Organic farming as rational choice: empirical investigations in environmental decision making

Best, Henning

ORGANIC FARMING AS A RATIONAL CHOICE

EMPIRICAL INVESTIGATIONS IN ENVIRONMENTAL DECISION MAKING

Henning Best

ABSTRACT

Based on a postal survey of farmers conducted in 2004 in Western Germany (n = 657), a rational choice model of the adoption of organic farming is tested. Using methods of direct utility measurement, rational choice (RC) theory is applied directly in the empirical study. By that, questionable assumptions on the variability of preferences and the type of preferences to use in RC explanations can be avoided. The results indicate that the subjectively expected utility model is well suited to explain the adoption of organic farming. Expectations on the development of operational characteristics of the farm and farmers' daily work are at the core of the decision. Farmers especially consider aspects like pest and weed control, the development of yields or the use of chemical substances. While solely economic factors like prices and marketing are also important, these are subordinate to operational aspects. In addition, a moderate impact of environmental concern regarding the adoption of organic farming is observed.

KEY WORDS • environmental behavior • organic farming • preferences • rational choice • utility

In recent years, the question of how economic prosperity and social progress can be reached without further negative impact on the environment has become more important than ever. Just recently, the Stern Review (Stern 2007) and the IPCC 4th assessment report (IPCC 2007) have emphasized that environmental problems, especially climate change, are man-made and will have serious, if not disastrous, consequences for human societies. Based on a rational choice perspective one would argue that large-scale environmental problems like acid rain, pollution, and climate change are the aggregate outcome of the environmental behavior of individual and corporate actors. To avoid further damage to the environment, it is necessary to

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establish structures that enhance pro-environmental behavior and sanction environmentally unfriendly acts. Such interventions, in turn, should be based on a detailed understanding of the reasons for human behavior in order to avoid misleading incentives. An example of a poorly planned intervention (a traffic reduction program) with an unsuited payoff-structure was given by Baltas and Xepapadeas (2001). To reduce the number of cars in the inner city of Athens, Greece, the council decided that cars with an even number plate were allowed access to the city centre only on even numbered calendar days, cars with odd number plates only on odd numbered days. However, Baltas and Xepapadeas (2001: 175) conclude: 'given the inefficiencies of the public transport system, many Athenians were motivated to purchase a new passenger car and to keep the old car as well in order to have both an odd and an even number plate.'

Rational choice theory has been applied to a number of environment related behaviors ranging from travel mode choice (e.g. Bamberg and Schmidt 1998; Davidov 2007) and fisheries management (Acheson 2004; Acheson and Gardner 2005) to the management of global commons (Dietz et al. 2003). Although previous research has shown that rational choice theory has good explanatory and predictive power for environmental behavior, the research has been restricted in some sense. Many studies have focused on individual, everyday behavior, like car use or waste recycling. Even though it has been shown that everyday behavior can be analyzed using rational choice theory (Friedrichs and Opp 2002), such behavior is usually quite routine. That is, the actors decide once what to do (e.g. commute by car or by public transport) and apply the result of that decision to similar situations in the time to come (see Camic 1992 for a treatise on habits). In addition, a great share of everyday environmental behavior is subject to the commons dilemma.[1] Finally, direct empirical applications of rational choice theory (that is, direct utility measurement) are used only rarely. Rather, most papers content themselves with testing some hypotheses that can be derived from rational choice theory. Although this kind of research can lead to valuable insights, a direct empirical application of rational choice should provide more in-depth information on both decision theory in general and the specific decision studied.

This paper seeks to broaden the scope of rational choice applications in environmental research by presenting an empirical study of the adoption of organic farming. As an object of decision-research, organic farming offers some advantages. First of all, a farmer does not decide whether or not to adopt organic farming on an everyday basis. Therefore, the analysis is not biased by routine behavior. Second, organically grown produce can realize a price premium on the market, and these premium prices (as well as governmental support payments) can act as selective incentives that alleviate the commons dilemma. Additionally, the decision to adopt or not to adopt organic farming is a quite fundamental decision on the organization of the farm. In an extreme case, a wrong decision might even lead to bankruptcy. Given the importance of the decision, it can be presumed that the farmer thoroughly considers the pros and cons of each alternative. This is especially important as this study directly applies rational choice theory (as suggested by Opp 1990; 1998) and empirically measures preferences and subjective probabilities.

Summarizing, my aim in this paper is twofold. The principal aim is to explain the adoption of organic farming using rational choice theory. By that, I hope to move toward a better understanding of decisions on sustainable farming systems in particular and environmental behavior in general. The empirical study additionally seeks to contribute to the discussion on direct applications of rational action theory.

What is Organic Farming?

Organic farming is an especially environmentally friendly way of producing agricultural goods (see Mäder et al. 2002). The aim of organic farming is to operate the farm as an integrated system as much as possible. The organic farming style seeks to maintain soil fertility, reduce pollution, guarantee species-appropriate husbandry, and produce healthy food. Organic farming is also intended to contribute to the solution of global energy and resource problems and to preserve small-scale, regionally oriented farming units like family farms (Bioland 2002). Following Lampkin, organic farming is 'best thought of as referring not to the type of inputs used, but to the concept of the farm as an organism, in which all the component parts – the soil minerals, organic matter, microorganisms, insects, plants, animals and humans – interact to create a coherent whole' (Lampkin 1994: 5). The main difference between organic farming and other forms of sustainable agriculture is this holistic viewpoint as well as the existence of a body of rules that clearly define organic farming.

Traditionally these guidelines have been issued by non-governmental grass roots organizations (for Germany see Bioland 2002; Demeter 2002; Naturland 2002). The most important internationally accepted guidelines on organic farming are set by the International Federation of Organic Agriculture Movements (IFOAM 2002). IFOAM rules consist of a multitude of rules on cultivation, animal husbandry and pest control that cannot be reviewed in detail in this paper. A fundamental attribute of organic farming is to avoid the use of GMOs, artificial pesticides and herbicides, and artificial fertilizers. The guidelines on environmentally sane cultivation are complemented by rules on species-appropriate husbandry. In addition to these internal guidelines, the EU-regulation 2092/91 on organic farming established a legal rule set that clearly defines which farming style may be called 'organic farming' in the European Union (EC 1991). In general, this legal rule set is less strict than the guidelines of the organic farming associations (NGOs). Since the 1990s the EU organic standards have gained importance greatly, and remain the single most important rule set on organic farming in Europe.

