Financial Well-Being of Farm Households: A Theoretical Framework and Application

Zekuan Dong[1], Frank Lupi[1], Melissa G. S. McKendree[1]

[1]*Department of Agricultural, Food, and Resource Economics, Michigan State University*

Abstract

The complexity of people's subjective consciousness has led some economists to rethink how to measure financial well-being (FWB). Historically, only objective financial measures were well considered. However, now subjective well-being measures, which take individuals' feelings and perceptions into account, are being incorporated. This paper proposes an innovative framework for studying farmers' FWB and applies it to U.S. beef producers. The conceptual framework we built consists of two sections: the determinants and measurements of farm households' FWB. In the determinants section, our framework analyzes the determinants of farm households through micro, meso, and macro levels, as well as their impacts on household or farm aspects. For the measurement section, besides financial ratios to measure objective FWB, we construct a survey to measure subjective FWB. Furthermore, a visualization evaluation figure is provided to present the measurement results. We then apply our framework to cattle grazing households in the U.S. This application illustrates our framework, shows its advantages, and examines the effects of some determinants on FWB.

Keywords: Financial well-being, Farm household, Perceived economic well-being
JEL Codes: I31, Q12, G50

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1 Introduction

The complexity of people's subjective consciousness has led some economists to rethink how to measure financial well-being (FWB). Historically, only objective financial measures were well considered. However, now subjective well-being measures, which take individuals' feelings and perceptions into account, are being incorporated. Most recent works define FWB as "a set of conditions that enable people to fulfill present and recurrent financial obligations (short-term needs), make consumption decisions without getting stressed financially (short-term wants), prepare for facing economic contingencies (long-term needs), and pursue future financial goals (long-term wants)" (García-Mata and Zerón-Félix, 2022). Indeed, FWB should now capture both objective (e.g., incomes, assets, and consumptions) and subjective (e.g., perceptions of current financial situation, confidence in the future, and sense of achievement) measures of people (Brüggen et al., 2017; Joo, 2008). Although the theories and empirical studies about consumers' FWB are well-developed, we find that the studies about farm households' FWB are scarce.

There are three main gaps in farm households' FWB that we seek to address and close. First, subjective aspects are usually undervalued in economic studies. Although many economic theories have included subjective aspects like risk aversion, tastes, and preferences into consideration, they usually treat them as "exogenous" (Becker, 1965; Hvide and Panos, 2014). In other words, they focus on how individuals' subjective characteristics influence their economic choices, but they rarely think reversely—How could economic activities change one's subjective aspects? Second, farmers' roles as both producers and consumers are not well considered in the context of FWB. Many works studying farmers' FWB use the same or similar frameworks constructed for consumers' FWB (İzmen and Üçdoğruk Gürel, 2020; Kassem, 2013), and some others consider both roles but only in objective views (Becker, 1965; Singh, Squire, and Strauss, 1986; Taylor and Adelman, 2003). Third, there is no compelling and widely used framework or research agenda to help understand farmers' FWB.

To address gaps in previous literature and consider farmers' unique characteristics, we propose a conceptual framework to systematically study farm households' FWB. The conceptual framework we built consists of two sections: the determinants and measurements of farm households' FWB. In the determinants section, our framework analyzes the determinants of farm households through micro, meso, and macro levels, as well as their impacts on household or farm aspects. For the measurement section, we assess the FWB through 16 dimensions within 4 categories, i.e., household-subjective category, household-objective category, farm-subjective category, and farm-objective category. Based on the framework, we further propose 16 detailed financial ratios to measure objective dimensions of FWB, and we construct a questionnaire with 38 questions to measure subjective dimensions of FWB. Finally, after aggregating the measurements (16 financial ratios and 38 survey questions) into the 16 dimensions, we provide a visualization evaluation figure to present and compare the measurement results.

We finally apply our framework to 65 cattle grazing households in the U.S. Generally, we find that these ranchers feel better with their household finances than the ranch's. And they are more positive about the ranches' future financial situations than the current ones. After regressing the subjective FWB on the ranchers' demographics, we find that individuals' age, herd size, land size, location, economics-related degree, household income, and expenditure have statistically significant impacts on their FWB perceptions. In addition to the analysis of their subjective aspects, we chose two ranch households with their objective dimensions to build our FWB measurement figures and provide comparisons. This application helps illustrate our framework and shows its advantages.

The remainder of the paper is organized as follows. In Section 2, we briefly discuss the theoretical foundations of general financial well-being. Section 3 provides a literature review focusing on farm households' FWB and discusses gaps in previous literature. In Section 4, we propose a specialized conceptual framework to study farm households' FWB, and Section 5 further discusses some details in designing empirical studies based on our framework. Section 6 applies our framework to beef ranchers in the U.S. to study their subjective FWB. Section 7

provides two ranches' FWB measurement figures as examples to illustrate our framework. Section 8 concludes.

2 General Financial Well-being

Economic well-being (EWB) and financial well-being (FWB) have historically been treated as equal to each other and used interchangeably (Joo, 2008). This interchangeability is applied in many related works (García-Mata and Zerón-Félix, 2022). Some other terminologies like financial satisfaction, financial happiness, financial wellness, financial efficacy, economic insecurity, and financial health also have similar meanings in previous literature (Ghazali et al., 2020; Nanda and Banerjee, 2021; Petro and Romaguera-de-la-Cruz, 2024). But some literature underlines the distinction between economic well-being and financial well-being. For example, Sorgente and Lanz (2017) define the objective components of financial well-being as economic well-being. Joo (2008), while noting that they are often used interchangeably, indicates that "generally, financial well-being tends to include broader aspects of financial life, and economic well-being is most often used with income level". This paper will cover these broader areas of financial life that include both objective and subjective aspects, which are usually denoted as financial well-being.

The understanding of financial well-being is dynamic over time, and this process has been speeding up in recent decades. García-Mata and Zerón-Félix (2022) systemically reviewed the origins and development of the conception of financial well-being. They believe financial well-being originates from a simple concept of "happiness or general satisfaction with the financial situation" and has developed into a more comprehensive connotation (García-Mata and Zerón-Félix, 2022; Porter, 1990). Kaur, Singh, and Singh (2021) apply a bibliometric analysis, and they find a significant increase in the number of published articles on financial well-being from 2 in 1995 to 44 in 2019. They also observe a surge in the number of publications from 2014 (Kaur, Singh, and Singh, 2021), many of which are conceptual.

At the core of these conceptual works is the definition of financial well-being, with recent works adding to our understanding in the following ways. First, financial well-being should

include people's perceptions or feelings (Brüggen et al., 2017; Salignac et al., 2020). Second, financial well-being should not only focus on the current situation but also on the financial future (Brüggen et al., 2017; Salignac et al., 2020). Third, a good state of FWB can not only meet people's financial obligations, but can also meet their desires, let them feel freedom, and enjoy life (García-Mata and Zerón-Félix, 2022). In this paper, we follow the definition provided by García-Mata and Zerón-Félix (2022), which defines financial well-being as "a set of conditions that enable people to fulfill present and recurrent financial obligations (short-term needs), make consumption decisions without getting stressed financially (short-term wants), prepare for facing economic contingencies (long-term needs), and pursue future financial goals (long-term wants)". This recent definition can help empirical studies measure individuals' economic well-being more comprehensively and methodically.

The above theoretical works not only define financial well-being but also provide some vital understanding of financial well-being. The Consumer Financial Protection Bureau (CFPB, 2017) provides four elements of financial well-being: "has control over one's finances", "capacity to absorb a financial shock", "on track to meet those financial goals", and "being able to make choices that allow one to enjoy life". Salignac et al. (2020) draw on two principles from previous studies, indicating that FWB should interact with an individual's environment and FWB should be understood within a life-course framework. They also argue for three dimensions of financial well-being: "meeting expenses and having some money left over, being in control, and feeling financially secure" (Salignac et al., 2020). Nanda and Banerjee (2021) provide a framework focused on the managerial implications for financial institutions, third-party organizations, consumer advocacy groups, public policymakers, and cross-cultural researchers. By employing a systematic review and meta-analysis, Ngamaba et al. (2020) expound and examine the association between financial well-being and subjective well-being. Moreover, some works explore conceptual frameworks or research agendas to guide future studies relative to financial well-being (Brüggen et al., 2017; Fu, 2020; Nanda and Banerjee, 2021; Salignac et al., 2020).

Besides the theoretical studies on the general FWB, review articles focused on more specific areas also contribute to the theory of FWB. Glenn et al. (2021) run a review about community-level intervention strategies that are used to promote financial well-being. Gonçalves, Ponchio, and Basílio (2021) focus on women's financial well-being and review articles in the area. They provide a great example by analyzing the determinants of women's FWB in three levels: individual level, household level, and society level. Some other articles review subareas of FWB related to consumers, researchers, and young adults (Lee, Lee, and Kim, 2020; Kaur, Singh, and Singh, 2021; Nanda and Banerjee, 2021; Shim et al., 2009; Sorgente and Lanz, 2017). However, to the best of our knowledge, there are no systematic review articles that focus on farm households' FWB.

