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Different Recruitment Processes for an Online-Survey Among German Livestock Farmers - Impacts on Sampling Biases and Data Quality

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Abstract

This paper discusses the methodological challenges of conducting online surveys for agricultural social science research, with a focus on the potential biases introduced by sampling processes. Online surveys often use convenience or quota sampling, which can lead to self-selection biases that compromise the validity, reliability, and generalizability of research findings. Response quality issues, such as straight-lining and response fatigue, further exacerbate these challenges. The study examines data from a survey of more than 600 German livestock farmers who were recruited through three different methods: informally through social media channels, formally through professional networks, and commercially through a market research service provider. Results show that the commercial sub-sample had shorter response times and higher rates of incorrect responses for a control question. The sub-samples also showed demographic variations and differences in personality traits, agricultural land areas, and farm characteristics. The role of quota requirements in shaping differences within the commercial sub-sample is emphasized in the discussion. This reveals limitations in online surveys' ability to represent objectively defined target populations. The interpretation of results is complicated by the absence of consistent theoretical concepts and clear ex-ante hypotheses. The paper concludes by recommending that agricultural social science researchers transparently disclose their sampling procedures. This will enable readers to make informed judgments on the reliability and validity of their findings.

Keywords: online survey, sample selection, sampling bias, recruitment process

1 Introduction

In recent years, the proliferation of online surveys has become increasingly prevalent in agricultural economics research (Avemegah et al. 2021). These surveys offer a convenient and cost-effective means of collecting data from a wide range of participants, including farmers, agricultural producers, policymakers, and consumers. However, despite their advantages, online surveys are not immune to methodological challenges, particularly concerning sample selection. The issue of sample selection bias has garnered considerable attention in the literature due to its potential to undermine survey findings (Carletto 2021). Sampling biases arise, as online surveys often use quota or convenience sampling instead of more appropriate though more challanging random selection procedures (Fricker 2016). This can impact the validity and generalizability of results. The potential risks of making inappropriate political and business decisions based on such results highlight the importance of critically scrutinizing the methods and outcomes of these studies (Ferraro et al. 2023).

Online surveys in agricultural economics research are prone to various sampling problems and biases, such as coverage faults, non-representative samples, and the presence of 'professional' respondents (Pecáková, 2016). Self-selection bias occurs when individuals choose whether or not to participate in a survey based on certain characteristics related to the research topic, leading to a non-random sample composition. Coverage bias arises from incomplete or inadequate coverage of the target population, resulting in underrepresentation or exclusion of certain groups. Nonresponse bias occurs when the characteristics of survey respondents differ systematically from those who did not respond, potentially skewing survey results. The selection of a sampling frame

can also introduce bias, as shown in a study that compared farm characteristics across different sampling frames (Emerson, 1995). Online surveys can exacerbate issues related to differences in sample composition and willingness to pay for certain attributes (Tait, 2009). The limitations of online surveys, including the inability to describe the population and the potential for self-selection bias, have been highlighted (Andrade, 2020). Challenges related to respondent selection and the potential for self-selection bias have been discussed in the context of internet surveys (Bradley, 1999). Carletto (2021) emphasized the importance of minimizing measurement error and maximizing coverage in agricultural data collection. Bethlehem (2010) explored methodological issues related to under-coverage and self-selection in web surveys, and discussed potential correction techniques.

Furthermore, online surveys are susceptible to response quality issues, including straight-lining, response fatigue, and careless response behavior (Ward et al. 2023). Straight-lining occurs when respondents consistently select the same response option without carefully considering the survey items, leading to artificially inflated or skewed data. This behavior undermines the validity of survey results by introducing systematic bias and distorting the true distribution of responses. Response fatigue refers to the declining attention and effort that respondents exhibit as they progress through a survey, especially in lengthy or repetitive questionnaires. As respondents become fatigued, they may provide hasty or inconsistent responses, compromising data quality. Careless response behavior involves respondents providing responses without adequately reading or comprehending survey items, leading to inaccurate or nonsensical data. These response quality issues pose significant challenges to researchers, necessitating the implementation of strategies such as attention checks, response validation checks, and randomized item presentation to mitigate their impact and enhance the reliability and validity of survey findings.