If a farm is certified to operate according to the EU-regulation on organic farming, the farmer not only protects the environment, but also is able to market his or her products as 'certified organic' and receive a premium price for them. As noted before, the adoption of organic farming differs from other forms of individual environmental behavior in one important aspect: as the price premium and subsidies can act as selective incentives, the problem of free riding and the establishment of public goods is minimized (see Olson 1965).

The beginning of modern organic farming in Germany can be traced to the end of the 1920s. Culturally, its emergence is seen in the context of the life-reform movement and Rudolf Steiner's anthroposophy.[2] Economically, the emergence can either be interpreted as a reaction to problems of decreasing soil fertility and the corresponding reduction in yields or can be taken as a measure against the beginning structural crisis of the agricultural sector (see Vogt 2000). Throughout most of the 20th century, however, organic farming remained in a very small cultural and economic niche. A more than marginal position, and a corresponding perception by the general population, wasn't reached until the end of the 1980s. Significant milestones in its development include the introduction of government subsidies in 1989 and the commencement of EU-regulation of organic agriculture in 1993.

In 1988, there were about 2000 organic farms in Germany. According to public statistics (see SOEL 2008), that number had doubled by 1992, yielding annual growth rates of about 20%. Since then, there has been considerable growth of the organic sector. On the national level, the number of certified organic farms has almost tripled in the last ten years. Certified organic farms numbered more than 18,700 by the end of 2007 and corresponded to 5.0% of all existing farms (5.1% of agricultural area). The development of organic farming in Germany and the studied regions is presented in Figure 1.

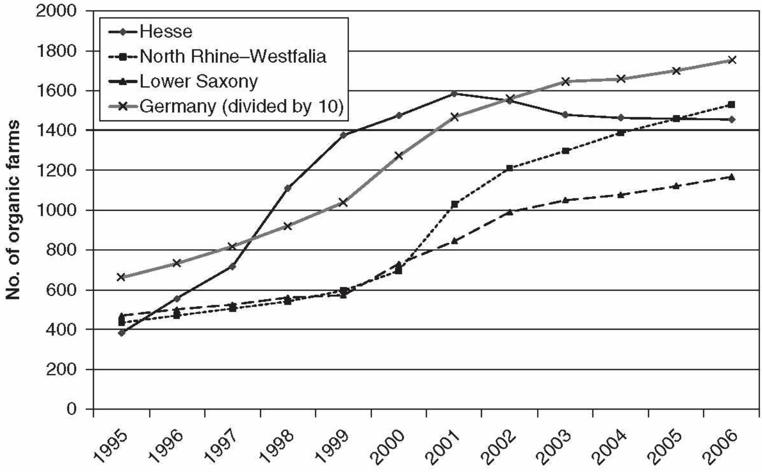

Figure 1. Development of organic farming in Germany

State of Research and Theoretical Considerations

State of Research

Although there have been quite a number of empirical studies on the adoption of organic farming internationally (e.g. Burton et al. 1999; Egri 1999; Midmore at al. 2001; Pietola and Lansink 2001; Schneeberger and Kirner 2001; Schneeberger et al. 2002), the previous research is limited by at least two shortcomings. First, there has been little empirical research on the determinants on the adoption of organic farming in Germany (for exceptions see Arp et al. 2001; Schramek and Schnaut 2004). Second, and more importantly, much research has been rather descriptive instead of being guided by a decision theory. In the following paragraphs I will summarize important results of these studies.

Important constraints of the adoption of organic farming are the operational and economic characteristics of the farm. In Germany, organic farms are on average larger than conventional farms (DBV 2002). The effect of farm size, however, varies internationally and should not be generalized. For example, in the US, especially California (Klonsky and Richter 2005), or Canada (Egri 1999), organic farms are appreciably smaller than conventional farms. These differences are due to a number of other differences between the countries and between organic/conventional farms. The difference in Germany is due to a relatively small share of organic part-time farmers and to the high number of organic farms in East Germany. The area under cultivation by East German farms, however, is above average. Closely linked to the size of agricultural area is the farm type. Many German organic farms specialize in milk production and cattle breeding, whereas the breeding of hogs or growing of sugar beet or maize is less common than in conventional farming (BMVEL 2004). As there are large differences between countries and regions in the agricultural market situation as well as in the natural setting (such as soil and climate), variations in both main products and agricultural area are expectable. Although these and other economic and operational constraints are of central importance for the cost of adopting organic farming, from a sociological perspective the subjective perception and valuation can be regarded as more important than the actual situation (see Thomas and Thomas 1928). Therefore, one would expect farmers to consider adoption of organic farming only if, based on their perception of the status quo, they expect organic farming to lead to future improvements and thus refrain from it in the opposite case. Indeed, Arp et al. (2001), Schneeberger and Kirner (2001) and Schneeberger et al. (2002) unanimously report that many conventional farmers expect a decrease in earnings from organic farming. This is mainly due to too-low producer prices and underdeveloped marketing channels. Further expected operational problems were bureaucratic processes, a fear of pests and weeds, and the necessary altering of staples. The above-mentioned differences between organic and conventional farmers in farm size and farm type might, in turn, be caused by differences in such subjective expectations.

Besides structural differences, there are a number of individual and demographic differences between organic and conventional farmers. Many studies from the 1980s – mostly qualitative research – report that organic farmers are on average younger and more highly educated than conventional farmers, have relatively little farming experience and come from a more urban background. Additionally, the share of female farmers is higher among organic farmers (see Padel 2001 for an overview). The age effect is regularly confirmed in newer studies. Duram (1997) finds an age difference of more than ten years, Pietola and Lansink (2001) of about two years and Burton et al. report a significant multivariate effect. Only in rare occasions (e.g. Egri 1999), no significant age difference between organic and conventional farmers is found. The gender and education differences, on the other hand, cannot be replicated by newer research. Burton et al. (1999) and Egri (1999) find equal education levels. With regard to gender, the results are mixed: whereas Burton et al. (1999) find a strong effect of (female) gender, Egri (1999) cannot confirm any differences and Midmore et al. (2001) report even a smaller share of female farmers in the organic group.

