopts several mechanisms that protect the milk sector during times of market disturbances. Since 1984, milk production was restricted by milk quotas for 31 years- a cap on the amount of milk that a farmer could sell every year without paying a levy. The primary intention of the quotas was to restrict over-production of milk and ensuring dairy farmers a more stable price for their milk (significantly above the price on world markets) regardless of market demand. Quotas were initially introduced for five years, but the end date was prolonged several times. Around 2008, considerably higher consumption of dairy products was registered with expected growth in the future; however, the quota regime did not enable EU producers to react to it. Consequently, the EU started to prepare the ending of milk quotas and increased quotas by 1% each year from 2009 over five consecutive years, until 2015, when dairy quotas were abolished. Their suppression allowed farmers the flexibility to expand their production and to react to the growing demand for milk products (Parzonko & Bórawski, 2020).

Beside milk quotas, other instruments of the EU to support farmers are still available - public intervention and private storage provisions, direct payments and rural development measures. They have been applied as a solution for raw milk price disturbances or to milk crisis in 2009 or 2014 (Augere-Granier, 2018).

This whole development and policies are related mainly to raw milk prices, for

which milk is purchased to be processed. The quality of milk (measured by the percentage of fat in a litre of milk) is also reflected in raw price and price depends on season and weather conditions as well. Raw prices consequently might influence overall dairy production and prices in all dairy sector. Nevertheless, a correlation between what farmers get paid and what the consumer pays for dairy products might not always be shown.

In the Czech Republic, the development of milk sector is tracked by Ministry of Agriculture that publishes Commodity cards for milk and dairy products in which milk production, consumption of milk, cattle breeding or international trade with milk are reported. The Czech status is also compared with other EU countries. The information is again more related to raw prices. Consumer prices of milk are published together with other foodstuff and non-alcoholic beverages by the Czech Statistical Office and used to determine the consumer price index.

2.4 Characteristics of Czech consumers

Even though the Czech consumer is perceived to be sensitive to price, quality of a product becomes dominant, too. With an increase in consumer purchasing power, the interest in organic and health products rises as well. Discount stores succeed and lead within the grocery market. However, the popularity of e-commerce is also growing, Czech online shops are preferred, but foreign online stores are welcomed since they offer lower prices of products or access to products that are not ordinarily available in the Czech Republic (Export Entreprises SA, 2020).

Factors that influence the consumer purchasing decision have changed as the purchasing power grows. Stávková *et al.* (2008) measure the influence of factors on the Czech consumer purchasing behaviour. Generally, perceived quality and products' characteristics are the most important factors for all commodity groups. Specifically, in the case of food and non-alcoholic drinks, factors of the necessity of need, and past experience plays a dominant role. The importance of price is ranked as the fourth.

In contrast, detailed examination of perceptions towards quality labels (e.g. Klasa, Český výrobek, Zdravá potravina or Fair Trade) by Asmalovskij & Sadílek (2016) shows that the quality label is not the main factor affecting a purchase

decision and price remains the leading criterion, followed by the origin of a product and appearance. Even though products with quality labels satisfy consumers' expectations in 98% of cases, only in 60%, these products are considered to be of higher quality than the conventional one.

In comparison to neighbouring countries, Poland and Slovakia, the Czech Republic is not an exception; price is an essential parameter in the consumer choice for other Eastern nations as well. By contrast, the Western-European prototype consumer is more quality-oriented (Horska *et al.*, 2011). Although the average monthly wage and purchasing power of Eastern countries are considerably lower, customers care about what they buy and they like to experience with a new brand even if they know that they have to pay extra. In terms of purchasing decision according to the purchase quality factor, customers from all three countries choose meat and milk products, fruit and vegetables. The trade-off between price and quality is also an important aspect. Still, the unwillingness to pay for a certain quality is not necessarily connected with a lack of interest in it. Other reasons might exist, for example, not considering a quality improvement to be worth of the price differential or not realising the specific quality of the product (Horska *et al.*, 2011).

2.5 Alternative food networks (AFNs)

In the last decades, changes in demand and supply for food have been observed. On the supply side, a greater variety of products are produced by firms, and more quality and standards requirements are applied along the supply chain. From the demand side, socio-demographic and consumer behaviour changes cause the creation of new preferences for food products (Berges & Casellas, 2009). New channels of food distribution have been created and labelled as alternative food networks. Several definitions of this term exist.

- Renting *et al.* (2003) explain AFNs as a *'broad embracing term to cover newly emerging networks of producers, consumers, and other actors that embody alternatives to the more standardised industrial mode of food supply'.*

- Ilbery & Maye (2006) define AFNs as *'a trend fighting against the unsustainability of mainstream industrial food production'.*
- According to Goodman & Goodman (2009), AFNs are *'new and rapidly mainstreaming spaces in the food economy defined by - among other things - the explosion of organic, Fair Trade, and local, quality, and premium speciality foods'.*

In comparison to 'conventional' food, food from alternative food networks is frequently described as embedded, traditional, natural and fresh, associated with biodiversity and extensive, organic and sustainable farming methods (Zoll *et al.*, 2018).

During the last two decades, the number of alternative food networks have been increasing especially in America and Europe, and also gained academic interest. First research became to emerge in the late 1990s, Whatmore & Thorne (1997) used the term 'alternative geography of food' and described international coffee fair trade movement. Since then, various research concerning AFNs has been done and covered different points of view - organics, fair trade, local and regional foods, public procurement or multiple kinds of AFN. For instance, farmer's markets, community-supported agriculture, box schemes[1] (Maye & Kirwan, 2010). Most types are characterised as short food supply chains based on direct selling to the customers from local farms.

More contemporary research connects AFNs with online shopping. (Wills & Arundel, 2017; Bernardi *et al.*, 2019). Wills & Arundel (2017) compare two groups of local food buyers, offline and online. Analysing data from a survey of 365 consumers and employing them in the logistic regression, they conclude that while online buying attracts people with a higher level of education, no difference in the income level between the two groups was found. Interestingly, online shoppers try to minimise costs more; online shopping allows them to save time by making their

[1]Community-supported agriculture is based on cooperation between community members (consumers) and farmers, where they share the risk of farming. Consumers subscribe to weekly deliveries of fresh farm products and can also assist in planting or other activities that farming needs. Similarly, in the box scheme system, people are delivered boxes with fresh seasonal fruit and vegetables.

purchase when it is more convenient for them and by having their orders delivered to their home or neighbourhood.

Other research develops reasons and motivations of participating in AFNs and the characteristics of the shoppers and the aspects that influence their purchasing decisions (Mastronardi *et al.*, 2019; Zoll *et al.*, 2018). Demographic variables - age, gender, income, education, as well as factors of products - freshness, quality, taste, price dominated in most studies. Generally, it is suggested that a typical customer of AFNs is female, better educated, with higher income (Hempel & Hamm, 2016; Cholette *et al.*, 2013; Gracia *et al.*, 2012).

Zepeda (2009) monitored numerous farmer's markets in the US and suggests that a typical shopper is *'a female motivated by a freshness and nutritional value, less sensitive to price, enjoys cooking in general and is often involved in other alternatives to traditional shopping (organic, fair trade, ethnic, cooperative)'*. Bavorova *et al.* (2016) confirm it in a study of German consumers - freshness and credibility in food safety are drivers of buying on farmer's markets.

2.5.1 Local food

Widely accepted and consistent definition of the local food does not exist. Different people perceive local food differently. Eriksen (2013) compares different approaches and names three domains of proximity that help to understand the term: geographical proximity, relational proximity and values of proximity. Pearson *et al.* (2011) mention the most commonly used approach, which defines local food based on the distance that the food travels from production to consumption. The distance is determined individually and differs across countries depending on their areas. In the United Kingdom, it is considered the range from the distance of 30 miles (approximately 48 kilometres), US studies have used a distance ranging somewhere from 30 to 150 miles (from 48 to 241 km) to define local food (Selfa & Qazi, 2005; Chambers *et al.*, 2007).

In the Czech context, the term of local or regional food is not defined either compared to the concept of organic production, which is determined by the law.

Project *Regionální potravina*[2] determines regional food as a product produced in a respective region, and it is made mainly from domestic raw materials. A region is a territorial unit defined by the administrative boundaries of the region, as a higher territorial self-governing unit (Regionální potravina, 2020). In the surveys of Pešková (2018) and Crhová (2016), the majority of people perceive local food in the same way - produced within the same region. In terms of the distance, the majority of respondents reported a range of 50 km.

Regarding local food, an expression 'locavore' was created, defined as *'a local resident who tries to eat only food grown or produced within a 100-mile radius'* (Thilmany *et al.*, 2008).

Local food is sometimes confused with organic but organic is primarily connected with the way of production, whereas local with the way of transportation. Hempel & Hamm (2016) compare them and study the importance of local food to German organic-minded consumers and their willingness to pay. They point out that local attribute is sometimes outweighed for organic buyers. Gracia *et al.* (2012) observe that local and organics are perceived to be complements.

Cranfield *et al.* (2012) identify factors affecting the purchase of locally produced food. Based on data from the survey of 1139 Canadian consumers, they note that attitudinal determinants have larger explanatory power than sociodemographic determinants. Bivariate probit model reveals that positive view on local farmers, interest in food quality and preparing meal of basic ingredients affect the likelihood of buying positively. Interestingly, per capita food expenditure, as a proxy variable for income, does not have a significant effect which suggests that propensity to purchase local food does not significantly differ among the higher and lower socioeconomic group.

2.5.2 Alternative food networks - the Czech perspective

The entrance of the alternative food networks to the Czech environment was influenced by the fact that Czechia, as a post-communist country, had to deal with the consequences of collectivisation of the agricultural sector. The transformation

[2] *Regional food* is a project of the Ministry of Agriculture that awards the most quality products in each region. Winning products can use label *Regional food*.

from centrally-planed to the free-market economy affects, besides other parts of the economy, also food production and retail development. During the communist period, private farming was almost entirely eliminated as a result of the collectivisation. Therefore, farmers' products almost disappeared from the markets. Although the restitution process, after the end of the communist era, returned many farms and agricultural land to their original owners or their descendants; a sudden growth of farmer's markets did not follow. The fast expansion of farm shops and farmer's markets began nearly 20 years later, in 2010, at first in big cities and gradually spread into the smaller ones within two years. Even though the emergence of some alternatives was delayed, compared to some western countries, the Czech Republic was one of the first post-communist countries where the AFNs appeared (Syrovátková, 2016).

One specific reason that triggered the sudden burst does not exist but a combination of factors. Zagata (2012b) gives a potential explanation - farmers and food producers looking for new selling channel, environmental activists, food fans demanding quality local food. Receiving support from public authorities also helped farmer's markets to emerge.

Nowadays, several types of AFNs exist in the Czech Republic. Farmer's markets are the most spread and were also the first type that emerged, but community supported agriculture or box schemes are also available to Czech consumers.

Spilková (2018) performs an analysis of the Czech shopper profile, distinguishing between retail formats and alternative channels. She notes that beside demographic and socio-economic characteristics, place of shopping belongs to key factors in segmentation of Czech shoppers. In terms of AFNs, she confirms the idea that they are preferred by women, highly educated people, in managerial positions or entrepreneurs.

Miškolci *et al.* (2017) determine the preferences of customers of two specific Czech alternative food chains (Náš Grunt and My Food). The findings suggest that while quality attributes of products such as quality, freshness, taste and origin are factors with the highest importance, the product price was ranked as the least important.

Konečný *et al.* (2016) analyse the concept of box schemes in the Czech Republic. The cooperatives are spread in all regions of the country; the higher number is

in the areas favourable for agriculture and around bigger cities due to higher population or higher purchase power (Prague, Brno). People mostly buy fruits and vegetables via box schemes.

First studies on alternative food networks have emerged in the 2000s. Živělová & Jánský (2007) pointed out the low awareness and availability of organic food at that time. Other authors dealing with organic food were Ščasný, Urban, Zvěřinová or Zagata. It is worth mentioning the studies of Urban *et al.* (2012) and Zagata (2012a) that simultaneously used the Theory of Planned Behaviour to the organic consumer. Overlapping findings show that people besides their attitudes towards organic are influenced by perceptions of what other people do.

As far as the author is concerned, the AFNs in the Czech Republic, especially the concept of local food, have been examined mostly by descriptive statistics or using qualitative analysis. The limited number of studies using regression analysis was conducted. For instance, Pešková (2018) tried to explain local-food-consumers' behaviour, besides other methods, using a logit model. Age and income have been recognised as significant factors affecting frequent buying of local food. Furthermore, lower perception of price and durability of food increase the chance of local food purchase.

The gradual evolution of AFNs is worth to up-to-date analysis. The thesis aims to bring another perspective to the discussed topic, by a study of purchasing local farm food in connection with online buying.

Chapter 3

Data description

Our study aims to examine the determinants of demand for dairy farm products. Moreover, we are interested in the characteristics of farm-food buyers. For this purpose, we use a unique data provided by a farm, which founded projects *Mléko z farmy*[1] and *Nákup z farmy* [2]. The whole concept and data will be described in this chapter. Section 3.1 provides the introductory description of the projects, Section 3.2 focuses on the analysis of data that are later employed to estimate the demand and characteristics of customers. Lastly, Section 3.3 describes data from a questionnaire that was distributed to customers of *Nákup z farmy* to gain additional information about them.

3.1 Description of the projects

3.1.1 Mléko z farmy (MZF)

The concept of *Mléko z farmy* (founded in 2010) is based on the production of the dairy farm products and their distribution in an innovative manner. The principle of the service is based on direct selling to the end customer from the vans that are accommodated to selling and keeping dairy products fresh. Vans stop on scheduled times and days at given places; people can come and buy any product from its

[1] *Milk from the farm* in English translation. The Czech version or MZF will be used in the thesis.

[2] *Purchase from the farm* in English translation. The Czech original or NZF will be used.

offer. The service is available mainly in the areas of Prague, Prague-East and Prague-West, also in some bigger towns, for example, Ústí nad Labem, Pardubice, Liberec.

The impulse for creating such service was the increasing pressure from supermarkets on small suppliers and manufacturers as well as the fact that the manufacturer itself has no control over how the product will be stored and sold to end customers (Mléko z farmy, 2020).

3.1.2 Nákup z farmy (NZF)

Nákup z farmy is an e-shop with farm products, developed from *Mléko z farmy* in 2016. It aims to unite local farmers and producers and to facilitate the distribution of farm products to the end customer. In other words, to offer fresh farm products to people directly, not through retailers. Farmers involved in the project take pride in family tradition, the high quality of production and the right treatment of animals and land. Customers purchase farm products via e-shop and choose from several types of delivery. Their orders can be delivered directly to their homes; they can pick it up at the farm or one of the stops of *Mléko z farmy*. *Nákup z farmy* offers a wide range of products, e.g. dairy, meat or fruits and vegetables (Nákup z farmy, 2020). Nowadays, *Nákup z farmy* is not the only online service offering farm products. During the time of its existence, other projects have been founded and operate in the same area, for example, *Scuk.cz, Z farmy domů, Svět bedýnek*.

