Project title: A behavioral economic analysis of compliance and non-compliance with food-safety and water-protection rules in primary production: a survey and experiment-based study

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Problem background: Over the last decades, citizens and consumers have become increasingly concerned about the challenges related to the agri-food sector. The primary focus of these concerns is on food quality and safety, environmental protection, animal welfare, and the free and informed choice of consumers. Troubled by the negative externalities of food production and a great number of food law offences and frauds, citizens and consumers call for more efforts to mitigate food risks and environmental problems caused by failures in food markets. Food safety and environmental threats may arise on all levels of the food supply chain; and safety precautions and controls may fail due to technical or human failures as well as the selfish misbehavior of food companies on any of these levels. Prominent examples are pesticide residues detected in fruit and vegetables (SCHULZE ALTHOFF et al. 2007), dioxin found in eggs (VZH 2013), the horsemeat scandal (DIE WELT 2013), or the rotten meat scandals (DIE WELT 2015; FAZ 2005). Negative externalities caused by primary production are often connected with the use of herbicides/pesticides (NAU et al. 2002: 98ff; HOPPE 2013) and nitrogen fertilizing (UBA 2014). Regulatory law aimed at reducing negative externalities is in force in both domains: minimum waiting periods and minimum distance-to-water rules apply to prevent pesticide residues in food and the eutrophication of waters. While the appeal of the law is evidently not always sufficient to prevent profitable rule-breaking, little knowledge is available regarding the question of what makes primary producers break or not break rules under identical conditions. This is due to the high access barriers in the research field of illicit behavior where actors are reluctant to provide information. An effective prevention of rule-breaking requires, however, that regulators understand the causes of compliance and non-compliance with the law.

Objectives and methods: Against the background of pervasive knowledge gaps in the research field of rule-breaking in primary production, we investigate two relevant decision contexts: In *fruit and vegetable production*, we focus on consumer protection and look at the compliance with minimum waiting periods after pesticide use. In *agricultural cash crop production*, we concern ourselves with water protection and look at the compliance with minimum distance-to-water rules when applying nitrogen fertilizer. With this research, we pursue three main objectives. First, in a positive analysis, we want to contribute to a better understanding of compliant and non-compliant behaviors in major fields of primary production where rule-breaking causes considerable negative externalities. Second, in a normative analysis, we aim to identify promising regulatory strategies and prevention measures that foster compliance. Third, in a superordinate methodological endeavor, we want to investigate if interdisciplinary approaches that combine economic and psychological conceptions of man

can make a substantial contribution to a better understanding of compliance behavior. To achieve these objectives, we resort to three different groups of behavioral models:

(1) We assess the explanatory power of various economic conceptions of man and consider both "narrow" and "broad" rational choice approaches (cf., KOROBKIN and ULEN 2000). Narrow rational choice models assume that economic agents are completely rational and strive exclusively for profits. However, agents may pursue multiple goals and, besides profits, strive for social recognition and consistency with their identity and internalized social values (AKERLOF and KRANTON 2010). Multi-goal decision-making can be included in broad rational choice concepts that model utility as a function of multiple goal achievements (cf., e.g., FEHR and GÄCHTER 1998). We investigate the influence of three groups of behavioral factors that foster (+) or hamper (-) compliance: material incentives (+/-), social rewards resulting from external social control (+/-), and the internal satisfaction resulting from behavior in line with internalized norms and identity (+/-). The two non-material behavioral determinants (sources of utility) have been referred to as external and internal "delta parameters" by OSTROM (2005). The concept of delta parameters can be associated with the concept of "protective factors" that reduce the utility of rule-breaking and shield or protect actors from yielding to material temptations (HIRSCHAUER and SCHEERER 2014).

(2) We assess the explanatory power of two psychological conceptions of man: the "personality trait theory" (Big Five personality model; cf., COSTA and MCCRAE 1992) and the "theory of planned behavior" (cf., FISHBEIN and AJZEN 1975, 2010). Personality trait theory tries to explain behavioral differences between individuals by five presumably stable (quasi-permanent) personality characteristics: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness. In contrast, the theory of planned behavior explains behavior as a function of the choices that are available to an individual ("actual control") and her/his intentions. The development of intentions, in turn, is understood as being a function of three theoretical constructs: subjective norm, attitude, and perceived control.

(3) We assess the explanatory power of mixed economic and psychological approaches. The mixed models start from the rationale that the simultaneous existence of rule-abiding and rule-breaking actors is to be explained by the latter being exposed to higher temptations and/or having less "protective factors" that shield them from yielding to material temptations. Complementing this utility-oriented approach, the five presumably stable personality characteristics of personality trait theory are additionally operationalized in regression models that analyze the behavioral determinants of experimentally observed compliant/non-compliant behaviors.

The primary data for the two decision contexts – "minimum waiting periods" (fruit/vegetable production) and "minimum distance-to-water requirements" (agricultural cash crops) – are gathered from two different sources: economic experiments in the form of business management games and questionnaire-based surveys. In the business management games, we gather data on monetary incentives and the corresponding behavior of farmers in experimentally controlled and context-specific decision environments. In addition, we specify various policy scenarios that are used in both contexts. The relative prices attached to the socially undesired choices (rule-breaking) are deliberately kept constant in all scenarios. The scenarios differ, however, with regard to the regulatory measures and the degree of negative externalities resulting from the socially undesired behavior as communicated to the experimental subjects. In an accompanying survey, we collect data on deltas, personality traits, and the constructs of the theory of planned behavior of the farmers. Data on socio-

demographic characteristics (e.g., gender, education) and additional control variables (e.g., for social desirability) are also collected.

The collection of data is followed by an econometric analysis that is based on the three behavioral models described above. That is, for both contexts we carry out several regression analyses. In these analyses, we estimate the dependent variable (experimentally observed behavior) as a function of the variables that represent the hypothesized behavioral determinants of each behavioral model (monetary incentives, deltas, personality traits, intentions). Furthermore, we use structural equation models to detect potentially multi-level and reciprocal causal relationships between endogenous variables.

To check for robustness, we triangulate methods and compare the results of each behavioral model within the respective decision context. To check for the impact of context on behavior, we contrast the results from the two decision environments, "minimum waiting period" (fruit/vegetable production) and "minimum distance-to-water requirements" (agricultural cash crops). The crucial question is whether the frequency of compliant and non-compliant behavior is different in these two fields. If we identify such a difference, we will try to identify the critical contextual features. To identify the commonalities within and the differences between the compliant and the non-compliant groups, we compare the two groups in both contexts.

Subsequently, we carry out a normative analysis to identify effective and cost-efficient regulatory strategies and prevention measures. This requires conditional forecasts based on the different conceptions and methods. A sensitivity analysis provides first indications regarding the extent to which regulators can steer the behavior of food businesses through a variation of various behavioral determinants. Finally, we use our study as a test whether the combination of economic and psychological conceptions of man can contribute to a better understanding of compliant and non-compliant behaviors. This is aimed at the development of a meta-approach in terms of a contextual "method of method triangulation" that improves the regulator's ability to forecast behavioral changes that are likely to be induced by regulatory innovations.

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