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Organic food consumption as an example of pro-environmental behavior: application of the theory of planned behavior

(Spotřeba biopotraviny jako příklad proenvironmentálního chování: aplikace teorie plánovaného chování)

Dissertation

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I dedicate this work to my parents and to Bára.

Abstract

This work has two objectives. At the empirical level, it seeks to investigate the role of attitudinal, normative and other factors influencing the intention of Czech consumers to purchase organic food, specifically by exploiting the theoretical framework of the theory of planned behavior. On a more theoretical level, this thesis seeks to extend the theory of planned behavior by including descriptive norms in its framework and subjecting such extended theory to an empirical test. The dissertation proceeds in seven chapters. The first three chapters are introductory in the sense that they discuss the motivation for the present work, provide definitions of organic food, and attempt to establish the link between the choice of organic food, as an example of individual pro-environmental behavior, on the one hand, and processes that lead to environmental degradation on the other. Chapter 4 introduces the theory of planned behavior, its assumptions and empirical applications in various domains, including organic food consumption. The empirical data from a small (N=253) yet country-representative survey of the general adult population are described in Chapter 5, together with the method of structural equation modeling that is primarily used to analyze them. In Chapter 6 we test four empirical models of intention to purchase organic food formulated using structural equation modeling. Our analysis demonstrates that the explanatory power of the model, with respect to prediction of intention, is quite high. We find that attitudes and subjective norms are strong predictors of the intention to consume organic food, while the effect of perceived behavioral control on the intention is usually very low and statistically insignificant. Our analysis reveals that the inclusion of descriptive norms in TPB and also introduction of household's past behavior increases its predictive power of the model and that the two variables have a relatively strong effect on intention. Theoretical and practical implications of the work are discussed in concluding chapter.

Keywords: organic food consumption, theory of planned behavior, structural equation modeling, proenvironemntal behavior

ABSTRAKT

Tato práce má dva cíle: jednak usiluje, s využitím teorie plánovaného chování, o vysvětlení záměru českých spotřebitelů nakupovat biopotraviny, a jednak se snaží o rozšíření teorie plánovaného chování o indikátory deskriptivních norem a minulého chování a následně tato rozšíření empiricky testuje. Disertace je členěna do sedmi kapitol. První tři kapitoly jsou úvodní a představují čtenáři motivaci, která podnítila tuto práci, diskutují definici biopotravin, a také se pokoušejí ukázat na vztah mezi spotřebou biopotravin jako příkladem individuálního proenvironmentálního chování a objektivními procesy vedoucími k poškozování životního prostředí. Kapitola čtyři představuje teorii plánovaného chování, její předpoklady a její využití v různých oblastech výzkumu, včetně výzkumu spotřeby biopotravin. Empirická data z malého (N=253), avšak reprezentativního spotřebitelského šetření české populace, jsou představeny v kapitole 5, společně s metodou strukturního modelování, která je hlavní metodou využitou k jejich analýze. V kapitole 6 jsou popsány výsledky testování čtyř empirických modelů záměru nakupovat biopotraviny odvozených z teorie plánovaného chování; tyto modely jsou testovány s využitím teorie plánovaného chování. Výsledky analýzy ukazují, že explanační síla empirických modelů záměru nakupovat biopotraviny je relativně vysoká. Zjišťujeme, že postoje a subjektivní normy jsou silnými faktory záměru nakupovat biopotraviny, zatímco efekt vnímané kontroly chování je slabý a statisticky nevýznamný. Naše analýza také ukazuje, že zařazení deskriptivních norem a dřívějšího spotřebitelského chování domácnosti do modelu teorie plánovaného chování značně zvyšuje vysvětlenou variabilitu záměru nakupovat biopotraviny a že obě tyto proměnné mají na záměr nakupovat biopotraviny silný vliv. V závěru práce jsou diskutovány teoretické a praktické implikace těchto zjištění.

Klíčová slova: spotřeba biopotravin, teorie plánovaného chování, strukturní modelování, proenvironmentální chování

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LIST OF ABBREVIATIONS

CFI - Comparative fit index

DBO model - *desires-beliefs-opportunities* model

EEA - European Environmental Agency

EV model/theory - expectancy-value model/theory

GLS – generalized least square

GMO - genetically modified organism

GWP - global warming potential

LCA - life-cycle analysis

ML – maximum likelihood

PBC - perceived behavioral control

RCT – rational choice theory

RMSEA - Root Mean Square Error of Approximation

SEM - structural equation modeling

TLI - Tucker-Lewis index

TPB - theory of planned behavior

TRA - theory of reasoned action

INTRODUCTION

This work has two objectives. At the empirical level, it seeks to investigate the role of attitudinal, normative and other factors influencing the intention of Czech consumers to purchase organic food, specifically by exploiting the theoretical framework of the theory of planned behavior. On a more theoretical level, this thesis seeks to extend the theory of planned behavior by including descriptive norms and past behavior in its framework and subjecting such extended theory to an empirical test.

Empirical literature that deals with factors of organic food consumption has two notable characteristics: 1. it is often driven by the practical concerns of producers, retailers and marketers, rather than by a theoretical understanding of consumption behavior; 2. when theoretical models are applied, they are usually suitable for application to specific examples of consumption behavior only and they do not have ambitions towards theoretical generalizability. The current situation, where a myriad of models used to explain organic food consumption exist, is somewhat unfortunate because it hinders comparison, accumulation and generalization of their results.

The theory of planned behavior is one of the most frequently used theories of human behavior applied in empirical research across a variety of social science disciplines. This theory has been tested in many empirical applications in different contexts, including an explanation of organic food consumption. The superiority of the theory of planned behavior *vis-à-vis* other behavioral theories lies in the fact that this theory is informed by ancillary theories of human behavior, yet it remains parsimonious and provides a good operational definition of its constructs. Indeed, as in other empirical applications, the theory of planned behavior retains a high predictive power within the area of organic food consumption. Our main motivation for application of the theory of planned behavior to an understanding of organic food consumption is to fill in the gap that exists in our knowledge of determinants of organic food consumption in the Czech Republic, above and beyond existing empirical studies.

Having stressed the strengths of the theory of planned behavior, we also have to acknowledge some of its weaknesses. Several studies have pointed out that the theory of planned behavior should incorporate such factors as personal norms, values, and some other factors in order to account properly for pro-environmental behavior, including also the consumption of organic food. These suggestions are inspired by existing alternative theories used with success specifically for the explanation of pro-environmental behavior, such as Value-Belief-Norm theory and norm-activation theory. The second aim of this thesis is specifically to examine whether an extension of the theory of planned behavior with the concept of personal norms is supported by empirical evidence. Structural equation modeling, exploiting the data from a consumer survey conducted in the Czech Republic in 2010, is used to empirically test this extension of the theory of planned behavior.

Our interest in organic food consumption is motivated by wider concerns that social sciences should play a more prominent role in the solving of environmental problems. Mankind is currently facing many local environmental problems such as pollution of water and air, as well as global environmental problems, of which global climate change, ozone layer depletion and loss of biodiversity are those with the highest potential of adverse effects. All these environmental problems can be, in the end, traced to human activities. What is even more important is some of the measures proposed to solve these problems particularly rely on the expertise of social sciences in changing human behavior which is harmful to the environment.

In any case, it would be a mistake to blame individuals in their role of consumers as being solely responsible for environmental degradation and it would be even more a mistake trying to find cures to current environmental problems relying only on an analysis of the factors that drive individual consumption. As a matter of fact, most environmental problems are caused by the interplay of aggregated individual behavior and institutional behavior. Indeed, even if we look at the area where the sovereign decision-making of consumers is important, such as in personal transportation, we immediately notice the immense influence of structural factors that set limits on and influence individual decision-making. Finally, the assumption of sovereignty of consumers may be a useful simplification of reality, but careful exploration of consumption behavior shows that it is only in part truly motivated and that mechanisms of habituation, routinization and unconscious imitation are all important ingredients of any consumption activity.

To put the problem more technically, it is estimated that household consumption activities in such countries as the Czech Republic are directly, but mostly indirectly responsible for about one third of all adverse environmental effects caused by human activity in these countries. Obviously consumption of food is an essential human need that cannot be fully avoided. Still, however, the negative effects of food consumption can be lowered somewhat; three strategies seem to be particularly efficient in this respect: minimization of a meat-based diet, minimization of the share of air-transported food, and a choice of food produced in more environmentally-friendly production systems such as organic agriculture. Thus, a better understanding of the factors that drive organic food consumption in the Czech Republic is tiny, yet a non-negligible contribution to the solution of environmental problems.

The novelty of the present study consists in two points. Firstly, this is one of the few existing studies which has applied the theory of planned behavior to an explanation of the intention to consume organic food in the Czech Republic and the first such study which uses a representative sample of the population, and also the first study which makes use of structural equation modeling, which enables it to estimate models with latent variable and relatively elaborate measurement models for some of the TPB variables. Secondly, this study is the first ever, as far as we are aware, which tests the extension of the theory of planned behavior with descriptive norms in the context of organic food consumption.

The thesis proceeds as follows. The first chapter describes the background and motivation of this work by showing how the activities of individuals, particularly in their role of consumers, are linked to environmental problems. In addition, this chapter also makes clear that it would be mistaken to focus solely on the role of individual consumers and, indeed, that such an excessive focus could be even counter-productive in the solution of environmental problems.

The second chapter provides a definition of what constitutes organic food and how the organic movement came into being. We base the definition of organic food used in this work on the legal definition of organic products as specified in both legal documents of the European Union and Czech legal documents. For this reason, and also because legal rules play such an important role in the operation of organic agriculture and organic food production, we devote a relatively large section of this chapter to a legal definition of organic food and organic food labeling.

Chapter three portrays the link between environmental problems and organic food consumption. This chapter exploits, among others, empirical results arising from studies that analyze the environmental burden of the life-cycle of conventional and organic food. This overview of the literature shows that there is not enough empirical evidence, especially in the case of organic food available on the Czech market, to claim that organic food is always more environmentally friendly than its conventional counterpart. In some cases, the link between organic food consumption and protection of the environment may actually very feeble and, in some cases, even non-existent. Organic food consumption can be viewed as environmentally-friendly behavior only under certain conditions. In any case, an organic system of food production also delivers other benefits closely related to environmental protection, such as a provision of higher standards of animal welfare.

Chapter four introduces the theory of planned behavior and discusses its applications in different fields, including organic food consumption. In addition, this chapter also discusses extensions of the theory of planned behavior aiming towards a better explanation of organic food consumption. Particular attention is paid in this chapter to the inclusion of personal norms within the framework of the theory of planned behavior.

Chapter five describes the method used to test the empirical model derived from the theory of planned behavior and extended by inclusion of personal norms against the data from a consumer survey. Detailed description of the data and measurement instrument is also covered in this chapter. Last but not least, this chapter also contains a discussion of statistical methods, namely structural equation modeling, used to test the model and its limitations in testing of the theoretical causal models.

Chapter six presents the empirical results of this work. These results are of two kinds. Firstly, we present findings regarding the relative effect of factors of organic food consumption, namely effect of attitudes, social and personal norms, and perceived behavioral control on the intention to purchase organic food. Secondly, we assess the empirical adequacy of the extended the theory of planned behavior for an explanation of the intention to consume organic food. Through consequent testing of four empirical models, we examine particularly extension of the theory of planned behavior with descriptive norms and past purchase behavior of individuals and households.

Chapter seven discusses the implications of our findings. We discuss both the practical relevance of our findings for the understanding of the factors of organic food consumption in the Czech Republic and we also discuss the implications of our work for the theory of planned behavior. In addition, we put forward suggestions for future research regarding determinants of pro-environmental behavior. We specifically want to point to some potentially very interesting areas of application of the theory of planned behavior to an explanation of pro-environmental behavior.

CHAPTER 1: ORGANIC FOOD CONSUMPTION AND ENVIRONMENTAL PROBLEMS

When urged to state their motives for consumption of organic food, consumers in the Czech Republic (Ščasný, Urban, & Zvěřinová, 2012) as well as abroad (Boccaletti, 2008) often mention environmental concerns as their motives (albeit by no means the most important ones) for the purchase of organic food. Indeed, the environmental friendliness of organic food consumption is recognized by some experts (Scialabba & Hattam, 2002) and also acknowledged in the legal framework that regulates production and processing of organic food in the Czech Republic (see section 2.2 for discussion)[1].

However, it is not trivial to show how the consumption of food relates to environmental protection. Indeed, as we demonstrate in Chapter 3, environmental friendliness of organic food is not fully established in the empirical literature and is frequently put into question by its critics. Besides the controversy surrounding the environmental profile of organic food, there is also the deeper question of whether environmental problems can be solved through the actions of isolated individuals in their capacity as consumers. Some suggest that the contention that the pro-environmental behavior of individuals contributes to the solution of environmental problems is counter-productive, because it removes responsibility from corporations and causes what is termed "individualization of responsibility",

[1] It is interesting to notice that organic farming is reffered to as "ecological agriculture" in the Czech legal documents.

which effectively precludes the solution of environmental problems through more profound structural changes in the system of production and consumption (Maniates, 2001).

The controversies that surround environmental friendliness and soundness of organic food consumption are common to most types of pro-environmental behavior and therefore it may be useful to take one step back and look at organic food consumption in a wider context, as an example of pro-environmental behavior. Although the term "pro-environmental behavior" and similar terms are frequently used in the literature, their meaning is far from trivial. In any case, various behaviors that fall within the category of pro-environmental behavior, including organic food consumption, have some very interesting common properties worthy of exploration.

The purpose of this chapter is specifically to show how individual behavior, such as environmentally responsible choice of food, can be linked to environmental problems and their solution. Besides explaining our motivation to deal with the topic of organic food consumption in the first place, we hope also to point to some of the issues that are common to any pro-environmental behavior, comprising also the consumption of organic food.

1.1 Linking human activity and environmental problems

Current environmental problems are, in the end, traceable to human activities (Gardner & Stern, 1996, p. 5). This is not unique situation in the history of mankind. As noted by Silver and DeFries (1990, p. 45), it is possible to document as early as 7000 BC in the Mediterranean the destruction of natural habitats by human activity, which profoundly changed the region. Several other large-scale and local environmental problems are documented in history that have resulted from human activity and particularly from over-exploitation of natural resources (WRI, 2000, pp. 6–7). The transformative effect of human activity on the environment has grown stronger over the last two centuries because the magnitude of industrial and agricultural production has increased so dramatically. Also, new environmental problems have arisen as unintended consequences of human inventions.[2]

People noticed environmental degradation caused by human activity long before the advent of modern societies. As a matter of fact, one of the accounts of ancient environmental degradation that is now commonly cited by environmentalists appears in Plato's dialog *Critias* (Plato, 1972), dating from the 4th century BC. In this dialogue, Critias describes, among others, how Attica used to look like in the Golden Age, and he compares it to contemporary Attica. It is interesting that in his account he describes some environmental damage that we would now describe as deforestation, erosion, change of local climate, loss of biodiversity and so on. However, it is questionable to what degree Plato himself associated these changes to human activity, for Critias is silent about the human causes of these environmental problems.

As Gardner and Stern (1996, p. 2) point out, the systematic study of the role of human activities as a factor of environmental degradation came only after World War II and entered public discourse in the early 1960s with Rachel Carson's popular book *Silent Spring* (Carson, 1962), which revealed the detrimental effect of the pesticide DDT on birds and also on human health. Even at the beginning of the

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[2] One such well known example is the introduction of Chlorofluorocarbons (CFCs) as refrigerants in the 1920s. The CFCs were considered to be safe replacement for earlier used substances but were phased out under the Montreal Protocol in the 1980 because of their depleting effects on stratospheric ozone layer, which were not foreseen at the time of their introduction.

1990s, Silver and DeFries stated that the human contribution to environmental problems is probably the least known of all the factors which contribute to environmental problems and they urged social scientists to join efforts to understand the processes behind environmental degradation (Silver & DeFries, 1990, pp. 31–32).

1.2 Environmental pressures from human activity

Throughout this work, we talk about the "environmental effects of human behavior". This term needs to be clarified. In fact, most of the average people's choices, including also the decision to buy organic food instead of conventional food, do not have any major direct effect on the environment. These choices, however, have an indirect effect by stimulating the demand for and supply of commodities. We use the term "environmental effects of behavior" as a mental shortcut to express the fact that human choice influences directly and indirectly how the environment is exploited and appropriated by humans, and therefore most of the environmental problems are, in the end, traceable to human activities.

A very convenient model widely used to represent the link between human activities and environmental impacts (or environmental problems, as we would called them) is the so called driver-pressure-state-impact-response framework (henceforth referred to as the DPSIR framework), used by many international organizations including UNEP, OECD and EEA to capture the link between various factors that contribute to environmental problems (EEA, 1997; Hertwich et al., 2010; OECD, 2004). This model posits that drivers (social, demographic and economic development) lead to environmental pressures (e.g. emissions, resource use, land use, climate change, land occupation etc.), which in turn affect states of the environment (e.g., air quality, water quality etc.). Changed states of the environment then result in environmental impacts (i.e., ecosystem loss, health loss and resource scarcity), which we call "environmental problems" throughout this work. Eventually, observed changes in states of the environment and/or observed environmental impacts can lead society to respond to the environmental degradation by adopting approaches that prevent and minimize these negative environmental impacts.

As we can see, the link between human activities and environmental impacts is very complex, with each step in the DPSIR framework having some uncertainties. For instance, environmental pressures associated with food production depend, among others, on technologies used to produce this food. A change in environmental states due to pressures is also contingent on many factors, climatic conditions being one of them. Finally, the link between changing states of the environment and environmental impacts may also be very complex and often non-linear: for instance, a relatively marginal change in water quality in a river may cause the disappearance of a fish species because it is no longer able to reproduce in the polluted environment. Indeed, it has been shown that different types of pressures play an important role in different environmental impacts. Thus, for instance, an ecosystem health is mostly affected by climate change, overexploitation of biotic resources, phosphorus and nitrogen pollution, habitat change and the introduction of invasive species. Human health, on the other hand, is affected by environmental pressures (in the narrow sense) relatively little (e.g., emissions of toxic substances and climate change) and most impacts come from a lack of sanitation, indoor combustion of solid fuels and a lack of access to safe water sources. Finally, the importance of human activity in causing biotic resource depletion is widely recognized, but there is no consensus on whether human activity can also cause abiotic resource depletion, with some claiming the market itself will regulate the intensity of abiotic resource extraction before these resources are depleted (Hertwich et al., 2010).

Most of the environmental pressures are directly caused by industrial and agricultural activities. In fact, the only area where the activities of individuals and households directly affect the environment is the combustion of fossil fuels, particularly due to space and water heating and to personal transportation. However, even here, the direct effect of the activities of individuals and households is rather marginal: the residential sector produces globally only 6% of all GHG emissions. However, viewed from the final-use perspective, consumers are responsible directly and especially indirectly through their consumption of goods and services for the majority of environmental pressures, with the remaining share being split between government consumption and investments (Hertwich et al., 2010, pp. 48–61).

1.3 Pro-environmental behavior

Social research has been focusing on individual behavior as a precursor of environmental problems since the 1970s. Maloney and Ward's (1973) portrayal of ecological crisis as caused by human maladaptive behavior and their contention that this crisis can be solved by changing this behavior is now very famous. The term "responsible environmental behavior" and similar terms (e.g. environmental, pro-environmental, green behavior etc.) have been used since then to denote behaviors that contribute to the solution of environmental problems (cf. S. Cook & Berrenger, 1981; Lipsey, 1977; Maloney & Ward, 1973).

The definition of pro-environmental behavior has been broadened over the course of time to include not just consumption-related activities, but also other types of behavior that have a direct and indirect environmental effect. For instance, Stern (2000, pp. 409–410) argues that there are four main types of pro-environmental behavior that can be distinguished analytically and also empirically: i) environmental activism which consists of an active involvement in environmental organizations and active participation in environmental demonstration; ii) non-activist behavior in the public sphere which includes non-activist support of the environmental movement and also both active and passive environmental citizenship; iii) behavior in organizations that influences these organizations (e.g., decision of a banker to invest in environmentally-friendly stocks); and finally, iv) private-sphere environmentalism, consisting of all activities that people do in the private sphere and which have some environmental effect.[3] According to Stern (2000) the first three pro-environmental behaviors can actually have a very large environmental effect if they succeed, because they potentially influence many other individuals (e.g., establishing a legal ban or introducing taxes on environmentally harmful activities can potentially affect a large number of people). The last one, private-sphere environmentalism, has a very small effect at the individual level but becomes important when aggregated over many individuals.

Organic food consumption is an example of private-sphere environmentalism, specifically green consumerism. Two issues are important with respect to private-sphere environmentalism. The first is the problem of the reduction of environmental responsibility. The second problem is due to the fact that private-sphere environmentalism needs to be aggregated over many individuals before it can have any actual effect on the environment.

1.3.1 Reduction of environmental responsibility

The problem of the reduction of environmental responsibility is present in private-sphere environmentalism at two levels. Firstly, private-sphere environmentalism may reduce the sense of personal responsibility for the environmental implications of one's own behavior. Secondly, at the

[3] The category of *private-sphere environmentalism* is extremely wide and, according to Stern (2000), can be further sub-divided to activities such as: a) purchase of major goods and services (e.g., a personal car), b) use and maintenance of environmentally significant goods, c) household waste disposal, and d) green consumerism.

societal level, excessive focus on private-sphere environmentalism may remove the responsibility for environmental degradation from corporate actors and obscure a structural solution to environmental problems.

With respect to the first aspect, reduction of individual responsibility, it needs to be acknowledged that green consumption is still a consumption and leads to some negative environmental effects. However, consumers may be motivated by the "green" profile of products to increase their consumption. This effect has been termed as "green rebound" or "mental rebound" (Girod & Haan, 2009), an extension of the economic principle of rebound effect or back-fire effect, identified earlier by economists particularly in the area of energy consumption (see Sorrell & Dimitropoulos, 2008). Empirically, however, green rebound effect does not play such a prominent role in organic food consumption, in part because organic food usually commands a relatively high price premium which precludes a re-spending effect (Girod & Haan, 2009). Besides this, the reduction of responsibility characteristic of green consumption is often exploited by marketing in the form of greenwashing. An extreme example is the advertisement campaign "Turn lights into flights." introduced by Tesco in Britain in 2009. In this advert, Tesco offered air miles to those who bought energy-saving light bulbs (Gillespie, 2009).

At the societal level, excessive focus on private-sphere environmentalism diverts attention from other forms of pro-environmental behavior and, above all, from structural factors that contribute to environmental problems. This shift of attention, characterized by some as "individualization of responsibility", obscures the fact that some other approaches such as political activity and profound change of production systems may be actually needed to prevent major forms of environmental degradation. Indeed, a focus on private activities removes all responsibility from the corporate sector, which has a great deal of liberty in deciding whether and how it implements environmentally friendly production processes (Maniates, 2001; Sandilands, 1993; Webb, 2012).

1.4 Environmental efficiency of private sphere environmentalism

The actual environmental effect of private-sphere environmentalism can be questioned for several reasons. The first reason, already mentioned, is that most of these behaviors have mainly an indirect environmental effect, which may not always lead to environmental impacts. Secondly, for private-sphere environmentalism to take significant effect, it has to be aggregated over many individuals. As a consequence, private-sphere environmentalism is always ridden with many social dilemmas and uncertainties. Third, many environmental problems are very complex, which adds new uncertainties and leads to knowledge gaps at various levels. The combination of indirect effects, presence of social and other dilemmas, uncertainties and knowledge gaps make the situation very difficult to apprehend for individuals who want to act pro-environmentally.

Several types of dilemmas are typical for pro-environmental behavior, such as social dilemmas, temporal and spatial dilemmas, and uncertainty (Staats, 2003). Social dilemmas enter pro-environmental behavior in several ways. Firstly, pro-environmental behavior typically incurs some costs to individuals (time, money, living standard, stream of services etc.), while it contributes to the preservation of a public good that is non-rival and non-excludable. An individual therefore always has strong incentives to enjoy the benefits of a healthy environment without making personally costly efforts to protect it. This leads to a free-riding issue and, at the collective level, to overexploitation and degradation of the public environmental good, or to what Garret Hardin has labeled as the *tragedy of commons* (Hardin, 1968). In a tragedy-of-commons situation, each individual is motivated to use the public good to the maximum, not because of his selfishness and greed, but because he or she knows that others will do the same.

Another type of social dilemma consists in the fact that the actions of each individual only contribute a little to the degradation or protection of the environmental good; this may create dis-incentives for an individual to engage in pro-environmental behavior because he or she feels powerless and unable to achieve particular goals of environmental protection.

Spatial and temporal dilemmas are also typical for pro-environmental behavior (Steg, 2003) and they follow from the fact that many environmental problems affect people that may be distant in time and space from those who, through their activity, contributed to the rise of these problems. An example of such a dilemma is apparent in the current discussion of whether actions should be taken to prevent emissions of GHGs because, under certain scenarios, the costs of these actions are born by the present generation living in developed countries, while the impacts of global change are likely to hit most severely future generations living particularly in developing countries (IPCC, 2007).

In addition to these dilemmas, there are usually many uncertainties at various levels involved in environmental problems.[4] First of all, there are many uncertainties and knowledge gaps in the best up-

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[4] It is often the case that interests groups that would be harmed by pro-environmental measures exploit uncertainties present in environmental problems to endorse their own interests. For instance, interests groups related to fossil fuel industry succeeded in changing attitudes and concerns of the U.S. public related to climate change during the 1990s, specifically by presenting evidence that made use of various types of uncertainties about global climate change. Only towards the end of 1990s did the scientific community convince policymakers and the general public about the seriousness and reality of the problem (Leiserowitz, 2005). In similar vein, Fromatz (2006, pp. 36–37) argues that initiatives to endorse health-related and environmental claims related to organic food were blocked in the U.S. by interests groups related to conventional food industry because these claims would harm

to-date scientific understanding of the mechanisms behind many environmental problems. A good example is, again, the issue of global climate change where IPCC (2007, p. 72) acknowledges that important uncertainties exist in our understanding and prediction of extreme climatic events, as well as in our understanding of how climate change will affect humans and natural systems and, indeed, also in our knowledge of how natural and human causes contribute to observed temperature changes at smaller than continental scale.

But even if scientists understand the core of environmental problems, the lay public usually retains only a general sense of these problems and is very slow in adopting up-to-date scientific understanding of the causes and possible consequences of and solution to environmental problems such as the global climate change (W. Kempton, 1997; Sturgis & Allum, 2004). The lay public usually uses simplified heuristics to understand these complex environmental problems (Sterman & Sweeney, 2007), which not only biases its judgments, but also makes it very difficult to communicate information about environmental problems.

Cognitive barriers also apply to public understanding of more complex man-made systems, some of which are very relevant for the understanding of environmental problems. For instance, early energy research has found that consumers have a poor understanding of the energy flows and energy-conserving potential in their dwellings (Willett Kempton & Montgomery, 1982). These cognitive limits

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their own interests. Interestingly enough, both health-related and environmental claims were introduced in the European organic food legal framework (see section 2.2) owing probably to much stronger position of groups that criticize some of practices use in conventional farming and food production (such as use of GMOs).

then lead consumers to incorrectly estimate the energy-saving potential of different conserving measures (Attari, DeKay, Davidson, & Bruine de Bruin, 2010; W. Kempton, Harris, Keith, & Weihl, 1985).

Almost as a rule, we find that lay people mistakenly judge the environmental friendliness of their actions.[5] For instance, Gatersleben et al. (2002) reveal that people often mistakenly believe that they save energy through certain energy-conserving actions, while they actually consume more energy than those who do not have these aspirations. Indeed, it has been shown that consumers incorrectly judge energy-saving potential of various conservation measures, overestimating the energy-saving potential of everyday energy curtailments and underestimating efficiency retrofits (Attari et al., 2010). In the area of food consumption, a recent study by Tobler et al. (2011) indicates that consumers incorrectly assess the environmental friendliness of their food choices. Consumers take into account distance rather than means of transportation of the food product and they also overestimate the negative environmental effects of packaging and conservation, and overestimate the environmental benefits of organic production.

[5] It is important to note that also social scientists were not immune against misjudging environmental friendliness of behavioral alternatives. A study by Kaiser et al. (2003) has compared indicators of pro-environmental behavior used in established scales of pro-environmental behavior in the past research with actual environmental effects that these behaviors would. The study reveals that for most parts, the behavior labeled as environmentally friendly was not different from other behavior in terms of actual environmental impacts.

1.4.1 Role of private sphere environmentalism in management of environmental problems

Now that we have shown how winding is the path which leads from the environmentally responsible behavior of individuals to the protection of the environment, the question arises whether it is at all reasonable to focus on individual pro-environmental behavior. We think that there are principally two reasons for such an interest.

The first reason is that under strong pressure, such as a pressing environmental crisis, even modern individualistic and liberal societies are capable of mobilizing their members for the sake of long-term collective goals. One example that is often quoted in this respect is the transformation of production and consumption patterns during the Second World War in the USA (Silver & DeFries, 1990, p. 60). Another example, also from US history, is the dual oil crisis of 1973 and 1979, which provoked reactions that surpassed imagination on many such as fuel rationing and fuel price control, public support of renewable energy, introduction of speed limits and energy-efficient cars, adoption of energy-saving measures and a decline in energy intensity of the economy by 42% between 1973 and 2001 (National Energy Policy Development Group, 2001, pp. 2–8). Indeed, the energy crisis also inspired President Carter's famous *Malaise Speech* in which he asked Americans to adopt energy-conserving actions (Carter, 1979), an unprecedented step that was against the prevailing sentiment of unrestrained consumerism at that time.

Secondly, knowledge of factors that influence environmentally responsible behavior of individuals can be a very useful tool in the hands of policymakers who want to steer behavior of individual consumers in ways that are, from environmental point of view, more desirable. Indeed, it is not a coincidence that social scientific research on energy-related behavior accelerated in the late 1970s and early 1980s, precisely because it provided very useful information to policy-makers who were struggling at that time to adjust their economies to energy scarcity.

Similar situations of pressing crises that initiate quick responses at the societal level are relatively rare. However, the knowledge of factors that influence pro-environmental behavior may be useful, even under the business-as-usual conditions. Policies aimed at changing people's everyday behavior may complement other, more ambitious policies which may take a longer time to implement. A great advantage of behavioral measures is that they can be adopted very quickly, usually with negative total costs, and they can be used to buy time before more profound measures targeting industry and agriculture are implemented. As an example, we may cite the results of the study by Dietz et al. (2009) who have estimated that policies promoting 17 pro-environmental activities such as weatherization, thermostat setbacks, line drying etc. would lead to a reduction of direct CO2 emissions of households by 20% or a 7.4% reduction in US national emissions CO2 emissions in 10 years.[6] Although these figures do not look very impressive, behavioral measures could be used in a short-term time horizon as a behavioral wedge to stabilize certain environmental problems before they spiral out of control.