3.2 Descriptive analysis

Firstly, the data of *Mléko z farmy*, containing sold quantities and prices of dairy products, are used to analyse own-price elasticity of the demand for farm dairy products - milk, butter, yoghurt and curd. In addition, they are combined with information from the Czech Statistical Office to be compared with the general development of consumer trends in the Czech Republic. Precisely, we use data of consumer prices, consumer price indices, per capita consumption of dairy products and expenditure of households on food.

Secondly, for the estimation of characteristics, we use data from *Nákup z farmy*, consisting of partial information about customers and their orders, and complete them by information gained from the questionnaire.

The descriptive analysis comprises a graphical comparison of consumer and farm prices of butter and milk; description of the development of MZF's sales, dairy consumption and household food expenditure. This section is ended by analysis of orders and customers of *Nákup z farmy* in Subsection 3.2.4 and is followed by the section covering the description of the questionnaire.

3.2.1 Price comparison

Milk

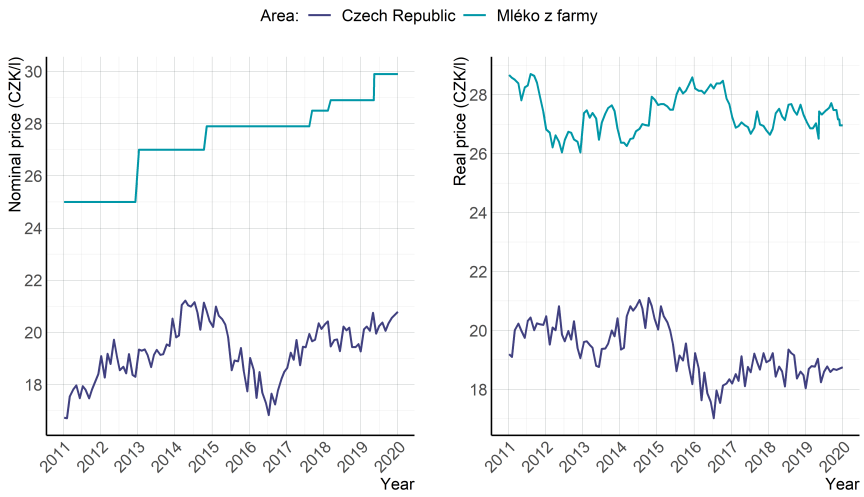


Figure 3.1: Price of milk
Source: CZSO (2020), MZF (2020). Author's computations.

Figure 3.1 depicts the comparison of milk consumer prices and the respective prices for which milk was sold by *Mléko z farmy*from 2011 to 2019.

The upper line on the left graph shows a gradual growth of MZF nominal prices; they changed only a few times within the given period. After launching the company in 2011, the price started at CZK 25 per litre; the price at the end of 2019 was CZK 29.90. The second line shows general consumer prices in the Czech Republic fluctuating from CZK 16.71 to 21.22 per litre. The price hit a

peak in 2014 and experienced the most significant drop in 2016. An explanation of the fall might be related to a decline in prices of raw milk on the European market. Overall, the consumer price was fluctuating, connected with different seasons. Comparing the general data obtained from the CZSO with the data from MZF, the difference is clearly seen, milk from MZF is more expensive, the gap ranges between 5 and 11 (CZK/litre); MZF milk price is higher by 42%.

Additionally, real prices of milk were compared (the graph on the right). Prices were adjusted for inflation using the consumer price index (CPI) with the base year 2015 (exact values of CPI are included in Appendix B). In both graphs, it seems that general prices do not influence the development of MZF prices, and they are not interconnected. For instance, MZF did not reflect the decreasing trend from 2014 to 2016.

Butter

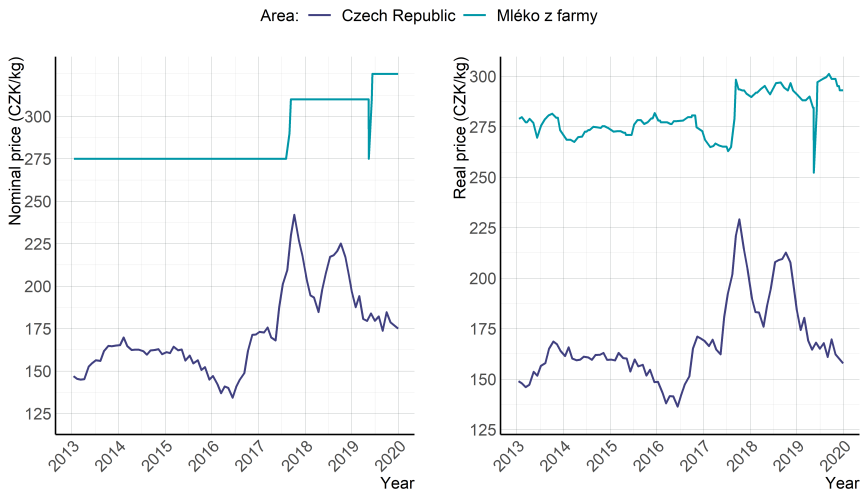


Figure 3.2: Price of butter
Source: CZSO (2020), MZF (2020). Author's computations.

Mléko z farmy started to produce butter two years after its launch, in 2013. The price started at CZK 55 per 200g (CZK 275/kg), changed only three times during the period and dropped only once. Similar to milk prices, MZF prices are higher in

comparison with the general consumer prices; the difference ranges between CZK 68 and 152. On average, butter from the farm is 75% more expensive.

From the general point of view, rapid growth between the second part of 2016 until the end of 2017 can be observed; due to the 'butter crisis' when the prices of butter spiked up in the whole Czech Republic for several reasons connected with the situation on the European dairy market mentioned in Section 2.3. Then prices dropped and started to grow again in the first quarter of 2018, but it did not exceed the 2017 level.

3.2.2 Sales

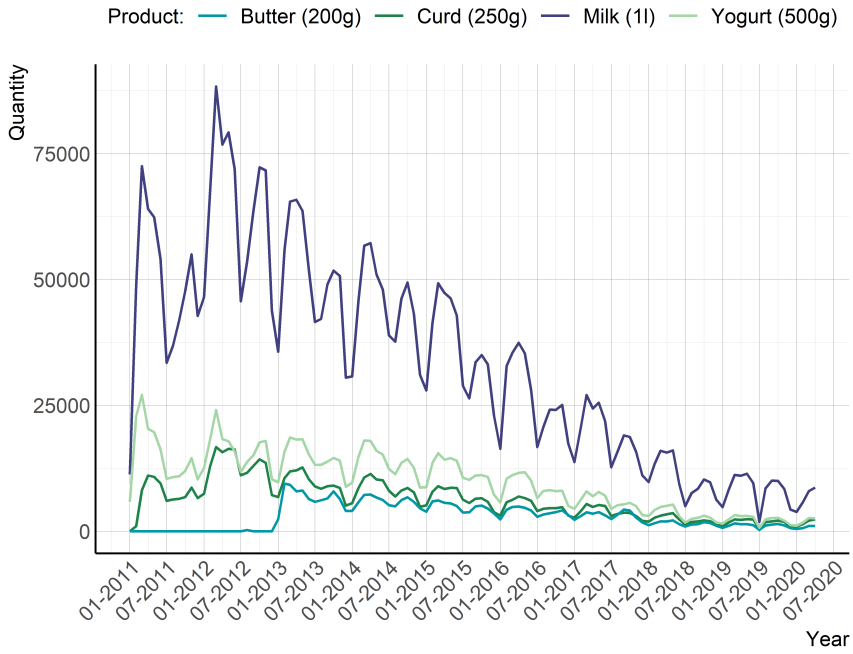


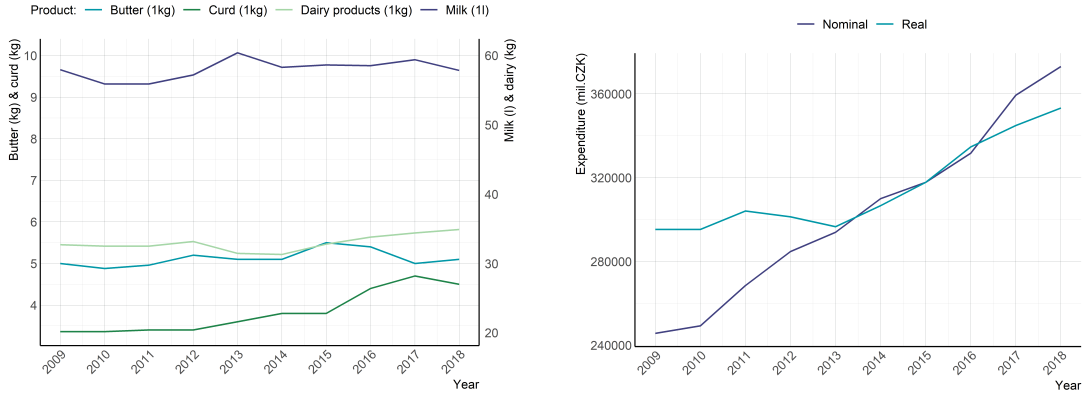
Figure 3.3: Sales

Source: MZF (2020). Author's computations.

Figure 3.3 captures the development of MZF's sales of dairy products, the most selling product is milk. All products face a declining trend, mainly milk. At the beginning of the project, only a few products were made, other dairy products were added gradually, the raw milk was used to produce them, the production of milk

decreased. Moreover, in 2011 the offer of farm and local products for a customer was not as broad as in 2020 when other farm projects started to operate on the market. The demand for farm products was also reflected by supermarkets or e-shops, who also extended their offer. Hence, increasing competition influences the decline in sales as well. Sales fluctuate seasonally, January and July are regularly the weakest months because the production is limited because of summer and Christmas holidays. The service is not available for part of these months.

3.2.3 Dairy consumption & food expenditure



(a) Consumption

(b) Household expenditure on food

Figure 3.4: Dairy consumption & household food expenditure
Source: CZSO (2019c;b). Author's computations.

The general development in the Czech Republic is captured by per capita consumption of dairy products and household expenditure on food. The data is available on the Czech Statistical Office until 2018. Figure 3.4a compares consumption of dairy products. Overall consumption of dairy products increases, while the consumption of milk and curd faces a declining trend. Butter consumption fluctuates, it hit a peak in 2015 and dropped considerably in 2017, the decrease might be connected with the growth of its prices in that period.

Expenditure of households on food is still increasing, also in real values (Figure 3.4b). Proportionally, food and non-alcoholic beverages formed 16% of the

total household expenditure in 2018. They rose by 1.4 percentage point between 2008 and 2018, which is regarded as the highest jump among the EU countries. The proportion in the European Union was 12.1% (Eurostat, 2019).

3.2.4 Nákup z farmy: customers and orders

Altogether, more than 10 thousand people have registered in the system of *Nákup z farmy* during the four years of its existence (between March 2016 and April 2020). Figure 3.5 demonstrates the rate of new customers per month. Since not all registered always have placed an order, bars are divided by the number of orders that people made during the whole period. The cumulative graph depicts the growth of the customer base; the curve seems to be rather concave.

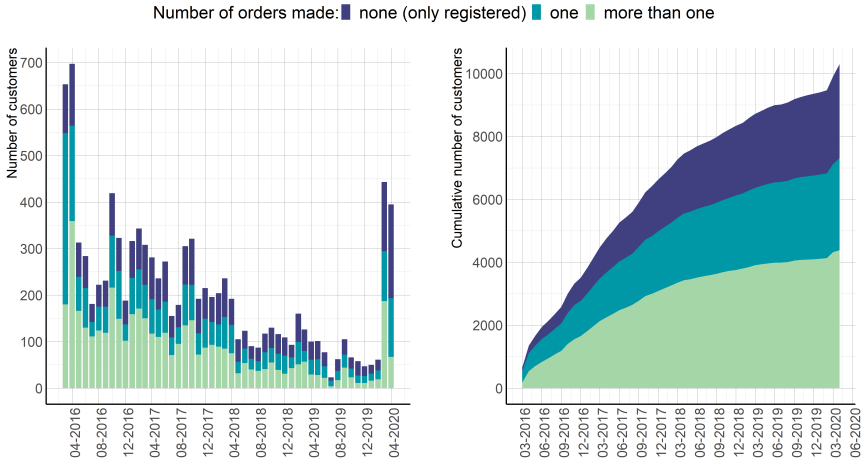


Figure 3.5: Customers
Source: NZF (2020). Author's computations.

On average, 33 orders are dispatched per day, 230 per week; the number varies depending on the season but also on the weekday - Saturday is the weakest day (Figure 3.6).

In March 2020, a significant change can be observed (for both, customers and orders) due to an unexpected situation of coronavirus pandemic when the government declared a state of emergency, cancelled organising of farmer's markets and restricted shopping possibilities. It was recommended to stay at home and

limit visiting frequented places. As a result of that, people inclined to online shopping, local and farm products included. Another online farm shops noticed a similar reaction of customers - project *Scuk.cz* announced the increase of turnover more than double (Doležalová & Pelikán, 2020). In the case of *Nákup z farmy*, orders tripled during the most severe period of coronavirus constraints, and new customers were attracted, the number of new coming in this period has exceeded the rates of three preceding years.

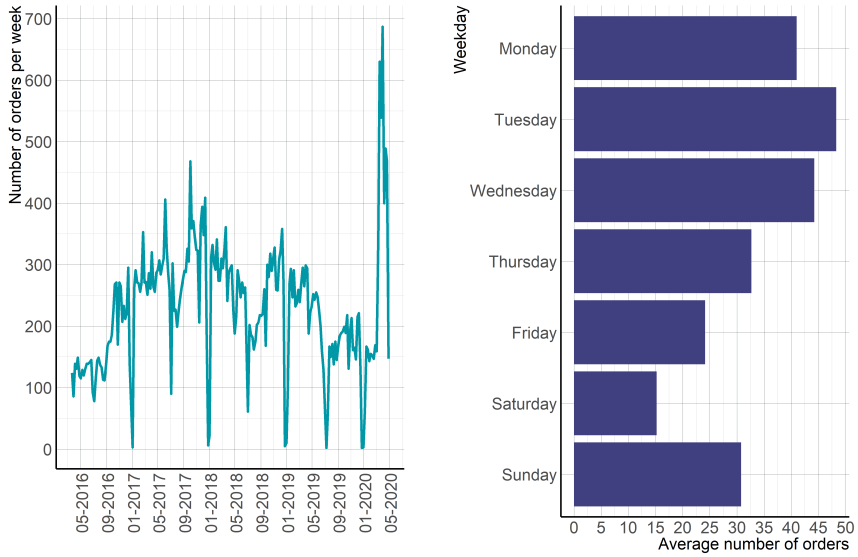


Figure 3.6: Orders
Source: NZF (2020). Author's computations.