3 Literature Review on Farmers' Financial Well-being

Despite arguments on several subtle issues, the fundamental theories for financial well-being are well-developed in previous literature. However, in empirical work, a one-size-fits-all theory could be inaccurate, which means theories and research agendas in subareas are needed. Also, there are some gaps in previous empirical works, which we will discuss in the following sections. In this paper, we will specifically focus on farm households since they have many unique characteristics. This approach, if carefully modified, can be applied to some other groups that share similar characteristics.

To better identify the gaps in previous literature related to farm households' financial well-being, we first construct a systematic literature review using the Scopus[1] database to search for relevant articles. Scopus is the largest abstract and citation database of peer-reviewed literature[2], and many review articles on financial well-being utilize this database (Datta, Behera et al., 2022; Gonçalves, Ponchio and Basílio, 2021; Kaur, Singh and Singh, 2021; Oczkowski and Doucouliagos, 2015; Sorgente, Totenhagen and Lanz, 2022).

[1] see: https://www.scopus.com/

[2] see: https://blog.scopus.com/about/

After the searching and cleaning procedures[1], a final set of 34 articles remains for further analysis (see Table 1). From Table 1, we can observe that in the context of studies related to farmers' financial well-being, the term "economic well-being" is mostly used (25 of the 34 articles), the term "financial health" is used for 7 articles, "financial satisfaction" and "financial well-being" are only used for once, respectively. Although all these 33 articles include terms like economic well-being or financial health in their titles, only 4 articles carefully discussed the terms' definitions (see Table A1 in the Appendix).

We then analyze their measures of economic well-being or other terms they use. Table A2 in the Appendix shows the details. Although in theoretical works, economic well-being and financial well-being have similar content with both subjective and objective aspects, empirical work related to farm households usually regards economic well-being as the objective side of financial situations. Some empirical work that includes subjective measures highlights the term "perceived economic well-being" (Beckett and Pebley, 2003; İzmen and Üçdoğruk Gürel, 2020). Some literature uses respondents' general perceptions of their financial situation, e.g., the general perception of economic conditions, comparison with past or neighbors (Beckett and Pebley, 2003; İzmen and Üçdoğruk Gürel, 2020; Simmons et al., 2007). While some other literature focuses more on detailed life experiences like income level, food security, childcare, employability, health care security, housing security, transportation, reliance on assistance programs, and capabilities (Akter and Basher, 2014; İzmen and Üçdoğruk Gürel, 2020; Mammen, Dolan, and Seiling, 2015). The most frequently used objective measures of financial well-being were income, consumption, wealth, financial index, and their derivatives (see Table A2 in the Appendix). Although various variables are used to measure the FWB of farmers, we

[1] Based on the different terms that refer to financial well-being that we discussed in Section 2, and combined with keywords that relate to farm households, we used the following searching logic to search articles: TITLE ("financial well being" OR "economic well being" OR "financial wellness" OR "financial happiness" OR "financial satisfaction" OR "financial health" OR " financial efficacy" OR "income satisfaction") AND TITLE ("farmer" OR "farm" OR "rural" OR "agriculture" OR "agricultural" OR "producer" OR "rancher") AND (LIMIT-TO (LANGUAGE , "English")).

The automatic search extracts 51 articles that meet the search logic. We then screen these articles with the following procedures: (i) the study objects should be rural individuals, households, or agricultural firms and farms, and articles with study objects like counties, communities, or rural hospitals are excluded; (ii) books or book chapters are excluded because most of them are not available; (iii) we carefully reviewed the full text of the articles and only kept those related to our topic.

find that agricultural economists seem to lag in studying farmers' subjective perceptions, although these subjective aspects are well discussed in works in other areas like sociology and psychology.

We further analyze the determinants of FWB mentioned in these articles. Details are available in Table A3 in the Appendix. We categorize these determinants into three analytical levels: Macro level, Meso level, and Micro level. Macro-level determinants include factors of societies, nations, economics, policies, and environments. Meso-level determinants include factors related to communities, parties, organizations, and groups. Micro-level determinants are factors at the individual or household level. Through this analysis, we find that the literature varies in choosing determinants, and every analytical level includes plenty of variables that might have an influence on FWB. Although factors are multitudinous, there are still some concerns about previous studies, which result in troubles for empirical studies. First, there is no convincing and widely used framework or research agenda to help decide what factors might affect farmers' FWB. Second, the boundary between FWB measures and FWB determinants is obscure. For example, while some articles may identify household income or household wealth as the measures or proxies of FWB (Hunter, Boardman, and Saint Onge, 2005; Katchova, 2008), others use income or wealth as the determinants of FWB (El-Osta, Mishra, and Morehart, 2007; İzmen and Üçdoğruk Gürel, 2020). Third, the dual roles of farmers are unidentified. Some papers consider farmers as consumers, while others consider them as producers, but only a few studies include both roles in their consideration. These gaps point out the need for a new framework specifically for farmers' FWB.

4 A Conceptual Framework for Farmers' FWB

A conceptual framework specifically for farmers is needed not only because of the gaps in previous literature, but also because farmers are different from other groups, at least in the following ways. First, individuals are not only consumers but also producers. By reviewing the theoretical work on financial well-being, we find that many papers only consider subjects as "consumers", although they use the word "individuals" to identify their study subjects. Thus,

the main measurement of individuals' financial well-being became whether or not their consumption can meet their needs and wants. Although there are well-developed agricultural household models that view farm households as both consumers and producers (Singh, Squire, and Strauss, 1986; Taylor and Adelman, 2003), financial well-being, especially subjective financial well-being, is still missing in these theories. Also, only a few empirical studies have implied that farmers are also producers (Akter and Basher, 2014; Archuleta et al., 2017), but the works do not provide a systematic theory or conceptual model to support their practice. Farmers' roles as producers distinguish them from consumers alone because farmers face risks in production, like weather, pests, and disease, and the uncertainty of their income can affect their perceptions of financial security. The influence of food price fluctuations also has complex effects on farmers. For most non-farm households, these fluctuations only influence their expenditures, but for farm households, their incomes may also be affected. Moreover, farmers' financial expectations and life goals might be different. Farmers' satisfaction with their careers is highly related to their farm business and their relationship with nature. Thus, farmers' family and business aspects are highly related to each other (Archuleta et al., 2017), and so are their financial decisions.

Second, farmers can consume their own-produced food. Farmers are usually primary commodity producers, which means their products can meet some of their basic needs, which is common for smallholders (Huang, Antonides, and Nie, 2020). The potential for own-produced food shapes farmers' risk tolerances, connection to markets, as well as their other behavior patterns.

Third, farm households might have different demographics and access to public resources compared to urban households. Their education level, religion, political leanings, race, accessibility to health care, as well as many other characteristics, might be different from urban households (Hu, 2024; Afoakwah and Koomson, 2021). This may not only shape their perceptions, like financial attitudes, skills, knowledge, and behavior patterns, but may also shape their local society.

Fourth, farm households can have both non-farm income and farm income. Many farm households have significant non-farm income not only because they can provide hired labor to others during slack seasons, but also because other household members can have non-farm occupations.

Fifth, many farm households have separate household and farm finances, yet both have impacts on their FWB. Many farm households keep separate finances for their farm for reasons like financial security, tax returns, management, or ownership structures. Although this pattern splits a farm's finances from the household's, both factors play vital roles for FWB.

To address these gaps in previous literature and fully consider farmers' characteristics, we propose the following conceptual framework (see Figure 1) to help understand farmers' FWB and provide research agendas for future empirical studies. Our conceptual framework consists of two sections: the determinants and the measurements of farmers' FWB, which are illustrated respectively by the two subfigures of Figure 1. In the first section (Panel (a) of Figure 1), we present a structure for how to systematically consider the determinants or influences of farmers' FWB. On the y-axis, we classify the influence into three analytical levels: Macro level, which includes those factors of societies, nations, economics, policies, and environments; Meso level, which includes those factors related to communities, parties, organizations, and groups; and Micro level, which includes those factors at the individual or household level. At every analytical level, we show several example factors to help understand the level classification. Then, for the x-axis, we consider the roles of farmers as consumers and producers. Then, the determinant listed in the left-hand would have stronger impacts on farm households' FWB when considering them as consumers, the determinant listed in the right-hand would impact more on their roles as producers, and the determinants listed in the middle would have impacts on both dimensions. By combining both the x-axis and y-axis, we could better classify these factors. For example, at the Micro level, home entertainment systems like TVs would affect the households' FWB more through their roles as consumers. Farm profit would be an influence that affects their FWB more through the producer channel. The age and education of household leaders could have impacts through both the consumer dimension and the producer dimension.

