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Why do farmers care about rented land? Investigating the context of farmland tenure

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Abstract: Rental shares of agricultural land have increased in many countries, as have soil degradation and erosion. Theory suggests that these trends may be correlated, yet empirical findings are mixed. This ambiguity indicates that a "tenure effect" on conservation may be highly contextual. Our research investigates farmers' soil conservation behavior on rented land and aims to disentangle the contextual factors involved. These factors include rental duration and security, the nature of the landlord-tenant relationship, plot-specific features of the land, formal requirements such as agri-environmental schemes (AES) or contractual obligations, as well as rental prices. We survey Austrian crop farmers and find, *prima facie*, no differences between rented and owned cropland in the application of 16 different soil conservation practices. We also find that, in our sample, renting appears to be secure and long term; there are few cases where landlord-tenant relationships are distant; where rented plots are far from the farmhouse; and most farmers in Austria participate in AES that are applied independent of tenure status. We therefore propose that a purported tenure effect is indeed contingent on the contextual factors listed above, which may support or counteract soil conservation on rented land. Thus, policy makers and extension services can foster soil conservation on rented land by addressing these contextual factors. Points of intervention include designing AES contracts in a way that reduces risks for tenant farmers, supporting secure and long-term renting, encouraging close landlord-tenant relationships, and promoting the inclusion of conservation requirements in rental contracts.

Key words: farmer behavior—landlord-tenant relationship—land ownership—leased land—soil conservation

Farming rented land is an integral part of agriculture and thus a key issue for soil conservation. Although there is substantial variation between countries, rental shares of agricultural land are high in many regions of the world, including the Global North. In several European Union (EU) member states, rental shares have increased in recent decades and exceed 50% in countries such as Germany and France (Ciaian et al. 2012b; European Commission 2020). This is often due to a combination of farm expansion (e.g., the average farm size in the EU-27 countries has increased by 40% from 2005 to 2016 [Eurostat 2018]) and competitive land sales markets (Ciaian et al. 2012c, 2012a). In the United States, rental shares have not changed substantially in recent years, but leasing is nevertheless of great importance: in some states up to 46% of land is rented, and overall 54% of cropland is farmed by tenants (Bigelow et al. 2016; Jackson-Smith and Petrzelka 2014).

There is a general preconception that only farmers who own their land have an adequate incentive to conserve soil and invest in practices that will pay off in the long run. In contrast, farmland renting and several aspects thereof have been seen as barriers to conservation (Soule et al. 2000; Carolan et al. 2004; Ranjan et al. 2019b). Since soil conservation is a global challenge (FAO and ITPS 2015; Montanarella and Vargas 2012), tenure has received scholarly attention as one potential influential factor for farmers' behavior in this respect.

Most research on the relationships between tenure status and farmers' conservation behavior falls into two categories: in one strand of literature, tenure is included as one explanatory variable among others when investigating the adoption of conservation activities. A wide variety of such activities has been examined in this way. Often, the type of measure investigated depends on the region of investigation due to different institutional backgrounds: European studies tend to focus on participation in agri-environmental schemes (AES), where participants receive compensation payments for adhering to specific practices. Studies from other regions, e.g., the United States, often take a broader approach and investigate the uptake of agricultural best management practices (BMP) such as conservation tillage. Although individual studies sometimes find a (statistically significant) relationship between tenure and conservation behavior, several reviews of the evidence do not confirm a consistent effect in any direction. For an overview of such reviews see Lastra-Bravo et al. (2015) on AES adoption in European Union (EU) countries; Prokopy et al. (2008) and Baumgart-Getz et al. (2012) on BMP adoption; Carlisle (2016) and Prokopy et al. (2019) on soil health or conservation practices all in the United States; and Knowler and Bradshaw (2007) as well as Wauters and Mathijs (2014) on soil conservation practices with a more global approach. Only one review of qualitative studies in the United States that investigates the uptake of conservation practices and programs finds that renting of agricultural land is consistently considered a barrier to their adoption (Ranjan et al. 2019a).

The second strand of literature is dedicated exclusively to the investigation of a "tenure effect," aiming to explain either farm management behavior and outcomes (such as investments or efficiency) or soil conservation efforts based on tenure status. Results here are similarly ambiguous. For the Global South, where tenure and in particular the renting of land is often insecure due to weak institutions, results tend to confirm the assumption that increased tenure security fosters long-term productive and environmentally beneficial investments (Lawry et al. 2014; Higgins et al. 2018), but there is also

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contradictory evidence (Place 2009; Fenske 2011). Research from North America dates as far back as the 1930s (Schickele and Himmel 1938), with interest increasing again in the 1980s (Lee 1980; Ervin 1982; Dillman and Carlson 1982; Lee and Stewart 1983; Derr 1987) and since the early 2000s. Already early studies find mixed evidence of a potential tenure effect, with, for example, Lee (1980) finding no effect but Ervin (1982) finding a negative effect of renting on soil loss, and van Vuuren and Ysselstein (1986) finding a negative effect of renting for several conservation measures. Lee and Stewart (1983) find renters to be *more* likely to practice minimum tillage than owners. Later, Cole and Johnson (2002) find no tenure effect for soil loss, whereas Soule et al. (2000) do find an effect for conservation practices such as minimum tillage, as does Fraser (2004) for the planting of soil conserving crops. More recently, Varble et al. (2016) find that tenants are more likely to use conservation tillage than owners, but less likely to rotate crops, and Deaton et al. (2018) find a tenure effect for cover crops, but this effect is contingent on lease length and the farming background of the landlord. For Europe, only a handful of studies exist. Myyrä et al. (2005) and Walmsley and Sklenicka (2017) investigate soil quality parameters for Finland and the Czech Republic, respectively, and find a negative tenure effect. Sklenicka et al. (2015) find a negative effect of renting on crop choice in the Czech Republic, while Leonhardt et al. (2019) find only very small effects for crop choice in neighboring Austria.

Thus, the literature to date appears inconclusive regarding the conventionally assumed negative effect of cropland renting on soil conservation. One lesson that can be drawn from this is that a potential tenure effect is probably highly contextual, depending on the farming practice under question, the region investigated, as well as details of renting, among other factors. Details of rental arrangements are taken up in few studies, including differentiating between share renters and cash renters (Ervin 1982; Soule et al. 2000), considering information on lease length (Fraser 2004; Deaton et al. 2018), or focusing on absentee landlords (Petrzelka et al. 2013; Petrzelka and Armstrong 2015) and how they and their relationships with tenants differ from residential landlords (Dillman and Carlson 1982; Ulrich-Schad et al. 2016). In addition, other aspects such as the personal relationship between landlords and tenants have been investigated in the context of rental prices (Bryan et al. 2015; Taylor and Featherstone 2018), but have also been suggested as a potentially important aspect for conservation by Carolan (2005) and Leonhardt et al. (2019). A more comprehensive investigation of these contextual factors within one study is, however, missing from the literature. Moreover, most studies focus on a single or a small number of conservation measures, disregarding that farmers may apply several measures at once.

Our study considers a wide array of different practices as well as several contextual factors of renting. In particular, this study aims to answer the following research question: which contextual factors potentially support or counteract an effect of tenure on soil conservation? As no secondary data that cover such information are publicly available, we collected data via a questionnaire survey with Austrian part-tenant farmers, i.e., farmers who farm both rented and owned land. We first examine this data set with respect to the existence of a tenure effect for a variety of soil conservation practices. We then investigate several circumstances of leasing and their potential for supporting or counteracting an effect of tenure on conservation practices. These include the length and security of rental, characteristics of the landlord-tenant relationship, and plot-level features of the land. We thus provide an unprecedented level of detail, which, we hope, will clarify previous investigations of the topic and help refine theoretical considerations of tenure and soil conservation.

