WORKING PAPER

Personal norms of sustainability and their impact on management – The case of rangeland management in semi-arid regions

by

Roland Olbrich, Martin F. Quaas,

and Stefan Baumgärtner

University of Lüneburg
Working Paper Series in Economics

No. 209

August 2011

www.leuphana.de/institute/ivwl/publikationen/working-papers.html

ISSN 1860 - 5508

Personal norms of sustainability and their impact on management – The case of rangeland management in semi-arid regions

Roland Olbrich[a*], Martin F. Quaas[b] and Stefan Baumgärtner[a]

[a] Department of Sustainability Sciences and Department of Economics, Leuphana University of Lüneburg, Germany

[b] Department of Economics, University of Kiel, Germany

Abstract

We empirically study personal norms of sustainability, conceptualized according to the norm-activation theory and operationalized under the notion of strong ecological-economic sustainability, for commercial cattle farmers in semi-arid rangelands of Namibia, a system that is subject to extensive degradation. We characterize farmers' personal norms, study their determinants, and analyze their impact on actual management based on the dual-preferences model. We find personal norms of sustainability that are heterogeneous across farmers, but vary little with socio-demographic or environmental characteristics. We find no evidence for a significant impact of personal norms on actual management behavior, which may be due to farmers not feeling capable for averting adverse long-term consequences of their management. This may contribute to the observed degradation of rangelands in Namibia.

Keywords: commercial cattle farming, Namibia, norm-activation theory, personal norms, dual-preferences model, semi-arid rangelands, sustainability

JEL-classification: D63, Q12, Q57

---

[*] Address for correspondence: Sustainability Economics Group, Leuphana University of Lüneburg, P.O. Box 2440, D-21314 Lüneburg, Germany. Phone: +49.4131.677-2530, fax: +49.4131.677-1381, email: olbrich@uni.leuphana.de.

1. Introduction

Sustainability is often viewed as a moral obligation to "pass on a world of undiminished life opportunities to members of future generations" (Howarth, 2007: 656) (Solow, 1993). As such, sustainability is a norm which is an independent determinant of individual behavior besides egoistic preferences and the opportunity set (Brekke et al., 2003; Young, 2008; Young and Burke, 2010). More specifically, it is a type of norms that determines behavior affecting the well-being of others through changes in the environment (Harland et al., 1999; Stern, 2000; Nordlund and Garvill, 2002). A crucial aspect of norms is that people are not bound to comply. People may have distinct norms but might not be aware of adverse, interpersonal consequences of their behavior or might not belief themselves capable of averting these consequences (Schwartz, 1973, 1977; Stern et al., 1999), and thus act as if these norms were non-existent. In this paper, we empirically characterize norms of sustainability for the case study of commercial cattle farming in semi-arid rangelands of Namibia, study their determinants, and analyze their impact on actual management behavior.

Previous studies on norms that determined environmentally significant behavior, such as recycling (e.g. Hopper and Nielsen, 1991; Thogersen, 1999), waste reduction (e.g. Thogersen, 1999) or renewable energy consumption (e.g. Ek and Söderholm, 2008) often equate these norms with norms of sustainability. However, it remains questionable whether this equation is valid as important aspects of sustainability are not explicitly clarified, such as what specific notion of sustainability is employed or whether the behavior at hand targets indeed sustainability. Furthermore, the typically studied economic actors are consumers, which may not be the ideal objects for studying norms of sustainability. Consumer behavior is only indirectly linked to the environment, while the direct impact on the environment is exerted by production, in particular in agriculture.

In this paper, we properly conceptualize, operationalize and analyze norms of sustainability. We conceptualize norms according to the norm-activation theory (Schwartz, 1973, 1977). Accordingly, sustainability may be viewed as an abstract social norm from which individuals derive concrete personal norms of sustainability which are heterogeneous across individuals. These personal norms provide guidance on how to act sustainably in specific situations only if they are activated, i.e. if individuals are aware of conditions that entail adverse consequences for others and feel capable for averting these consequences. We operationalize personal norms under the notion of strong ecological-economic sustainability (Pearce et al., 1989; Daly et al., 1994; Ekins et al., 2003; Baumgärtner and Quaas, 2009). For sustainability of an ecological-economic system, it is important to maintain both the condition of the ecosystem, so that it may continue to provide essential services to humans, and to maintain the income of the actors, so that their livelihood is secured (Baumgärtner and Quaas, 2009). Accordingly, we examine two specific personal norms of sustainability which are the level at or above which ecosystem quality should be sustained ("personal ecosystem norm") and the level at or above which income should be sustained ("personal income norm"). We analytically relate these personal norms to behavior using the dual-preferences model (Brekke et al., 2003; Conlin et al., 2003; Young and Burke, 2010). Herein, they constitute an independent determinant of behavior besides egoistic preferences, and are traded-off against egoistic preferences by a non-negative weighting factor. This factor may be interpreted as the activation of the personal norm: if the factor is positive (zero) then the norm impacts (does not impact) on behavior since it is activated (not activated).

We chose commercial cattle farming in semi-arid rangelands of Namibia as a case study since we previously identified critical components for the system's sustainability (Quaas et al., 2007; Olbrich et al., 2011c; Quaas and Baumgärtner, 2011), among them the aforementioned condition of the ecosystem and the income of farmers. Furthermore, farmers as the main economic actors are closely linked to the environment. Namibian rangelands suffer from degradation in the form of bush encroachment where the historical coexistence of grass and bush vegetation is replaced by a dense bush vegetation (de Klerk, 2004). Bush encroachment does not only impair the ecosystem's condition, such as by reducing biodiversity (e.g. Griffin, 1998; Maggs et al., 1998), but also severely reduces farmer's income as it limits cattle production. It is frequently hypothesized that inadequate farm management contributes to bush encroachment (de Klerk, 2004).

Against this background, we pursue the following research questions: 1) What personal ecosystem and income norms can be found among commercial cattle farmers in Namibia? 2) What determines these norms? 3) Do these norms impact on actual management? We approach these questions empirically based on a large-scale, representative mail survey of 1.916 farmers that we conducted in August 2008 (Olbrich et al., 2009). Herein, we elicited personal ecosystem and income norms, management employed by farmers as well as socio-demographic and environmental characteristics.

We find firstly that farmers have personal ecosystem and income norms that are heterogeneous across individuals. Secondly, these norms are independent of each other and vary only little with socio-demographic or environmental characteristics. Thirdly and most importantly, we find no evidence for a significant impact of personal norms on actual management. Thus, suggests that the weighting factors of the dual-preferences model are zero, indicating that the personal norms of sustainability are not activated. We hypothesize that personal norms are not activated because farmers do not feel capable of averting adverse long-term management consequences and thus do not pursue sustainable management.

This paper is organized as follows. Section 2 details the conceptual background of our analysis – norm-activation theory, notion of sustainability, system description and dual-preferences model. Section 3 describes the methods used to collect and analyze our data. Results are presented in Section 4, and Section 5 discusses and concludes.

2. Conceptual background

2.1 Norm-activation theory

Several approaches have been developed to conceptualize norms, which may broadly be divided into two strands. The first strand views norms as "a standard, customary, or ideal form of behavior to which individuals in a social group try to conform" (Young and Burke, 2010), and thus views norms to be homogenous across individuals within a population (Elster J., 1989; Hausman and McPherson, 2006; Young and Burke, 2010).

The second strand emphasizes the individual nature of norms, which are viewed to be heterogeneous across individuals (Schwartz, 1973; Ajzen, 1991). In order to account for individual differences in norms we follow this second strand, and more specifically, the norm-activation theory (Schwartz, 1973, 1977). This theory was originally developed to explain social behavior, where "other people are directly affected by the consequences of one's behavioral choices" (Harland et al., 1999: 2508). It has been extended to environmentally significant behavior that indirectly affects others through "[changing] the availability of materials or energy from the environment or [altering] the structure and dynamics of ecosystems or the biosphere itself" (Stern, 2000: 408) As such it has been frequently employed in the environmental psychological literature (e.g. Hopper and Nielsen, 1991; Stern et al., 1999; Stern, 2000; Bamberg and Schmidt, 2003), but has also been applied in the economic literature (Thogersen, 1999; Brekke et al., 2010). It distinguishes norms at two levels: *social norms* are abstract and only vague guides to behavior, but are shared by all individuals of a group; *personal norms* as "expectations that people hold for themselves" (Schwartz, 1973), which derive from social norms, are concrete determinants of behavior, but are heterogeneous across individuals. They are learned in and modified through social interaction. Furthermore, they are tied to a person's self-image and are thus enforced through mechanisms such as guilt or pride (Schwartz, 1973). A crucial aspect of the norm-activation theory is that personal norms must be activated in order to affect behavior. To this end, individuals must firstly be aware of specific conditions that entail adverse consequences for others. Secondly, they must feel capable for averting these interpersonal consequences (Schwartz, 1973; Stern et al., 1999).[1]

Sustainability as a moral obligation to confer undiminished life opportunities to future generations (Solow, 1993; Anand and Sen, 2000; Howarth, 2007) is a norm that prescribes a form of environmentally significant behavior as this behavior affects the well-being of future generations through changes in the environment. Defined in such a general way, it is rather vague on how to act in specific situations and we consequently conceptualize it as a social norm in the sense of the norm-activation theory. Individuals may then be imagined to hold concrete expectations for themselves on how to act sustainably in specific situation. For example, a farmer may have expectations on how he should utilize rangeland so that future generations may still make a living of it. We conceptualize these expectations as personal norms of sustainability.

2.2 Notion of sustainability

We operationalize these personal norms under the notion of strong ecological-economic sustainability. According to this notion, relevant natural and economic stocks and services have to be conserved at or above specified thresholds, and have to be conserved independently[2] of each other (Pearce et al., 1989; Daly et al., 1994; Ekins et al., 2003). A given behavior, such as a farm management behavior, is sustainable if it ensures this conservation of stocks and services.[3]

What to conserve, i.e. which stocks and services, and how much of it, i.e. the respective thresholds, are normative expectations that we consider at the individuals level. Thus, we operationalize personal norms in the way that each individual holds separate norms for each

---

[1] Individuals balance compliance with the norms with fulfilment of egoistic needs. As such they may not feel capable for complying with the norm (and thus not feel capable for averting adverse consequences) for ethically sound and less sound reasons.

[2] In this respect, strong sustainability differs from weak sustainability which only requires that the aggregate value of stocks and services has to be conserved (e.g. Pearce and Atkinson, 1993; Pezzey and Withagen, 1998).

[3] Strong sustainability may also be operationalized under conditions of uncertainty where the conservation of stocks and services is not deterministic with respect to a behaviour due to stochastic system dynamics. For example, (Baumgärtner and Quaas, 2009) develop an operational criterion for strong sustainability under uncertainty, termed ecological-economic viability. The criterion expands on the traditional notion of strong sustainability by also requiring that the acceptable risk has to be specified that conservation fails due to the stochastic system dynamics.

relevant stock and service in a given ecological-economic system where each norm specifies the threshold at which the respective stock or service should be conserved. As mentioned above, personal norms may be heterogeneous across the population and thus different individuals may ascribe different thresholds for a given stock or service.

Finally, we note that since farmers in our case study own their farms and typically pass it on to their children (Olbrich et al., 2011a), we will not consider sustainability towards all members of the future generation in general, but rather dynastic sustainability that specifically is concerned with one's own children, their children's children and so forth.

2.3 System description

Commercial cattle farming in semi-arid rangelands of Namibia is a rain-fed grazing system (Mendelsohn, 2006; Quaas et al., 2007). The dominant biome is tree-and-scrub savannah (MET, 2002) which is characterized by a competition between grass and woody bush vegetation. Annual precipitation is on average 374 mm and the majority of rainfall occurs in a rainy season from November to April (Olbrich et al., 2011c). On the rangeland, grass grows during the rainy season and serves as the main feed for cattle. Cattle have to feed continuously and thus grass production in the rainy season has to maintain cattle throughout the following dry season and, if a drought occurs, also during the rainy and dry season thereafter. Finally, cattle production provides income to farmers who may in addition receive income from alternative on- and off-farm sources (Olbrich et al., 2011a).

The farmer has several management strategies at his disposal by which he can impact on the various system components and ultimately cattle production (Olbrich et al., 2011a). Firstly, farmers may manage the land by adjusting land size for scale effects of cattle production ("rangeland size increase") and by adjust land distribution to achieve spatial diversification ("spatial diversification"). Secondly, farmers may manage cattle feed. They may respond to the seasonality in grass production by resting part of their rangeland in order to provide continuous feed for cattle ("resting rangeland"). They may also compensate for brief shortages in feed as well as for insufficient nutrients by providing cattle with supplementary feed in the form of purchased hay and licks ("additional feed"). Finally, farmers may directly manage the cattle herd. They may choose cattle breeds adapted to local environmental conditions from among a variety of breeds that differing both in ecological requirements and productivity ("breed adaptation"). They may also choose one of various cattle production systems, such as weaner (selling cattle at age 9 months) or ox (selling at age 18-24 months) production, which differ in their requirements for environmental condition and profits ("production system adaptation").