With regard to the actual motives for the adoption of organic farming, Padel (2001) summarizes the dominant motives of the 1980s as closely linked to agriculture itself, such as problems with erosion, soil protection or animal health. Economic motives seem to dominate more these days. Padel mentions the resolution of financial problems, reduction of expenses (e.g. for pesticides and fertilizers) or simply the wish to yield a higher profit. Besides these motives, ideological motives were and are important for the decision on adoption of organic farming. According to Padel (2001), the focus has shifted from religious and philosophical considerations to political and environmentalist motives. The effect of environmental concern on the adoption is confirmed by the majority of more recent studies (e.g. Loibl 1999; Burton 1999; Midmore et al. 2001).

Rational Choice and Organic Farming

As mentioned before, a weak point of previous research is a lack of theory. In this section, the research findings summarized above are embedded in the context of rational choice theory, and a framework for the explanation of the adoption of organic farming is presented.

The meta-theoretical foundation of rational choice theory is the so-called methodological individualism: social facts (called macro phenomena) result from the interaction and aggregation of individual actors. Therefore, if social phenomena are to be explained, recourse to information on individual behavior, on the micro level, is necessary (see Coleman 1990). This is the point where rational choice theory sets in: it offers a micro theory that proposes how humans behave on average. Human behavior is conceptualized as the result of decision making: before acting, the actor has to choose between several action alternatives. In a nutshell, rational choice theory proposes that an actor is subject to certain (societal and individual) constraints. Given the constraints, he or she evaluates the action alternatives and chooses the alternative that optimally satisfies his or her preferences (see Opp 1999: 173). In this context, constraints restrict the alternatives the actor can choose from and preferences define the goal the actor tries to attain.

These basic considerations leave wide scope for interpretation, extension and specification. This paper draws upon the wide variant of rational choice (see Opp 1999 for the distinction between 'wide' and 'narrow' varieties). It is assumed that preferences can vary between individuals and that preferences *per se* are not restricted. They can be selfish, altruistic or whatever. Whereas narrow approaches additionally restrict the consequences to those assumed to be 'hard' (like time or money), wide variants of rational choice take soft consequences into account as well as hard consequences.

An important specification concerns the decision rule. For the purpose of this study, I will use the simple, yet very flexible, subjective expected utility (SEU) theory (see Fishburn 1981). SEU theory posits that from several alternatives, one is chosen which the actor subjectively (that is, based on his or her preferences) ascribes the highest utility. The SEU of an alternative j can be calculated as the sum of the partial utility derived from each consequence. A consequence's partial utility, in turn, is defined as the product of the probability p that the consequence comes true and the utility U of that consequence. To recapitulate, each alternative's subjective utility is calculated as follows:

$$SEU_j = \sum_{i=1}^{n} p_{ji} U_i$$

Given these considerations, the decision by a farmer of whether or not to adopt organic farming can be modeled as a comparison of the subjective utility of organic and conventional farming. If the expected utility of adopting organic farming is higher, the farmer should adopt it – or remain a conventional farmer in the opposite case. The research findings described above (e.g. the differences regarding the type of farm) should therefore be indirect effects. As the market for beef and organic milk is better than the market for organic pork – and the cost for altering the staples is usually lower, cattle farmers should, on average, expect a higher utility from organic farming than hog farmers and should thus exhibit a higher probability of an adoption. Whereas many studies have applied rational choice only indirectly by formulating hypotheses on which behavior can be understood as rational in specific situations, the approach of this paper is a direct one. Using a direct measurement of utility and subjective probabilities, SEU scores can be included in regression models and the connections between context, utility, and the decision can each be explored thoroughly. Regarding the example outlined above, the effect of farm type should diminish when the SEU is controlled in multivariate models. The direct empirical application of rational choice leads to some specific problems that will be addressed in the next section.

Methods

Operationalization of Rational Choice Variables

As outlined above, this paper intends to explain the adoption of organic agriculture using SEU theory. In a nutshell, SEU theory states that actors compare their action alternatives based on the expected utility of the alternatives (the SEU score). This SEU score is calculated as product sum of the probability p that a consequence occurs when the alternative is chosen and the utility U of the consequence: $\text{SEU} = \sum p_i U_i$. A major prerequisite for this evaluation is that the farmer is in a decision situation. Only if he or she has broken with his or her behavioral routine and has searched for action alternatives, further assessment of these alternatives' consequences, utility, and subjective probabilities is meaningful. Therefore, the sampling frame or the survey itself needs to ensure that the respondents were in fact in such a decision situation.

If this prerequisite is met, it must be inquired empirically which consequences the actors perceive, how they value these consequences, and the probability they expect of each consequence to occur if they choose a given alternative. This raises a number of methodological questions to be discussed below (a more in-depth treatment of operationalization issues is given in Best 2007).

Which Consequences?

It is possible that different actors perceive different consequences. To avoid problems that may arise, Bouffard (2002) suggests to not present a preset list of consequences, but to use an open question on consequences in the survey (subject generated consequences). Although this strategy may have its advantages, there are two strong arguments against subject generated consequences: first, the use of open questions on topics that are to be further evaluated in the course of the survey is very difficult to realize in surveys and places a burden on the respondents. When a postal survey is used (as in this research project), a simple and straightforward questionnaire is especially important to avoid a low response rate or invalid results. Second, experimental research has shown that the (positive or negative) formulation of consequences activates a frame in the interviewee that influences the decision behavior – and thus the answering behavior as well (see Kahnemann and Tversky 1984; Tversky and Kahnemann 1988). To ensure a definite frame for all respondents and to avoid methodological problems in the interview, I decided to use a preset list of consequences.

This, in turn, raises the question of which consequences to use in the survey. Following the method of Ajzen and Fishbein 1980, Friedrichs et al. 1993 recommend determining the modal salient consequences in a pretest using open questions. In his studies on political protest Opp (2001; 2004) mainly relies on group discussions. For the purpose of this study, I combined the two approaches. The consequences were acquired using a postal pretest with open questions, and the results were complemented with information gathered in a series of group discussions and qualitative interviews with farmers and representatives of farmers' associations. In total, 9 modal salient consequences of an adoption of organic farming were found in the pilot studies:

- Easy and effective control of pests and weeds
- High yields of agricultural produce
- Security against food scandals
- Environmentally friendly mode of production
- Enough leisure time
- High subsidies
- Not having to use chemical substances
- Long-term economic security for the farm.