The underlying theoretical model can be described as follows: tenure is one determinant of the soil conservation practices that farmers apply on their arable land. We focus on renting (where landowners transfer part of their rights to a tenant for a limited period of time) as opposed to full ownership. In line with the literature mentioned above, we hypothesize that farmers are less concerned about soil conservation on rented plots than on plots they own and thus apply fewer soil-conserving practices. Due to the shorter planning period associated with a lease, renters are less likely than owners to reap the benefits of conservation investments, particularly those with a long pay-back period. However, we further assume—and know from previous research—that the following factors may influence the existence or intensity of this tenure effect: the length and security of renting (Deaton et al. 2018), plot characteristics such as its distance to the farmhouse or farming difficulties (e.g., sloping land and soil quality) (Deaton et al. 2018; Leonhardt et al. 2019), the rental price (Ranjan et al. 2019b), and the relationship tenants have with their landlords (including kinship or other personal ties as well as whether the landlord is residential or absentee) (Ulrich-Schad et al. 2016; Bryan et al. 2015; Taylor and Featherstone 2018; Leonhardt et al. 2019). In addition, we posit that conservation requirements specified in the rental contract may also influence a tenure effect (Derr 1987), as may farm-level aspects such as participation in AES that need to be applied to an entire farm operation (Sklenicka et al. 2015).

Materials and Methods

We conducted our study in Austria, a country that follows the general trend of structural change in agriculture with increasing farm sizes and increasing rental shares. A particularly interesting feature of Austrian agriculture is a strong focus on sustainable farming techniques, including comparably high shares of organic farming and strong support for and uptake of voluntary AES (BMLFUW 2019). This section introduces the particularities and developments of the Austrian agricultural sector as well as our questionnaire design, data, and methods of analysis.

Study Area: Austria. In the past decades, the number of farms in Austria has decreased steadily, while the utilized agricultural area (UAA) per farm has increased from 12.6 ha in 1990 to 19.7 ha in 2016 (BMLFUW 2017). Compared to many other European countries with a similar historical and economic development, Austrian agriculture, however, remains relatively small scaled. This is mostly due to the alpine nature of Austria's geography, which also makes crop production predominant only in the country's relatively flat northeast and southeast. Austria's accession to the EU in 1995 has not altered the ongoing trend toward larger farms, but has changed the institutional setting of subsidies and AES. Austrian agricultural policy is now guided by the Common Agricultural Policy (CAP) of the EU with its two pillars of production support (first pillar) and rural development (second pillar). Payments from the first pillar are based on a farms' land area and tied to compliance with so-called

"greening" requirements (keeping permanent grassland intact, growing more than a single crop, and taking 5% of cropland out of production for flower strips, fallow, etc.). Being part of the second pillar, AES are of major importance for Austrian farming: both payment levels as well as participation rates are among the highest in the EU (Zimmermann and Britz 2016). Farms can select from over 20 different schemes with various environmental and societal objectives and differing intensities (BMLFUW 2015). Per-hectare payment levels are designed to compensate farmers for additional costs or losses caused by the practice. In 2018, 83% of all farms that received any subsidies (which 86% of farms, farming over 99% of Austrian cropland, do; Hofer and Gmeiner 2012) received AES payments for, on average, three different schemes per farm (BMLFUW 2019). Farmers usually sign up for these schemes for a period of five or six years within a given CAP period.

Renting of agricultural land is of increasing importance for Austrian farmers, and for crop farmers in particular. Between 1960 and 2010, the amount of rented land has almost tripled (Holzer et al. 2013) and amounted to 39.2% of UAA in 2012, the last year where this information is available. The share of part-tenants has increased from 41.9% in 2001 to 69.6% in 2012 (BMLFUW 2002, 2013). Full tenants who do not own any of their land are rare; in 2010, 6% of farmers rented all their land according to the farm structure survey (Statistik Austria 2010). The share of rented land varies by region, ranging from 24.6% in the mountainous midwest to 63.6% in the east, and is higher for cropland (43.8%) than for grassland (32.7%) (BMLFUW 2013; all data are for 2012). Fixed cash rental arrangements are predominant, with sharecropping being virtually inexistent. As data on rental prices, contract durations, or other contract specifics are not centrally collected or published, we do not have any a priori information on these factors. The law on agricultural land renting includes nonbinding "reference durations" of 5 to 15 years for the renting of different types of agricultural land as well as the concept of an "adequate rent," both of which serve primarily as reference points for conflict resolution (Holzer et al. 2013).

Data Collection. As part of a larger project on renting and ownership of cropland in Austria, we designed an online questionnaire for Austrian farmers participating in the farm accountancy and data network (FADN). This network is used to gather annual micro-economic data for official reports at the EU level. The FADN is designed to be representative of "commercial" farms, thus only farms with a standard output (a measure of a farm's production potential) between 15,000€ and 750,000€ are eligible. These eligible farms are representative of around 50% of all farms, but over 90% of all farms' economic activity and 93.5% of cropland (BMLFUW 2018). Out of the 76,056 eligible farms, 1,897 were part of the FADN in 2017 (AWI and BMLFUW 2018). Farms are selected into the network based on strata that reflect different farm types, economic size classes, regions, and mountain farm classification categories (reflecting different levels of natural handicaps). Participation is voluntary, but initiated by extension services.

Data collection for the FADN is administered by an Austrian tax and accountancy consultancy firm on behalf of the federal ministry. This firm assisted us in pretesting the questionnaire, identifying and contacting farmers, disseminating the questionnaire, and ensuring an adequate response rate. We invited those 1,147 FADN-farmers who farmed at least 5 ha of cropland and rented part of this land to participate in the study in winter and spring 2017/2018. Farmers were contacted first via email, with two reminders sent out. In addition, regional FADN advisors contacted and encouraged farmers who had not responded yet via phone and during their annual farm visits, which take place during winter/spring. Where necessary, these advisors also assisted with completing the questionnaire during farm visits. Using such different modes of contacting and surveying respondents contributes to adequate response rates and representativeness (Stern et al. 2014). Since contact details (email addresses, phone numbers, and addresses) remained with the consultancy firm for data protection reasons, we did not conduct any additional nonresponse bias checks. A total of 344 fully completed questionnaires were returned, 1 of which had to be excluded since the respondent did not rent any cropland at the time of the survey. This response rate of over 31% ensures reasonable statistical power (Faul et al. 2007). For those analyses that compare rented and owned plots directly, we excluded another 5 respondents as they did not own any of their cropland.

Table 1 compares respondents and nonrespondents based on economic indicators from the official FADN data set. While respondents were required to enter their 5-digit FADN ID for completing the survey, only 300 provided a correct ID that could be

Table 1
Comparison of survey respondents' and nonrespondents' characteristics and arithmetic means.

Variable	Nonrespondents	Respondents†	Significant difference in median‡
n	847	300	—
UAA (ha)	46.40	52.56	**
Share arable land (of UAA) (%)	74.30	81.05	**
Rental share (of UAA) (%)	39.48	46.28	***
Livestock ha^{-1} (LU)	1.28	1.23	—
Capital ha^{-1} (1,000€)	11,532.35	9,917.45	***
Labor ha^{-1} (AWU)	0.05	0.04	**
Income ha^{-1} (€)	1,126.39	1,048.68	—
Productivity (inputs/outputs)	1.16	1.13	—
AES payments ha^{-1}	159.68	168.81	—
Fertilizer ha^{-1} (100 kg)	0.92	0.94	—
Payments for LFA ha^{-1}	51.53	39.33	—

Notes: UAA = utilized agricultural area. LU = livestock unit. AWU = annual work unit. LFA = less favored area.

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

†Only those who provided a correct farm accountancy and data network (FADN) ID.

‡Test for significance in differences: Wilcoxon rank-sum test for non-normally distributed data.

Table 2
List of soil conservation practices considered in the survey and existence of respective agri-environmental schemes (AES).