[6] This study is also interesting in that - unlike similar studies (e.g., Gerald T. Gardner & Stern, 2008; Vandenbergh, Barkenbus, & Gilligan, 2008) - it takes into account actual efficiency of policies as found by previous empirical studies.

1.5 ENVIRONMENTAL EFFECT AND ENVIRONMENTAL MOTIVATION OF BEHAVIOR

From what has been said, it is apparent that the intention of individuals to act in an environmentally friendly way does not always match the actual environmental impacts of their behavior. This was the reason for Stern (2000) to propose a distinction between pro-environmental behavior defined by its intention and pro-environmental behavior defined by its actual environmental impact. In our view, this distinction may be actually extended to a typology of pro-environmental behavior as represented in Table. This typology makes sense not just analytically, but also from an empirical point of view because - as we have sought to demonstrate throughout this chapter - environmental intention and environmental impact are frequently unrelated.

Table 1.1: Typology of pro-environmental behavior with respect to its motivation and actual environmental effect[7]

		Pro-environmental motivation	
		Significant	**Marginal**
Environmental impacts	**Significant**	Type 1 (intended and efficient pro-environmental behavior): I lower the thermostat of my heater because I think that it is an efficient way to save energy and cut on GHG emissions.	Type 2 (unintended but efficient pro-environmental behavior): I turn off standby mode in appliances because I am concerned about the risk of short circuit failure.
	Marginal	Type 3 (intended but inefficient pro-environmental behavior): I turn off lights in unused rooms because I think that it is an effective way to save energy and cut down on GHG emissions.	Type 4 (unintended and inefficient pro-environmental behavior): I turn off lights in unused room because I am used to doing so.

[7] Evaluation of environmental effects of activities given here as examples is based on our own estimates of energy-saving potential of these activities presented elswhere (see Ščasný, Urban, & Zvěřinová, 2012).

A particular environmental behavior that we observe in reality would probably not neatly fit in any of the four categories. For instance, we would probably hardly find any behavior that has absolutely no effects on the environment. Similarly, when we talk about environmental motivation, we are neglecting the fact that the range of motivational factors of pro-environmental behavior is very wide (this topic is discussed in detail in Chapter 3 of this work), ranging from primitive beliefs through more general attitudinal factors such as values and concerns to very specific environmentally-relevant attitudes. In addition, the mechanisms of how these factors influence a particular behavior may vary from fully rational behaviors through value-based behaviors to habitualized behaviors that involve very little cognitive activity (Biel & Dahlstrand, 2005). Still, however, the typology may be useful for understanding the similarities and differences between various types of pro-environmental behavior.

We will argue in Chapter 4 that organic food consumption actually exemplifies all four types of pro-environmental behavior. Motivation to consume organic food ranges from pure environmental motives (which are relatively rare, however) to highly habitualized behavior or behavior that is led by a different type of motivation. This insight has important connotations for the modeling of organic food consumption and specifically for the application of the theory of planned behavior towards an understanding of organic food consumption.

*   *   *

To wrap up our presentation in this chapter, we can say that any pro-environmental behavior, including also consumption of organic food, involves many uncertainties and dilemmas which make the decision situation very complex for those consumers who are motivated specifically by their environmental concerns. Nonetheless, environmental motivation is neither necessary, nor a sufficient condition for any behavior to be considered pro-environmental by its actual environmental effects. Even if individual behavior can be considered pro-environmental by its actual effects, its usefulness in preventing and mitigating environmental problems is rather limited and should rather be thought of as one of many ingredients in a policy mix necessary for the solution of environmental problems.

CHAPTER 2: WHAT IS ORGANIC FOOD?

What is organic food? There is both a short and long answer to this question.

To give the reader a shorter answer that would be sufficient for those who are mainly interested in the empirical part of this work, we may define organic food as any food, processed or unprocessed, that is labeled as organic in accordance with the laws currently in force in the Czech Republic. Such a definition, albeit a bit too legalistic for social scientists and perhaps tautological too, is well in line with the literature which points to the fact that organic food is characteristic of practices and input used in its production and not by the intrinsic properties that the product has (Zakowska-Biemans, 2011). For this reason some working in the field of organic food consumption define organic products as "credential goods" (Boccaletti, 2008), to stress the fact that constitutive characteristics of organic food (i.e. processual characteristics) have to be certified by credentials (i.e., labels) because they cannot be ascertained in any other way, the least from their sensory characteristics. Legal regulations are critical for the definition and sanctioning of these credentials[8] and therefore the legal definition is certainly of interest.

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[8] Some could perhaps argue that legal sanctioning is not important in less developed organic markets which use informal mechanism of trust and shame to provide organic credential. However, we can observe that there was a tendency to develop formal credential mechanism early in the history of organic movement. For instance, the biodynamic label *Demeter* has been introduced as early as 1927, only three years after Rudolph Steiner gave his seminal lectures on biodynamic agriculture in Koberwitz in 1924 (Demeter-International, 2012). Although organic agriculture has not been formally defined in national law of most countries until 1990s, labels that certified organic or organic-like products were protected under commercial law much earlier.

The long answer would point to the ambiguity of the meaning of the term "organic" as used by different agents, including producers, retailer, or consumers. This ambiguity has many sources. Some of these could be related to the history of the organic movement and its current development; others have to do with the way the term "organic" has been appropriated by the decision sphere and incorporated in legal documents. Although we are not going to explore this topic fully in this work, we think it worthwhile in this section to point to the wider context of the organic movement and its legal framing.

2.1 Rise of the organic movement

Although most of today's consumers in the Czech Republic are probably not aware of it, an organic system of production and processing has a history that goes well back to the 19th century, to the period when the industrialization of agriculture was under way and many were becoming concerned about a transformation that alienated agricultural practices from natural processes. One of the important steps in this transformation was the scientific contribution of Justus von Liebig, and other organic chemists, to understanding of the role of mineral substances as plant nutrients, especially the role of nitrogen. The discoveries of organic chemistry of that time allowed for the substitution of manure and guano, of which supplies were limited, by industrially produced substances (Fromartz, 2006). The increase in the potential of agricultural production due to the invention of synthetic chemicals was dramatic. Nowadays, it is estimated that the use of synthetic fertilizers is responsible for between 40% and 60% of the average crop yield in such countries as the USA or England, and probably an even higher share in the tropics (Stewart, Dibb, Johnston, & Smyth, 2005).

As Fromartz (2006) points out, the organic movement proper started at the beginning of the 20th Century. Three figures have had enormous influence on its founding and development. The first such figure is Sir Albert Howard (1873-1947), a British agricultural scientist influenced by Eastern spirituality and his experience with local farmers in India, which affected his opposition to a mechanistic view of agricultural practices and particularly to chemical fertilizers. Howard proposed that soil health is the source of health of plants and animals, which in turn enables the production of healthy food for people. Instead of chemical fertilizers, he advocated the use of a composting method and, indeed, his method of composting is still used up to now. Rudolph Steiner (1961-1925), the Austrian philosopher and social reformer, is another important figure in the history of the organic movement, and his influence remains strong even today, especially in German-speaking counties. Steiner, dubbed a pseudoscientist by some, formulated principals of biodynamic farming which are based on the idea that soil, plants and animals compose a harmonic self-sustaining system. From the technical point of view, biodynamic farming is similar to organic farming in that it views agricultural systems holistically and advocates the use of "natural" agricultural techniques such as the use of manure and compost instead of chemical fertilizers. Last but not least, the history of the organic movement is also associated with the figure of Major General Robert McCarrison (1878-1960), a nutritionist and physician from Northern Ireland, a proponent of natural diet who demonstrated by his observations and experiments that the nutritional quality of food has important effects on the health of animals and humans.

Several national organizations propagating the principles of biodynamic and organic agriculture were founded in the first half of the 20th Century, including *Demeter International* (an international biodynamic certification organization established in 1928), the *Australian Organic Farming and Gardening Society* (an Australian-based organic agricultural organization, the first to use the term "organic" in its name), and the *Soil Association* (a UK-based charity founded in 1946 which supports organic farming, educates about nutritional issues and opposes intensive farming). Dissatisfaction with the industrial system of agricultural production and the further growth in the popularity of the organic movement came in the late 1960s as a by-product of youth counterculture movements (Fromartz, 2006).

An international umbrella organization of organic farmers, the *International Federation of Organic Agriculture Movements* (*IFOAM*), was founded in 1972 to provide guidelines, standards, and coordination for international organic movements. One of the founders of *IFOAM*, Roland Chevriot, expressed in a concise form the motives which led to the foundation of *IFOAM*: "At the time when industrial expansion is questioned and notions of "Quality" and "Survival" are raised, it seems necessary to me that organic agriculture movements make themselves known and coordinate their actions... The food quality and ecology crisis is no longer a national problem, but an actual international concern to which we must rapidly bring our solutions" (Chevriot, 1972). The international organic movement has been growing steadily since the 1970s and, currently, the official structure of the movement, *IFOAM*, has as many as 750 member organizations in 108 countries (IFOAM, 2012). Indeed, the organic system of production and certification has been codified in the form of binding legal norms in Western European countries since the 1980s, and since the early 1990s in the whole European Economic Community, as well as in the USA and Canada. The development of organic farming proper in the Czech Republic started shortly after the Velvet Revolution in 1989 (see section 2.3 further below for details).

2.2 Legal definition of organic food

The legal framework for the definition of organic products in the Czech Republic is set by a set of EU regulations, namely Council Regulation (EC) No 834/2007 (further referred to as the Council Regulation) as implemented and amended by Commission Regulation (EC) No 710/2009 and Commission Regulation (EC) No 889/2008, and further amended by Commission Regulation (EU) No 271/2010 and Commission Regulation (EC) No 1254/2008. Further specification of the organic legal framework in the

Czech Republic is set by Act No. 344/2011 Coll.[9] which came into force in January 2012 and which amends the earlier Act No 242/2000 Coll. on organic farming.

The introductory paragraph of the preamble of Council Regulation characterizes organic farming as "an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes". In addition the Council Regulation specifically stresses the dual advantage of organic farming that benefits individual consumers by providing them with products which have some superior characteristics in comparison to conventional products, and also the community, by maintaining a system of agricultural production that has lower environmental effects in addition to other benefits.

The description of organic farming provided by the Council Regulation in not entirely accurate because, as we shall argue later in this work, organic farming may pose its own environmental risks. Specifically, we will argue that certain practices used in organic farming actually require more non-renewable energy resources and organic farming also creates certain risks for animal welfare. Further,

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[9] One such specification above and beyond regulations in force in the EU states that Czech organic farms can allow conventional animals on their premises for the purpose of grazing for no more than 90 days per year. This provision is meant to prevent practices when conventional animals were continuously grazing on organic farms. Under the previous legal arangement, the farms could proclaim their grassland organic and receive financial support without implementation of organic animal husbandry which was considered more demanding and risky.

we will also argue that many consumers base their choice of organic products on beliefs about organic food that are not quite supported by empirical evidence. For this reason it may be a bit shallow to say that organic farming satisfies the preferences of these consumers. Finally, organic farming and production does not only use natural processes and substances because it needs to keep a certain level of flexibility in meeting special requirements of animal and plant health, product quality and consumers' satisfaction. However, the introductory preamble of the Council Regulation summarizes nicely why organic farming and production has become socially desirable. Let us now look more closely at how processes of organic production are legally defined.

The main processual characteristic of organic farming and production, as expressed in the Council Regulation, is that it is as much as possible a closed system which seeks to minimize all types of external inputs at all stages of production and processing, wherever this is possible and reasonable. All synthetic inputs are severely restricted in organic farming and the use of any genetically modified organism is banned altogether. All inputs used in organic farming, such as feed for animals, pesticides, fungicides, pest-control substances, all raw materials and food ingredients, additives and other substances employed in food processing, should come, ideally, from organic farming and, in the best case, from the same farm or from a farm in the same region. Besides producing its own inputs, organic farms also seek to turn waste into farming inputs: reuse, compost or at least recycle waste thus further limiting material and energy flows.

But clearly, it is not always possible to maintain such a closed agricultural system for various reasons. Indeed, it must be clearly specified what constitutes reasonable causes for the recourse to non-organic inputs such as plant protection products, fertilizers, feed additives and processive aids, and cleaning and disinfection. As a matter of fact, much of what constitutes the current organic legal framework consists in setting a narrow line between acceptable and unacceptable inputs in organic farming.

The limits of acceptable inputs for organic products apply to plant and animal production as well as processing. In plant production, only authorized fertilizers and soil conditioners can be use, and mineral nitrogen fertilizers are banned altogether. However, the European system, as defined in the Council Regulation is flexible enough to allow the use of synthetic fertilizers in cases when an alternative does not exist or when it leads to unacceptable environmental hazards. To prevent damage by pests, plant diseases and weeds, organic farming prioritizes prevention though the use of natural enemies, choice of resistant species and varieties, crop rotation practices, and mechanical and thermal cultivation processes. Despite this, authorized so called "green" pesticides and fungicides can be used in organic farming in the EU, including such pesticides as bacterial toxins, pyrethrum, rotenone, copper and sulphur, and substances with fungicidal effects such as potassium bicarbonate. Although these substances are of non-synthetic origin, some of them have become controversial due to their adverse health and environmental side effects. One such an example is the pesticide rotenone, which has been phased out as a green pesticides in the USA and Canada because of health concerns (Pest Management Regulatory Agency, 2008; US EPA, 2007) but still remains in use in the EU.[10]

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[10] However, we do not want to suggest that pesticide- and fungicide-related risks in organic agriculture are of the same magnitude as those in conventional production. Far from that, we only argue that certain types of pesticides and fungicides are used in organic farming, which may pose health and environmental risks. An analysis of samples of agricultural produce from EU-27 countries conducted in 2008 showed that levels of pesticides

Organic animal production is another area where legal regulations established through Council Regulation come into play. It is also one of the areas where non-organic inputs are recognized as essential: non-organic animals are allowed in the organic system for breeding purposes and their products can be deemed organic after a certain conversion period. The purpose of this provision is specifically to increase genetic variability and the potential of organic husbandry. Organic animal production also subscribes to high standards of animal welfare and proclaims that "the development, physiological and ethological needs of animals are met" and further adds that "permanent access to open-air areas, minimization of livestock transport and suffering including the time of slaughter" must be ensured (Council Regulation, article 14). Feed for organic animals should be provided ideally from the holding where these animals are kept or from the same region. Of great importance is that the Council Regulation specifically allows for certain flexibility in organic husbandry with respect to the use of non-organic feed additives and medicines and other substances that are necessary to maintain the health of animals. These provisions were adopted particularly to prevent situations, reported previously, when strict regulations on the use of non-organic medicine, especially antibiotics, were pushing some farmers to expose their organic animals to unnecessary health risks due to restrictions on the use of antibiotics (compare Allen, 2010). This undue strictness was probably caused by the fact that organic agriculture

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residuals were lower in organic than in conventional produce: 0.9% of organic produce exceeded the pesticide threshold, while it was 3.7% of conventional fruit and vegetable produce (EFSA, 2010). Data from a survey of vegetable growers in the USA, conducted before the restrictions put on rotenone, revealed that rotenone was, in fact, used only by 5% of producers. Another green pesticide recognized for its carcinogenic potential, pyrethrum, was by less than 2% of producers (Fernandez-Cornejo, Greene, Penn, & Newton, 1998). Unfortunately, no such data are available for organic agriculture in the EU.

consisted mainly of plant production and it took some time before rules for organic animal husbandry could be developed (Lund & Algers, 2003).

Food processing is the third area that is strictly regulated under the organic production regime. Food can be deemed organic only if at least 95% of the weight of its agricultural content consists of ingredients of organic origin. Products containing a lower share of organic ingredients can display information about organic content but cannot be certified as organic food. Ingredients of a non-organic origin are acceptable in organic food processing only when no organic alternative exist for them and only in those cases where they have a substantive role in the technology of processing or where they are necessary for the food to meet specific nutritional requirements or dietary requirements set by food regulations. As of now, no specific legal provisions are made for organic mass catering, neither at EU level, nor in the Czech Republic.

2.2.1 Certification of organic products

As noted earlier, a credential system which allows tracing the organic origin of products throughout their whole life-cycle is a critical condition for the existence of organic system of production. The Council Regulation, as amended by Commission Regulation (EU) No 271/2010, states that only products that comply with the EU regulations of organic production (for details see previous sections), can be marketed as organic products in the EU; all such products must display the EU organic logo (" Euro-leaf"). The certification is issued by EU member states or by certification bodies which are authorized by member states.

Certification of organic products in the Czech Republic is further regulated by Act No 242/2000 Coll., on organic farming, as implemented by Decree No 16/2006 Coll. These Czech legal norms specify, above and beyond the EU legal rules of organic certification, under what conditions the Czech organic label, the so called "Organic Zebra", is issued. To make a long story short, if a product is to be recognized as organic, one of the three authorized certification bodies (Kez, o.p.s., Biokont CZ, or ABCERT AG) have to certify it as organic and the logo of the *Organic Zebra* must be displayed on it, together with a number which references one of the three national certification bodies.

Organic products certified in the Czech Republic must bear both labels, the Czech *Zebra* and the *European Leaf*. Organic products produced in other EU countries and sold in the Czech Republic must display the EU organic logo and they can be additionally re-certified in the Czech Republic to bear also the Czech national organic logo. Finally, products from non-EU countries must be certified (or recognized as organic products if they come from specific countries) under provision of Commission Regulation (EC) No 834/2007, as further amended, and bear the EU organic logo, and - optionally - can also be re-certified in the Czech Republic to also bear the Czech national organic logo.

This legal framework leads to the situation where all organic products sold in the Czech market must bear the EU organic logo. Nonetheless, the Czech national organic logo displayed on products, side by side with the European Leaf, only implies that the product was certified in the Czech Republic and not that it was necessarily produced in the Czech Republic. Consumers should be able to identify from the information sticker on the product packaging whether the product comes from one of the EU countries or whether the whole product or its parts come from non-EU countries. In any case, producers are not obliged to indicate which EU country the product comes from. As of now, representatives of Czech organic producers are holding talks with the Czech Ministry of Agriculture about the possibility of changing the Czech national organic label so that it would allow for the identifying of products coming from the Czech Republic. This may help Czech consumers to identify locally produced organic food.

2.3 The Czech organic market and Czech organic agriculture

It is relatively difficult to describe the Czech organic market because statistical data on imports of organic products to the Czech Republic from EU member countries and exports from the Czech Republic to the member countries have not been gathered since the accession of the Czech Republic to the EU in 2004. Only direct imports from and exports to non-EU countries are reported (which are probably rather marginal in the total turnover of the Czech organic market). Estimates of imports and exports within the EU, which probably constitute the bulk of organic food sold in the Czech Republic, are only estimated using surveys of retailers, expert judgment of marketing experts, and consumer surveys, all of which are probably subject to (mostly unknown) errors that bias these estimates. Precise statistics are available only for the production of Czech organic agriculture. Nonetheless, since it is not known how much of its produce is exported to EU-member states (this can only be estimated based on surveys of producers), such statistics add only little to a precise description of the Czech organic market.

It is estimated that sales of organic food in the Czech Republic totaled 1.8 billion CZK in 2009, thus equaling 0.71% of total food and drink turnover in the Czech Republic that year. However, no up-to-date estimates of the total turnover of organic products are available as of now. But the expectations were that the market would continue growing (Hrabalová, 2011). In any case, average per capita expenditures on organic food were estimated to equal about 170 CZK annually or € 6.50 in the Czech Republic in 2008. The figures for that year are very low in comparison to those of developed organic markets such as Denmark (€ 139), Switzerland (€ 133), Austria (€ 104), but similar to those found in Estonia (€ 9), Croatia (€ 8.3), Portugal (€ 7) and Greece (€ 5) (BÖLW, 2010).

Expenditures on organic food in the Czech Republic in 2007 are estimated to be dominated by processed organic foods (48%), followed by dairy products (21%), drinks (11%), meat and meat products

(7%), unprocessed cereals, legumes and nuts (6%) and fruit and vegetables (6%). A very important change in the organic market development in the Czech Republic came in 2008 when large retail chains introduced organic products and the share of organic products sold in large supermarkets and the share of sales of organics in hypermarkets in the total turnover of organic food rose from 6.5% to 74% (Václavík, 2009). Indeed, as Thogersen et al. (2010) point out, the share of organic food sold in large retail chains is an indicator of organic market development.

It has been estimated that imported food constituted as much as 57% of all organic food sold in the Czech Republic in 2008. Imports include mainly processed food, such as non-alcoholic beverages, pasta, dairy products, but also meat and processed meat products, and also processed vegetables. Some of the large international retail stores which operate in the Czech Republic - including Tesco, Plus and Kaufland - prefer to import organic products from suppliers that service their stores also in other countries, and not from Czech producers. A lack of domestic production and processing capacities is another reason for such a high share of imported products (Václavík, 2009).

It is important to note that the development of organic farming proper in the Czech Republic started only after the Velvet Revolution in 1989 and has had its ups and downs since then. While years 1990 and 1991 seemed very promising for organic farming, as the sector grew very fast, partly in response to direct subsidies to farmers, this developments slowed down in the mid-1990s only to resume in 1998, in response to the introduction of new supportive measures (cf. Hrabalová, 2011). In 1993 the first Czech national directive on organic farming was introduced. This also included regulations regarding inspections and certifications of organic farms as well as the in introduction of the official label certifying organic produce, "BIO". Agricultural environmental measures supporting, among others, also organic farming were introduced in 1998 and the sector started growing again. In 2001 Act No 242/2000

Coll., on organic farming, came into force, which authorized the organic certifying body KEZ, o.p.s. In 2004, the Rural Development Program of the Ministry of Agriculture came into force and the Action Plan for Organic Farming was approved. Another two organic certification bodies, Biokont CZ and ABCERT AG, were authorized in 2006. Additional measures of the Rural Development Program for the years 2007-2013 came into force in 2007.

Following the *Action Plan for Organic Farming until 2010*, the Ministry of Agriculture issued the *Program for Ecological Farming and Organic Food* in 2008, which aimed at better information for consumers, marketing, education, support of mass catering, research, and provision of expert advice in the area of organic farming and organic food. Responding to the need to transfer knowledge between various agents active in the area of organic farming and organic food, the *Czech Technology Platform for Organic Agriculture* was launched in 2009. In 2010, the second *Action Plan for Developing Organic Farming in 2011-2015* was approved and came into force in 2011. In 2012, Act No 344/2011 Coll. came into force. This amended Act No 242/ 2000 Coll., On Organic Farming. This new legal regulation harmonizes Czech legal regulations with EU organic legislation and specifies details of their administration in the Czech Republic.

In 2010, there were over 3500 organic farms in the Czech Republic and the total area of organically cultivated land equaled 448 thousand hectares or 11% of all agricultural land in the country (of which more than one third is forest). Organic farmland consisted mainly of grass land (82%), followed by arable land (12%), and orchards, vineyards and hop-gardens (1.3%) (Hrabalová, 2011).

When asked about retail of their products, as much as 75% of farms reported that they were forced to sell part or all their produce as conventional; additionally 17% of farms did not sell any of their products on the market. The main plant production from Czech organic farms (i.e. wheat products, legumes and potatoes), was exported in 2010. On the other hand, fruit and vegetable production was mainly sold in the Czech Republic. Finally, most of Czech organic animal products are also sold on the Czech market, mainly for further processing. Measured by their turnover, dairy production, pastry and confectionery products, and the category of other processed food which includes mainly baby food, are the most important categories of Czech processed organic food. About 30% of all processed organic food is exported, while 41% of the remaining share of processed food is sold in the large retail chains that operate in the Czech Republic, and another 24% is sold in small Czech specialized health food stores (Hrabalová, 2011).

CHAPTER 3: ENVIRONMENTAL FRIENDLINESS OF ORGANIC FOOD CONSUMPTION

Residential consumption, including food consumption, has considerable environmental effects. The purpose of this chapter is to look at whether choice of organic food as opposed to conventional food decreases these impacts and if organic food consumption can be deemed pro-environmental behavior. This chapter will highlight some of the problems, especially various types of uncertainties that we typically found when trying to isolate pro-environmental behavior.

3.1 FOOD CONSUMPTION AND ITS ENVIRONMENTAL BURDENS

Globally, and on average, the residential sector is directly, but mostly indirectly responsible for over 50% of environmental impacts of human activity in all impact categories, with the remaining part being attributable to the consumption of the government sector and investments (Hertwich et al., 2010, pp. 48–61). However, the exact contribution of the residential sector varies across countries and impact categories. It was estimated that in 2009 the final consumption of the Czech residential sector was responsible for 23% of national consumption of raw materials and biomass and for 32% of greenhouse gasses emitted in the Czech Republic, with the remaining share being allocated to the government sector, investments and exports (Kovanda & Hák, 2012). Taking into account the fact that a large proportion of exports is consumed by the residential sector abroad, we can see that domestic and foreign residential sectors are responsible for a significant share of the environmental effects of human activity.

Looking more into detail on the environmental effects of residential consumption, we find that particularly three types of consumption activities are responsible for these effects: transportation, energy consumption related to housing, and food consumption. As a matter of fact, beverage and food consumption (excluding dining out) is responsible for between 20% and 30% of household consumption impacts in most of the impact categories (abiotic resource depletion, global warming, ozone layer depletion, human toxicity, eco-toxicity, photo-chemical oxidation, acidification) and as much as 60% in the eutrophication impacts category in the EU25 countries (Tukker et al., 2006, pp. 91–92). This large share of environmental impacts attributable to food and drink consumption can be explained by a combination of relatively large share of expenditures on food and beverages in the EU25 (almost 20%) and relatively high environmental impacts per Euro spent on food and beverages (esp. in the case of meat, cheese, poultry and milk that rank in top 35 product groups with highest impact).

Considering the importance of environmental impacts of food consumption, it is not surprising that several authors have advocated a change in food diet as a means of lowering the adverse environmental effects of food consumption (Baroni, Cenci, Tettamanti, & Berati, 2007; Carlsson-Kanyama, 1998; Carlsson-Kanyama & González, 2009; González, Frostell, & Carlsson-Kanyama, 2011; Jungbluth, Tietje, & Scholz, 2000; Marlow et al., 2009; Virtanen et al., 2011). However, food consumption fulfills one of the basic human needs and influences physical and psychological health and therefore cannot be changed beyond certain limits given by nutritional requirements. Another reason why food diet cannot be changed arbitrarily lies in the fact that food consumption is deeply embedded in the socio-cultural practices of given societies[11] and constitutes what is called "food culture".[12]

Several changes of diet have been proposed in order to reduce the environmental burden of food consumption, such as replacing meat in the diet with plant-based foods (Baroni et al., 2007; Carlsson-Kanyama, 1998; Carlsson-Kanyama & González, 2009; González et al., 2011; Jungbluth et al., 2000; Marlow et al., 2009; Virtanen et al., 2011), particularly replacing animal protein foods with high protein plant-based foods (González et al., 2011), lowering the share of meats associated with high energy inputs and high enteric fermentation (Carlsson-Kanyama & González, 2009), consuming food with low energy and other inputs in the processing stage (Carlsson-Kanyama, 1998; Carlsson-Kanyama & González, 2009), refraining from food transported by air (Carlsson-Kanyama & González, 2009; Jungbluth et al., 2000), or choosing to consume organic rather than conventional food (Baroni et al., 2007; Jungbluth et al., 2000).

Among dietary curtailments, some of them are widely accepted and perceived as significant from an environmental point of view (e.g. switching from a meat-based to a plant-based diet), while others

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[11] Virtanen et al. (2011) note in this respect that changing culturally defined eating patterns in ways that are environmental benign (and that would also have important positive health effects) by, for instance, switching to vegetarianism, would require development of new recipes and new eating habits that would respect seasonality of products and traditional choices of each cuisine.

[12] It is interesting to notice that spread of organic food consumption across various European countries has been - to a large extent - determined by differences in food cultures in these countries (for discussion of this issue see Thøgersen, 2010).

(including also switching to organic food consumption) are mentioned only rarely because their environmental significance depends on other factors (energy intensity of a particular production method, attributes of conventional alternatives, energy intensity of transportation mode, production efficiency etc.). Thus, for instance, it has been found that, under strict *ceteris-paribus* conditions, organic food sold in Switzerland fares better in environmental impacts than conventional food but this advantage can be easily overturned by other attributes of the production and post-production phase, namely air transportation, deep freezing of products, or the use of glass containers (Jungbluth et al., 2000). Somewhat similar results were shown by Gonzáles et al. (2011) who revealed that organic beef meat available in Sweden has relatively low energy inputs but, overall, its GHG emissions were not the lowest of all beef meats available on the market. In addition, Gonzáles et al. (2011) also found that domestic organic milk has slightly higher energy inputs than imported milk, but somewhat lower GHG emissions. These discrepancies are due to particular climatic conditions of Sweden which make imports of food from certain countries with favorable climate an environmentally friendly alternative.[13] On the other hand, results presented in the study by Baroni et al. (2007) suggest that in Italy, the organic versus conventional food choice actually matters more with respect to the environmental impacts of food consumption, than the switch from an omnivorous to a vegetarian diet. However, this result seems to be rather exceptional in the context of other empirical studies.

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[13] This phenomenon is sometimes also referred to as *comparative environmental advantage* (viz. note 21 further below).

To shed more light on the environmental friendliness of organic food consumption, we review major empirical evidence provided by life-cycle analysis studies of agricultural production and also studies of final consumption of specific groups of food such as meat, meat-based products and eggs, dairy products, basic carbohydrate food, fruit and vegetables, and a residual category of mixed products and drinks. But before we proceed to the review of the pertinent literature, we will deviate from the main exposition and introduce briefly the method of life cycle analysis used in the studies that we review to quantify the environmental burdens of organic food consumption.

3.2 Life cycle analysis

Several methods are used to assess the environmental impacts of organic food consumption such as ecological footprint analysis[14], monetary valuation[15] and life-cycle analysis. Results obtained through

[14] The basic idea of *Ecological footprint analysis*, introduced in the literature by W. Rees in 1992 (Rees, 1992), is relatively simple and consists of the comparison of human requirements on biosphere related to production of goods and services with the capacity of biosphere to provide these resources and services. Requirements on biosphere are standardized in the form of "global hectare" or the theoretical plot of land that would be needed to generate these resources and services. Ecological footprinting is very helpful in that it expresses environmental impacts associated with human activities in standardized common units. By fixing the measurement unit of impact to "global hectare", the ecological footprinting can also reveal whether activities of individuals, groups, or whole humankind, exceed carrying capacity of the environment. An example of Ecological footprint study of organic food consumption is the study by Collins, Flynn and Netherwood (2005) that analyzes food consumption in Cardiff, UK. This study finds that food consumption is responsible for almost one third of the residents' total footprint. Interestingly, the results of this study also suggest that food eaten outside of home is responsible for one third of this impact, although it establishes only 10% of amount of food consumed implying that consumption of food at home has lower environmental impacts per unit amount of food. Further, this study

these different methodologies are not directly comparable because each of them is based on different assumptions and uses specific indicators of environmental impacts.