Subjective Utility and Probabilities

For each of the salient consequences, the survey queried the utility of that consequence using a 5-point Likert-type scale.[3] Then, separated for each alternative (adoption of organic farming or continuation of conventional farming), the subjective probability that each consequence comes true if the alternative is chosen should be indicated on a 5-point rating scale (certain to definitely not). This measurement leads to values for p and U in the utility formula SEU = $\sum p_i U_i$. As can be seen from the formula, SEU states that a decision is not influenced by probabilities and utility scores *per se*, but rather by the product (or the product sum) of the variables.

However, the use of a product term in statistical methods, like regression or correlation analysis, is based on certain assumptions about the scale level of the variables involved. If the variables are measured on interval scale level, product terms must be treated like interaction effects. Consequently three variables: the product term and the two main effects, have to be included in the models to avoid serious bias introduced by scale transformations (see e.g. Allison 1977; Evans 1991).[4] With nine consequences, the sum is 27 variables. Additionally, the use of a pre-calculated product sum (the actual SEU) is questionable with interval scale variables.

According to Evans (1991: 9, fn 4) ‘it is not at all clear whether it would be feasible to undertake … [an] analysis in which the additive composites were used as single variables.’ To avoid the lengthy and ambitious procedure involved in the use of main effects, it must be ensured that the variables are measured on ratio level. That is, in addition to interval level requirements, the variables must provide a ‘natural’ zero point which is fixed as well as meaningful in form and content. As probabilities range axiomatically from 0 to 1 (with 1 being the equivalent of ‘certain’ and 0 of ‘definitely not’), the criterion is met by an appropriate coding of the *p* variable. The utility was measured ranging from ‘very good’ to ‘very bad’. As ‘(very) bad’ implies a negative utility (i.e. cost, and thus a preference for the avoidance of the consequence) and ‘(very) good’ a positive utility, the zero point must necessarily be chosen for the middle category. Therefore, the utility scores were coded bipolar in five categories from −2 to +2, the probabilities unipolar in five categories from 0 to 1.

Given this coding, it is justified to assume ratio scale level and to calculate the partial SEU contribution of each consequence as the product of *p* and *U*. This utility contribution can range from −2 to +2. The total utility gained from each alternative is calculated as the sum of each consequence's SEU contribution.[5] SEU_o shall denote the utility gained from an adoption of organic farming, SEU_c that of conventional farming. As rational choice theory states that a decision is based on a comparison of the alternatives, it is convenient to compute a variable that denotes this comparison. This utility difference is retrieved as UD = $SEU_o - SEU_c$. It can theoretically range from −18 to +18, the empirical range is from −8.5 to +9.5. A positive UD refers to advantages of organic farming, a negative sign to advantages of conventional farming.

Data Collection

The following analysis is based on a mail-in survey of 1500 organic and 1500 conventional farmers in three West-German regions (North Rhine – Westphalia, Hesse, and Lower Saxony) conducted in winter/spring of 2004. The list of certified organic farms was compiled using address data supplied by the governmental organic certification authorities and the addresses of conventional farms were drawn randomly from governmental registers on EU subsidies (‘INVEKOS’). The primary operators of these farms were contacted by mail and sent a fully structured questionnaire. The questionnaire focused on farm structure, perceived consequences of the conversion, choice related variables, farmers' environmental attitudes, and socio-demography. The survey was designed following Dillman's 'Tailored Design Method' (see Dillman 2000). In all, 969 organic and 826 conventional farmers completed the questionnaire and sent it back to the University of Cologne. Thus, the survey yielded an adjusted response rate of 63%.

For the purpose of this paper, only a sub sample of farms is used. In the group of organic farmers, only those who adopted organic farming between 2000 and 2002 are studied, and the sample of conventional farmers was restricted to those who stated they had considered adopting organic agriculture in the past. These restrictions are necessary to ensure that all farmers had been in a decision situation and are thus able to give valid information on the decision process. The reduced sample consisted of 163 conventional and 494 organic farmers.

Results

The empirical analysis of determinants of the adoption of organic farming proceeds in three steps. First, I investigate to what degree the decisions of the farmers vary with socio-economic and individual factors. Then I present the results of the direct measurement of SEU variables and analyze the decisions based on rational choice theory. Finally, I explore the relation between socio-economic factors and SEU scores and the results are controlled multivariately.

When interpreting the results it must be kept in mind that the analyses solely reflect farmers who considered adopting organic farming in the study period. They are, therefore, not representative for the group of all organic or all conventional farmers. This restriction, as noted above, was intended when choosing the sampling strategy and should be seen as a feature rather than a limitation.

Structural and Socio-economic Constraints

To start with, there are differences in the regional distribution of conventional and organic farmers (see Table 1). In the study period from 2000 to 2002 relatively more farmers adopted organic methods in the states of Hesse and especially North Rhine – Westfalia than in Lower Saxony. Although the disparity is statistically significant, it is not of great magnitude. More important are the observed differences in farm related characteristics. Whereas in the conventional group full-time farming is dominant with about two-thirds of all farmers, the opposite is the case among organic farmers. Therefore, part-time farmers have a higher probability of deciding

Table 1. Socio-economic and demographic characteristics by farming style (column percentages)

	Conventional farmers	*Organic farmers*	*chi²*
Region			10.6***
Hesse	19.6	23.1	
Lower Saxony	38.7	25.4	
North Rhine – Westfalia	41.7	51.5	
Occupation			36***
Full-time farming	63.2	36.3	
Part-time farming	36.8	63.7	
Farm type			37.2***
Cash Crop	20.1	8.1	
Fodder crop / cows	29.6	51.4	
Finishing pigs / poultry	22.6	18.8	
Mixed	24.5	15.3	
Other	3.1	6.4	
Agricultural area			26.8***
Up to 29 ha	31.0	54.0	
30 to 99 ha	48.4	35.1	
100 ha and above	20.6	10.9	
Age			1.9
Up to 39 years	25.5	31.4	
40 to 59 years	68.0	62.4	
60 years and above	6.5	6.1	
Education			1.2
Low (9 years)	32.0	36.1	
Medium (10 years)	33.3	27.8	
High (13 years)	34.6	36.1	
N_{min}	153	471	

+: $p \leq 0.1$; *: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$ (two-sided)

in favor of organic farming. Corresponding relations can be identified regarding the size of agricultural area: smaller farms were more likely to adopt organic farming methods than larger farms. Additionally, there are differences between both groups in the farm type. In the organic sample, the share of cash crop and mixed farms is relatively low, the share of cattle crop relatively high.