Practice	Nationwide AES
Applying compost	None
Conservation tillage (including no-till, strip-till, and mulch till)	Specific AES (all erosion-prone crops of the farm)
Creation of wind protection elements (e.g., hedgerows)	None
Cultivation of cover crops—"Intercropping"	Specific AES (on 10% of cropland)
Cultivation of cover crops—"Evergreen"	Specific AES (on 85% of cropland)
Cultivation of winter-hardy cover crops	Option in both cover crop AES
Diversified crop rotation	Minimum crop rotation part of Common Agricultural Policy greening and AES
Not applying fertilizer	Reduction or seasonal prohibition of synthetic fertilizer part of several AES
Not applying fungicides and growth regulators	Specific AES (all plots with cereals)
Not applying pesticides	Reduction or seasonal prohibition part of several AES
Not applying sewer sludge	Part of AES in designated groundwater protection regions during specific time periods
Organic farming	Specific AES (entire farm operation)
Precision farming	No AES, but investment subsidies may apply
Preservation of valuable landscape elements	Part of AES (if present)
Regular soil sampling	Part of AES in designated groundwater protection regions
Use of machinery that prevents soil compaction	None

matched to the FADN data set for this comparison. Survey respondents farmed larger farms and had a higher share of arable land and rented land than nonrespondents. This is possibly due to our focus, which may have made specialized crop farmers (which tend to have a larger UAA than farms with livestock) with higher shares of rented land more likely to reply or be approached by FADN advisors. Respondents were also less capital and labor intensive than nonrespondents; however, this is related to their larger UAA (capital and labor endowments were not significantly different between both groups). Thus, given the sampling criteria and topical focus, our survey participants appear not to differ significantly from all FADN farms in terms of economic indicators.

Questionnaire Design. Our questionnaire consisted of three main parts and took participants about 20 to 30 minutes to complete. All relevant parts of the questionnaire can be found online: https://homepage.boku.ac.at/leonhardth/JSWC_questionnaire/. Part one contained general questions on the leasing of cropland, including the amount of land rented, its distance to the farmhouse, from whom it was rented, and rental conditions (type of contract, length of rental, specific requirements, and rental price).

In part two, respondents were asked to consider a typical rented and a typical owned plot of cropland that they farmed and provide further details. We asked them to select plots that were, in their opinion, representative of the majority of plots they rented or owned. Focusing on specific plots was necessary to investigate plot-specific features and because Austrian farmers usually rent a number of plots from several landlords. For these "typical" plots, respondents were first asked to state for each of the practices listed in table 2 whether they applied it on each of the plots with compensation, without compensation, or not at all. Table 2 also shows whether any nationwide AES support these practices, but does not list regional or local schemes or legal restrictions. Second, respondents were asked to provide some characteristics of their typical rented and owned plots, including farming difficulties (steep slopes, poor soil quality, and protected area), their distance to the farmhouse, and farmers' relationship with the owners (of rented plots) or previous owners (of owned plots).

In the third part of the questionnaire, we asked respondents about their observations of other farmers' conduct on rented and owned land—a topic that had come up in previous interviews. We asked respondents to indicate whether and why they thought others did or did not treat rented land differently than owned land in several closed questions, with the option to provide more information in a text field.

The final part of the questionnaire gathered some demographic information and included an open-ended question to give respondents the possibility to raise any additional aspects of renting and soil conservation that they thought were important or missing. Providing interesting additional information, 83 (24%) respondents made use of this opportunity.

Data Analysis. To analyze the existence of a tenure effect, we compare respondents' stated soil conservation practices on their typical rented and owned plots. To assess the statistical significance of differences we use a McNemar's test statistic (McNemar 1947), which determines whether the proportion of farmers applying the practice only on their rented plot equals the proportion of farmers applying the practice only on their owned plot. In addition, we create a simple aggregate index of management differences by summing up the number of practices applied on the typical rented plot and subtracting the number of practices applied on the typical owned plot. We use descriptive statistics (counts, percentages, and means) to analyze respondents' observations concerning other farmers, as well as a content analysis of the corresponding open-ended questions (details below).

To analyze contextual factors of renting, we consider the rental conditions of the typical plots, the information gathered on the circumstances of renting in general, and the answers to the corresponding open-ended questions. We compare plot-related variables (distance to the farmhouse and farming difficulties) for farmers' typical rented and owned plots, using Wilcoxon signed-rank tests (for the continuous and nonnormally distributed variables) and McNemar's test statistics (for

the yes/no variables on the presence of specific farming difficulties). We use an analysis of variance (ANOVA) and Tukey's honest significance test (Tukey 1949) to examine how the aggregate index of management differences differs by landlord–tenant relationships. To describe general rental conditions that may influence a potential difference between renting and ownership as well as respondents' observations relating to other farmers, we use descriptive statistics (counts, percentages, and means) of quantitative responses and a content analysis of qualitative responses.

All responses to the open-ended questions are analyzed using content analysis with inductive coding (Mayring 2015). We code all relevant answers and group them into two categories, corresponding to our main research interests: "differences between rented and owned plots" and "contextual factors that explain (the lack of) differences." Codes are specific practices or contextual factors and are simply listed in the results.

All quantitative data handling and analysis was conducted with R (R Core Team 2018) using base functions and the data.table package (Dowle and Srinivasan 2019); figures and graphs were produced using the package ggplot2 (Wickham 2016). The software package atlas.ti was used for qualitative data analysis.

Descriptive Information. Table 3 lists demographic characteristics of survey respondents as well as basic information on their rental contracts. Respondents were slightly older than the national average according to agricultural beneficiaries data (especially farmers between 50 and 59 were overrepresented in our survey [42%] compared to all beneficiaries [35%]); and fewer women participated (13%) than would be expected (officially, 26% of all farms are operated by women, which may, however, be biased upward due to retirement insurance reasons; BMLFUW 2018). Concerning other characteristics, our sample is either by design not representative of the general farming population (only farms with rented and arable land), or no data for comparison are available (information on education and rental contracts). The data participants entered in the survey do not fully match up with data from the FADN for the amount of arable land farmed, which may be due to the way this number is calculated in the FADN (as a sum of several subcategories). Among survey participants, most rental contracts were written contracts and most land was rented in exchange for monetary rent.

Table 3
Respondents' personal and farm characteristics as stated in the questionnaire

Variable	Value
Mean age (min-max)	49 (19 to 69)
Mean years farming experience (min-max)	21 (<1 to 57)
Gender: male (%)	87
Level of education (*n* [%]):	
Compulsory school	11 (3)
Apprenticeship	25 (7)
Specialized agricultural education	79 (23)
Master craftsman (agricultural or other)	146 (43)
Matura (degree permitting university entrance)	60 (17)
University/technical college	19 (5)
Rented arable land in ha, mean (median)	25.3 (14.1)
Owned arable land in ha, mean (median)	24.3 (20)
Rental share of arable land in %, mean (median)	44 (43.48)
Rental contracts (% rented land):	
Written without help	46
Written with help (extension services, notary, etc.)	35.5
Verbal	18.5
Rent type (% rented land):	
Monetary rent	92.5
Nonmonetary benefits	2.2
No compensation	5.2
Rent paid in € ha^{-1}, mean (median)	354 (300)

The majority of respondents were from those federal states of Austria where arable land is prevalent: Lower Austria (151), Styria (59), Upper Austria (47), and Burgenland (30). The remaining 13 identifiable survey respondents were from the states in Austria's mountainous west and south (only those with a correct FADN ID).

Results and Discussion

The Existence of a Tenure Effect. Table 4 reports the responses for each soil conservation practice for both "typical" plots. The first column shows the number (and share) of respondents who applied the respective practice on both their plots and received subsidies for doing so. The second column similarly shows the number of farmers who applied the practice on both plots, but without subsidies. The third and fourth column report numbers of respondents who applied the practice on neither of their typical plots and on only one of the plots, respectively. The following columns provide more details for the latter case, showing whether farmers applied the practice on only their rented (column five) or owned (column six) plot, and whether there is a statistical significance between those two numbers (last column). We do not show all potential answers in table 4, as there were very few cases where a practice was applied with subsidies on one of the plots and without subsidies on the other (percentages per row do not sum to 100 for this reason). In addition, we do not show whether those who made a difference between rented and owned land applied each practice with or without subsidies, as respondents made very few differences between rented and owned plots in general (see next paragraph). A test for marginal homogeneity over all answer categories confirms that there are no statistically significant differences between the two plots that are based on the distinction between subsidized and unsubsidized. We therefore collapse the "yes, subsidized" and "yes, unsubsidized" categories into one "yes" category for all further analyses.