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also points out that as much as 98% of all impacts of food consumption are due to food production, and only 1.7% due to transportation and other food-related activities. Meat products account, according to this study, for about one third of food's impacts, dairy products for slightly less than the second third of total impacts, while the remaining share is spread over consumption of non-alcoholic drinks (3,4%), alcoholic drinks (9.6%), fruit and vegetables (10,3%), confectionery (4.6%) and bread, flour and cakes (3.6%). The study reveals that if the share of organic products in the Cardiff's residents' food baskets rose from 1% found in 2001 to 100%, the footprint of food consumption of the whole Cardiff would be reduced by remarkable 39%.

[15] An alternative way to assess environmental impacts of organic food consumption is economic approach based on valuation of externalities associated with organic food production and consumption. An example of such analysis is the work by Pretty et al. (2005) that seeks to estimate environmental cost of UK weekly basket of food by calculating its negative environmental externalities. This study uses cost-based approach (i.e., analysis of the supply side rather than the demand side) and takes into account various costs associated with environmental degradation due to food production and consumption, such as replacement costs, costs of substitute goods, costs associated with loss of earning and also clean-up costs. Pretty et al. (2005) find that negative environmental externalities (excluding subsidies) equal to 8% of the price of the food basket; the largest share of these externalities is from the farm production (41%), domestic road transport (38%), and shopping transport (around 21%). The study concludes that externalities to the farm gate would decrease by between 12% (potatoes) to 43% (milk) if the production system was converted from conventional to organic one. The study finds that monetary equivalent that is equivalent to decrease in negative externalities of organic vs. conventional food equals only 4 to 7% of the price premium put on organic food and hence "the difference [in the prices of organic and conventional products] can only be partially explained as representing the value of on-farm natural capital being built by farmers through improvements to soils, biodiversity and landscape" (Pretty et al., 2005, p. 10); this finding implies that only relatively small share of price premium put on organic food products is justified by environmental benefits that organic food delivers.

Life-cycle analysis (LCA), also known as life-cycle assessment or cradle-to-grave analysis, is a holistic method that evaluates environmental impacts of all product stages (from raw material extraction, processing, manufacturing, transportation, retail, use and disposal) over a wide range of environmental impact categories. The LCA thus follows a specific product through its life-cycle (or specific parts of it) and assesses how each stage of product life-cycle interacts with the environment through extraction of production inputs and deposition of all unwanted by-products or waste.[16]

Currently, there are probably hundreds of LCA studies of various agricultural products and food. However, relatively few of these studies compare the environmental profiles of organic and conventional food. Although the body of LCA literature is growing quickly, it is still somewhat difficult to draw general conclusions regarding the environmental impacts of specific food items and their consumption and it still remains difficult to compare organically and conventionally produced food. We decided to devote a relatively large space to the review of pertinent LCA literature focusing on food consumption because we want to illustrate many uncertainties and inconsistencies that exist in the environmental assessment of food products. These inconsistent findings are reflected in conflicting and inconsistent environmental

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[16] The early LCA studies conducted in the late 1960s and through 1970s focused especifically on environmental burdens of product packaging and waste management; they used different methodologies and, as a consequence, arrived frequently at inconsistent results. To prevent similar problems in the future, standards (especially in the form of ISO 14040 series) of LCA were developed and implemented in consequent LCA research (Baumann & Tillman, 2004).

claims issued by producers and retailers and also by scientists, thus increasing the cognitive burdens of information processing on the side of consumers.

The holistic nature of LCA and especially the fact that it uses indicators of several impact categories may lead to inconclusive results where the product is superior in one environmental aspect, but lags behind in another one. Such a situation is, as we shall see in the next section, a very typical result of LCA studies which compare the environmental impacts of organic food with that of conventional food. Another situation that complicates comparison of results from different LCA studies arises when these studies do not cover the same environmental impacts or when certain impacts known to exist for a specific product have not been properly investigated by LCA. Finally, methodologies used to capture different environmental effects are not equally developed due to the fact that some of these effects are more difficult to quantify than others.

Foster and his colleagues (2006) argue that LCA is very suitable to capture some of the impacts associated with food consumption such as climate change potential due to emissions of greenhouse gasses, acidification from acid gas emissions, eutrophication caused by emissions of nutrients, impacts of ozone precursors on low-level air quality, stratospheric ozone depletion through emissions of ozone-depleting substances, and depletion of biotic and abiotic resources. Other environmental effects of food production and consumption are relatively more difficult to capture by standard LCA (namely release of toxic substances into water, land-use and water consumption impacts), while other impacts are frequently omitted from LCA (e.g. impacts on biodiversity, landscape aesthetics, and local water use). Also animal welfare, one of the key impact categories relevant for organic agricultural production (and also an important attribute of organic products from consumer point of view), is usually not considered in LCA studies (for discussion of animal welfare see the section 3.3.1.1 below).

Another limitation of LCA studies of organic food consumption lies in the fact that data on certain phases of the life cycle of food products (particularly the post-retail phase) are very scarce. For instance, a review of existing LCA studies relevant for food consumption provided by Tukker et al. (2006) shows that many of the environmental effects of food consumption are well established and considered significant (energy consumption, land use, non-renewable resource depletion and particularly ones related to energy use, water use, eutrophication, and acidification), while some other impacts are acknowledged, but there is a lack of consensus across various studies concerning their significance (e.g., greenhouse gas emissions, smog , waste).

Last but not least, LCA poses some methodological problems that need to be dealt with from normative positions. Foster and his colleagues (2006, p. 20) give an example of such a methodological riddle: suppose that someone is driving his car to a supermarket to buy 1 kg of pasta and 9 kg of groceries. The methodological question arises: how much of the emissions from the journey should be attributed to the purchase of 1 kg of pasta? Should we attribute them 0% (marginal increase in fuel consumption of the car due to additional 1 kg of freight is close to zero), 10% (proportion of weight of pasta in the shopping basket) or 100% (perhaps the purchase of pasta was the main reason to go grocery shopping and 9 kg of the remaining groceries increased marginal fuel consumption at the rate close to zero). Obviously, each of these methodological decisions is justifiable and right in its own way.

3.3 Environmental impacts of production and final consumption of food categories

Despite various deficiencies and limitations, the LCA method is very useful for the description and comparison of environmental impacts of organic versus conventional food consumption. In this section we review the LCA literature which deals with the environmental impacts of food production and final consumption of specific food categories such as meat and meat products, dairy products, basic carbohydrate food, fruit and vegetables, drinks and mixed products. By reviewing the pertinent studies, we hope to find an answer to the following questions:

- At what stage of the food life-cycle do the largest environmental effects arise?
- How important is the switch from a conventional to an organic mode of production with respect to the overall environmental effect of food consumption?
- Can we consider the choice of organic food over the conventional to be generally environmentally friendly?

By answering these questions we hope to shed more light on whether consumer decisions, and what types of decisions, related to organic food consumption have effects on the environment. In addition, we hope to contribute to the understanding of the uncertainties and complexities of decision-making that an ideal consumer would face, even if he made an effort to gather the most up-to-date knowledge about the environmental impacts of organic food consumption. Finally, this perhaps somewhat lengthy account of the environmental pros and cons of organic products is specifically meant to point to the fact that some commonly held conceptions about the environmental profile of organic food are not yet fully supported by the available empirical evidence.[17]

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[17] We hope that our argument here will not be understood as an effort to undermine legitimacy of organic agriculture. Quite on the contrary, we think that clear awareness of the limits of our knowledge in the area of organic production can prevent us from making unsupported claims that open the field to critique and delegitimize it among consumers. We think that pointing to "blind spots" in our knowledge of the issue can help to focus research on areas where the gaps in our knowledge are most pronounced.

3.3.1 ON-FARM PRODUCTION

Direct comparison of organic and conventional farming is complicated by the fact that in practice both types of farm management vary substantially. The question then is what type of conventional system do we mean: conventional, integrated or even an integrated system that incorporates some measures aimed at minimizing adverse environmental impacts? And when we talk about conventional farming, do we mean the average organic farm as typically found in a particular country, or do we mean the farm with the best practice, or the farm with the best practice and additional measures on top to further limit negative environmental impacts? A general comparison of organic and conventional farming is also complicated by the fact that some impacts are unknown or based on insufficient empirical evidence, including emissions of NO2 and CH4, and water use (Stolze, Piorr, Häring, & Dabbert, 2000).

Several interesting studies summarize the environmental differences between organic and conventional farming, including meta-analysis Mondelaers et al. (2009) and overviews of European LCA studies (Hansen, Alrøe, & Kristensen, 2001) and LCA studies conducted in developed countries (Scialaba, 2010). In addition, a study by United Nations (2007) provides an account of the benefits and problems related to organic farming word-wide. Also of interest is a review based on multi-criteria analysis of literature and expert accounts from 18 European countries, including the Czech Republic (Stolze et al., 2000). Finally, two individual studies are of interest to us: a study by Cobb et al. (1999) which compares the environmental impacts of organic and conventional farming on two neighboring plots of land on the same farm in the UK, and a study by Scialaba (2010) which analyzes global change mitigation and the adaptation potential of organic farming.

Results of these studies suggest that organically managed farms have a higher content of organic matter in the soil (Cobb et al., 1999; Hansen et al., 2001; Mondelaers et al., 2009; Scialabba & Hattam, 2002; Stolze et al., 2000) and the soil generally has better properties which makes it less vulnerable to soil erosion (Scialabba & Hattam, 2002). In addition, organic agriculture has been found to have higher agro-biodiversity and to increase the biodiversity of the neighboring landscape (Cobb et al., 1999; Mondelaers et al., 2009; Scialabba & Hattam, 2002; Stolze et al., 2000), as well as aesthetical value and ecological services provided by the landscape (Scialabba & Hattam, 2002).

When compared on a per-hectare basis to conventionally managed farms, organically managed farms have a lower nutrient release (Cobb et al., 1999; Hansen et al., 2001), a generally lower on-farm balance of nutrients (Stolze et al., 2000), a lower energy intensity (Scialabba & Hattam, 2002; Stolze et al., 2000; United Nations, 2007), a lower pesticide release (Hansen et al., 2001) and a lower overall global warning potential (Cobb et al., 1999). In addition, it is argued that organic farming has enormous climate change mitigation and adaptation potential when compared to conventional farming (Scialabba & Müller-Lindenlauf, 2010). On the other hand, it is recognized that organic farming has low self-sufficiency in feed (Hansen et al., 2001).

This generally rosy picture changes when the comparison is made on a per-unit-of-product basis because organic farms have relatively lower yields than conventional farms. On a per-unit-of-product basis phosphorus and nitrate leaching becomes higher in organic farming (Mondelaers et al., 2009), as also do GHG emissions (Mondelaers et al., 2009; Stolze et al., 2000). Lower land-use efficiency of organic farming may also initiate land-clearing (particularly in developing countries) and ensuing GHG emissions, and further increase the requirement of fossil fuels, which are relatively higher in organic farming anyway because of mechanical cultivation and harvesting replacing chemical weed and pest control.

The study by Wood, Lenzen, Dey and Lundie (2006) demonstrates the complexity of farming system comparisons using data from a detailed survey of organic and conventional farms. This study shows that most environmental effects, such as direct energy use, energy related emissions, and greenhouse gas emissions are higher in organic farms, while direct water use is significantly higher in conventional farms. However, indirect environmental effects are always higher in conventional farms and the total environmental burdens of conventional production (i.e., direct plus indirect effects) are also, according to this study, higher in conventional farms.

It is also known that poor management of organic farms can worsen their negative environmental effects. For example, the leaking of water-polluting substances (Cobb et al., 1999; Hansen et al., 2001; Stolze et al., 2000) poses risks to the health and welfare of animals (Stolze et al., 2000) and can even lead to the situation when farms have a worse environmental profile than conventional farms. An important thing to note with respect to the global warming potential of agricultural production is that it is dominated by N2O and CH4 emissions, not by CO2 emissions from fuel use (Williams, Audsley, & Sandars, 2006). Since N2O comes from soil management and animal manure management and CH4 from enteric fermentation and manure management, overall GWP is sensitive to how individual farms are kept. Certain traits of organic farming, particularly refraining from the use of mineral fertilizers, obviously lowers the GWP, but this advantage can be overridden by other processes (enteric fermentation, ruminant livestock) which may be comparable in conventional and organic farming (Williams et al., 2006).

There is a critical lack of original comparative LCA studies for organic and conventional farming in the Czech Republic and in fact we were able to locate only three studies that are partially relevant for our discussion here, although none of them is a standard LCA and only two of the studies are primarily comparative studies. The first piece of work, a methodologically somewhat flawed review study by Samsonová et al. (2005), discusses the potential of leaking of water polluting substances from conventional and organic agricultural systems in the Czech Republic and Germany. The study concludes that the water-polluting potential per hectare of land is lower in organic farming, but when compared on a per-kilogram-of-product basis, the two systems have very similar impacts on aquatic environments.

Somewhat more scientifically rigorous is the input-output comparative study of organic and conventional agriculture in the Czech Republic conducted by Valtýniová and Křen (2007), which shows that while fossil energy inputs per hectare are higher in organic agriculture, the total energy inputs per hectare are lower in organic systems. Nonetheless, the total energy efficiency of the two systems (i.e. ratio of inputs and outputs), as found in the Czech Republic, is very similar due to the lower productivity of the organic agricultural system.

Finally, Jarušková (2009) compares organic and conventional plant production in the Czech Republic and finds that on a per-hectare basis, organic production has a better environmental profile, but this pattern is reversed when the comparison is made on a per-kilogram-of-product basis because of the lower productivity of Czech organic agriculture (which is even lower than that in Western EU countries).

3.3.1.1 Animal Welfare

Animal welfare is an issue that needs to be discussed in relation to organic agriculture because the claim of high animal welfare has been incorporated into many legal definitions of organic farming (see e.g. Council Regulation (EC) No 834/2007) and also because animal welfare is an important attribute of organic food from the point of view of consumers (Harper & Makatouni, 2002; Millock, Wier, &

Andersen, 2010; Olesen, Alfnes, Røra, & Kolstad, 2010; Tsakiridou, Boutsouki, Zotos, & Mattas, 2008; Verhoef, 2005), although there is an indication that consumers' understanding of the concept of animal welfare is different from that of organic farmers (Harper & Makatouni, 2002; Vanhonacker, Verbeke, Van Poucke, & Tuyttens, 2008). Last but not least, the claim of higher animal welfare remains still somewhat controversial because there is not enough empirical evidence, at the present moment, that organic animal husbandry really attains higher animal welfare (cf. Kijlstra & Eijck, 2006; Lund & Algers, 2003).

Many authors who have studied the history of the organic movement point out that animal husbandry was not present at its beginnings (perhaps with the exception of biodynamic agriculture) and even was antithetical to some of its founding principles, such as vegetarianism (see e.g. Lund & Algers, 2003; Vogt, 2007). As a matter of fact, the ethical aspects of animal husbandry and the value of high animal welfare may and actually do clash with other values cherished by the organic movement (Verhoog, Lund, & Alrøe, 2003, p. 89). For example, the nose-ringing of pigs, which is allowed in organic farming specifically to maintain the plant protective layer of soil (environmental motive), clashes with the animal welfare requirement that pigs should be allowed to perform their basic behavior. Similarly, artificial insemination, allowed in organic farming and providing fast progress in breeding and an increase in production capacity (i.e. mostly economic principle), is also in opposition to the basic needs and desires of animals. Finally, the restriction on the use of antibiotics (motivated by concerns about consumers' health) puts animals at risk of increased morbidity and mortality (Padel, Schmidt, & Lund, 2003, pp. 62–63). Other similar examples are feeding animals with cereals and pulses, which makes animals compete for food with humans (an ethical conflict, especially at the global level) (Baars, Wagenaar, Padel, & Lockeretz, 2003); dehorning in cows and beak trimming in hens (a conflict with the safety of workers and animals) (Menke, Wailblinger, Studnitz, & Bestman, 2003, pp. 163–188); the endorsement of homeopathy and phytotherapy, which are frequently found by farmers to be inefficient (a conflict with economic and also animal welfare aspects of organic farming) (Kijlstra & Eijck, 2006). In the light of these tensions, Hovi et al. (2003) suggest that there is an urgent need to solve conflicts between public health, animal welfare, environmental protection, and economic efficiency.

However, the use and measurement of animal welfare and particularly the comparisons of animal welfare in conventional and organic systems seems to be very problematic at the present moment. Several authors have specifically pointed to the lack of quality comparative studies that would compare animal welfare in conventional and organic production systems (Kijlstra & Eijck, 2006; Lund & Algers, 2003). This fact has several reasons. One is that animal welfare is difficult to measure in a standardized way. Even though direct indicators of animal welfare (such as lifetime reproduction success, measures of body damage, disease levels, life expectancy, and the occurrence of stereotypes in behavior of animals) and also efforts to measure indirectly subjective preferences of animals have been accumulating since the late 1980s (see Broom, 1991), they have not been transformed into a standardized and accepted measure of animal welfare that could be used readily in LCA research. In addition, organic farmers were for a long time reserved towards quantitative empirical science (refusing its quantifying, rationalistic and techno-manipulative tendency) and mainstream science was hesitant to deal with issues related to the organic movement (because they viewed the organic movement as pseudo-scientific). Indeed, the organic movement was from the beginning more concerned about practical issues of organic production than with conducting research studies which would compare organic to conventional produce. Finally, as has been already noted, animal husbandry was only slowly incorporated into the system of organic production and therefore the issue of animal welfare appeared relatively later in its history (Lund & Algers, 2003). The comparison of animal welfare in conventional and organic production systems is also complicated by the fact that there is considerable variation in animal welfare in different types of organic and conventional farms (Müller-Lindenlauf, Deittert, & Köpke, 2010).

Overall, organic husbandry includes some aspects of animal rearing that are potentially very beneficial for animal welfare, such as allowing animals in larger housings and providing them with outdoor access, feeding them with organic feed, ensuring longer weaning periods, performing no tail and teeth clippings, minimizing the stress during rearing, transportation and slaughter, and ensuring that developmental, ethological, and physiological needs of animals are met (Kijlstra & Eijck, 2006 and also Council Regulation (EC) No 834/2007). On the other hand, organic animal husbandry poses its own risks to animal welfare and health such as increased risk of certain parasites, relatively lower ration control (due to refraining from the use of nutritionally well balanced but "artificial feeds"), higher incidence of parasitic and bacterial diseases related to outdoor and loose housing and free-range production, and also risks related to restrictions on the preventive use of medicine and to longer withdrawal times (Hovi et al., 2003; Kijlstra & Eijck, 2006; Lund & Algers, 2003). We think that Lund and Algers's (2003) observation made 10 years ago that there was not enough empirical evidence at the present moment which would justify the claims of higher animal welfare in organic agriculture vis-à-vis conventional agriculture is still valid even today. The lack of data on animal welfare is even more apparent in the Czech Republic, where no country-specific study has been published until now.

3.3.2 Environmental impacts of specific food product categories

3.3.2.1 Meat and meat products

Meat and meat products are generally associated with the highest environmental impacts, ranging between 4% and 12% in most impact categories of the total EU-25 environmental impacts due to consumption, and between 14% and 23% for eutrophication (Tukker et al., 2006). The proportion of consumption impacts attributable to egg consumption is usually not reported separately. However, a study by (Cederberg, Flysjö, Sonesson, Sund, & Davis, 2009) estimates for Sweden that egg consumption is responsible for less than 2% of environmental impacts attributable to animal product consumption. This figure is an indication of the impacts that we could expect also in other EU countries, including the Czech Republic.

A review of pertinent LCA studies shows that on per-kilogram bases, different animal products can be ordered with respect to their environmental impacts (especially in terms of GWP, land use and energy use; no clear patterns for euthrophication and acidification) from the highest ranking beef and lamb meat, followed by farmed salmon meat, pork, chicken, eggs, and whole milk (de Vries & de Boer, 2010; EWG, 2011; Foster et al., 2006). The relatively low effect of eggs and whole milk is due to their higher content of water, but they become comparable to pork and chicken meat when compared on a per-kilogram-of-protein basis.

The main factors responsible for the differences between the environmental impacts of meats are efficiency of agricultural operation, differences in feed efficiency, differences in enteric CH4 emissions between monogastric animals and ruminants, manure management system, grazing practices, differences in reproduction rates and time needed before the animal reaches slaughtering weight, and also some of the post-production stages, such as effects due to freezing of products during processing and storage, their cooking, and wastage (amount of waste and its handling) (de Vries & de Boer, 2010; EWG, 2011). From the post-production phase, freezing and cooking are responsible for 3% and 4% of impacts respectively (EWG, 2011), while wastage of meat can be between 4% and 8% of the food purchased for the household, thus increasing all environmental impacts by up to 8% compared to the effects of food consumption without wastage (Sonesson, Anteson, Davis, & Sjödén, 2005). Post-production impacts are, obviously, higher for highly processed animal products (Foster et al., 2006). However, most of the environmental impacts of meat and egg consumption come predominately from the production stage and range somewhere between 68% (canned tuna fish meat) and 90% (lamb and beef meat) of their respective environmental impacts. Interestingly, fish meat production has relatively high environmental effects both for sea fishing (high fossil fuel consumption, impacts on marine biodiversity and fish stocks – see, e.g., Ziegler, Nilsson, Mattsson, & Walther, 2003) and also for fish farming (due to feed supply production, waste production, chemical releases, impacts on biodiversity and landscape requirements - see, e.g., Black, 2001).

One of the few studies that compares organic and conventional meats in terms of their environmental profiles has been produced by Williams et al. (2006) specifically for England and Wales. This study shows that organic production minimizes primary energy use by 15 to 40% for all meats, with exception of organic poultry meat, which has 30% higher primary energy consumption than its conventional counterpart. GHG emissions are lower in organic sheep and pig meat production, but they are higher for beef and poultry meat; the difference is largest for sheep meat (as much as 30%). Other environmental impacts also vary across the types of meats, but generally speaking, all organic meat productions seem to be higher in eutrophication and acidification potential, nitrogen losses, and poultry meat also in abiotic resource use. As far as we are aware, no study reports results of such comparison for eggs. Nonetheless, we may speculate that a comparison of organic and conventional eggs, with respect to their environmental impacts, would be somewhat similar to a comparison of organic and conventional poultry meat because the two types of products have a similar environmental profile.

The observation that organic meat and possibly also eggs are not always associated with lower environmental effects is not surprising and is given by the fact that most of the sources of adverse environmental effects are inherent to any animal production system and independent of whether they come from an organic or conventional production system.

As far as we are aware, there are only two Czech studies that are relevant for comparison of organic and conventional meat production, although only one of them is a relatively rigorous LCA study and neither of them analyzes the full life cycle of meat products. The first study is an LCA conducted by Plch et al. (2011) which compares organic and conventional beef production in the Czech Republic with respect to GHG emissions. This study concludes that organic beef production is associated with GHG emissions which are twice as high as those of conventional production. Interestingly, this study reveals that more than 76% of GHG emissions of organic beef are due to feed inputs, while the majority of GHG emissions of conventional beef is attributable to enteric fermentation.

The study of Zagata (2009) examines to what degree does chicken husbandry in the Czech Republic comply with sustainable food production principals. The study is methodologically somewhat flawed, but its results can be taken, with some cautions, as the first indication that the organic production sector is becoming more differentiated in the Czech Republic, and that large organic farms do resemble conventional farms in that they are highly specialized and rely highly on external inputs, which may lead to their being unsustainable. In any case, a more scientifically rigorous analysis would be needed to confirm these results.

3.3.2.2 Dairy products

Dairy products are the food class with the second highest environmental impacts, constituting between 2% and 5% of the EU-25 environmental consumption impacts in most impact categories and between 10% and 13% of total impacts of eutrophication (Tukker et al., 2006). When compared on a per-kilogram-of-protein basis, the environmental impacts (particularly GWP, land use and energy use) of milk consumption are comparable to those of pork, chicken and egg consumption (de Vries & de Boer, 2010) and can be even higher for processed products such as natural cheese than for pork meat (EWG, 2011).

It is interesting to note that environmental impacts of primary production outweigh other phases of the life cycle of dairy products, even for highly processed food such as ice cream (Foster et al. 2005) or semi-hard Swedish cheese (Berlin, 2002). Moreover, the impacts in the production phase (including also GHG emissions) are not associated with energy use, but rather come from the enteric processes of ruminant animals and also from soil processes. Changing the source of energy inputs in the production stage therefore makes only a little difference in terms of these environmental impacts. The processing phase becomes more significant for food items that use dried milk powder (esp. due to its energy intensity).

Consumer can affect the energy requirements of dairy products also indirectly through the choice of packaging and reduction of wastage. Packaging choice is important in terms of energy requirements, but also other impacts, especially in the case of liquid milk and yogurt where the energy intensity associated with the most energy-intense packaging (one-time use glass bottles) is more than seven times higher than that of the least energy requiring packages (refillable high-density polyethylene and polycarbonate bottles, and the flexible pouch) (Keoleian & Spitzley, 1999).

Also wastage seems to be an issue for dairy products, although the data are very scarce here. A study by Sonnesson et al. (2005) finds that dairy products ranked number one in terms of wastage in Sweden, probably due to their perishable nature. In fact, the study reveals that mean after-storage wastage of dairy products is equal to 162% of diaries consumed, with after-meal wastage equaling to about 32% of diaries consumed. These figures basically suggest that households throw out more than half of diaries that they buy and that most of them are thrown out before food preparation in the household. In this way, wasting not only unnecessarily doubles the environmental burdens associated with food consumption, but it also creates additional environmental problems of municipal waste disposal.

An LCA study by Thomassen et al. (2008) which compares the direct and indirect environmental impacts of production of 1 kg of milk in an organic farm and a conventional farm reveals that on-farm energy use and euthrophication are lower in the organic system, while on-farm acidification potential and GWP are lower in the conventional system. Nonetheless, when on-farm as well as indirect off-farm effects are taken into account, total acidification and GWP per kg of milk are comparable for both conventional and organic farms. Total, as well as indirect land use per 1 kg of milk, are both higher in the organic system.

Comparisons of environmental impacts of milk production sometimes give inconsistent results across countries as can be demonstrated with three studies that compare organic and conventional milk production in England and Wales (Williams et al., 2006), in Sweden (Cederberg & Mattsson, 2000) and in Denmark (Thomassen et al., 2008). The three studies agree that in per-unit-of-milk comparison, direct energy consumption, pesticide releases, and abiotic resource use are lower in an organic system, while land-use and nitrogen release are lower in a conventional milk production system. However, they do not agree on whether GWP and acidification are lower in an organic system or not. The finding of Thomassen et al. (2008) that indirect impacts in all impacts categories are lower in an organic system due to lower requirements of external output are interesting in this respect. Consequently, the organic system becomes better in these categories when indirect effects are included (primary energy use) or comparable to the conventional system (GWP and acidification). As is the case with most LCA studies, none of the above mentioned studies of dairy production considers animal welfare. However, the study by Müller et al. (2010) has found that animal welfare varies considerably, even among organic farms, so one may assume that these differences would be even more pronounced when organic and non-organic meat production is compared.

In any case, variations in the management of specific organic farms influence the environmental profile of these farms significantly and probably also affects the health and nutritional attributes of their products. For instance, the study by Müller et al. (2010) revealed that there is considerable variation even between organic farms in their environmental impacts; the study concludes that farms with high feeding intensity have lower climate impacts and lower land-use, while those farms with lower inputs and that stick more to traditional ways of organic farm management (usually mixed farms that do not use feed concentrates) are able to keep higher standards of animal welfare, higher milk quality (as measured by content of omega-3-acids, conjugal linoleic acids, and antioxidants) and lower ammonia losses, but are worse in climate impacts and land use.

Unfortunately, to our knowledge, there are no LCA studies that compare the environmental effects of other dairy products from conventional and organic systems. Indeed, no study, either for milk or other dairy products, has been conducted in the Czech Republic.

3.3.2.3 Basic carbohydrate food

Basic carbohydrate food, such as potatoes, rice, bread, pasta, flour, and other cereal products, is the third most important food category in terms of its environmental impacts, accounting for about 3.3%

of total environmental consumption impacts due to eutrophication and for slightly more than 1% of impacts in other impact categories (Tukker et al., 2006).

This category of food includes products that are very heterogeneous with respect to their production, processing, and consumption patterns. Correspondingly, the patterns that we observe for their environmental impacts across their life-cycle and across various impact categories are very different and difficult to summarize in a concise form. An illustration of the complexity of the environmental impacts of this class of food is provided by Andersson and Ohlsson (1999) in a study that compares the life-cycle of bread produced in Sweden in large and small industrial bakeries, a local bakery and a home bakery. The results of this study suggest that primary production dominates the life-cycle of bread with respect to euthrophication and is also very important in GHG emissions, acidification and thermal energy use. Processing is a dominant source of photo-oxidant compounds, while its contribution to other impacts is of medium relevance (electrical energy consumption, global warming potential, acidification) or rather minimal (eutrophication). Transportation is significant in all impact categories except for electricity use. Packaging is significant in thermal energy use and also is noticeable in photo-oxidant compound formation, but it seems to be negligible in other impact categories. Finally, the consumer phase seems to be almost invisible in all impact categories, perhaps with the exception of electric energy (due to the storage of bread in freezers). Comparing the four production systems, the study concludes that bread produced in small industrial bakeries and local bakeries has the lowest environmental effects in terms of energy use and is comparable in terms of global warming, acidification, and euthrophication to a large industrial bakery and home baking.

The post-retail phase of life cycle, especially energy use involved in the transportation of food home from the shop and cooking, seems to be particularly important for two food items from this food category: potatoes (EWG 2011) and pasta (Carlssson -Kanyama and Boström-Carlsson 2001). Interestingly enough, the latter study estimates that home cooking can, under certain conditions (single-portion cooking), account for as much as half of the whole energy use across the lifecycle of spaghetti due to the longer cooking time. No similar study has been, to our knowledge, conducted for rice but it can be hypothesized that home cooking may actually play an important role in terms of energy use (Foster et al., 2006).