3.3 Questionnaire

Information about customers provided by the shopping system of *Nákup z farmy* is limited. Therefore, a questionnaire was created to find out customers' characteristics, which are later analysed in the regression. In the survey, we include questions about socio-demographics (age, gender, occupation), but also questions about purchasing decisions, shopping habits and attitudes towards alternative food networks. The whole structure of the questionnaire is included in Appendix A.

Customers that registered on *Nákup z farmy* were determined as the main tar-

get group. To validate this fact, people were asked for filling an e-mail, through which answers could be interfaced to the information from the system. Afterwards, the data were joined together with information about orders and purchased products.

Responses were collected in the second half of March 2020 (16.3. 2020 - 1.4. 2020). Firstly, the questionnaire was shared on the Facebook page of *Nákup z farmy*. Subsequently, the questionnaire was sent to customers by e-mail to address the target group better. In total, 468 responses were collected, 373 were chosen for the regression analysis - 319 were connected with the system, 54 answers were added if a person marked that he had never made an order, so he did not have to be registered in the system. For result interpretation, all relevant responses (455) were taken into account, not depending on the validation of e-mail.

3.3.1 Questionnaire results

The results are summarised in Figure 3.7 - Figure 3.10. They mostly display the comparison of both samples (all relevant answers vs answers used in the probit models) to be able to determine differences.

Results indicate some similarities between respondents. The responses were gained mainly from women (75%); people with a tertiary or secondary level of education (55% and 44%, respectively), who are employed (51%), have their own business (17%), are retired (14%) or currently on parental leave (12%), students and other groups are minorities. The age of respondents ranges between 19 and 79 years. The majority live in Prague (40%); small towns represent 21%, villages 20%. Respondents usually buy foodstuff for two to four people. 51% of households are childless (nobody is younger than 18 years of age), one child is in 23% of households, families with two children represent 20%. Average food expenditure per capita per week without expenses at restaurants was estimated to CZK 1044; Figure 3.7f does not display four outliers that emerged in the sample.

One part of the questionnaire focused on the places that are commonly used for buying food. Respondents were asked to evaluate each suggested place on a scale from 0 to 5. Zero means that they *never* purchase food in a given place; one stands for *the least often* and five for *the most often*. Supermarkets were marked as the

most often for 33% of respondents. The trend of buying foodstuff mainly on the internet was not widely observed; the scale has quite proportional distribution. However, the usage of e-shops is only complementary to other formats for the majority. Likewise, farmer's markets and other alternative food shops are visited but do not represent the primary source of foodstuff.

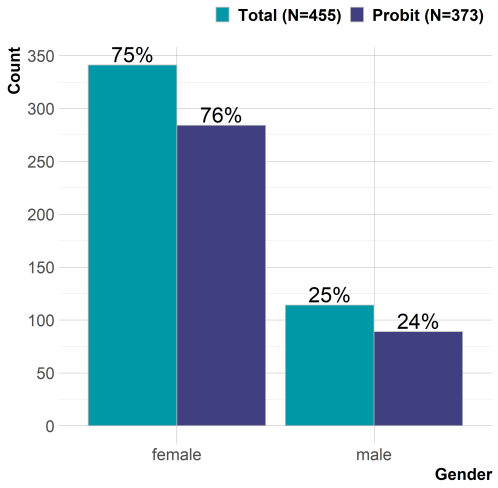
In the part where the respondents were asked to decide about factors that affect their purchase decision making, similar attitudes revealed, too. 99% of people stats that the quality of a product plays a role as well as the origin (90%) and freshness (99%). A large number of participants (94%) think that promotion does not influence them; similarly, 85% does not select foodstuff based on the design of the packaging. 92% states that they try to support local producers.

On the other hand, different opinions were expressed about the influence of a price, personal recommendation or size of a product. According to 39% of people, local and organic products form between 26-50% of their total food purchase, for 34% of people it is less than 25%. Nevertheless, two thirds of people think that local and organic food is readily available in their surroundings. The majority of people also expressed a positive attitude towards abiding by rules of a healthy lifestyle - they are interested in what they eat, do exercise, and even 82% take an environmental friendly production of foodstuff into consideration.

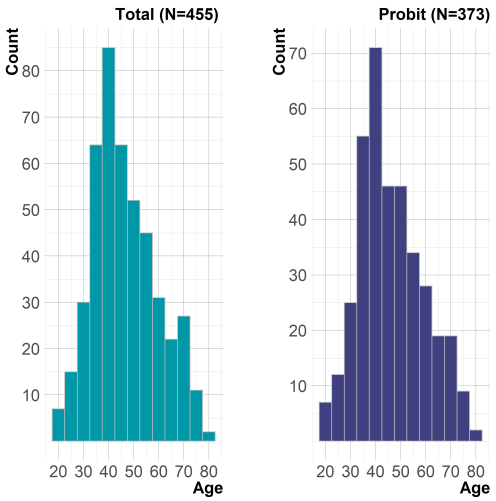
Nákup z farmy is used mainly for buying dairy products (in 41% of cases). 27% of people primarily buy meat and smoked products; 9% fruit and vegetables. 15% of the respondents reported that they had not used the service yet. Examples of reasons for not using the service are high price of farm products, the expectation of complicated system, self-sufficiency or buying from other local producers; preference to see a product before buying it or not shopping online.

Figure 3.7: Results of the questionnaire

(a) Gender



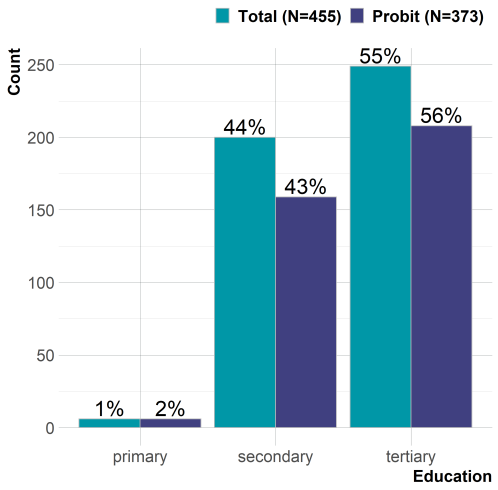
(b) Age



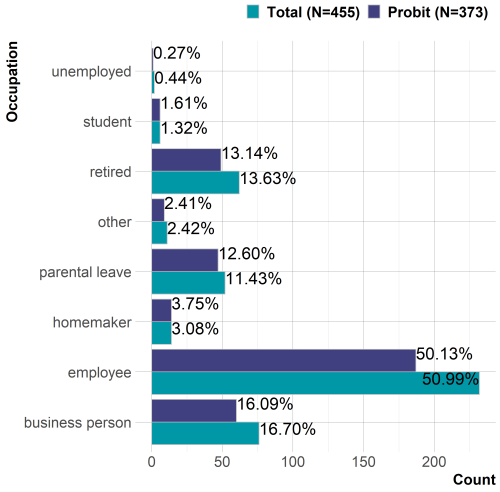
Total: MIN=19, med=44, mean(sd)=46.52±12.80, MAX=79

Probit:MIN=19, med=44, mean(sd)=46.23±12.87, MAX=79

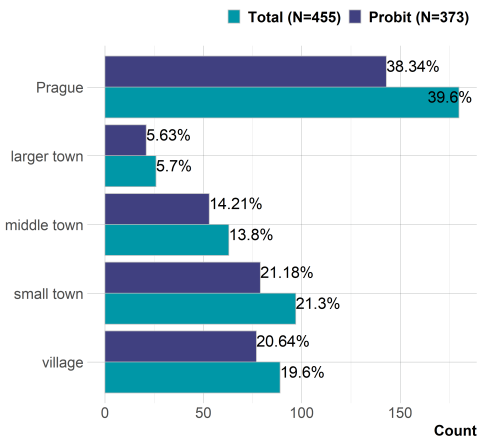
(c) Education



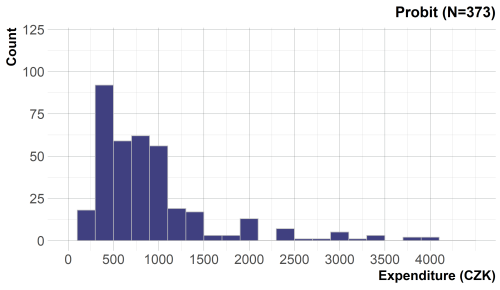
(d) Occupation



(e) Place of residence



(f) Food expenditure per capita per week

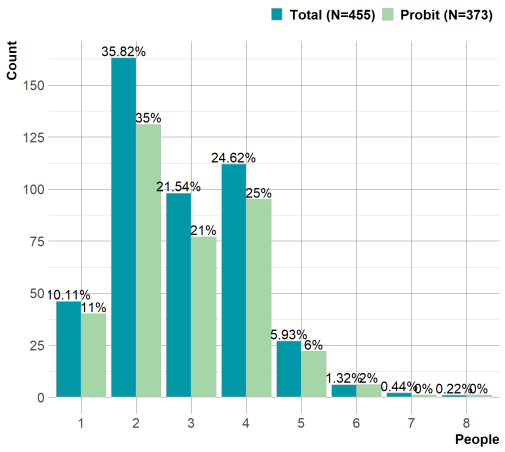


Note: Outliers are not shown

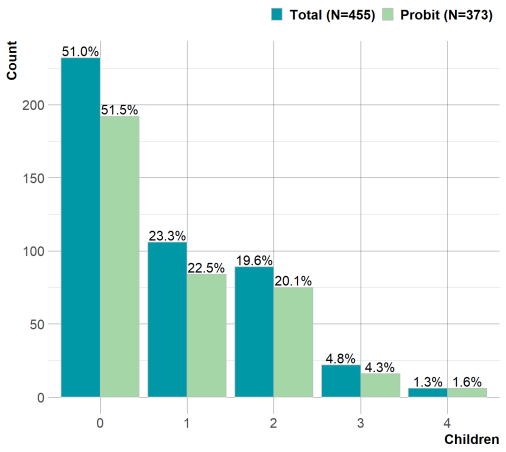
Probit:MIN=125,med=750,mean(sd)=1044±1020,MAX=10000

Figure 3.8: Results of the questionnaire (cont.)

(a) Number of members in a household



(b) Number of children in a household



(c) Places used for buying food

Frequency: 0 = never; 5=the most often

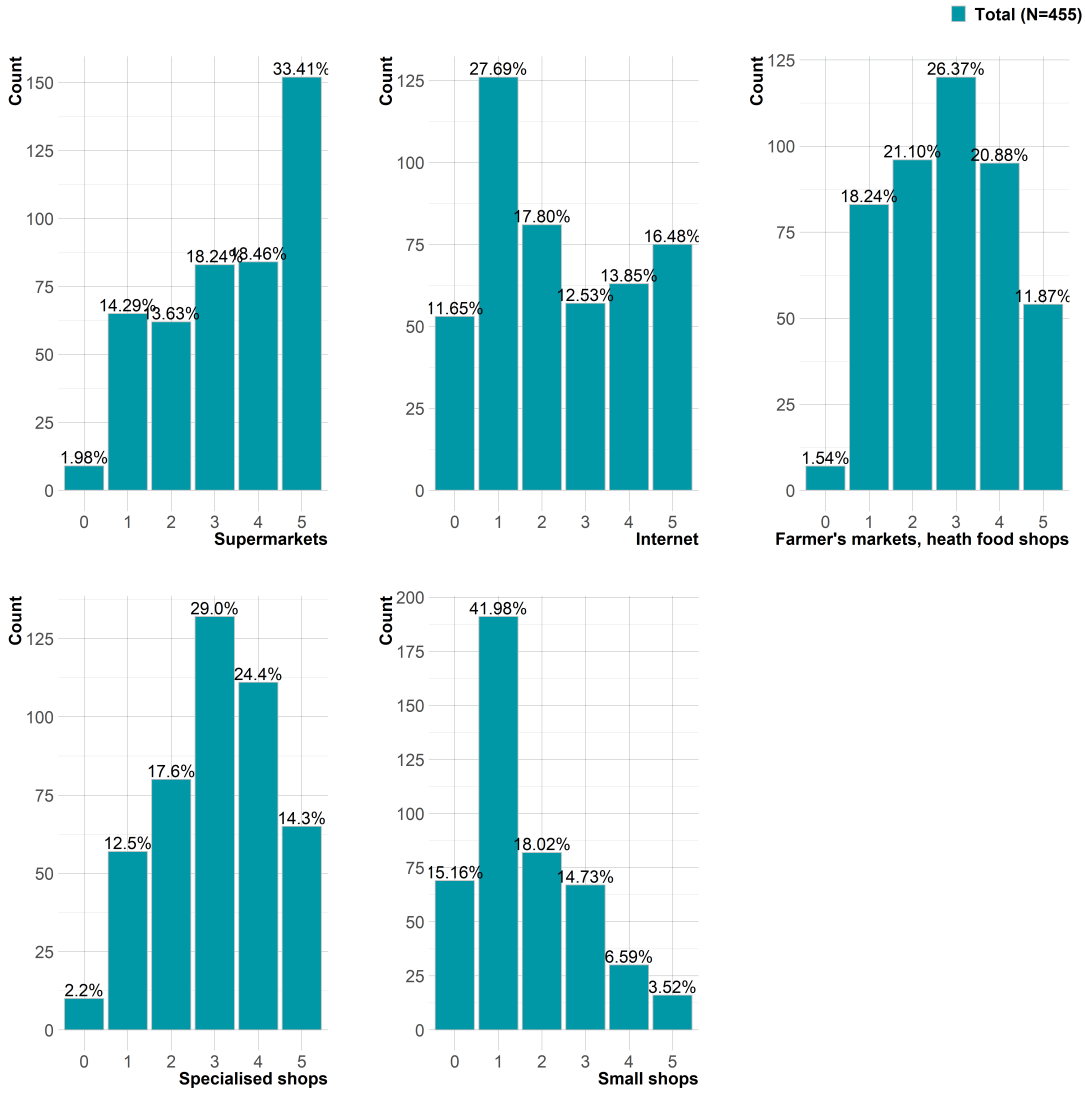


Figure 3.9: Results of the questionnaire (cont.)