We see that the most frequent soil conservation practices applied on both rented and owned plots were crop rotation (94.4%) and intercropping (cover crops on 10% of a farm's cropland) (81.1%). In contrast, 92% of respondents indicated not creating wind protection elements on either rented or owned plots, and just over 85% indicated not using

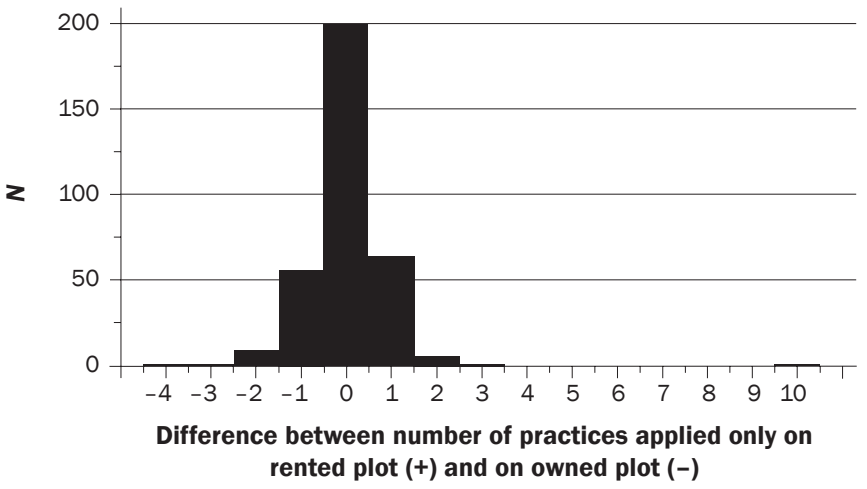
Table 4
Comparing farmers' conservation practices on their typical rented and owned plots.

Which soil conservation practices do you apply on your typical rented/owned plot?	Stated soil conservation practices						Test statistics
	On BOTH subsidized	On BOTH unsubsidized	On NEITHER	On EITHER	On rented only	On owned only	Matched pairs
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n*	*n*	χ^2 (*p*-value)
Compost	4 (1.2)	26 (7.7)	289 (85.5)	18 (5.3)	8	10	0.05 (0.81)
Conservation tillage	136 (40.2)	23 (6.8)	163 (48.2)	12 (3.6)	8	4	0.75 (0.39)
Crop rotation	164 (48.5)	137 (40.5)	11 (3.2)	8 (2.4)	3	5	0.12 (0.72)
"Evergreen" cover crops	72 (21.3)	22 (6.5)	234 (69.2)	8 (2.4)	3	5	0.12 (0.72)
Intercropping	246 (72.8)	20 (5.9)	48 (14.2)	16 (4.7)	7	9	0.06 (0.8)
Landscape elements	110 (32.5)	22 (6.5)	148 (43.8)	50 (14.8)	23	27	0.18 (0.67)
No fertilizer	47 (13.9)	6 (1.8)	277 (81.9)	7 (2.1)	6	1	2.28 (0.13)
No fungicide	83 (24.6)	27 (8.0)	212 (62.7)	11 (3.3)	5	6	0 (1)
No pesticide	50 (14.8)	9 (2.7)	264 (78.1)	10 (3.0)	5	5	0 (1)
No sewer sludge	47 (13.9)	107 (31.7)	148 (43.8)	27 (8.0)	20	7	5.33 (0.02)*
Organic farming	76 (22.5)	1 (0.3)	256 (75.7)	5 (1.5)	2	3	0 (1)
Precision farming	8 (2.4)	34 (10.1)	290 (85.8)	4 (1.2)	2	2	0 (1)
Soil protecting machinery	19 (5.6)	82 (24.3)	213 (63.0)	13 (3.9)	5	8	0.31 (0.58)
Soil samples	37 (10.9)	129 (38.2)	134 (39.6)	28 (8.3)	14	14	0 (1)
Wind protection elements	4 (1.2)	7 (2.1)	311 (92.0)	14 (4.1)	5	9	0.64 (0.42)
Winter-hardy cover crops	56 (16.6)	22 (6.5)	239 (70.7)	15 (4.4)	11	4	2.4 (0.12)

Note: Percentages in one line do not sum to 100 as not all possible combinations are depicted.
*$p < 0.05$.

precision farming, and not applying compost. Concerning subsidized and unsubsidized practices, we cannot assess whether AES had an impact on the uptake of measures since not all AES are applicable to all farms. However, we see that, for example, the three practices with the highest share of respondents in the "on neither" column are all practices for which no AES exist. Conversely, the practices with the smallest share of respondents in this column are a diversified crop rotation and intercropping, two practices that are part of the two most widespread AES for crop farmers. Turning to columns 5 to 7, the results show that respondents very rarely indicated applying different soil conservation practices on their typical rented and owned plots. Looking at the number of respondents who applied different practices on rented and owned plots, we see that preserving valuable landscape elements (14.8%), taking regular soil samples (8.3%), and not applying sewer sludge (8%) were the most commonly mentioned. However, there appears to be no clear direction of differences for the former two practices—similar numbers of respondents indicated applying them on their rented or owned plot only. Not applying sewer sludge on plots is the only practice where we see a statistically significant difference at the 5% level: 20 farmers refrained from using sewer sludge only on their typical rented plot, while 7 did so only on their typical owned plot.

Figure 1
Distribution of the aggregate index of management differences between rented and owned plots. Zero means the same number of practices is applied on both typical plots.



For further analyses, we create an aggregate index of management differences (the number of practices applied on the typical rented plot minus the number of practices applied on the typical owned plot). Figure 1 shows the distribution of this index, confirming again that there is no clear direction of differences: a majority of farmers applied the same number of practices on both their plots (index = 0), and similar numbers differed by one (or more) practices in either direction (i.e., a similar number of respondents applied one more practice on their rented plot than on their owned plot as the

other way around). The outlier at +10 stems from a farmer who stated that he applied 10 of the listed practices only on his rented plot.

Looking at farmers' observations about *other* farmers, 104 out of the 343 respondents (30.3%) stated that others did apply different practices on rented and owned plots, whereas 239 (69.7%) stated that they did not observe any differences. Those who observed a difference were presented with a number of practices and could select whether they thought others applied each practice more, less, or equally on their rented plots compared to owned plots. Respondents mostly observed less careful soil tillage (83), less prevention of soil compaction (65), and a less diversified crop rotation (63) on rented fields (figure 2). Those 25 farmers who observed "other" differences were asked to provide more detail in a text field. They mentioned that others, on their rented land, cultivated soil that was too wet, neglected liming, used less cover crops/catch crops, and focused on "short-term profit" and "intensively getting everything out of it." The topic also recurred in the open-ended general question at the end of the questionnaire. Here, farmers mentioned differences in liming and the application of phosphorus-potassium (P-K) fertilizer to the detriment of rented lands, as well as more humus formation on rented plots compared to owned plots.

Considering these results, we see a surprising discrepancy between respondents' self-reported practices (no differences between rented and owned land) and their perceptions about others (almost one-third of respondents observed differences). As a previous study of agricultural land tenure in Austria has also found a very limited tenure effect based on secondary data that are subject to external cross-checking (Leonhardt et al. 2019), we tend to give greater credence to farmers' self-reported behavior than to their observations about others. However, this finding also shows some important limitations of our approach, which we discuss further below. Before doing so, however, we turn to our main research aim: the potential explanations about why or under which circumstances rented land might be treated differently from owned land.