A sustainability problem arises at least partly from inadequate farm management (de Klerk, 2004) that has two main adverse ecosystem and economic consequences. In regards to the ecosystem consequence, inadequate managements may impacts on the natural grass-bush coexistence by increasing the proportion of bushes. This bush encroachment in turn entails, for example, a decrease in biodiversity (Griffin, 1998; Maggs et al., 1998). A proxy for bush encroachment is the capacity to support grazing cattle ("grazing capacity"), and the time series of grazing capacity demonstrates that bush encroachment is indeed a major concern in the cattle farming region: nowadays, the grazing capacity is on average only 0.08 Large Stock Units[4] per hectare (LSU/ha)[5] (Olbrich et al., 2011a) which is much lower than the historic value of above 0.1 LSU/ha that characterized a largely undisturbed ecosystem (de Klerk, 2004). In regards to the economic consequences, bush encroachment results in a given farm being able to support only a low cattle production due to insufficient forage. This in turn results in farm income being too low to meet operating and living cost (Lubbe, 2007; Peltzer, 2007; Steir, 2007).

Based on this sustainability problem and on the aforementioned system dynamics, we consider ecosystem condition of the rangeland, measured as grazing capacity, as well as income received from cattle farming as the relevant services that have to be conserved for strong ecological-economic sustainability. In accordance with our description of personal norm of sustainability from Section 2.2. we postulate that farmers have personal ecosystem and income norms that specify the threshold at or above which ecosystem condition and income have to be conserved, respectively. Those farmers who comply with the norms then chose management among the aforementioned strategies in such a ways as to conserve ecosystem conditions and income above the thresholds specified in their personal norm.

2.4 Dual-preferences model

Our analytical approach integrates personal norms into a behavioral model while maintaining individual optimization, which is a crucial aspect for an economic analysis of the impact of norms on behavior (Postlewaite, 2010). Specifically, we relate personal norms to behavior

[4] A Large Stock Unit (LSU) is a standard measure for livestock quantity in Namibia. In the case of cattle, one cattle equals one LSU.

[5] Typically, grazing capacity is reported as hectare per Large Stock Unit. We report the inverse here and use it throughout this paper as our later interpretation of results will then be more intuitive.

using the dual-preferences model (Brekke et al., 2003; Conlin et al., 2003; Young and Burke, 2010), which in its original form is specified as

$$U(a) = u(y) - \frac{\gamma}{2} \cdot (\bar{g} - g(a))^2 \, . \tag{1}$$

Here, utility depends on egoistic preferences *u*(.) over private income *y* as well as on self-image which captures the deviation of an individual behavioral consequence *g*(.) from a norm $\bar{g}$. If the individual does not comply to the norm, i.e. if $\bar{g} \neq g(.)$, then he receives a penalty to overall utility. Egoistic preferences and self-image are traded-off against each other by the factor γ which weights how strongly the individual wishes to comply to the norm.

We apply this model to commercial cattle farming in Namibia and include the aforementioned personal norms of sustainability. Equation (1) then expands to

$$\begin{aligned} U(a) &= u(y(a)) - \frac{\gamma}{2} \cdot \{\max(\bar{g} - g(a),0)\}^2 - \frac{\upsilon}{2} \cdot \{\max(\bar{y} - y(a),0)\}^2 \\ &= u(pf(g(a)) - c(a)) - \frac{\gamma}{2} \cdot \{\max(\bar{g} - g(a),0)\}^2 - \frac{\upsilon}{2} \cdot \{\max(\bar{y} - [pf(g(a)) - c(a)],0)\}^2 \end{aligned} \, . \tag{2}$$

Self-image now capture the deviation of behavior consequences from two norms that pertaining to ecosystem condition and income which we realize by two separate terms. For the term denoting self-image in respect to ecosystem condition, we consider as a specific behavioral consequence *g*(.) the *actual* ecosystem condition of the rangeland which dependent on the farmer's management choice *a*. $\bar{g}$ is then the farmer's personal ecosystem norm, i.e. how high the ecosystem condition *should* be, and the weighting factor γ capture how strongly the farmer wishes to comply to the personal ecosystem norm. For the term denoting self-image with respect to income, we consider as a specific behavioral consequence *y*(.) the *actual* income a farmer receives form cattle farming that likewise depends on the management choice *a*. $\bar{y}$ is then the farmer's personal income norm, i.e. how high income *should* be, and the weighting factor υ captures how strongly the farmer wishes to comply to the personal income norm. We can rewrite income as a function of cattle production *f*(.) sold at market price *p* minus costs *c*(.) that are incurred during the production process. Furthermore, cattle production may be viewed to depend only indirectly on *a*, instead having ecosystem condition as a direct input. Thus, *f*(.) becomes a function of *g*(a).

Following our conceptualization of personal norms of sustainability, we allow for heterogeneity of both personal norms across farmers. We also capture two crucial aspects of strong ecological-economic sustainability. Firstly, we realize the idea that services should be conserved independently by introducing both personal norms additively and separately. Secondly, as services should be conserved at or above thresholds we model compliance with the norms piecewise: farmers only receive a penalty to overall utility if actual ecosystem condition or actual income are below the respective personal norms, not if they are above.

Having formulated the model, we are now interested in how a change in the norms $\bar{g}$ and $\bar{y}$ impacts on the management choice a. We approach this by calculating the first order condition of Equation (2) with respect to the choice variable and by subsequently solving for this variable. To this end, we need to specify the involved function. We specify a quadratic utility function as $u(y) = \alpha \cdot y - \frac{\beta}{2} \cdot y^2$ with $\alpha > 0$, $\beta > 0$ and $u'(y) = \alpha - \beta \cdot y > 0$ which is increasing and concave in y. We also specify grazing capacity as linear and increasing in management choice, i.e. $g(a) = g \cdot a$ with $g > 0$, constant returns to scale, i.e. $f(g(a)) = f \cdot g(a) = \phi \cdot a$ with $\phi > 0$ and constant marginal costs, i.e. $c(a) = c \cdot a$ with $c > 0$.[6] Furthermore, we standardize prices to unity. Profit y(a) may then be rewritten as $y(a) = f(a) - c(a) = (\phi - c) \cdot a \equiv \varphi \cdot a$ and is increasing for all a if we assume that $\phi > c > 0$ and thus $\varphi > 0$.

Considering only the case that the farmer does not already comply to the norms, i.e. that $\bar{g} - g(a) > 0$ and that $\bar{y} - y(a) > 0$, it is then straightforward to show that the optimal management choice a can be expressed as

$$a^* = \psi_1 + \gamma \cdot \psi_2 \cdot \bar{g} + \upsilon \cdot \psi_3 \cdot \bar{y} \quad (3)$$

with constants ψ_1, ψ_2, $\psi_3 > 0$ (for proof, see the Appendix A.1).

Hence, one finds that a change in optimal management choice a^* for a change in the personal ecosystem norm $\bar{g}$ or in the personal income norm $\bar{y}$ is zero if and only if γ or υ, respectively, equal zero. Thus, a change in the norms always leads to a change in management if the farmer is concerned with self-image in respect to ecosystem condition or income. Conversely, even if

[6] We tested the validity of the specifications regarding the grazing capacity function and production function in our data using simple OLS regressions. Regarding the grazing capacity function we cannot reject a linear relationship between extent of the strategy and the actual grazing capacity at the 5% significance level for three out of the six management strategies noted in Section 2.3 (i.e. for spatial diversification, resting rangeland and additional feed) and deem it likely that we might find the same for the remaining three strategies if relevant covariates are included in a multiple regression. In regards to the production function, we likewise cannot reject a linear relationship between actual grazing capacity and number of cattle at the 5% significance level. Thus, we deem our specifications to be realistic concerning those two functions. We could not perform a similar analysis for the cost function as we do not have data on production costs.

the farmer has distinct ecosystem and income norms a change will not affect management if he is not concerned with self-image, i.e. if γ or υ equal zero. This latter case may be interpreted in line with the norm-activation model: the farmer has distinct personal norms, but the norms are not activated.

3. Data

3.1 Data sources

Description of data collection

In August 2008, we elicited personal norms of sustainability, management strategies and socio-demographic characteristics of commercial cattle farmers in Namibia through a mail-in questionnaire. A detailed description of the survey can be found in (Olbrich et al., 2009), which also includes a copy of the questionnaire.

We sent out questionnaires to all cattle farming members of the Namibia Agricultural Union (NAU), the main interest group of commercial farmers, and to all farmers that deliver cattle to MeatCo, the largest slaughterhouse in Namibia. We mailed out a first batch of questionnaires in the period 19th – 21st of August 2008, and a second batch as a follow up on the 15th of September 2008. We reached 1,916 of an estimated total number of 2,500 farmers. 399 questionnaires were returned, equaling a return rate of 20.8%.

In addition to the quantitative data collection, we conducted qualitative interviews with farmers, local scientists and decision makers in the agricultural, political and financial sector throughout four research visits in March/April 2007, October 2007, July/August 2008 and February/March 2010.

Elicitation of personal norms

As detailed in Section 2.2, we operationalize personal norms of sustainability under the notion of strong ecological-economic sustainability. Prior to designing the questionnaires we inquired in our qualitative interviews with farmers and local agricultural scientists which services are critical for the sustainability of the farming system. On the basis of these interviews we preselected the already in Section 2.3 noted ecosystem condition of the rangeland and income as the two most critical services, and elicited the personal ecosystem norm, i.e. the minimum threshold at or above which ecosystem condition should be sustained, and the personal income norm[7], i.e. the minimum threshold at or above which income should be sustained. We measured the ecosystem norms as grazing capacity in the unit hectare per Large Stock Unit and the income norm as net annual income[8] in the unit Namibian Dollar (N$).

Elicitation of management strategies, ecosystem condition, income and further characteristics

In regards to farmers' management, we elicited self-reported extent of various on-farm management strategies. On the basis of our qualitative interviews we selected the six most relevant management strategies that pertain to on-farm management choices (c.f. Section 2.3): rangeland size increase, spatial diversification, resting rangeland, additional feed, breed adaptation and production system adaptation. For each strategy we asked farmers to self-report the extent of the strategy on a six-item Likert-scale ranging from "not at all important" to "very important". We elicited actual ecosystem condition as grazing capacity in the unit ha/LSU. For confidentiality reasons we elicited total net annual income only as interval data where farmers indicated which of the following income intervals they belong to: [N$ 0, N$ 50.000], [N$ 50.001, N$ 150.000], [N$ 150.001, N$ 250.000], [N$ 250.001, N$ 350.000], [N$ 350.001, ∞[. Finally, we elicited the fraction of total income that derives from cattle farming.

We also elicited a variety of socio-demographic characteristics: gender, age, experience on present farm (i.e. number of years operating the present farm), ethnicity (i.e. Afrikaans or other ethnicities)[9], education (high school graduation at most vs. some sort of apprenticeship or college/university education), household size, ownership structure of the farm (single owner or multiple owners), living off farm (as a proxy for part-time farming vs. full-time farming), NAU membership, area of rangeland, net area of rented land (area of land rented minus area of land rented out), and cattle quantity. Finally, we elicited as additional environmental characteristics the deviation of actual from optimal bush cover as well as the regional location of the farm in Namibia (Erongo, Hardap/Karas, Khomas, Kunene, Omaheke, Oshikoto, Otjozondjupa) to cover a variety of environmental characteristics that are not captured in the grazing capacity. A list of all elicited variables along with their summary statistics is given in Table 1.

---

[7] Strictly speaking, we elicited the personal income norm in respect to income from cattle farming only and not in respect to total income, i.e. income from cattle farming plus income from other sources. However, we will refer to this income from cattle farming simply as "income" for the remainder of the paper.

[8] We define net annual income as gross revenues minus operating expenses, taxes and interest on loans.

[9] Afrikaans is the most common ethnicity. Other ethnicities are predominantly German.