(a) Factors influencing purchasing decision

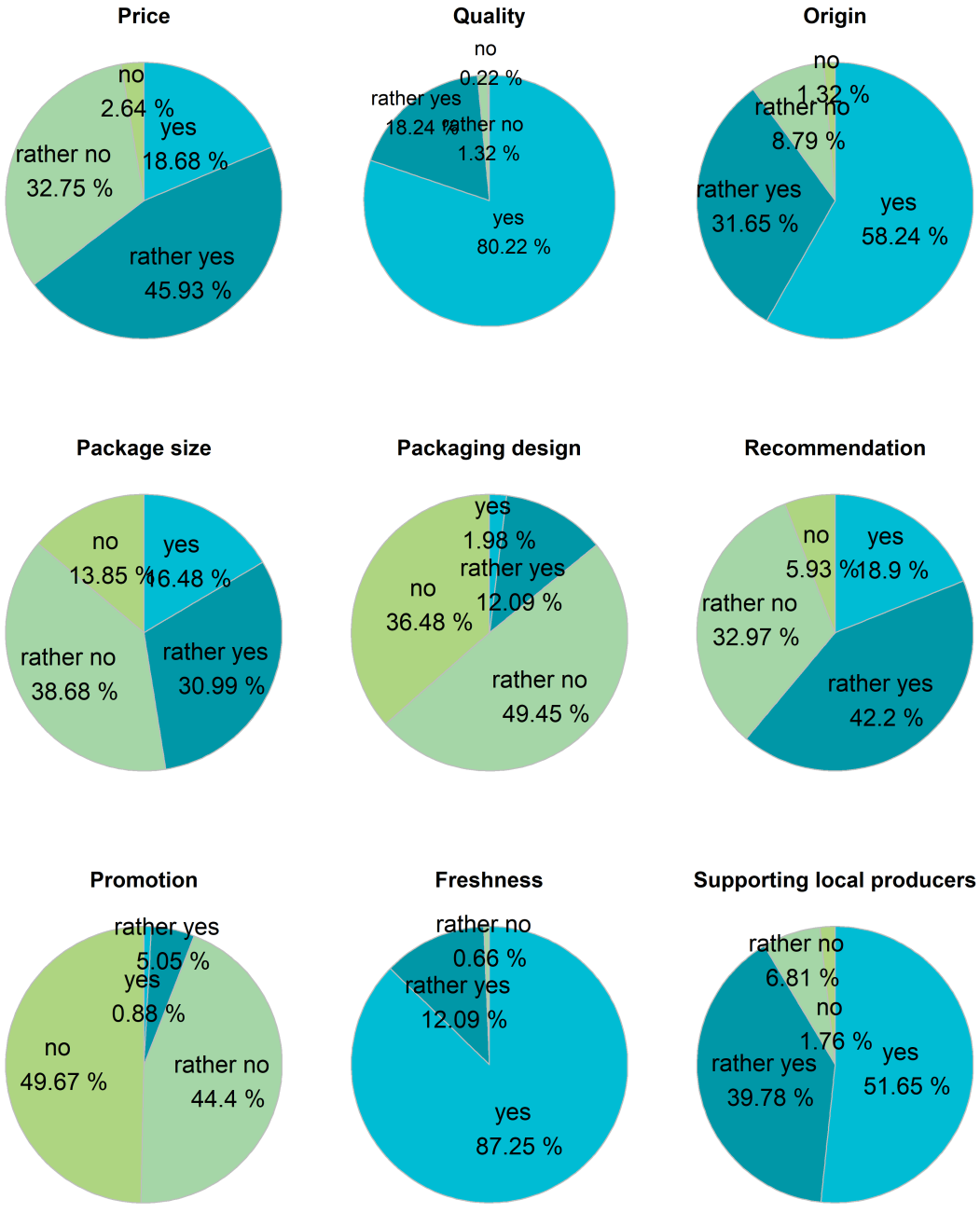
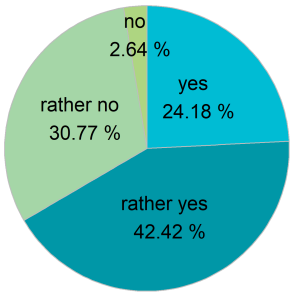
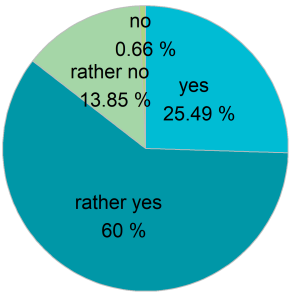


Figure 3.10: Results of the questionnaire (cont.)

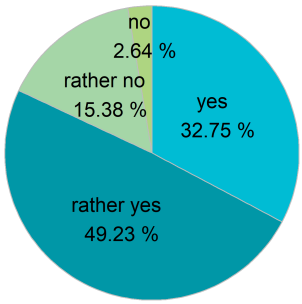
(a) Availability of local food



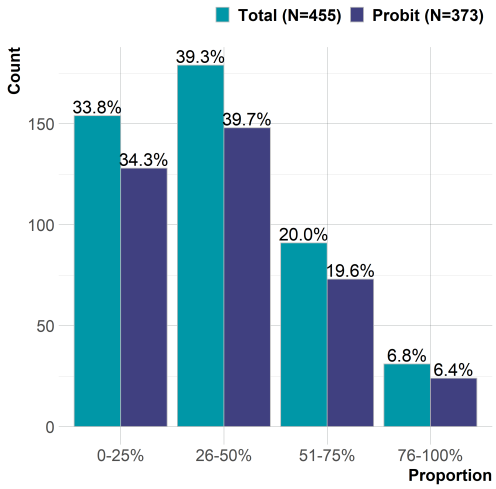
(b) Healthy lifestyle



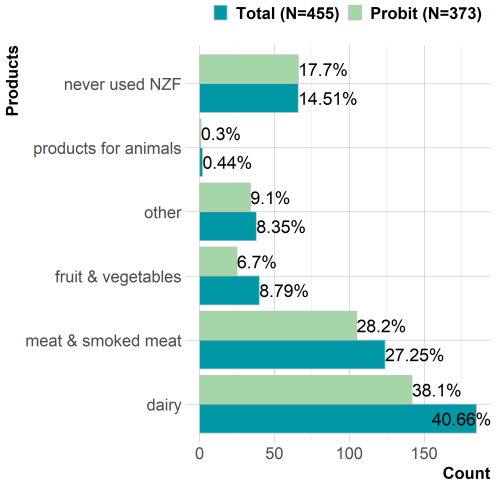
(c) Interest in eco-friendly food production



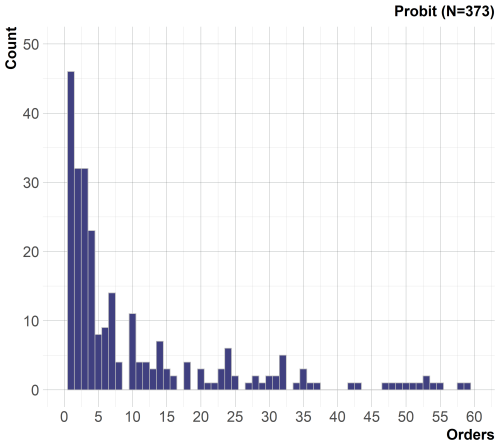
(d) Proportion of local & organic food in the total food purchase



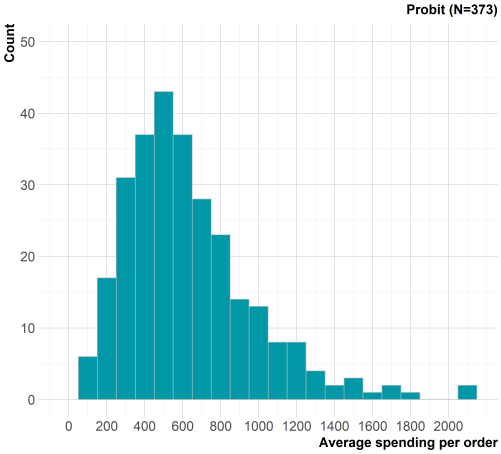
(e) Products mostly bought on NZF



(f) Number of orders made



(g) Average spending per order



Note: An outlier is not shown

Probit: MIN=0, med=3, mean(sd)=16.26+61.3, MAX=1088

Probit:MIN=0,med=456.61,mean(sd)=474.97±404.34,MAX=2144.66

3.3.2 Description of a model sample

When we accommodate the summary to the sub-sample selected for the models, the proportions of responses are represented similarly as before; percentages correspond to the whole sample. Using this sub-sample, we can also analyse the products that customers ordered. However, the inference is limited - respondents wrote an e-mail address that coincides with the system, but they may use another account, or there is more than one account in one household. From the sub-sample, the summary of orders and spending was made. Both information is analysed for the period from the date of registration of a customer until April 2020. The median of orders is three orders. An average number of purchases is higher - 16 orders; however, it is pulled by an outlier - a person who made 1088 orders. On average people usually spend approximately CZK 475 per order.

We distinguish between several categories of products that people purchase: meat and smoked meat products; fruits and vegetable; dairy products were further divided into butter, milk, curd, cheese (balkan cheese, mozzarella, steamed cheese), yoghurt and other dairy products (kefir, buttermilk, curd dessert, ice-cream); individual category was created for eggs. Purchased products are treated as binary variables, the group was labelled as 1, if a person had bought a product from the category; otherwise as 0.

Several observed patterns will be described in the following paragraph. From the sample of 373 respondents, 260 of them have ever bought a dairy product, 250 meat or smoked meat products. From those who placed an order only once; 85% of these orders consisted of at least one kind of dairy product, 65% contained a meat product. Clearly, with an increasing number of orders, more product categories were covered, though exceptions - customers buying only limited types of products, emerged. Furthermore, regarding dairy products, cheese was purchased the most, followed by milk, yoghurt, butter, the least was curd.

After analysing the responses from the questionnaire, some answers are not convenient to be employed as independent variables in the models, for example, some factors - quality, origin, freshness. Other answers need to be accommodated to our purpose. From all categorical variables, individual binary variables were done; variables for places for shopping are also binary - if a person evaluated the

place by 4 or 5, it was assessed as a frequent visit and marked as 1, otherwise 0. Questions, for which possible answers were *yes*, *rather yes*, *rather no* or *no*, were labelled as 1 if a person expressed positive attitude, negative attitude was marked as 0.

To be able to examine the features of customers, we created three other binary variables. Variable *buy* is equal to one if a person ever placed an order on NZF, zero otherwise. Then, the binary variable *more*1 (equal to one if the number of orders is higher than 1) was created to examine what are the characteristics of people who did not only try the e-shop, but they also returned to order another time. In other words, people who made more than one order from the date of their registration until processing the results of the survey (April 2020). Lastly, *more*10 is a binary variable distinguishing between people who made more than 10 orders or less. People with more than ten orders can be considered to be frequent customers.

To conclude, the dependent variables will be *buy*, *more*1, *more*10 to analyse the effect on the likelihood of placing an order. Additionally, average spending per order will be the fourth dependent variable to examine factors affecting how much a person spends per order. Moreover, the likelihood of buying a specific product will also be analysed. Thus, individual product categories will be the last group of dependent variables.

Chapter 4

Methodology

This chapter aims to describe the methodology. Firstly, we are interested in consumer demand and own-price elasticity. For the estimation, we use data from *Mléko z farmy* in monthly time series form, described in Section 3.2, and ordinary least squares regression that is covered in Section 4.1. Secondly, we focus on the characteristics of local-food consumers, precisely customers of the project *Nákup z farmy*, we also aim to estimate characteristics of people purchasing specific commodities on NZF. We employ data from the questionnaire described in Section 3.3, together with data about orders of customers that filled the questionnaire and the probit model described in Section 4.2.

4.1 Ordinary Least Squares

The data from *Mléko z farmy* containing sold quantities and prices of dairy products will be used to analyse price elasticity of demand for farm dairy products and describe the relationship between the general development in the Czech Republic and the local farm production. It will be analysed using ordinary least squares method for time series data. Data is generated from 2011 to 2018 and adapted to monthly form, 2011 is the first year when *Mléko z farmy* started to offer its services regularly; 2018 is the last year for which general data from CZSO about consumption, the expenditure of households is available. Since the production of butter began later, the data for butter is from 2013 to 2018.

Summary of variables

Sold quantity of a product is treated as a dependent variable; the products are *milk*, *butter*, *yoghurt* and *curd*. Price of a given product is the main independent variable, and its lags are also included to identify potential delayed reaction to a price change. For direct interpretation of the coefficients for prices as elasticities, both variables are in a logarithmic form.

To capture consumer's trends in the Czech Republic, we include variables expressing per capita consumption of a given good and expenditure of households on food in the Czech Republic. For covering fluctuations and seasonality, dummy variables of months January to November are added, leaving December as the base group. Lastly, the variable *route* is introduced as a proxy variable for the number of selling places of MZF in a given period.

Additionally, dummy variable *crisis* is added to the model for *butter*, capturing the period from June 2017 to December 2017, to find out if an increase in prices of butter in the Czech Republic had some effect on *Mléko z farmy*'s sales of butter. The hypothesis is that the rise in general price might lower the gap, and thus the price difference would not be so significant, and a consumer would be more willing to support local farmers and buy butter of higher quality from the farm. Hence, we expect that the coefficient for the variable will be significant and positive.

Assumptions for time series regression

Being able to apply the OLS method, it is required to satisfy following assumptions to ensure consistency and efficiency of estimators and use t statistics and F statistics for standard inference. Wooldridge (2015) describes them as:

1. Linearity & Weak dependence:
   The stochastic process $\{(x_{t1}, x_{t2}, ..., x_{tk}, y_t) : t = 1, 2, ..., n\}$ is stationary, weakly dependent and follows the linear model:

$$y_t = \beta_0 + \beta_1 x_{t1} + \beta_2 x_{t2} + ... + \beta_k x_{tk} + u_t, \tag{4.1}$$

   where $\{u_t : t = 1, 2, ..., n\}$ is the sequence of errors or disturbances; n is the number of time periods.

2. No Perfect Collinearity: no explanatory variable is constant nor a perfect linear combination of the others.

3. Zero conditional mean: independent variables are contemporaneously exogenous : $E(u_t|x_{t1}, x_{t2}, ..., x_{tk}) = 0$, for all $t = 1, 2, ...n$.

4. Homoskedasticity: $Var(u_t|x_{t1}, x_{t2}, ..., x_{tk}) = \sigma^2$, for all $t = 1, 2, ...n$.

5. No serial correlation (no autocorrelation): $E(u_t, u_s|\mathbf{x_t}, \mathbf{x_s}) = 0$,for all $t \neq s$.

6. Normality: the errors u_t are independently and identically distributed as Normal$(0, \sigma^2)$.

Before running the regression, the first assumption of weak dependence and stationarity of variables need to be examined. The Augmented Dickey-Fuller test (1979) is used for this purpose and tests the hypothesis of a unit root against the alternative of stationarity, or in some cases, trend stationarity. Rejecting the null hypothesis means stationarity of a variable. For variables *quantity*, *price*, *route* and *expenditure*, the null hypothesis cannot be rejected, variables are not stationary. Thus, the first difference of variables ($\Delta x = x_t - x_{t-1}$) is introduced and tested again. The null hypothesis of the ADF test can be rejected for them, now[1]. Therefore, the models are estimated with the first difference of these variables.

Regression equation

To sum up, the models are estimated as follows[2]:

$$\begin{aligned} dln\_q\_product_t = \beta_0 &+ \beta_1 dln\_p\_product_t + \beta_2 dln\_p\_product_{t-1} + \beta_3 dln\_p\_product_{t-2} + \\ &+ \beta_4 d\_route_t + \beta_5 con\_product_t + \beta_6 dln\_expend_t + \\ &+ \beta_7 jan_t + \beta_8 feb_t + \beta_9 mar_t + \beta_{10} apr_t + \beta_{11} may_t + \beta_{12} jun_t + \\ &+ \beta_{13} jul_t + \beta_{14} aug_t + \beta_{15} sep_t + \beta_{16} oct_t + \beta_{17} nov_t + u_t, \ t = 1, 2, ..., n \end{aligned} \tag{4.2}$$

where *dln_q_product* represents the first difference of the above-mentioned dependent variable, β_1 to β_{17} are the regression coefficients for the aforementioned

[1]Results of tests are stated in Table B.3.