Despite these methodological challangens, socio-economic empirical studies of livestock farms remain essential for several reasons. Firstly, they can enhance the sustainability of these systems by integrating human objectives and technical knowledge (Gibon, 1999). Secondly, they can provide insights into the social perceptions of livestock farming, which are crucial for its sociocultural sustainability (Boogaard, 2011). Thirdly, they can aid in the development of policies to enhance farm household incomes and enterprise mixes (Komarek, 2012). Fourthly, they can address societal expectations of livestock farming regarding environmental effects (Milne, 2005). Fifthly, they can examine the roles of livestock in in a wider context, particularly in terms of their socio-economic benefits and environmental impacts (Herrero, 2013). Finally, they can offer a thorough evaluation of the expenses and advantages of livestock systems, considering both market and non-market connections (Moll, 2005).

Against this background, this article addresses the question of whether the extent and significance of these problems can be empirically assessed. The article presents the results of an empirical study that aims to shed light on the influences of different recruitment procedures and sampling methods on response behavior in online surveys. The focus is on the hypothesis that the response behavior does not depend on the recruitment procedure or the sampling method. This article critically analyses and discusses this hypothesis, contributing to the further development of online survey methodology in agricultural economics research. It offers insights for more precise and reliable data collection in this area.

2 Data and methods

Different recruitment processes have been employed for an online survey among German livestock farmers (n=619). The recruitment pathways have been documented for each participant. Three different recruitment groups with different financial compensation mechanisms have been identified: (1) an informal recruitment process via social media and informal networks of messenger services (n=155), (2) a formal recruitment process via newsletters from professional networks and invitations from professional farming magazines (n=158) and (3) a commercial recruitment process via quota sampling from a market research service provider (n=306). Quota requirements referred to livestock farming as a major income source and different livestock types on farm. While farmers were paid a financial compensation in the commercial recruitment, the informal and formal recruitment relied solely on the intrinsic motivation of participants. Meta-data, quality control variables, socio-demographics, personality data, farm structural data as well as livestock related attitudes are compared by recruitment process.

The study employed the method of bivariate comparisons using a t-test in Excel as an initial, approximative, preliminary analysis. This method allowed for preliminary findings from the available data, although they may not be accurate in some cases. The t-test was specifically conducted for unpaired samples to test for differences between two subsamples. A two-tailed test was used to detect possible effects in both directions. The t-test implementation assumed unequal variances of the two groups, indicating heteroscedasticity. This was done to ensure the analysis was robust to possible differences in variance between the groups. Although formally not correct we used the t-test for convenience reasons also to approximate significant differences in the

frequencies of dummy variables between the sub-samples. A low p-value indicates that the observed differences may not be random and can therefore be considered statistically significant at the conventional 5%-threshold level.

3 Results

- 3.1 Meta data

Farmers sampled via the commercial process take significantly less time to complete the questionnaire. They also give significantly shorter comments although the share of respondents giving comments is very similar across all subsamples. Commercially recruited farmers have the lowest share in correctly answering a control question as compared to the informal and formal recruitment process. The overall share of respondents correctly identifying a fake-association is only slightly above the fifty percent margin and does not differ between the sub-samples. No straight-liners are identified, but the commercial sub-sample showed more undifferentiated responses, as indicated by the significantly lower mean standard deviations for the attitude variables measured on Likert scales.

Tab 1:
Comparisons of survey meta-data differentiating the three sub-samples showing mean and standard-deviations in parentheses or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commercial	formal vs commercial
Time (min)	30,51 (±15,26)	29,49 (±14,77)	24,34 (±8,38)	27,14 (±12,43)		0,557	0,000	0,000
Additional comment	23%	18%	19%	20%		0,356	0,371	0,875
Comment (letters)	221 (±204)	381 (±393)	127 (±136)	214 (±257)		0,054	0,018	0,002
Control question correct	97%	92%	90%	92%		0,088	0,003	0,416
Fake association identified	55%	53%	57%	55%		0,602	0,779	0,377
Mean SD of 5-step Likert scales	1,15 (±0,18)	1,14 (±0,18)	1,11 (±0,19)	1,13 (±0,19)		0,594	0,009	0,041

- 3.2 Socio-demographics

The commercial sub-sample is significantly older than the other two sub-samples, especially the formal sub-sample. Farmers from the formal sub-sample tend to have significantly higher shares of higher education degrees and of female farmers as compared to the informal and the commercial sub-samples.