These differences in farm type are not surprising from a rational choice perspective. The farm type and other characteristics of the farm impose certain constraints on the farmers' decisions. Differences in such constraints could result in differences in the cost : utility ratio of an adoption. For example, effective means to control pests and weeds are of central importance for

Table 2. Utility scores and subjective probabilities of consequences

	Organic farmers			*Conventional farmers*		
Consequence	u^a	$p_c^{\,b}$	$p_o^{\,c}$	u^a	$p_c^{\,b}$	$p_o^{\,c}$
Easy and effective control of pests and weeds	0.10	0.71	0.35	1.38	0.66	0.31
High yields of agricultural produce	–0.07	0.61	0.33	1.02	0.64	0.23
Secure sales and marketing	0.26	0.55	0.63	1.19	0.52	0.40
Security against food scandals	0.33	0.33	0.63	1.10	0.40	0.43
Environmentally friendly mode of production	0.85	0.39	0.87	1.10	0.65	0.73
Enough leisure time	–0.37	0.34	0.34	0.68	0.34	0.21
High subsidies	0.22	0.36	0.68	–0.65	0.31	0.48
Not having to use chemical substances	0.87	0.35	0.86	–0.12	0.36	0.80
Long-term economic security for the farm	0.28	0.40	0.57	1.17	0.50	0.39

N (org.) = 494; *N* (conv.) = 163
[a] Cost/utility of the consequence
[b] Probability that the consequence occurs if the farm is operated conventionally
[c] Probability that the consequence occurs if the farm is operated organically

cash crop farmers. Many conventional farmers, therefore, assume that an effective pest control is difficult, if not impossible, in organic farming. In cattle farming, on the contrary, the control of weeds and pests is rather unproblematic. Additionally, many conversions to organic farming took place against the background of the BSE crisis ('mad cow disease') that hit Germany in 2000/2001. The fear and the anger of consumers obviously targeted mainly cattle farmers. By adopting organic farming, the farmer could seek a higher security against such food scandals and gain a better image in the population.

Utility Expectations

As the subjectively expected utility of a conversion to organic farming was empirically measured in the survey, it is possible to empirically explore the validity of RC explanations like in the examples above. Additionally, a more detailed analysis of the decision process is possible.

Following SEU theory, the basis of a decision is the evaluation of the subjective utility and the probability of the consequences that may follow the decision. Table 2 therefore presents mean values for the subjective probabilities and utility scores by farming style. As outlined in the methods section, nine consequences proved to be modals salient for the decision. The evaluation of both utility and probabilities is roughly as one could expect ad hoc. First of all, it can be seen that preferences are not constant, but vary between individuals and groups. Conventional farmers who decided against organic farming have a strong preference for easy pest control, high yields, secure sales, and long-term economic security, whereas these preferences are less pronounced among organic farmers. Almost all signs are plausible, which can be interpreted as an indicator for a valid measurement. The only exception is the negative utility which organic farmers ascribe to leisure, which might be interpreted as entrepreneurial spirit. At first glance, the lower preference of organic farmers for environmentally sound production seems disturbing. A closer inspection, however, reveals that the definition of 'environmentally sound' differs between conventional and organic farmers, as the subjective probabilities indicate many conventional farmers regard conventional farming as environmentally friendly, whereas organic farmers do not share that point of view.

The subjective probabilities, like the utility scores, are plausible and vary between groups and individual farmers, but the variation between groups is lower than in the case of utility. For example, both groups of farmers expect, with a rather high probability around 0.7, that the control of weeds and pests is easy when farming conventionally. When the farm is converted to organic, this probability declines to only 0.3. It is striking that the subjective probabilities for the case of a non-adoption (p_c) are, with exception of the environmental friendliness, very much the same for conventional and organic farmers. Considerable differences can be observed with regard to the expectations of organic farming (p_o) only: for example concerning the long-term economic security or the high yields. In both cases, the organic farmers had a far better anticipation of the organic farming style. The marginal differences in p_c can be interpreted in a way that the expectations of organic farming were of a far higher importance to the decision than the evaluation of the status quo (at least when only farmers in a decision situation are considered, that is, they were primarily interested in fundamental changes on their own farms).

Nonetheless, following SEU theory, probabilities and utility scores are not, *per se*, sufficient for the decision. They are only a necessary antecedent for the calculation of SEU values which can be calculated from the product sum of probabilities and utility. Although SEU theory

Table 3. Expected utility and utility difference by farming style

	Organic farmers			Conventional farmers			
	SEU_c^a	SEU_o^b	UD^c	SEU_c^a	SEU_o^b	UD^c	r_{bis}^d
Easy and effective control of pests and weeds	0.12	0.08	–0.03	0.94	0.38	–0.56	0.47***
High yields of agricultural produce	–0.02	0.01	0.03	0.68	0.22	–0.45	0.51***
Secure sales and marketing	0.16	0.21	0.05	0.62	0.47	–0.15	0.35***
Security against food scandals	0.12	0.27	0.15	0.46	0.50	0.05	0.12*
Environmentally friendly mode of production	0.35	0.78	0.43	0.74	0.82	0.08	0.27***
Enough leisure time	–0.04	–0.02	0.02	0.31	0.16	–0.15	0.29***
High subsidies	0.12	0.23	0.11	–0.20	–0.32	–0.12	0.26***
Not having to use chemical substances	0.31	0.79	0.48	0.06	–0.05	–0.11	0.41***
Long-term economic security for the farm	0.15	0.24	0.09	0.64	0.49	–0.15	0.33***
Total (sum)	1.26	2.61	1.35	4.25	2.70	–1.57	0.58***

N (org.) = 494; *N* (conv.) = 163; †: $p \leq 0.1$; *: $p \leq 0.05$; **: $p \leq 0.01$; ***: $p \leq 0.001$ (two-sided)
[a] (Partial) utility of the consequence if the farm is operated conventionally
[b] (Partial) utility of the consequence if the farm is operated organically
[c] (Partial) utility difference between the two alternatives (SEU_o–SEU_k)
[d] Biserial correlation between UD and farming style

states that the consequences work to compensate and the alternatives are evaluated and compared in toto (that is, a good evaluation regarding sales and marketing could possibly outweigh a bad evaluation regarding subsidies), looking at evaluation of the single consequences sheds light on their relative importance. Therefore, Table 3 summarizes the (partial) utilities for each consequence by farming style.