[2]The equation slightly differs for butter; variable *crises* is added.

explanatory variables and u is an error term. Description of variables is summarised in Table 4.1, descriptive statistics is enclosed in Appendix B. Number of observations n differs depending on the time when MZF started to sell the given product.

Table 4.1: Variables used in the time series models

Dependent variable	Description
dln_q_milk	first difference of a logarithmic form of quantity of milk in litres sold by *Mléko z farmy*
dln_q_butter	first difference of a logarithmic form of quantity of butter in kilograms sold by *Mléko z farmy*
dln_q_yoghurt	first difference of a logarithmic form of quantity of yoghurt in kilograms sold by *Mléko z farmy*
dln_q_curd	first difference of a logarithmic form of quantity of curd in kilograms sold by *Mléko z farmy*
Independent variable	Description
dln_p_product	first difference of a logarithmic form of price (per 1 litre or 1 kilogram) of a product (milk, butter, yoghurt, curd), for which it was sold on *Mléko z farmy*, adjusted for inflation
con_milk	milk consumption per capita in the Czech Republic
con_butter	butter consumption per capita in the Czech Republic
con_dairy	consumption of dairy products per capita in the Czech Republic
con_curd	curd consumption per capita in the Czech Republic
dln_expend	first difference of a logarithmic form of expenditure of households on food, adjusted for inflation
d_route	first difference of number of routes of *Mléko z farmy*
month	binary variable equal to 1 in a respective month
crisis	binary variable equal to 1 in a month when the Czech Republic experiences a 'butter crisis'

Tests

Potential problem of multicollinearity, violation of the second assumption, will be examined by Variance Inflation Factor (VIF), which is computed for each independent variable in a regression. The value ranges from 1, meaning no multicollinearity, value above 10 may indicate collinearity problem (Wooldridge, 2015).

Heteroskedasticity will be tested by White (White, 1980) and Breusch-Pagan tests (Breusch & Pagan, 1979). Both of them test the null hypothesis of homoskedasticity against the alternative of heteroskedasticity of residuals. Similarly, autocorrelation will be tested by the Breusch-Godfrey test (Breusch, 1978; Godfrey, 1978) with the null hypothesis of no autocorrelation. If the null hypothesis in one of the tests will be rejected at 5% significance level, standard errors will be estimated robustly using Newey-West heteroskedasticity and autocorrelation consistent standard errors (Newey & West, 1987). Lastly, normality of residuals will be verified by the Shapiro-Wilk test (Shapiro & Wilk, 1965) with the null hypothesis of normal distribution of residuals.

4.2 Probit Model

Dependent variables[3], that are introduced to observe consumer characteristics, have features of a binary variable, in such models we are mainly interested in the response probabilities: $P(y = 1|\mathbf{x}) = P(y = 1|x_1, ..., x_k)$.
For this purpose, probit, logit or a linear probability model are usually used. The advantage of probit or logit model, in comparison to the linear probability model, is their nonlinear character and the fact that a partial effect of any explanatory variable is not constant. Probit and logit model assumes the form:

$$P(y = 1|\mathbf{x}) = G(\beta_0 + \beta_1 x_1 + ... + \beta_k x_k) = G(\beta_0 + \mathbf{x}\beta), \ where \tag{4.3}$$

G is a function with values strictly between zero and one: $0 < G(z) < 1, z \in \mathbb{R}$, ensuring that the estimated response probabilities are strictly between zero and

[3]except variable expressing average spending per order

one. In the probit model, G is the standard normal cdf :

$$G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(v)dv, \tag{4.4}$$

where $\phi(z)$ is the standard normal density

$$\phi(z) = \sqrt{\frac{1}{2\pi}} \exp\left(\frac{-z^2}{2}\right). \tag{4.5}$$

Logit model defines G as the logistic function. The exact rule of selection between probit and logit model is not defined. Logit model is usually preferred in health sciences partly because coefficients can be interpreted in terms of odd ratios, whilst probit model is used by economists and political scientists because it can deal with the problem of heteroscedasticity. Therefore, we will use the probit model to define characteristics of customers. For example, Uzunoz & Akcay (2012) or Schrock (2010) use similar methodology to define factors of milk consumption and consumer characteristics influencing purchase or organic milk, respectively.

Both probit and logit models are estimated using maximum likelihood estimation (MLE), which is, under general assumptions, consistent, asymptotically normal and asymptotically efficient for random samples. This allows computing asymptotic t tests and confidence intervals (Wooldridge, 2015).

Interpretation of probit models

Probit models for their nonlinear relationship do not have a clear interpretation. It is not possible to interpret the coefficient directly; the effect is not the same for all levels. The partial effect of continuous independent variable x_j should be computed; however, it has the same sign as the coefficient β_j. In the case of binary variables, the partial effect from changing x_1 from zero to one is, ceteris paribus:

$$G(\beta_0 + \beta_1 + \beta_2 x_2 + ... + \beta_k x_k) - G(\beta_0 + \beta_2 x_2 + ... + \beta_k x_k). \tag{4.6}$$

Therefore, in order to determine if the effect of x_1 is positive or negative, it is sufficient to know the sign of the coefficient of β_1. In order to find the magnitude of the effect, it is necessary to estimate the quantity in Equation 4.6 (Wooldridge,

2015). Results in Chapter 5 will be stated in the form of marginal effects, determining changes in probability of a dependent variable under the influence of the investigated independent variable, where the other independent variables are fixed. Results of the estimated models and coefficients before determining marginal effects are covered in Appendix B.

The quality of the models will be measured by McFadden pseudo R-squared (1974), the area under ROC curve (AUC) will be used as an overall measure of fit.

4.2.1 Variables used in the models

Following tables (Table 4.2-Table 4.4) summarise variables that were taken into account during creating the models. Descriptive statistics (mean and standard deviation) of variables is summarised in Table B.6.

Table 4.2: Variables used in the probit models

Dependent variable	Description
buy	binary variable equal to 1 if a person made an order on *Nákup z farmy*
*more*1	binary variable equal to 1 if a person made more than 1 order on NZF
*more*10	binary variable equal to 1 if a person made more than 10 orders on NZF
ln_av_spend	logarithmic form of an average amount that a person has spent per one order on *Nákup z farmy*
product	binary variable equal to 1 if a person bought respective product on NZF. Chosen products are *milk*, *butter*, *yoghurt*, *curd*, *cheese*, *meat*, *egg* and *vege_fru* - abbreviation of fruit and vegetables

Table 4.3: Variables used in the probit models (cont.)

Independent variable	Description
gender	binary variable equal to 1 if a person is a man
age	numerical variable expressing how old a person is
ln_av_exp	numerical variable expressing estimated amount of money spent for food and beverages per week per person in logarithmic form
household	number of people, for which a person normally buys foodstuff, number of people in a household
children	number of children in the household
retired	binary variable equal to 1 if a person is retired
mater	binary variable equal to 1 if a person is on a maternity leave
tertiary	binary variable equal to 1 if a person's completed education is tertiary
Prague	binary variable equal to 1 if a person lives in Prague
town_bigger	binary variable equal to 1 if a person lives in a town having more than 20 000 inhabitants
avail_lf	binary variable equal to 1 if local and organic food is easily available for a person to buy in his surroundings
spend2650	binary variable equal to one if local and organic food represents 26-50% of total foodstuff that a person buys
spend5175	binary variable equal to one if local and organic food represents 51-75% of total foodstuff that a person buys
spend76100	binary variable equal to one if local and organic food represents 76-100% of total foodstuff that a person buys

Table 4.4: Variables used in the probit models (cont.)

Independent variable	Description
recom	binary variable equal to 1 if a person is influenced by personal recommendation during his purchase decision making
price	binary variable equal to 1 if a person is influenced by the price of a foodstuff
pack_look	binary variable equal to 1 if a person is influenced by a packaging design of a foodstuff
pack_size	binary variable equal to 1 if a person is influenced by a package size of a foodstuff
lifestyle	binary variable equal to 1 if a person sticks to the rules of a healthy lifestyle
internet	binary variable equal to 1 if a person buys foodstuff very often on the internet
supermarket	binary variable equal to 1 if a person buys foodstuff very often in the supermarkets
alter_shops	binary variable equal to 1 if a person buys foodstuff very often in the health food shops or on farmer's markets
specialised_shops	binary variable equal to 1 if a person buys foodstuff very often in butchers, bakeries
meat	binary variable equal to 1 if a person bought meet or smoked meat products on *Nákup z farmy*
vege_fru	binary variable equal to 1 if a person bought fruit or vegetables on *Nákup z farmy*
dairy	binary variable equal to 1 if a person bought some kind of dairy product on *Nákup z farmy*
av_spend	numerical variable expressing average spending of a person on *Nákup z farmy* per order
years	numerical variable expressing how long a customer has been registered on *Nákup z farmy*
freq_month	numerical variable expressing the frequency of shopping on *Nákup z farmy* per month

4.2.2 Regular customer

Firstly, we are interested if there exist differences between customers of NZF that have placed an order there and people that have not. In this case, variable *buy* is dependent variable. Secondly, we investigate if a difference emerges as the number of orders increases and we introduce a response binary variable $more1$. From the aforementioned independent variables we chose such combination, which performed the best values of pseudo R^2 and AUC. The two models are described by the following equation:

$$\begin{aligned} buy/more1_i = \beta_0 &+ \beta_1 gender_i + \beta_2 age_i + \beta_3 household_i + \beta_4 retired_i + \beta_5 Prague_i + \\ &+ \beta_6 ln\_av\_exp_i + \beta_7 spend2650_i + \beta_8 spend5175_i + \beta_9 spend76100_i + \\ &+ \beta_{10} avail\_lf_i + \beta_{11} lifestyle_i + \beta_{12} price_i + \beta_{13} recom_i + \\ &+ \beta_{14} pack\_look_i + \beta_{15} supermarket_i + \beta_{16} internet_i + \\ &+ \beta_{17} alter\_shops_i + u_i, \ i = 1, 2, ..., 373; \end{aligned} \tag{4.7}$$

where *buy* and $more1$ are above-mentioned dependent variables, β_1 to β_{17} are the regression coefficients for the explanatory variables described in Table 4.3 and Table 4.4, u is an error term.

Then, we define a variable $more10$, equal to 1 if a person has made more than 10 orders, to estimate characteristics of a frequent buyer. The form of a model is similar, moreover, variables $dairy$, $meat$, $vege\_fru$ are included to identify, for which category of products people regularly return. Thus, the model is described by the following equation:

$$\begin{aligned} more10_i = \beta_0 &+ \beta_1 gender_i + \beta_2 age_i + \beta_3 household_i + \beta_4 retired_i + \beta_5 Prague_i + \\ &+ \beta_6 ln\_av\_exp_i + \beta_7 spend2650_i + \beta_8 spend5175_i + \beta_9 spend76100_i + \\ &+ \beta_{10} avail\_lf_i + \beta_{11} lifestyle_i + \beta_{12} price_i + \beta_{13} recom_i + \beta_{14} pack\_look_i \\ &+ \beta_{15} supermarket_i + \beta_{16} internet_i + \beta_{17} alter\_shops_i + \\ &+ \beta_{19} dairy_i + \beta_{20} meat_i + \beta_{21} vege\_fru_i + u_i, \ i = 1, 2, ...373. \end{aligned} \tag{4.8}$$

Afterwards, we run the OLS regression for average spending per order. For this purpose the sample is restricted only to people who have already spent some money on *Nákup z farmy* ($i = 1, 2, .., 260$). In the log-level model, which allows semi-elasticity interpretation, we regress *ln_av_spend*, the logarithmic form of average spending per order on the same independent variables as in Equation 4.8, only variable *years* is added.

4.2.3 Buyers of different products

Lastly, the analysis of factors that influence buying of different category of products is conducted. Dependent variables are *milk*, *butter*, *yoghurt*, *curd*, *cheese*, *egg*, *meat* and *vege_fru*. Similar independent variables as in (4.7) are involved in the models. The formula for the models is following:

$$\begin{aligned} product_i = \beta_0 &+ \beta_1 gender_i + \beta_2 household_i + \beta_3 retired_i + \beta_4 town\_bigger_i + \\ &+ \beta_5 Prague_i + \beta_6 ln\_av\_exp_i + \beta_7 freq\_month_i + \beta_8 spend2650_i + \\ &+ \beta_9 spend5175_i + \beta_{10} spend76100_i + \beta_{11} recom_i + \beta_{12} lifestyle_i + \\ &+ \beta_{13} supermarket_i + \beta_{14} specialised\_shops_i + \\ &+ \beta_{15} av\_spend_i + u_i, \ i = 1, 2, ..., 373; \end{aligned} \tag{4.9}$$

where *product* represents above-mentioned dependent variables, β_1 to β_{15} are the regression coefficients for the explanatory variables described in Table 4.3 and Table 4.4, u is an error term.

Chapter 5

Results

In this chapter, the results of the models presented in the previous chapter are described. First, the time series models estimated by OLS are described in Section 5.1, then Section 5.2 provides the results of the probit models for characteristics of customers.

5.1 Demand for dairy products

Table 5.1 presents the results of the estimated models. Dummy variables for months capture the seasonality of product sales similarly across the models. Mostly all months reveal a significant statistical difference related to the base month December, only in July (*jul*) there is either no difference or in the case of *milk*, the effect on sales is negative. The results correspond with the seasonality, which can be seen in Figure 3.3. Variable *d_route* has a positive significant effect, the same for all four products, the quantity sold is higher, with more selling possibilities in a month. The price elasticity of demand varies across different products. The models reveal that the price sensitivity of demand for a product is not always shown immediately but in some cases, after some time:

milk: The increase in price by 1% causes decrease in the purchase of milk by 1.25%, the change is reflected immediately and it is not projected into the next periods.

butter: In the case of butter, we can observe an interesting pattern. The

coefficient of price in the first period is positive, which is not in line with microeconomic theory - a 1% increase in price leads to a 1.64% increase in quantity bought. Nevertheless, the effect of the change on the next periods is negative. The unexpected immediate positive effect might be caused by the fact that the prices do not change so often, as could be seen in Figure 3.2. Hence, the customers do not expect the change in price. So that when they once decide to visit the selling place and buy butter, they do not change their intention and buy it even for the higher price. However, next time, before they make the decision, they already know about the price increase and do not go there. Also, the effect of the change is large (2.32% for both change in $t-1$ and also change in time $t-2$). It indicates that the change in quantity sold is highly sensitive to the change in price. According to Wooldridge (2015), the sum of three coefficients can be interpreted as a long term propensity (-3.005 %). Usually, butter made by small local producers has a specific taste and other features that make it incomparable with a similar product in supermarkets. However, even a small change in price leads to a change in customers' decision; when they consider the price to be too high, they will stop buying it in the following period.

yoghurt: In comparison to the previous products, yoghurt is less sensitive to price - a 1% increase in price causes a 0.75% decrease in quantity. The change is reflected in the same period; changes from previous periods are not significant.

curd: The coefficient of the price is significant only in the second period, a 1% increase in price in period $t-1$ leads to a decline in the quantity bought in a period t by 1.448%. The demand for curd is more elastic than for milk but less than for butter.