Tab 2: Comparisons of socio-demographics differentiating the three sub-samples showing mean and standard-deviations in parentheses or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commercial	formal vs commercial
Age in years	47,32 (±12,27)	45,32 (±12,96)	49,63 (±10,68)	47,96 (±11,81)		0,166	0,049	0,000
Female	14%	16%	9%	12%		0,580	0,123	0,032
Technical training	66%	55%	71%	66%		0,052	0,270	0,001
Academic eduation	28%	42%	27%	31%		0,009	0,720	0,001

- 3.3 Personality

Farmers in all sub-samples have relatively high honesty-humility values and low values for emotionality. Regarding HEXACO-personality traits only significantly lower openness values for the commercial sub-sample can be identified, whereas there are no remarkable differences for the other personality traits.

Tab 3: Comparisons of HEXACO-personality traits differentiating the three sub-samples showing mean and standard-deviations in parentheses (Likert-scales from 1-completely disagree to 5-comletely agree) or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commercial	formal vs commercial
Honesty-humility	4,21 (±0,51)	4,24 (±0,54)	4,21 (±0,56)	4,22 (±0,54)		0,662	0,980	0,610
Emotionality	2,78 (±0,67)	2,79 (±0,6)	2,75 (±0,59)	2,77 (±0,61)		0,849	0,685	0,500
Extraversion	3,74 (±0,52)	3,7 (±0,51)	3,65 (±0,54)	3,68 (±0,53)		0,535	0,102	0,337
Agreeableness	2,99 (±0,53)	3,07 (±0,52)	2,99 (±0,48)	3,01 (±0,5)		0,182	0,964	0,120
Conscient-iousness	3,63 (±0,57)	3,68 (±0,6)	3,58 (±0,55)	3,62 (±0,57)		0,466	0,363	0,084
Openess to experience	3,46 (±0,57)	3,42 (±0,60)	3,22 (±0,60)	3,33 (±0,61)		0,483	0,000	0,001

- 3.4 Farm structural data

Table 4 reveals distinctions across the sub-samples in various farm characteristics. For instance, full-time farming is highest among the commercial sub-sample, followed by the formal and informal sub-samples. Also, organic farming exhibits slight variability across sub-samples. Land size, measured in hectares, displays significant variation across sub-samples, with the commercial sub-sample reporting the largest mean value. Animal husbandry as the main income source of income is prevalent across all sub-samples, with the highest percentage observed in the commercial sub-sample, followed by formal and informal sub-samples. These findings underscore the diverse farm structures and practices across different types of agricultural operations.

Tab 4: Comparisons of farm structural data differentiating the three sub-samples showing mean and standard-deviations in parentheses or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		infor-mal vs formal	informal vs commer-cial	formal vs commer-cial
Full-time farming	82%	85%	100%	92%		0,403	0,000	0,000
Organic farm	14%	10%	8%	10%		0,273	0,079	0,573
Land in ha	153 (±322)	105 (±91)	241 (±464)	184 (±371)		0,073	0,018	0,000
Soil quality (0-100)	43,46 (±18,24)	42,3 (±16,02)	44,65 (±16,59)	43,75 (±16,9)		0,553	0,496	0,141
Animal husbandry main income	88%	92%	100%	95%		0,230	0,000	0,000
Cattle (heads)	243 (±401)	228 (±227)	254 (±264)	246 (±303)		0,755	0,811	0,444
Pigs (heads)	2391 (±3495)	2204 (±2064)	1777 (±1646)	2048 (±2304)		0,729	0,228	0,134
Poultry ('000 heads)	37,76 (±86,04)	30,08 (±49,98)	14,52 (±18,03)	23,58 (±46,6)		0,809	0,444	0,220

- 3.5 General livestock related attitudes

Table 5 presents a detailed comparison of livestock-related attitudes among the three distinct sub-samples. The range of attitudes being considered encompasses various viewpoints on animal welfare and practices related to livestock farming. The participants from the informal, formal, and commercial sub-samples hold different views on various topics related to animal meat consumption. These include sentiments towards those

opposing animal meat consumption, the necessity of scientific research on animals, the acceptability of animals being kept for human consumption, the right of humans to use animals, the importance of animal welfare concerns, and the justification of intensive farming for affordable meat, eggs, and dairy. Notable differences are observed across sub-samples. For example, participants in the commercial sub-sample generally perceive scientific research on animals as less necessary and more cruel compared to the informal and formal sub-samples. Additionally, attitudes towards the production of inexpensive meat, eggs, and dairy products in intensive conditions vary between sub-samples, with the commercial sub-sample differing significantly from the formally recruited sub-sample.