It can be seen from the table that farmers who decided against an adoption (conventional group) have a negative utility difference (UD) for almost all consequences. This means that they value conventional farming more than organic farming in almost all respects. Positive results of an adoption are expected only with regard to the security against food scandals and the environmental impact of farming. Organic farmers, on the contrary, regard organic farming to be the better alternative concerning all consequences, except the ease of pest control. Not surprisingly, it follows that the grand utility difference of conventional farmers is negative (−1.6) whereas that of organic farmers is positive (1.4). It is, however, interesting to note that the differences in UD are mostly due to the evaluation of conventional farming, not of organic farming. Both groups expect a SEU around 2.6–2.7 from organic farming, but conventional farmers expect a far higher SEU from conventional farming (4.3) than organic farmers (1.3). This can be interpreted as due to the effect that the farmers who adopted organic during the study period did not decide for organic because they thought it was a great thing, but because they disliked certain aspects of conventional farming. The relatively positive evaluation in the conventional group, however, reflects the fact that only farmers who considered organic farming were analyzed. It is likely (but difficult to measure) that the evaluation of organic farming would be considerably worse among farmers who never thought of an adoption.

As can be seen from the biserial correlations between SEU and the decision to adopt organic farming or not, not all consequences are of equal importance. The highest correlations were calculated for yields, pest control and chemical substances (above 0.4), followed by economic aspects like sales and long-term prospects with correlation coefficients around 0.3. This means that aspects of daily farm work are central to the decision: if the farmer expects to be less satisfied with his daily work on an organic farm than on a conventional one, he or she will not adopt organic. The other consequences like subsidies, food scandals, and spare time contribute to the decision, but are not of great importance. Given the magnitude and consistence of these correlations, it is not surprising that the overall utility difference between conventional and organic farming is closely related to the decision. The biserial correlation between UD and the probability of adoption of organic farming is very high (0.6). This means that, on average, conventional farmers conceived of conventional farming as the better alternative with a higher utility, and organic farmers evaluated organic farming to be better. In a deterministic formulation of rational choice, this proposition should be valid not only on average, but for each and every farmer. As can be seen from a classification table, this is of course not the case (see Table 4).

Nonetheless, the prognostic strength of the utility difference is remarkable. More than 76% of all conventional farmers expect a negative utility difference from a conversion (that is, they evaluate conventional farming to be an alternative better than organic farming), and about 13% are indifferent with a UD of ± 0.5. Only 11% of the conventional farmers expect

Table 4. Prognostic strength of utility difference (column percentages)

Utility difference	*Conventional farmers %*	*Organic farmers %*	*N*
Negative	76.1	28.4	255
$-0.5 \leq UD \leq 0.5$	13.2	11.4	75
Positive	10.7	60.2	301
N (100 %)	159	472	631

phi = 0.42; $chi^2 = 129.3$ ($p \leq 0.001$)

a positive UD and, following rational choice theory, should have adopted organic farming. In the group of organic farmers, the RC explanation is applicable as well, though it shows minor weaknesses. More than 60% of the organic farmers expect a positive utility difference and only about 11% are indifferent. There is, however, a substantial share of organic farmers (28%), that expects a negative utility difference and thus contradicts rational choice. In another paper (Best 2008a), I argued and showed empirically that this result can be explained with the effect of environmental concern.[6] As this is not the focus of the present paper, I will leave this discussion aside.

Utility and Constraints – Multivariate Models

Before the results are to be controlled in multivariate models, some remarks on the relation of constraints and the expected utility seem worthwhile. The relation between structural constraints and utility considerations is especially important, as it points out the coupling of macro and micro levels in the multilevel model of sociological explanation (see e.g. Coleman 1990). The coupling of both levels, following rational choice theory, manifests in group-typical constraints and opportunities as well as in differences in the evaluation of alternatives due to structural conditions. Due to the conception of the study, however, the analysis of macro conditions is possible only to a very limited degree. The farm-related constraints, in particular, should be attributed to the meso level rather than the macro level.

Table 5 summarizes the utility differences by socio-economic and structural constraints, for both organic and conventional farmers. The more interesting of the two is arguably the conventional group. It is, when referring to the population of farmers, by far the larger one. The discussion will therefore focus on conventional farmers. Regarding the geographic origin and individual/demographic variables, there is little

Table 5. Utility difference by socio-economic constraints and adoption of organic farming

	Conventional farmers		*Organic farmers*	
	UD	η	*UD*	η
Region		0.07		0.11^{+}
Hesse	–1.63		1.33	
Lower Saxony	–1.37		1.11	
North Rhine – Westphalia	–1.72		1.85	
Occupation		0.36***		0.08^{+}
Full-time farming	–2.11		1.65	
Part-time farming	–0.58		1.17	
Farm type		0.16		0.15*
Cash crop	–1.93		2.69	
Fodder crop / cows	–1.54		1.15	
Finishing pigs / poultry	–1.83		1.10	
Mixed	–1.15		1.67	
Other	–0.81		1.36	
Agricultural area		0.33***		0.12*
Up to 29 ha	–0.64		1.06	
30 to 99 ha	–2.11		1.79	
100 ha and above	–1.69		1.40	
Age		0.16		0.05
Up to 39 years	–1.23		1.44	
40 to 59 years	–1.78		1.33	
60 years and above	–0.88		0.87	
Education		0.18^{+}		0.01
Low (9 years)	–1.05		1.27	
Medium (10 years)	–1.60		1.34	
High (13 years)	–1.95		1.36	
N_{min}	150		452	

$^{+}$: $p \leq 0.1$; *: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$ (two-sided)

difference in UD. Only formal education has some influence: the more years of schooling a farmer has, the better he or she relatively evaluates organic farming. Rather marked relationships can be identified between the expected utility and farming related constraints. Full-time farmers expect a clearly negative utility difference as a result of a conversion, whereas part-time farmers only expect a slightly negative result. Similar differences exist regarding the size of the farm. While farmers with a small cultivated area expect only a slightly negative UD, operators of larger farms expect an appreciably more negative UD. Relative to the conventional farming style, part-time farmers and operators of small farms therefore evaluate organic farming more positively than do full timers and farmers with large farms. A possible explanation could be that small, part-time operated farms employ a less intensive, more sustainable, farming style and therefore would have a lower cost if they adopted organic farming. Additionally, smaller farms are less dependent on sales and the generation of revenues from their market activity. Given the higher subsidies for organic farming, it may be an acceptable alternative. It is surprising, however, that there are no significant differences in UD by farm type. Differences would have been especially plausible here, as the distribution of organic and conventional farmers (and thus the probability of an adoption) clearly varied by farm type. Although failing to reach statistical significance, at least the small share of cash crop farmers in the organic group can be explained. In the conventional group, cash crop farmers evaluate organic farming worse than all other farmers (UD = −1.9), whereas the opposite is the case in the organic sample (UD = +2.7). This result indicates that cash crop farms are converted to organic farming only under very special circumstances, since a conversion would be very costly under average conditions.