237 At the core of Panel (a) of Figure 1 is the dependent variable: farm households' FWB,
238 which can be further analyzed through Panel (b) of Figure 1. To systematically measure the
239 farm households' FWB, we build Panel (b) of Figure 1 with 16 dimensions of measures. We
240 propose these dimensions based on previous works of García-Mata and Zerón-Félix (2022),
241 Greninger et al. (1996), Kim and Lyons (2008), Farm Financial Scorecard[1], et al. These 16
242 dimensions are divided into four categories based on whether they are subjective/ objective
243 sides and household/ farm sides. In the **household-subjective category**, we have four
244 dimensions: 1) household short-term needs (HSN), 2) household short-term wants (HSW), 3)
245 household long-term needs (HLN), and 4) household long-term wants (HLW). In the **farm-**
246 **subjective category**, there are the following four dimensions: 1) farm short-term needs (FSN),
247 2) farm short-term wants (FSW), 3) farm long-term needs (FLN), and 4) farm long-term wants
248 (FLW). In the **farm-objective category**, we have five dimensions: 1) farm solvency (FS), 2)
249 farm liquidity (FL), 3) farm profitability (FP), 4) farm repayment and replacement capacity
250 (FRRC), and 5) farm financial efficiency (FFE). Finally, in the **household-objective category**,
251 we have the following three dimensions: 1) household solvency (HS), 2) household liquidity
252 (HL), and 3) household investment (HI).
253 In each dimension, there is at least one (usually more) measure (perceptions or financial
254 ratios) to assess the corresponding aspect of farm households' FWB. Although there would be
255 some flexibility for researchers to choose detailed measures based on their circumstances, we
256 suggest a series of measures in each dimension of our framework (see Table 2). We also
257 provide the rules to transfer these measures (perceptions or financial ratios) into unified
258 numerical scores from 1 to 5, where score 1 means the worst, while score 5 means the best.
259 The detailed rules can be seen in Table 2. The next problem is how to transfer the measures'
260 scores within the same dimension into an aggregated score of the dimension. Ideally, a
261 weighted average should be used, which gives more weight to the more meaningful or
262 informative perceptions or financial ratios. This method can be illustrated with the following
263 equation:

[1] see: https://www.cffm.umn.edu/wp-content/uploads/2019/02/FarmFinanceScorecard.pdf

$$S_d = \sum_{m \in d} W_m \times S_m \quad (1)$$

Where S_d is the aggregated score of the dimension d. m represents the measures within the dimension d. W_m and S_m are the weight and score of the measure m, respectively. And W_m follows $\sum_{m \in d} W_m = 1$. Researchers, when using our framework, should carefully decide the weights of measures based on the study purpose and the measures' significance to the farmers.

With the aggregated scores of dimensions calculated above, a rose diagram can be drawn to illustrate and compare the FWB of different farm households (See Panel (b) of Figure 1). For instance, in our sample figure, the dimension "FL" is graded with "5" and the dimension "HSW" is graded with "4", and two corresponding circular sectors with different sizes are drawn based on these grades.

Our proposed conceptual framework provides a comprehensive and efficient system to understand farmers' FWB and help conduct empirical studies. Farmers' characteristics as consumers and producers are taken into full consideration, the potential missing variable problems can be avoided, and significantly, both subjective and objective aspects are included in the system.

5 Designing a Questionnaire Based on Our Framework

In this section, to support future works related to farmers' FWB, we propose a list of measures for the dimensions of our framework and provide several more keys for research design. Our list of measures is in Table 2. Specifically, survey questions are proposed for measuring subjective perceptions, and financial ratios are proposed for measuring objective dimensions. For each of the 16 dimensions, we propose at least one question/ ratio to measure the corresponding aspect. Researchers who want to apply our framework should include all 16 dimensions and choose at least one question/ratio in every dimension to measure it.

During the survey design and evaluation, we refer to the procedures proposed by Boateng et al. (2018), Gehlbach and Brinkworth (2011), and Kaplowitz et al. (2004). We first list all the related survey questions used in the literature we reviewed. Then we choose and modify some

290 of the questions to best fit our research purposes. To apply our framework, we further construct
291 some questions by ourselves, especially for the farm subjective FWB questions, as there is less
292 literature related. After finishing the survey draft, we invite experts to validate the survey.
293 These experts include professors, farm business extension educators, and researchers in
294 research institutions.[1] We then follow the protocols provided by Beatty and Willis (2007),
295 Boateng et al. (2018), and Fowler (1995) to conduct 2 rounds of cognitive interviews with some
296 of our experts and 3 more ranchers. Finally, we sent the survey to 31 ranches for pilot testing.
297 The pilot testing results suggest content validity and reliable item/scale development of our
298 survey.

299 Besides the measures provided in Table 2, we strongly suggest that researchers pay
300 attention to the following three points in constructing questionnaires. First, researchers should
301 know the farmers' goals for their farm operations and their lives, especially their financial goals.
302 Farmers' perceptions about their financial situations are highly related to their expectations and
303 goals. Because of the difference in financial goals, two farmers with similar financial situations
304 might have significantly different perceptions of well-being. Thus, understanding their goals
305 can help to understand their subjective perceptions. Second, researchers need to know farmers'
306 self-consumption levels because they might impact FWB. For example, a farmer with a higher
307 self-consumption level may be less affected by the risks of price fluctuation and food insecurity.
308 Further, consuming the food produced by themselves could make them less concerned about
309 food safety issues and strengthen their bond with the farms. Finally, self-consumption
310 behaviors may significantly reduce transaction costs, such as fuel and time spent traveling to
311 food stores. Finally, in an ideal circumstance, the importance of every measure and dimension
312 to the farmers should be surveyed. In Equation (1) of Section 4, we provide a weighted average
313 method to aggregate the scores of measures into scores of dimensions. The weights depend on
314 both the study purpose of researchers and the measures' significance to farmers.

[1] Some of these experts can be found in the acknowledgment.

6 Application: Subjective FWB of U.S. Cattle Producers

To empirically apply our framework and the subjective FWB questions, we distributed a survey to the U.S. cattle producers. From May to June 2023 and from April to September 2024, we sent the survey out to 88 cattle ranches[1] located in Michigan, Oklahoma, Texas, Wyoming, and Colorado.[2] We received 178 valid questionnaires (95 in 2023 and 83 in 2024) from 100 respondents distributed in 70 ranches. Although we share the same sponsors and 37 participating farms with Vivas and Hodbod (2024), this study is different in many ways. While Vivas and Hodbod (2024) focus on measuring ranchers' social well-being and exploring how regenerative grazing affects their perceptions, this work aims to study their well-being from a financial perspective. Furthermore, Vivas and Hodbod (2024) concentrate more on the subjective aspects of ranchers' well-being, but this study takes both ranchers' subjective perceptions and objective financial records into consideration. Finally, our work includes the ranchers' demographic to analyze its impacts on FWB.

There are some ranches that correspond to multiple households, and some households with multiple individuals filling out the survey, so we observe a higher number of individual responses than the number of ranches. We provide their summary statistics for the 70 ranches in Table 3. These 70 ranches have ranch sizes from 11 acres to 400,000 acres, with an average of 18,331 acres. Their year-average cattle herd size ranged from 3 head to 25,050 head, with an average of 1,089 head. Generally, ranches in Wyoming have the largest land size and herd size, while those in Michigan have the smallest. We provide the demographic description for the 178 observations in Table 4. Overall, most respondents are male, and their age ranges from 29 to 82, with an average of about 52.

Summary statistics for the 8 subjective FWB dimensions are shown in Table 5[3]. The subjective FWB score averages 4.03 and ranges from 2.44 to 4.93. Notice that in our framework,

[1] Since we use cattle producers as example, we would call them as both ranches (ranchers) and farms (farmers). In this paper, we won't strictly distinguish these two terms, and we believe our framework is applicable for both groups.

[2] The 83 ranches form a purposive sample of ranches participating in university research and they span a range of grazing practices.

[3] As we showed above, a weighted-average method should be the ideal approach to aggregate scores of these subjective measures into dimensions and further into an overall index. However, in this case, we just use a simple-average method for two reasons. First, during our surveying procedures, we were also collecting a lot of other information like their farm overviews, social well-being, and demographics,

the theoretical range of FWB score is from 1 to 5, where score 1 means the worst FWB feeling and 5 means the best. Thus, this 4.03 average FWB score shows these ranchers "somewhat agree" that they are in good financial situations. When we focus on these 8 dimensions, we can observe that they feel best in the household short-term wants and farm long-term needs dimensions, with an average of 4.30, and they feel worst in the farm short-term wants dimension, with an average of 3.33. Interestingly, their average household subjective FWB score, which is 4.21[1], is larger than the average farm subjective FWB score, which is only 3.84[2]. We believe one crucial reason leading to higher household FWB perceptions is their off-farm income, and this situation is more frequently observed in those smaller ranches. Ranchers with smaller ranches usually have more spare time and are more likely to have an off-farm job to support the household (for some small ranchers, they even report their major occupation as non-farm), thus their household financial situation could be better than the farms. Another interesting point we find is that the belief about the farm's future is better than their perceptions of the current farm's financial situation. The average farm short-term perception score is 3.62[3], and the average farm long-term score is 4.07[4]. Despite their native positive expectations about the future, we believe one reason could be that the drought in 2022 resulted in more financial stress in the short run[5].

To further explore the potential determinants of their subjective FWB, we estimate the following regression model to test the relationship between respondents' characteristics and their subjective FWB:

which makes farmers take about 40 minutes averagely to finish the survey. Thus, adding more questions asking about the weights of every measure/dimension would overwhelm them and make them carelessly answer questions. Second, the primary purpose of this study is providing a framework for understanding farmers' FWB, thus the importance of every measure/dimension are not significantly different in our study. Based on these two reasons, we are only able to provide a case study with sample-average method.