Contextual Factors: The Circumstances of Renting. For our quantitative analysis of contextual factors that may influence a tenure effect, we compare the typical rented and owned plots with respect to their characteristics and relate these characteristics to the indicator of soil management practices introduced above (figure 1). First, the typical owned plots were on average closer to the farmhouse (mean distance 1.9 km) than rented plots (3.3 km). This difference of 1.4 km is statistically significant ($p < 2.2e^{-16}$). However, there is no statistically significant relationship between the distance of a rented plot to the farmhouse and the aggregate index of management differences ($p = 0.415$).

Second, we used three items to assess difficulties farmers are often confronted with on their land and which might force them to apply specific soil conservation practices: steep slopes, protected area, and poor soil quality. Table 5 depicts the prevalence of these difficulties on respondents' typical plots. While some respondents had to deal with difficulties on some of their plots, we do not find any statistically significant differences in the proportion of difficulties between rented and owned land.

Third, we asked about respondents' social ties with the owners (of rented plots) or previous owners (of owned plots) of their plots. We see that only 4.4% of our respondents indicated renting their typical rented plot from landlords they did *not* know personally or from a company or organization. All other farmers rented from family/relatives (20.4%) or landlords they otherwise knew personally (75.1%). All respondents acquired their typical owned plot either from a previous owner they knew personally, such as family/relatives (95.3%) or others (4.7%).

Figure 2
Observations about other farmers' practices on rented land. Only includes responses of participants who observed different soil conservation behavior by others on rented and owned land.

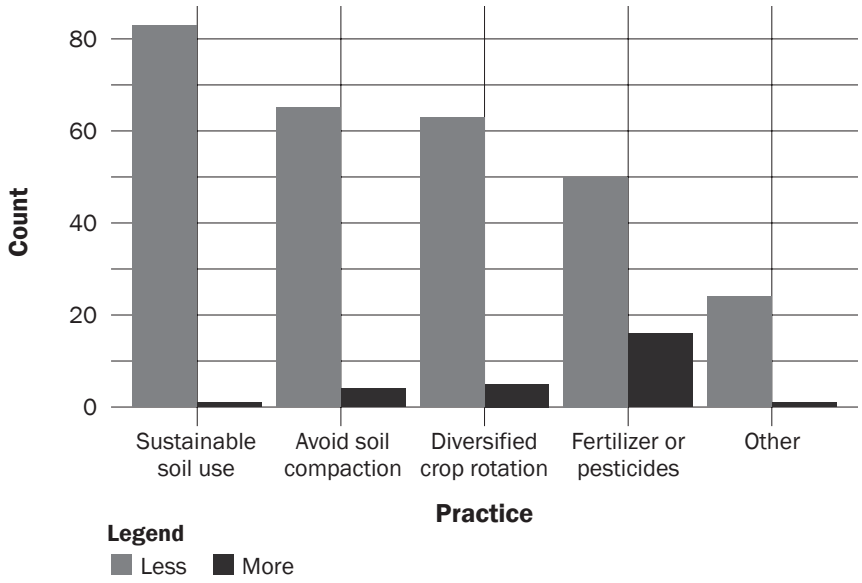


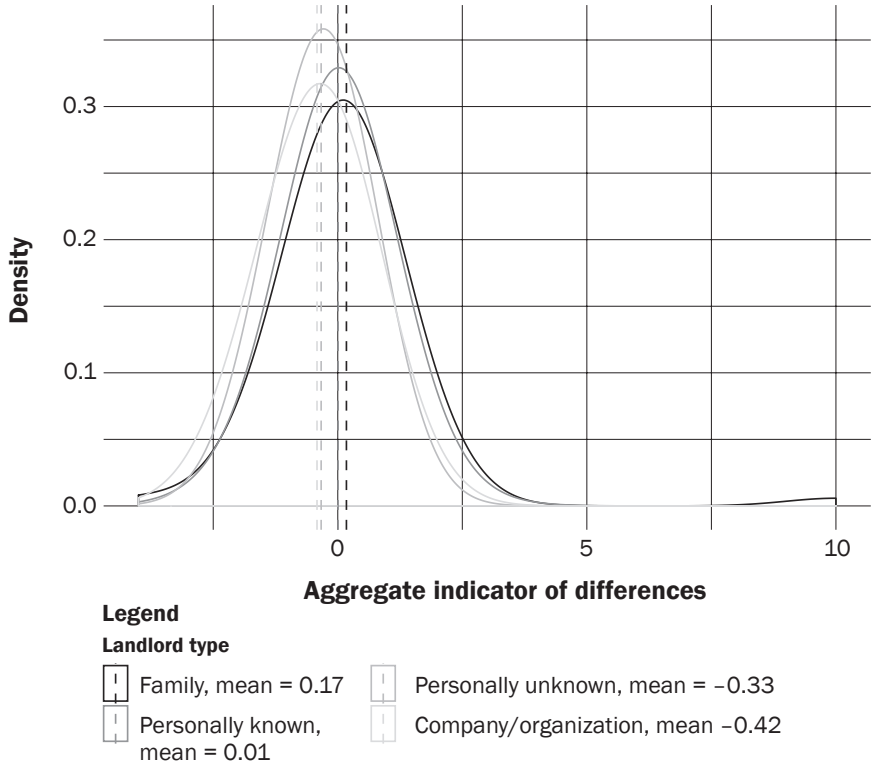
Table 5
Prevalence of plot related difficulties on rented and owned plots.

Are you confronted with specific difficulties?	Stated difficulties: On BOTH	On NEITHER	On rented only	On owned only	Test statistics
	n	*n*	*n*	*n*	χ^2 (*p*-value)
None	218	86	17	17	0 (1)
Slope	68	237	13	20	1.09 (0.30)
Protected area	18	310	3	7	0.9 (0.34)
Poor soil quality	49	253	17	19	0.03 (0.87)

Thus, whether rented or owned, farmers had close social relations with their landlords or previous owners. To test whether this relationship has an impact on conservation measures, we investigate whether the indicator of management differences between the two typical plots (figure 1) varies by landlord-tenant relationship type. The grouped density plot in figure 3 shows that the arithmetic means of the aggregate index do vary by relationship type as expected: the closer the landlord-tenant relationship, the more practices were applied on the rented plot compared to the owned plot and vice versa. However, these differences are not statistically significant between any two of the four groups according to an ANOVA ($p = 0.199$) and ensuing Tukey's honest significance test.

Due to the lack of substantial and directional differences between rented and owned plots regarding characteristics of as well as practices applied on these plots, further comparative and multivariate analyses of the plot-related data did not reveal any statistically significant relationships. We thus do not display any results of such further analyses and models here. However, the more general descriptive and qualitative information from the other parts of the questionnaire that we present in the following provides additional insights.

Figure 3
Density plot of the aggregate indicator of management differences (cf. figure 1) by landlord-tenant relationship type.



First, we consider the general information on rented cropland that respondents provided in the first part of the questionnaire. This confirms that most of the respondents' rented cropland was typically close to their farmhouse, with 84% of all rented land being within 5 km, and an additional 12% within 10 km of the farmhouse location. Only 4% and 0.5% of rented cropland were between 10 and 20 km, or more than 20 km away, respectively. Moreover, and confirming the results for the typical rented plots, 48% of respondents indicated that they rented some land from family, with the average respondent renting 22.4% of their rented land from family. The majority of rented land, 71.2%, was rented from people that farmers knew personally (90% of respondents rented some land from this category of owners), and only 1.6% and 4.6% of rented land were owned by landlords not personally known and by organizations or companies, respectively.

In addition, cropland renting appeared to be very secure and long term for most farmers. A total of 72.2% of rented land was under contracts with unlimited duration (with 85% of respondents indicating that they rented at least some cropland under such contracts). Further, 15% of rented cropland was under five-year contracts, 7.9% under limited contracts longer than five years, and only 3.7% under shorter contracts. Of those respondents who had some land under limited-duration rental contracts, 91% indicated that they expected to "likely" (40%) or "very likely" (51%) have their contracts renewed after the end of the rental period (further, 8% were neutral and only one respondent considered it very unlikely that his/her contract would be extended).