All in all, the relation between the relative utility of an adoption and socio-economic constraints is rather weak, especially compared to the distributional differences shown in Table 2. Two arguments can serve to explain this deficiency. First, it could be that the distribution is due to influences that are not related to utility considerations. Second, it might be possible that the measurement of utility used in this study is not precise enough to cover complex internal processes on farms.

To multivariately control the results presented in the last paragraphs, four logistic regression models were estimated (see Table 6). For each model, in addition to unstandardized logistic regression coefficients and z-values, xy-standardized coefficients were calculated following the method outlined by Long (1997). Strictly speaking, these coefficients refer to the effect on a latent variable that underlies the observed binary outcome; the y-standardization is therefore based on estimations of this latent variable, particularly on the latent variable's standard deviation. Nonetheless, in practical work they can be roughly interpreted like standardized coefficients in OLS regression.

In model 1, only socio-economic controls are used as predictors. The model explains 15% of pseudo-variance and is therefore fitted to the data only moderately. As could be expected from the descriptive analyses, neither demographic variables (age and gender) nor the geographic region are relevant for the probability of an adoption. The decision to adopt

Table 6. Logistic regression of the conversion to organic farming

	Model 1			*Model 2*			*Model 3*		
	b	*z*	$b_{std\text{-}xy}$	*b*	*z*	$b_{std\text{-}xy}$	*b*	*z*	$b_{std\text{-}xy}$
Lower Saxony	–0.03	–0.12	–0.01	–0.38	–1.12	–0.07	–0.22	–0.58	–0.03
NRW	0.05	0.20	0.01	–0.16	–0.52	–0.03	0.30	0.79	0.05
Part-time farming	1.09	4.22	0.27	1.06	3.68	0.21	0.93	2.82	0.16
Fodder crop / cows	1.53	4.38	0.38	1.91	5.42	0.39	1.68	4.33	0.28
Finishing pigs / poultry	0.78	2.08	0.15	1.39	3.49	0.22	1.50	3.30	0.20
Mixed	0.60	1.69	0.11	0.78	2.15	0.12	0.67	1.56	0.09
Other	1.85	2.69	0.21	2.22	2.93	0.20	2.93	2.83	0.22
Farm size (ha)	0.00	0.54	0.03	0.00	0.54	0.02	0.00	1.59	0.08
Age	–0.02	–1.45	–0.08	–0.01	–0.99	–0.05	–0.01	–0.53	–0.03
Medium education	–0.10	–0.34	–0.02	0.20	0.62	0.04	0.12	0.32	0.02
High education	0.03	0.11	0.01	0.20	0.62	0.04	–0.08	–0.20	–0.01
Utility difference				0.45	8.99	0.54	0.43	7.55	0.44
Env. concern							0.83	4.01	0.19
Evaluation colleagues							1.09	5.81	0.35
Intercept	0.42			0.03			–6.23		
R^2 (Nagelkerke)	0.15			0.40			0.55		
N	576			557			535		

Reference Groups: Hesse, full-time farming, cash crop, low education

organic or not is rather influenced by properties of the farm: part timers are more likely to convert their farm than full-time farmers. The bivariate effect of the farm size can be traced to a covariation with the occupation and is therefore not significant in the multivariate model. The probability of an adoption, as expected, varies with the type of farm even in the multivariate model. Fodder crop farmers adopt organic with a higher probability than farms specialized in finishing pigs or poultry, and these again with a higher probability than holders of a mixed farm. Cash crop farmers are the least likely to convert.

The impact of these farm related constraints remains more or less constant when other variables are included in the model. It is, however, important to note that the decision is very closely related to utility considerations – as posited by rational choice theory. When the utility difference of an adoption is included in model 2, the explained variance rises to an excellent 40%. The standardized logit coefficient of UD is over 0.5. Therefore, over and above the influence of farm characteristics, at least 25% of the differences in the probability of an adoption are due to differential utility expectations. The higher the utility of an adoption is evaluated relative to the utility of staying conventional, the higher is the probability that the farm is converted to organic.

In model 3, two additional control variables are entered into the equation: environmental concern and the evaluation of organic farming among the farmer's neighbors and colleagues. Although environmental concern and environmental values are not the main topic of this paper (but see Best 2009), they are prominent in the discussion on organic farming and environmental behavior in general.[7] It can be seen that environmental attitudes have a positive impact on the probability of an adoption: even under control of utility expectations and structural variables the effect is statistically significant and of substantial magnitude. This result implies that environmental attitudes should not be neglected in the analysis and explanation of environmental behavior. The second control variable, evaluation of organic farmers by colleagues, is included in the model to capture neighbor effects. Neighbor effects are prominent in the diffusion literature (e.g. Rogers 1995). As innovations spread based on information, especially in earlier phases of the diffusion process, first-hand experiences are important. From a rational choice point of view, colleagues' attitudes towards and experience with organic farming can decrease transaction costs and determine how much the farmer receives social recognition (or disapproval) for changing his or her farming style. Empirically, a strong positive effect can be observed, that is, the better the evaluation of organic farming by colleagues, the higher the probability of an adoption. It must be noted, however, that colleagues' perception of organic farming was measured as of the time of the survey; therefore, the correlation cannot reliably be interpreted as a causal relationship. Rather, at least part of the effect's strength to alter the respondent's adoption may be due to changes in colleagues' opinions of organic farming.