Our findings can be compared with previous studies. Compared to the conventional dairy products, the demand is elastic. Estimated elasticity for milk contradicts the study of Schrock (2010), whose estimate was lower than one. Moreover, our result yields comparable finding with the whole milk; the estimate of Vargová & Jamrich (2018) was -1.42.

Different size of an effect of change in price change on a change in quantity change bought might be caused not only by a type of a product itself but also by the difference between prices of a conventional and local farm product. In connection with the literature review, Bunte *et al.* (2007) suggest that lowering the gap changes the elasticity of demand for a product to be less sensitive to price. Nevertheless, the data available for our analysis does not allow us to investigate the relationship between local and conventional products more; scanner data would be useful for this purpose. Different estimates might also be caused by the different level of similarity of complements that people can buy in the conventional retail format. Sometimes the perception of higher quality of local farm product can be outweighed by its low durability.

The effect of the general consumption is not observed; the variable is not significant for any product. The expenditure on food has a significant negative effect on the quantity sold of butter and curd. The coefficient indicates that when households spend more money on food, they do not necessarily buy these local farm products. Actually, they purchase less of them. In other words, the developments of these two variables are related negatively. The variable *crisis* in the model for *butter* has a positive but not significant effect on the sales. We cannot reject the hypothesis that the coefficient is equal to zero; and the conclusion about the impact of lowering the gap of the prices cannot be made.

Overall, the models report high values of R^2, 0.9 on average, and also adjusted R^2 is high, which is caused by including seasonal trends directly into the models. Hence, it is impossible to determine what proportion of total variation in the dependent variable is explained by the rest of explanatory variables. Even though the residuals are homoskedastic, autocorrelation cannot be rejected. Thus, all models were estimated using Newey-West standard errors. Average values of VIF in any model were not higher than 5; there is no evidence of multicollinearity. Residuals are normally distributed. Results from the tests are summarised in Table B.4.

To sum up, the relationship between the small local producer and the consumer trend in the Czech Republic has not been obsserved. However, a more extended period would be needed for better assessment and also a comparison with other small local producers would be useful to be able to generalise our conclusion.

Table 5.1: Results of the time series models

	Dependent variable:			
	dln_qmilk	dln_qbutter	dln_qyoghurt	dln_qcurd
	(1)	(2)	(3)	(4)
jan	0.148*** (0.049)	0.156** (0.066)	0.332*** (0.055)	0.351*** (0.048)
feb	0.368*** (0.056)	0.356*** (0.087)	0.437*** (0.055)	0.491*** (0.055)
mar	0.322*** (0.050)	0.274*** (0.067)	0.341*** (0.046)	0.380*** (0.041)
apr	0.226*** (0.039)	0.213*** (0.060)	0.236*** (0.052)	0.354*** (0.040)
may	0.116** (0.049)	0.166** (0.067)	0.200*** (0.046)	0.239*** (0.040)
jun	0.062 (0.039)	0.072 (0.058)	0.133*** (0.038)	0.213*** (0.038)
jul	−0.166*** (0.040)	−0.023 (0.063)	−0.028 (0.040)	−0.029 (0.035)
aug	0.270*** (0.051)	0.324*** (0.069)	0.296*** (0.048)	0.283*** (0.045)
sep	0.408*** (0.039)	0.402*** (0.066)	0.359*** (0.030)	0.412*** (0.032)
oct	0.229*** (0.048)	0.334*** (0.065)	0.283*** (0.042)	0.285*** (0.040)
nov	0.187*** (0.039)	0.121** (0.055)	0.253*** (0.034)	0.263*** (0.035)
d_route	0.005*** (0.001)	0.004*** (0.001)	0.005*** (0.001)	0.005*** (0.0005)
dln_p_product	−1.254** (0.506)	1.635** (0.820)	−0.752** (0.340)	−0.673 (0.591)
dln_p_product_1	−0.688 (0.652)	−2.321*** (0.702)	0.012 (0.430)	−1.448** (0.643)
dln_p_product_2		−2.320*** (0.774)		−0.367 (0.699)
dln_expend	−0.651 (0.685)	−3.929*** (0.431)	−1.035 (0.784)	−1.498* (0.790)
cons_milk	−0.021 (0.051)			
cons_but		0.423 (0.730)		
cons_dairy			−0.059 (0.073)	
cons_curd				−0.057 (0.188)
crisis		0.014 (0.040)		
Constant	−0.099 (0.257)	−0.393 (0.316)	−0.096 (0.200)	−0.266*** (0.069)
Observations	94	70	94	92
R^2	0.928	0.887	0.906	0.923
Adjusted R^2	0.913	0.847	0.886	0.905
Residual Std. Error	0.076 (df = 77)	0.100 (df = 51)	0.081 (df = 77)	0.076 (df = 74)
F Statistic	61.892*** (df = 16; 77)	22.258*** (df = 18; 51)	46.326*** (df = 16; 77)	52.163*** (df = 17; 74)

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

5.2 Characteristics of customers

From the description of the sample, we expect certain results. For instance:

- In terms of gender, the probability that a person who orders on *Nákup z farmy* is a woman is higher than that is a man.
- Those who are used to frequent buying on the internet are more likely to place a higher number of orders .
- Those who do not visit specialised shops such as butchers frequently will more likely buy meat on NZF.
- The higher proportion of local food in the total food purchase will positively influence ordering on *Nákup z farmy*. Coefficients of *spend*76100, *spend*5675 are expected to be significant and positive related to the base group *spend*025.

5.2.1 Regular customer

Table 5.2 summarises results of four models with dependent variables *buy*, *more*1, *more*10 and *ln_av_spend*, respectively. In the first two models, we investigated, what factors influencing if a person places an order and return to buy. Following variables were significant:

Women are 10% more likely to place an order, and they are more likely to do so also repeatedly (more than once); it is usually a woman in a household, who takes care of food and cooking.

Retired people are 18% less likely to return and order again. Maybe they are discouraged by the higher price of farm products, or they are used to certain purchasing habits and do not want to change them. Access to the internet may also play a role.

People living in Prague are 14.5% more likely to try the e-shop and 11% more likely to return to place an order again. In a city there are usually not many possibilities to be self-sufficient with foodstuff, there, e.g. to grow

fruit or vegetables or to keep hens for eggs. As mentioned in the literature review (Syrovátková, 2016), Prague is the place where the development of AFNs and short food supply chains primarily began, and people are already used to the alternatives and online shopping.

The variable expenditure on local food has an expected effect such that people, who reported that they buy only (76-100%) or mostly (51-75%) local food are more likely to place an order compared to the base group. However, the difference between the base group 0-25% and 26-50% has not been observed.

The availability of local food decreases the likelihood of placing an order by more than 8%. People, for whom local food is easily available in their surroundings, might not need to order it online.

People who are affected by personal recommendation are more than 8% less likely to become customers. Those people might be more conservative towards trying new alternatives and discovering new ways. Alternatively, in their surroundings, there are no people who buy on *Nákup z farmy*, or people have a negative experience.

Nevertheless, the pseudo R^2, which is not higher than 0.10 in the first two models, suggests that the models do not explain the variability of regressand to a great extent, which indicates that sociodemographic variables do not have such explanatory power. Similar results were concluded by Cranfield *et al.* (2012).

Frequent customer

The explanatory power of the model *more*10 is higher (pseudo R^2=0.370). It seems that the characteristics of a regular consumer were captured more precisely. Still, most of the chosen explanatory variables do not have a significant effect on being a regular customer - e.g. gender, age, retired, Prague. Variable *spend*76100 has a significant effect. 'Locavores' are more likely to become regular customers as well as people who are used to online shopping. Moreover, we can evaluate the effect of different categories. The aim was to estimate which products turn people

into regular customers. Buying fruit and vegetables increases the probability of being a regular customer by 31.7%; dairy and meat by 15%.

Average spending per order

The average amount of money spent per one order depends on the number of products purchased in one order and the price of bought products. The result interpretation admits both possibilities.
The model's independent variables explain 29.2% ($R^2 = 0.292$) of variation in the dependent variable, F-test for overall significance implies that we can reject the null hypothesis on less than 1% significance level. In the model, 11 regressors are significant:

The coefficient of variable *meat* is statistically significant at 1% significance level, indicating that a customer purchasing meat tends to spend more on average by 53.7%. Meat is usually one of the most expensive products in a customer's purchase. Buying *dairy* also influences the average spending positively; however, the effect is lower compared to meat. In comparison to the probit model for $more10$, the coefficients of fruit and vegetables (*vege_fru)* have different signs. It suggests that people buy these products repeatedly but usually in less expensive orders. They may buy only those that do not cost so much compared to meat.

An interesting effect can be observed at the coefficient of *alter_shops*, that indicates frequent customer's buying on farmer's markets or in health food shops. People, who rather choose these alternative ways of shopping are likely to make more orders (coefficient is positive in the model $more1$); however, their average spending per order is estimated to be lower by 11.7%. These alternatives might be seen as complements to *Nákup z farmy*. If they visit farmer's markets, they buy many things there and do not need to buy so many products via the e-shop. In other words, people support the idea of alternative food networks, but they do not use NZF as the primary source of farm local products. In contrast, people who are used to frequent buying on the internet tend to spend more by 11.4%.

In terms of factors influencing purchasing decisions, people influenced by price spend less by 10%. People who are not affected by the design of packaging make, on average, more expensive orders. The packaging of farm products is not usually the main marketing channel.

People living in Prague spend more per order by 12%, which can be caused by higher income in Prague or by the same explanation as in the previous model.

The positive relationship between the average expenditure on food and average spending was observed, with higher weekly expenditure on food, the average spending per order also rises. More people in a household imply higher spending; they need a higher quantity of products. On the other hand, retired people spend less by 24.9%, the higher price of products can cause that they possibly cannot afford to pay so much, or usually, they live alone, so they do not need so many products per one order.

Variable $lifestyle$ also has a negative effect on average spending. People might prefer smaller orders, or they are fans of other alternative eating trends as vegan or vegetarian that do not go together with eating dairy and meat.

Since the model was estimated using the OLS method, it is necessary to verify the assumptions that are tested similarly to the previous OLS regressions. Multicollinearity was tested by VIF, where values did not surpass the value of 5. Subsequently, both Breusch-Pagan and White tests for heteroskedasticity cannot reject the null hypothesis (H_0: homoskedasticity). Thus, a robust estimation was not needed. Lastly, the Shapiro-Wilk test of normality cannot reject null hypotheses (H_0: residuals are normally distributed). Tests results are covered in Table B.4.

Table 5.2: Marginal effects in the probit models (regular customer)

	Dependent variable:			
	buy	more1	more	ln_av_spend
	probit	*probit*	*probit*	*OLS*
	(1)	(2)	(3)	(4)
gender	−0.104* (0.057)	−0.138** (0.061)	0.011 (0.048)	−0.060 (0.075)
age	0.002 (0.002)	0.004 (0.003)	0.003 (0.002)	0.005 (0.003)
household	0.039 (0.032)	0.010 (0.035)	−0.022 (0.030)	0.073** (0.029)
retired	−0.090 (0.104)	−0.180* (0.107)	−0.067 (0.075)	−0.249** (0.125)
Prague	0.145*** (0.043)	0.111** (0.049)	−0.007 (0.038)	0.128** (0.061)
ln_av_exp	0.024 (0.035)	0.020 (0.038)	0.014 (0.030)	0.084* (0.048)
spend2650	0.085* (0.049)	0.075 (0.057)	−0.036 (0.047)	−0.040 (0.074)
spend5175	0.135** (0.055)	0.132* (0.069)	−0.035 (0.056)	0.099 (0.092)
spend76100	0.149** (0.066)	0.227*** (0.079)	0.186** (0.087)	−0.071 (0.131)
avail_lf	−0.089* (0.046)	−0.088* (0.052)	0.002 (0.041)	−0.072 (0.064)
lifestyle	−0.013 (0.061)	−0.059 (0.066)	−0.013 (0.057)	−0.191** (0.088)
price	0.048 (0.047)	−0.001 (0.052)	−0.037 (0.041)	−0.109* (0.064)
recom	−0.086* (0.044)	−0.115** (0.049)	−0.073* (0.039)	0.073 (0.062)
pack_look	−0.037 (0.062)	−0.009 (0.068)	−0.009 (0.057)	−0.281*** (0.089)
supermarket	0.072 (0.047)	0.076 (0.052)	−0.013 (0.042)	−0.030 (0.067)
internet	−0.005 (0.049)	−0.044 (0.055)	0.071* (0.043)	0.114* (0.066)
alter_shops	0.020 (0.048)	0.135** (0.054)	0.035 (0.041)	−0.117* (0.066)
dairy			0.150** (0.065)	0.306** (0.119)
meat			0.157*** (0.060)	0.537*** (0.097)
vege_fru			0.317*** (0.043)	−0.120* (0.071)
years				−0.041 (0.026)
Constant				5.050*** (0.469)
Observations	373	373	373	280
Pseudo R^2 (R^2)	0.076	0.079	0.370	(0.292)
Adjusted R^2				0.234
Log Likelihood	−193.647	−226.818	−137.082	
LR Chi^2/ F Statistic	29.403	43.992	161.52	5.063*** (df =21; 258)
AUC	0.6902	0.6854	0.8818	
Note:				*p<0.1; **p<0.05; ***p<0.01

5.2.2 Buyers of different products

Table 5.3 displays the estimated models for determinants of purchasing different products. Pseudo R^2 for the models ranges between 0.13 and 0.48, the lowest for *curd*, the highest for *meat*. AUC is higher than 0.7 for all models.
Generally, the influence of factors determining the purchasing of a specific product is marginal. Only some independent variables are significant for some products:

Being a man decreases the probability of purchasing *butter*, *curd* and *fruit and vegetables* by 14%, 11.5% and 11.4%, respectively. Generally, men eat less vegetable; or women buy them for kids, especially fruit or curd.

More people in a household negatively affect the purchase of *butter* and *curd*. A similar pattern was observed by Schrock (2010) - having more than three children decrease the likelihood of buying organic milk.

It seems that there is no difference between most of the products purchased by retired people; only *eggs* are 14% less likely to be bought by them. The tendency of older people to keep hens is still high, or they may have own source (friends, neighbours) of home eggs and do not need to buy them.

Interestingly, people living in bigger towns, with more than 20 000 inhabitants less likely purchase some products, the coefficient of *town_bigger* is negative for dairy products and fruit and vegetables. It might be due to the possibilities where *Nákup z farmy* is available; the service is more available in small towns and villages.