There are relatively few studies available that compare the environmental impacts of basic carbohydrate food produced in conventional and organic systems and almost no studies available for processed food. A study by Williams et al. (2006) compares environmental impacts of organic and conventional potato production in England and Wales and finds that organic potatoes are associated with lower GHG emissions, lower acidification potential and lower pesticide releases, but higher primary energy use, eutrophication potential, abiotic resource use, land use and total nitrogen losses. However, the difference between organic and conventional potatoes is easily overridden by effects due to their storage and type of variety (i.e., early vs. second early vs. main crop potatoes) (Foster et al., 2006; Williams et al., 2006).

An LCA study by (Williams et al., 2006) has also compared the environmental profile of conventional and organic wheat produced in England and Wales with the result that organic wheat is environmentally more friendly due to lower primary energy use, global warming potential, and abiotic resource use and worse in euthrophication, acidification, land use, and higher nitrogen losses. As far as we are aware, no study has compared the environmental profiles of organic and conventional grain-based products such as pastry, bread, pasta or similar products. As mentioned earlier in this section, processing and post retail phases may be very important for all these products and therefore it is not possible to tell, based on the results for bread wheat, what would be the environmental profiles of these products in comparison to their conventional counterparts.

Currently there have been only two studies conducted in the Czech Republic that are partially relevant for our discussion. The first of them is a study by Lustigová and Kušková (2006) which compares the conventional and organic production of wheat in the Czech Republic using the indicator of ecological footprint.[18] Not surprisingly, this study finds that organic wheat has a somewhat lower ecological footprint than conventional wheat on a per-ha-of-farmland basis (1.1 vs. 1.3 of global ha.), but the ratio becomes reversed when the footprint is compared on a per-kilogram-of-product basis due to the lower yields of organic system.

Jarušková (2009) goes a step further than the previous study and compares, in terms of energy inputs of final products, Czech domestic organic and conventional plant production with production imported from abroad. The results of Jaruškova's study are extremely interesting and show that organic wheat imported from such countries as the UK or the Netherlands is associated with lower energy inputs than Czech conventional or organic produce, even when the energy requirements of transportation are included. In addition, she also demonstrates that organic potatoes imported from the border regions of Austria or Germany to the Czech Republic have lower energy inputs than domestically grown organic or conventional potatoes due to the relative inefficiency of domestic agriculture.

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[18] As noted earlier (see note 14 above), the ecological footprint method is not fully consistent with the LCA methodology.

3.3.2.4 Fruit and vegetables

According to a review of studies discussed by Tukker et al. (2006), fruit and vegetables (excluding potatoes, which are dealt with in the previous section 3.3.2.3) account jointly for less than 2% of the environmental impacts of the EU 25 countries. An overview of LCA studies targeting fruit and vegetables has revealed that in particular, water and energy requirements, GHG emissions (especially N2O emissions) and land use are noteworthy (Foster et al., 2006). A large proportion of these impacts arises in the cultivation stage (Blanke & Burdick, 2005; Carlsson-Kanyama, 1998). However, the environmental importance of the cultivation stage can be overridden by post-cultivation stages in highly processed products such as tomato ketchup (Andersson, Ohlsson, & Olsson, 1998) or by negative impacts associated with long-distance transportation such as the import of apples from New Zealand to Europe (Blanke & Burdick, 2005), although the latter is subject to some disputes in LCA community (see the discussion further below).

Fruits and vegetables, including legumes, are not just important source of vitamins, fats, trace elements and anti-oxidants but also sources of proteins. As a matter of fact, a study by Carlsson-Kanyama (1998) shows quite convincingly, that by changing the structure of a diet and, in particular, replacing animal proteins with leguminous proteins in a diet, a remarkable reduction of environmental impacts of food consumption can be achieved, particularly in terms of global change potential.

Fruit and vegetables are generally quite perishable and their production depends on climatic and seasonal conditions. Efforts to conserve fruits and vegetables, making use of climatic and seasonal conditions when transporting them over long distances, and also efforts to use sophisticated methods to grow them in countries where it would not be otherwise possible (e.g., growing tomatoes, cucumbers and green peppers in Iceland using geothermal energy) are a few of the ways to deal with these distinguishing features of fruits and vegetables. Although it is obvious that these different activities, embedded in the production and distribution of fruits and vegetables, have significant environmental effects, the relative importance of these effects varies greatly across products, production and distribution facilities, and also in response to many other factors. In consequence, it is very difficult if not impossible for lay consumers to decide which products have lower environmental impacts. A few examples will illustrate these complex decision situations.

Consumers are frequently urged by environmental campaigners to buy locally grown fruit and vegetables as these are thought to be associated with lower environmental effects.[19] This plea receives empirical support in certain cases. For instance, a study by Blanke and Burdick (2005) compares the energy requirements of apples locally grown in Germany with those imported to Germany from New Zealand finds that the energy intensity of locally-grown apples is 27% lower than that of imported apples.[20]

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[19] Indeed, empirical research by Tobler et al. (2011) demonstrates that these pleas are mirrored in consumers' beliefs about environmental burdens of food products: when urged to judge environmental friendliness of different food products, Swiss consumers indicated that local food is the most environmentally friendly and food transported from distant countries is the most environmentally damaging. However, consumers' judgments were biased in that they ignored mode of transportation and type of local production practices.

[20] Interestingly, as much as 13% of energy requirements of local apples are due to their storing in controlled atmosphere that preserves high quality of apples in the winter months, and so one may hypothesize that the difference between the two types of apples could be even larger if consumers accepted lower quality of domestically grown apples stored in simple cellar.

However, an LCA study by Schlich and Fleissner (2004) which compares small-scale locally produced and imported large-scale produced fruit juices concludes that the imported products require less energy than those produced locally. Consequently, these authors argue that the size of the production and distribution facility is a more important factor in a products' energy intensity than transportation and also that long-distance sea transportation has smaller energy requirements than local transportation.[21]

Environmental burdens associated with fruit and vegetable consumption depend also on the delivery form of the product. This can be illustrated with the results of a study by Lingthart and his colleagues (2005) who compared different delivery formats for carrots (peeled fresh, bunched fresh, frozen in bags, frozen in cartons, and canned carrots) in terms of their environmental effects, nutritional quality and cost. This study finds that when wastage, transportation and storage are considered, canned carrots are, together with fresh bunched carrots and carrots in bags, among the most eco-efficient

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[21] Elaborating on their findings, Schlich and Fleissner (2004) propose the concept of "ecology of scale", an analogy to "economy of scale" concept, to denote their observation that large-scale production and distribution facilities provide the same products using less energy. Higher energy efficiency of production and distribution is explained by higher efficiency of logistics and by higher investments of larger companies in energy recovery and energy saving technologies. Although the study by Schlich and Fleissness is criticized for methodological shortcomings and for lack of generalizability, even its critics agree that in some cases the imported goods win over locally produced goods in terms of their environmental impacts (see, e.g., Jungbluth & Demmeler, 2004). In addition, some authors also hypothesize that there may exist "comparative ecological advantage" from shifting production to places where primary production can be grown with lower adverse environmental effects (Foster et al., 2006, p. 144), which also supports the case of global trade and long-distance transportation.

delivery formats for carrot available in the Danish market, outperforming fresh peeled products and also frozen products. Interestingly enough, this study found a relatively low effect of delivery format on the nutritional content of carrots and therefore canned carrots are proposed in this study as a viable alternative to fresh products when the latter are difficult to obtain.

A comparison of fruits and vegetables produced in organic and conventional systems is difficult to generalize because of the sensitivity of this product category to climatic conditions and also due to the relative scarcity of data and lack of comparative LCA studies. A study by de Backer et al. (2009) compares organic and conventional leek production in Belgium and reveals that when compared on a per-hectare basis, the organically produced leek has a better environmental profile in all impact categories. However, when the produce is compared on a per-kilogram basis and lower production efficiency comes into play, the conventional leek outperforms the organic one in that it is associated with lower abiotic resource depletion, stratospheric ozone depletion, photochemical oxidant formation and euthrophication potential. The study then concludes that there is lack of evidence for clear environmental friendliness of organically produced leeks.

Another study, a modular LCA by Jungbluth et al. (2000) compares the environmental impacts (using Eco-indicator 95 and Indicator of Ecological Scarcity) associated with the consumption of 15 vegetable products in Switzerland and finds that organic products have lower environmental effects. However, the difference between the environmental impacts of organic vegetable products on the one hand and integrated, or conventional products on the other, is not that large and can be easily overridden by other factors in the life-cycle of these products such as long-distance air transportation, use of energy-intensive processing (e.g., deep freezing of products) or use of certain packaging materials (e.g., glass containers). In a similar vein, the study by Liu et al. (2010) based on LCA of pear production from cradle to point of sale in China reveals that GHG emissions and fossil energy use do not depend so much on the farming system, as on the production chains due to farm topography and machinery use, seasonality of products, and also on local farming practices including manure management. These authors then go on to suggest that a switch to organic farming system is one among many factors which improve the environmental profile of pear products, the others being the replacement of a traditional storage system by a controlled atmosphere storage system, use of manure for biogas production, or a reduction of mechanical cultivation.

One of the few studies that finds an important effect of the production system on the environmental profile of apples is a randomized experimental study by Reganold et al. (2001) which compares organic and integrated apple-growing systems in the state of Washington on a per-hectare basis. This study finds that an organic system has as much as four-times lower potential of negative environmental impacts than a conventional system, while having also a slightly higher energy-efficiency than a conventional system. Nonetheless, these somewhat optimistic results for organic production of apples are cautioned by the results of another empirical study by Mouron et al. (2006), who compared 12 Swiss apple-growing integrated farms with regard to their environmental impacts. They find that the differences given by variations in farm management within the integrated system result in a variation in energy use, aquatic ecotoxicity and euthrophication that range by a factor of six when compared on a per-kilogram-of-apples basis. One may therefore infer from the results of the two studies that organic apple production has a better environmental profile under a strict *ceteris-paribus* condition when doing comparisons on a per-hectare basis, but that the environmental advantage of organic apples is not clear when other factors such as variable management practices and production efficiency are taken into account.

Finally, there is some empirical evidence that certain organic vegetable production systems can have an even worse overall environmental profile. For instance, the comparative LCA study of tomato production in England and Wales by Williams et al. (2006) reveals that organic tomatoes grown in greenhouses have environmental burdens twice as high as those from conventional greenhouse production in all impact categories except for pesticide use. The poor environmental profile of organic tomatoes is given by a combination of lower yields of organic tomatoes production (roughly 75% of the conventional) and lower average yields of the mix of tomato types used currently in organic production (i.e., specialist and on-the-vine tomatoes). These results suggest that the difference between organic and conventional greenhouse tomatoes production would not be that pronounced if the same mix of tomatoes types was used in the two systems.

As far as we are aware, no comparative LCA study for organic fruits and vegetables available on the Czech market has been conducted and therefore, no claims about the environmental attributes of organic fruit and vegetables sold in the Czech Republic can be made.

3.3.2.5 Drinks, mixed products and other items

Beverages are estimated to contribute by less than 2% to consumption-related impacts in the EU-25 countries, with roasted coffee and alcoholic beverages being the most noteworthy contributors (Tukker et al., 2006). Beverages are particularly remarkable for their eutrophication effect, but also for their water requirements in the production and processing stages (Foster et al., 2006).

The category of mixed products has probably environmental impacts below 3% of all consumption-related environmental impacts in the EU-25 in all impact categories. Among the items that are most significant in terms of their environmental impacts are edible fats and oils, sweets and other confectionery, and also potato chips and similar highly processed snacks (Tukker et al., 2006).

To our knowledge, only the study by Williams et al. (2006) compares the environmental profiles of organic and non-organic products from this product category; specifically they compare the environmental burdens of oilseed rape production in England and Wales. Their results suggest that organically produced oilseed rape is, in comparison to its conventional counterpart, associated with a slightly lower primary energy use, acidification potential, pesticides use, and abiotic resource use, comparable nitrogen losses and global warming potential, but with higher euthrophication potential and land use. Unfortunately, no comparative LCA study for organic products from this food category has, until now, been conducted in the Czech Republic.

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A review of LCA studies presented in this chapter demonstrates that the choice of organic food over its conventional counterpart can be proclaimed, under relatively restrictive conditions, as an environmentally friendly choice. However, the green profile of organic food, *vis-à-vis* its conventional substitute cannot be generalized for all food items and it cannot be even generalized for specific food items, or for specific countries. Importantly, the review documents also that frequently there is not enough empirical evidence (particularly in the case of the Czech Republic) to compare conclusively organic and conventional foods in terms of their environmental profile. We have also made an effort to demonstrate in this review just how complex and difficult task it is to compare the environmental profile of organic and conventional products. It is therefore no surprise that consumers usually fail to evaluate correctly the environmental friendliness of their food choice (cf. Tobler et al., 2011; see also discussion in section 1.4).

The largest environmental effects associated with food consumption arise mainly in the production stage. Highly processed products, or those products that are transported by air, have relatively high impacts in the production and post-production stages. The switch from conventional to organic products is therefore beneficial from an environmental point of view, especially for less processed products. However, other factors, such as climatic conditions, long-distance air transportation and the relative inefficiency of organic production can easily make the choice of organic food environmentally unfriendly. This somewhat simplifying conclusion is, however, complicated by imports of organic food that constitute a relatively large share of organic food sold in the Czech market (see our discussion in section 2.3). As a matter of fact, transportation can increase the environmental effects of food consumption but, on the other hand, imported food can have a better environmental profile due to a comparative climatic advantage and/or the high environmental efficiency of the producer. The environmental friendliness of food choice cannot be based solely on an organic attribute of food and would require additional information which Czech consumers probably do not have when choosing organic products.

Chapter 4: Theory of planned behavior and its application to explanation of organic food consumption[22]

The theory of planned behavior is one of the attempts to relate attitudes and other motivational factors to behavioral intention and actual behavior. The discussion about the link between various motivational factors on the one side and behavioral intention and behavior on the other has a long history in social sciences. Among the first who proposed studying attitudes as a way to understanding behavior were Thomas and Znaniecki (1996), and it was through their work that the "attitude-behavior" discourse entered the social sciences.

However, the early enthusiasm about the usefulness of attitudes in the understanding of behavior was moderated by an experiment conducted by LaPiere in the early 1930s (see La Piere, 1934), which demonstrated that verbally expressed attitudes towards foreigners are not always manifested in actual behavior. This skepticism towards the usefulness of the concept of attitudes in an explanation of behavior increased in the 1950s and 1960s, when several empirical studies showed that the relationship between attitudes and behavior is very weak or non-existent (for a review of these studies see e.g. Liska 1974) and some authors even argued that the concept of attitudes should be abandoned altogether (Wicker, 1969).

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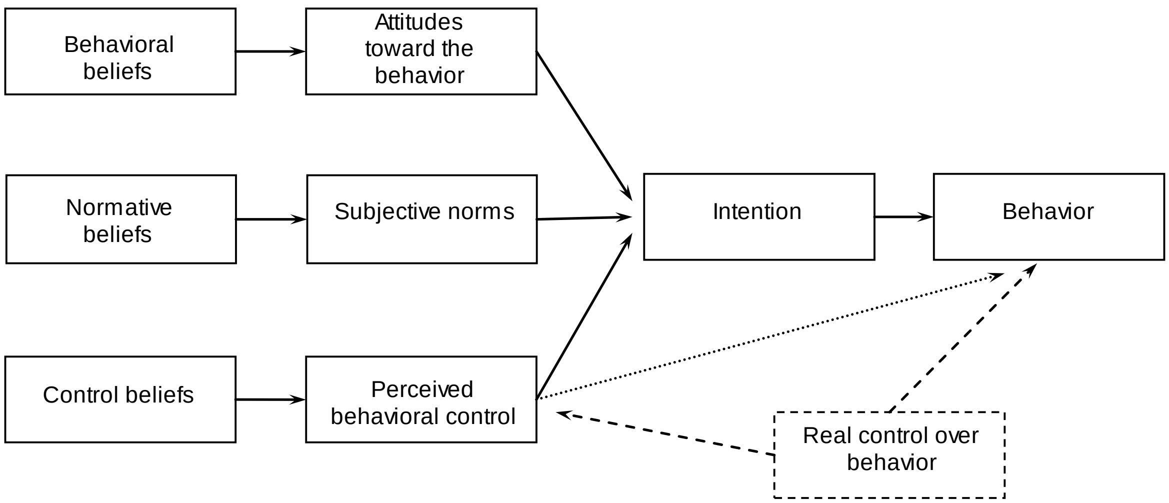
[22] This chapter draws substantially from two review articles that I have written together with Markéta Braun Kohlová (Urban & Braun Kohlová, 2008a, 2008b) and also from the manuscript submitted recently for publication in the Czech Sociological Review (Urban, Zvěřinová, & Ščasný, 2012), which is based on a survey done jointly with Iva Zvěřinová and Milan Ščasný.

The theory of planned behavior proposed by I. Ajzen (1985, 1991) is a direct extension of the theory of reasoned action (see, e.g., Fishbein & Ajzen, 1975) and builds on a critique of previous attitudinal theories. TPB borrows from the leaning theory (see e.g. Doob, 1947; Osgood, Suci, & Tannenbaum, 1957) the notion that overt behavior does not automatically follow from attitudes, but must be positively reinforced in the learning process and also that the formation of attitudes follows from cognitive beliefs. The latter principle has been more fully developed in expectancy-value theories (see e.g., Fishbein, 1963) which, generally speaking, argue that a person's attitude towards the object is proportional to the sum of beliefs about the object, multiplied by their respective evaluations. The proposition that attitudes are a function of cognitive beliefs and their evaluation has also been expressed in the Balance Theory (Heider, 1946).

4.1 Elements of TPB

The theory of planned behavior postulates that "planned" behavior (i.e. the behavior that is at least partly reflected upon by the performer) is a function of the intention to act and perceived behavioral control. The intention to act is, in turn, a function of attitudes, subjective norms, and related to perceived behavioral control. Finally, TPB assumes that attitudes, subjective norms and perceived behavioral control are formed based on attitudinal, normative and control beliefs and their respective evaluations (for original formulation of TPB see Ajzen, 1985, 1991). A convenient graphic representation of the TPB theory is displayed in figure 1.

Figure 4.1: Conceptual model of TPB



(Adapted from Ajzen, 2005: 126)

In contrast to many attitudinal theories that use the tripartite concept of attitudes proposed originally by Rosenberg and Hovland (1960), which assumes cognitive, conative and affective dimension of attitude, TPB reserves the term attitudes for affective judgments only. The remaining two dimensions from the tripartite concept of attitudes, cognitive and conative elements, enter the TPB model as two independent constructs, beliefs and behavior respectively (Ajzen, 2005). Attitudes are therefore conceptualized as a positive or negative affective evaluation of behavioral outcomes within the TPB framework (Ajzen, 1991, p. 191). This somewhat restrictive definition of attitudes is, in fact very, advantageous for TPB and also the earlier TRA because it allows for a clear operational definition of attitudes and also for an analysis of processes that lead to the formation of attitudes. In addition, the discriminant validity of the three constructs of attitudes, beliefs and manifested behavior also seems to be supported empirically (Ajzen, 2005, p. 21).

Subjective norms are conceptualized in TPB as subjectively perceived normative pressures from other people, be it family or friends, co-workers, but also experts whose opinion the performer takes seriously in given situation such as medical staff, tax advisors, gym trainers etc. (Ajzen, 1991, p. 195, 2005, p. 124). What people constitute the circle of significant others that exert normative pressure on the particular individual is an empirical question.

In fact, the conceptualization of normative factors in TPB is probably one of its weakest points and has been criticized extensively in the literature and several extensions of the TPB framework have been proposed that aim to remedy these shortcomings. The inclusion of descriptive norms in the TPB framework which is discussed (see section 4.3.1) and tested empirically in this work (section 6.4) is one of such extensions.

As mentioned earlier, theory of planned behavior extends theory of reasoned by including perceived behavioral control as an additional factor of behavioral intention (solid arrow from PBC to intention in figure 1) and behavior (dotted line from PBC to behavior). The inclusion of PBC as an additional factor of behavioral intention is based on an extension of Bandura's self-efficacy theory (Bandura, 1977) which suggests that one's expectations related to behavior affect motivation to and execution of that behavior. There was also an additional rationale for the inclusion of the direct link from PBC to behavior: it had been frequently found in previous empirical studies that intention had failed to predict behavior, particularly in such situations when the behavior was constrained considerably by external conditions thus causing the level of volitional control over such behavior to be relatively low (Ajzen, 1991, p. 183). The effect of external conditions on behavior is difficult to measure directly, but it can be approximated under reasonable assumptions (that actors have certain degree of familiarity with the situation and can judge the difficulty or easiness of that behavior before *ex-ante*) by perceived behavioral control. Obviously, the degree to which PBC approximates real control over behavior is an empirical question.

Besides focusing on factors of intention and behavior, TPB also sheds light on the formation of attitudes, subjective norms and perceived behavioral control. Both TRA and TPB have incorporated the expectancy-value (EV) model proposed earlier by Fishbein (1963). In its original formulation the EV model stated that positive evaluation of cognitive beliefs about certain objects leads to the formation of positive attitudes towards these objects. The EV model assumes that several cognitive beliefs are usually related to any attitudinal object and that each of these beliefs may be evaluated differently. The resulting attitude of each person is then proportional to the sum of products of his/her cognitive beliefs and their respective evaluations by the person.

The theory of planned behavior also extended the expectancy-value model to the formation of subjective norms and perceived behavioral control. Subjective norms are formed on the basis of normative beliefs (i.e., beliefs about whether a significant other would approve of an action) and motivation to comply with these perceived normative pressures. In a similar vein, perceived behavioral control results from control beliefs (i.e., beliefs about the presence of factors that facilitate or hinder particular behavior) weighted by the perceived power to overcome each of these factors. Similarly to attitudes, also in the case of subjective norms and perceived behavioral control, there are usually many beliefs, each of which is evaluated independently of others and the resulting subjective norm or perceived behavior control is proportional to the sum of products of these beliefs and their evaluations.

4.1.2 Rational-choice-theory assumptions in TPB

The theory of planned behavior assumes that "being neither capricious nor frivolous, human social behavior can be best described as following along lines of more or less well-formulated plans" and that "human being usually behave in a sensible manner; that they take account of available information and implicitly or explicitly consider implications of their actions" (Ajzen, 1985, pp. 11–12). These assumptions make the theory of planned behavior one of the variants of rational choice theory. The degree to which TPB is similar to RCT is of interest here because of the “overwhelmingly negative attitudes of sociologists toward the RCT” (Heckathorn, 1997). An important question is what assumptions TPB shares with RCT which would make it open to critique which is frequently addressed to RCT, and which of the assumptions that RCT makes are relaxed in TPB and therefore would not constitute rationale for its critique.

Two assumptions are an important ingredient of any RCT (see Opp, 1999, p. 173): an assumption that people have preferences which influence their action (preference proposition) and an assumption that people choose those actions that satisfy their preferences to the maximum degree, taking into account constraints (utility maximization proposition).

What is called "preferences" in RCT enters TPB in the form of attitudes and subjective norms (i.e., attitudes as a person's preferences with respect to certain objects, and subjective norms as preferences to obey the wishes of other people). TPB assumes that behavioral intention is proportional to the linear combination of attitudes, subjective norms and perceived behavioral control and, in addition, that each of these factors is formed based on an evaluation of specific beliefs according to expectancy-value model (Ajzen, 1985). In this respect, TPB accepts both preference proposition and utility maximization. However, TPB understands these assumptions as a useful simplification, or a way to describe how things are "on average", and does not claim that the formal model of TPB is a good description of what each and everyone of us does in each situation when deciding on the course of his or her action. The formal model of TPB does not imply that "people consciously review every step in the chain each time they engage in a behavior" and that, in fact, "once formed, attitudes, norms, and perceptions of control, and intention can be highly accessible and readily available to guide performance of the behavior. That is, people do not have to review their behavioral, normative, and control beliefs for these constructs to be activated." (Ajzen, 2005, p. 126). In other words, TPB assumes analytical rather than ontological rationality of the actors.

Another important point with respect to preference proposition is that TPB assumes that only accessible or salient beliefs are instrumental in the formation of attitudes, subjective norms and perceived behavioral control (Ajzen, 1991). Because salient beliefs are individual-specific, the empirical model of TPB uses modal beliefs (i.e., beliefs most commonly associated with a given target behavior in a certain population) as a useful approximation of salient beliefs to explain the formation of attitudes, subjective norms and perceived behavioral control in given population. These modal beliefs are elicited in a qualitative pre-survey which precedes quantitative application of TPB (cf. Ajzen, 2002a). TPB therefore does not expect everybody has formed beliefs, attitudes and subjective norms with respect to any object but rather, it expects that it is an empirical question to what degree people have formed their preferences with regard to a certain situation and, further, assumes that modal beliefs may be a useful proxy for individual-specific salient beliefs.

It should also be mentioned that the theory of planned behavior is, as its name suggest, most suitable for an explanation of behavior that is "planned", in the sense that it reflected upon by the actor, and, on the other hand, it cannot explain reflexive and compulsive behaviors and actions of people whose cognitive skills are severely limited (c.f. Ajzen, 2005, p. 108). Although limiting the application of TPB only to "planned behavior" may seem to be very restrictive, empirical applications of TPB demonstrate that this theory remains relatively robust to deviation from the assumption of "planning" and retains a relatively high predictive power, even when the behavior is automated and habitualized, owing to the fact that "cognitive regulation of routine behavior is evident even in relative simple action sequences" and also because TPB is suitable to account for the formation of particular behavior into the form that has been habitualized in the course of action (viz. Bamberg & Schmidt, 2003, p. 185).

The theory of planned behavior can be also shown to relax some of the assumptions of what is labeled as a "narrow" formulation of RCT. It has been shown by Opp (1999) that the assumptions of the narrow version of TPB are too strict and should be replaced by a "wide" version of RCT which assumes that:

1. all kind of preferences, and not just the egoistic ones explain behavior;

2. all kinds of constraints, not just tangible ones, govern human behavior;

3. subjects need not to be fully informed;

4. perceived as well as objective constraints are relevant;

5. constraints together with preferences explain behavior.

The theory of planned behavior shares all these assumptions with the wide version of RCT; specifically it accepts (cf. Ajzen, 1985, 1991, 2005) that:

1. not just attitudes and beliefs related to self-interest motivate behavior, but a whole range of other types of motives, such as altruistic and bio-centric attitudes and social norms, affects behavior;

2. perceived constraints in the form of perceived behavioral control are a factor of behavior;

3. subjects act on their beliefs, regardless of whether these are truthful or false;

4. TPB acknowledges the role of objective constrains of behavior, but since these are difficult to measure practically, it proposes that perceived constrains may be a proxy for actual constraints under certain conditions;

5. TPB assumes that motivational factors, together with perceived and actual constrains of behavior, affect the behavior.

The theory of planned behavior therefore seems to overcome some of the inadequacies and limitations of the narrow version of RCT.

4.2 Applications of TPB

Up to now, TPB has been applied in over 1000 empirical applications (see complete bibliography in Ajzen, 2012). One of the most frequent applications of TPB has been in the field of health-care (for an overview see Godin & Kok, 1996) and health-related research (for an overview see Albarracín, Johnson, Fishbein, & Muellerleile, 2001; Bennett & Bozionelos, 2000; Godin, 1993; Hagger, Chatzisarantis, & Biddle, 2002; Hausenblas, Carron, & Mack, 1997). Apart from research focusing on health-related behavior, a wide variety of topics including travel behavior (Bamberg, 2006; Bamberg, Ajzen, & Schmidt, 2003; Bamberg, Rölle, & Weber, 2003; Davidov, Schmidt, & Bamberg, 2003; Yang-wallentin, Schmidt, Davidov, & Bamberg, 2004) and consumption behavior (see Ch. J. Armitage, Sheeran, Conner, & Arden, 2004; Bogers, Brug, van Assema, & Dagnelie, 2004; Brug, de Vet, de Nooijer, & Verplanken, 2006; Fortin, 2000; Kang, Hahn, Fortin, Hyun, & Eom, 2006; Kassem & Lee, 2004; Kassem, Lee, Modeste, & Johnston, 2003; Kuther, 2002; Lien, Lytle, & Komro, 2002; Mannetti, Pierro, & Livi, 2002; Tonglet, 2002 to list only the most recent)have been analyzed using TPB. Other applications of TPB have covered such diverse topics of behavioral research as leisure activities, social deviance, political participation, and school performance.

There are several applications of the theory of planned behavior in the domain of pro-environmental behavior (for an overview of these studies see Staats, 2003). The theory of planned behavior has been frequently applied to an explanation of recycling behavior (see Boldero, 1995; Cheung, Chan, & Wong, 1999; Chu & Chiu, 2003; Knussen & Yule, 2008; Mannetti, Pierro, & Livi, 2004; Nigbur, Lyons, & Uzzell, 2010; Taylor & Todd, 1995), conservation behavior and general pro-environmental behavior (Beedell J. & Rehman T., 2000; Florian G. Kaiser, 2006; Florian G. Kaiser & Gutscher, 2003; Florian G. Kaiser, Hübner, & Bogner, 2005; Florian G. Kaiser & Scheuthle, 2003; Florian G. Kaiser, Wölfing, & Fuhrer, 1999) and also energy use (Abrahamse & Steg, 2009). Several studies have also applied the theory of planned behavior to an explanation of organic food consumption (Arvola et al., 2008; A. J. Cook, Kerr, & Moore, 2002; Dean, Raats, & Shepherd, 2008; Gracia & de Magistris, 2007; Saba & Messina, 2003; Sparks & Shepherd, 1992; Tarkiainen & Sundqvist, 2005; Thøgersen, 2009).

The explanatory power of the theory of planned behavior in these diverse applications is quite high. In fact, empirical models based on the theory of planned behavior do, on average, explain as much as 39% of variability of intention and 27% of variability of behavior (see meta-analysis of TPB studies by C.J. Armitage & Conner, 2001).

Discussion and applications of TPB in the Czech context is relatively limited. Probably the earliest discussion of TRA and TPB in the then Czechoslovak/ Czech context was provided by Výrost (1988) and a somewhat extended account has also been given by Výrost and Slaměník (1997). Two recent studies focused specifically on the discussion of the usefulness of TPB in sociology (Urban & Braun Kohlová, 2008b) and a general discussion of the strengths and weaknesses of this theory (Urban & Braun Kohlová, 2008a). Besides these general accounts of TPB, two other review studies have focused on the usefulness of TPB as a conceptual framework for the understanding of contingent valuation method applied in non-market valuation (see Urban, 2005) and the applicability of TPB in the context of behavioral intervention in the health domain (see Horváth & Vysloužil, 2005).