3.2 Calibration of variables and statistical specification

Calibration of variables

For our subsequent analysis, we calibrate personal norm variables in such a way that higher values denote more demanding personal norms. For example, the personal norm that income should be sustained at or above N$200,000 is more demanding, in the sense that it is more difficult to comply with, than the personal norm that income should be sustained at or above N$100,000. The respective variable for the personal income norm is already correctly calibrated in the way it was elicited, but we have to make adjustments to the personal ecosystem norm. We inverse the elicited variable, i.e. we use now a variable measured in Large Stock Unit per hectare (LSU/ha) instead of hectare per Large Stock Unit. Correspondingly, we also invert the variable for actual ecosystem condition which is now likewise used in the unit LSU/ha. In regards to income data which we elicited in the form of interval data we convert these data to discrete data by using the interval midpoints as income. We then multiply this variable by the fraction of total income that derives from from cattle farming to acquire the income that derives from cattle farming.[10]

Statistical specification

We generate results for Research Question 1 (characterization of personal norms) through descriptive statistics. We approach Question 2 (determinants of personal norms) firstly by analyzing whether both norms are correlated by employing a Pearson correlation. We then model the personal norms as being dependent on actual income, actual ecosystem condition and on the other socio-demographic and environmental characteristics. Thus, for each of the two elicited personal norms, we estimate

$$N_{ji} = \lambda_0 + \lambda_Z Z + \varepsilon_i \qquad (4)$$

where N_j is one of the j = 1, 2 elicited personal norms (i.e. the personal ecosystem or income norm), Z a vector of socio-demographic and environmental characteristics and ε_i are unobserved factors. Even though personal norms may impact on each other, we do not include the respective other norm in the equation since we then incur an endogeneity problem that we cannot adequately address as we cannot construct suitable instrumental variables. However, we perform robustness checks in which we include the respective other norm and show that

[10] We do this so that what we measure by the actual income variable corresponds to what we measure by the personal income norm variables (which in the strict sense measures the income norm in respect to income from cattle farming).

its inclusion does not change our results (Appendix B.1, Equation 4a). Thus, we conclude that we do not incur an omitted variables bias by not including the respective other norm in Equation (4).

We analyze Question 3 (impact of personal norms on management) by modeling each of the six management strategies as a function of the personal ecosystem and income norm while controlling for socio-demographic and environmental characteristics. For each strategy we estimate the equation

$$S_{ki} = \nu_0 + \nu_{\bar{g}} G[\bar{g}_i] + \nu_{\bar{y}} Y[\bar{y}_i] + \nu_x X_i + \chi_i \tag{5}$$

with

$$G[\bar{g}_i] = \begin{cases} \bar{g}_i - g_i & \text{for } \bar{g}_i > g_i \\ 0 & \text{otherwise} \end{cases}, \qquad Y[\bar{y}_i] = \begin{cases} \bar{y}_i - y_i & \text{for } \bar{y}_i > y_i \\ 0 & \text{otherwise} \end{cases}$$

where S_k is the self-reported extent of management strategy k = 1, …, 6, $\bar{g}$ the personal ecosystem norm, g the actual ecosystem condition, $\bar{y}$ the personal income norm, y the actual income, X a vector of socio-demographic and environmental characteristics and χ_i are unobserved factors. Similar to Equation (4), the different management strategies may impact on each other but we do not include the respective other strategies in Equation (5) since we then incur an endogeneity problem that we likewise cannot adequately address as we cannot construct suitable instrumental variables. However, we perform robustness checks in which we include the respective other strategies and show that their inclusion does not change our results (Appendix B.2, Equation 5a). Thus, we conclude that we do not incur an omitted variables bias by not including the respective other strategies in Equation (5).

With the term $G[.]$ and $Y[.]$ we achieve a piecewise regression over the personal ecosystem norm $\bar{g}$ and income norm $\bar{y}$, respectively, which is a reduced form of the standard piecewise regression function (for proof, see Appendix A.2). For farmers who do not comply with the ecosystem (income) norm, i.e. for whom the actual ecosystem condition (income) is lower the ecosystem (income) norm, $G[.]$ ($Y[.]$) is positive. Conversely, for farmers who comply with the ecosystem (income) norm, i.e. for whom actual ecosystem condition (income) is at least as high as the ecosystem (income) norm, $G[.]$ ($Y[.]$) is zero. This corresponds to properties of the behavioral model of Equation (2) that states that personal norms only impact on utility if the actual values are below the respective norms. Finally, rescaling $\bar{g}$ and $\bar{y}$ by subtracting the actual values g and y ensures that the pieces are joined together at the respective breakpoints.

We are especially interested in the coefficients $\nu_{\bar{g}}$ and $\nu_{\bar{y}}$ that describes the effect of a change in the ecosystem and income norms on the extent of management for a given strategy (conditional on the actual ecosystem condition and income being lower than the respective norms). In order to interpret these coefficients we draw on the result for optimal management a^* that we have developed in Equation (3). Specifically, we see that non-zero values for these coefficients imply that the weighting factors γ and υ are non-zero, i.e. that self-image with respect to ecosystem condition and income indeed impact on utility. Conversely, if the coefficients are zero, this implies that γ and υ equal zero, i.e. that self-image does not play a role in utility maximization. In the latter case, farmers may have distinct personal norms, but they do not factor into their choices regarding management.

Robustness checks

We have already mentioned two robustness checks above that we perform for Equation (4) and (5). In addition, we perform various other checks for Equation (5) since this equation is used to produce our most relevant results. These checks involve different definition of income, the application of different regression models and expansion of Equation (5) that include the effect of social interactions on compliance with personal norms. These robustness checks are explained in detail in Appendix B.2.

4. Results

4.1 Characterization of personal norms

For the norm pertaining to sustainable ecosystem condition of the rangeland, we find that grazing condition should on average be at or above 0.08 LSU/ha with a standard deviation of 0.03 LSU/ha (Figure 1a, Table 1). For the personal norm pertaining to sustainable income, farmers indicated on average that annual net income should be at or above N$275,107 with a standard deviation of N$206,991 (Figure 1b, Table 1).

Thus, we find personal norms of sustainability that are heterogeneous across individuals with both norms unimodally distributed and clustered around intermediate values. This heterogeneity of personal norms can be explained by the norm-activation theory, which predicts that individuals differ in the concrete specification of personal norms. Indeed, such heterogeneity has been demonstrated for a variety of personal norms such as those pertaining to littering (Kallgren et al., 2000), recycling (Hopper and Nielsen, 1991; Thogersen, 1999) and environmentally friendly transportation (Widegren, 1998; Bamberg and Schmidt, 2003).

4.2 Determinants of personal norms

When examining determinants of personal norms we firstly find that both personal norms are not correlated with each other as indicated by a Pearson's correlation (r=0.03, p=0.59). Thus, farmers seem to attain these norms independently from each other. Only few previous studies have analyzed the interrelation between personal norms, but found that different norms are positively correlated (Widegren, 1998; Thogersen, 1999). Thørgersen (1999) examined the underlying reason for this correlation and hypothesized that the "correlation may indeed be caused by them [i.e. personal norms] having shared [mental] antecedents" (Thogersen, 1999: 67). Such antecedents may be a person's values, which Thørgersen (1999) could indeed demonstrate, but a person's values explained only a small share of variability in personal norms. This suggests that the determination of norms through mental antecedents is much more complex. In the light of this we find it not unsurprising that the specific norms we elicited are not correlated. However, our survey was not design to examine in depth the relationship between different norms and their antecedents, and we thus may not hypothesize on the reasons of norms being uncorrelated.

We find little evidence of socio-demographic and environmental characteristics impacting on personal norms (Table 2). Both ecosystem and income norm are significantly positively related to actual ecosystem condition and actual income, respectively: for each unit increase in actual ecosystem condition the ecosystem norm increases by 0.60 LSU/ha, and for each unit increase in actual income the income norm increases by 0.69 N$. This positive relationship conforms to predictions of the behavioral model of Equation (2), where an increase in ecosystem condition (income) leads to an increase in the ecosystem (income) norm and vice versa.[11]

Area of rangeland is significantly related to both norms but in opposite direction: each hectare of rangeland is associated with a decrease in the ecosystem norm by 1.4e-06 LSU/ha and an increase in the income norm by N$ 6.8. If we interpret area of rangeland as a proxy of wealth then these findings indicate that more wealthy farmers have lower ecosystem norms but higher income norms. Farm experience is significantly negatively related to both norms. For each additional year of experience, the ecosystem norm decreases by 8.3e-04 and the income norm by N$ 3,400. We find no other socio-demographic or environmental characteristic that is related with both norms. The remaining characteristics are at most related to only one norm

[11] Calculating the first order condition of Equation (2) (c.f. in Appendix A.1) and solving for $\overline{g}$ and $\overline{y}$, respectively, yields this prediction.

with the majority of characteristics not being related to either norm. Thus, by and large, we do not find that personal norms of sustainability vary systematically across subpopulations.

4.3 Impact of personal norms on management

We find no significant interaction even at the 10% significance level between the personal norms and self-reported management for any of the six analyzed strategies, regardless of whether covariates are excluded (Table 3) or included (Table 4). Thus, we find no evidence that the factors weighting self-image versus egoistic preferences in the dual-preferences model are non-zero. This means that there is no evidence that personal norms impact on actual behavior. These results agree with previous findings that even distinct norms may have little or no impact on behavior, as for example demonstrated for helping behavior (Schwartz, 1977) or car use (Bamberg and Schmidt, 2003).

Socio-demographic and environmental characteristics have only a sporadic effect on management with only two strategies, *spatial diversification* and *additional feed*, showing any significant relation with more than three characteristics. Reversely, only one characteristic, rented rangeland area, is related to more than two strategies, i.e. *rangeland size increase, spatial diversification* and *production system adaptation*. As one would expect, we find that *rangeland size increase* is positively related to rented rangeland area, where each ha increases the extent of this management strategy by 7.5e-05, and that *spatial diversification* is related to both rangeland area and rented rangeland area, where each ha increases the extent by 7.2e-05 and 9.7e-05, respectively. Beyond this observation we cannot discern any other expected relationship. We conclude that choice of management does by and large not systematically vary across subpopulation.

4.4 Robustness checks

To test the sensitivity of our results, we perform a variety of robustness checks which are detailed in Appendix B.1 and B.2.

Robustness check for analysis of Research Question 2 (determinants of personal norms)

We examine whether estimation results for the coefficients of determinants of a given personal norm are sensitive to the inclusion of the respective other norm (which we previously excluded to avoid a potential endogeneity problem). Results for this check show that almost all coefficients previously significant (insignificant) remain significant (insignificant) in the robustness check. Furthermore, all coefficients that are significant in the original equation retain sign and order of magnitude in the robustness check, and vice versa. We thus conclude that we can exclude the respective other norms without incurring an omitted variable bias for almost any variable.

Robustness check for analysis of Research Question 3 (impact of personal norms on management)

We perform several checks for this Research Question. In the first check we examine whether estimation results for the coefficients of personal norms on a given management strategy are sensitive to the inclusion of the respective other management strategies (which we previously excluded to avoid a potential endogeneity problem). Results show that coefficients are unchanged and we conclude that we can exclude the respective other management strategies without incurring an omitted variable bias in respect to the personal norm coefficients.

A series of three checks involve alternative specifications of the income variables as logarithmic income – where we simultaneously also use the logarithm of the personal income norm –, and as the lower and upper bound of the income interval elicited in the questionnaire (whereas we previously used the mid-points of the intervals). Estimating results confirm our previous results in that we do not find evidence that personal norms impact on management.

In three further checks we employ alternative regression models, namely ordered probit and ordered logit models as well as a Zellner's seemingly unrelated regression system where we estimate all six management strategies jointly. Again, estimate results confirm our previous results in that we do not find evidence that personal norms impact on management.

Finally, in two checks we test whether other farmers' management and personal norms, respectively, impact on compliance with personal norms. We assume that farmer know about management and norms of other farmers in their region through exchange with these farmers on a variety of regional platforms provided by the NAU. Thus, for those farmers who are members of the NAU and operate full-time (many part-time farmers do not live in their farms' region and can attend these platforms only rarely), we calculate regional averages of the extent of management and of the level of personal norms, respectively. In one check, we then interact individual farmers' personal norms with the regional averages of the management strategy that is currently estimated. In the other check, we interact the individual farmers' personal norms with the respective regional averages of the personal norms. We find no evidence that either the management or personal norms of other farmers influences compliance with the personal norms.

5. Discussion and conclusion

For the empirical case study of commercial cattle farming in semi-arid rangelands of Namibia, where farmers as the main economic actors are closely linked to the environment, we have conceptualized personal norms of sustainability according to the norm-activation theory, operationalized them under the notion of strong ecological-economic sustainability and analyzed them with an adapted dual-preferences model. We find that 1) individual farmers have personal norms of sustainability that are heterogeneous across individuals, 2) these norms are uncorrelated with each other and vary only little with socio-demographic and environmental characteristics, and 3) there is no evidence that these norms have an impact on actual management.

