RESEARCH ARTICLE

Social ties and food insecurity in woman-headed households

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Abstract

Food insecurity is a global concern, as set in the Sustainable Development Goal 2. Previous research has focused on the demographics and socioeconomic determinants of food insecurity, while little attention has been paid to the role of social ties. Using a national representative survey of Chile, that includes a questionnaire to measure prevalence of food insecurity and 11 social ties, we estimate the prevalence of four groups using a sample of 70,677 households. Then, we focus on the sub-sample of 29,203 woman-headed households, who experience the largest food insecurity prevalence. We use a descriptive analysis, followed by a principal component analysis to aggregate 11 social ties in fewer components to assess the associations between social ties and food insecurity and to identify the ties with stronger impact. The results show that woman-headed households, without a partner, have a prevalence of moderate or severe food insecurity of 32.8%, 30.9%, 24.7%, after none, one and two social ties, respectively. This decreasing trend is also observed in woman-headed households with partners. We also found that the 11 social ties studied are highly correlated among them; they can be explained by two indexes—economic and education components. In particular, we found that economic and educational social ties are associated to a larger effect on food insecurity prevalence. This study provides evidence for policy-makers regarding investment on social ties to tackle food insecurity.

KEYWORDS
FIES questionnaire, food security, household behavior, SDG2, social ties, woman-headed households

1 | INTRODUCTION

Social ties are specific connections between individuals or groups, such as friendships, academic or work relationships, or memberships in formal organizations, such as churches or unions (Granovetter, 1973). Social ties can contribute by improving mental (Kawachi & Berkman, 2001) and physical health (Seeman, 1996), and by facilitating or increasing access to resources (Sletten, 2011;

Wegener, 1991). Another benefit that can result from having social ties is that they can lead to improved food security (Nieminen et al., 2013; Nosratabadi et al., 2020). According to the Food and Agriculture Organization (1996), FAO, "Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life".[1] In 2022, as presented by FAO et al. (2023), approximately 2.4 billion people

experienced moderate or severe food insecurity worldwide.[2] Despite various efforts to decrease the prevalence of food insecurity, such as food boxes distributed by the government (Giacoman et al., 2021), the recent COVID-19 pandemic has increased the relevance of food insecurity in the public policy agenda. According to the FAO et al. (2023), the COVID-19 pandemic caused that at least 122 million additional people began to experience hunger in the world.[3]

Regarding the mechanism to improve food security, it is possible that social ties mitigate food insecurity by providing emotional support in addition to access to resources. This emotional support can involve sharing activities with others such as buying food, cooking, or sharing meals (Woltil, 2012). Valliant et al. (2022) found that older adults living alone, especially those with depression (Goldberg & Mawn, 2015), have a higher prevalence of food insecurity. Hunt et al. (2019) found that those who reported feelings of loneliness were more than twice as likely to experience food insecurity. Therefore, considering that food insecurity is an experience, as defined by FAO (1996), providing emotional support may act as a mediator, indirect path, through which a household can reduce their food insecurity.

Social ties could contribute to food security by enhancing the well-being of individuals. King (2017) developed a quantitative study in an urban setting in the United States and found that social support and cohesion reduced the risk of becoming and remaining food insecure. The study also suggested that to improve household access to food, interventions should be developed at the neighborhood level, to promote social ties and reduce food insecurity. Schmeer et al. (2015) developed a study focusing on interviewing women in an urban setting in Nicaragua, and showed that greater maternal social support results in reduced odds of experiencing household food insecurity.

The impact of social ties on food insecurity may be due to multiple characteristics such as the types and strength of community social ties (Niles et al., 2021). A study by Martin et al. (2004), measuring social ties through a scale, found that low-income households living in the United States in neighborhoods with strong social ties are half as likely to go hungry than households living in a neighborhood with weak social ties. The authors identified that a household with strong social ties is characterized by belonging to an organization, having an older adult in the household, and having the trust (or connection with) of someone who can lend a car (but not own one).