Average expenditure on food negatively affects the likelihood of purchasing *milk* and *butter*. Those who spend more on food are less likely to purchase these products. They might have different eating habits and preferences.

More frequent buyers are more likely to buy dairy products - milk, curd and cheese. In contrast to other farm products, dairy products have a longer tradition on *Nákup z farmy*. Moreover, they are offered for the whole year compared to seasonal fruit and vegetables. Furthermore, they are perishables and spoil quickly so that people have to buy them more frequently.

*Spend*76100 affects significantly four products; locavores are more likely to buy fruit and vegetables, also dairy products - precisely milk, butter and curd.

Being influenced by recommendation increases the probability of purchasing *milk* and *yoghurt* by 10% but decrease *meat* by 6.5%. It is possible that people have a negative experience with buying meat or it has not been recommended them yet because their surrounding has not tried it yet.

People sticking to a healthy lifestyle are more likely to buy *milk* and *eggs*. In particular, buying free-range or cage-free eggs is one of the current topics. It can be assumed that people that express interest in a healthy lifestyle can be interested in this issue and would prefer eggs from local farmers with the known origin.

People buying foodstuff mainly in supermarkets are 9% more likely to buy butter and yoghurt on *Nákup z farmy*. Local dairy products, especially butter or yoghurt, are not usually offered by supermarkets so that people use NZF to indulge these products.

The significant negative effect of buying in specialised shops on buying *meat* has not been proven; the coefficient is not statistically significant. Surprisingly, it is significant and negative for *cheese*. The effect of the emergence of new specialised shops offering a variety of cheese might be reflected in this case.

Only variable *av_spend* is significant for all categories of products; undoubtedly, higher spending per order leads to a higher probability that customers include a given product in their purchase.

To conclude, our results of characteristics confirm some findings from the literature review. *Nákup z farmy* is not an exception among alternative food networks. NZF is preferred by women, being interested in and buying preferably local and organics; which is in line with the outcome of Zepeda (2009). In the Czech context, our results can be compared with the analysis of Pešková (2018), whose estimation revealed that regarding socio-demographic variables, age (+), income (+) and

self-employment (-) significantly affect the probability of frequent purchase of local food. In our analysis, the effect of age is also positive but not significant. Income can be approximate by the expenditure on food which has a positive effect on the average amount spent on NZF, but negative on buying milk and butter.

During the model estimation, many variables gathered from the questionnaire have not a significant effect on purchase, for example, age, number of children or level of education. Results of the questionnaire indicate that people who are connected with this project are better educated, the majority of respondents have secondary or tertiary education. In terms of purchase habits, they are interested in the quality and origin of purchasing product. Supermarkets remain the most frequent shopping place for most of the respondents.

Table 5.3: Marginal effects (buyers of different products)

	Dependent variable:							
	milk	butter	yoghurt	curd	cheese	meat	egg	vege_fru
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
gender	−0.087 (0.055)	−0.143*** (0.051)	−0.069 (0.055)	−0.115** (0.051)	−0.072 (0.053)	−0.017 (0.042)	−0.020 (0.056)	−0.114** (0.058)
household	−0.016 (0.021)	−0.061*** (0.021)	−0.016 (0.021)	−0.043** (0.021)	−0.017 (0.020)	0.00001 (0.017)	−0.019 (0.022)	0.005 (0.022)
retired	0.005 (0.071)	0.026 (0.072)	0.121 (0.074)	−0.042 (0.069)	−0.075 (0.069)	0.028 (0.052)	−0.143** (0.073)	0.049 (0.076)
Prague	−0.042 (0.050)	−0.051 (0.048)	0.045 (0.052)	−0.024 (0.049)	−0.042 (0.049)	0.036 (0.041)	0.080 (0.054)	0.003 (0.054)
town_bigger	−0.152** (0.063)	−0.133** (0.057)	−0.161*** (0.061)	−0.120** (0.056)	−0.093 (0.061)	0.048 (0.047)	−0.014 (0.066)	−0.158** (0.066)
ln_av_exp	−0.070** (0.036)	−0.076** (0.035)	0.001 (0.036)	−0.003 (0.035)	−0.026 (0.035)	0.003 (0.029)	0.017 (0.036)	−0.006 (0.038)
freq_month	0.028** (0.012)	0.005 (0.009)	0.015 (0.010)	0.018** (0.009)	0.025* (0.013)	−0.002 (0.009)	0.001 (0.010)	0.0003 (0.010)
spend2650	0.059 (0.052)	0.061 (0.052)	0.021 (0.054)	0.043 (0.053)	−0.015 (0.050)	0.001 (0.041)	0.060 (0.054)	0.098* (0.055)
spend5175	0.025 (0.069)	0.227*** (0.071)	0.019 (0.071)	0.088 (0.072)	0.023 (0.067)	−0.075 (0.056)	0.065 (0.071)	0.150** (0.072)
spend76100	0.207** (0.094)	0.307*** (0.097)	0.142 (0.103)	0.223** (0.107)	0.089 (0.097)	0.102 (0.081)	0.129 (0.104)	0.162 (0.100)
recom	0.100** (0.047)	0.005 (0.046)	0.100** (0.047)	−0.032 (0.046)	0.042 (0.045)	−0.065* (0.037)	0.001 (0.048)	−0.058 (0.050)
lifestyle	0.120* (0.064)	0.021 (0.064)	0.062 (0.065)	−0.031 (0.066)	0.039 (0.064)	−0.037 (0.053)	0.147** (0.064)	0.059 (0.070)
supermarket	0.063 (0.049)	0.098** (0.048)	0.092* (0.050)	−0.0005 (0.049)	0.020 (0.047)	−0.025 (0.039)	0.044 (0.051)	0.012 (0.052)
specialized_shops	−0.061 (0.048)	−0.069 (0.048)	0.034 (0.048)	−0.015 (0.047)	−0.103** (0.046)	0.018 (0.038)	−0.033 (0.049)	−0.044 (0.051)
av_spend	0.0005*** (0.0001)	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0003*** (0.0001)	0.001*** (0.0001)	0.001*** (0.00003)	0.0005*** (0.0001)	0.0004*** (0.0001)
Observations	373	373	373	373	373	373	373	373
Log Likelihood	−198.763	−198.322	−208.840	−200.468	−181.815	−127.826	−211.355	−223.374
LR Chi^2	119.34	88.121	85.811	59.9	141.36	233.74	91.789	70.273
Pseudo R^2	0.231	0.182	0.170	0.130	0.279	0.478	0.178	0.136
AUC	0.829	0.781	0.782	0.749	0.866	0.923	0.797	0.756

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

Chapter 6

Conclusion

Recent development and changes in eating habits and consumer preferences have led to the growth of alternative food networks (AFNs). This thesis offers qualitative analyses of the demand for farm dairy products and the combination of trends of supporting local farmers and purchasing foodstuff on the internet. Previous studies have examined different types of AFNs; the thesis brings another perspective. For this purpose, we utilise unique data from two interconnected projects, *Mléko z farmy* and *Nákup z farmy* (e-shop with farm products) that were founded by a small local farm producing dairy products.

The empirical section of the thesis consists of two main parts. Firstly, time series data of sales and prices of *Mléko z farmy* were used to estimate own-price elasticity of demand for the dairy products (specifically milk, butter, yoghurt and curd). Further, they were combined with data from the Czech Statistical Office to compare the development of sales with consumer trends in the Czech Republic, i.e. consumer prices, consumption of dairy products and expenditure of households on food.

The comparison of consumer prices of milk and butter (as recorded by CZSO) with the respective prices at the local farm shows that nominal prices of farm products are higher and grow steadily, whereas consumer prices fluctuate more. Own-price elasticity of demand was estimated to be elastic for milk, butter and curd and inelastic for yoghurt. The response to the change in price is not always

shown immediately. It may be caused by the fact that nominal prices of farm dairy products do not change very often.

The second aim of the thesis was to scrutinise characteristics of customers that buy local farm food and order it on the internet using the service of *Nákup z farmy* (NZF). We combined data from *Nákup z farmy* with the additional data from the questionnaire that was distributed to NZF's customers. Information about sociodemographics and buying preferences were asked. Subsequently, characteristics were examined in several models from different perspectives. Factors affecting the likelihood that a person places an order, returns to buy again and becomes a regular customer were estimated in the probit models. These were further compared with the OLS model estimating effects that influence the average amount of money spent per order. Additionally, determinants of buying specific products were also analysed.

Results indicate that women living in Prague buying mostly local and organic food are the dominant group of customers. As for shopping places, people who are used to the frequent ordering of foodstuff on the internet are more likely to be regular customers of NZF, and their orders are on average more expensive. Likewise, people visiting alternative shopping places as organic, farmer's shops or farmer's markets are more likely to make more than one order; however, they make on average less expensive orders. The effects that significantly influence buying specific products are marginal and vary across estimated models. Nevertheless, estimated characteristics and preferences of consumer mostly coincide with the results of studies concerning other types of alternative food networks.

This work contributes to existing knowledge of AFNs by providing one of the first estimates of local-food demand using Czech data and unique data set. However, the data structure might be the main limitation of this study. Further analysis of demand would require a longer period of time and different type of data, for example, scanner panel data with sociodemographic information of individual consumers, to be able to estimate income and cross-price elasticity of demand for local and organic or conventional food. Available data from the questionnaire provides elementary information. More in-depth analysis and psychological point of view would be needed to understand consumer decision making better. Moreover, the study was conducted at the beginning of the coronavirus pandemic. Even though

the part of data description considers this period and observes the first changes in consumer preferences towards online buying, further comparison of changes in purchasing decisions would be interesting.

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Appendix A

Questionnaire

Questionnaire was created using Google Forms and respondents were asked for answering questions with the following structure:

A.1 English version

1. Gender
   - male
   - female
2. Age (years)
3. Education
   - none
   - primary
   - secondary
   - tertiary
4. Occupation
   - employee
   - student
   - parental leave
   - homemaker
   - business person
   - retired
   - unemployed
   - other

5. Where do you permanently live (by population)?

   - village (<3000)
   - town (3001-20000)
   - town (20001-90000)
   - town (>90 000 inhabitants)
   - Prague

6. Evaluate the following places based on how often you buy food there. Use scale from 0 (never), 1 (the least often) to 5 (the most often):

   - supermarkets
   - small and convenience stores
   - farmer's markets, health food shops
   - internet
   - specialised shops (butchers, bakers,...)

7. For how many people do you usually buy food (how many people live in your household)? (count)

8. How many of them are younger than 18 years of age? (count)

9. How much money does your household usually weekly spend on food (excluding spending at restaurants)? (amount in CZK)

10. Do the following items affect your food purchasing decisions?
    (Possible answers: Yes/ Rather yes/ Rather no/ No)

    - price
    - quality
    - freshness
    - the origin of product
    - supporting local producers
    - personal recommendation
    - package size

- packaging design
- promotion

11. Which products do you mostly order on *Nákup z farmy*?

- dairy products
- meat
- fruits and vegetables
- products for animals
- other products (eggs, pastry, beverages,...)
- I have not used *Nákup z farmy* yet

12. Why have not you used *Nákup z farmy* yet? (Open question)

13. Have you ever used *Nákup z farmy* for buying dairy products?

- yes, for several times
- yes, once
- not yet

14. Is local and organic food easily available in your surrounding?

- yes
- rather yes
- rather no
- no

15. What proportion of your total food purchase does local and organic food form?

- 0-25%
- 26-50%
- 51-75%
- 76-100%

16. Do you adhere to the principles of a healthy lifestyle?

- yes
- rather yes
- rather no
- no

17. Are you interested in the approach of food producers to the protection of the environment?

- yes
- rather yes
- rather no
- no

18. Your comments (Open question)

A.2 Czech version

Dobrý den,
jmenuji se Barbora Jakubová a studuji Institut ekonomických studií na Fakultě sociálních věd Univerzity Karlovy. V současné době provádím průzkum ve spolupráci s Nákupem z farmy pro účely mé bakalářské práce. Ráda bych Vás požádala o vyplnění tohoto dotazníku. Zabere Vám maximálně 5 minut Vašeho času.
Získané informace jsou důvěrné a budou použity pouze pro účely mé bakalářské práce.
Děkuji za spolupráci.
Barbora Jakubová
*Povinné pole

E-mailová adresa: *
Slouží ke zvýšení důvěryhodnosti prováděného výzkumu a nebude využita pro žádné reklamní či jiné účely.

1) Jste: *
žena
muž

2) Jaký je Váš věk? *

3) Jaké je Vaše nejvyšší dosažené vzdělání? *
bez vzdělání nebo neúplné základní vzdělání
základní
střední (s maturitou či bez)
vysokoškolské (včetně vyššího odborného)

4) V současné době jste: *
zaměstnanec
podnikatel
student
nezaměstnaný
v důchodu
v domácnosti
na mateřské dovolené
Jiné:

5) Kde trvale bydlíte? *
vesnice (méně než 3000 obyvatel)
malé město (3 001 - 20 000 obyvatel)
střední město (20 001 - 90 000 obyvatel)
větší město (více než 90 000 obyvatel)
hlavní město Praha

6) Označte následující místa podle toho, jak často v nich nakupujete potraviny: *

	0 (nikdy)	1 (nejméně často)	2	3	4	5 (nejčastěji)
- supermarkety						
- specializované obchody (řeznictví, pekařství, ...)						
- malé obchody/večerky						
- obchody se zdravou výživou, farmářské trhy						
- internet						

7) Pro kolik osob většinou nakupujete (počet osob v domácnosti včetně Vás)? *

8) Kolik osob je mladších 18 let? *

9) Jakou částku týdně přibližně vydá celá Vaše domácnost na potraviny (bez útrat v restauračních zařízení)? (Kč) *

10) Ovlivňují následující položky Váš výběr při nákupu potravin? *

	ano	spíše ano	spíše ne	ne
- cena				
- kvalita (složení)				
- čerstvost				
- původ výrobku				
- podpora lokálních výrobců				
- doporučení od známých				
- velikost balení výrobku				
- atraktivita obalu				
- reklama				

11) Službu Nákup z farmy využíváte nejvíce k nákupu: *
mléčných výrobků
masa a uzenin
ovoce a zeleniny
produktů pro zvířata
jiných produktů (vajec, pečiva, nápojů, ...)
zatím jsem službu nevyužil/a

12) Využil/a jste někdy Nákup z farmy k zakoupení mléčných výrobků? *
ano, již několikrát
ano, jednou
ne

13) Službu Nákup z farmy jsem zatím nevyužil/a, protože:

14) Jsou ve Vašem okolí lokální či bio potraviny snadno dostupné? *
ano
spíše ano
spíše ne
ne

15) Jak velkou část ve Vašem košíku přibližně zaujímají lokální či bio potraviny nebo výrobky od malých producentů? (%) *
0-25%
26-50%
51-75%
76-100%

16) Dodržujete zásady zdravého životního stylu? *
(pohyb, vhodné potraviny, relaxace)
ano
spíše ano
spíše ne
ne