The last conclusion is of particular relevance, as it may explain the observed degradation of rangelands in Namibia. Some discussion is needed, however. Firstly, it is theoretically impossible to demonstrate that an impact of norms on management does not exist: we cannot accept the null hypothesis but only fail to reject it. In reality, norms may impact on management but a sample bias or an inappropriate choice of econometric methods might preclude the detection of this impact. We have no indication that our sample might be biased in those characteristics that are crucial for this study (Olbrich et al., 2009),[12] and rerunning our analysis with common alternative regression models as well as with alternative specifications of variables and equations demonstrated that results are robust. Thus, even though we may not make a definite statement, we consider it at least highly probable that norms do not impact on management. Secondly, we cannot estimate management strategies jointly in a simultaneous equation model, even though strategies are significantly interrelated, as we cannot construct suitable instrumental variables. Instead, we estimate each management strategy separately without including the respective other management strategies. Robustness checks show that we do not incur an unobserved variable bias for the coefficients of primary interest, i.e. the personal norm coefficient, and we thus conclude that this approach is justified. Thirdly, we formulate the behavioral model under certainty and may thus only consider deterministic sustainability. Given that semi-arid rangelands a subject to a variety of risks (Olbrich et al., 2011c), a more realistic approach would be the use of a model that describes behavior under uncertainty where we then would consider sustainability under

[12] No database exists that contains all commercial cattle farmers and their key socio-demographic characteristics. We thus compared samples from two subpopulations, NAU members and MeatCo customers, but found no difference in important socio-demographic characteristics (Olbrich et al., 2009). We add here that samples also do not differ in personal norms and on-farm management strategies (t-tests, p>0.1 for all personal norms and strategies).

uncertainty. However, we cannot estimate such a model as we could not elicit all the required information with our cross-sectional survey, specifically the individual, on-farm distributions of ecosystem condition and income.

Notwithstanding these limitations, we believe that our analysis provides novel insights into why farmers' management behavior may contribute to the pervasive degradation in Namibia: farmers have personal norms but they do not impact on behavior, presumably because they are not activated. This in turn suggest that activation may promote behavioral changes that may entail sustainability of cattle farming, which is similar to suggestions voiced in the environmental psychology literature for promoting pro-environmental behavior (Stern, 2000). To this end, one first has to clarify why norms are not activated. From our qualitative interviews we have anecdotic evidence that farmers are aware that inadequate management degrades the environment and thus has adverse consequences to future generations (Joubert, 2008; Neumann, 2008). Moreover, farmers may feel incapable of averting adverse consequences of their management as they rather pursue short-term profit (Pack, 2008). Thus, we hypothesize that norms are not activated because farmer feel not capable of averting adverse consequences of their behavior. A next question then is why this might be the case. This information is required to decide whether taking measures for norm activation is justified (farmers may have ethically sound reasons for not feeling capable) and exactly what measures to take. Clearly, this requires more study, and we consider it worthwhile. Further investigating norms of sustainability and their activation is a promising approach to promote sustainability of livestock farming in semi-arid rangelands.

Acknowledgements

We thank Maik Heinemann, Christian Pfeiffer, Daan van Soest and Joachim Wagner for helpful comments. We also thank our cooperating organizations Namibia Agricultural Union, Namibian Agricultural Trade Board and Agra Co-operative Ltd. Finally, we thank the German Federal Ministry of Education and Research (BMBF) for financial support under grant No. 01UN0607.

References

Ajzen, I., 1991. The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179–211.

Anand, S., Sen, A., 2000. Human development and economic sustainability. World Development 28, 2029–2049.

Bamberg, S., Schmidt, P., 2003. Incentives, Morality, Or Habit? Predicting Students' Car Use for University Routes With the Models of Ajzen, Schwartz, and Triandis. Environment and Behavior 35, 264–285.

Baumgärtner, S., Quaas, M.F., 2009. Ecological-economic viability as a criterion of strong sustainability under uncertainty. Ecological Economics 68, 2008–2020.

Brekke, K.A., Kipperberg, G., Nyborg, K., 2010. Social Interaction in Responsibility Ascription: The Case of Household Recycling. Land Economics 86, 766–784.

Brekke, K.A., Kverndokk, S., Nyborg, K., 2003. An economic model of moral motivation. Journal of Public Economics 87, 1967–1983.

Conlin, M., Lynn, M., O'Donoghue, T., 2003. The norm of restaurant tipping. Journal of Economic Behavior and Organization 52, 297–321.

Daly, H.E., Cobb, J.B., Cobb, C.W., 1994. For the common good: Redirecting the economy toward community, the environment, and a sustainable future, 2nd ed. Beacon Press, Boston, United States.

de Klerk, J., 2004. Bush Encroachment in Namibia. Report on Phase 1 of the Bush Encroachment Research, Monitoring and Management Project. Ministry of Environment and Tourism, Windhoek, Namibia.

Ek, K., Söderholm, P., 2008. Norms and economic motivation in the Swedish green electricity market. Ecological Economics 68, 169–182.

Ekins, P., Simon, S., Deutsch, L., Folke, C., Groot, R., 2003. A framework for the practical application of the concepts of critical natural capital and strong sustainability. Ecological Economics 44, 165–185.

Elster J., 1989. Social norms and economic theory. Journal of Economic Perspectives 3, 99–117.

Griffin, M., 1998. The species diversity, distribution and conservation of Namibian mammals. Biodiversity and Conservation 7, 483–494.

Harland, P., Staats, H., Wilke, H.A., 1999. Explaining proenvironmental intention and behavior by personal norms and the theory of planned behavior. Journal of Applied Social Psychology 29, 2505–2528.

Hausman, D.M., McPherson, M.S., 2006. Economic analysis, moral philosophy, and public policy, 2nd ed. Cambridge University Press, New York, United States.

Hopper, J.R., Nielsen, J.M., 1991. Recycling as Altruistic Behavior: Normative and Behavioral Strategies to Expand Participation in a Community Recycling Program. Environment and Behavior 23, 195–220.

Howarth, R.B., 2007. Towards an operational sustainability criterion. Ecological Economics 63, 656–663.

Joubert, D., 2008. Personal communication, interview conducted on 21st July 2008, Polytechnic of Namibia, Windhoek, Namibia.

Kallgren, C.A., Reno, R.R., Cialdini, R.B., 2000. A focus theory of normative conduct: When norms do and do not affect behavior. Personality and Social Psychology Bulletin 26, 1002–1012.

Lubbe, L., 2007. Personal communication, interview conducted on 19th October 2007, Ministry of Agriculture, Water and Forestry, Windhoek, Namibia.

Maggs, G.L., Craven, P., Kolberg, H.H., 1998. Plant species richness, endemism, and genetic resources in Namibia. Biodiversity and Conservation 7, 435–446.

Mendelsohn, J., 2006. Farming systems in Namibia. Research & Information Services in Namibia, Windhoek, Namibia.

MET, [Ministry of Environment and Tourism], 2002. Atlas of Namibia Project. Ministry of Environment and Tourism, Windhoek, Namibia.

Neumann, N., 2008. Personal communication, interview conducted on 30th July 2008, Ministry of Agriculture, Windhoek, Namibia.

Nordlund, A.M., Garvill, J., 2002. Value structures behind proenvironmental behavior. Environment and Behavior 34, 740–756.

Olbrich, R., Quaas, M.F., Baumgärtner, S., 2009. Sustainable use of ecosystem services under multiple risks – A survey of commercial cattle farmers in semi-arid rangelands in Namibia. Working Paper Series in Economics No. 137, Leuphana University Lüneburg, Germany.

Olbrich, R., Quaas, M.F., Baumgärtner, S., 2011a. Characterizing commercial cattle farms in Namibia: Risk, management and sustainability. Manuscript.

Olbrich, R., Quaas, M.F., Baumgärtner, S., 2011b. Risk and risk management in Namibian commercial cattle farming. Manuscript.

Pack, W., 2008. Personal communication, interview conducted on 26th July 2008, Farm Grünental, Gobabis, Namibia.

Pearce, D.W., Atkinson, G., 1993. Capital theory and the measurement of sustainable development: An indicator of "weak" sustainability. Ecological Economics 8, 103–108.

Pearce, D.W., Marandya, A., Barbier, E.B., 1989. Blueprint for a green economy. Earthscan, London.

Peltzer, T., 2007. Personal communication, interview conducted on 18th–19th October 2007, Farm Onjossa, Okahandja, Namibia.

Pezzey, J.C., Withagen, C.A., 1998. The rise, fall and sustainability of capital-resource economies. Scandinavian Journal of Economics 100, 513–527.

Postlewaite, A., 2010. Social norms and preferences, in: Benhabib, J., Bisin, A., Jackson, M.O. (Eds.), Handbook of social economics. North Holland, Amsterdam, Netherlands, pp. 31–67.

Quaas, M.F., Baumgärtner, S., 2011. Optimal grazing management rules in semi-arid rangelands with uncertain rainfall. Working Paper Series in Economics No. 193, Leuphana University Lüneburg, Germany.

Quaas, M.F., Baumgärtner, S., Becker, C., Frank, K., Müller, B., 2007. Uncertainty and sustainability in the management of rangelands. Ecological Economics 62, 251–266.

Schwartz, S.H., 1973. Normative explanations of helping behavior: A critique, proposal and empirical test. Journal of Experimental Social Psychology 9, 349–364.

Schwartz, S.H., 1977. Normative influences on altruism. Advances in Experimental Social Psychology 10, 221–279.

Solow, R., 1993. Sustainability: an economist’s perspective, in: Dorfman, R., Dorfman, N.S. (Eds.), Economics of the environment. Selected readings, 3rd ed. Norton, New York, United States, pp. 179–187.

Steir, H., 2007. Personal communication, interview conducted on 12th October 2007, Steir Vente Associates, Windhoek, Namibia.

Stern, P.C., 2000. New environmental theories: toward a coherent theory of environmentally significant behavior. Journal of Social Issues 56, 407–424.

Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., Kalof, L., 1999. A value-belief-norm theory of support for social movements: The case of environmentalism. Research in human ecology 6, 81–97.

Thogersen, J., 1999. Spillover processes in the development of a sustainable consumption pattern. Journal of Economic Psychology 20, 53–81.

Widegren, O., 1998. The new environmental paradigm and personal norms. Environment and Behavior 30, 75–100.

Young, H.P., 2008. Social norms, in: Durlauf, S.N., Blume, L. (Eds.), The New Palgrave Dictionary of Economics, 2nd ed. Palgram Macmillan, Basingstoke, United Kingdom.

Young, H.P., Burke, M., 2010. Norms, customs and conventions, in: Benhabib, J., Bisin, A., Jackson, M.O. (Eds.), Handbook of social economics. North Holland, Amsterdam, Netherlands.

Zellner, A., 1962. An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. Journal of the American Statistical Association 57, 348.

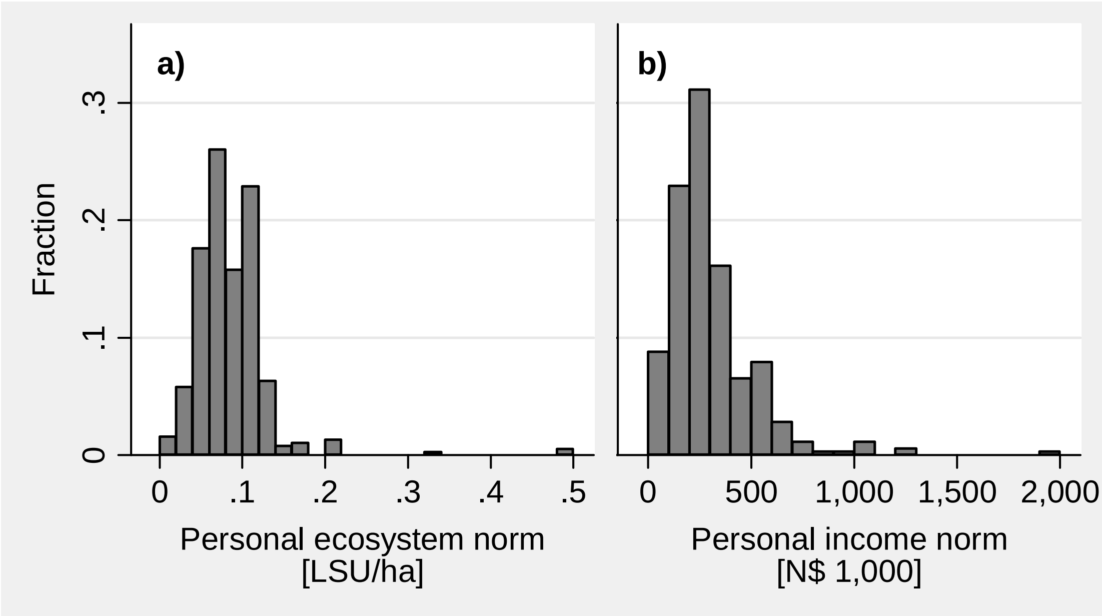

Figure 1: a) Personal ecosystem norm, measured in Large Stock Units per hectare [LSU/ha], N=380. b) Personal income norm, measured in 1,000 Namibian Dollar [N$1,000], N=353.

Table 1: Summary statistics. Mean, standard deviation, minimum and maximum for all those farmers who do not display missing values for any variable used in the estimation of management strategies (c.f. Equation 5, Table 4). N=260.