[1] 4.21= (4.22+4.30+4.15+4.18)/4

[2] 3.84= (3.90+3.33+4.30+3.83)/4

[3] 3.62= (3.90+3.33)/2

[4] 4.07= (4.30+3.83)/2

[5] Although they finished the survey during May to June 2023, they just finished their tax report of 2022, and we were asking them to recall the past financial situation, so the drought in 2022 could impact their perceptions. They also expressed their operation financial stress in 2022 in the interviews we conducted.

$$y_i = \alpha + \beta_1 Herdsize_i + \beta_2 Landsize_i + \beta_3 Age_i + \beta_4 Gender_i + \beta_5 Eco\_degree_i + \beta_6 Occupation_i + \beta_7 Marriage_i + \beta_8 Education_i + \beta_9 Religion_i + \boldsymbol{\beta}_{10}\mathbf{State}_i + \boldsymbol{\beta}_{11}\mathbf{Income}_i + \boldsymbol{\beta}_{12}\mathbf{Expenditure}_i + \varepsilon_i$$

where y_{it} is the subjective FWB scores of the respondent i, and we use the household subjective FWB scores, farm subjective FWB scores, and overall subjective FWB scores to run the regression separately for each. $Herdsize_i$ and $Landsize_i$ are his/her ranch's year-average cattle number in 100 heads and land size in 100 acres. Age_i is the respondent's age, and $Gender_i$ is a dummy variable that indicates the self-reported gender identity. Eco_degree_i is a dummy variable indicating if the respondent has degrees or certifications related to finance/economics/management. $Occupation_i$ is a dummy variable indicating if they consider their primary occupation as a farmer/rancher. $Marriage_i$ is a dummy variable indicating their marital status, $Marriage_i = 1$ for those married or living with a partner or significant other, $Marriage_i = 0$ for those single, widowed or divorced. $Education_i$ is a continuous variable that indicates their education level in years[1]. Then $\mathbf{State}_i$, $\mathbf{Income}_i$, and $\mathbf{Expenditure}_i$ are vectors each contains several variables indicating the respondent's characteristics of the state they are located, household income[2], and expenditure[3]. The details of these characteristics can be found in Table 4 and Table 5.

We first use OLS regressions to examine the potential effects of these farmers' characteristics on their household FWB, farm FWB, and overall FWB, respectively. Then, notice that the FWB indices are continuous variables with a range of [1,5], which means their perceptions are censored at 1 and 5. Thus, we further provide Tobit regressions to control for

[1] We transfer the original reported discrete education level into a continuous education year variable. Specifically, High school diploma or GED=12, Some college, but no degree=13, Associates or technical degree=14, Bachelor's degree=16, Graduate or professional degree=19.

[2] Ideally, we should divide the household income into non-farm and farm income because our framework distinguishes these two sections. However, when collecting the farms' financial records, most farmers can't accurately divide these two parts and can only provide an overall range of the total income. Thus, we are only able to include the total household income into regressions.

[3] For the household income and expenditure variables, we first build a continuous variable using the media of their reported income/expenditure category shown in Table 4 (for example, if one reports the income as \$25k-\$50k, we use 37.5= (25+50)/2 as the continuous variable). We then interpolate value "0" for those prefer not to report their income/expenditure. Finally, we build a dummy variable which equals to one if they didn't report income/expenditure, equals to zero otherwise. We also tried some other methods for interpolation and building variables for income/expenditure, they all generate robust results. These results are available upon request.

censoring. Furthermore, since there are multiple individuals from the same ranches, they are likely not independent within groups. Thus, all the reported estimators are clustered at the ranch level to allow for intragroup correlation. That is, the observations are independent across ranches but not necessarily within ranches.

The results of the regression are shown in Table 6. Columns (1)-(3) report the results of OLS regressions, and columns (4)-(6) report the results of Tobit regressions. From the estimates of our regression, we obtain some statistically significant evidence that characteristics like age, herd size, land size, location, economics-related degree, household income, and expenditure have impacts on people's FWB perceptions. Specifically, we see that if the respondent is 1 year older, the household, farm, and overall FWB scores increase by about 0.01, which means older people feel better about their financial situation. If the land size they managed increases by 100 acres, their household and overall subjective FWB scores will increase by 0.03. Another interesting counterintuitive finding is the negative relationship between herd size and household FWB. One reason could be that the ranch households with fewer cattle usually have more off-farm income to support the household finances. Furthermore, we can see that if a respondent has a degree related to finance/economics/management, they feel significantly worse about their farm FWB, but we don't observe similar differences for their household FWB. A positive relationship between household annual income and the subjective FWB is observed, which accords with our intuition. As for the household annual expenditure, a negative relationship is observed, which means the more expenditure pressure they have, the worse they feel. We also observe that the ranchers located in Michigan have relatively lower farm subjective FWB.

Although we don't observe statistically significant evidence that gender, marital status, education level, primary occupation as farmers, or religion have impacts on people's FWB perceptions from our regression, we can't conclude that these factors are irrelevant. We believe our 2-year short panel and relatively small sample size of 178 observations limit further statistical findings. For example, this 2-year panel with very few time variations doesn't allow us to use approaches like TWFE to control for unobserved factors, so endogeneity related to

omitted variables could potentially sabotage our results. Moreover, since our sample is only from cattle producers in 5 states in the U.S., we know less about farmers in other areas with different enterprises. Further studies are needed to explore these potential determinants' impacts on a broader scope.

7 Application: Combining Objective and Subjective FWB of U.S. Cattle Producers

Unlike the long-neglected subjective FWB measures, objective financial measures are commonly used by economists or extension educators to value farms' financial situations. The Farm Financial Standards Council (FFSC)[1] suggests that, to build a cogent farm financial report, 4 financial statements are required: the balance sheet, income statement, statement of cash flow, and statement of owner equity (FFSC, 2022). FFSC further proposed 13 financial ratios within 5 categories to measure farms' financial situation. These 5 categories are liquidity, solvency, profitability, repayment and replacement capacity, and financial efficiency (FFSC, 2022). Many extension arms of universities accept these protocols and construct several Farm Financial Scorecards[2] based on the measures/ratios FFSC recommends. Although the appearances of these scorecards vary, they usually have the same 5 categories and 13 ratios[3] that FFSC recommended. For example, extension services of the University of Minnesota, the University of Vermont, Michigan State University, the Ohio State University, and the University of Wisconsin-Madison are currently using or have used the Farm Financial Scorecard to do farm financial analyses. Since these ratios are well-developed and widely used, we also include these ratios in our framework to measure farm objective FWB; details of these 13 ratios can be found in Table 2[4].

[1] See: https://ffsc.org/

[2] One example can be seen: https://www.cffm.umn.edu/wp-content/uploads/2019/02/FarmFinanceScorecard.pdf

[3] FFSC sometimes changed the suggested ratios when updating the Farm Guidelines for Agriculture in the past decade. For example, in 2011, there are 21 suggested ratios in these 5 categories, but in 2022, only 13 ratios. So the Farm Financial Scorecard build at different points might have different ratios included.

[4] Although we use these ratios following the previous literature, we modified some of them. Because when calculating some farm financial ratios, these literatures sometimes mix household and farm finance. For example, when calculating the Farm Debt Coverage Ratio,

For the household objective measures, we follow the suggested financial ratios used by Baek and DeVaney (2004). Specifically, they used liquidity ratio, debt-to-assets ratio, and investment ratio to measure household objective financial wellness. These ratios are also widely used in some other studies (Kim and Lyons, 2008; Lyons and Yilmazer, 2005). The details of these ratios are shown in Table 2.

To parallel the scores that we proposed for subjective measures, we also value these objective measures with scores 1 to 5. These rules for assigning scores to the ranges of ratios are given in Column 3 of Table 2. Notice that these rules are based on previous studies[1] but modified according to the financial data we collected, so these range-to-score rules may not work for all the farms in further studies. The economic background could vary over farms with different locations, enterprises, time periods, operating methods, etc., and these differences could change the evaluation criterion for financial health. Thus, we suggest that researchers adjust the range-to-score rules for objective ratios based on their empirical studies.

After transferring the financial ratios to the 1 to 5 scores, we average the scores within every dimension. For example, there are Current Ratio and Working Capital as % of Gross Revenues within the farm liquidity dimension, so we first give scores to these two ratios separately based on the range-to-score rules, and then average them to calculate the general score for the farm liquidity dimension. This procedure yields one score for each objective dimension, which we combine with subjective scores to build the FWB measurement figure shown in our framework (see the second subfigure of Figure 1).

Through the FWB measurement figures, one can analyze farm households' FWB in a comparable and visualized way without missing much vital information. To illustrate, we provide two ranch households in the U.S. as examples (see Figure 2 and Figure 3). From June to August 2023, we interviewed 53 ranches to collect their 2022 financial records and help

Farm Financial Scorecard also include the off-farm income. But since we separate household from farm in our framework, we also modify these ratios to show "pure" farm finance or "pure" household" finance.