Examples of initiatives to aid food insecurity representing community social ties are vast. In Latin America, low-income communities organize neighborhood kitchens or what is called in Spanish *olla común* (a literal translation into English "common or shared pot") as a way to mitigate food insecurity (Santos et al., 2022). In an *olla común*, people collaborate by exchanging food, cooking utensils and appliances (e.g., stove), and by volunteering to provide one meal a day to the community (Shrivastav et al., 2022). Previous research has documented the *olla común* in Chile after the economic crisis of the 80s, such as the work presented by Hiner (2011). Then, the *olla común* appears again after the COVID-19 pandemic. Other initiatives such as the exchange of local/self-grown fresh food products could serve as examples of how social ties can improve food availability and access in communities (Lope-Alzina, 2014). Lee et al. (2018) found

that urban households in Perú, particularly those that share food regularly, maintain food security and that affiliation with a more established, larger, and well-connected community is positively correlated with greater food security.

There are many examples of community led or citizens' initiatives and their positive impact on food security. However, there is little research looking at the association of social ties when assessing food insecurity, and the one available is scattered (Nosratabadi et al., 2020). Previous research on food security has concentrated on socioeconomic determinants at the household level, often overlooking the role of social ties, implicitly assuming that each household exists in isolation (Silva et al., 2023), which is far from the reality. While food insecurity keeps increasing, academic research maintains its focus on determinants at the household level, and little attention has been given to analyze the relation among households and between household and other agencies.

Therefore, this study aims to fill this gap by exploring the association between households, social ties, and food insecurity, looking in particular at woman-headed households in Chile. We selected woman-headed households because they experience higher levels of food insecurity (Felker-Kantor & Wood, 2012; Grimaccia & Naccarato, 2022; Jung et al., 2017; Njuki et al., 2022), especially single mothers with children (Magaña-Lemus et al., 2016; Santos et al., 2022; Schmeer et al., 2015), and who are likely to be (or should be) a public policy target. Woman-headed households have a higher prevalence of food insecurity, compared to man-headed ones. Craig et al. (2023) estimated the effect of bridging and bonding on rural households in Malawi. Their results showed that bonding social ties and bridging social ties were associated with better access to food, in which the first decreases the odds of being food insecure to a greater extent for woman-headed households and the later for male-headed households. Moreover, linking social ties correlated with lower access to food shows that the benefit varies by context. Dhokarh et al. (2011) found a strong relationship between participation in social events, like church activities or soup kitchens, and food security among low-income women with children in the United States. Additionally, Dzanja et al. (2015) found that in rural communities in Malawi, help between neighbors and family in times of economic distress constitutes a safety net that benefits households by reducing their food insecurity. Therefore, gender is expected to be relevant in our analysis.

In addition, taking advantage that our dataset includes 11 types of social ties, we want to analyze the relation between different types of social ties and food insecurity. Dhokarh et al. (2011) found, in Puerto Rico, that not having a car was associated with food insecurity. On the contrary, having a car could mitigate food insecurity. Similarly, Mirabitur et al. (2016) found that students at a public university without access to a car were 2.2 times more likely to experience food insecurity compared to students with access to a car. Therefore, the lack of access to transportation could exacerbate food procurement problems (Garasky et al., 2006; Valliant et al., 2022). Language support constitutes yet another type of social tie that can help overcoming social isolation. In Puerto Rico, Dhokarh et al. (2011) found that

speaking only Spanish was associated with a higher prevalence of food insecurity, while receiving assistance with language translation reduced it. Hunt et al. (2019), conducted a study among adults in an urban setting, where English is the official language, and found that respondents identifying English as their mother tongue had less odds of experiencing food insecurity. Soldavini et al. (2019) found that international undergraduate students were more likely to suffer from food insecurity. This may happen because international students are generally on their own or may not fully master the local language. Language support could help undergraduate students increase their levels of food security.

Our study is one of the few that focuses on the relation among households, which helps to open a new set of strategies to tackle food insecurity. Our findings will provide evidence to policy-makers about a key social group as it is (low-income) woman-headed households with children, that could directly enhance policies supporting social ties as a means of improving food security. Additionally, this study provides an example of how food security and social ties could be included in a nationwide socio-economic survey, whose results are freely available and accessible. Finally, the outcomes of this study challenge the current approach of direct economic support to households providing a holistic understanding of the importance of social ties and therefore investment on them by public policies.