Variable	Definition	Mean	Std. dev.	Min	Max
Personal norms					
Ecosystem norm	Minimum threshold at or above which grazing capacity should be sustained, in Large Stock Unit per hectare	0.08	0.03	0.01	0.33
Income norm	Minimum threshold at or above which annual net income from cattle farming should be sustained, in N$	275,107	206,991	4,000	2,000,000
Socio-demographic characteristics					
Income	Net annual income from cattle farming; calculated as mid-points of six intervals of total annual income, corrected for fraction derived from cattle farming, in N$	114,019	96,820	0	360,000
Female	Female	0.03	0.16	0.0	1.0
Age	Age in years	54.0	11.6	27.0	90.0
Farm experience	Experience in farming in years	24.6	12.8	1.5	70.0
Afrikaans	Afrikaans	0.5	0.5	0.0	1.0
Low education	No college or apprenticeship education	0.2	0.4	0.0	1.0
Household size	Number of household members	3.3	1.6	0.0	8.0
Single ownership	Farm operated under single owner	0.7	0.5	0.0	1.0
Living off farm	Farmer lives off farm during week, proxy for part-time farming	0.2	0.4	0.0	1.0
NAU member	Member of the Namibia Agricultural Union	0.83	0.37	0.0	1.0
Rangeland area	Area of rangeland in hectares	8,212	5,460	0	44,244
Rented rangeland area	Area of net rented (i.e. rented minus rented out) rangeland in hectares	1,314	2,905	-5,000	13,000
Cattle quantity	Number of cattle in April 2008	478	393	0	3,200
Environmental characteristics					
Optimal-actual bush cover deviation	Deviation of actual from optimal bush cover on farm, in percent	-15.8	20.8	-80.0	30.0
Ecosystem condition	Ecosystem condition measured as Large Stock Unit per hectare	0.08	0.03	0.02	0.33
Erongo	Farm located in Erongo	0.06	0.23	0.00	1.00
Hardap/Karas	Farm located in Hardap or Karas	0.04	0.20	0.00	1.00
Khomas	Farm located in Khomas	0.20	0.40	0.00	1.00

Variable	Definition	Mean	Std. dev.	Min	Max
Kunene	Farm located in Kunene	0.09	0.29	0.00	1.00
Omaheke	Farm located in Omaheke	0.23	0.42	0.00	1.00
Oshikoto	Farm located in Oshikoto	0.02	0.14	0.00	1.00
Otjiozondjupa	Farm located in Otjiozondjupa	0.36	0.48	0.00	1.00
Management strategies [1=not at all important, 6=very important]					
Rangeland size increase	Purchase/lease of extra rangeland for scale effects	3.3	1.6	1.0	6.0
Spatial diversification	Purchase/lease of extra rangeland in areas with different rainfall patterns	3.2	1.7	1.0	6.0
Resting rangeland	Resting part of rangeland in good rainy seasons as buffer for bad seasons	4.6	1.6	1.0	6.0
Additional feed	Purchase of supplementary feed	4.6	1.6	1.0	6.0
Breed adaptation	Choice of breed adapted to high variability in grass production	4.5	1.5	1.0	6.0
Production system adaptation	Choice of cattle production system	4.4	1.4	1.0	6.0

Table 2: Determinants of personal norms of sustainability. OLS regression, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	**Ecosystem norm**	**Income norm**
Income	–2.4e–09	6.9e–01***
	(2.36e–08)	(1.33e–01)
Female	–1.5e–02	1.0e+04
	(1.13e–02)	(6.95e+04)
Age	8.1e–04***	1.2e+03
	(2.51e–04)	(1.40e+03)
Farm experience	–8.3e–04***	–3.4e+03***
	(2.20e–04)	(1.23e+03)
Afrikaans	–2.2e–03	2.2e+04
	(4.40e–03)	(2.43e+04)
Low education	8.3e–03	1.5e+04
	(5.20e–03)	(2.88e+04)
Household size	2.6e–03*	–4.3e+03
	(1.36e–03)	(7.52e+03)
Single ownership	2.1e–03	–4.6e+03
	(4.56e–03)	(2.56e+04)
Living off farm	–3.4e–03	–2.2e+03
	(5.31e–03)	(2.96e+04)
NAU member	3.2e–03	2.0e+04
	(5.67e–03)	(3.18e+04)
Rangeland area	–1.4e–06**	6.8e+00*
	(6.34e–07)	(3.49e+00)
Rented rangeland area	7.7e–08	–4.0e+00
	(7.83e–07)	(4.33e+00)
Cattle quantity	1.3e–05	–6.6e+00
	(8.92e–06)	(4.89e+01)
Optimal–actual bush cover deviation	–9.7e–05	–4.7e+02
	(1.11e–04)	(6.09e+02)
Ecosystem condition	6.0e–01***	9.1e+04
	(7.14e–02)	(3.97e+05)
Erongo	–2.3e–02**	1.8e+04
	(9.51e–03)	(5.36e+04)
Hardap/Karas	–1.8e–02	1.8e+05***
	(1.21e–02)	(6.62e+04)
Khomas	–9.9e–03*	4.5e+03
	(5.74e–03)	(3.23e+04)
Kunene	–5.3e–03	–4.7e+04
	(7.58e–03)	(4.22e+04)
Omaheke	–4.4e–03	1.0e+04
	(5.63e–03)	(3.09e+04)
Oshikoto	–1.3e–02	–7.8e+04
	(1.61e–02)	(8.80e+04)
Constant	6.9e–03	1.3e+05
	(1.66e–02)	(9.06e+04)
Adjusted R^2	0.303	0.165
F–statistic	7.120	3.679
Model significance	0.000	0.000
Observations	297	286

Table 3: Impact of personal norms on management, without covariates. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	**Rangeland size increase**	**Spatial diversification**	**Resting rangeland**	**Additional feed**	**Breed adaptation**	**Production system adaptation**
Ecosystem norm	–5.180	1.196	2.048	2.084	2.511	1.729
	(4.848)	(4.808)	(2.926)	(2.906)	(2.578)	(2.660)
Income norm	7.8e–07	1.2e–07	–3.0e–08	3.8e–07	7.5e–08	4.2e–07
	(5.2e–07)	(5.2e–07)	(4.8e–07)	(4.7e–07)	(4.2e–07)	(4.3e–07)
Constant	3.220***	3.181***	4.601***	4.557***	4.491***	4.346***
	(0.137)	(0.137)	(0.121)	(0.120)	(0.106)	(0.109)
Adjusted R^2	0.004	–0.006	–0.005	–0.002	–0.003	–0.002
F–statistic	1.612	0.063	0.245	0.615	0.502	0.717
Model significance	0.201	0.939	0.783	0.541	0.606	0.489
Observations	299	318	326	327	325	326

Table 4: Impact of personal norms on management, with covariates. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	Rangeland size increase	Spatial diversification	Resting rangeland	Additional feed	Breed adaptation	Production system adaptation
Ecosystem norm	–1.943	5.884	3.540	–0.036	2.714	4.018
	(5.731)	(5.642)	(3.153)	(3.081)	(2.865)	(2.915)
Income norm	4.7e–07	–5.1e–08	3.9e–07	2.6e–08	1.6e–07	4.2e–07
	(5.8e–07)	(5.8e–07)	(5.2e–07)	(5.1e–07)	(4.7e–07)	(4.8e–07)
Female	0.192	–0.031	1.135**	0.379	1.104**	0.436
	(0.645)	(0.625)	(0.562)	(0.549)	(0.511)	(0.519)
Age	–0.006	0.001	–0.001	0.012	0.014	0.009
	(0.013)	(0.013)	(0.012)	(0.011)	(0.011)	(0.011)
Farm experience	–0.016	–0.006	0.013	–0.019*	–0.008	0.006
	(0.012)	(0.012)	(0.010)	(0.010)	(0.009)	(0.010)
Afrikaans	0.367	0.077	0.486**	0.141	0.011	0.174
	(0.224)	(0.221)	(0.197)	(0.193)	(0.179)	(0.182)
Low education	0.109	0.222	0.111	0.344	0.077	–0.133
	(0.278)	(0.268)	(0.237)	(0.231)	(0.216)	(0.219)
Household size	0.042	0.035	0.046	0.036	0.076	–0.008
	(0.068)	(0.069)	(0.061)	(0.060)	(0.056)	(0.057)
Single ownership	–0.090	0.092	0.332	–0.053	–0.086	–0.284
	(0.232)	(0.231)	(0.207)	(0.202)	(0.188)	(0.191)
Living off farm	0.190	0.480*	0.322	0.475**	0.138	–0.069
	(0.266)	(0.269)	(0.239)	(0.233)	(0.217)	(0.220)
NAU member	–0.135	–0.293	–0.128	0.218	–0.115	0.241
	(0.285)	(0.285)	(0.256)	(0.250)	(0.233)	(0.237)
Rangeland area	6.5e–06	7.2e–05**	4.0e–05	1.3e–05	2.2e–05	7.5e–05***
	(3.0e–05)	(3.1e–05)	(2.8e–05)	(2.7e–05)	(2.5e–05)	(2.5e–05)
Rented rangeland area	7.5e–05*	9.7e–05**	–4.5e–05	–3.0e–05	–8.7e–06	–5.5e–05*
	(3.9e–05)	(3.9e–05)	(3.5e–05)	(3.5e–05)	(3.2e–05)	(3.3e–05)
Cattle quantity	1.9e–04	–1.0e–03**	–8.9e–04**	1.6e–04	–1.6e–05	–4.9e–04
	(4.1e–04)	(4.2e–04)	(3.8e–04)	(3.7e–04)	(3.4e–04)	(3.5e–04)
Optimal–actual bush cover deviation	–0.004	–0.003	0.001	0.002	–0.003	–0.003
	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)	(0.005)
Erongo	0.387	–0.502	0.189	–1.430***	0.280	0.324
	(0.473)	(0.485)	(0.435)	(0.425)	(0.404)	(0.401)
Hardap/Karas	–0.784	–0.592	–0.751	–0.482	–0.770	–0.649
	(0.590)	(0.606)	(0.544)	(0.532)	(0.494)	(0.503)
Khomas	–0.029	–0.010	0.023	–0.291	0.011	0.232
	(0.300)	(0.300)	(0.265)	(0.259)	(0.240)	(0.246)
Kunene	0.170	0.414	–0.029	–0.336	0.328	0.403
	(0.383)	(0.377)	(0.338)	(0.330)	(0.306)	(0.312)
Omaheke	–0.347	–0.261	–0.154	0.652***	0.094	–0.056
	(0.284)	(0.283)	(0.251)	(0.245)	(0.228)	(0.232)
Oshikoto	–0.642	–0.838	0.530	0.419	0.113	0.409
	(0.761)	(0.786)	(0.706)	(0.690)	(0.641)	(0.652)
Constant	3.525***	2.986***	3.807***	3.836***	3.483***	3.209***
	(0.752)	(0.761)	(0.675)	(0.660)	(0.614)	(0.625)
Adjusted R^2	0.027	0.028	0.039	0.090	–0.006	0.023
F–statistic	1.346	1.385	1.553	2.333	0.918	1.317
Model significance	0.147	0.125	0.061	0.001	0.568	0.163
Observations	261	278	284	284	283	283

Appendix A: Proofs

A.1 Calculation of first order condition

Assume $\bar{g} - g(a) > 0$ and that $\bar{y} - y(a) > 0$. Then, differentiating Equation (2) with respect to a and specifying the involved functions as detailed in Section 2.4 yields the first order condition:

$$\begin{aligned}\frac{dU(a)}{da} &= u'(y(a)) \cdot y'(a) + \gamma \cdot (\bar{g} - g(a)) \cdot g'(a) + \upsilon \cdot (\bar{y} - y(a)) \cdot y'(a) \\ &= (\alpha - \beta \cdot \varphi \cdot a) \cdot \varphi + \gamma \cdot (\bar{g} - a) + \upsilon \cdot (\bar{y} - \varphi \cdot a) \cdot \varphi = 0\end{aligned} \tag{2a}$$

Rearranging the equation yields

$$(\upsilon \cdot \varphi^2 + \gamma + \beta \cdot \varphi^2) \cdot a = \alpha \cdot \varphi + \gamma \cdot \bar{g} + \upsilon \cdot \varphi \cdot \bar{y}$$

and finally

$$a^* = \psi_1 + \gamma \cdot \psi_2 \cdot \bar{g} + \upsilon \cdot \psi_3 \cdot \bar{y} \tag{3}$$

with

$$\psi_1 = \frac{\alpha \cdot \varphi}{(\upsilon \cdot \varphi^2 + \gamma + \beta \cdot \varphi^2)} > 0, \psi_2 = \frac{1}{(\upsilon \cdot \varphi^2 + \gamma + \beta \cdot \varphi^2)} > 0, \ \psi_3 = \frac{\varphi}{(\upsilon \cdot \varphi^2 + \gamma + \beta \cdot \varphi^2)} > 0$$

The change in optimal management is thus characterized by the following result:

Proposition 1: *A change in optimal management choice* a* *for a change in the norm* $\bar{g}$ *is zero if and only if* γ *equals zero.*

Proposition 2: *A change in optimal management choice* a* *for a change in the norm* $\bar{y}$ *is zero if and only if* υ *equals zero.*

A.2 Reduced form of the piecewise regression

The full form for the piecewise regression of Equation (5) is

$$S_{ji} = \nu_0 + \nu_{\bar{g}n} G_n[\bar{g}_i] + \nu_{\bar{g}c} G_c[\bar{g}_i] + \nu_{\bar{y}n} Y_n[\bar{y}_i] + \nu_{\bar{y}c} Y_c[\bar{y}_i] + \beta_x X_i + \chi_i \tag{5a}$$

with

$$G_n[\bar{g}_i] = \begin{cases} \bar{g}_i - g_i & \text{for } \bar{g}_i > g_i \\ 0 & \text{otherwise} \end{cases}, \qquad G_c[\bar{g}_i] = \begin{cases} g_i - \bar{g}_i & \text{for } \bar{g}_i \le g_i \\ 0 & \text{otherwise} \end{cases}$$

and

$$Y_n[\bar{y}_i] = \begin{cases} \bar{y}_i - y_i & \text{for } \bar{y}_i > y_i \\ 0 & \text{otherwise} \end{cases}, \qquad Y_c[\bar{y}_i] = \begin{cases} y_i - \bar{y}_i & \text{for } \bar{y}_i \le y_i \\ 0 & \text{otherwise} \end{cases}$$

Rescaling the norms $\bar{g}$ and $\bar{y}$ by subtracting the actual values g and y ensures that the pieces are joined together at the respective breakpoints.