[1] The studies using these household financial ratios usually only have 2 evaluations (i.e., acceptable or not) based on the ratios' ranges. And most Farm Financial Scorecard only separate the ratios' ranges into 3 categories and provide 3 evaluations (i.e., vulnerable, medium, strong). So, we need to expand these ranges into 5 categories and assign them score 1 to 5.

454 build their financial reports. These ranches correspond to the same group that filled out the
455 subjective FWB surveys[1].

456 Figure 2 shows the FWB measurements of two ranch households. The first ranch
457 household (hereinafter, RH 1) is located in Texas, managing 1,500 acres of land. The main
458 enterprise of RH 1 is a cow-calf enterprise, and the 2022 average number of breeding cows
459 kept is about 190. The second ranch household (hereinafter, RH 2) is located in Wyoming
460 operating 6,000 acres of land (hereinafter, RH 2). They are also mainly a cow-calf enterprise,
461 and the 2022 average number of breeding cows they kept is about 500.

462 We can see the advantage of our framework by jointly analyzing these two households. In
463 the household-objective category, both RH 1 and 2 perform well in the household investment
464 (HI) and household solvency (HS) dimensions, but RH 2 is worse off in the household liquidity
465 (HL) dimension. This difference visually reveals that RH 2 has more liquidity pressure. This
466 liquidity pressure is also reflected in their household-subjective category — RH 2 feels worse
467 (than RH 1) in the household short-term needs (HSN) and household short-term wants (HSW)
468 dimensions. In the farm-objective category, RH 2 performs equal to or better in all the
469 dimensions than RH 1. However, in the farm-subjective category, RH 2 feels worse in every
470 dimension than RH 1. After looking into their detailed financial information, we believe two
471 potential reasons lead to this difference. First, RH 2 only owns 15% of the ranch, and it is not
472 the primary decision maker and manager. On the contrary, RH 1 owns 25% and is the primary
473 decision maker and manager. Thus, RH 1 can benefit more from the ranch and has more
474 accurate perceptions of the ranch's finances. Second, RH 1 has about triple the household total
475 assets and non-farm income compared to RH 2, but RH 1 has a smaller ranch. This means that
476 RH 1 can provide more potential financial support to the ranch when needed, thus RH 1 can
477 feel more positive about the ranch's finances.

478 These two ranches provide powerful evidence to support the necessity of dividing
479 households from farms, as well as distinguishing subjective aspects from objective aspects.
480 Since each of these four categories (i.e., household-subjective, household-objective, farm-

[1] Note that we were only able to interview 53 ranches, which is less than the 83 ranches filled out the subjective surveys.

subjective, and farm-objective) can vary from the others, one could have biased results for FWB without distinguishing these four aspects. For example, if researchers only focus on farm-objective measures, like much of the agricultural economics literature, they would conclude that RH 2 is much better than RH 1. However, RH 2's perception of the ranch is more negative than RH 1's. Also, if researchers only focus on household-subjective measurements, as the Consumer Financial Protection Bureau did, they will ignore the fact that RH 2 is operating a more profitable ranch.

8 Conclusions and Implications

This article contributes to the literature on farm households' financial well-being, with a specific focus on developing a conceptual framework to measure FWB by distinguishing subjective and objective aspects, as well as separating household finance from farm finance. We systematically review previous literature related to the basic theory of FWB and studies about farm households' FWB. We identified gaps since previous studies usually ignore the subjective measures, along with ambiguities between household and farm finances. Thus, we construct a conceptual framework to help understand the determinants and measurements of farm households' FWB. We categorize the determinants into micro, meso, and macro levels, as well as their impacts on the household or the farm aspects. For the measurements of FWB, we develop a visualization evaluation figure that measures the FWB through 16 dimensions within 4 categories, i.e., household-subjective category, household-objective category, farm-subjective category, and farm-objective category. Each dimension in the objective categories has one or several financial ratios to measure. Each dimension in the subjective categories has several perception questions to measure.

We then apply our framework to 65 cattle grazing households in the U.S. Through the joint analysis of their subjective FWB and characteristics, we find individuals' age, herd size, land size, location, economics-related degree, household income, and expenditure have statistically significant impacts on their FWB perceptions, but we fail to find significant impacts from land size, gender, location, marital status, education level, or religion. In addition to the empirical

analysis of their subjective aspects, we chose two ranch households' objective scores to build our FWB measurement figures. This application provides instructions for using our framework and shows its advantages.

Policy implications are many. Our research has shown the close relationships among farmers' perceptions, financial goals, and financial performances. It also reveals the interactions and distinctions between household finances with farm finances. Public policies should not only focus on monetary support for agriculture and farmers but also pay attention to the subjective results of these policies. In addition to government payment or transfer payment policies, programs like financial education, management education, and psychological services may also be helpful to improve farm households' FWB and the sustainability of farms. Moreover, our framework, especially the subjective FWB survey, provides tools for farmers to self-analyze their financial status. During the objective data collection interviews that happened after filling out the survey, many respondents shared their appreciation since our survey helped them to rethink their financial situation, reorganize their farm management, and replan for their financial future. Because of the generalizability of our framework, further studies can easily apply it to groups beyond farmers with only minor modifications.

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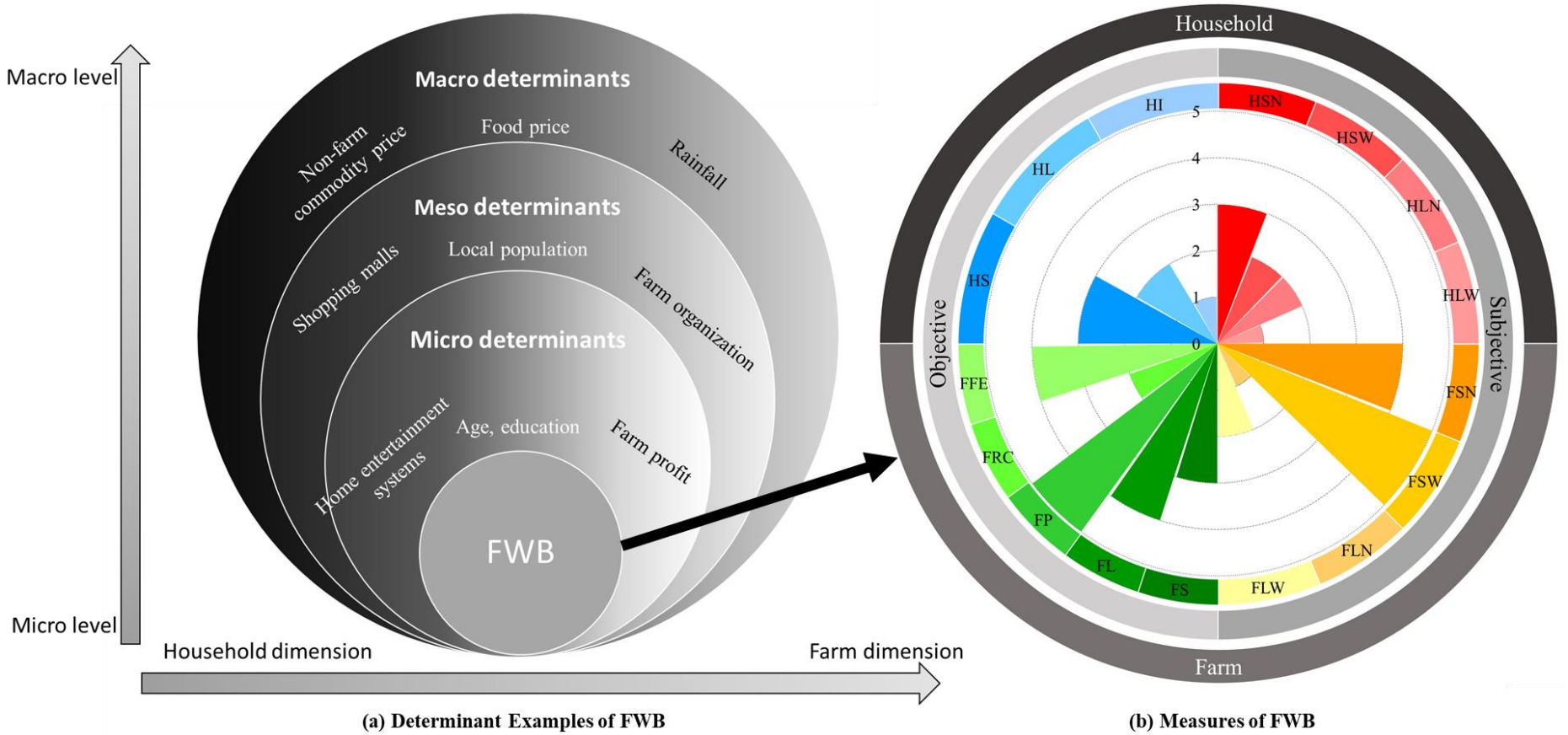
Table 1: Articles Summary