Only a couple of studies have attempted to test TPB empirically in the Czech Republic. Three studies (Urban & Ščasný, 2007; Urban, Ščasný, & Zvěřinová, 2008; Zvěřinová, 2011) have applied TPB or its elements to an explanation of organic food consumption in the Czech Republic (see discussion in section 4.2.1.1), one study used TPB to explain energy-conserving behavior of university students (Urban, Zvěřinová, & Proková, 2010), and one study used TPB to explore health-related aspects of life-style among future medical nurses (Horváth & Ivanová, 2007).

4.2.1 Applications of TPB to responsible food choice

Several studies have also applied the theory of planned behavior to an explanation of organic food consumption (Arvola et al., 2008; A. J. Cook et al., 2002; Dean et al., 2008; Gracia & de Magistris, 2007; Saba & Messina, 2003; Sparks & Shepherd, 1992; Tarkiainen & Sundqvist, 2005; Thøgersen, 2009; Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011). Only four of these studies focused on an explanation of purchase behavior (Gracia & de Magistris, 2007; Saba & Messina, 2003; Tarkiainen &

Sundqvist, 2005; Thøgersen, 2009; Zvěřinová, 2011), while the remaining studies focused on an explanation of the intention to purchase organic food.

The explanatory power of organic food consumption models based on the theory of planned behavior varies noticeably. The explained variance of intention to purchase organic food varied between 24% in the case of the intention to purchase organic vegetables over the next week (A. J. Cook et al., 2002), and 83% for the intention to purchase organic tomatoes and processed organic sauce (Thøgersen, 2009). The explained variance of organic food consumption also varies considerably between 18% for the purchase of organic tomatoes and tomato sauce (Thøgersen, 2009) and 82% for the purchase of organic bread and flour (Tarkiainen & Sundqvist, 2005). Still, however, judged by the explanatory power of models that are readily used in social sciences, the explanatory power of TPB seems to be relatively high, even in the domain of organic food consumption.

Besides serving as a prediction model, TPB is also very useful in obtaining an understanding of why people consume organic food. TPB helps to better understand the role of attitudes, social norms and perceived behavioral control as determinants of intention to consume organic food, and the role of behavioral intention and perceived behavioral control in affecting actual consumption of organic food.

A theoretical framework, rather than *ad hoc* modeling, is advantageous, not just because it leads to an accumulation of otherwise very disparate research findings and their placement within the broader picture, but it also helps illuminate the theoretical and empirical gaps in our knowledge concerning organic food consumption (see the excellent review, based conceptually on TBP by Aertsens, Verbeke, Mondelaers, & Huylenbroeck, 2009).

4.2.1.1 Applications of TPB to responsible food choice in the Czech Republic and other relevant empirical evidence

As pointed out in section 4.2, applications of TPB to organic food consumption are quite limited. Beside the TPB studies that are directly relevant for the present work, there are some other pieces of evidence which come from various consumer surveys which we shall also discuss here because they relate to constructs found in TPB.[23]

Several empirical studies of organic food consumption in the Czech Republic have been published, all of which are based on cross-sectional data from consumer surveys. Unfortunately, only two of these studies use data representative of the Czech adult population (OECD, 2011; Synergy Marketing & GfK, 2006), three other studies exploit data representative of the Znojmo region and/or the capital Prague (Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011). Another study is based on a typological sample of a specific segment of the Czech population (people living in large towns, with high-school or higher education, higher-than-average income, aged 16-50; see Ogilvy, 2008), while the remaining studies (Živělová, 2005, 2006; Živělová & Jánský, 2006, 2007a, 2007b) are based on data coming from convenience samples. Therefore generalization of their results to any clearly defined population is very problematic. Only three of the studies aim at an exploration of factors of intention to consume organic food (Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011), while the remaining studies are purely descriptive and mostly use only univariate statistics.

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[23] For instance, many of these surveys elicit consumers' beliefs about organic food.

When asked to indicate associations that come to their mind when thinking about organic food, Czech consumers indicate that organic food is food without chemicals (31% of respondents), healthy food (24%), environmentally friendly food (12%), natural food (11%) and safe food (9%) (Synergy Marketing & GfK, 2006). A higher frequency of salient beliefs related to the health and quality attributes of organic food among Czech consumers is found also in an OECD study (2011) and seems to be rather typical for organic food consumption word-wide (Boccaletti, 2008). Interestingly, however, Czech consumers seems to rate the importance of health-related motives relative to the importance of environmental motives much higher than consumers in European countries such as France, Italy, Norway, the Netherlands, Sweden, of which all have developed organic markets, but comparably to consumers in Canada, Australia and Mexico (OECD, 2011). The higher importance attached by Czech consumers to the stated health-related motives or beliefs relative to environmental ones is also apparent in other empirical studies (Ogilvy, 2008; Urban et al., 2008; Zvěřinová, 2011; Živělová & Jánský, 2006, 2007a).

Barriers to organic food indicated by Czech consumers include lack of information about organic food (indicated by 32% of respondents), the habit of purchasing conventional food (32%), the higher price of organic food (31%), insufficient availability of organic food in grocery stores (19%), lack of trust in organic certification (17%), and a too narrow assortment of organic food available on the market (7% of respondents) (Synergy Marketing & GfK, 2006). Higher price, lack of information about organic food, a narrow assortment of organic food and a lack of availability of organic food on the market are consistently mentioned as the main barriers to the purchase of organic food also in other studies (c.f. Ogilvy, 2008; Urban & Ščasný, 2007; Zvěřinová, 2011; Živělová & Jánský, 2007b), although the ordering of these barriers according to their importance is not the same across the studies.

Beside these purely descriptive results, three studies attempt also to test a hypothesis about factors of intention to consume organic food (or willingness to pay, WTP) and past consumption of organic food. Two of these studies focus on determinants of willingness to pay for organic food (Urban & Ščasný, 2007; Urban et al., 2008) and exploit data from a survey of a representative sample of the adult population of the capital city of Prague (N=351). The two studies do not test the complete model of the theory of planned behavior but, instead, use two of its elements, attitudes and subjective norm in combination with socio-economic and psychological variables to explain willingness to pay for organic food (that is conceptualized as the intention to expend on organic food). The results of the two studies suggest that past purchase behavior can be explained by subjective norms, pro-environmental attitudes and presence of children in a household; the probability of non-zero WTP is positively affected by subjective norms, the presence of children in a household, a higher level of education, and is also higher for female respondents and, finally, the absolute magnitude of WTP for organic food is positively affected by the age of respondents, their educational attainment, their total expenditures on food and their income (Urban & Ščasný, 2007). In addition, there is also evidence of considerable heterogeneity of factors that affect the stated WTP for different food items (milk and yogurts, cheese, meat, eggs and fruit and vegetables) (Urban et al., 2008).

Finally, the work by Zvěřinova (2011), which exploits two samples of the adult population representative of the capital city of Prague (n1=330) and the region of Znojmo (n2=354), is probably the most complete attempt to use the theory of planned behavior in the context of organic food consumption in the Czech Republic. This study finds that the probability of organic food purchase (indicated by past purchase behavior) is positively affected by the present intention to consume organic food, knowledge of organic food, knowledge of the correct organic logo, and residence in the capital of

Prague (as opposed to the rural Znojmo region). Further, the study also reveals that the intention to consume organic food is affected by (directly measured) attitudes and subjective norms, but not by perceived behavioral control. When the author replaced the direct measures of TPB constructs with indirect ones in order to explore belief-basis of norms, attitudes and perceived behavioral control, she found that attitudes related to health-, quality- and taste-attributes of organic food and (injunctive) subjective norms related to partner, parents and own children have the strongest effect on intention to consume organic food, while perceived behavioral control has, again, no direct effect on intention.

4.3 Critique and extensions of TPB

Although the theory of planned behavior is relatively well received in social sciences (as indicated by sheer number of its empirical applications), several critical points have been addressed to the theory. In this section we mention only some of these critical arguments. A discussion of other critical points directed at TPB can be found, for instance, in the review article by Urban and Braun Kohlová (2008a). Apart from criticism that is directed at assumptions of rationality, utility maximization and other RCT-like assumptions of TPB (discussed in some in the section 4.1.2 above), the following three critical arguments have been directed at TPB:

1. TPB can be criticized for not demonstrating sufficiently causal and temporal flow of influences between its constructs. For instance Cook et al. (2005) argue that the correlation found between beliefs, attitudes and behavior is due to people's tendency to be consistent in their account of what they do and what they think, rather than due to a causal chain leading from beliefs trough attitudes, intention to behavior. This interpretation is, in fact, very close to Greve's (2001) remark that constructs of TPB are constitutive elements of intention rather than its causal factors. Indeed, Thøgersen

(2011) has found empirically (and explained theoretically by cognitive dissonance theory) that consumers update their beliefs after they purchase organic food in order to minimize the uneasiness that follows from inconsistency in their beliefs, suggesting that the direction of causation between beliefs and behavior may be actually reversed.

The issue of direction of causation in TPB is a difficult one. On the one hand, there is a wealth of evidence from previous theories which TPB draws from, such as EV theory, that beliefs lead to formation of attitudes and these, in turn, affect behavior. On the other hand, it is also true that most studies use only cross-sectional data to test TPB and that out of those that use longitudinal and experimental evidence, none has specifically tested the direction of causality at each model level. This issue therefore cannot be decided conclusively at the present moment, although it is fair to say that the empirical evidence in support of auxiliary theories (EV theory and others) on which TPB was built seems to be stronger than the empirical evidence against the causal ordering of constructs with TPB.

2. Also frequently discussed with respect to TPB is its empirical adequacy. Ever since its formulation at the beginning of the 1990s, there have been attempts to demonstrate that some explanatory variables are missing in TPB. As a matter of fact, I. Ajzen has invited efforts to extend TPB in its original formulation (viz Ajzen, 1991, p. 199) by claiming that TPB is principally open to addition of new variables, under the condition that it is well demonstrated that such variables consistently and significantly improve the predictive capacity of TPB.

A review of TPB by Conner and Armitage (1998) shows that particularly the following six extensions are very frequent: i) inclusion of indicators of belief salience, ii) inclusion of indicators of past beliefs or habit, iii) differentiation between indicators of perceived behavioral control and self-efficacy, iv) inclusion of moral norms, v) inclusion of the construct of self-identity and, finally, vi) inclusion of affective beliefs. Three of these extensions, namely the inclusion of personal norms, past behavior and self-identity are frequently found in TPB studies which focus on pro-environmental behavior (Staats, 2003). In this work we focus on another extension of TPB and that is the inclusion of descriptive norms (see section 4.3.1 for a detailed discussion of this extension of TPB).

One of the problems with similar extensions of TPB lies in the fact that they often use an increase in the explained variance of the dependent variable due to the inclusion of an additional variable as the main argument for the variable to be retained in the model. This argument is, however, very problematic. As Trafimow (2004) convincingly shows, a change in the R-square may be inflated due to poor reliability of the measurement of constructs originally included in the model or it may be, on the other hand, attenuated due to the shared variability or explanatory variables caused by their correlation. In addition, ΔR-square may give a false impression of the improvement of predictive power of the model due to the non-linear relationship that exists between explained variance of the dependent variable and the ratio of correct predictions of the model. Therefore what is apparently needed is that extensions of TPB are theoretically well justified and rigorously tested by means of empirical analysis.

3. A more general critique of TPB, and similar RCT models, lies in the claim that they focus on the behavior of individuals and tend to view their actions as a discrete choice situation. The allegation of segmentation is not faithful to the original formulation of TPB. In fact TPB is quite versatile with respect to the level of generality of the behavior being analyzed and its temporal framework.[24] The focus on the individual in TPB is a methodological decision and does not imply that individuals are not affected by external social and other factors. Indeed, two factors that mirror these external conditions are directly included in the TPB framework (i.e., subjective norms and perceived behavioral control).

An analytical focus on the explanation of individual behavior does not need to be an obstacle to an explanation of social phenomena. Models of individual behavior have been applied to an explanation of social phenomena by Hedström (2005, 2006) and by Hedström and Swedberg (1996), who elaborated on Coleman's (1986) macro-micro-macro relations scheme. An explanation of social phenomena proceeds in three steps. Firstly, a plausible model of individual behavior is formulated25. Secondly, an interaction

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[24] TPB has higher predictive power when applied to aggregated behavior because peculiarities of specific behaviors do cancel out at more general level (Ajzen, 2005, p. 80).

[25] The *desires-beliefs-opportunities* model (DBO) proposed by (Hedström 2006) to explain intention and behavior of individuals is actually very similar to TPB model. Unlike TPB, however, the DBO model does not include

mechanism between individual agents is specified. Third, an agent-based simulation is used to emulate the social reality that would result if the two previous steps were true. Fourth, this emulation is compared to data on social reality. If the result of the simulation is very different from the actual data, than either the first or the second, or both of these steps, are incorrect. If the simulation is close to the actual data, than the behavioral and interaction models specified in steps 1 and 2 are taken as a plausible explanation of the social phenomenon observed in reality.

Unfortunately, use of TPB in agent-based simulations is very limited (see, e.g., Kniveton, Smith, & Wood, 2011 for an appliacation in the context of migration flow; and Zhang, Nuttall, & Group, 2007 for an application on smart metering adoption), but the usefulness of TPB in an explanation of macro-social phenomena using the macro-micro-macro relations scheme has been demonstrated empirically for instance in the study of travel mode choice by Bamberg and Schmidt (Bamberg & Schmidt, 1998).

4.3.1 Descriptive norms in the TPB framework

Of particular relevance to the subject matter of this study are attempts to improve conceptualization and measurement of social norms in the TPB framework because normative influences can be expected to be important in a situation where environmental, social and altruistic motives play a

normative pressures as a factor of intention. Also the empirical evidence in support of DBO is much weaker than in case of TPB.

prominent role, such as in the cases of pro-environmental behavior or, in our case, organic food consumption.

As a matter of fact, the concept of subjective norms as originally included in TPB (viz. Ajzen, 1991) captures only one of many facets of norms, the injunctive norms (what ought to be done according to other people) and neglects other types of norms such as descriptive norms (what others do) or moral norms (what is right to do). Improper conceptualization and measurement of normative influences is held to be responsible for the fact that from the three predictors of intention, social norms are found to have the weakest effect (see meta-analysis by C.J. Armitage & Conner, 2001) or even no effect on intention (Conner, Norman, & Bell, 2002; Mahon, Cowan, & McCarthy, 2006; Terry & O'Leary, 1995).

One of the modifications of TPB consists of the introduction of descriptive norms as an additional predictor of behavioral intention. While injunctive norms are followed because people seek to gain approval of others and avoid their sanctions, the effect of descriptive norms is more indirect. Descriptive norms are perceptions of what other people do and therefore may be used to infer other people's attitudes and norms (Rivis & Sheeran, 2003) or information about the reality (Deutsch & Gerard, 1955). Imitation of the behavior of others may then serve to gain recognition as a group member by others or simply to adjust one's own perception of reality.

A recent meta-analysis of 14 TPB studies which included descriptive norms as an additional predictor of intention shows that descriptive norms have a significant effect on intention after controlling for other TPB variables and that the inclusion of descriptive norms increases the explained variance of intention by 5% (Rivis & Sheeran, 2003). An additive and independent effect of descriptive norms on intention is also found in a meta-analysis of TPB studies by Melnyk et al. (2010).

Most of the studies that include descriptive norms as an additional variable in the TPB framework focus on health-related behavior (see Rivis & Sheeran, 2003 for their overview), three focus on healthy eating (Berg, Jonsson, & Conner, 2000; Nordrehaug Astrøm & Rise, 2001; Povey, Conner, Sparks, James, & Shepherd, 2000), one on eating as such (Tuu, Olsen, Thao, & Anh, 2008), while no study has tested extended TPB within the context of organic food consumption. In any case, it is interesting to notice that of the four studies that test the addition of descriptive norms in the food-related context, only the study by Povey et al. (2000) finds no significant effect of descriptive norms on intention when controlling for other TPB variables.

Another issue that is closely related to poor conceptualization of normative effects in the TPB framework is the interaction of normative and attitudinal effects that is observed in most TPB studies and which is manifested as a correlation between attitudes and subjective norms; such correlations have also been observed in the context of organic food consumption (Arvola et al., 2008; A. J. Cook et al., 2002; Sparks & Shepherd, 1992; Tarkiainen & Sundqvist, 2005; Thøgersen, 2009). Indeed, when injunctive and descriptive norms are entered separately as predictors of intention, they appear to be both correlated with attitudes: for instance, the meta-analytical study by Rivis and Sheeran (2003) revealed that the mean correlation between attitudes and descriptive norms equals 0.38 and the correlation between injunctive norms and attitudes equals 0.44 and is significantly higher. Also a recent meta-analysis of TPB studies by Melnyk et al. (2010) finds that both injunctive and descriptive norms are correlated with attitudes and that the former correlation is higher.

The reasons for the correlation of attitudes and subjective norms, measured as one construct or measured as two independent constructs of injunctive and descriptive norms, is not clear. Some of the early studies based on the theory of reasoned action found that the correlation between attitudes and social norms was due to the strong causal path from attitudinal beliefs to social norms (Shimp & Kavas, 1984), while others found evidence of a causal path leading from normative beliefs to attitudes (Vallerand, Deshaies, Cuerrier, Pelletier, & Mongeau, 1992). Given almost complete lack of longitudinal or experimental evidence, most studies can only hypothesize why norms and attitudes are correlated and attribute this affect to the social-learning effect of norms on attitudes or alternatively to a selection mechanism, whereby attitudes affect social norms (Rivis & Sheeran, 2003).

4.3.2 Past behavior in the TPB framework

The addition of an indicator of past behavior in the TPB framework is another frequent and very important extension of the model. Several empirical studies have shown that past behavior is an additional explanatory factor in the TPB model (for their review see Conner & Armitage, 1998). Indeed, past behavior has proved to be an additional explanatory variable also in the context of responsible food choice (see, e.g., Sparks & Shepherd, 1992). Although inclusion of past behavior is a very popular extension of the TPB model, opinions differ on where exactly should past behavior be added in the model (i.e. whether it should affect present behavior and/or other variables in the model) and how should any such effect or lack of thereof be interpreted theoretically.

Probably the most common way of the introduction of past behavior in the TPB framework is to include it as an additional predictor of (present) behavior. Since TPB is assumed to be sufficient for an explanation of behavior, the addition of past behavior in the model constitutes a test of the model's sufficiency for an explanation of behavior. If past behavior is found to have an effect on present behavior, there is some other factor which influences this behavior which is not captured in the model (Ajzen, 1991, p. 202). Indeed, the meta-analysis of TPB studies by Conner and Armitage (1998) shows that past behavior increases explained variance of behavior on average by 13%.

There are two broader explanations possible for the unmediated effect of past behavior on present behavior. Firstly, the observed statistical effect of past behavior on present behavior unmediated by TPB variables may be due to shortcomings of the empirical model such as correlated measurement errors of the measures of past and present behavior due to similar items being used for their measurement; the predictive power of the original model may be low due to low reliability of measures of TPB constructs, or the measures of TPB constructs are not compatible (Ajzen, 2002b). However, Conner and Armitage (1998, p. 1438) argue that an increase in explained variance of the dependent variables is generally "probably too large to be solely attributable to common method variance effects".

Secondly, there may be some substantial reasons for why past behavior has an unmediated effect on present behavior; frequently such an effect is interpreted as an indication of habitualized behaviors [26]

[26] In accordance with Aarts et al. (1998, p. 1359), we define habitualized behaviors as "goal-directed automatic behaviors that are mentally represented". The goal-directedness of habitual behavior consists in automated cognitive processes being triggered by specific situations. These automated processes than partly guide the behavior and replace some of the elaborate reasoning that would guide it in non-habitual situations (ibid.). However, as pointed out by Bamberg et al. (2003), even the simplest behavior requires certain level of cognitive processing. It is necessary to notice that, as Bargh (1989) makes clear, assumption that behavior is either cognitively controlled, or automated, is incorrect because there are different aspects of automation. Behavior may be labeled as automated because it is unaware, unintentional, effortless, autonomous (no need of conscious intentional monitoring), or involuntary. These different aspects need not to go hand in hand and they also do not imply that behavior does not involve certain level of cognitive control. Experimental studies show that habitualization leads to simplification of cognitive processing of information, specifically to more focus being put on

(see review and discussion of such studies in C.J. Armitage & Conner, 2001; Conner & Armitage, 1998). Nonetheless, other authors caution against such an interpretation because repetition of the behavior in the past is a necessary but not sufficient condition for habitualization of behavior and also because the effect of past behavior may reflect effects of other external variables, such as self-identity or personal moral beliefs, not included in the model (Aarts, Verplanken, & Knippenberg, 1998; Ajzen, 1991).

Another way to include past behavior in TPB is to assume that it predicts behavioral intention beyond and above attitudes, subjective norms and perceived behavioral control. A couple of studies have demonstrated that past behavior is an additional predictor of behavioral intention in the case of various types of behaviors (see, e.g., the meta-analysis by Conner & Armitage, 1998), including also organic food consumption (Sparks & Shepherd, 1992). The effect of past behavior intention is interpreted in these studies as another type of habitualized behavior where behavioral intention is formed and solidified to certain degree and does not reflect minute changes in attitudes, subjective norms and perceived behavioral control. Meta-analysis of empirical studies have revealed that the inclusion of past behavior increases on average explained variance of intention by 7.2% (Conner & Armitage, 1998).

Last but not least, past behavior may be included in the TPB framework as a predictor of attitudes, subjective norms and perceived behavioral control, or their constitutive beliefs (see Conner &

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certain information, while neglecting other, but does not completely replace cognitive processing (see e.g. Aarts et al., 1998). It appears therefore more appropriate to talk about degree to which particular behavior is habitualized or automated, rather than about habitualization or automation as a distinct feature of certain behavior.

Armitage, 1998 for meta-analysis of these studies). This inclusion of past behavior is not truly an extension of the TPB framework because both TRA and TPB assume that behavioral, normative and control beliefs are updated due to new experience which people gather in course of their action. It is therefore not surprising that, for instance, experience with consumption of organic food has been found to influence attitudes towards organic food (Thøgersen, 2009). It is also very likely that direct experience with organic food influences also control and normative beliefs.

Inclusion of past behavior in the TPB framework at various levels of the model reveals interesting information about behavior, although the interpretation of the effect of past behavior is not always clear. In any case, the effect of past behavior on behavioral intention and (present) behavior is usually interpreted as an indication of insufficiency of the TPB model, either due to shortcomings of the empirical measurement model or due to more substantial reasons such as habitualization of behavior or omission of other variables from the model. On the other hand, the effect of past behavior on attitudes, subjective norms and perceived behavior control, or on their respective beliefs, is consistent with TPB and can be interpreted as an influence on past experience on the formation of attitudes, subjective norms, and perceived behavioral control, or on their constitutive beliefs.

* * *

To conclude our presentation in this section, we may say that the theory of planned behavior is a middle-range action theory that has been applied in many diverse areas and has received considerable empirical support. The theory of planned behavior proposes that behavior can be explained from behavioral intention and perceived behavioral control and that intention may be predicted from attitudes, beliefs and perceived behavioral control, which are, in turn, formed on the basis of cognitive beliefs and their respective evaluation.

The theory of planned behavior accepts assumptions of the "wide" version of rational choice theory. We have reviewed some of the criticism directed at TPB and also extensions of TPB. Two of these extensions, inclusion of descriptive norms and past behavior as additional factors of behavioral intention will be empirically tested in the present work.

CHAPTER 5: DATA AND METHOD[27]

5.1 WORKING HYPOTHESES

Based on the review of the theory of planned behavior provided in chapter 4, and particularly following the literature on extensions of TPB by the inclusion of descriptive norms (see section 4.3.1) and past behavior (section 4.3.2), we formulate 11 working hypotheses that will guide the empirical analysis presented in chapter 5; these hypotheses are summarized in table 5.1 bellow.[28]

[27] Part of this chapter, especially section 6.4 elaborates on my analysis presented in the manuscript submitted recently for publication in the Czech Sociological Review (Urban, Zvěřinová, & Ščasný, 2012), which is based on a survey done jointly with Iva Zvěřinová and Milan Ščasný.

[28] Notice that these are working hypotheses that summarize our expectations of results, based on theory and previous empirical evidence, rather than falsifiable statistical null hypotheses. However, it would not be difficult to arrive at falsifiable null hypotheses, usually by negating these working hypotheses. As a consequence, we take the empirical tests presented in Chapter 6 as evidence that increases or decreases the plausibility of these working hypotheses. We formulate these working hypotheses rather than their counterparts (falsifiable statistical null hypotheses) because the latter would not be realistic and therefore scientifically worthless. Consider, for instance, testing the null hypothesis "attitudes, injunctive norms, and perceived behavioral control do not explain any variability of intention," (from working hypothesis #2) or the null hypothesis "correlation between descriptive norms and attitudes is exactly zero" (from working hypothesis #6). From the technical point of view, however, the statistical tests presented in chapter 6 aims to reject specific null hypotheses.

Table 5.1: Working hypotheses and their empirical test

#	Working hypothesis	Empirical evidence
1	Injunctive and descriptive norms related to the consumption of organic food can be distinguished empirically.	confirmatory factor analysis on indicators of subjective norms; additionally also test of descriptive and convergent validity in models 1 through 4;
2	Attitudes, injunctive norms, and perceived behavioral control explain a considerable proportion of the variability of intention.	estimates of path coefficients from model 1; R-square value for intention model 1
3	Addition of descriptive norms in the TPB model increases explained variance of intention.	comparison of R-square value of intention in models 1 and 2
4	Descriptive norms have a significant effect on intention after controlling for other TPB variables.	estimates of path coefficients from model 2
5	Injunctive norms are correlated with attitudes.	estimates of correlation between latent constructs in model 2
6	Descriptive norms are correlated with attitudes.	estimates of correlation between latent constructs in model 2
7	Correlation between attitudes and injunctive norms is higher than the correlation between descriptive norms and attitudes.	estimates of correlation between latent constructs in model 2; possibly also test for the equality of estimated correlations
8	Including a respondent's past purchase behavior in the model does not increase explained variance of intention.	comparison of R-square value of intention in models 2 and 3
9	Respondent's past purchase of organic food does not have a direct effect on intention after other factors of intention are accounted for.	estimates of path coefficients from model 3
10	Including a household's past purchase behavior in the model does not increase explained variance of intention.	comparison of R-square value of intention in models 2 and 3
11	A household's past purchase of organic food does not have a direct effect on intention after other factors of intention are accounted for.	estimates of path coefficients from model 4

To test these hypotheses, we have formulated four empirical models of the intention to purchase organic food. These models are displayed in the convenient form of path diagrams in figure 5.1 below and discussed concisely in section 5.4 below.

5.2 DATA

The data exploited in this study come from a survey of the general adult population of the Czech Republic. The survey was devised by Charles University Environment Center and the data were collected by the opinion poll agency IBSR in November and December 2010, in compliance with ISOMAR standards. The survey took the form of structured face-to-face computer-assisted interviews and used quota sampling with quotas for age, gender, education level, and size of the place of residence.

Socio-economic and demographic characteristics of our sample are displayed in appendix 5.1. The total sample consists of 252 observations. The sample resembles the general adult population of the Czech Republic very well in terms of gender, age, municipality size, average net per capita household income and average household size. We notice only slight differences between the sample and the population with regard to educational attainment (a slight over-representation of people with primary education and lower secondary education and under-representation of people with upper secondary education) and marital status (a slight under-representation of those who have never been married and over-representation of married people). Chi-square test of goodness of fit and one-sample t-test reveals no statistically significant differences between the population and the sample in terms of socio-economic and demographic structure and we deem the sample to be representative of the Czech adult population.

5.2.1 Sample size

Obviously, the relatively small size of our sample poses some limitations for the present study. Most importantly, the small sample size increases sampling error and decreases the power of statistical tests, thus increasing Type II error.

There is no simple rule of thumb as to the sample size needed for structural equation modeling because it depends on normality of data, estimation method, complexity of the model, and patterns that exist between the observed variables. Some authors argue that as many as 20 observations for each free parameter estimated are needed (Tanaka, 1987), while others argue that 10 (Schreiber, Nora, Stage, Barlow, & King, 2006) or even 5 observations (Bentler & Chou, 1987) per one free parameter are sufficient. In any case, there is a contention that the critical sample size for sufficient statistical power of structural models is 200 observations

Models 1 through 4 have 34, 45, 51 and 51 free parameters respectively per 252 observations in our data, meaning that models 1 and 2 safely meet the Bentler and Chou's (1986) recommendation of a minimum of 5 observations per each free parameter, and models 3 and 4 are very close to meeting this requirement. Indeed, our study also meets the requirement of a minimum of 200 observations for a SEM study (Garver & Mentzer, 1999).

5.3 Measures

Measures of TPB latent constructs, i.e. subjective norms, attitudes, perceived behavioral control and intention, are adopted primarily from Ajzen (2002a) and Francis et al. (2004). Bearing in mind the principle of correspondence of TPB constructs (Ajzen, 1991, 2005), i.e. the requirement that all constructs are measured at the same level of generalizability with respect to target, action, context and time, we have defined the target behavior as "a respondent's buying of organic food in the next month" and have formulated indicators of all TPB constructs accordingly. The wording of measurement items is displayed in appendix 6.1. Prior to the main survey, we also conducted 40 semi-structured interviews to elicit salient beliefs about organic food (not reported here) and also to test whether the direct measures of attitudes and subjective norms were well understood by respondents.

Subjective norms

We follow Ajzen's (2002a) recommendation and a common practice in the TPB research and include two indicators of descriptive (sn1, sn2) and two indicators of injunctive norms (sn3, sn4) – see appendix 6.1 for wording of items. Descriptive subjective norms are a person's perception of whether significant others perform the target behavior, while injunctive norms are a respondent's perception that significant others approve of his or her enacting of the target behavior.

Attitudes

We initially formulated and tested in a pre-survey several semantic-differential scales that included both instrumental and experiential items as recommended by Ajzen (2002a) and practically performed in many TPB studies. However, our pre-survey revealed that respondents were hesitant to indicate their attitudes towards the purchase of organic food on experiential scales (pleasant-unpleasant, unenjoyable-enjoyable) because it seemed to them “weird”, while they expressed no hesitation in indicating their answers on instrumental scales. As a consequence, we decided to omit the experiential items from the questionnaire, but we think that it would be worth future exploration to examine whether the unwillingness on the side of consumers to evaluate organic food consumption on an experiential scale was due to inappropriate wording of our experiential items or for other substantial reasons. The attitudinal measure used in the survey consists of five items, three of which are more specific (at2, at3, at4) and two more general (at1, at5) – see appendix 6.1 for their wording.