Tab 5: Comparisons of livestock related attitudes differentiating the three sub-samples showing mean and standard-deviations in parentheses (Likert-scales from 1-completely disagree to 5-comletely agree) or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commercial	formal vs commercial
I find people who are against keeping animals for meat too sentimental.	4,19 (±1,01)	3,97 (±1,14)	4,03 (±1,07)	4,05 (±1,07)		0,085	0,119	0,636
Much scientific research carried out on animals is unnecessary and cruel.	2,74 (±1,08)	2,49 (±0,98)	2,95 (±1,02)	2,78 (±1,04)		0,041	0,053	0,000
It is perfectly okay for animals to be kept for human consumption.	4,69 (±0,69)	4,66 (±0,73)	4,52 (±0,75)	4,60 (±0,73)		0,709	0,019	0,062
In principle, humans have the right to use animals as they see fit.	3,59 (±1,14)	3,29 (±1,23)	3,29 (±1,16)	3,36 (±1,18)		0,029	0,009	0,978
There is too much fuss about animal welfare these days, when there are so many problems for people that need to be solved.	3,70 (±1,07)	3,71 (±1,04)	3,69 (±1,11)	3,70 (±1,08)		0,967	0,862	0,821
The production of cheap meat, eggs and dairy products justifies keeping farm animals in intensive conditions.	3,14 (±1,23)	3,36 (±1,3)	2,99 (±1,2)	3,12 (±1,24)		0,131	0,219	0,003
Farming livestock in accordance with the legal minimum standard corresponds to my personal ideal.	3,1 (±1,15)	3,13 (±1)	3,33 (±1,05)	3,22 (±1,07)		0,848	0,040	0,042

- 3.6 Attitudes towards livestock on own farm

Table 6 provides a detailed analysis of attitudes towards livestock on participants' own farms across the three sub-samples. It evaluates different attitudes related to the participants' relationships with animals on their farms. Notable aspects include pride in the performance of the animals, the importance placed on the welfare of these animals, the emphasis on safe handling even if it affects animal behavior, and the perception of digitalization contributing to greater animal welfare. Key findings include generally high mean values across all subsamples for pride in animal performance and the importance of animal welfare, with no significant differences observed. The mean values for safe handling of animals, even if it affects their behavior, are consistent across sub-samples. The perceived contribution of digitalization to animal welfare exhibits variations, although statistical significance is not uniformly established. The results indicate that participants hold nuanced attitudes towards the livestock on their own farms. These findings highlight areas of consensus and potential divergence.

Tab 6: Comparisons of attitudes related to livestock on own fam differentiating the three sub-samples showing mean and standard-deviations in parentheses (Likert-scales from 1-completely disagree to 5-comletely agree) or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commercial	formal vs commercial
I am proud on the performance of the animals on my farm.	4,42 (±0,75)	4,40 (±0,91)	4,36 (±0,74)	4,39 (±0,79)		0,826	0,414	0,640
The welfare of the animals on my farm is very important to me.	4,82 (±0,6)	4,86 (±0,52)	4,84 (±0,38)	4,84 (±0,48)		0,525	0,697	0,671
For my own protection, safe handling of the animals on my farm is important, even if this affects their behavior.	3,72 (±1,12)	3,63 (±1,09)	3,66 (±1,07)	3,67 (±1,09)		0,502	0,619	0,777
Digitalization on my farm is conducive to greater animal welfare.	3,26 (±1,31)	3,44 (±1,17)	3,28 (±1,17)	3,32 (±1,21)		0,202	0,873	0,164

- 3.7 Political parties

Tab 7 presents a comparative analysis of preferred political party affiliations among three distinct sub-samples. Notably, significant disparities are observed in preferred political party affiliations across the sub-samples. Regarding political party preferences the conservative christian democratic party is the party with the highest approval rates among the survey farmers. Secondly most often chosen option was the “no party” option and third the liberal party. There are no major difference between the subsamples except that the conservatives are less favored by the informally recruited farmers and they have a significantly higher share of no party preference. These findings underscore the divergent political inclinations among different segments of the agricultural community, shedding light on the nuanced socio-political landscape within the sector.