Authors (Year)	Journal	Terms used related to FWB
Vavrek et al. (2022)	International Food and Agribusiness Management Review	Financial Health
Bartholomae et al. (2021)	Family and Consumer Sciences Research Journal	Financial Well-Being
Vavrek, Kravčáková Vozárová and Kotulič (2021)	Agriculture (Switzerland)	Financial Health
Kumar et al. (2020b)	The Indian Journal of Labour Economics	Economic Well-Being
Kumar, Sonkar and Saroj (2020)	Economic and Political Weekly	Economic Well-Being
Ma et al. (2020)	Review of Development Economics	Economic Well-Being
Mello, Azizi and Kama (2020)	Human Organization	Economic Well-Being
Kumar et al. (2020a)	Journal of Agricultural and Resource Economics	Economic Well-Being
İzmen and Üçdoğruk Gürel (2020)	Annals of Regional Science	Economic Well-Being/Perceived Economic Well-Being
Hong, Chang and Dai (2018)	Land Use Policy	Economic Well-Being
Lu and Horlu (2017)	Journal of Rural Studies	Economic Well-Being
Archuleta et al. (2017)	Journal of Family and Economic Issues	Financial Satisfaction
Kosanlawit, Soni and Shivakoti (2017)	Water (Switzerland)	Economic Well-Being
Mammen, Dolan and Seiling (2015)	Journal of Family and Economic Issues	Economic Well-Being
Smale and Mason (2014)	Journal of Development Studies	Economic Well-Being
Akter and Basher (2014)	Global Environmental Change	Economic Well-Being
Kopta (2013)	Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis	Financial Health
Kassem (2013)	Life Science Journal	Financial Health/Perceived Financial Health
Mojoyinola and Blinkhorn (2013)	International Journal of Health Promotion and Education	Economic Well-Being
Matyas and Silva (2013)	Natural Hazards	Economic Well-Being
Kopta (2009)	Agricultural Economics	Financial Health
Katchova (2008)	American Journal of Agricultural Economics	Economic Well-Being
Chang, Lambert and Mishra (2008)	Agricultural Economics	Economic Well-Being
El-Osta, Mishra and Morehart (2007)	Agricultural Economics	Economic Well-Being
Simmons et al. (2007)	Journal of Family and Economic Issues	Economic Well-Being
Austin et al. (2006)	Journal of Research in Childhood Education	Economic Well-Being
Hunter, Boardman and Saint Onge (2005)	Rural Sociology	Economic Well-Being
Mykerezi and Mills (2004)	Review of Regional Studies	Economic Well-Being
Beckett and Pebley (2003)	Rural Sociology	Economic Well-Being
Allen-Smith (1994)	The Review of Black Political Economy	Economic Well-Being
Gustafson (1989)	American Journal of Agricultural Economics	Financial Health
Klein and Tkatchyk (1987)	Canadian Journal of Agricultural Economics	Financial Health
Hill (1982)	Journal of Agricultural Economics	Economic Well-Being
Chase and Lerohl (1981)	Canadian Journal of Agricultural Economics	Economic Well-Being

Figure 1: Conceptual Framework



(a) Determinant Examples of FWB **(b) Measures of FWB**

Note: Figure 1 presents a conceptual framework to study farmers' FWB. The first figure shows the relationships of the determinants in macro, meso, and micro levels, and illustrates how they ultimately impact the core of the framework: farmers' FWB. The second figure illustrates the 16 dimensions to measure farmers' FWB. In the **household-subjective category**, we have four dimensions: 1) household short-term needs (HSN), 2) household short-term wants (HSW), 3) household long-term needs (HLN), and 4) household long-term wants (HLW). In the **farm-subjective category**, there are four dimensions: 1) farm short-term needs (FSN), 2) farm short-term wants (FSW), 3) farm long-term needs (FLN), and 4) farm long-term wants (FLW). In the **farm-objective category**, we have five dimensions: 1) farm solvency (FS), 2) farm liquidity (FL), 3) farm profitability (FP), 4) farm repayment and replacement capacity (FRRC), and 5) farm financial efficiency (FFE). Finally, in the **household-objective category**, we have the following three dimensions: 1) household solvency (HS), 2) household liquidity (HL), and 3) household investment (HI).

Table 2: Suggested Measures/ Survey Questions of FWB

Categories/ Dimensions/ Measures	Answers and the corresponding scores in parentheses	Source
Household Subjective		
Household short-term needs		
To what extent do you agree with the following statements about your household?		
My household could find the money to pay for a financial emergency that costs about $2,000.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Garman and Sorhaindo (2005)
My household could handle a major unexpected expense.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from CFPB (2017)
How often do these statements apply to your household?		
I worry about being able to meet normal monthly living expenses.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from Prawitz et al. (2006)
My household is just getting by financially.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from CFPB (2017)
My household is behind with its finances.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from CFPB (2017)
My household's finances control my life.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from CFPB (2017)
My household has money left over at the end of the month.	Always (5); Often (4); Sometimes (3); Rarely (2); Never (1)	Modified from CFPB (2017)
Household short-term wants		
To what extent do you agree with the following statements about your household?		
Because of our money situation, I feel like we will never have the things we want in life.	Strongly agree (1); Somewhat agree (2); Neither agree nor disagree (3); Somewhat disagree (4); Strongly disagree (5)	Modified from CFPB (2017); Netemeyer et al. (2018)
My household's financial situation is better than others in my community.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Hira and Mugenda (1999)
My household's current financial situation is better than it was 5 years ago.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Hira and Mugenda (1999)
My household can enjoy life because of the way we manage our money.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from CFPB (2017)
How often do these statements apply to your household?		

My household wants to go out for entertainment (eat, watch a movie, etc.) but doesn't go because we can't afford to.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from Prawitz et al. (2006)
Giving a gift for a wedding, birthday or other occasion would put a strain on my household's finances for the month.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Modified from CFPB (2017)
Household long-term needs		
To what extent do you agree with the following statements about your household?		
My household is securing its financial future.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from CFPB (2017)
My household has saved (or will be able to save) enough money to last to the end of my life.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Netemeyer et al. (2018)
I am confident that my household can repay its long-term debt on time (e.g., housing mortgage).	My household doesn't have any long-term debt (5); Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Brand et al. (2022)
I am concerned the money my household has saved or will save won't last.	Strongly agree (1); Somewhat agree (2); Neither agree nor disagree (3); Somewhat disagree (4); Strongly disagree (5)	Modified from CFPB (2017)
Household long-term wants		
To what extent do you agree with the following statements about your household?		
My household will achieve its long-term financial goals	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Garman and Sorhaindo (2005); Hira and Mugenda (1999); Netemeyer et al. (2018)
Over the next 5 years, I think my household's financial situation will be better than others in my community.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Hira and Mugenda (1999)
Farm Subjective		
Farm short-term needs		
To what extent do you agree with the following statements about the farm/ranch?		
The farm/ranch's financial condition is strong enough to survive the next year.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors

I am comfortable with the farm/ranch's projected cash flow for the next year.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Johnson, Lessley and Hanson (1998)
The farm/ranch could find the money to pay for a financial emergency that costs about 15% of its annual cash sales.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Garman and Sorhaindo (2005)
How often does this statement apply to the farm/ranch?		
The farm/ranch is profitable.	Always (5); Often (4); Sometimes (3); Rarely (2); Never (1)	Modified from Johnson, Lessley and Hanson (1998)
Farm short-term wants		
To what extent do you agree with the following statements about the farm/ranch?		
The farm/ranch is generating enough profit to meet short-term goals (3 years or less).	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
My time and ability that I invest in the farm/ranch is earning a greater return than if I invested it into another job.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Johnson, Lessley and Hanson (1998)
My financial investment in the farm/ranch is earning a greater return than if I invested it elsewhere.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Johnson, Lessley and Hanson (1998)
How often does this statement apply to the farm/ranch?		
The farm/ranch delays purchasing equipment because of financial strain.	Always (1); Often (2); Sometimes (3); Rarely (4); Never (5)	Constructed by authors
The farm/ranch's net worth (owner's equity) is _____ it was 5 years ago.	A lot less than (1); Less than (2); About the same as (3); More than (4); A lot more than (5)	Modified from Brand et al. (2022)
Farm long-term needs		
To what extent do you agree with the following statements about the farm/ranch?		
I am likely to stop farming/ranching or significantly change the farming/ranching operation in the next five years because of a tough financial situation.	Strongly agree (1); Somewhat agree (2); Neither agree nor disagree (3); Somewhat disagree (4); Strongly disagree (5)	Constructed by authors
I am confident that the farm/ranch can repay its long-term debt on time (e.g., real estate).	My farm/ranch doesn't have any long-term debt (5); Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Brand et al. (2022)