The behavioral model in Equation (2) states that personal norms do not influence utility if farmers comply with the norms, i.e. if actual values exceed the respective norms. For the regression equation this implies that the coefficients $\nu_{\bar{g}c}$ and $\nu_{\bar{y}c}$ are zero for the terms G_c[.] and Y_c[.], respectively, which describe the pieces where norms are complied with.

Thus,equation (5a) can be reduced to

$$S_{ki} = \nu_0 + \nu_{\bar{g}} G[\bar{g}_i] + \nu_{\bar{y}} Y[\bar{y}_i] + \nu_x X_i + \chi_i \tag{5}$$

where $\nu_{\bar{g}}$, $\nu_{\bar{y}}$, G[.] and Y[.] correspond to $\nu_{\bar{g}n}$, $\nu_{\bar{y}n}$, G_n[.] and Y_n[.], respectively.

Appendix B: Robustness checks

We perform several robustness checks for Research Question 2 (determinants of personal norms) and Research Question 3 (impact of personal norms on management). If indicated, we have provided estimation results of the checks in tables at the end of this appendix. Tables with estimation results for the other checks are available upon request.

B.1 Robustness check for analysis of Research Question 2 (determinants of personal norms)

Other personal norm as covariate

As previously noted, N_j, that is one of the j = 1, 2 elicited personal norms, may also depend on the respective other norm, but including the other norm may create an endogeneity problem. We cannot adequately address this problem in a simultaneous equation model as we do not have suitable instrument variables. Instead, we here augment Equation (4) by also including the other norm as a covariate and estimate

$$N_{ji} = \tau_0 + \tau_{ON} ON_i + \tau_Z Z + \theta_i \qquad (4a)$$

where ON_i the respective other elicited norm and θ_i is the error term. All other variables are defined as in Equation (4). Results show that almost all coefficients significant (insignificant) in Equation (4) remain significant (insignificant) in Equation (4a) (Table 5). The exception are the dummy variables for farm location in the region Khomas, which is no longer significant in the robustness check, and for farm location in Hardap/Karas, which is significant in the robustness check. Furthermore, all coefficients that are significant in Equation (4) retain sign and order of magnitude in Equation (4a), and vice versa. We thus conclude that we can exclude the respective other norms without incurring an omitted variable bias for almost any variable.

B.2 Robustness checks for analysis of Research Question 3 (impact of personal norms on management)

Other management strategies as covariate

We expect that S_k, i.e. the self-reported extent of management strategy k = 1, …, 6, also depends on the extent of the respective five other management strategies, but, similar to above, we cannot adequately address the ensuing endogeneity problem. Instead, we here augment Equation (5) by including the respective five other strategies as covariates and estimate

$$S_{ki} = \delta_0 + \delta_{\bar{g}} G[\bar{g}_i] + \delta_{\bar{y}} Y[\bar{y}_i] + \delta_{OS} OS_i + \delta_x X_i + o_i \qquad (5a)$$

where OS_i a vector of the respective five other management strategies and o_i is the error term. All other variables are defined as in Equation (5). Estimation results of Equation (5a) show that the coefficients of personal norms remain insignificant (Table 6). We thus conclude that we do not incur an omitted variable bias for the coefficient of primary interest, i.e. the personal norm coefficients, by excluding these other strategies.

Alternative income definitions

We perform three robustness checks in which we employ alternative specification of the income variable to estimate Equation (5). In the first, we substitute both the personal income norm and actual income by their respective logarithms. In the second and third check we address the fact that we did not elicit the precise level for actual income but rather income intervals. Previously, we use interval mid-points as an approximation to precise actual income. We now instead use the lower bound of the income interval in the second robustness check, and the upper bound of the income interval in the third check. Estimate results for all checks confirm our previous results in that we do not find evidence that personal norms impact on management.

Alternative regression models

We perform three robustness checks in which we employ alternative regression models to estimate Equation (5). In the first two checks, we defined S_k, the self-reported extent of management strategy k = 1, …, 6, as an ordinal variable whereas we previously had defined it as a continuous variable. We then estimate Equation (5) as an ordered probit model (first check) and as an ordered logit model (second check). For the third check, we estimate the previously separate equations for the six management strategies jointly in a seemingly unrelated regression system (Zellner, 1962). We thereby allow for correlation of the error terms across equations, essentially assuming that unspecified factors impact equally on all six strategies. Again, estimate results for all checks confirm our previous results in that we do not find evidence that personal norms impact on management.

Influence of other farmers' personal norms and management

Previously, we assumed that compliance with the personal norms is independent of what other farmers are doing. Here, we conduct two robustness checks of this assumption for Equation (5) which we expand by additionally allowing for social interactions to influence compliance. Ideally we would require information on exactly what other farmers a given farmer interacts, but we do not have this information. Instead, we make use of various other information: firstly, the NAU provides a variety of platforms for meetings and knowledge exchange between their members; secondly, NAU members within a region are more likely to interact than NAU members between regions as the NAU provides many of its platforms at the major regional cities; and thirdly, only full-time farmers regularly interact on these platforms since part-time farmers typically do not have the time to attend these platforms (many part-time farmers do not live in their farms' region and can attend these platforms only rarely). Thus, we focus on farmer who are NAU members and live on farm, and group farmers by regions.

We firstly examine whether other farmers' management influence compliance with personal norms. To this end, we assume that farmers discuss their farm management at the NAU platforms and that based on these discussions each farmer can deduce the average level of extent for each strategy in his region. Thus, we calculate regional averages for the extent of each management strategy and interact them with farmers' individual ecosystem and income norms, respectively, estimating the equation

$$\begin{aligned} S_{ki} = \eta_0 + \eta_{\bar{g}} G[\bar{g}_i] + \eta_{\bar{y}} Y[\bar{y}_i] + \eta_{S_k R} S_{ki}^R \\ + \eta_{\bar{g} \times S_k R} G[\bar{g}_i] \times S_{ki}^R + \eta_{\bar{y} \times S_k R} Y[\bar{y}_i] \times S_{ki}^R + \eta_x X_i + \mu_i \end{aligned} \quad (5b)$$

where S_{ki}^R is the regional averaged extent of management Strategy *k*, $G[\bar{g}_i] \times S_{ki}^R$ and $Y[\bar{y}_i] \times S_{ki}^R$ are interaction effects between the regional averaged extent of this strategy and the ecosystem norm and income norm, respectively, and μ_i is the error term. All other variables are defined as in Equation (5). We run two specifications, one without X_i (for which we provide no table) and one with X_i (Table 7). Estimation results confirm our previous findings as neither the main effect of the personal norms nor their interaction effects impact on management. Thus, we find no evidence that other farmers' management, as averaged per region, influences compliance with the norms.

Secondly, we examine whether other farmers' personal norms influence compliance with personal norms. Again, we assume that farmers know the regional averaged level for each personal norm based on exchange at NAU platforms. We calculate regional averages for the personal ecosystem and income norm and interact them with farmers' individual ecosystem and income norms, respectively, estimating the equation

$$\begin{aligned} S_{ki} = \kappa_0 + \kappa_{\bar{g}} G[\bar{g}_i] + \kappa_{\bar{y}} Y[\bar{y}_i] + \kappa_{\bar{g}R} \bar{g}_i^R + \kappa_{\bar{y}R} \bar{y}_i^R \\ + \kappa_{\bar{g} \times \bar{g}R} G[\bar{g}_i] \times \bar{g}_i^R + \kappa_{\bar{y} \times \bar{y}R} Y[\bar{y}_i] \times \bar{y}_i^R + \kappa_x X_i + \varsigma_i \end{aligned} \quad (5c)$$

where $\bar{g}_i^R$ and $\bar{y}_i^R$ are regional averaged levels for the personal ecosystem and income norm, respectively, $G[\bar{g}_i] \times \bar{g}_i^R$ and $Y[\bar{y}_i] \times \bar{y}_i^R$ are interaction effects between an individual farmer's ecosystem norm and the regional averaged ecosystem norm, and between and individual farmers' income norm and the regional averaged income norm, respectively. ζ_i is the error term. All other variables are defined as in Equation (5). We run two specifications, one without X_i (for which we provide no table) and one with X_i (Table 8). Again, we find that neither the main effect of personal norms nor their interaction effects are significant in either the model with or without covariates. Thus, we find no evidence that other farmers' personal norms, as averaged per region, influence compliance with the norms.

Table 5: Determinants of personal norms of sustainability with the respective other personal norm included. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	**Ecosystem norm**	**Income norm**
Ecosystem norm		3.3e+05
		(3.33e+05)
Income norm	1.1e–08	
	(1.15e–08)	
Income	–1.2e–08	6.9e–01***
	(2.61e–08)	(1.34e–01)
Female	–1.0e–02	1.3e+04
	(1.29e–02)	(6.97e+04)
Age	8.6e–04***	1.0e+03
	(2.62e–04)	(1.44e+03)
Farm experience	–8.6e–04***	–3.2e+03**
	(2.34e–04)	(1.28e+03)
Afrikaans	–2.1e–03	2.3e+04
	(4.53e–03)	(2.44e+04)
Low education	8.7e–03	1.6e+04
	(5.41e–03)	(2.93e+04)
Household size	2.8e–03**	–5.6e+03
	(1.40e–03)	(7.61e+03)
Single ownership	2.0e–03	–4.0e+03
	(4.77e–03)	(2.57e+04)
Living off farm	–3.6e–03	–2.3e+03
	(5.51e–03)	(2.97e+04)
NAU member	1.9e–03	1.9e+04
	(5.91e–03)	(3.18e+04)
Rangeland area	–1.5e–06**	7.3e+00**
	(6.54e–07)	(3.53e+00)
Rented rangeland area	1.4e–07	–3.9e+00
	(8.18e–07)	(4.40e+00)
Cattle quantity	1.3e–05	–1.1e+01
	(9.10e–06)	(4.92e+01)
Optimal–actual bush cover deviation	–1.1e–04	–5.2e+02
	(1.16e–04)	(6.26e+02)
Ecosystem condition	6.0e–01***	–9.5e+04
	(7.38e–02)	(4.45e+05)
Erongo	–2.4e–02**	2.7e+04
	(9.97e–03)	(5.43e+04)
Hardap/Karas	–2.1e–02*	1.9e+05***
	(1.25e–02)	(6.68e+04)
Khomas	–7.7e–03	9.4e+03
	(6.11e–03)	(3.30e+04)
Kunene	–5.0e–03	–4.4e+04
	(7.87e–03)	(4.23e+04)
Omaheke	–4.8e–03	1.5e+04
	(5.78e–03)	(3.12e+04)
Oshikoto	–1.3e–02	–7.3e+04
	(1.64e–02)	(8.83e+04)
Constant	4.7e–03	1.3e+05
	(1.70e–02)	(9.13e+04)
Adjusted R^2	0.300	0.167
F–statistic	6.525	3.571
Model significance	0.000	0.000
Observations	284	284