As model 3 brings together all variables studied, the relative importance of the indicators can be evaluated. First of all, the model fit is excellent with $R^2 = 0.56$. With a standardized logit coefficient of 0.44, the multiple correlation between the utility difference and the decision is extraordinary high, and UD is clearly the most important predictor in the model. This result emphasizes the relevance of direct empirical applications of rational choice. Besides utility considerations, there still is an impact of farming related constraints, as outlined in the discussion of model 1. Although the decision is determined first and foremost by utility considerations and constraints, attitudes, values, and the social context are of some importance as well, as outlined above.

Discussion and Summary

All in all, the decision for or against an adoption of organic farming was explained more than satisfyingly. It was shown that the direct application of rational choice can lead to valuable insight into environmental behavior in particular and may generally help to improve decision analysis. With a multivariate model that explains more than 40% of pseudo-variance, the model fit certainly exceeds what usually is expected in the social sciences. This, in turn, can be interpreted as an indication of the advantages of direct applications of rational choice.

It was shown empirically that the preferences of actors vary and that 'soft', non-tangible, consequences are relevant in the decision process. It can therefore be concluded that the 'narrow' variant of rational choice theory, which posits that only egoistic and tangible preferences should be accepted for RC-explanations and that preferences are constant between actors (cf. Opp 1999), is not particularly suited for the explanation of individual behavior. The sometimes expressed opinion that (soft) preferences should not be used to explain behavior because they *cannot* be measured appropriately (e.g. Olson 1965: 61; Diekmann 1996: 93ff) could not be approved in this paper. Although there may be some caveats to consider, the direct measurement of utility can be accomplished even under the constraints of a postal survey. To allow a valid utility measurement, the analyses were restricted to farmers that adopted organic farming in 2000–2002, and to conventional farmers who considered an adoption. In spite of these precautions, it must be noted that a bias in the utility measurement can possibly be introduced by perception changes or selective retrospection at the time of the survey.

In addition to the general results on decision theory, there are interesting results on the specific topic of this paper, the adoption of organic farming. The most important one, I think, is that most farmers expected a relatively low utility from a conversion (SEU_o). The farmers that opted against organic agriculture expected a utility of 2.7 from organic, but 4.3 from conventional farming. Organic farmers (i.e. those farmers that had decided in favor of conversion) expected with $SEU_o = 2.6$ even a marginally lower utility for organic farming than conventional farmers did, but evaluated conventional agriculture clearly worse with 1.3. Therefore, most farmers did not engage in organic farming because they thought of it as offering a bright, shiny new future, but because they were rather unsatisfied with aspects of the conventional farming style. Organic farming, they thought, may not be very good, but conventional is worse. Given that BSE was a major topic in the media during the study period, the low SEU of conventional farming is not too much a surprise.

Nonetheless, a sustainable growth strategy for organic farming cannot rely on food scandals, but rather has to improve the vision of organic farming in the agricultural population. The direct utility measurement applied in this study offers some insight into the topics that are most important for farmers. Therefore, suitable starting points for the advancement of organic farming can be outlined. In the first place, the farmers think about their daily work, about how the operational flow on an organic farm can be accomplished: Will I be able to control pests and weeds? How are the yields going to develop after the conversion? And do chemical substances do more harm or more good? The second most important topic is farm economics: Will there be a market for my products? Can I guarantee long-term economic security by the adoption of organic farming? And how is the work load going to develop? Further considerations involve subsidies and the ecological performance of organic farming. The future development of organic agriculture in Germany will depend on how the farmers answer the questions outlined above. Although there is a growing market demand, and thus good economic prospects, the results of this study emphasize the important role of operational questions and the daily work on an organic farm.

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NOTES

1. In a commons dilemma, a collective good is used by individuals, and in the absence of enforced norms or social embeddedness of the actors, there are strong individual incentives for free-riding. Therefore, individually rational behavior may lead to irrational outcomes in the aggregate (see Hardin 1968 for a popular treatise; recent studies on commons include Janssen and Ostrom 2008).
2. Anthroposophy is a 'philosophy based on the view that the human intellect has the ability to contact spiritual worlds' (Britannica, 2006). Steiner's quasi-religious work includes, among other things, guidelines on organic farming in the so-called biodynamic agriculture (see Steiner 2004).
3. Survey question (translated from German): A decision on the farming style may lead to certain positive or negative consequences. Below you find a list with some of these consequences. When you thought about adopting organic farming: did you think the

following consequences were good or bad? Response scale: Very good; good; neither good nor bad; bad; very bad.

4. Product terms are sensitive to additive transformations. Consequently, regression estimates would artificially differ if the utility scores were coded e.g. 0 to 5 instead of −2 to 2.
5. The calculation of an unweighted sum of all partial utilities implies that the utility components are of equal importance or, in our case, the utility is measured on identical scales (e.g. in currency units). Following research on attitude measurement (e.g. Fishbein and Ajzen 1975: 80), it is assumed that respondents classify all items that are measured with the same (Likert-type) scale on the *same evaluative dimension*. An alternative to making this assumption would be to estimate weights using e.g. McFadden's random utility model.
6. It can be shown that the probability of an adoption of organic farming is correlated with environmental concern. If the sample is grouped by utility difference as in Table 4, it becomes apparent that the correlation is valid only if the adoption would be costly for the farmer (that is, the farmer expects a negative UD). In this group, the impact of environmental concern is very strong with a correlation coefficient of about 0.5.
7. Commonly referenced under the key word 'conventionalization', there is a debate in the organic farming scene on the results of the recent boom. Besides their possible connection to agribusiness and the food industry, new market entrants are feared to not be committed to organic values (see e.g. Buck et al. 1997 or Best 2008b). An alternative interpretation of the current trends is given by Padel (2001), who refers to Rogers' adoption/diffusion framework. From a rational choice perspective, early and later adopters would be expected to differ in preferences and subjective probabilities (p and U).

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HENNING BEST is lecturer and research fellow at the Department for Methods of Empirical Social Research at the University Mannheim, Germany. He holds a PhD in Economics and Social Sciences from the University of Cologne. From 2002 to 2007 Henning Best was a doctoral student and, later, post-doc at the Research Institute for Sociology and the Institute for Applied Social Research, University of Cologne. His research interests include environmental sociology, rational choice, social inequality and quantitative methods of social research.

ADDRESS: Department for Methods of Empirical Social Research, Faculty of Social Sciences, University Mannheim, Mannheim, D- 68131, Germany [email: best@uni-mannheim.de]