I am confident the farm/ranch can handle revenue risks (e.g., yield, price, quality) over the next 10 years.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
To the best of my knowledge, the ratio of the farm/ranch's debt to assets (farm/ranch debt divided by farm/ranch assets) is:	Less than 20% (5); Between 20%-39% (4); Between 40%-59% (3); Between 60%-80% (2); More than 80% (1)	Modified from Johnson, Lessley and Hanson (1998)
Farm long-term wants		
To what extent do you agree with the following statements about the farm/ranch?		
The farm/ranch's profit is sufficient to meet long-term goals (e.g., environmental sustainability, financial sustainability, farm/ranch succession, etc.).	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
Over the next 5 years, the farm/ranch's financial situation will be better than other farms/ranches in my community.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Modified from Delaney and Huselid (1996); Singh (2004)
I still want to be a farmer/rancher in 5 years.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
The farm/ranch will be able to financially support my successor or heirs (even if I do not have a plan for this yet).	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
If there was land for sale that I wanted to buy, the farm/ranch has resources or access to credit that are sufficient to make the purchase.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
I am confident the farm/ranch can adapt to changes in the agricultural industry (e.g., policies, technology, etc.) over the next 10 years.	Strongly agree (5); Somewhat agree (4); Neither agree nor disagree (3); Somewhat disagree (2); Strongly disagree (1)	Constructed by authors
Household Objective		
Household solvency		
Debt-to-asset ratio = total debts/total assets	Over 0.6 (1); 0.6-0.5 (2); 0.5-0.3 (3); 0.3-0.1 (4); Less than 0.1(5)	Baek and DeVaney (2004); Kim and Lyons (2008); Lyons and Yilmazer (2005)
Household liquidity		

The liquidity ratio= liquid assets/monthly expenses[1]	Less than 1.5 (1); 1.5-2.0 (2); 2.5-3.0 (3); 3.0-5.0 (4); over 5.0 (5)	Greninger et al. (1996); Baek and DeVaney (2004); Kim and Lyons (2008); Lyons and Yilmazer (2005)
Household investment		
The investment assets ratio= investment assets/net worth	Less than 0.1 (1); 0.1-0.2 (2); 0.2-0.3 (3); 0.3-0.4 (4); over 0.4 (5)	Baek and DeVaney (2004); Kim and Lyons (2008); Lyons and Yilmazer (2005)
Farm Objective		
Farm liquidity		
Current ratio= Total current farm assets/ Total current farm liabilities	Less than 1 (1); 1-1.3 (2); 1.3-2.0 (3); 2.0-3.0 (4); over 3.0 (5)	FFSC, 2022
Working Capital as % of Gross Revenues = Working capital/ Gross revenues	Less than 0.05 (1); 0.05-0.1 (2); 0.1-0.3 (3); 0.3-0.5 (4); over 0.5 (5)	FFSC, 2022
Farm solvency		
Debt-to-asset ratio= Total farm liabilities / Total farm assets	Over 0.8 (1); 0.8-0.6 (2); 0.6-0.3 (3); 0.3-0.1 (4); Less than 0.1 (5)	FFSC, 2022
Farm profitability		
Rate of return on farm assets= (Income from operations - Owner withdrawals for unpaid labor and management)/ Average total business assets	Less than 0.02 (1); 0.02-0.04 (2); 0.04-0.08 (3); 0.08-0.11 (4); Over 0.11 (5)	FFSC, 2022; Yi and Ifft (2019)
Rate of Return on Equity= (Income from operations - Total interest expense - Owner withdrawals for unpaid labor and management)/ Average total business net worth	Less than 0.01 (1); 0.01-0.03 (2); 0.03-0.10 (3); 0.10-0.15 (4); Over 0.15 (5)	FFSC, 2022
Operating Profit Margin Ratio= (Income from operations - Owner withdrawals for unpaid labor and management)/ Gross revenues	Less than 0.10 (1); 0.10-0.15 (2); 0.15-0.25 (3); 0.25-0.35 (4); Over 0.35 (5)	FFSC, 2022
Asset Turnover Ratio= Gross revenues/ Average total business assets	Less than 0.20 (1); 0.20-0.30 (2); 0.30-0.45 (3); 0.45-0.55 (4); Over 0.55 (5)	FFSC, 2022

[1] The standard household liquidity ratio should be constructed by household liquidity assets divided by monthly expenses (Greninger et al., 1996). It reveals the number of months that a household could continue to meet its expenses if loses all its income because of incidents, illness, unemployment, etc. However, many empirical literatures use monthly income to substitute monthly expenses in constructing liquidity ratios (DeVaney, S. A., 1994; Baek and DeVaney, 2004; Kim and Lyons, 2008). This limitation is because of the dataset availability of U.S. consumers (Chang, Hanna and Fan, 1997). Thus, we suggest researchers use the standard liquidity ratio construction (liquid assets/monthly expenses) if they can access or collect the expense information. If not, the construction of using household income as a substitution could be an option.

Farm repayment and replacement capacity		
Debt coverage ratio= Repayment and replacement capacity/ Uses of repayment and replacement	Less than 1.0 (1); 1.0-1.3 (2); 1.3-1.8 (3); 1.8-2.5 (4); over 2.5 (5)	FFSC, 2022
Replacement Coverage Ratio= Repayment and replacement capacity/ (Uses of repayment and replacement capacity + Replacement allowance/Unfunded capital expenditures)	Less than 0.7 (1); 0.7-1.1 (2); 1.1-1.5 (3); 1.5-2.0 (4); over 2.0 (5)	FFSC, 2022
Farm financial efficiency		
Operating expense ratio= (Total operating expenses - Depreciation expense - Amortization expense)/ Gross revenues	Over 0.9 (1); 0.9-0.8 (2); 0.8-0.6 (3); 0.6-0.5 (4); Less than 0.5 (5)	FFSC, 2022
Depreciation/Amortization Expense Ratio= (Depreciation expense + Amortization expense)/ Gross revenues	Over 0.15 (1); 0.15-0.10 (2); 0.10-0.05 (3); 0.05-0.03 (4); Less than 0.03 (5)	FFSC, 2022
Interest Expense Ratio= Total farm interest expense/ Gross revenues	Over 0.15 (1); 0.15-0.10 (2); 0.10-0.05 (3); 0.05-0.03 (4); Less than 0.03 (5)	FFSC, 2022
Income from Operations Ratio= (Income from operations - Total interest expense)/ Gross revenues	Less than 0.05 (1); 0.05-0.10 (2); 0.10-0.20 (3); 0.20-0.30 (4); over 0.30 (5)	FFSC, 2022

Table 3 Summary Statistics for Ranches

State	Number of ranches	Minimum ranch size (acres)	Average ranch size (acres)	Maximum ranch size (acres)	Minimum year-average cattle herd size (heads)	Average year-average cattle herd size (heads)	Maximum year-average cattle herd size (heads)
Michigan	34	11	429.1	2000	3	156.9	1236
Colorado	9	5000	24888.9	76000	185	1472.2	4345
Wyoming	12	1100	83973	400000	172	4282.8	25050
Texas	11	450	3134.1	11200	87	446.6	1040
Oklahoma	4	158	612	1450	53	335.3	1085
All	70	11	18331.3	400000	3	1089.0	25050

Table 4 Ranchers' Demographics

Total Number of observations	178	Location	
Total Number of respondents	100	Colorado	23
Number of respondents in 2023	95	Michigan	89
Number of respondents in 2024	83	Oklahoma	6
Gender identity:		Texas	29
Male	108	Wyoming	31
Female	70	Primary occupation as farmer/rancher:	
Age:		Yes	109
Minimum	29	No	69
Average	51.84	Household income before tax during the past 12	
Maximum	82	months:	
Maximum education level:		Less than $25,000	3
High school diploma or GED	9	$25,000-$49,999	12
Some college, but no degree	22	$50,000-$74,999	36
Associates or technical degree	17	$75,000-$99,999	31
Bachelor's degree	77	$100,000-$149,999	35
Graduate or professional degree	53	$150,000 or more	47
Having degrees or certifications related to		Prefer not to say	14
finance/economics/ management		Household expenditure during the past 12	
Yes	36	months:	
No or prefer not to say	142	Less than $10,000	4
Current marital status:		$10,000-$24,999	8
Single	9	$25,000-$49,999	41
Married	155	$50,000-$74,999	35
Living with a partner or significant other	8	$75,000-$99,999	32
Divorced	5	$100,000-$149,999	22
Widowed	1	$150,000 or more	12
Have religion		Prefer not to say	24
Yes	143		
No	35		

Table 5 Summary Statistics of Subjective FWB scores

Dimensions	Minimum	Median	Mean	Maximum	St Dev
HSN (household short-term needs)	1.71	4.29	4.22	5.00	0.64
HSW (household short-term wants)	2.17	4.50	4.30	5.00	0.61
HLN (household long-term needs)	1.75	4.25	4.15	5.00	0.77
HLW (household long-term wants)	1.50	4.00	4.18	5.00	0.73
FSN (farm short-term needs)	1.25	4.13	3.90	5.00	0.88
FSW (farm short-term wants)	1.40	3.40	3.33	4.80	0.79
FLN (farm long-term needs)	2.00	4.50	4.30	5.00	0.62
FLW (farm long-term wants)	1.50	4.00	3.83	5.00	0.78
Average	2.44	4.11	4.03	4.93	0.55