Perceived behavioral control

Perceived behavioral control is measured with two items, one item which captures controllability, or the perceived level of control that the person has over the purchase of organic food (pbc1), and the other which captures self-efficacy or perceived ability to purchase organic food (pbc2) – see appendix 6.1 for their wording. The two items should theoretically (see Ajzen, 2002a) load on the same latent construct.

Intention to purchase organic food

The intention to purchase organic food in the next month was measured by a single item, with respondents indicating their level of agreement with the statement “I intend to buy organic food in the next month” on a 7-point Likert-like scale. The use of the single item measure precludes us from estimating measurement error of the intention scale.

All measurement items for the TPB construct used in this study had been previously employed in studies on organic food consumption to measure attitudes and subjective norms (Arvola et al., 2008; Dean et al., 2008; Sparks & Shepherd, 1992; Thøgersen, 2009; Thøgersen & Ölander, 2006), perceived behavioral control (Arvola et al., 2008; Dean et al., 2008; Thøgersen, 2009) and intention (Sparks & Shepherd, 1992; Tarkiainen & Sundqvist, 2005; Thøgersen, 2009).

Past purchase behavior

Besides the measures of the TPB constructs, some of the models include a respondent's (*buyRe*) and a household's (buyHh) past purchase of organic food; these two variables are measured with observed binary indicators *buy1* and *buy2* respectively (see appendix 6.1 for their wording). Similarly to intention and PBC, we fix loadings in the measurement models of the latent variables buyRe and buyHh to 1 and their measurement errors to 0.

5.4 Empirical models

To test the hypothesis formulated in section 5.1, we estimate four empirical models (see their graphical representation in the convenient form of path diagram in figure 5.1). Model 1 is a model implied by the original formulation of TPB which includes an injunctive facet of subjective norms (inorm), attitudes (*attitude*), and two indicators of perceived behavioral control (*pbcCo*, *pbcEf*) as factors of intention.[29]

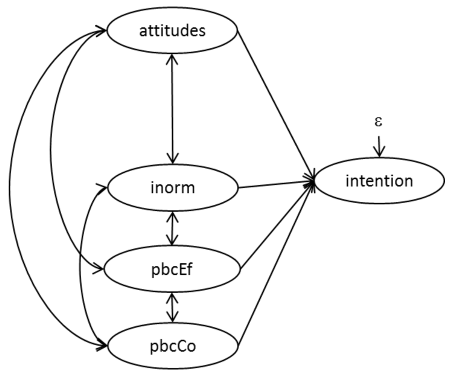
Additionally, this model, similarly to the remaining three models, assumes that the three factors of behavioral intention may be correlated. Model 2 extends model 1 by including descriptive norms (*dnorm*) as an additional factor of intention. Model 3 extends the model 2 by adding past purchase behavior of a respondent (*buyRe*) as an additional factor of intention. Additionally, we assume that *buyRe* may also affect other factors of intention due to the learning process which is expected based on theory (see discussion in section 4.3.2). Finally, model 4 extends model 2 by the addition of past purchase behavior of a household (*buyHh*).[30] Again, we assume that *buyHh* may affect other factors of intention due to the learning effect. In models 1 through 4 we also assume that the latent variable intention may be influenced by other factors not captured in the model; these unaccounted factors are assumed to be normally distributed and independent of explanatory factors of intention, and to enter the residual error term, ξ. In addition, models 3 and 4, we assume that similar residual terms, $\xi 1$ through

[29] The reason for why the two indicators of PBC are entered separately in the model rather than as two indicators of underlying latent variable of perceived behavioral control, is empirical and has to do with low convergent validity of the two constructs (see section 6.2.3 for discussion).

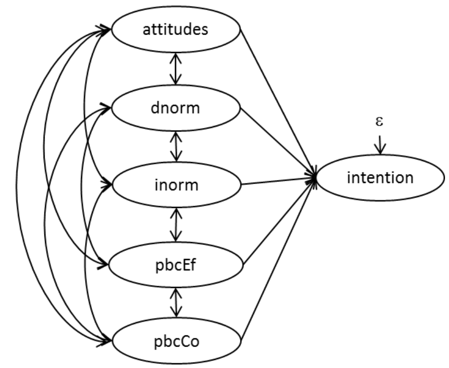
[30] The reason why model 4 extends model 2 and not model 3 is that such a model would have too many free parameters for the relatively small sample size of our dataset and also because of the finding that the addition of *buyRe* in model 3 does not increase explained variance of intention in comparison to model 2.

$\xi 5$, also affect the five factors of intention (*attitude*, *inorm*, *dnorm*, *pbcCo*, *pbcEf*) which become endogenous in these models.

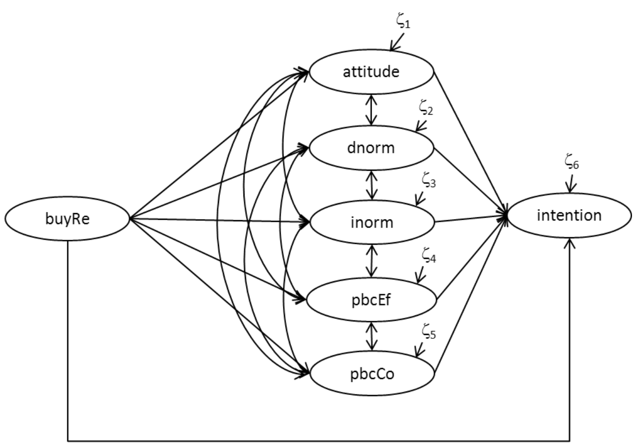
Figure 5.1: Path diagram of the four tested models (model 1 through model 4)



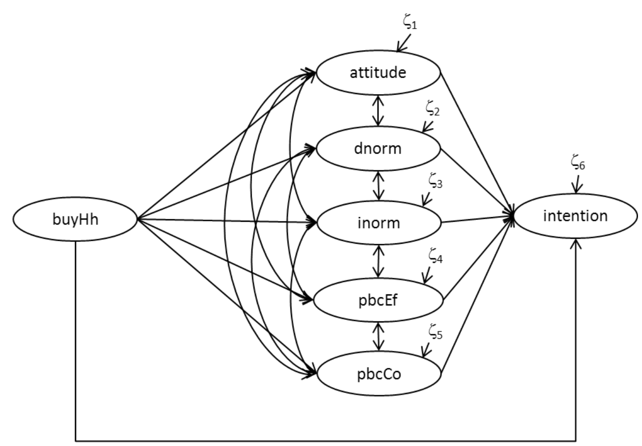
Model 1



Model 2



Model 3



Model 4

5.5 METHOD

The empirical models are tested using structural equation modeling (Bollen, 1989). SEM is very advantageous for the purpose of our study specifically because it allows us to test the models with latent variables and estimate their measurement errors. For these reasons, the popularity of SEM has been growing and SEM became almost a standard tool for testing complex models in many fields, including economics, psychology and sociology (for a review documenting the growth of SEM see Hershberger, 2003).

The core idea of SEM is that it is possible to reproduce a population variance-covariance matrix if we know the model which correctly explains variation in the data. Although different estimators may be used to estimate the model parameters, all estimators basically aim to minimize the discrepancy between the model-implied and empirical variance-covariance matrix of observed variables.

The models tested in this work can be sub-divided into measurement and structural parts. The structural part of the model specifies the relationship between latent variables, and takes in each model and for each individual, *i*, the following form:

$$\boldsymbol{\eta}_i = \boldsymbol{\alpha} + \mathbf{B}\boldsymbol{\eta}_i + \boldsymbol{\zeta}_i \qquad (1)$$

where **η** (*m* x 1) is a vector of endogenous latent variables, **α** is a vector of constants for each endogenous variable, **B** (*m* x *m*) is a matrix of regression coefficients among η's with the diagonal elements equal to zero and **I-B** being a non-singular matrix (because a particular latent variable is assumed not to affect itself), and **ζ** (*m* x 1) is a vector of residuals.

The measurement part of each model specifies the relationship between observed indicators and latent variables, η's , and can be specified for each individual, *i* , as:

$$\mathbf{y}_i^* = \boldsymbol{\lambda}\eta_i + \boldsymbol{\varepsilon}_i \ , \qquad (2)$$

where **y*** (*k* x 1) is a vector of unobserved continuous outcome variables, **λ** (*k* x 1) is a vector of regression coefficients for the regression of *y*'s on the latent variable, η, and **ε** (*k* x 1) is a vector of residuals. The length of the vectors, *k*, depends on how many empirical indicators are used for measurement of the latent variable. For instance, latent variable *attitude* is measured by four indicators (k=4), *inorm* and *dnorm* are each measured by two indicators (k=2), while latent variables *intention*, *pbcCo*, *pbcEf*, *buyRe*, and *buyHh* are each measured by one indicator[31] (k=1).

As a matter of fact, we do not observe *y**'s in our study directly. Instead, we measure categorical outcome variables *y*'s, using Likert-types scales, semantic differential scales, and dummy indicators. This fact is often ignored in social research and it is frequently assumed that y* = y in measurement models such as the one presented in equation 2.

However, several simulation studies have shown that categorical nature of observed variables, especially in combination with non-normality and use of Maximum-likelihood (ML), or General-least-square (GLS) estimators, may cause several problems in estimation such as high chi-square values of the model and higher probability of Type 1 error, modest underestimation of some fit indexes some (NFI, TLI, CFI), moderate to severe underestimation of standard errors of parameter estimates, underestimation of factor loadings and factor correlations, and underestimation of errors of variances leading often to spurious correlations (West, Finch, & Curran, 1995, pp. 62–64). On the

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[31]As is apparent from equation 2, measurement models with one observed indicator per measurement model cannot be estimated because this formulation leads to three unknowns per equation and therefore lambda's and eta's must be fixed to some value in order to estimate the latent variable, η (see also note 34).

other hand, other simulation studies have also shown that parameter estimates remain relatively valid under reasonable assumptions even when the data depart considerably from the assumption of normality (McDonald & Ho, 2002).

As is clear from this short account, the choice of appropriate estimation method is a critical step in the application of SEM. We have opted for Full Information Maximum Likelihood (FIML) in the present study, which allows us to handle item non-response more efficiently and minimize loss of statistical power and also minimize estimate bias (Arbuckle, 1996). Strictly speaking, other estimators such as asymptotically distribution free method (Browne, 1984) or weighted least squares mean variance adjusted estimator (Muthén & Muthén, 2010) would be more appropriate with the ordinal data available for this study. However, these alternative estimation methods require very large sample sizes and therefore their use is effectively ruled out in our case. Nonetheless, it has been shown that ML and FIML estimator perform relatively well with categorical data with more than 5 categories which resemble normal distribution (Rigdon, 1998) and also that this estimation method is relatively robust to mild departures from multivariate normality (McDonald & Ho, 2002; West et al., 1995). The models are estimated in MPlus, version 6.1 (Muthén & Muthén, 2010).

An important condition for the model parameters to be estimable is that both measurement and path models are identified and therefore the whole can be identified. A sufficient condition of identifiability of the path model is the *precedence rule* proposed by McDonald and Ho (2002) that all covariances of residual errors of causally ordered variables are zero. This condition is satisfied in all four models that we formulate (compare figure 5.1) as the non-directional paths are only between variables which are not causally related in the proposed models (i.e. attitudes, two facets of subjective norms, and two facets of perceived behavioral control). A sufficient condition for identifiability of measurement model is the requirement of *independent cluster basis,* which requires that each latent factor has at least two pure indicators if the factors are correlated and at least three if they are not. This independent cluster basis requirement is met for the latent variables *attitude*, *inorm* and *dnorm*. Identification of the remaining latent variables, which have only one observed indicator each, is possible because we constrain their factor loadings to one and their measurement errors to zero which is technically identical to including observed variables in the model without the need to specify measurement model.

5.5.1 EVALUATION OF THE MODEL FIT

The assessment of the model fit in SEM is still a bit controversial, with some arguing that fit indices do not add any new information besides that which can be learned from chi-square statistics (cf. Barrett, 2007) and others pointing to the fact that a too strict reliance on fit indices can hide poor fit of models and lead to misinterpretation of results (e.g. Hayduk, Cummings, Boadu, Pazderka-Robinson, & Boulianne, 2007). Problems with the use of fit indices stem from the fact that there is no established mathematical ground for the use of fit indices and well as for their choice and there is also no sufficiently strong correlation among various fit indices (McDonald & Ho, 2002). For this reason there is a consensus that several fit indices should be assessed, possibly from different classes of fit indices and also that the assessment of global fit indices should be complemented with an inspection of standardized residuals for the discrepancy between observed and implied variance-covariance (or correlation) matrices (Hoe, 2008; McDonald & Ho, 2002).

We report and evaluate the following global fit indices:

1. Chi-square value, an absolute fit index, which assesses the discrepancy between the empirical and implied variance-covariance matrix. In addition, we also examine relative chi-square value, an index which should be less sensitive to sample sizes; its value should not exceed threshold of 3 for good fitting models (Kline, 2004);

2. Tucker-Lewis index (TLI), one of the relative fit indices that compare the fit of the tested model with the fit of the null or independence model. We accept values of TLI above the threshold of 0.9 suggested in the literature (Hoe, 2008; Hu & Bentler, 1999) as an indication of a good fitting model;
3. Comparative Fit Index (CFI), one of the noncentrality-based indices based on a non-centrality parameter. What CFI shares with all indices from this class is that they use non-central chi-square distribution to test whether the alternative model (i.e., observed and implied variance-covariance matrices are not equal), rather than the null hypothesis (i.e., observed and implied variance-covariance matrices are equal), can be rejected. We accept the CFI >0.9 as an indication of a good fitting model as suggested in the literature (Hoe, 2008; Hu & Bentler, 1999);
4. Root Mean Square Error of Approximation (RMSEA), another of the non-centrality based indices, which basically measures the discrepancy between the observed and estimated variance-covariance matrices per degree of freedom in terms of population and not the sample, and therefore is less sensitive to sample sizes. We follow MacCallum, Browne and Sugawara (1996) and use the values of RMSEA of 0.01, 0.05, and 0.08 or lower as an indication of excellent, good, and mediocre model fit respectively. In addition, however, we are also aware of the fact that even good fitting models with low degrees of freedom (which is the case of our measurement models) result in high RMSEA and therefore RMSEA is probably not a good indicator of model fit for such models (Kenny, Kaniskan, & McCoach, 2011).

In addition to global fit indices, we also report and assess normalized correlation residuals (i.e., normalized difference between empirical and model-implied correlation matrices) as recommended by McDonald and Ho (2002). Models that are a good approximation of the data should not have normalized correlations residual exceeding threshold value of 1.96 and the discrepancies should be equally spread across the matrix.

5.6 Relevance of SEM with cross-sectional data for testing of causal hypotheses

Throughout this work we refer to the testing of four empirical models derived from and extending the theory of planned behavior. We interpret these results as having implications for the theory itself, particularly for causal relationships that exist, according to this theory, among attitudes, subjective norms, perceived behavioral control and the intention to purchase organic food. However, the link between the testing of statistical hypotheses on one hand and the corroboration of theoretical statements on the other is quite complex.

Statisticians were (and some of them still are), until recently, very hesitant to deal with the issue of causality and causal interpretations of statistical models (cf. Holland, 1986). The uneasiness regarding the concept of causality has a long history and has been present in modern science at least since Hume's famous critique of causality and induction (2000). This uneasiness about the concept of causality contrasts with the readiness of many social scientists to assume that their analysis is truly capable of revealing causal relationships (for examples and a critique of such an inappropriate approach in studying causality in the field of econometrics see e.g. Leamer, 1983).

Inappropriate interpretation of the results of statistical analysis with respect to causal inference has a great deal to do with confusing a predictive and causal interpretation of statistical models (c.f.,Gelman & Hill, 2007, p. 34), with the former being necessary, but not a sufficient basis, for making counterfactual claims that are part of the latter. An important and frequently misunderstood issue is the fact that the main problem of causal inference is not the quality of data which the analysis rests on (i.e., experimental vs. longitudinal vs. cross-sectional), but rather, inescapable *fundamental problem of causal inference* (e.g., Holland, 1986) or the fact that we cannot observe a certain state and its counterfactual state at the same time.

The *fundamental problem of statistical inference* cannot be truly solved and can only be evaded by accepting certain assumptions, such as homogeneity, independence and invariance assumptions in the examination of properties of studied subjects, an assumption of independence in experimental studies on populations, and assumptions of ignorability, conditional ignorability, and explosability in studies that use statistical inference (Holland, 1986; Rubin, 1974). Although statistical inference based on data from well controlled randomized experiments is perceived generally to be more relevant for answers to causal research questions, other types of evidence, for instance statistical inference based on non-experimental data, can also be relevant for such claims, and, in fact, differs only by the degree of its relevance for making such claims given by plausibility of assumptions that it has to accept (Rubin, 1974, p. 699). To put it more bluntly, no empirical evidence can prove a causal statement but empirical evidence of a certain type is more relevant for increasing the plausibility of such claims.

Also important to note is that a test of an empirical model, as basically a test of any statistical hypothesis, provides negative evidence in the sense that is can only indicate that something went wrong in the chain leading from theory to formulation of a testable empirical hypothesis. To put it differently, if the theory is correct and if all the subsequent steps leading to the formulation of the empirical model were correct, the population data should not reject the model. However, the model which is not rejected by the data does not imply a correct theory. This issue is perhaps even more pronounced in the context of SEM because the test of model fit is based on the discrepancy of observed and model-implied variance-covariance matrices. The problem typical for SEM is that for any empirical matrix, we can arrive at many theoretical matrices which will reproduce the empirical matrix very well. Therefore for SEM-based application it is critical to justify each empirical model theoretically before its testing and to respect the fact that rejection of an empirical model invalidates the chain leading to the theory and perhaps the theory itself, whereas a positive result does not, in a strict sense, validate its causal claims.

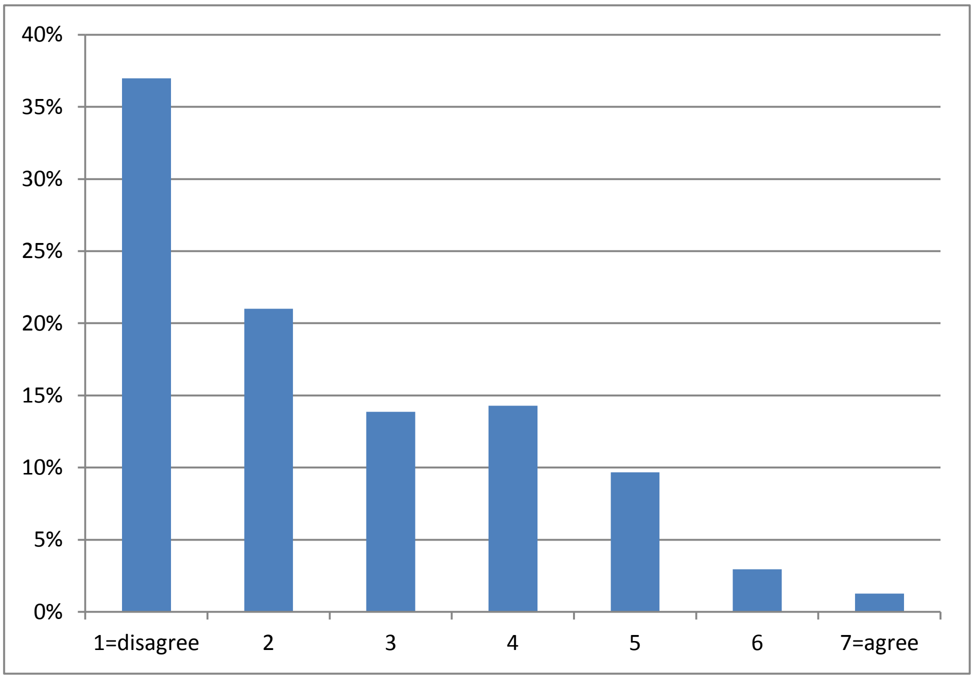
CHAPTER 6: RESULTS

This chapter presents the main empirical findings of this work, specifically the testing of the four empirical models formulated in Chapter 5, and a somewhat more exploratory analysis of the behavioral beliefs which affect the formation of attitudes. The empirical results presented in this chapter are discussed in more depth in Chapter 7.

6.1 PRELIMINARY ANALYSIS

The sample relative frequency of respondents' agreement or disagreement with the statement designed to measure the intention to buy organic food over the period of the next month is displayed in figure 6.1. The distribution of answers is right-skewed, with only few observations in the "completely agree" category. This result is not surprising if we consider that only a small fraction of the Czech consumers buy organic food and even less of them purchase organic food on a regular basis (see section 2.3 for a discussion of organic food consumption trends in the Czech Republic).

Figure 6.1: "I intend to buy organic food in the next month." (rel. frequencies, sample, N=252)



The descriptive statistics of other observed variables are reported in concise form in appendix 6.1 and the frequency of respondents' answers to the question that elicited the strength of behavioral beliefs is displayed in the form of a stacked bar plot in figure 6.2 below.

As a matter of fact, most of the observed variables have a low frequency of one of the polar categories of answers and therefore we decided to merge answer categories 1 and 2 in attitudinal indicators (at1 through at4), indicators of perceived behavioral control (pbc1 and pbc2), and also indicators of the strength of behavioral beliefs (bb1 through bb7). We also merged answer categories 6 and 7 in indicators of subjective norms (sn1 through sn4) and intention (int). In addition, we have shifted the scales of attitudes, perceived behavioral control and behavioral beliefs to the left by subtracting 1 from their scores so that all measures, except for the indicators of past behavior (buy1, buy2), take a value from 1 to 6.[32]

6.1.1 Normality of the data

Before we proceed to testing the models, we examine whether the requirement of multivariate normality of the data, an important assumption of ML estimator, is met. Absolute values of the indices of univariate skewness of the data (viz. table 2) are mostly below the threshold of 0.5 and always below the cutoff value of 1 suggested by Bulmer (1979) as an indication of approximate symmetry and slight skewness respectively, with the exception of the indicator of respondent's past purchase (*buy1*) that has a skewness index of 2.15, an indication of highly skewed data. Absolute

[32] Such a linear transformation should not have any effect on the estimated variance-covariance matrix. However, use of different metrics of variables may cause non-convergence of the FIML algorithm and therefore is not preferable.

values of indices of univariate kurtosis are nowhere near the value of 8 suggested as a cutoff value for extreme kurtosis that would affect ML estimates (Kline, 2004, p. 63), although the kurtosis index of *buy1* is slightly higher than in the remaining variables and reaches values of 2.16.

After inspection of univariate normality, which is a necessary but not sufficient condition for multivariate normality, we now proceed to testing of multivariate normality for the four subsets of observed variables that enter models 1 to 4. We test multivariate normality with generalized Shapiro–Wilk's test for multivariate normality proposed by Villasenor Alva and Estrada (2009) and implemented in package mvShapiroTest in the statistical environment R. The test fails to reject the null hypothesis that the data is distributed multivariate normal at the 0.01 level of statistical significance for the subset of variables that enter models 1 and 2, but not for model 3 (MVW=0.9543, p-value<2.2e-16) and model 4 (MVW=0.978, p-value<9.5e-6). Although the subset of variables that enter model 4 seems to be closer to the assumption of multivariate normality, neither data used in model 3 nor those in model 4 can be claimed to satisfy the requirement of multivariate normality. Therefore we have to be aware of potential problems that arise due to the use of ML estimator to non-normal data in models 3 and 4 (see discussion is 5.5) and treat the results from these models with caution. On the other hand, the data that are used for estimation of models 1 and 2 depart from the requirement of multivariate normality only slightly, and since all variables in these dataset have more than 5 outcome categories, we believe that the FIML estimator can produce reliable parameter estimates for these two models.

6.2 Measurement models

Before fitting the full model, we assess the fit and other properties of the measurement models for each latent construct as advised in the literature (Anderson & Gerbing, 1988; Hoe, 2008; McDonald & Ho, 2002). Specifically we assess internal consistency reliability of the measures using

Cronbach's alpha, unidimensionality of measures using principal component analysis, convergent validity by inspecting size and statistical significance of factor loadings and discriminant validity by inspecting size and confidence intervals of correlations between latent constructs.

6.2.1 Subjective norms

The subjective norm scale composed of the four items (*sn1, sn2, sn3, sn4*) has excellent internal consistency reliability (α=0.87) and is one-dimensional as judged by the results of principal component analysis (eigenvalue of 2.89 for the first factor extracted, and eigenvalue <1 for the second factor extracted). These results would indicate that the two items form actually one scale and not two scales as we expected. However, confirmatory factor analysis (not reported here in detail) shows that a one-factor measurement model for social norms does not fit the data particularly very well (chi-square=34.6 with 2 d.f., p-value<0.001, rel. chi-square=17.3, RMSEA=0.27, CFI=0.926, TLI=0.777). An alternative measurement model which assumes that injunctive and descriptive items load on different latent variables fits the data significantly better (the chi-test for nested models suggest significant improvement, with p-value< 0.001) and also with fit indices suggesting a good fit (chi-square=2.1 with 1 d.f., p-value<0.14, rel. chi-square=2.1, RMSEA=0.071, CFI=0.997, TLI=0.984).

An inspection of tables 6.2 and 6.4 reveals that factor loadings for the two latent constructs of social norms are substantial and significantly different from 0 indicating convergent validity of the measurement model. Correlations between injunctive norms (*inorm*) and descriptive norms (*dnorm*) are relatively high[33] (see tables 6.3 and 6.5), ranging between 0.69 and 0.71, but all of these correlations are statistically different from 1, suggesting discriminant validity of the two measures.

6.2.2 ATTITUDES

The attitude scale composed of the five attitudinal items (at1 through at5) has an acceptable, but not excellent, internal consistency reliability (α=0.779) and forms a one-dimensional scale (eigenvalue of the first factor extracted by principal component analysis is 2.838, while it is <1 for the second factor extracted). Nonetheless, confirmatory factor analysis (not reported here in detail) reveals that a one-factor measurement model composed of the five items does not fit the data very well (chi-square=54.57 with 5 d.f., p-value<0.001, rel. chi-square=10.9, RMSEA=0.215, CFI=0.843, TLI=0.686).

Unfortunately, there is no theory-based justification for re-specification of the measurement model suggested in the literature. Anderson and Gerbing (1988) argue that in similar cases, deletion of an indicator from the measurement model is a more desirable remedy to a misfit of the measurement model than *ad hoc* introduction of correlated measurement errors or use of an indicator related to multiple factors because these two latter solutions would make the interpretation of underlying latent constructs difficult. It is also important to notice that an independent cluster basis requirement for measurement model identification severely limits our ability to test more complex measurement models with our data. For these reasons we have left the item with the lowest loading on the underlying latent factor (*at5*) out of the measurement model.

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[33] Which is in line with literature (see section 4.3.1).

The ensuing measurement model fits the data relatively well (chi-square=9.049 with 2 d.f., p-value<0.011, rel. chi-square=4.5, RMSEA=0.128, CFI=0.962, TLI=0.890) although not perfectly.[34] We retain this model for further analysis.

These results support the first hypothesis formulated section 5.1 that descriptive and injunctive norms can be distinguished empirically.

6.2.3 Perceived behavioral control

The two indicators of perceived behavioral control (*pbc1, pbc2*) produce a scale with very low internal consistency reliability (α=0.31). In addition, principal component analysis reveals that one-dimensionality of this measure is dubious (eigenvalues are 1.19 and 0.90 for the first and second factor extracted). For these reasons we decided to enter the two indicators in the structural model independently. This is equivalent to specifying a measurement model where observed variables *pbc1*

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[34] Because of the positive bias of RMSEA for models with low degrees of freedom (Kenny, Kaniskan, & McCoach, 2011) and generally low TLI values for models with low correlations between the observed variables (which follows from its definition as a relative fit index) we accept the fit of this model as sufficiently good approximation of the data. Acceptability of the model fit is also supported by relatively low normalized residuals for the five attitudinal items in the models estimated (see tables in appendix 6.2, 6.3., 6.4 and 6.5). However, since the fit of the measurement model is not perfect and since the misfit in the 5-item measurement model (not reported here in detail) is highest for items at1 and at5 that are mutually correlated (but not enough to form an independent factor), we think that it would be worthwhile to explore latent factors underlying attitudes to organic food more thoroughly in the future research.

and *pbc2* load respectively on two latent variables pbcEf and pbcCo, with the two loadings fixed to 1 and measurement errors fixed to 0 as displayed in tables 6.2 and 6.4.[35]

6.2.4 Behavioral intention and past behavior

Our data contain only one indicator for behavioral intention (*int*), past purchase of organic food by the respondent (*buy1*) and past purchase behavior of the household (*buy2*). With one-indicator measurement models for the three latent variables, we are not able to estimate their measurement errors, and therefore we fix factor loadings of these variables to 1 and their measurement error to 0, similar to how we specified measurement models for perceived behavioral control.

To keep the distinction between latent constructs and their observed indicators, we label the latent variables of behavioral intention, the respondent's past purchase and the household's past purchase as *intention*, *buyRe* and *buyHh* respectively (viz. tables 6.2 and 6.4 below), although these variables are, technically speaking, identical to their observed indicators *int*, *buy1* and *buy2*.

After the adjustments, the convergent validity of the measurement models seems to be good, with all factor loadings substantially and significantly different from 0 (viz. tables 6.2 and 6.4). Although latent variable of attitudes (*attitude*) is highly correlated with the two facets of subjective norms (*inorm*, *dnorm*) and moderately correlated with the self-efficiency facet of perceived

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[35] Other arbitrary values that the error variance of the latent variable can be fixed at in cases when there is only one indicator of the latent construct are discussed in Anderson and Gerbing (1988). Our decision to fix the error variance at 0 is not realistic (because the variable is measured with some - unknown - measurement error) but leads to the most conservative (i.e. largest) estimate of the standard error of parameter estimate.

behavioral control (*pbcEf*), as can be seen in tables 6.3 and 6.5, estimated confidence intervals of these correlations are statistically different from 1, suggesting sufficient discriminant validity.

6.3 Test of the TPB model

The fit of the empirical model 1 derived from TPB and estimates of structural parameters are reported in table 6.3 below, while the parameters from its measurement model are displayed in table 6.2 below. The fit of model 1 seems to be sufficient (relative chi-square, and RMSEA bellow and CFI above the thresholds) but not excellent (chi-square test is significant with p-value of 0.003 and TLI is just below the 0.9 threshold). An inspection of normalized residual correlations (viz. appendix 6.2) reveals that the misfit of model is evenly distributed over the whole matrix, which supports the contention that the model is an acceptable approximation of the data.

Model 1 explains as much 44% variability in intention, a result that is comparable to results of similar studies (see section 4.2 and 4.2.1 for details on explained variance of intention in similar TPB studies).

Table 6.2: Measurement part of models 1 and 2 (standardized solution).