Table 6: Impact of personal norms on management with respective other management strategies included. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	**Rangeland size increase**	**Spatial diversification**	**Resting rangeland**	**Additional feed**	**Breed adaptation**	**Production system adaptation**
Ecosystem norm	–5.064	5.602	0.712	–0.672	1.664	1.359
	(4.527)	(4.545)	(5.366)	(5.180)	(4.620)	(4.691)
Income norm	5.9e–07	–5.1e–07	1.4e–07	9.1e–08	–3.3e–09	4.0e–07
	(4.6e–07)	(4.6e–07)	(5.4e–07)	(5.2e–07)	(4.7e–07)	(4.7e–07)
Female	0.075	–0.223	0.865	0.104	0.919*	–0.006
	(0.516)	(0.519)	(0.608)	(0.589)	(0.522)	(0.534)
Age	–0.003	–0.003	–0.001	0.008	0.005	0.003
	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)	(0.011)
Farm experience	–0.012	0.003	0.015	–0.011	–0.005	0.013
	(0.010)	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)
Afrikaans	0.213	–0.097	0.538**	0.110	–0.009	0.163
	(0.180)	(0.182)	(0.211)	(0.206)	(0.184)	(0.187)
Low education	0.008	0.138	0.020	0.215	–0.070	–0.248
	(0.222)	(0.223)	(0.263)	(0.253)	(0.226)	(0.229)
Household size	0.020	0.007	–0.002	0.026	0.082	–0.054
	(0.054)	(0.054)	(0.064)	(0.062)	(0.055)	(0.056)
Single ownership	–0.166	0.214	0.363*	–0.052	–0.071	–0.240
	(0.185)	(0.186)	(0.218)	(0.211)	(0.189)	(0.191)
Living off farm	–0.113	0.232	0.335	0.342	0.058	–0.026
	(0.213)	(0.214)	(0.251)	(0.242)	(0.217)	(0.220)
NAU member	0.026	–0.245	–0.009	0.236	–0.185	0.377
	(0.227)	(0.228)	(0.268)	(0.259)	(0.231)	(0.233)
Rangeland area	–3.5e–05	5.0e–05**	3.9e–05	–7.3e–06	–9.6e–06	6.5e–05**
	(2.5e–05)	(2.5e–05)	(2.9e–05)	(2.8e–05)	(2.5e–05)	(2.5e–05)
Rented rangeland area	2.2e–05	6.0e–05*	–5.8e–05	–4.0e–05	1.4e–05	–6.5e–05**
	(3.1e–05)	(3.1e–05)	(3.7e–05)	(3.6e–05)	(3.2e–05)	(3.2e–05)
Cattle quantity	7.3e–04**	–9.4e–04***	–8.9e–04**	3.7e–04	2.4e–04	–4.2e–04
	(3.3e–04)	(3.3e–04)	(3.9e–04)	(3.8e–04)	(3.4e–04)	(3.5e–04)
Optimal–actual bush cover deviation	–0.002	–0.002	0.001	0.003	–3.1e–04	–0.001
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Erongo	0.697*	–0.409	0.145	–1.223***	0.287	0.219
	(0.389)	(0.393)	(0.463)	(0.440)	(0.398)	(0.405)
Hardap/Karas	–0.445	0.150	–0.573	–0.271	–0.450	–0.339
	(0.469)	(0.472)	(0.555)	(0.536)	(0.478)	(0.486)
Khomas	–0.036	0.057	–0.021	–0.288	–0.117	0.340
	(0.238)	(0.239)	(0.282)	(0.271)	(0.242)	(0.245)
Kunene	–0.053	0.327	–0.151	–0.543	0.212	0.192
	(0.305)	(0.306)	(0.361)	(0.346)	(0.310)	(0.315)
Omaheke	–0.183	–0.194	–0.270	0.804***	0.064	–0.070
	(0.229)	(0.230)	(0.271)	(0.257)	(0.234)	(0.237)
Oshikoto	–0.267	–0.453	0.578	0.606	–0.011	0.498
	(0.604)	(0.606)	(0.713)	(0.688)	(0.615)	(0.623)
Rangeland size increase		0.596***	0.033	0.043	0.042	–0.020
		(0.053)	(0.077)	(0.075)	(0.067)	(0.068)
Spatial diversification	0.591***		0.067	0.206***	0.004	0.142**
	(0.052)		(0.077)	(0.073)	(0.066)	(0.067)
Resting rangeland	0.023	0.048		2.6e–04	0.133**	–0.051
	(0.055)	(0.056)		(0.063)	(0.056)	(0.057)
Additional feed	0.033	0.160***	2.8e–04		0.054	–0.033
	(0.057)	(0.057)	(0.068)		(0.058)	(0.059)
Breed adaptation	0.041	0.004	0.180**	0.068		0.326***
	(0.064)	(0.065)	(0.075)	(0.073)		(0.063)
Production system adaptation	–0.019	0.134**	–0.067	–0.040	0.316***	
	(0.063)	(0.063)	(0.075)	(0.072)	(0.061)	

Dependent variables:	Rangeland size increase	Spatial diversification	Resting rangeland	Additional feed	Breed adaptation	Production system adaptation
Constant	1.306*	–0.235	3.102***	3.065***	1.718**	2.035***
	(0.701)	(0.710)	(0.810)	(0.781)	(0.711)	(0.718)
Adjusted R^2	0.394	0.424	0.058	0.126	0.104	0.136
F–statistic	7.468	8.343	1.615	2.435	2.162	2.563
Model significance	0.000	0.000	0.034	0.000	0.001	0.000
Observations	260	260	260	260	260	260

Table 7: Impact of personal norms on management with regional averages (reg. avr.) of management and interaction effects. For brevity sake, abbreviations of management strategies, as indicated in the table header, are used. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables:	**Rangeland size increase [RSI]**	**Spatial diversification [SD]**	**Resting rangeland [RR]**	**Additional feed [AF]**	**Breed adaptation [BA]**	**Production system adaptation [PSA]**
Ecosystem norm	226.917	162.589	54.092	52.695	–23.475	116.911
	(138.691)	(165.166)	(326.528)	(36.105)	(119.537)	(287.491)
Income norm	–1.3e–05	–1.9e–05	–2.6e–05	–2.8e–07	2.2e–05	4.7e–06
	(1.3e–05)	(1.2e–05)	(5.0e–05)	(5.5e–06)	(2.0e–05)	(1.3e–05)
Reg. avr. RSI	–2.269					
	(1.581)					
Ecosystem norm x Reg. avr. RSI	–69.299					
	(42.128)					
Income norm x Reg. avr. RSI	4.1e–06					
	(4.0e–06)					
Reg. avr. SD		–3.371*				
		(1.801)				
Ecosystem norm x Reg. avr. SD		–47.971				
		(51.492)				
Income norm x Reg. avr. SD		5.9e–06				
		(3.6e–06)				
Reg. avr. RR			0.285			
			(2.229)			
Ecosystem norm x Reg. avr. RR			–10.803			
			(70.410)			
Income norm x Reg. avr. RR			5.6e–06			
			(1.1e–05)			
Reg. avr. AF				–0.379		
				(23.166)		
Ecosystem norm x Reg. avr. AF				–10.063		
				(6.921)		
Income norm x Reg. avr. AF				1.1e–07		
				(1.2e–06)		
Reg. avr. BA					–0.170	
					(2.512)	
Ecosystem norm x Reg. avr. BA					5.838	
					(26.597)	
Income norm x Reg. avr. BA					–5.1e–06	
					(4.5e–06)	
Reg. avr. PSA						0.602
						(1.551)
Ecosystem norm x Reg. avr. PSA						–25.070
						(64.083)
Income norm x Reg. avr. PSA						–9.4e–07
						(3.0e–06)
Female	–0.377	–0.748	1.366*	–0.121	1.156*	0.606
	(0.747)	(0.762)	(0.714)	(0.715)	(0.620)	(0.655)
Age	–0.006	0.017	0.005	0.018	0.010	0.013
	(0.018)	(0.017)	(0.015)	(0.015)	(0.013)	(0.014)
Farm experience	–0.021	–0.016	0.021	–0.018	–0.008	0.005
	(0.015)	(0.014)	(0.013)	(0.013)	(0.011)	(0.012)
Afrikaans	0.552**	0.138	0.519**	0.157	0.161	0.179
	(0.271)	(0.263)	(0.245)	(0.244)	(0.213)	(0.226)
Low education	0.203	0.433	0.466	0.518*	0.368	–0.034
	(0.341)	(0.318)	(0.289)	(0.290)	(0.253)	(0.268)
Household size	0.018	0.023	0.137*	0.048	0.088	–0.004
	(0.087)	(0.088)	(0.081)	(0.082)	(0.070)	(0.074)

Dependent variables:	Rangeland size increase [RSI]	Spatial diversification [SD]	Resting rangeland [RR]	Additional feed [AF]	Breed adaptation [BA]	Production system adaptation [PSA]
Single ownership	–0.025	0.122	0.215	0.095	–0.266	–0.270
	(0.290)	(0.287)	(0.265)	(0.264)	(0.231)	(0.246)
Rangeland area	4.7e–05	1.4e–04***	1.0e–04***	6.6e–06	7.5e–05**	6.7e–05*
	(4.3e–05)	(4.3e–05)	(4.0e–05)	(4.0e–05)	(3.4e–05)	(3.7e–05)
Rented rangeland area	3.6e–05	8.4e–05*	–3.5e–05	–2.7e–05	–2.2e–05	–1.9e–05
	(4.6e–05)	(4.7e–05)	(4.3e–05)	(4.3e–05)	(3.8e–05)	(4.0e–05)
Cattle quantity	3.8e–04	–1.3e–03**	–1.8e–03***	4.1e–04	–4.6e–04	–2.1e–04
	(5.3e–04)	(5.3e–04)	(4.9e–04)	(4.9e–04)	(4.3e–04)	(4.6e–04)
Optimal-actual bush cover deviation	–0.007	–0.006	0.005	0.004	–0.001	–0.002
	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Erongo	0.467	–1.246	–0.900	–2.199	–0.332	0.134
	(0.614)	(0.767)	(0.580)	(26.852)	(0.528)	(0.670)
Hardap/Karas	0.805	1.318	–0.180	–1.333	–0.738	–0.065
	(1.109)	(1.298)	(0.858)	(32.867)	(1.264)	(1.635)
Khomas	–0.831	–0.863	0.069	–0.181	–0.422	0.095
	(0.805)	(0.726)	(0.342)	(6.106)	(0.768)	(0.438)
Kunene	–0.595	0.118	–0.652	–0.710	0.268	0.275
	(0.657)	(0.487)	(0.434)	(7.751)	(0.525)	(0.416)
Omaheke	–0.361	–1.177*	–0.403	1.249	–0.376	–0.034
	(0.351)	(0.665)	(0.372)	(20.411)	(0.497)	(0.284)
Constant	10.770**	12.690**	1.780	5.089	4.480	0.434
	(5.218)	(5.763)	(10.098)	(106.801)	(11.414)	(6.850)
Adjusted R^2	0.066	0.051	0.074	0.106	–0.012	–0.035
F–statistic	1.594	1.483	1.731	2.084	0.895	0.694
Model significance	0.057	0.089	0.030	0.005	0.598	0.836
Observations	177	190	194	194	193	193