2 | MATERIALS AND METHODS

Social ties vary depending on who or what the person is tied to, being typically classified as formal or informal. Formal social ties are those established with organizations or individuals with different social and demographic characteristics (Granovetter, 1973), while informal social ties refer to relationships with family and friends (Ferlander, 2007). For this study, we analyzed the effect of a set of 11 informal social ties on food insecurity in two ways:

1. Showing the association of informal ties with the percentage of the population that experiences food insecurity, through descriptive statistics, graphical analysis, and a set of probit models; and
2. Analyzing the effect of marital status (with a partner vs. without a partner) on food insecurity, and how social ties can mediate this effect.

The following sections describe the datasets use, the food security assessment method, and the models.

2.1 | Dataset

The *Encuesta Nacional de Caracterización Socioeconómica de Hogares de Chile*, known as the CASEN Survey (National Socio-Economic Household Characterization Survey) is a household survey, cross-sectional and multipurpose in nature, conducted by the *Ministerio de Desarrollo Social y Familia*. The CASEN has been conducted biennially

or triennially since 1987. To date, 15 versions of the survey have been conducted. The sampling units of the 2017 CASEN Survey are households, selected through probabilistic, stratified, and multistage sampling. The interview is conducted with one informant per household, usually the head of the household or, alternatively, a person aged 18 or older who is a habitual resident of the household. Through the report of the informant, data are collected from all members of the household who are habitual residents of the dwelling.

In the 2017 CASEN Survey, the sample size reached 70,948 households, in which 83,232 family units and 216,439 individuals were identified and characterized. The information was collected between November 2, 2017 and February 4, 2018. The variable of interest in determining the sample size was the income poverty rate, and the sample was representative, for this indicator, at the national level, by residential area (urban and rural), and by regions (MIDESO, 2018). The questionnaire of the 2017 CASEN Survey was applied in paper format and in face-to-face interviews. The questionnaire of the 2017 CASEN Survey consists of seven thematic modules: Registration of residents; education; employment; income; health; identities, networks, and participation; and housing and environment (MIDESO, 2018).

A unique feature of the CASEN survey is that since 2017 includes the Food Insecurity Experience Scale (FIES) questionnaire and a set of 11 social ties variables. The social ties encompass a wide range of social support dimensions, including assistance with caregiving for sick or disabled family members, access to resources such as cars or financial help, aid with legal matters and technology, support for household repairs, assistance in job searches, availability of someone for advice, help with language skills, and proximity to individuals with higher education degrees. To the best of our knowledge, there is no other publicly available national dataset that combines the FIES questionnaire and social ties variables in a representative manner, allowing for their integration with socioeconomic indicators for analysis.

2.2 | Assessment of food security

We assessed food insecurity using the FIES questionnaire for various reasons. The FIES survey is widely regarded as the standard instrument for measuring food insecurity in nationally representative samples, such as the CASEN survey. Moreover, the FIES is globally calibrated to ensure the comparability of food insecurity results with those of other countries (Saint Ville et al., 2019). Ultimately, the official Sustainable Development Goals (SDGs) indicator framework identifies the FIES-based estimation of moderate or severe food insecurity prevalence as SDGs of Indicator 2.1.2. (FAO, 2022).

Following the procedure presented by Viviani (2016), we converted the FIES questionnaire answers into parameters associated with the probability of experiencing moderate or severe food insecurity. The FAO procedure can be summarized in three main steps:

1. We encoded the answers as binary (yes–no), excluding the answers "does not know" and "does not answer";

2. We calculated the parameters of the items to express food insecurity and thus assigned the position of the items according to the parameters, based on the general pattern of responses, in a relative scale of severity;
3. We compared, using the equating function, the CASEN item parameters with the Standard Global vector, to later generate the probability of food insecurity per household.

Finally, following Erdenesan (2020), we conducted a statistical validation using Infit, reliability, and correlation matrix. More details of the validation procedure can be found in Silva et al. (2023).

2.3 | Models

2.3.1 | Probit model

For our analysis we use restricted and full or unrestricted probit model to analyze the relationship of social ties with the probability of presenting food insecurity in the household. The restricted version only has social ties as explanatory variables, while the full probit model adds household and household head characteristics. We used the probit model since it is a latent variable model and our variable of interest takes binary values (food secure vs. food insecure). The model to estimate is:

$$\Pr(Y = 1|X) = \Phi(X^T \beta). \tag{1}$$

This model estimates the probability of food insecurity being equal to 1 given the explanatory covariant X, using the cumulative distribution function of the standard normal distribution. The coefficients β indicate how each covariant affects the probability of experiencing food insecurity.