Construct	Item	Wording	Model 1			Model 2		
			Loading	**S.E.**	**P-val.**	**Loading**	**S.E.**	**P-val.**
dnorm (descriptive norms)	sn1	Most people whose opinion I value buy organic food. Strongly disagree - strongly agree (7-point Likert-like scale).				1.37	0.082	<0.001
	sn2	Most people who are important to me buy organic food. Strongly disagree-strongly agree (7-point Likert-like scale).				1.363	0.08	<0.001
inorm (injunctive norms)	sn3	Most people who are important to me think that I... (should not - should: 7-point Likert-like scale) ...buy organic food in the next month.	1.241	0.110	<0.001	1.261	0.103	<0.001
	sn4	People whose opinion I value would… (disapprove-approve: 7-point Likert-like scale) of my buying of organic food in the next month.	1.289	0.114	<0.001	1.247	0.105	<0.001
attitude	at1	[Buying organic food in the next month would be for you…]… bad - good (7-point Likert-like scale)	0.674	0.099	<0.001	0.671	0.099	<0.001
	at2	… not beneficial - beneficial (7-point semantic scale)	1.075	0.106	<0.001	1.076	0.106	<0.001
	at3	… disadvantageous - advantageous (7-point semantic scale)	0.960	0.095	<0.001	0.965	0.095	<0.001
	at4	… unreasonable - reasonable (7-point semantic scale)	1.094	0.108	<0.001	1.085	0.108	<0.001
	at5	… not right - right (7-point semantic scale)	excluded					
pbcEf (self-efficacy)	pbc1	Buying organic food in the next month is… difficult - easy (7-point Likert-like scale) for me.	loading fixed to 1 a measurement error fixed to 0					
pbcCo (controll-ability)	pbc2	My buying of organic food in the next month depends only on my decision and not on external conditions. Disagree-agree (7-point Likert-like scale).	loading fixed to 1 a measurement error fixed to 0					
intention	int	I intend to buy organic food in the next month. Disagree-agree (7-point Likert-like scale).	loading fixed to 1 a measurement error fixed to 0					

Table 6.3: Structural part of models 1 and 2 (standardized solution).

	Model 1			Model2		
	Estimate	**S.E.**	**P-value**	**Estimate**	**S.E.**	**P-value**
R2 for intention	0.435			0.487		
Regression weights						
attitude -> intention	0.472	0.128	0.000	0.443	0.12	<0.001
dnorm -> intention				0.536	0.18	0.003
inorm -> intention	0.610	0.145	0.000	0.27	0.203	0.183
pbcEf -> intention	0.062	0.067	0.359	0.022	0.063	0.725
pbcCo -> intention	-0.152	0.050	0.003	-0.072	0.054	0.184
Correlations						
attitude <-> dnorm				0.41	0.077	<0.001
attitude <-> inorm	0.544	0.083	0.000	0.54	0.081	<0.001
attitude <-> pbcEf	0.248	0.118	0.035	0.247	0.118	0.036
attitude <-> pbcCo	0.026	0.140	0.851	0.028	0.14	0.84
dnorm <-> inorm				0.705	0.056	<0.001
dnorm <-> pbcEf				0.359	0.1	<0.001
dnorm <-> pbcCo				-0.482	0.124	<0.001
inorm <-> pbcEf	0.443	0.108	0.000	0.441	0.108	<0.001
inorm <-> pbcCo	-0.034	0.145	0.814	-0.023	0.144	0.874
pbcEf <-> pbcCo	0.484	0.170	0.004	0.474	0.169	0.005
Full model fit (measurement + structural)						
Chi-square (d.f.)	48.6(20)			72.5 (32)		
P-value	0.003			0.002		
Rel. chi-square	2.43			2.26		
CFI	0.935			0.952		
TLI	0.887			0.919		
RMSEA	0.075			0.071		

An inspection of table 6.3 reveals that attitudes (*attitude*) and the injunctive facet of subjective norms (*inorm*) have a positive and statistically significant effect on behavioral intention, the controllability facet of perceived behavioral control (*pbcCo*) has a statistically significant and negative effect on intention, while the estimated path coefficient of self-efficacy facet of PBC (pbcEf) is positive but insignificant. The positive effect of attitudes, norms and self-efficacy are in line with the theory, but the negative effect of controllability is not. As a matter of fact, the actual size of the effect is very small (standardized path coefficient of –0.15) and would not be usually considered large enough for meaningful interpretation (see, e.g., Hoe, 2008). In any case, one of the plausible explanations for an unexpected negative effect of controllability is that it actually mirrors the effect of social pressures to buy organic food from significant others. Such social pressure would be expected to decrease controllability of behavior, but increase intention to buy organic food, resulting in negative effect of controllability on behavior intention. This interpretation is supported by the results from model 2, 3 and 4 where the addition of descriptive norms in the model explained out much of the direct effect of controllability on intention and where controllability is strongly and negatively correlated with descriptive norms.

The relatively low direct effect of self-efficacy (which can be observed in all 4 models - compare tables 6.3 and 6.5) is not unseen in TPB studies on organic food consumption (see, e.g., Dean et al., 2008) and is also consistent with the findings of previous Czech studies which focused on organic food consumption (viz. Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011) and which revealed no significant effect of PBC on intention. There are two possible explanations for why those who intend to buy organic food, and those who do not, differ only very little in how difficult they perceive such a behavior. Firstly, it may be that Czech consumers do not have their intentions in regard to organic food purchase properly formed and they do not take behavioral constraints related to the purchase of organic food into account when thinking about whether to buy organic food.

Secondly, all consumers irrespective of whether they intend or not to buy organic food might have formed relatively similar beliefs about the difficulty of organic food purchase. Unfortunately, we are not able to decide from our results which one of these explanations is the more plausible. In any case, we think that this question is certainly worthy of exploration in future research, not least because of the fact that a similar pattern has been found in all TPB studies on organic food consumption conducted in the Czech Republic.

The interpretation of the positive and significant effects of the injunctive facet of social norms (*inorm*) and attitudes (*attitude*) in model 1 is in line with the theory and indicates that the two factors increase the intention of consumers to purchase organic food. Although the point estimate of the coefficient for attitudes seems to be lower than that for injunctive norms in model 1, we cannot reject the null hypothesis that the two parameters are equal in the population due to their relatively large standards errors (the same is true also for comparison of attitudinal and normative effects in models 2, 3 and 4). Therefore we are unable to decide which of these two effects, attitudinal or normative, influences more the intention to purchase organic food.

Results from model 1 support the second hypothesis that attitudes, injunctive norms and perceived behavioral control account jointly for a large proportion of explained variance of intention.

6.4 Inclusion of descriptive norms in TPB model

The fit of the model 2 (TPB model extended by inclusion of descriptive norms) seems to be sufficient (see table 6.3) as measured by all fit indices, except for the chi-square value, which is significant (p-value of 0.0003). However, as we have argued in 5.5.1, the chi-square test may be too strict and a relative chi-square value (which is well below the recommended threshold of 5 in model 2) should be considered instead.

The model explains 49% of variability of intention, meaning that the addition of descriptive norms in the models increases explained variance of intention by 5 percentage points. This result supports our contention about the usefulness of addition of descriptive norms in the TPB model. Moreover, since injunctive (*inorm*) and descriptive norms (*dnorm*) are highly correlated, the contribution of the descriptive norms to the explanation is probably much higher than what could be inferred from the increase in the explained variance of intention (c.f. Trafimow, 2004). This result supports the third hypothesis that including descriptive norms in the TPB model increases its predictive power.

Estimates of path coefficients for the model 2 (viz. table 6.3) reveal that only attitudes and descriptive norms (*dnorm*) now have a direct effect on intention, while the effect of injunctive norms (*inorm*) and effects of the two facets of perceived behavioral control (*pbcEf*, *pbcCo*) have shrunk and are now all insignificant, although their directions remain the same as in model 1. The attenuation of the path coefficients after the introduction of descriptive norms in the model is most likely caused by collinearity due to descriptive norms being highly correlated with injunctive norms (r=0.71), and moderately correlated with self-efficacy or *pbcEf* (r=-0.42) and controllability or *pbcCo* (r=0.36). In any case, these results seem to suggest that descriptive norms have an effect on behavioral intention, although this effect appears not to be completely independent of injunctive norms and perceived behavioral control. Whatever the case, results from model 2 indicate that not including descriptive norms in the model results in overestimation of the direct effect of injunctive norms on intention on the one hand, and omission of an important predictor of intention on the other. As discussed in section 4.3.1, the interaction of TPB constructs is frequently found in empirical applications of the model but the theory does not provide an explanation of its cause.

Unfortunately, the data exploited in this study does not allow us say which of the directions of causation are more plausible, whether norms affect formation of attitudes, or whether attitudes affect formation of subjective norms, or whether all these factors are affected by another factor not captured by the model. Also the direction of causation between the descriptive and injunctive norms is not well established in the literature and our present research is unable to provide an answer to this question.

These results seem to support fourth hypothesis that descriptive norms have direct effect on intention, and also the fifth and sixth hypotheses that injunctive and descriptive norms are correlated with attitudes (viz. also results from model 1 with respect to correlation of attitudes and injunctive norms). However, our results do not support the seventh hypothesis that injunctive norms are correlated with attitudes strongly than descriptive norms are: large standard errors of correlation coefficients do not allow us to reject statistical null hypothesis about their equality.

In any case, the proportion of explained variance of intention, which amounts to 44% in model 1 and 49% in model 2, is well within the range of values of explained variance found across empirical TPB studies in the domain of organic food consumption (24 - 83%, see section 4.2.1) and higher than is the average explained variance of intention across TPB applications in general (39%, see section 4.2). This result indicates that the present model, judged by other TPB applications, explains intention reasonably well. On a more general level, this result also indicates the model's assumption that the intention to purchase organic food follows reasonably from an individual's attitudes and subjective norms.

6.5 Inclusion of respondent's past behavior in the TPB model

Estimates of the measurement part of model 3 which includes past purchase behavior of the respondent (*buyRe*) as an additional predictor are displayed in table 6.4 and estimates of its structural parameters are shown in table 6.5. The fit of the model is sufficient (see table 6.5) as judged by all fit indices, except for the chi-square test. The inclusion of the indicator of a respondent's past purchase behavior increases the explained variance of intention by less than 1 percentage point compared to model 2 (compare tables 6.3 and 6.5 and). A closer look at the structural parameters estimates displayed in table 6.5 reveals that *buyRe* has a statistically significant positive effect only on the self-efficacy of perceived behavioral control, but not on intention, or on any other of the remaining factors of intention.

Table 6.4: Measurement part of models 3 and 4 (standardized solution).

Construct	**Items**	**Wording**	**Model 3**			**Model 4**		
			Loading	**S.E.**	**P-Value**	**Loading**	**S.E.**	**P-Value**
dnorm	sn1	wording of these items is the same as that reported in table 1	1.373	0.082	<0.001	1.375	0.082	<0.001
	sn2		1.362	0.08	<0.001	1.355	0.08	<0.001
inorm	sn3		1.262	0.103	<0.001	1.267	0.103	<0.001
	sn4		1.247	0.105	<0.001	1.242	0.106	<0.001
attitude	at1		0.671	0.099	<0.001	0.667	0.099	<0.001
	at2		1.076	0.106	<0.001	1.074	0.106	<0.001
	at3		0.965	0.095	<0.001	0.973	0.096	<0.001
	at4		1.084	0.108	<0.001	1.094	0.108	<0.001
	at5		excluded					
pbcEf (self-efficacy)	pbc1		loading fixed to 1 and measurement error fixed to 0					
pbcCo (controllability)	pbc1		loading fixed to 1 and measurement error fixed to 0					
intention	int		loading fixed to 1 and measurement error fixed to 0					
buyRE	buy1	I have bought organic food previously.	loading fixed to 1 and measurement error fixed to 0			not included		
buyHH	buy2	My household has bought organic food previously.	not included			loading fixed to 1 and measurement error fixed to 0		

Table 6.5: Structural part of models 3 and 4 (standardized solution).

	Model 3			Model 4		
	Estimate	**S.E.**	**P-Value**	**Estimate**	**S.E.**	**P-Value**
R2 for intention	0.491			0.576		
Regression weights						
buyRE -> attitude	0.227	0.227	0.317			
buyHH -> attitude				0.245	0.162	0.131
dnorm ->inorm						
buyRE -> dnorm	0.13	0.208	0.532			
buyHH -> dnorm				0.456	0.146	0.002
buyRE -> inorm	0.315	0.22	0.152			
buyHH -> inorm				0.522	0.154	0.001
attitude -> intention	0.438	0.12	<0.001	0.465	0.114	<0.001
dnorm -> intention	0.546	0.181	0.003	0.518	0.162	0.001
inorm -> intention	0.262	0.204	0.199	0.131	0.192	0.495
pbcEf -> intention	0.013	0.063	0.843	0.037	0.058	0.525
pbcCo -> intention	-0.07	0.054	0.192	-0.05	0.049	0.305
buyRE -> intention	0.272	0.231	0.238			
buyHH -> intention				1.047	0.16	<0.001
buyRE -> pbcEf	0.589	0.272	0.031			
buyHH -> pbcEf				0.143	0.199	0.471
buyRE -> pbcCo	0.113	0.325	0.729			
buyHH -> pbcCo				-0.27	0.241	0.262
Correlations						
dnorm <-> attitude	0.409	0.077	<0.001	0.399	0.078	<0.001
inorm <-> attitude	0.535	0.082	<0.001	0.542	0.082	<0.001
pbcEf <-> attitude	0.233	0.117	0.046	0.245	0.117	0.037
pbcCo <-> attitude	0.028	0.14	0.842	0.033	0.14	0.812
inorm <-> dnorm	0.708	0.056	<0.001	0.693	0.058	<0.001
pbcEf <-> dnorm	0.352	0.1	<0.001	0.355	0.101	<0.001
pbcCo <-> dnorm	-0.477	0.124	<0.001	-0.451	0.125	<0.001
pbcEf <-> inorm	0.417	0.108	<0.001	0.441	0.109	<0.001
pbcCo <-> inorm	-0.027	0.144	0.851	0.014	0.144	0.925
pbcEf <-> pbcCo	0.474	0.167	0.005	0.485	0.169	0.004
Full model fit (measurment + structural)						
Chi-square (d.f.)	74.8 (37)			79.3 (37)		
P-value	0.0002			0.0001		
Rel. chi-square	1.5			1.6		
CFI	0.956			0.954		
TLI	0.921			0.917		
RMSEA	0.064			0.067		

As we have mentioned in section 6.1.1, the variable *buyRe* is highly skewed and the subset of variables that enter model 3 does not meet the requirement of multivariate normality. Multivariate non-normality of the data combined with categorical data with less than 5 categories (buyRe has only 2 categories - viz. appendix 6.1) can lead to biased estimates when ML estimator is used. However, as discussed in sections 5.5, ML estimator produces relatively unbiased estimates of regression weights and correlations even with non-normal data, but estimates of their standard errors are likely to be biased. Bearing this in mind, we may look once again at the path coefficients estimates reported in table 6.5. As a matter of fact, the value of the estimated coefficient of the direct effect of *buyRe* on intention appears to be relatively low (0.272) even when compared to other effects of *buyRe* in model 3. Although this result should still be taken with caution, we tend to interpret it as an indication of a very low or non-existent direct effect of a respondent's past purchase behavior on his intention when other TPB variables are controlled for. Such a result would support the sufficiency of TPB for an explanation of intention to buy organic food.

The positive effect of the respondent's past purchase behavior on the self-efficacy facet of perceived behavioral control is in line with Bandura's (1977) social learning theory, which predicts that experience with the behavior increases self-efficacy. In fact, this principle is used, for instance, in environmental learning, where the practice of pro-environmental activities is used to strengthen self-efficacy and to promote pro-environmental behavior (cf. Hungerford & Volk, 1990). Our results only attest to the importance of direct experience for formation and promotion of self-efficacy in the context of organic food consumption.

Our results therefore support the eighth hypothesis that including individuals' past purchase behavior in the model does not increase its predictive power with respect to intention, and also the ninth hypothesis that individuals' past purchase behavior does not have any direct effect on intention when the TPB factors are accounted for.

6.6 Inclusion of a household's past behavior in the TPB model

Because household eating practices have been shown to be an important factor of food consumption in previous research (see our discussion is 4.3.1), we have decided to test also an extension of the TPB model with the indicator of a household's past organic-food purchase in model 4. Since extension of the TPB model with the past behavior of a household has not been analyzed empirically, and certainly not in the context of organic food consumption, we take this exercise as an exploratory analysis rather than a test of a theoretically justified extension of TPB.

The fit of model 4 is sufficient by all fit indices, except for the chi-square test (see table 6.5 above). Interestingly, the addition of past purchase behavior of the household, *buyHh*, in the model increases explained variance of intention by almost 9% compared to model 2 (compare tables 6.3 and 6.5 above), which is a considerable improvement on the model's predictive power. Detailed inspection of table 6.5 reveals that *buyRe* has a strong positive and statistically significant direct effect on intention and also a positive and statistically significant effect on descriptive and injunctive norms. Interestingly, the estimated coefficients of the direct effects of attitudes and descriptive norms on intention remain very similar in model 4 as they were in model 2, which suggests that *buyHh* complements attitudes and descriptive norms as predictors of intention rather than explain them away. Another important thing to notice is that the size of the standardized coefficient for the effect of *buyRe* on intention, which equals to 1.05, is, in fact, the strongest factor of intention. Although we should take estimates from model 4 with some caution due to deviation of data from multivariate normality (as discussed at the beginning of this section), the size of the effect of *buyRe* suggest that this effect should not be ignored.

Both the increase in explained variance of intention seen in model 4 in comparison to model 2, and the magnitude of the direct effect of a household's past behavior on intention, descriptive and injunctive norms, took us by surprise and, as far as we are aware, has not been addressed in the literature. One possible interpretation of this effect is that it mirrors the consumption practices of the household. However, this interpretation does not explain why a households' past behavior does not also affect attitudes. Another possible explanation is that the effect of a household's past behavior captures effect of another variable not included in the model which affects behavior of the whole household, such as shared moral or other norms. In fact, moral norms are often found to play a role as factors of intention in the context of pro-environmental behavior (Staats, 2003) and specifically organic food consumption (see, e.g., Arvola et al., 2008; Dean et al., 2008). However, the effect of omitted moral norms should be also manifested in model 3, which it apparently is not since the effect of past behavior on intention is relatively weak in that model. Finally, the effect of a household's past behavior may be interpreted as an effect of background variables (e.g., a household's income) that constrains the behavior of household members. However, even this explanation does not seem to be sufficient because i) such an effect should be mediated by PBC according to TPB, and ii) such an effect would be also visible in model 3, which is not the case.

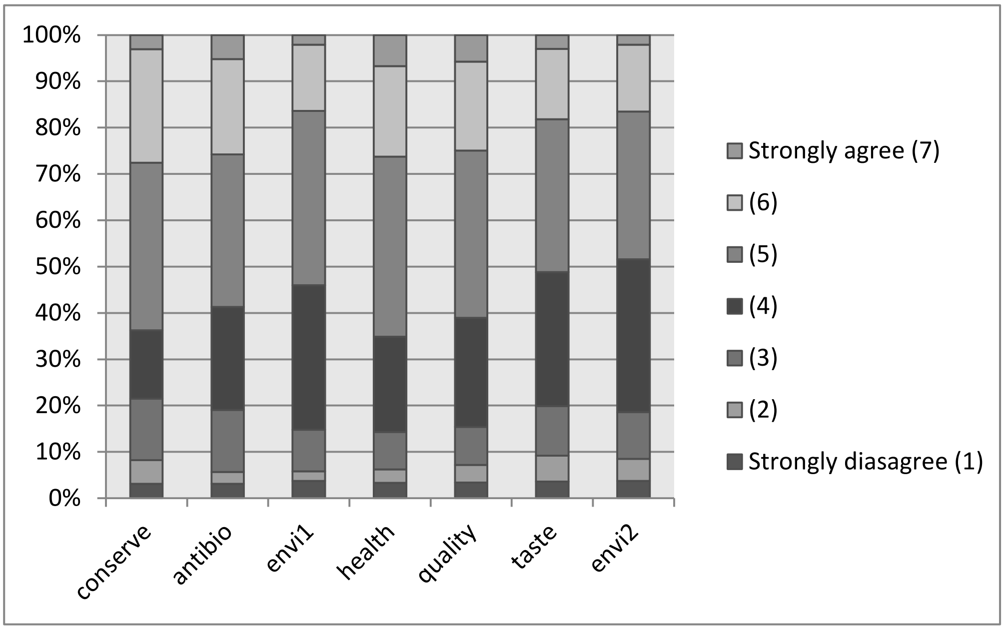
The question what causes the strong effect of a household's past behavior on intention and injunctive and descriptive norms remains open and we think that future research should demonstrate whether our unexpected finding was due to some methodological shortcoming in the model, noise in the data, or possibly due to a more substantial reason. Anyway, our unexpected results reject the tenth hypothesis that inclusion of household's past behavior in the TPB model does not increase explained variance of intention, and also rejects the eleventh hypothesis that household's past purchase behavior does not have any effect on intention after TPB factors are accounted for.

6.7 Exploration of the belief basis of attitudes

Our analysis shows that attitudes have a significant positive effect on intention to consume organic food and that the size of this effect is relatively robust and insensitive to model specification (compare estimates in tables 6.3 and 6.5). TPB accepts the assumption of value-expectancy theory that attitudes are formed on the basis of cognitive beliefs and their respective evaluations, as discussed particularly at the beginning of Chapter 4.

Information about the belief basis of attitudes is very interesting from a practical point of view; intervention campaigns can be design to target these beliefs and promote intention to consume organic food and actual consumption (viz. Hardeman et al., 2002 for a review of intervention studies based on TPB). Figure 6.2 displays reported belief strengths of six modal behavioral beliefs elicited in our study. The average score of belief strength (compare table reported in appendix 6.1) is highest for beliefs related to health- (*taste, antibio*) and quality-related attributes (*quality*) of organic food, while the beliefs about environmental friendliness of organic food (*envi1*) and environmental friendliness of its production (*envi2*) score on average as fourth and sixth out of six beliefs according to their strength. These results support the contention that health- and quality- related underlying motivation is more important for the purchase of organic food among Czech consumers. Another interesting thing to note is that the average strength of the belief about overall environmental friendliness of organic food (*envi1*) appears to be higher than that of the belief about environmental friendliness of organic food production (*envi2*). This is one example of inaccurate beliefs about organic food that consumers form because, as we have pointed out in chapter 3, the environmental friendliness of organic food production is more established than the overall environmental friendliness of organic food consumption vis-à-vis conventional food.

Figure 6.2: Strength of modal behavioral beliefs (relative frequencies, sample, N=252)



Our initial goal was to regresses these belief-strength scores on a direct measure of attitude to see which of the beliefs contribute most to the formation of attitude. However, preliminary analysis has revealed that all seven behavioral beliefs are strongly correlated (see table 6.6) and their simultaneous inclusion in the model is causes strong collinearity and deflation of estimated regression parameters.

Table 6.6: Bivariate correlation of attitude score and modal beliefs (point estimates of PPMCC, sig. of t-test)

Variable	Short description	Variable							
		attitude	**conserve**	**antibio**	**envi1**	**health**	**quality**	**taste**	**envi2**
attitude	factor score of the latent variable	1							
conserve	no preservatives and additives	0.125	1						
antibio	no anti-biotics and steroids residuals	.197**	.706**	1					
envi1	environmentally friendly	.246**	.506**	.509**	1				
health	healthier	.250**	.510**	.631**	.555**	1			
quality	higher quality	.306**	.545**	.600**	.506**	.751**	1		
taste	more tasty	.340**	.508**	.572**	.452**	.656**	.772**	1	
envi2	production is more environmentally friendly	.349**	.467**	.516**	.604**	.581**	.685**	.631**	1

Note: ***stands for sig. level 0.001; ** for sig. level 0.01 and * for sig. level 0.05.

We therefore ran exploratory factor analysis (not reported here in detail) to see whether perhaps the variability in the indicators of belief strength could be explained by a set of (uncorrelated) underlying factors. However, our analysis has shown that all indicators load on one common underlying factor. In fact, our inability to identify several underlying factors might have been caused by relatively low sample size and multi-collinearity which both lead to large standard errors of parameter estimates.

In any case, table 6.6 reveals that the strength of all modal beliefs, with the exception of the *conserve* belief (i.e., belief that organic food contains preservatives), is correlated with the latent factor of directly measured attitudes. This result indicates that attitude formation with regard to organic food consumption is probably affected by each of the seven beliefs about organic food. In other words, attitudes to organic food seems to be related (at least statistically) to health-related beliefs about organic food (beliefs *antibio, health*), environmentally-related beliefs (*envi1, envi2*) and also quality- or taste-related beliefs (*quality, taste*) but not to beliefs about presence of preservatives and additives in organic food (*preservatives*). Unfortunately, we are not able, with the present data, to estimate separately the contribution of each of these beliefs to formation of attitudes.

The fact that various beliefs about various organic food are correlated is not surprising because, as cognitive dissonance theory predicts (Festinger, 1957), people tend to harmonize their conflicting cognitions. A similar mechanism has been, in fact, found to harmonize beliefs of consumers about organic food in an empirical study by Thøgersen (2011). However, the cross-sectional empirical evidence examined in the present study does not allow us to examine the mechanism that leads to harmonization of consumers' beliefs about organic food.

*   *   *

To sum up the results of empirical analysis presented in this chapter, we may say that TPB provides a very useful framework for an explanation of the intention of Czech consumers to buy organic food. Our analysis demonstrates that the explanatory power of the model, with respect to prediction of intention, is quite high when compared to similar models of individual behavior used in social sciences. We find that attitudes and subjective norms are strong predictors of the intention to consume organic food, while the effect of perceived behavioral control on the intention is usually very low and statistically insignificant. Our analysis also shows that the inclusion of descriptive norms in TPB increases its predictive power and that descriptive norms have a relatively strong effect on intention.

The finding that descriptive norms play such a prominent role in the TPB framework, and especially the fact that they were found to have a direct effect on the intention to purchase organic food, is consistent with the findings of previous studies which have revealed the role of descriptive norms in the context of food consumption. This study indicates that the effect of the subjective facet of descriptive norms extends also to organic food consumption and that subjective perception of whether or not other people consume organic food not only affects the intention to consume organic food, but also interacts with attitudes and injunctive norms.

The addition of an indicator of a respondent's past behavior in the model increased explained variance of intention only by a small margin. Surprisingly to us, the inclusion of household's past purchase behavior indicator in the TPB framework increases explained variance of intention by almost 10 percentage points and this variable also seems to influence subjective norms. Several explanations of this unexpected result are put forward, but their validation remains for future research.

Our analysis of the belief-basis of attitudes has revealed that the strength of various modal beliefs about organic food held by consumers is strongly correlated. Health- and quality-related beliefs seem to be stronger than beliefs about the environmental friendliness of organic food and its production method. However, we were not able to separate empirically the individual contribution of each of these beliefs to the formation of attitudes because behavioral beliefs were strongly correlated and their joint inclusion in the model caused strong collinearity and deflation of the estimated parameters.

The results presented in this chapter are relevant for an explanation of the intention to consume organic food and not the actual organic food consumption. However, as TPB assumes (see section 4.1) and its many empirical applications seem to support (see section 4.2), intention can be used to predict behavior with considerable accuracy. As a matter of fact, behavioral intention explains on average some 27% of variability in actual behavior across empirical applications of TPB in various domains, and between 18 and 82% in empirical applications aimed specifically at explaining organic food consumption (see section 4.2.1 for discussion). Therefore our results may also be taken as an indication of which factors affect actual purchase behavior, and how they do so. However, only future research which uses longitudinal or experimental data will be able to properly analyze which factors drive Czech consumers' actual consumption of organic food.

CHAPTER 7: DISCUSSION, CONCLUSIONS AND AVENUES FOR FUTURE RESEARCH

The purpose of this final chapter is to summarize the results of the present work and discuss them in the wider context of organic food consumption and pro-environmental behavior. This chapter will also point to some of the limitations of the present work and suggest some avenues for future research which can elaborate on our findings and overcome some of the limitations of the present study.

7.1 SUMMARY OF THE WORK

The main objectives of the present work were two. Firstly, we aimed at an exploration of attitudinal, normative, and perceived control factors as drivers of the intention of Czech consumers to purchase organic food. In this, we used the theory of planned behavior to guide our inquiry. Secondly, and perhaps with more relevance for the theoretical discussion of action theories, we have attempted to test various extensions of the theory of planned behavior, particularly the inclusion of descriptive norms in the model, which have not so far been examined within the context of organic food consumption.

This dissertation proceeds in seven chapters, with this last one providing the conclusions and discussion of the work. The first three chapters are introductory in the sense that they discuss the motivation for the present work, provide definitions of organic food, and attempt to establish the link between the choice of organic food, as an example of individual pro-environmental behavior, on the one hand, and processes that lead to environmental degradation on the other. While Chapter 1 discusses the link between individual behavior and environmental degradation on a more theoretical and conceptual level, elaborating on and extending the concept of environmentally significant behavior, Chapter 3 attempts to link the choice of organic food to the alleviation of environmental problems on a more empirical and concrete level by discussing evidence from LCA studies which compare the environmental profiles of conventional and organic food.

Chapter 4 introduces the theory of planned behavior, one of the middle-range action theories, widely used for an explanation of behavioral intention and behavior in different contexts. Besides presenting constitutive elements of this theory, its assumptions and empirical applications in various domains, including organic food consumption in the Czech Republic, this chapter also discusses critique of the theory and its empirical extensions which answer some of the critical points. Two of these extensions of TPB are presented more thoroughly, namely the inclusion of descriptive norms and past behavior as predictors of intentions. These extensions are relevant for the context of organic food consumption; they are are then empirically tested in Chapter 6.

The empirical data from a small (N=253) yet country-representative survey of the general adult population are described in Chapter 5, together with the method of structural equation modeling that is primarily used to analyze them. In this chapter we also provide a more thorough discussion of working hypotheses that are presented in the form of four testable empirical models. Several limitations of the method and empirical data used in the present work are discussed, namely the relevance of the results of structural-equation modeling for the testing of causal hypotheses, limitations given by the relatively small sample size, and problems related to the use of maximum-likelihood estimator with the observed categorical-outcome variables.