Tab 7: Comparisons of preferred political party differentiating the three sub-samples showing mean and standard-deviations in parentheses or percentages for dummy variables and p-values for two-sample t-tests

	Informal (n=155)	Formal (n=158)	Commercial (n=306)	All (n=619)		informal vs formal	informal vs commerci-al	formal vs commerci-al
CDU	35%	54%	48%	46%		0,001	0,009	0,241
FDP	17%	14%	12%	14%		0,397	0,114	0,516
AfD	8%	4%	8%	7%		0,222	0,778	0,077
Grüne	3%	4%	3%	3%		0,784	0,869	0,636
SPD	1%	0%	2%	1%		0,319	0,199	0,014
DieLinke	0%	0%	2%	1%		.	0,025	0,025
Others	4%	2%	3%	3%		0,300	0,612	0,475
No party	32%	22%	22%	25%		0,060	0,035	0,986

Note: In the German multi-party system the parties can basically describe as follows: CDU: Conservative; FDP: Liberals; AfD: Right populist; Grüne: ecologicals; SPD: Social democrats; DieLinke: Left populist;

4 Discussion

In the comparison of subsamples recruited via different processes our null-hypothesis of no differences between the sub-samples could not be confirmed. This indicates that the overall sample might be biased by the different recruitment processes. For the meta-data especially the commercially recruited sub-sample shows lower quality indicators than the two openly recruited samples. This might be linked to the extrinsically motivated farmers from the commercial market research service provider who pays the farmers for participation in the survey and for whom it can be assumed that they try to reduce answering time as much as possible. For the openly recruited participants of the informal and formal sub-sample a high level of intrinsic motivation can be assumed to answer such a lengthy questionnaire of more than half an hour in average. With regard to future-orientation and expected transformations in the livestock sector, the higher age of the commercially recruited farmers might be relevant when it comes to investment planning for longer time periods in the future. In this regard it is also remarkable that the commercially recruited farmers have lower openness scores in the HEXACO-personality traits, which might indicate more reserved positions towards change and transformational processes.

Differences between the sub-samples of different recruitment processes are partly conditioned by the quota requirements for the commercial sub-sample. The market research service provider was commissioned to fulfill certain quotas relating to farm structural data – although they were not able to reach these quota requirements, e.g. for the number of poultry farms. Generally, employing commercial market research companies to recruit farmers for online surveys in agricultural economics research is not a silver bullet for sampling and poses several potential challenges. These challenges include the risk of biased sample composition due to prioritization of efficiency over representativeness, limited agricultural expertise leading to inappropriate sampling strategies, and difficulties in accessing certain farming demographics. Furthermore, there is a possibility of overrepresentation of specific farming segments and conflicts of interest arising from financial incentives. Quality control issues, such as compromised data quality and inadequate validation measures, also pose concerns. Researchers must carefully weigh these drawbacks against the benefits of outsourcing recruitment, implementing strategies to mitigate potential biases and ensure the integrity and reliability of survey findings.

Though post-hoc story telling might be able to explain some of the differences detected between the sub-samples, there is no consistent theoretical concept to derive clear ex-ante hypotheses. By definition online surveys via quota sampling or open self-selection sampling can not be regarded as representing some objectively defined target population. These recruitment processes are by definition not suitable to generate data from a population unwilling or unable to participated in online surveys. A prerequisite for “representative” samples would be complete lists of the target population, a true random sampling procedure and a mechanism to rule-out non-responses. Although this would formally generate representative samples, response errors in data collecting could be aggravated by the obligation to participate in such surveys.

5 Limitations and further research

The paper used very approximative statistical methods for identifying possible difference between the three sub-samples. The non-random sampling questions the application of test-statistics very fundamentally. Even if one accepts the sample as quasi-random an ANOVA-procedure would be more appropriate than repeated t-tests between sub-samples. As the decisions of farmers to be recruited through different strategies might be

influenced by several factors simultaneously, multi-variable approaches like multinomial regression models might be suitable to analyze factors the impact the recruitment decision. However, the most interesting reference group of non-participants is not available by definition. Therefore, some fundamental challenges cannot be solved easily.

6 Conclusions

Sampling in empirical research within agricultural social science is a multifaceted endeavor devoid of a universal solution. Hence, meticulous attention to detail and transparency regarding sampling procedures are imperative for agricultural social science researchers. By comprehensively disclosing and discussing the intricacies and constraints of their sampling methodologies, researchers enable stakeholders to make informed assessments regarding the reliability and validity of research outcomes. Furthermore, the comparative analysis of sub-samples recruited through distinct recruitment methodologies presents an invaluable opportunity to deepen our understanding of sampling biases, their magnitude, and consequential impacts on research outcomes. Through such comparative assessments, researchers can elucidate the nuances of sampling biases, thereby refining methodological approaches and enhancing the robustness of empirical findings within agricultural social science research.

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Transparency

Different AI-tools were used to assist in the writing process and in the literature review.

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