2.3.2 | Principal component analysis

Principal component analysis (PCA) was conducted to examine the relationship among the 11 social ties variables considered in our analysis. PCA is particularly pertinent in our study because the social ties variables may exhibit correlations with each other. By employing PCA, we aim to reduce the dimensionality of the dataset to its primary components, which encapsulate the majority of the variation observed in the outcome (Kherif & Latypova, 2020). Subsequently, we regressed the socioeconomic characteristics to the principal components resulting from the PCA. The data analysis, both the regressions models and the PCA, was conducted using the Stata 17.0 software.

3 | RESULTS

This section assesses the association of food insecurity and social ties, and their unique relevance. The analysis will begin with descriptive

statistics of the sample and graphical comparison of food insecurity prevalence across a set of social ties. Second, using alternative probit model specifications, the effect of a set of social ties on food insecurity will be analyzed; finally, using PCA we will explore whether the social ties can be reduced to a few indexes.

3.1 | Descriptive statistics

Table 1 compares descriptive statistics by household head gender and by marital status. Each average is compared using a linear regression and statistical weights. Household income, household head education, type of household and region are set of categorical variables; therefore, the mean is interpreted as a proportion of the total sub-sample. Additionally, mean differences are calculated for each gender, emphasizing how the characteristics vary depending on the marital status of the household head.

Man-headed households, on average, have 0.2 children when they do not have a partner, while when they have a partner, it increases to 0.9 children per household. In contrast, woman-headed households have 0.7 children when they do not have a partner and 0.9 children when they have a partner. In other words, on average, woman-headed households without partners have more children than their man-headed counterparts.

As seen in Table 1, when comparing marital status groups, with a partner versus without a partner, results show that means are significantly different from zero by household head gender. A man-headed household without a partner has significantly different means compare with women-headed household in terms of household-head age (53.3 vs. 56.2 years old), number of children (0.2 vs. 0.7), income categories (66% vs. 72% in low income bracket), education of the household head, type of household (urban vs. rural), region category, and percent of population that experience food insecurity (13.1% vs. 16.8%). However, even being significantly different from zero, in some cases, the difference may not be relevant.

The prevalence of households experiencing moderate or severe food insecurity, at national level, is also presented in Table 1. Woman-headed households without a partner have a prevalence of food insecurity of 16.8%, which is the largest of the four groups studied in Table 1. Also, women-headed households without a partner are older (56.2 year), with a larger proportion of low-income households (72%), larger proportion of low-education (74% up to high school level) and urban households (92%). It is then clear that woman-headed households without a partner are the most vulnerable group. Responses of FIES questionnaire can be seen in Table A4 of supporting information.

Considering that the objective of this study is to analyze the relation between social ties and food security, we define having a partner as a social tie within the household or intra-household social tie. In this way, a household has social ties within its members and between households (among-households social ties). In order to analyze both types of social ties, we used only woman-headed households in the analysis, which allowed us to focus on the most vulnerable group, the

TABLE 1 Descriptive statistics by household-head gender and marital status.