Table 6 Analysis Results

	OLS Model			Tobit Model		
	(1)	(2)	(3)	(4)	(5)	(6)
	Household FWB	Farm FWB	Overall	Household FWB	Farm FWB	Overall
Age	0.0130***	0.0095*	0.0112***	0.0136***	0.0095**	0.0112***
	(0.0046)	(0.0050)	(0.0042)	(0.0046)	(0.0047)	(0.0040)
Herd size (100 head)	-0.0063***	-0.0023	-0.0043*	-0.0061***	-0.0023	-0.0043*
	(0.0023)	(0.0035)	(0.0024)	(0.0022)	(0.0034)	(0.0023)
Land size (100 acre)	0.0003**	0.0003	0.0003*	0.0003**	0.0003	0.0003*
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0002)	(0.0001)
State (default is OK):						
CO	-0.1446	-0.4840	-0.3143	-0.1769	-0.4840	-0.3143
	(0.1936)	(0.3114)	(0.2278)	(0.1884)	(0.2960)	(0.2166)
MI	-0.0384	-0.4525**	-0.2455	-0.0281	-0.4525**	-0.2455
	(0.1426)	(0.2199)	(0.1625)	(0.1370)	(0.2091)	(0.1545)
TX	-0.0676	-0.2703	-0.1689	-0.0261	-0.2703	-0.1689
	(0.1764)	(0.2854)	(0.1994)	(0.1748)	(0.2713)	(0.1896)
WY	0.0169	-0.1021	-0.0426	0.0240	-0.1021	-0.0426
	(0.2060)	(0.2594)	(0.2032)	(0.2001)	(0.2467)	(0.1932)
Gender identity (default is male)						
Female	-0.0936	-0.0946	-0.0941	-0.0991	-0.0946	-0.0941
	(0.1151)	(0.1260)	(0.1018)	(0.1127)	(0.1198)	(0.0968)
Current marital status (default is divorced/single)						
Living with a partner or significant other /married	0.0475	0.0056	0.0265	0.0280	0.0056	0.0265
	(0.3130)	(0.2507)	(0.2606)	(0.3161)	(0.2384)	(0.2477)
Education level	0.0282	-0.0002	0.0140	0.0339	-0.0002	0.0140
	(0.0220)	(0.0287)	(0.0224)	(0.0222)	(0.0273)	(0.0213)

Continued Table 6 Analysis Results

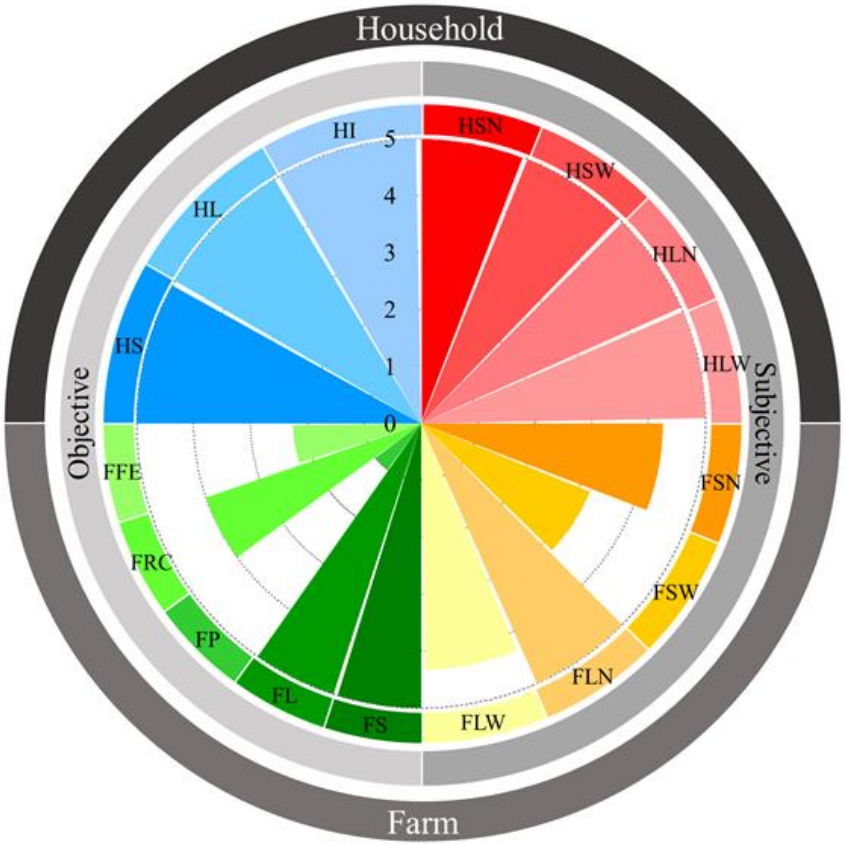
	OLS Model			Tobit Model		
	(1)	(2)	(3)	(4)	(5)	(6)
	Household FWB	Farm FWB	Overall	Household FWB	Farm FWB	Overall
Economics-related degree (default is No):						
Yes	-0.0428	-0.2744*	-0.1586	-0.0331	-0.2744**	-0.1586
	(0.1127)	(0.1390)	(0.1055)	(0.1124)	(0.1321)	(0.1003)
Primary occupation as farmer/rancher (default is No):						
Yes	0.0898	0.2820	0.1859	0.1274	0.2820*	0.1859
	(0.1502)	(0.1704)	(0.1400)	(0.1467)	(0.1620)	(0.1331)
Household income (1000$):	0.0065***	0.0043***	0.0054***	0.0071***	0.0043***	0.0054***
	(0.0010)	(0.0013)	(0.0010)	(0.0011)	(0.0012)	(0.0010)
Not_report_income	1.0627***	0.4827*	0.7727***	1.2155***	0.4827*	0.7727***
	(0.2764)	(0.2664)	(0.2379)	(0.2946)	(0.2533)	(0.2262)
Household expenditure (1000$):	-0.0033***	-0.0035**	-0.0034***	-0.0040***	-0.0035**	-0.0034***
	(0.0011)	(0.0014)	(0.0012)	(0.0012)	(0.0014)	(0.0011)
Not_report_expenditure	-0.3807*	-0.2293	-0.3050*	-0.4551**	-0.2293	-0.3050*
	(0.2122)	(0.1940)	(0.1803)	(0.2132)	(0.1845)	(0.1715)
Having religion (default is No or Prefer not to say):						
Yes	0.0414	-0.1313	-0.0449	0.0234	-0.1313	-0.0449
	(0.1284)	(0.1458)	(0.1266)	(0.1295)	(0.1387)	(0.1204)
Constant	2.5610***	3.4571***	3.0090***	2.4333***	3.4571***	3.0090***
	(0.5144)	(0.6127)	(0.5103)	(0.5386)	(0.5825)	(0.4852)
Observations	178	178	178	178	178	178

Note: Standard errors are in parentheses, and the standard errors are clustered at the ranch level

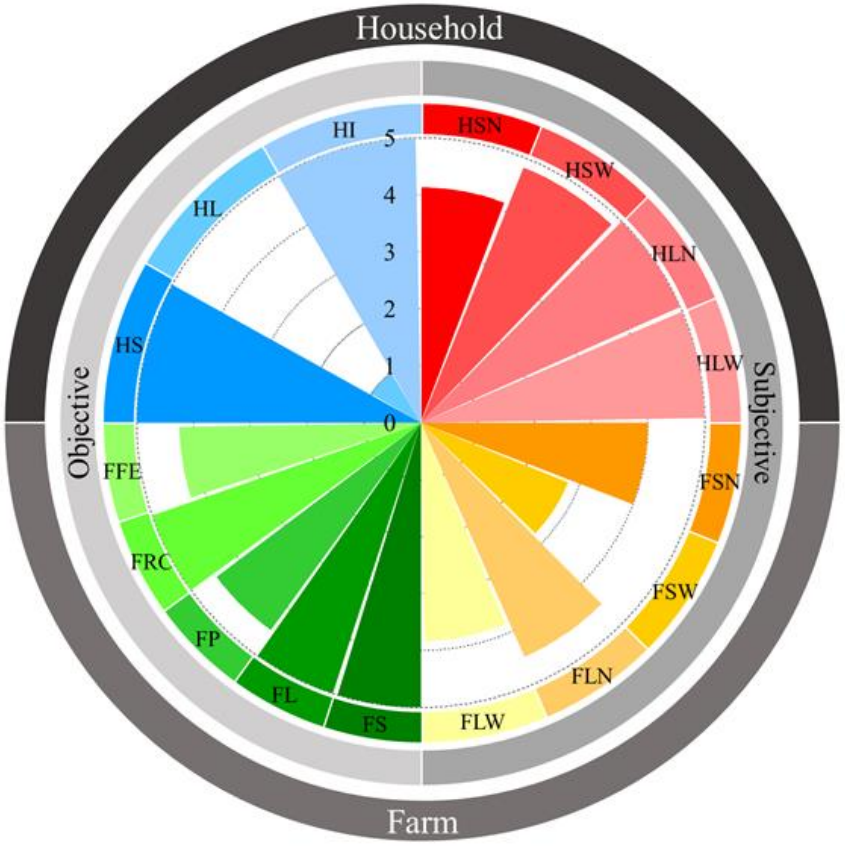
* p < 0.1, ** p < 0.05, *** p < 0.01

The Tobit model sets the left-censoring limit at 1 and the right-censoring limit at 5.

Figure 2: Examples of FWB measurements



Ranch household 1 (RH 1)



Ranch household 2 (RH 1)