17) Zajímáte se o přístup výrobců potravin k ochraně životního prostředí? *
(recyklovatelné obaly, možnost nákupu bez obalu, zacházení se zvířaty a půdou, ...)
ano
spíše ano
spíše ne
ne

18) Prostor pro Vaše komentáře:

Appendix B

Tables

Table B.1: Descriptive statistics: Variables before adapting for the time series models

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
q_milk	96	37,443.550	19,701.580	4,963	20,701	49,734.2	88,353
q_curd	95	1,755.524	937.803	246.000	997.875	2,233.625	4,181.000
q_yoghurt	96	5,557.901	2,718.546	860	3,426.5	7,296.8	13,551
q_butter	73	1,065.442	519.392	57.750	669.500	1,458.250	2,367.250
route	96	159.927	40.692	36	132.5	192.2	210
con_milk	96	4.865	0.107	4.667	4.816	4.911	5.042
con_curd	96	0.329	0.040	0.283	0.296	0.369	0.392
con_butter	96	0.431	0.015	0.413	0.423	0.438	0.458
con_dairy	96	2.754	0.101	2.608	2.688	2.829	2.908
expenditure	96	29,698.440	1,830.788	26,782.920	28,142.900	31,278.500	33,010.940
p_butter	73	278.378	9.100	262.906	272.547	280.612	296.935
p_curd	95	129.888	3.264	124.514	127.384	132.261	137.773
p_milk	96	27.406	0.703	26.042	26.839	28.019	28.703
p_yoghurt	96	45.738	2.065	41.667	43.989	47.421	48.975
crisis	96	0.094	0.293	0	0	0	1

Table B.2: Descriptive statistics: Variables used in the time series models

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
dln_q_milk	94	−0.022	0.258	−0.634	−0.151	0.152	0.695
d_route	94	−0.426	25.701	−86	−14.8	14	64
dln_p_milk	94	−0.0005	0.012	−0.027	−0.007	0.006	0.050
dln_p_milk_1	94	−0.0004	0.012	−0.027	−0.007	0.006	0.050
dln_expend	94	0.001	0.013	−0.027	−0.006	0.007	0.062
con_milk	94	4.869	0.104	4.667	4.830	4.942	5.042
dln_q_butter	70	−0.019	0.256	−0.456	−0.177	0.111	0.787
d_route	70	−1.057	27.063	−86	−16	13.8	67
dln_p_butter	70	0.0001	0.015	−0.049	−0.006	0.006	0.083
dln_p_butter_1	70	0.001	0.014	−0.027	−0.006	0.006	0.083
dln_p_butter_2	70	0.001	0.014	−0.027	−0.005	0.006	0.083
con_but	70	0.434	0.015	0.417	0.425	0.450	0.458
crisis	70	0.129	0.337	0	0	0	1
dln_expend	70	0.0001	0.024	−0.162	−0.005	0.007	0.062
dln_q_yoghurt	94	−0.027	0.242	−0.584	−0.132	0.112	0.602
d_route	94	−0.426	25.701	−86	−14.8	14	64
dln_p_yoghurt	94	0.0003	0.015	−0.027	−0.007	0.006	0.086
dln_p_yoghurt_1	94	0.0004	0.015	−0.027	−0.007	0.006	0.086
dln_expend	94	0.001	0.013	−0.027	−0.006	0.007	0.062
con_dairy	94	2.755	0.102	2.608	2.646	2.854	2.908
dln_q_curd	92	−0.024	0.247	−0.641	−0.120	0.094	0.620
d_route	92	−0.641	25.743	−86	−15.2	14	64
dln_p_curd	92	−0.001	0.011	−0.027	−0.007	0.006	0.034
dln_p_curd_1	92	−0.001	0.011	−0.027	−0.007	0.006	0.034
dln_p_curd_2	92	−0.001	0.011	−0.027	−0.007	0.006	0.034
dln_expend	92	0.001	0.013	−0.027	−0.006	0.007	0.062
con_curd	92	0.331	0.040	0.283	0.300	0.375	0.392

Table B.3: Augmented Dickey-Fuller test

Variable	ADF test with constant and trend			
	Level		First difference	
	ADF	p-value	ADF	p-value
ln_q_milk	-0.173	0.99	-5.158	0.000
ln_p_milk	-2.733	0.226	-7.256	0.000
ln_q_butter	0.007	0.99	-3.16	0.092
ln_p_butter	-2.96	0.14	-6.129	0.000
ln_q_yoghurt	2.24	0.99	-4.394	0.002
ln_p_yoghurt	-2.46	0.347	-7.171	0.000
ln_q_curd	-1.017	0.94	-6.439	0.000
ln_p_curd	-2.737	0.22	-7.117	0.000
route	0.393	0.99	-6.053	0.000
ln_expend	-2.547	0.305	-4.51	0.001

Table B.4: Summary table of tests for the models estimated by OLS

model	B.-P.	p-value	White	p-value	B.-G.	p-value	Shap.-Wilk	p-value	VIF
milk	10.206	0.8556	0.2688	0.874	13.655	0.000	0.9836	0.289	2.549
butter	14.929	0.6668	0.200	0.904	5.400	0.020	0.9855	0.5954	2.307
yoghurt	17.712	0.341	0.739	0.691	3.985	0.046	0.9918	0.7789	2.521
curd	9.053	0.939	0.169	0.919	4.9896	0.026	0.9806	0.1873	2.550
ln_av_spend	22.071	0.3954	0.437	0.804	-	-	0.9934	0.2585	1.324

VIF: mean values

Table B.5: Consumer price index: Food and non-alcoholic beverages

	1	2	3	4	5	6	7	8	9	10	11	12
2011	87.2	87.5	87.7	88.1	89.9	88.5	88.3	87.1	87.3	88	89.4	91.2
2012	93.2	93.6	95.4	93.9	94.7	96	94.5	93.5	93.6	94.4	94.7	96
2013	98.6	98.3	99.2	98.6	99.3	102	99.8	98.7	98	97.7	98.4	100.6
2014	102.4	102.4	102.8	101.9	101.8	100.9	100.6	100	100.1	100.2	99.9	100.2
2015	100.9	100.8	100.8	101.1	101.5	101.5	99.6	98.8	99.5	99.2	98.5	97.6
2016	98.9	99.2	99.2	99.5	99	98.4	98.9	98.3	98.3	98	100.1	100.8
2017	102.4	103.8	103.6	103.1	103.5	103.7	104.6	103.8	103.9	105.6	105.8	106.4
2018	107	106.2	105.6	105	106	106.5	104.5	104.4	105.3	105.8	104.5	105.8
2019	106.8	107.6	107.6	106.9	109	109.4	108.8	108.5	107.9	108.8	110.1	110.9

Consumer price index according to COICOP/ECOICOP - basic index, average of year 2015=100
Source: CZSO (2019a)

Table B.6: Descriptive statistics: Variables used in the probit models

Variable	Mean	St. Dev.
buy	0.751	0.433
more1	0.627	0.484
more10	0.271	0.445
ln_av_spend	2.740	0.240
milk	0.512	0.501
butter	0.354	0.479
yoghurt	0.405	0.492
curd	0.308	0.462
cheese	0.590	0.493
meat	0.635	0.482
chicken	0.477	0.500
egg	0.458	0.499
vege_fru	0.493	0.501
gender	0.239	0.427
age	46.231	12.869
ln_av_exp	2.906	0.294
household	2.879	1.231
children	0.791	0.981
retired	0.131	0.338
mater	0.126	0.332
tertiary	0.558	0.497
Prague	0.383	0.487
town_bigger	0.198	0.399
avail_lf	0.665	0.473
spend025	0.343	0.475
spend2650	0.397	0.490
spend5175	0.196	0.397
spend76100	0.064	0.246
recom	0.606	0.489
price	0.614	0.487
pack_look	0.153	0.360
pack_size	0.466	0.500
lifestyle	0.847	0.360
internet	0.295	0.457
supermarket	0.504	0.501
alter_shops	0.574	0.495
specialized_shops	0.665	0.473
orders	16.263	61.299
dairy	0.697	0.460
years	2.408	1.573
freq_month	1.089	2.449
av_spend	476.005	404.344

N = 373; ln_av_spend (N=270)

Table B.7: Results of the probit models (regular customer)

	Dependent variable:			
	buy	more1	more10	ln_av_spend
	probit	*probit*	*probit*	*OLS*
	(1)	(2)	(3)	(4)
gender	−0.329* (0.176)	−0.381** (0.168)	0.058 (0.232)	−0.060 (0.075)
age	0.010 (0.008)	0.012 (0.008)	0.014 (0.010)	0.005 (0.003)
household	0.025 (0.067)	−0.016 (0.063)	−0.074 (0.087)	0.073** (0.029)
retired	−0.383 (0.312)	−0.546* (0.290)	−0.345 (0.367)	−0.249** (0.125)
Prague	0.507*** (0.162)	0.319** (0.147)	−0.026 (0.184)	0.128** (0.061)
ln_av_exp	0.071 (0.119)	0.054 (0.111)	0.067 (0.144)	0.084* (0.048)
spend2650	0.290 (0.178)	0.219 (0.168)	−0.181 (0.226)	−0.040 (0.074)
spend5175	0.516** (0.241)	0.398* (0.222)	−0.167 (0.275)	0.099 (0.092)
spend76100	0.626* (0.359)	0.767** (0.343)	0.847** (0.410)	−0.071 (0.131)
avail_lf	−0.293* (0.169)	−0.248 (0.156)	0.009 (0.195)	−0.072 (0.064)
lifestyle	−0.073 (0.213)	−0.185 (0.202)	−0.058 (0.270)	−0.191** (0.088)
price	0.156 (0.160)	−0.004 (0.150)	−0.174 (0.191)	−0.109* (0.064)
recom	−0.302* (0.160)	−0.338** (0.148)	−0.351* (0.190)	0.073 (0.062)
pack_look	−0.129 (0.201)	−0.032 (0.194)	−0.049 (0.275)	−0.281*** (0.089)
supermarket	0.245 (0.163)	0.219 (0.153)	−0.061 (0.200)	−0.030 (0.067)
internet	−0.041 (0.169)	−0.132 (0.157)	0.339* (0.198)	0.114* (0.066)
alter_shops	0.097 (0.162)	0.392*** (0.152)	0.165 (0.199)	−0.117* (0.066)
dairy			0.784** (0.400)	0.306** (0.119)
meat			0.825** (0.367)	0.537*** (0.097)
vege_fru			1.497*** (0.232)	−0.120* (0.071)
years				−0.041 (0.026)
Constant	−0.402 (1.011)	−0.464 (0.951)	−3.590** (1.438)	5.050*** (0.469)
Observations	373	373	373	280
Pseudo R^2 (R^2)	0.076	0.079	0.370	(0.292)
Adjusted R^2				0.234
Log Likelihood	−193.647	−226.818	−137.082	
LR Chi^2/ F Statistic	29.403	43.992	161.52	5.063*** (df =21; 258)
AUC	0.6902	0.6854	0.8818	
Note:				*p<0.1; **p<0.05; ***p<0.01

Table B.8: Results of the probit models (buyers of different products)

	Dependent variable:							
	milk	butter	yoghurt	curd	cheese	meat	egg	vege_fru
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
gender	−0.280 (0.178)	−0.494*** (0.189)	−0.219 (0.176)	−0.398** (0.188)	−0.247 (0.180)	−0.084 (0.210)	−0.063 (0.174)	−0.331* (0.170)
household	−0.053 (0.068)	−0.203*** (0.072)	−0.050 (0.068)	−0.143** (0.071)	−0.061 (0.070)	0.00003 (0.085)	−0.060 (0.067)	0.014 (0.065)
retired	0.015 (0.230)	0.086 (0.238)	0.378 (0.231)	−0.141 (0.241)	−0.257 (0.233)	0.143 (0.266)	−0.448* (0.238)	0.144 (0.225)
Prague	−0.138 (0.165)	−0.173 (0.166)	0.140 (0.160)	−0.081 (0.164)	−0.149 (0.172)	0.178 (0.204)	0.243 (0.161)	0.009 (0.158)
town_bigger	−0.492** (0.208)	−0.470** (0.215)	−0.525** (0.214)	−0.423** (0.216)	−0.317 (0.208)	0.248 (0.243)	−0.043 (0.202)	−0.462** (0.199)
ln_av_exp	−0.229* (0.118)	−0.253** (0.119)	0.004 (0.115)	−0.011 (0.115)	−0.090 (0.121)	0.017 (0.145)	0.053 (0.112)	−0.016 (0.110)
freq_month	0.092** (0.041)	0.018 (0.029)	0.047 (0.032)	0.061** (0.030)	0.086* (0.045)	−0.011 (0.046)	0.002 (0.029)	0.001 (0.029)
spend2650	0.193 (0.171)	0.205 (0.178)	0.066 (0.170)	0.142 (0.177)	−0.051 (0.175)	0.007 (0.205)	0.184 (0.168)	0.288* (0.164)
spend5175	0.082 (0.224)	0.721*** (0.228)	0.060 (0.223)	0.283 (0.223)	0.078 (0.233)	−0.380 (0.283)	0.198 (0.217)	0.437** (0.215)
spend76100	0.690** (0.337)	0.968*** (0.322)	0.434 (0.314)	0.672** (0.313)	0.314 (0.351)	0.527 (0.433)	0.394 (0.319)	0.481 (0.311)
recom	0.325** (0.153)	0.018 (0.154)	0.317** (0.151)	−0.104 (0.152)	0.145 (0.158)	−0.325* (0.187)	0.002 (0.149)	−0.168 (0.146)
lifestyle	0.394* (0.215)	0.071 (0.219)	0.198 (0.212)	−0.101 (0.212)	0.134 (0.220)	−0.189 (0.274)	0.464** (0.214)	0.173 (0.205)
supermarket	0.207 (0.161)	0.333** (0.166)	0.291* (0.160)	−0.002 (0.161)	0.068 (0.165)	−0.124 (0.196)	0.135 (0.157)	0.034 (0.153)
specialized_shops	−0.199 (0.155)	−0.230 (0.156)	0.106 (0.154)	−0.049 (0.156)	−0.356** (0.160)	0.088 (0.190)	−0.100 (0.151)	−0.128 (0.148)
av_spend	0.002*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.002*** (0.0003)	0.004*** (0.0004)	0.001*** (0.0002)	0.001*** (0.0002)
Constant	0.419 (0.946)	1.051 (0.954)	−1.460 (0.931)	−0.373 (0.936)	0.228 (0.970)	−1.049 (1.157)	−1.560* (0.911)	−0.572 (0.891)
Observations	373	373	373	373	373	373	373	373
Log Likelihood	−198.763	−198.322	−208.840	−200.468	−181.815	−127.826	−211.355	−223.374
LR Chi^2	119.34	88.121	85.811	59.9	141.36	233.74	91.789	70.273
Pseudo R^2	0.231	0.182	0.170	0.130	0.279	0.478	0.178	0.136
AUC	0.829	0.781	0.782	0.749	0.866	0.923	0.797	0.756

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