In Chapter 6, with the use of structural equation modeling, we test four empirical models of intention to purchase organic food formulated in Chapter 5. The first model is derived from the original formulation of the theory of planned behavior, the second model includes descriptive norms as an additional factor of intention, while the third and the fourth models include, as additional predictors of intention to purchase organic food, respondent's and household's past purchase behavior respectively. This chapter brings several interesting findings relevant for the main research objectives of this dissertation. Firstly, a model based on the original formulation of TPB explains as much as 44% of variance in intention, with injunctive norms and attitudes to organic food being the main predictors of intention. Secondly, the addition of descriptive norms in the model increases explained variance of intention by a non-negligible 5 percentage points, and descriptive norms also become a predictor of behavioral intention. Thirdly, the addition of a respondent's past behavior in the model does not appear to increase its predictive power as the indicator of individual past behavior affects only perceived behavioral control. We interpret this result as an indication that the TPB-implied model is sufficient for an explanation of behavioral intention. However, inclusion of a household's past purchase behavior in the model increases the explained variance of intention by an additional 10% when compared to model 2. This result surprised us, not least because it is not fully consistent with TPB. We present and discuss several hypothetical explanations for this result, but none of them seems to be completely plausible as far as we can judge based on our results and the question of what is causing this effect that can be observed in our data, remains open to future research.

In addition to testing the four empirical models, we also attempt to explore the behavioral beliefs which underlie the formation of attitudes in chapter 6. Our study has elicited six modal behavioral beliefs about attributes of organic food which concern their superior quality, healthiness, better taste, and environmental quality. Our analysis reveals that the six modal beliefs are highly inter-correlated, causing strong multi-collinearity, which effectively precludes estimation of their unique contribution to the formation of attitudes with the present data. In any case, since all but one of these beliefs (the belief about absence of preservatives and additives in organic food) are highly correlated with the direct measure of attitudes, we may infer that five of the six beliefs may be instrumental in the formation of attitudes. Additionally, we offer an explanation for why the five beliefs are correlated, which receives theoretical support in cognitive dissonance theory and also in the empirical research on organic food consumption.

7.2 Discussion of findings

We see the main value of the present work in shedding more light on the two central research topics, these being the exploration of factors that explain the intention to purchase organic food by Czech consumers and the testing of extensions of the theory of planned behavior in the context of organic food consumption. Besides these rather obvious contributions, we think that the value of the present work also lies in its attempt to discuss the role of choice of organic food, an example of individual pro-environmental behavior, in alleviation of environmental problems because this discussion points to the conceptual and empirical difficulties of delineating pro-environmental behavior which usually remain hidden in a social-scientific analysis of pro-environmental behavior. Let us now elaborate somewhat more in detail of these issues.

7.2.1 Environmental friendliness of organic food consumption: beyond ceteribus-paribus assumption

The organic system of food production is seen by many as a way to decrease the environmental burden of food consumption (as discussed in Chapter 2). However, in reality it is actually very difficult to compare the environmental friendliness of organic food consumption as a behavioral alternative to conventional food consumption.

In the three introductory chapters of this work we attempt to show how, and under what conditions, individual pro-environmental behavior can contribute to the alleviation of environmental problems using an example of organic food consumption. We elaborate on Stern's (2000) concept of environmentally significant behavior and show that pro-environmental behavior can be classified along dimensions: presence or absence of environmental motivation and objective contribution of the specific behavior to the alleviation of environmental problems.

In chapter 3 we have provide a review of pertinent life-cycle-analysis studies on the environmental impacts of conventional and organic food consumption with specific focus on five classes of food: meat and meat products, dairy products, basic carbohydrate food, fruit and vegetables, and drinks and mixed products. This chapter demonstrates that choice of organic as opposed to conventional food can be classified as environmentally significant behavior in terms of its impacts only under very restrictive conditions.

One of the difficulties in comparison of different behavioral alternatives in terms of their environmental impact lies is the fact that the life-cycle of each product is associated with different environmental impacts and commensurability of these impacts and their comparability between products may be problematic. To give an example, we refer to section 3.3.2.2 where we present the results of LCA studies of dairy product which show that organic milk may be considered environmentally friendlier than conventional milk by some impacts (direct energy use, pesticide releases, and abiotic resource use) but environmentally less friendly in terms of other impacts (land-use and nitrogen releases), while the results of comparative studies are inconclusive with respect to other impact categories (global-warming potential and acidification).

Another difficulty for the comparison of the environmental friendliness of organic and conventional food lies in the fact that for some product categories, some types of impacts, and some parts of life-cycle of products, the data on environmental impacts are very scarce and often does not allow us to say whether the organic or conventional form of the product is more environmentally friendly. For instance, there are no studies that compare the environmental profile of conventional and organic dairy products other than for milk. Also, there are no studies for eggs, drinks and most of mixed products (see sections 3.3.2 through 3.3.2.5). Although many would claim that animal welfare is higher in an organic system of production, this fact is far from obvious due to the lack of empirical evidence from quality comparative studies (see section 3.3.1.1).

Another obstacle for the comparison of organic and conventional food consumption is given by the fact that many environmental impacts associated with organic food consumption are frequently omitted from comparative LCA analyses (release of toxic substances into water, land-use and water-consumption impacts). Some are difficult to even consider within the LCA framework (impacts on biodiversity, landscape aesthetics and local water use and also animal welfare) (see section 3.2). Other methods for evaluation of the environmental impacts of food consumption, such as ecological footprint analysis (see note 14), or the economic valuation of externalities (see note 15), are even more limited in what type of impacts they take into account.

Other obstacles to the comparison of the environmental profile of food consumption lie in the fact that we actually know very little about the post-production and specifically about the post-retail phases of the life cycle of food and there are indications that these parts of the life-cycle can make a significant difference with respect to the environmental profile of food consumption. To give an example, we refer the reader to section 3.3.2.4 where the results of two LCA studies are discussed. One of these studies compares the environmental profile of locally grown German apples with apples imported to Germany from New Zealand; this study finds that the local apples have a better environmental profile than the imported ones. Another German study on fruit juices finds, however, that fruit juices imported to Germany from South America have a better environmental profile than those produced locally because the adverse environmental effects of sea-transportation are outweighed by the generally lower environmental burdens of fruit production due to climatic conditions and the ecology of scale of the exporting country.

Other pieces of empirical evidence discussed in sections 3.3.2.2 and 3.3.2.3 point to the importance of the post-retail phases of food consumption. For example, we show that cooking certain side dishes, such as pasta, rice or potatoes can account for as much as half of all energy used during their respective life-cycles. Another post-retail issue is wastage. This is a very important factor, especially in the case of dairy food and meat and in high income countries, e.g. Sweden, where up to 62% of all dairy products that are purchased by households is wasted. This not only creates additional environmental burdens associated with waste disposal, but also more than doubles the requirements on production and processing capacity, also significantly increasing their environmental burdens.

The comparison of the environmental profile of organic and conventional food consumption is even more complicated by the fact that variations in management practices within a given production system can, in many cases, influence the environmental profile of an agricultural product more that the difference between conventional and organic modes of production (as discussed in sections 3.3.1 through 3.3.2.5).

The evaluation of the environmental profile of organic food consumption in Czech Republic is more difficult than in other countries, specifically because empirical evidence concerning the comparison of conventional and organic food sold in the Czech Republic is very scarce and sometimes missing altogether. There is no study that compares organic and conventional dairy products, fruit and vegetables and mixed products and drinks and some of the LCA studies that compare organic and conventional on-farm production as a whole, meat production and carbohydrate food production are actually of poor quality.

However, there is a more fundamental problem than a lack of information regarding the environmental profile of food and that is the fact that most comparative studies are based on ceteris-paribus assumptions, while the behavioral choices that consumer face usually violate these assumptions. One example that illustrates this point is mentioned in section 3.3.2.4 and consists of the fact that organic green-house tomatoes are actually of a different type than conventional green-house tomatoes. The worse environmental performance of organic tomatoes is given not just by the specific aspect of the production method (i.e. its lower production efficiency), but also by the requirements of this specific type of tomato. Consumers who buy these organic tomatoes therefore purchase not only their organic-related attributes, whatever these may be, but also other attributes related to the particular type of tomato.

A somewhat similar problem arises in the case of Czech consumers who want to buy organic meat and who are forced to buy beef meat because other types of organic meat are not readily available. As we have discussed in section 3.3.2.1, the consumption of beef meat is associated with the highest environmental burdens of any meat and therefore choosing organic meat implies choosing meat with the worst environmental profile. These examples illustrate that the ceteribus-paribus assumption actually limits our understanding of the environmental friendliness of behavioral alternatives in real-life situations.

7.2.2 Explanation of pro-environmental behavior and extension of the TPB framework

Apart from elaborating on the objective definition of environmental significance, this work exploits the theory of planned behavior to explain the choice of organic food. The choice of organic over conventional food is usually driven by many motives, including those related to social and environmental responsibility, economic incentives and barriers, as well as factors related to one’s own well-being and altruistic concerns for the well-being of family members. Czech consumers have become interested in organic food only relatively recently, which has resulted in a rapid growth of the Czech organic market. Despite this trend, however, relatively little is known about the factors that motivate Czech consumers to prefer organic food over conventional food. The studies which have focused on organic food consumption in the Czech Republic thus far have been either purely descriptive or used samples representative of specific sub-populations. This study is the first which uses the theory of planned behavior to explain the intention of the Czech adult population to purchase organic food.

The present study shows that TPB is relatively successful in explaining Czech consumers' intention to buy organic food. We find that particularly consumers' attitudes and their subjective norms have a strong effect on behavioral intention, while there is a small or even no effect of perceived behavioral control on intention. Our finding that PBC has only little or no effect on intention is not unusual within the context of organic food consumption (see e.g. Dean et al., 2008), and is consistent with the findings of previous Czech TPB studies which have focused on organic food consumption (Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011), and is also reflected in the design of several TPB studies which do not even include PBC as an explanatory variable of intention (Arvola et al., 2008; Saba & Messina, 2003; Tarkiainen & Sundqvist, 2005). Attitudes and subjective norms have been, on the other hand, shown to affect the intention to consume organic food not only in the Czech Republic (Urban & Ščasný, 2007; Urban et al., 2008; Zvěřinová, 2011), but also elsewhere (Arvola et al., 2008; A. J. Cook et al., 2002; Dean et al., 2008; Sparks & Shepherd, 1992; Thøgersen, 2009).

This work is also the first study known to us which uses the TPB model extended with descriptive norms as an additional predictor of behavioral intention in the context of organic food consumption. Our results show that descriptive norms are an empirically distinct factor and that their inclusion in the TPB model increases its predictive power. Interestingly, we have also found that the inclusion of descriptive norms in the TPB model suppresses the effect of injunctive norms and perceived behavioral control on intention due to the correlation of descriptive norms with other TPB constructs. Unfortunately, the data exploited in this study does not allow us say which of the directions of causation are more plausible, whether norms affect formation of attitudes, or whether attitudes affect formation of subjective norms, or whether all these factors are affected by another factor not captured by the model. Also the direction of causation between the descriptive and injunctive norms is not well established in the literature and our present research is unable to provide an answer to this question.

Our results indicate that Czech consumers are strongly influenced in their decision to consume organic food not just by their attitudes to organic food and by social pressure from significant others, but also by the perception of what other people do. Interestingly, the last factor seems to be at least as strong, if not stronger, than the previous two. As discussed in section 4.3.1, descriptive norms may provide consumers with information about whether certain behavior is reasonable and/or socially acceptable. Therefore the beliefs that people form about whether certain behavior is frequently performed may serve as an indication of the social desirability of this behavior and its reasonability and may stimulate its performance. As we discuss further below, this "normalization of behavior" (i.e., increasing beliefs that such behavior is "normal") is a useful intervention tool applicable also to the promotion of green behavior.

The finding that descriptive norms play such a prominent role in the TPB framework, and especially the fact that they were found to have a direct effect on the intention to purchase organic food, is consistent with the findings of previous studies which have revealed the role of descriptive norms in the context of food consumption. This study indicates that the effect of the subjective facet of descriptive norms extends also to organic food consumption and that subjective perception of whether or not other people consume organic food not only affects the intention to consume organic food, but also interacts with attitudes and injunctive norms.

The importance of the social context of organic food consumption seems to be also supported by our finding that past purchase behavior of organic food in the household has a positive effect on the intention to purchase organic food. Although we are not able to explain this result fully, one of the working hypotheses is that norms or practices shared by a household with respect to organic food consumption may have influenced the intention to purchase organic food.

The results presented in this chapter are relevant for an explanation of the intention to consume organic food and not the actual consumption. However, as TPB assumes (see section 4.1) and its many empirical applications seem to support (see section 4.2), intention can be used to predict behavior with considerable accuracy. As a matter of fact, behavioral intention explains on average some 27% of variability in actual behavior across different empirical applications of TPB in various domains, and between 18 and 82% in empirical applications aimed specifically at explaining organic food consumption (see section 4.2.1 for discussion). Therefore our results may also be taken as an indication of which factors affect actual purchase behavior, and how they do so. However, only future research which uses longitudinal or experimental data will be able to properly analyze which factors drive Czech consumers' consumption of organic food.

We may now return to the conceptual classification of environmentally significant behavior discussed in Chapter 1. The present work shows how organic food consumption can be positioned with respect to the two dimensions of pro-environmental behavior that we proposed. Our analysis suggests that beliefs about the environmental friendliness of organic food consumption are probably only some of the beliefs that lead to formation of attitudes, but we were not able to isolate their unique contribution to the formation of attitudes. In any case, other factors, particularly subjective norms and a household's past purchase behavior (which most likely mediates the effect of other variables not accounted properly by the model) explain a large portion of the intention to consume organic food. This result does not make pro-environmental motivation necessarily marginal, but definitely sets limits as to its role as a driver of intention to consume organic food.

In addition, our review of LCA literature presented particularly in Chapter 3 points also to limiting conditions under which we may take organic food consumption as an example of pro-environmental behavior. In fact, the choice of organic food over conventional becomes an environmentally friendly one mostly under strict ceteris-paribus conditions that are usually not met in real-life decision situations which the consumer faces. Taking this into account, we tend to classify organic food consumption as environmentally marginal by its impact.

7.3 Practical implications

This work has several practical implications especially for communicating the advantages of organic food consumption and for the marketing of organic food. Firstly, our survey of LCA literature has shown that organic food consumption can be proclaimed to be environmentally friendlier than conventional food consumption only under relatively restrictive conditions and mostly under ceteris-paribus assumption which is usually not realistic. These findings imply that environmental friendliness should be claimed only for specific product categories and specific environmental impacts, rather than as a general proclamation of the overall green profile of organic food. This recommendation relates also to the communication of animal-welfare attributes of organic food consumption. Although higher standards of animal husbandry are central to organic agriculture, there is not enough evidence which would support the overall and clear superiority of the organic production system with respect to animal welfare. Therefore specific claims about the advantages of organic animal rearing (e.g., free-range, open pastures etc.) are more correct and less susceptible to doubt, based on the existing empirical evidence or lack thereof.

Secondly, it is apparent that the organic labeling scheme does not provide a clear indication of the environmental profile of organic food, which is an important attribute for many consumers. It would be therefore advisable to provide consumers with additional information about the organic friendliness of food, for instance in the form of a simplified rating of a food's carbon or ecological footprint.

Thirdly, our analysis has also revealed that attitudes and subjective norms affect intention to purchase organic food. Behavioral intervention in the form of a marketing campaign may take the advantage of our findings and use strategies that promote behavioral or normative beliefs and/or their affective evaluations. TPB has been successfully applied in tens of interventions studies in different domains (see Hardeman et al., 2002 for a systematic review of such interventions studies) and can be used as a theoretical support for designing such interventions. Our findings, which attest to the prominent role of normative factors as determinants of organic food consumption, also give some credit to the use of intervention methods which aim to influence specifically these normative factors. A good prospect in this respect may be the social norms approach (Perkins, 2003), used with success in health-related behavior and substance-abuse prevention. In fact this approach has also been proposed by Rettie and her colleagues very recently (2012) as a tool for marketing of organic food. The basic idea of this intervention approach consists precisely in "normalizing" target behavior, i.e. strengthening beliefs that the behavior is performed by many people and that it is, in fact, a "normal" behavior.

7.4 Novelty of present work

The novelty of the present study consists in two points. Firstly, this is one of the few existing studies which has applied the theory of planned behavior to an explanation of the intention to consume organic food in the Czech Republic and the first such study which uses a representative sample of the population, and also the first study which makes use of structural equation modeling, which enables it to estimate models with latent variable and relatively elaborate measurement models for some of the TPB variables. Secondly, this study is the first ever, as far as we are aware, which tests the extension of the theory of planned behavior with descriptive norms in the context of organic food consumption.

Besides these two central points, we think that our work also contributes to the discussion about the friendliness of organic food consumption. As far as we are aware the survey of LCA literature presented in Chapter 3 is probably the most extensive overview of food related LCA literature and also the most comprehensive survey of LCA literature relevant for the comparison of conventional and organic food. Indeed, as far as we are aware, no similar review has been conducted for the Czech food-related and organic-food related LCA studies.

7.5 Limitations

The limitations of the present study should be mentioned as well. We think that the relatively small sample size disadvantages our study specifically by decreasing its statistical power. The second limitation of the present study is given by the fact that we use a very simple measurement model, with only one indicator in the case of the five constructs used in this study (intention, the two facets of PBC, and the two indicators of past behavior), with the result that we are not able to estimate measurement error for these variables. Finally, we have to bear in mind that our data are cross-sectional and therefore their relevance for testing of causal hypothesis is lower than that of longitudinal or experimental data. On the other hand, we firmly agree with (Rubin, 1974) that no data can principally prove causal hypothesis and that different types of data (experimental, observational etc.) differ only in the level of their relevance for the testing of causal hypothesis.

Other than that, we should also acknowledge the limitation given by the design of the study that focuses on an explanation of intention to purchase of organic food and not on the actual purchase behavior. Although behavioral intention may be assumed to predict behavior quite well under reasonable assumptions (see discussion in section 4.2), our results can be, strictly speaking, generalized only to the prediction of intention to purchase organic food and not to the actual purchase of organic food.

Finally, we would like also to acknowledge the limitations of the LCA review presented in section 3. Although we are convinced that this review is a valuable contribution among similar review studies, we actually think that what is needed at the present moment is a comprehensive meta-analytical comparative study based on data from LCA literature which would make the comparison of organic and conventional food more precise and which would also point to blind spots in our knowledge of the environmental impacts of food consumption more clearly, which a qualitative overview such as the one that we have conducted, cannot provide.

7.6 Avenues for future research

We think that future research exploring organic food consumption in the Czech Republic should particularly focus on the role of normative factors of organic food consumption because, as our analysis has shown, these have a very strong effect on the intention to consume organic food and probably also on actual organic food consumption. Another issue that should be addressed by future research is the role of a household's past consumption as a factor of intention and possibly also of actual consumption. This effect has not been explained by the present study and its source remains uncertain. But in any case, this effect does not seem to be fully consistent with the theory of planned behavior.

Also an empirical investigation of beliefs that underlie the formation of attitudes, and other TPB constructs, will be very valuable. Another issue closely related to the belief structure of attitudes is why and through what mechanism do different attitudinal beliefs become so much correlated. We have pointed to cognitive dissonance theory as one possible theoretical account for this process, but other explanations are also possible. This issue is also very important from a practical point of view because these interactions that exist between various behavioral beliefs can be exploited in intervention and marketing campaigns aimed at the promotion of organic food consumption.

Future research should also address the limitations of the present study, particularly its small sample size, risk of biased estimates due to use of ML estimator with categorical outcome variables, and rather simple measurement model for several TPB constructs, which does not allow for the estimation of measurement errors.

APPENDIX

Appendix 5.1: Descriptive statistics of the population and the sample

	Czech population	**Sample**
Number of observations	--	252
Gender		
Males	48.7% [1]	47.4%
Females	51.3%	52.6%
Age groups		
18-39	40.1%[2]	38.7%
40-59	32.5%	34.8%
60+	27.4%	26.5%
Highest educational attainment		
Primary education and not completed	19.1%[1]. [3]	26.1%
Lower secondary	34.9%	35.6%
Upper secondary and post-secondary	32.9%	24.9%
Tertiary	13.2%	13.4%
Marital status		
Never married	40.2%[1]	22.9%
Married	42.1%	57.3%
Divorced	10.4%	9.9%
Widowed	7.3%	9.9%
Municipality size groups		
less than 5000 inhabitants	38.0%[1]	36.4%
5000 to 19999 inhabitants	18.4%	17.8%
20000 to 49999 inhabitants	11.6%	12.6%
50000 to 99999 inhabitants	9.9%	8.3%
100000 or more inhabitants	22.1%	24.9%
Average net monthly per capita income of the household [CZK]	12206[4]	12476
Std. dev.	--	6105
Average household size	2.5[4]	2.7
Std. dev.	--	1.2

Notes: [1] population data from CZSO (2011a); [2] population data from CZSO (2011b); [3] Czech population aged 15+; [4] data for the Czech households are from CZSO (2011c).

Appendix 6.1: Descriptive statistics of observed variables.

Item	Indicator	Wording	Min.	Max.	Mean	S.D.	Skewness	Kurtosis
at1	attitude	[Buying organic food in the next month would be for you…]… bad - good (7-point Likert-like scale)	1	7	5.12	1.24	-0.35	-0.53
at2	attitude	… not beneficial - beneficial (7-point semantic scale)	1	7	4.68	1.49	-0.24	-0.76
at3	attitude	… disadvantageous - advantageous (7-point semantic scale)	1	7	3.88	1.38	0.25	-0.78
at4	attitude	… unreasonable - reasonable (7-point semantic scale)	1	7	4.77	1.48	-0.51	-0.68
sn1	social norm (descriptive)	Most people whose opinion I value buy organic food. Strongly disagree - strongly agree (7-point Likert-like scale).	1	7	2.76	1.51	0.41	-0.93
sn2	social norm (descriptive)	Most people who are important to me buy organic food. Strongly dissagre-strongly aggree (7-point Likert-like scale).	1	7	2.79	1.49	0.38	-0.82
sn3	social norm (injunctive)	Most people who are important to me think that I... (should not - should: 7-point Likert-like scale) ...buy organic food in the next month.	1	7	3.14	1.54	0.02	-1.12
sn4	social norm (injunctive)	People whose opinion I value would… (disapprove-approve: 7-point Likert-like scale) of my buying of organic food in the next month.	1	7	3.33	1.56	-0.03	-1.07
pbc1	perceived behavioral control (self-efficacy)	Buying organic food in the next month is… difficult - easy (7-point Likert-like scale) for me.	1	7	3.73	1.42	0.39	-0.56
pbc2	perceived behavioral control (controllability)	My buying of organic food in the next month depends only on my decision and not on external conditions. Disagree-agree (7-point Likert-like scale).	1	7	4.78	1.76	-0.14	-1.28
int	intention	I intend to buy organic food in the next month. Disagree-agree (7-point Likert-like scale).	1	7	2.51	1.54	0.68	-0.73
buy1	past behavior (respondent)	Have you ever bough organic food? (dummy, 1 if yes, 0 otherwise)	0	1	0.13	0.34	2.15	2.64
buy2	past behavior (household)	Has your household ever bough organic food? (dummy, 1 if yes, 0 otherwise)	0	1	0.31	0.46	0.81	-1.36
conserve	behavioral belief	[To what degree do you agree or disagree with the following statements?] Organic food… does not contain preservatives and other artificial additives. (1=disagree, 7=agree)	1	7	3.65	1.29	-0.54	-0.51
antibio	behavioral belief	…does not contain residuals of animal anti-biotics and stereoids.	1	7	4.65	1.25	-0.28	-0.47
envi1	behavioral belief	…is environmentally more friendly than conventional food.	1	7	4.52	1.10	-0.36	0.10
health	behavioral belief	…is healthier than conventional food.	1	7	4.78	1.23	-0.43	-0.03
quality	behavioral belief	…is of higher quality than conventional food.	1	7	4.70	1.25	-0.39	-0.14
taste	behavioral belief	…tastes better than conventional food.	1	7	4.44	1.23	-0.28	-0.33
envi2	behavioral belief	…is produced in an environmentally more friendly way than conventional food.	1	7	4.40	1.18	-0.28	-0.22
Number of observations					252			

Appendix 6.2: Sample correlations and normalized residuals of observed and model-implied cor. matrices (model 1)

	at1	**at2**	**at3**	**at4**	**sn3**	**sn4**	**int**	**pbc1**	**pbc2**
at1	0.113	1.254	-0.712	0.249	-1.168	1.421	-1.171	-1.336	0.718
at2	0.488	-0.066	0.039	-0.563	-1.187	-0.492	-0.052	-1.172	0.644
at3	0.318	0.503	0.009	0.354	-0.437	-0.115	0.293	1.211	-0.66
at4	0.41	0.48	0.532	0.153	0.623	1.4	0.494	0.603	-0.477
sn3	0.151	0.232	0.282	0.386	-0.036	-0.112	0.318	-0.047	-0.842
sn4	0.359	0.277	0.296	0.441	0.672	-0.143	-0.7	0.051	0.818
int	0.198	0.379	0.389	0.423	0.518	0.421	-0.016	-0.015	0.038
pbc1	-0.006	0.039	0.212	0.172	0.261	0.258	0.2	-0.003	0.023
pbc2	0.06	0.057	-0.036	-0.023	-0.08	0.044	-0.164	0.196	-0.007

Note: Sample correlations reported in the lower triangle, normalized residuals on the diagonal and in the upper triangle.

Appendix 6.3: Sample correlations and normalized residuals of observed and model-implied cor. matrices (model 2)

	at1	at2	at3	at4	sn1	sn2	sn3	sn4	int	pbc1	pbc2
at1	0.067	1.216	-0.721	0.274	-1.429	-1.102	-1.289	1.175	-1.185	-1.296	0.737
at2	0.486	-0.112	-0.021	-0.63	-0.588	0.468	-1.204	-0.684	-0.098	-1.283	0.684
at3	0.319	0.504	-0.014	0.423	0.999	0.748	-0.413	-0.174	0.339	1.126	-0.664
at4	0.408	0.473	0.537	0.166	-0.428	0.2	0.554	1.354	0.496	0.708	-0.504
sn1	0.093	0.229	0.342	0.24	-0.02	-0.036	0.49	-0.419	-0.08	0.093	0.266
sn2	0.121	0.315	0.326	0.293	0.862	-0.051	-0.081	-0.406	-0.032	0.026	-0.209
sn3	0.133	0.222	0.275	0.365	0.574	0.534	-0.036	-0.129	0.473	-0.052	-0.963
sn4	0.339	0.267	0.298	0.436	0.505	0.513	0.666	-0.196	-0.766	0.089	0.824
int	0.196	0.375	0.393	0.418	0.564	0.576	0.515	0.424	-0.009	-0.012	0.034
pbc1	-0.003	0.031	0.206	0.179	0.242	0.24	0.252	0.265	0.198	-0.001	0.028
pbc2	0.062	0.06	-0.035	-0.024	-0.234	-0.271	-0.083	0.049	-0.169	0.193	-0.007

Note: Sample correlations reported in the lower triangle, normalized residuals on the diagonal and in the upper triangle.

Appendix 6.4: Sample correlations and normalized residuals of observed and model-implied cor. matrices (model 3).

	at1	at2	at3	at4	pbc1	pbc2	sn1	sn2	sn3	sn4	int	buy1
at1	0.071	1.229	-0.724	0.274	-1.312	0.746	-1.449	-1.11	-1.296	1.164	-1.193	0.115
at2	0.486	-0.104	-0.019	-0.614	-1.267	0.671	-0.619	0.467	-1.188	-0.667	-0.077	-0.124
at3	0.319	0.504	-0.024	0.399	1.107	-0.633	1.001	0.736	-0.442	-0.191	0.317	0.416
at4	0.407	0.473	0.535	0.172	0.698	-0.525	-0.359	0.23	0.571	1.387	0.514	-0.293
pbc1	-0.004	0.032	0.205	0.178	-0.005	0.026	0.089	0.021	-0.053	0.096	-0.007	-0.031
pbc2	0.064	0.06	-0.032	-0.025	0.196	-0.006	0.278	-0.243	-0.959	0.829	0.032	0.008
sn1	0.092	0.227	0.342	0.246	0.243	-0.23	-0.006	-0.04	0.484	-0.421	-0.083	-0.215
sn2	0.12	0.315	0.325	0.295	0.241	-0.27	0.862	-0.064	-0.092	-0.419	-0.03	0.421
sn3	0.131	0.222	0.272	0.365	0.249	-0.083	0.576	0.535	-0.039	-0.136	0.468	-0.021
sn4	0.338	0.267	0.296	0.438	0.263	0.049	0.508	0.515	0.666	-0.203	-0.774	-0.208
int	0.195	0.376	0.391	0.418	0.197	-0.167	0.566	0.577	0.516	0.425	-0.009	0.011
buy1	0.05	0.048	0.083	0.036	0.14	0.022	0.026	0.071	0.087	0.075	0.117	0

Note: Sample correlations reported in the lower triangle, normalized residuals on the diagonal and in the upper triangle.

Appendix 6.5: Sample correlations and normalized residuals of observed and model-implied cor. matrices (model 4).

	at1	at2	at3	at4	pbc1	pbc2	sn1	sn2	sn3	sn4	int	buy2
at1	0.088	1.3	-0.668	0.322	-1.29	0.744	-1.399	-1.05	-1.268	1.176	-1.263	-0.259
at2	0.488	-0.114	-0.007	-0.595	-1.299	0.688	-0.565	0.529	-1.179	-0.634	-0.096	0.174
at3	0.322	0.506	-0.008	0.376	1.107	-0.684	0.984	0.738	-0.409	-0.191	0.379	-0.199
at4	0.41	0.475	0.539	0.204	0.672	-0.517	-0.377	0.194	0.563	1.33	0.535	0.046
pbc1	-0.002	0.031	0.207	0.178	0.003	0.025	0.073	0.044	-0.035	0.079	-0.001	-0.066
pbc2	0.06	0.057	-0.04	-0.029	0.193	-0.007	0.299	-0.295	-0.97	0.804	0.03	0.003
sn1	0.095	0.232	0.343	0.247	0.242	-0.225	-0.014	-0.036	0.485	-0.451	-0.126	-0.459
sn2	0.123	0.318	0.325	0.293	0.241	-0.269	0.862	-0.053	-0.046	-0.423	-0.016	0.626
sn3	0.136	0.227	0.282	0.371	0.254	-0.081	0.576	0.534	-0.028	-0.126	0.515	0.059
sn4	0.343	0.277	0.305	0.443	0.267	0.05	0.51	0.515	0.666	-0.212	-0.796	-0.353
int	0.19	0.376	0.4	0.424	0.205	-0.158	0.56	0.571	0.513	0.421	0.005	0.028
buy2	0.042	0.094	0.066	0.085	0.043	-0.071	0.165	0.241	0.202	0.177	0.451	0

Note: Sample correlations reported in the lower triangle, normalized residuals on the diagonal and in the upper triangle.

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