Considering that landlords may require tenants to use or refrain from particular practices, we asked respondents whether this was the case for any of their rented land. Most (92%) indicated no such requirements by landlords; 6% (22 participants) reported a prohibition of applying sewer sludge, and five were required to avoid soil compaction, while taking soil samples and enhancing the humus-content of soil were each mandatory for three respondents. Two farmers indicated in a text field of the survey that their landowners required them to plant legumes or not plant silage maize (*Zea mays* L.), others reported particular requirements tied to specific landscape elements, water protection, or compensation areas. Looking at those 22 participants who were prohibited to use sewer sludge on some of their rented land, we find that none of these 22 respondents stated that they refrain from sewer sludge use on their rented plot only. On the contrary, 2 out of the 27 respondents who differed between their rented and owned plot with respect to sewer sludge stated that they refrain from the use of sewer sludge on their typical *owned* plot only, thus applying sewer sludge on their typical rented plot. Therefore, contractual requirements do not provide an explanation for the one practice where we find a significant effect of tenure on its application.

Second, we turn again to the observations that respondents made about other farmers' soil management. Figures 4 and 5 present the frequencies of answers to the closed questions on reasons why others did or did not make a difference between rented and owned land. We see that those who did think that others treat rented land differently than owned land largely believed that this was due to short or insecure rental, followed by a large distance

Figure 4
Explanations for a tenure effect in other farmers' behavior. Only includes responses of participants who observed different soil conservation behavior by others on rented and owned land.

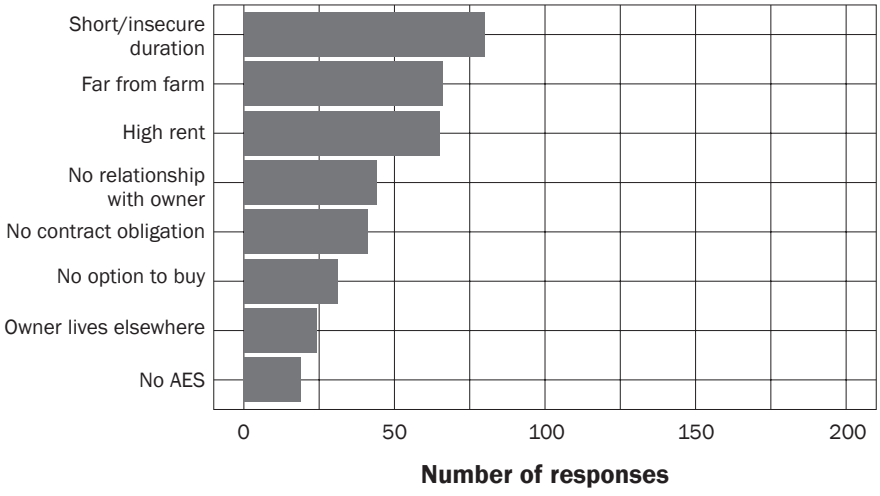
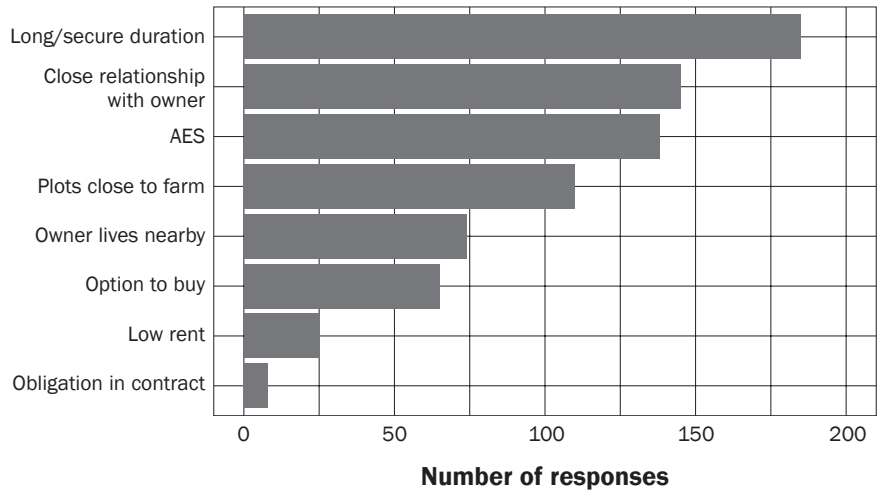


Figure 5
Explanations for the lack of a tenure effect in other farmers' behavior. Only includes responses of participants who observed the same soil conservation behavior by others on rented and owned land.



between the farmhouse and rented plots, high rental prices, no close relationship with landowners, and no contractual obligations to take care of rented land. In the text field, some respondents added that other farmers wanted to keep costs down or that treating rented land worse than owned land was due to ignorance by tenants as well as landowners. Those respondents who thought that others treated rented and owned land equally mainly believed that this was due to long and secure rental, close social relationships with landowners, participation in AES, and distances between plots and the farmhouse being similar. Additional arguments provided in the text field were that only good soil use ensured good yields and income, that it was easiest to use the same machinery, crop rotation, and work program on the entire farm, independent of tenure, that plots were often contiguous or even swapped between farmers, such that ownership status was blurred, and that it was a general principle for other farmers to treat all soils well.

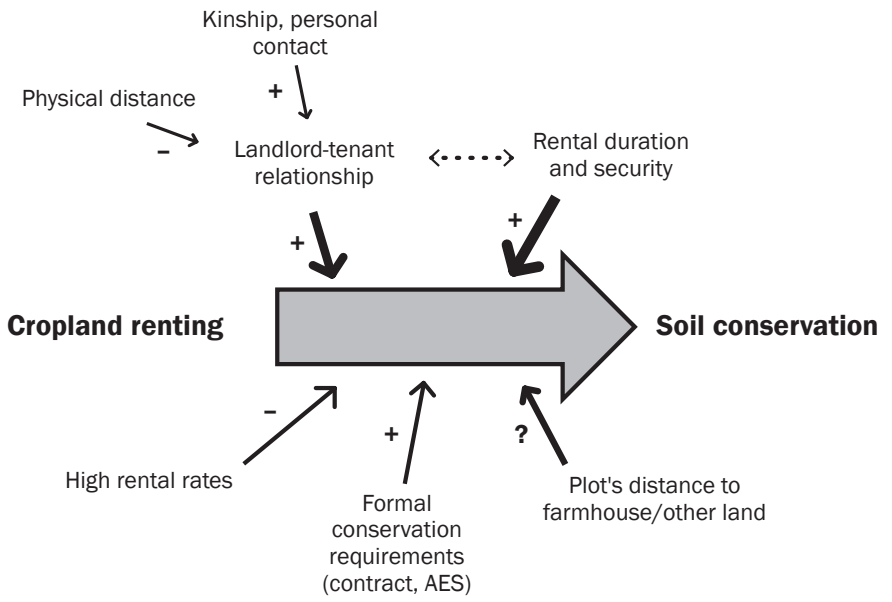
Third, the arguments provided in the open-ended question at the end of the questionnaire on why rented and owned plots were treated differently included the distance between farmhouse and the plots, and that "on owned soils the owner = operator takes on more responsibility. When the owner is someone else, for sure some responsibility for the soil is lost." Others provided rationales for why they themselves or others made no difference based on tenure, including again the argument that treating the soil well is important for yields and earnings, that long-term contracts lead to similar treatment, that plots were contiguous and sometimes swapped between farmers, and that the general principles and attitudes of a farmer were more important than property status as illustrated by this quote: "I treat every soil (whether rented or owned) the same! This is where our food grows, and we should take proper care of this soil!"

While not directly explaining the *differences* between rented and owned plots, another line of reasoning was recurrent in the answers to the final open-ended question: if landlords' main focus is to receive the highest rent possible, they may rent their land to farmers who are less careful in their soil use than others, either because these tenants are then subject to strong economic pressures or because they generally do not have a conservation mindset. Two quotes illustrate this to the point: "The landlord decides whether rented plots are treated decently. If you always want to achieve the highest rent … you have to live with the fact that the tenant will by necessity need to "exploit" the soil, as otherwise he will have to put money into it [i.e., make a loss]," and "High rents evoke an exploitation of the soil—but mostly by farms that do the same on their own plots."