Table 8: Impact of personal norms on management, with regional averages (reg. avr.) of personal norms and interaction effects. For brevity sake, abbreviations of personal norms are used for regional averages and in interaction effects, as indicated. OLS regressions, coefficients with standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Dependent variables	**Rangeland size increase**	**Spatial diversification**	**Resting rangeland**	**Additional feed**	**Breed adaptation**	**Production system adaptation**
Ecosystem norm [EN]	92.577	87.279	44.258	53.929	4.649	–20.460
	(71.531)	(69.955)	(36.567)	(36.646)	(31.905)	(33.857)
Income norm [IN]	1.1e–07	–5.7e–06	4.8e–07	2.6e–06	1.4e–06	1.6e–07
	(6.0e–06)	(6.2e–06)	(5.7e–06)	(5.8e–06)	(5.1e–06)	(5.3e–06)
Reg. avr. EN	34.910	41.764	–6.391	–21.343	15.853	–6.807
	(32.411)	(32.770)	(30.386)	(30.452)	(26.551)	(28.041)
Reg. avr. IN	–1.7e–06	–4.0e–06	–4.7e–06	1.8e–05***	–3.9e–06	–1.6e–06
	(6.9e–06)	(6.8e–06)	(6.2e–06)	(6.2e–06)	(5.4e–06)	(5.7e–06)
EN x Reg. avr. EN	–3.3e–04	–2.8e–04	–1.3e–04	–1.7e–04	–6.8e–06	7.9e–05
	(2.5e–04)	(2.5e–04)	(1.2e–04)	(1.2e–04)	(1.0e–04)	(1.1e–04)
IN x Reg. avr. IN	4.5e–06	6.3e–05	–9.8e–06	–2.8e–05	–2.3e–05	4.5e–06
	(7.2e–05)	(7.3e–05)	(6.8e–05)	(6.8e–05)	(6.0e–05)	(6.3e–05)
Female	–0.358	–0.770	1.460**	–0.101	1.140*	0.570
	(0.753)	(0.768)	(0.713)	(0.715)	(0.623)	(0.658)
Age	–0.009	0.007	0.005	0.018	0.011	0.012
	(0.018)	(0.017)	(0.015)	(0.015)	(0.013)	(0.014)
Farm experience	–0.016	–0.008	0.022*	–0.018	–0.008	0.006
	(0.015)	(0.014)	(0.013)	(0.013)	(0.011)	(0.012)
Afrikaans	0.567**	0.144	0.510**	0.163	0.140	0.172
	(0.273)	(0.264)	(0.245)	(0.245)	(0.213)	(0.226)
Low education	0.220	0.349	0.495*	0.520*	0.340	–0.055
	(0.343)	(0.319)	(0.289)	(0.289)	(0.253)	(0.266)
Household size	0.022	0.013	0.149*	0.052	0.094	–0.013
	(0.088)	(0.088)	(0.081)	(0.082)	(0.071)	(0.075)
Single ownership	–0.099	0.010	0.221	0.104	–0.268	–0.297
	(0.291)	(0.286)	(0.265)	(0.265)	(0.233)	(0.244)
Rangeland area	3.9e–05	1.2e–04***	1.1e–04***	9.6e–06	7.5e–05**	6.3e–05*
	(4.4e–05)	(4.3e–05)	(4.0e–05)	(4.0e–05)	(3.5e–05)	(3.7e–05)
Rented rangeland area	4.5e–05	9.2e–05*	–3.3e–05	–2.9e–05	–2.1e–05	–1.9e–05
	(4.7e–05)	(4.7e–05)	(4.3e–05)	(4.3e–05)	(3.8e–05)	(4.0e–05)
Cattle quantity	4.2e–04	–1.2e–03**	–1.8e–03***	4.0e–04	–4.8e–04	–2.0e–04
	(5.4e–04)	(5.3e–04)	(4.9e–04)	(4.9e–04)	(4.3e–04)	(4.6e–04)
Optimal–actual bush cover deviation	–0.007	–0.005	0.007	0.004	–0.002	–0.003
	(0.007)	(0.006)	(0.006)	(0.006)	(0.005)	(0.006)
Erongo	1.423	1.025	–1.399	–2.039*	–0.043	–0.029
	(1.128)	(1.154)	(1.073)	(1.075)	(0.950)	(0.990)
Hardap/Karas	2.078	3.162*	–0.289	–2.710*	0.404	–0.530
	(1.606)	(1.636)	(1.514)	(1.517)	(1.320)	(1.397)
Khomas	0.305	0.325	–0.161	0.067	–0.150	–0.012
	(0.406)	(0.404)	(0.369)	(0.370)	(0.322)	(0.344)
Kunene	0.006	0.234	–0.881*	–0.144	0.106	0.284
	(0.577)	(0.556)	(0.513)	(0.514)	(0.448)	(0.474)
Constant	0.469	–0.454	4.863	–0.006	3.293	4.290
	(3.341)	(3.381)	(3.128)	(3.135)	(2.736)	(2.890)
Adjusted R^2	0.054	0.042	0.079	0.106	–0.018	–0.033
F–statistic	1.475	1.390	1.784	2.094	0.836	0.709
Model significance	0.094	0.129	0.023	0.005	0.672	0.820
Observations	177	190	194	194	193	193

Working Paper Series in Economics

(recent issues)

No.208: *Roland Olbrich, Martin F. Quaas, Andreas Haensler and Stefan Baumgärtner*: Risk preferences under heterogeneous environmental risk, August 2011

No.207: *Alexander Vogel and Joachim Wagner*: Robust estimates of exporter productivity premia in German business services enterprises, July 2011

No.206: *Joachim Wagner*: Exports, imports and profitability: First evidence for manufacturing enterprises, June 2011

No.205: *Sebastian Strunz*: Is conceptual vagueness an asset? Resilience research from the perspective of philosophy of science, May 2011

No.204: *Stefanie Glotzbach*: On the notion of ecological justice, May 2011

No.203: *Christian Pfeifer*: The Heterogeneous Economic Consequences of Works Council Relations, April 2011

No.202: *Christian Pfeifer, Simon Janssen, Philip Yang and Uschi Backes-Gellner*: Effects of Training on Employee Suggestions and Promotions in an Internal Labor Market, April 2011

No.201: *Christian Pfeifer*: Physical Attractiveness, Employment, and Earnings, April 2011

No.200: *Alexander Vogel*: Enthüllungsrisiko beim Remote Access: Die Schwerpunkteigenschaft der Regressionsgerade, März 2011

No.199: *Thomas Wein*: Microeconomic Consequences of Exemptions from Value Added Taxation – The Case of Deutsche Post, February 2011

No.198: *Nikolai Hoberg* and *Stefan Baumgärtner*: Irreversibility, ignorance, and the intergenerational equity-efficiency trade-off, February 2011

No.197: *Sebastian Schuetz*: Determinants of Structured Finance Issuance – A Cross-Country Comparison, February 2011

No.196: *Joachim Fünfgelt and Günther G. Schulze*: Endogenous Environmental Policy when Pollution is Transboundary, February 2011

No.195: *Toufic M. El Masri*: Subadditivity and Contestability in the Postal Sector: Theory and Evidence, February 2011

No.194: *Joachim Wagner*: Productivity and International Firm Activities: What do we know?, January 2011

No.193: *Martin F. Quaas* and *Stefan Baumgärtner*: Optimal grazing management rules in semi-arid rangelands with uncertain rainfall, January 2011

No.192: *Institut für Volkswirtschaftslehre*: Forschungsbericht 2010, Januar 2011

No.191: *Natalia Lukomska, Martin F. Quaas and Stefan Baumgärtner*: Bush encroachment control and risk management in semi-arid rangelands, December 2010

No.190: *Nils Braakmann:* The causal relationship between education, health and health related behaviour: Evidence from a natural experiment in England, November 2010

No.189: *Dirk Oberschachtsiek and Britta Ulrich:* The link between career risk aversion and unemployment duration: Evidence of non-linear and time-depending pattern, October 2010

No.188: *Joachim Wagner:* Exports and Firm Characteristics in German Manufacturing industries, October 2010

No.187: *Joachim Wagner:* The post-entry performance of cohorts of export starters in German manufacturing industries, September 2010

No.186: *Joachim Wagner:* From estimation results to stylized facts: Twelve recommendations for empirical research in international activities of heterogenous firms, September 2010 [forthcoming in: De Economist]

No.185: *Franziska Dittmer and Markus Groth:* Towards an agri-environment index for biodiversity conservation payment schemes, August 2010

No.184: *Markus Groth:* Die Relevanz von Ökobilanzen für die Umweltgesetzgebung am Beispiel der Verpackungsverordnung, August 2010

No.183: *Yama Temouri, Alexander Vogel and Joachim Wagner:* Self-Selection into Export Markets by Business Services Firms – Evidence from France, Germany and the United Kingdom, August 2010

No.182: *David Powell and Joachim Wagner:* The Exporter Productivity Premium along the Productivity Distribution: First Evidence from a Quantile Regression for Fixed Effects Panel Data Models, August 2010

No.181: *Lena Koller, Claus Schnabel und Joachim Wagner:* Beschäftigungswirkungen arbeits- und sozialrechtlicher Schwellenwerte , August 2010
[publiziert in: Zeitschrift für Arbeitsmarktforschung 44(2011), 1-2, 173-180]

No.180: *Matthias Schröter, Markus Groth und Stefan Baumgärtner:* Pigous Beitrag zur Nachhaltigkeitsökonomie, Juli 2010

No.179: *Norbert Olah, Thomas Huth and Dirk Löhr:* Monetary policy with an optimal interest structure, July 2010

No.178: *Sebastian A. Schütz:* Structured Finance Influence on Financial Market Stability – Evaluation of Current Regulatory Developments, June 2010

No.177: *Franziska Boneberg:* The Economic Consequences of One-third Co-determination in German Supervisory Boards: First Evidence from the German Service Sector from a New Source of Enterprise Data, June 2010
[forthcoming in: Schmollers Jahrbuch / Journal of Applied Social Science Studies]

No.176: *Nils Braakmann:* A note on the causal link between education and health – Evidence from the German short school years, June 2010

No.175: *Torben Zülsdorf, Ingrid Ott und Christian Papilloud:* Nanotechnologie in Deutschland – Eine Bestandsaufnahme aus Unternehmensperspektive, Juni 2010

No.174: *Nils Braakmann:* An empirical note on imitative obesity and a puzzling result, June 2010

No.173: *Anne-Kathrin Last and Heike Wetzel:* Baumol's Cost Disease, Efficiency, and Productivity in the Performing Arts: An Analysis of German Public Theaters, May 2010

No.172: *Vincenzo Verardi and Joachim Wagner:* Productivity premia for German manufacturing firms exporting to the Euro-area and beyond: First evidence from robust fixed effects estimations, May 2010

No.171: *Joachim Wagner:* Estimated capital stock values for German manufacturing enterprises covered by the cost structure surveys, May 2010
[published in: Schmollers Jahrbuch / Journal of Applied Social Science Studies 130 (2010), 3, 403-408]

No.170: *Christian Pfeifer, Simon Janssen, Philip Yang and Uschi Backes-Gellner:* Training Participation of an Aging Workforce in an Internal Labor Market, May 2010

No.169: *Stefan Baumgärtner and Martin Quaas:* Sustainability Economics – general versus specific, and conceptual versus practical, May 2010
[forthcoming in: Ecological Economics]

No.168: *Vincenzo Verardi and Joachim Wagner:* Robust Estimation of Linear Fixed Effects Panel Data Models with an Application to the Exporter Productivity Premium, April 2010

No.167: *Stephan Humpert:* Machen Kinder doch glücklich? April 2010

No.166: *Joachim Wagner:* Produktivität und Rentabilität in der niedersächsischen Industrie im Bundesvergleich. Eine Benchmarking-Studie auf der Basis vertraulicher Firmendaten aus Erhebungen der amtlichen Statistik, April 2010
[erschienen in: Statistische Monatshefte Niedersachsen, Sonderausgabe "Kooperation Wissenschaft und Statistik - 20 Jahre Nutzung von amtlichen Mikrodaten", S. 30 - 42]

No.165: *Nils Braakmann:* Neo-Nazism and discrimination against foreigners: A direct test of taste discrimination, March 2010

No.164: *Amelie Boje, Ingrid Ott and Silvia Stiller:* Metropolitan Cities under Transition: The Example of Hamburg/ Germany, February 2010

No.163: *Christian Pfeifer and Stefan Schneck:* Relative Wage Positions and Quit Behavior: New Evidence from Linked Employer-Employee-Data, February 2010

No.162: *Anja Klaubert:* "Striving for Savings" – religion and individual economic behavior, January 2010

No.161: *Nils Braakmann:* The consequences of own and spousal disability on labor market outcomes and objective well-being: Evidence from Germany, January 2010

No.160: *Norbert Olah, Thomas Huth und Dirk Löhr:* Geldpolitik mit optimaler Zinsstruktur, Januar 2010

No.159: *Markus Groth:* Zur Relevanz von Bestandseffekten und der Fundamentalen Transformation in wiederholten Biodiversitätsschutz-Ausschreibungen, Januar 2010

No.158: *Franziska Boneberg:* Die gegen das Drittelbeteiligungsgesetz verstoßende Aufsichtsratslücke existiert. Replik zu „Das Fehlen eines Aufsichtsrates muss nicht rechtswidrig sein" von Alexander Dilger, Januar 2010
[erschienen in: Zeitschrift für Industrielle Beziehungen, 1 (2010)]

No.157: *Institut für Volkswirtschaftslehre:* Forschungsbericht 2009, Januar 2010

No.156: *Alexander Vogel, Joachim Wagner, Kerstin Brunken und Arno Brandt:* Zur Beschäftigungsentwicklung in der Region Hannover - Ein Vergleich mit 12 deutschen Verdichtungsräumen, Dezember 2009

No.155: *Nils Braakmann and Joachim Wagner:* Labor market adjustments after a great import shock: Evidence from the German clothing industry and the Multi-Fibre Arrangement, December 2009

No.154: *Joachim Wagner:* Zehn Jahre *European Data Watch*: Dokumentation von Datensätzen für die empirische Wirtschafts- und Sozialforschung und Zugangswegen zu den Daten, Dezember 2009
[erschienen in: AStA - Wirtschafts- und Sozialstatistisches Archiv 4(2010), 2, 141-149]

No.153: *Joachim Wagner:* Offshoring and work performance: Self-Selection, effects on performance, or both? December 2009
[published in: Review of World Economics 147 (2011), 2, 217 - 247]

(see www.leuphana.de/institute/ivwl/publikationen/working-papers.html for a complete list)

Leuphana Universität Lüneburg
Institut für Volkswirtschaftslehre
Postfach 2440
D-21314 Lüneburg
Tel.: ++49 4131 677 2321
email: brodt@leuphana.de

www.leuphana.de/institute/ivwl/publikationen/working-papers.html