Our Findings in Context. Figure 6 summarizes the main factors that we identified as influential for the (non-)existence of a tenure effect. The "+" and "–" signs indicate the hypothesized direction of the influence, and line thickness indicates how important we believe each factor to be in comparison to the others. The "?" indicates that the direction of this factor's influence is unclear.

First, rental security and long-term rental periods appear to be major factors that counteract a negative effect of renting for soil conservation. This confirms previous studies

Figure 6
Hypothesized influences on tenure effect, including suspected importance (line thickness) and direction (+/–/unclear).



(Deaton et al. 2018; Ranjan et al. 2019b), makes intuitive sense, and is a major reason why many countries have legal minimum rental periods for agricultural land (Ciaian et al. 2012d), providing tenant farmers with a longer planning horizon. Despite a lack of such (binding) regulations in Austria, we find that leasing appears to be secure and long term for our respondents, perhaps due to close landlord-tenant relationships (see next paragraph). In addition to secure renting, tenants may sometimes have the option to buy their rented land in the future, extending the time horizon for this land even further. With such prospects for rented land, investments into its soil quality make economic sense for farmers just like for their owned land. The respondents of our questionnaire frequently raised this argument themselves in their comments: only good treatment of the land ensures good yields and earnings in the long run.

Second, a mechanism that has both an influence on rental security as well as on how farmers treat their land is the relationship between landlords and tenants. In our sample, tenants mostly knew their landlords personally. Additionally, a substantial number of respondents even rented land based on verbal agreements, requiring a certain level of trust that most likely requires knowing each other personally. In general, a close personal relationship increases mutual trust and commitment, and thus may implicitly enhance rental security as well. Other studies have found an impact of the relationship between the contractual partners on aspects such as land sales prices, land rental prices, and rental contract type (Perry and Robinson 2001; Bryan et al. 2015; Taylor and Featherstone 2018), confirming that this relationship is an important contextual factor.

In addition to this general mechanism, recent literature suggests that it may make a difference for tenants' conservation behavior whether their landlords live close by or far away: absentee landlords have been found to differ from residential landlords, with consequences for conservation measures (Petrzelka and Armstrong 2015; Ulrich-Schad et al. 2016). The physical distance between landlord and tenant may not only have an impact on the personal relationship between both parties but also on how closely landowners can monitor farmers' conduct. The further away a landlord lives from the land they rent out, the more distant the personal relationship between them and the tenant may be, and the less likely it is that the landlord can observe what the tenant does. This may, in turn, have an impact on tenants' behavior and care—a principal-agent problem, where the principal (the landlord) cannot fully control the behavior of the agent (the tenant) due to asymmetric information, and both have differing interests or goals (Eisenhardt 1989). As research on principal-agent problems in agricultural land renting has shown, this problem may be mediated and thus addressed by contractual terms, including lease length and type (Lichtenberg 2007; Oskam and Feng 2008). In addition to these fundamental contract terms, it would be possible to include specific conservation requirements in rental contracts. While we do not find such contractual obligations to be widespread among our respondents, others have already suggested this as a policy measure (Ranjan et al. 2019b).

On the other side of this coin, the prevalence of close relationships as opposed to a principal-agent problem may also explain our finding that farmers were more likely to refrain from the use of sewer sludge on their rented plots as opposed to their owned plots. Since we cannot explain this finding by contractual requirements, a plausible explanation could be a "signaling" effect as also described by Leonhardt et al. (2019): applying sewer sludge is potentially seen as detrimental to soil and environment in the long run (especially since a general prohibition for all of Austria has recently been discussed), because sewer sludge has the potential to contain heavy metals, microplastic and other problematic materials, despite being a readily available fertilizer (Oliva et al. 2009). As landlords mostly know their tenants and may even observe their conduct, tenants may fear that their landlords object to the use of sewer sludge even if not formally required in the contract and adjust their behavior accordingly. This may similarly apply to other conservation measures, counteracting a negative tenure effect.

A third reason that may explain the (non-) existence of a tenure effect is a plot's location with respect to the farmhouse or other land of a farm. Rented plots are often further away from the center of a farm than owned plots, making travel more time consuming and costly. This may influence the practices that farmers apply on these plots (Grammatikopoulou et al. 2013), especially if measures require multiple trips to a single plot. It is important to note, however, that this difference does not necessarily mean that less soil conservation happens on the more remote plots—it may also have an opposite effect, depending on the type of practice chosen and how time consuming it is. We indeed find that our respondents' rented plots were further away from the farmhouse

than owned plots, but do not find differences in the type or the number of practices applied. One reason for this may be that a mean distance of 3.3 km in our sample is still manageable and thus may not influence soil management. In this regard, a "typical" plot may also be different from a potential "extreme" or "outlier" plot; i.e., while some rented plots might indeed be at a distance to the farm that does have an effect on how that plot is treated, this may not be the typical plot a farmer thinks of when answering the questionnaire. Another aspect of a plot's location is that if rented plots are contiguous to other (owned) plots, or a single management unit consists of several plots with differing tenure status, this likely leads to uniform treatment of this land due to procedural reasons—for better (Leonhardt et al. 2019) or worse (Sklenicka et al. 2014).

Fourth, AES may be an important reason for why there is no effect of renting on soil conservation. Many of the practices we investigate are part of such subsidized schemes, and in Austria participation in these schemes is generally high. Several AES require farmers to apply the subsidized measures on all relevant plots of the farm (e.g., on all erosion-prone crops), irrespective of ownership status. Subsidies for organic farming are the strictest in this case: the entire farm operation needs to be farmed organically in order to receive the respective subsidies. Such requirements will, by default, decrease differences between rented and owned plots for AES participants. However, even for measures that are not part of any AES (e.g., using soil-protecting machinery, precision farming, application of compost, or creating wind protection elements), we do not see substantial differences between rented and owned plots, confirming the lack of an overall adverse effect of renting under the current circumstances in Austria. The same is true for measures that do not need to be applied on the entire farm, such as cover crops. Nevertheless, AES may be an important mechanism counteracting a negative tenure effect on soil management by encouraging conservation measures in general, especially if their application is required on all plots of a farm. Sklenicka et al. (2015) similarly find that greening requirements from the CAP as implemented in the Czech Republic equalize an otherwise existing tenure effect. In addition, in Austria, agricultural policy and AES even have an impact on the rental market, as rental contracts are sometimes tied to the CAP period so that farmers have some security in their subsidy income. Moreover, AES commitments are tied to the land to some degree, i.e., in case a tenant farmer loses part of his land to another farmer, the new farmer can continue the AES commitments with little administrative effort. Even if this is not the case, the farmer who initially entered into the AES contract does not lose any payments for the period where the practice was actually applied. This reduces the risk that tenants face when entering into an AES contract, likely encouraging participation of rented land in such schemes.

One last influential aspect are rental prices. Previous research confirms that high rental rates may be a barrier to conservation efforts (Ranjan et al. 2019b). Depending on whether this effect is direct (a farmer needing to make an immediate profit from a particular rented plot to compensate for high rental payments) or indirect (landlords who are asking for high rents attract tenants who farm intensively and are focused on short-term returns), overall effects will appear in a direct comparison of practices on rented and owned land or only on a general level. Related to this argument, several respondents expressed concerns about the future developments of (rising) land rental prices and their potential effect.

Together with other aspects such as farmers' "fundamental attitude to treat every soil well," as well as procedural reasons (such as uniform machinery use or crop rotation plans), the factors depicted in figure 6 and described here all appear to work against a potential adverse effect of cropland renting in the Austrian context. It is therefore perhaps not surprising that we find no tenure effect, as there are few cases where landlord-tenant relationships are distant, where rented plots are far from the farmhouse, and there are generally few commercial farms that do not participate in AES. Our study thus adds to the literature that finds little or no association between the ownership status of land and soil conservation efforts (Prokopy et al. 2019) but provides valuable additional insights on underlying contextual explanations.

Limitations and Generalizability. The above-mentioned discrepancy between respondents' self-reported behavior and their observations about others indicates limitations but also potential for improvement of the study design of future investigations. We see at least four explanations with respect to this discrepancy, which can be used as guidance for improvements in future research.

First, our questionnaire design might be to blame for the different results, as we did not use the same list of soil conservation practices in part two (practices on typical rented and owned plots) and part three (observations about others) of our questionnaire, due to the different possibilities and objectives of these two sections. While part two of the questionnaire was designed to compare the application of very specific measures (e.g., "using winter-hardy cover crops"), part three needed to be more general (e.g., "careful soil tillage"), as it is hardly possible to observe others' behavior in such detail. More general aspects of respondents' soil management might therefore not be reflected in their specific answers, such as the timing of measures, care and thoroughness of applying them, or attentiveness to specificities of plots. On the other hand, other farmers' specific practices might not be easily observed by neighbors, leading to an incomplete picture of actual soil conservation. In addition, as briefly mentioned above, statements about farmers' own behavior were related to their typical plots, which may not be fully representative of all plots and the practices applied there. There may be "nontypical" rented as well as owned land, for which we cannot draw any conclusions here. While a focus on specific plots was necessary in our case, other options such as asking farmers about their most recently rented plot or plots preselected by the interviewer are conceivable.

Second, our respondents may have misreported their own behavior. This could be due to, for example, a social desirability bias (Grimm 2010) or a biased perception of their behavior. However, since the survey was in most cases conducted without an interviewer present (Dillman et al. 2009) and we asked for very specific and potentially testable behavior, we hope to have reduced this bias. External cross-checking (e.g., via agricultural beneficiaries data) could provide insights into the extent of misreporting for AES, but to date this is not feasible with our data. As Leonhardt et al. (2019) show, these beneficiaries data can also provide valuable insights by themselves, but are usually limited to unspecific indicators of behavior such as crop choice.

Third, our respondents might have had a wrong perception of others' behavior. This

could be caused by projecting preconceived opinions onto others' behavior, similar to effects such as confirmation bias or cherry-picking for evidence (Nickerson 1998; Kahneman 2011). This explanation appears likely to us, as there is a preconceived opinion among the general public that farmland renting leads to short-sighted behavior, while empirical results are mixed. This could be reflected in our questionnaire, with respondents having a preconceived opinion but reality being different. Unfortunately, we cannot check for such a bias unless we could link our data to geospatial agricultural beneficiaries data (which is available in theory).

Fourth, while the FADN is designed to be economically representative, we cannot fully exclude the possibility that our sample of respondents is not representative of the population of all farmers, with respondents being less inclined than others to differ their practices based on property status. Both participation in the FADN as well as in our survey were essentially voluntary, although in both cases encouraged by extension services/FADN advisers. While the FADN is not a network in the sense of the word (participants do not know each other), these are nevertheless farmers who are aware about the economics of their farm in great detail based on the numbers they report, which may potentially alter their (business) behavior compared to the general population of farmers. In addition, while our study participants did not differ substantially in unexpected ways from eligible nonparticipants with respect to economic indicators (table 1), we do not know whether they differed in socio-psychological characteristics such as attitude toward conservation. Since participants were contacted in different ways (email, telephone, and in-person), we hope that such bias is small, but as we did not have the opportunity to conduct nonresponse bias checks we cannot know with certainty.

In addition to these points of concern that may all apply to some extent, it is important to note that our results are based on the particular ecological, social, and institutional context of agriculture in Austria. For example, compared to many other countries of the Global North, farming in Austria is relatively small scaled and family-farm oriented, and many farms are run part-time (BMLFUW 2019). This is both a result of and a reason why agricultural policy has already for many years focused on the multifunctionality of agriculture (i.e., agriculture as a provider of ecological, social, and economic goods and services; van Huylenbroeck et al. 2007) in, for example, its subsidy schemes (BMLFUW 2015). Social networks in the countryside are often tightly knit; people know each other well, including their neighbors and landlords. These circumstances have an influence on the context of renting that we have investigated.

Aside from these wider circumstances, the immediate contextual factors are of obvious importance. We may therefore see negative effects of renting on conservation efforts where any or several of the factors depicted in figure 6 are different than in the Austrian case. This is in line with, for example, findings from the Global South, where tenure is often insecure and studies tend to find a negative effect on conservation investments (Higgins et al. 2018). The Czech Republic is another example; here landlord-tenant relationships are often distant and farms as well as fields are very large (despite fragmented ownership) due to the country's history (Sklenicka et al. 2014). Sklenicka et al. (2015) and Walmsley and Sklenicka (2017) have, correspondingly, found a negative effect of renting on soil conservation. However, it is not clear which or how many of the contextual factors are necessary conditions for successful mitigation of a negative tenure effect. Comparing several regions with different institutional and cultural backgrounds would be an interesting option for future research to draw better conclusions. Moreover, focusing on individual selected contextual factors or barriers should be considered in future studies. For any such research, we recommend to carefully consider the practice under question, as this may be another factor that has an influence on the existence of a tenure effect (Varble et al. 2016), although we do not find differences by practice in our study.

Summary and Conclusions

This study investigates the contextual factors of renting that influence whether or not farmers apply different soil conservation practices on rented and owned cropland. We find that rental duration and security, the landlord-tenant relationship, the location of plots, formal requirements such as contractual agreements and AES, as well as rental prices all have an influence on the relationship between cropland renting and soil conservation practices. Given the current circumstances of agricultural land renting in Austria with respect to these factors, we do not find significant differences in the practices that the surveyed farmers applied on their rented plots compared to plots they owned for 16 different conservation measures. Due to this lack of differences, we cannot confirm quantitatively whether this is truly due the contextual factors described, but our descriptive and qualitative evidence (e.g., from the answers to open-ended survey questions) supports this argument. Further research focusing on the individual factors as well as in contexts where farmers do differ their practices based on tenure status of a plot would be required to draw better conclusions about, for example, the intensity of relationships or necessary versus contingent contextual factors.

Understanding that a tenure effect is contingent on the factors listed above can be used by policy makers to provide an institutional framework that supports soil conservation on rented land in cases where renting does have detrimental effects on farmers' behavior. One option are land market regulations, as they can directly influence rental security and rental rates and are thus powerful instruments, but possibly to the detriment of market efficiency and dynamism. Austria's rental market is not strongly regulated compared to some other European countries (Ciaian et al. 2012d), and in the current situation there appears to be no need for further market intervention from a soil conservation point of view. However, for other contexts, this may well be an option to increase tenant farmers' security, both in terms of planning horizon as well as financially. Such regulations may especially be important in regions where a substantial number of farmers are full tenants, as their dependence on renting exacerbates insecurities. AES are another evident intervention point, but they require careful design for cases where rental is not secure for the full commitment period. Encouraging rental contract durations that are in line with scheme commitment periods would serve the same purpose. Altering lease terms may in general be a promising option (Ranjan et al. 2019b). As extension services in Austria often provide templates for rental contracts that many farmers make use of, adjusting these templates accordingly provides some leverage in this respect. For example, conservation measures such as soil testing or cover crops could be included as

explicit requirements by interested landlords or tenants.

Other contextual factors are more difficult to address by policy makers or extension services, most notably the relationship between landlords and tenants. Ranjan et al. (2019b) list some measures, including improving the communication between landlords and tenants, and informing landowners about soil conservation. This seems especially important for absentee landlords (Petrzelka et al. 2013). Establishing platforms to support local rental markets and thereby support geographical proximity between tenants and landlords may be another option, as are pre-emptive land purchasing rights for local farmers, as they exist in some countries (Ciaian et al. 2012e). When such contextual factors are accounted for, rental markets can be an efficient way of allocating agricultural land without adverse long-term effects on soil conservation.

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