	Man-headed Without partner Mean	SE	With partner Mean	SE	Diff b	Woman-headed Without partner Mean	SE	With partner Mean	SE	Diff b
Age household head, years	53.328	(18.216)	52.542	(15.277)	2.207**	56.204	(17.205)	47.619	(14.919)	8.860**
No. of children at household	0.177	(0.542)	0.870	(1.029)	−0.686**	0.646	(0.949)	0.875	(1.020)	−0.263**
Income category										
Low income	0.659	(0.474)	0.488	(0.500)	0.164**	0.720	(0.449)	0.494	(0.500)	0.208**
Medium income	0.124	(0.329)	0.155	(0.361)	−0.049**	0.114	(0.317)	0.170	(0.376)	−0.061**
High income	0.217	(0.413)	0.357	(0.479)	−0.115**	0.167	(0.373)	0.336	(0.472)	−0.148**
Education household head										
Elementary and mid school	0.314	(0.464)	0.279	(0.449)	0.049**	0.340	(0.474)	0.271	(0.444)	0.076**
High school	0.371	(0.483)	0.442	(0.497)	−0.061**	0.416	(0.493)	0.411	(0.492)	−0.021**
College	0.286	(0.452)	0.253	(0.435)	0.011	0.225	(0.417)	0.289	(0.453)	−0.045**
Graduate school	0.029	(0.168)	0.026	(0.158)	0.002	0.019	(0.137)	0.029	(0.169)	−0.010**
Type of household										
Urban	0.872	(0.334)	0.856	(0.352)	0.011	0.919	(0.272)	0.895	(0.306)	0.027**
Rural	0.128	(0.334)	0.144	(0.352)	−0.011	0.081	(0.272)	0.105	(0.306)	−0.027**
Regions category										
Metropolitan	0.390	(0.488)	0.402	(0.490)	−0.010	0.397	(0.489)	0.407	(0.491)	0.005
North	0.125	(0.331)	0.115	(0.319)	0.021**	0.116	(0.321)	0.141	(0.348)	−0.039**
Center	0.335	(0.472)	0.341	(0.474)	−0.024**	0.352	(0.478)	0.298	(0.457)	0.063**
South	0.150	(0.357)	0.142	(0.349)	0.013	0.135	(0.342)	0.154	(0.361)	−0.029**
FIES questionnaire results										
inseg.	0.131	(0.337)	0.093	(0.290)	0.033**	0.168	(0.374)	0.118	(0.322)	0.038**
Observations	8,860		32,180		41,040	21,324		7,879		29,203

Note: Standard errors in parentheses.
Abbreviation: FIES, Food Insecurity Experience Scale.
**5% significance level.

largest proportion of food insecure households, while keeping a relatively large dataset of 29,203 households.

Table 2 shows the descriptive statistics of the 11 social ties for woman-headed household by marital status (with vs. without a partner). In this sub-sample, households without a partner have a smaller proportion of social ties, for seven variables—"having someone who/to help to care of a disabled member or a child," "can lend a car," "help in home repairs," "help finding a job," "ask for advice," "help with other languages," and "help with technology." Then, four out of 11 social ties have a similar proportion in households with and without a partner, these are "help to care for sick house member," "having someone who can lend money from," "help with legal advice," and "closeness to someone with a college degree." Therefore, a household with a partner does not necessarily participate more in every social tie.

Additionally, social ties may be correlated to some degree; we considered these potential correlations before using social ties as explanatory variables in probit models. Considering that values above

0.4 can be classified as moderately correlated, 6 out of 11 social ties, at least, can be classified as moderately correlated. As we will present later on, it would be inappropriate to include explanatory variables with relevant correlations in a probit model. Based on this criterion, we only kept five social ties that do not present moderate correlation (see Table A1 of supporting information). These social ties are: "help to take care disable or children," "someone who can lend a car," "provide tech advice," "help with home repairs," and "help with another language." Table 2 shows the descriptive statistics of the 11 social tie variables.

As shown in Figure 1, households with a greater number of social ties tend to have a lower prevalence of food insecurity, in particular in those experiencing severe food insecurity. Comparing woman-headed households without social ties, the results show that the prevalence of being food insecure is higher for those without a partner at home. Furthermore, when this comparison is made for households that do have social ties, a greater decrease in the prevalence of food insecurity is observed for those that do

TABLE 2 Social ties frequency in woman-headed households per marital status.

	Woman without partner		Woman with partner		Diff
	Mean	SE	Mean	SE	b
Help to care for sick house member	0.884	(0.321)	0.898	(0.303)	−0.010
Help to care of a disabled member or care for child	0.813	(0.390)	0.844	(0.363)	−0.028**
Having someone who can lend a car from	0.797	(0.402)	0.837	(0.369)	−0.034**
Having someone who can lend money from	0.761	(0.427)	0.775	(0.418)	−0.006
Help with legal advice	0.722	(0.448)	0.727	(0.445)	−0.006
Help with technology	0.808	(0.394)	0.854	(0.353)	−0.042**
Having help to do house repairs	0.712	(0.453)	0.797	(0.402)	−0.078**
Help finding a job	0.564	(0.496)	0.613	(0.487)	−0.053**
Having someone to ask for advice	0.802	(0.398)	0.836	(0.370)	−0.018**
Help with other languages	0.468	(0.499)	0.492	(0.500)	−0.024**
Closeness to someone with a college degree	0.706	(0.455)	0.728	(0.445)	−0.010
Observations	21,324		7879		29,203

Note: Standard errors in parentheses.
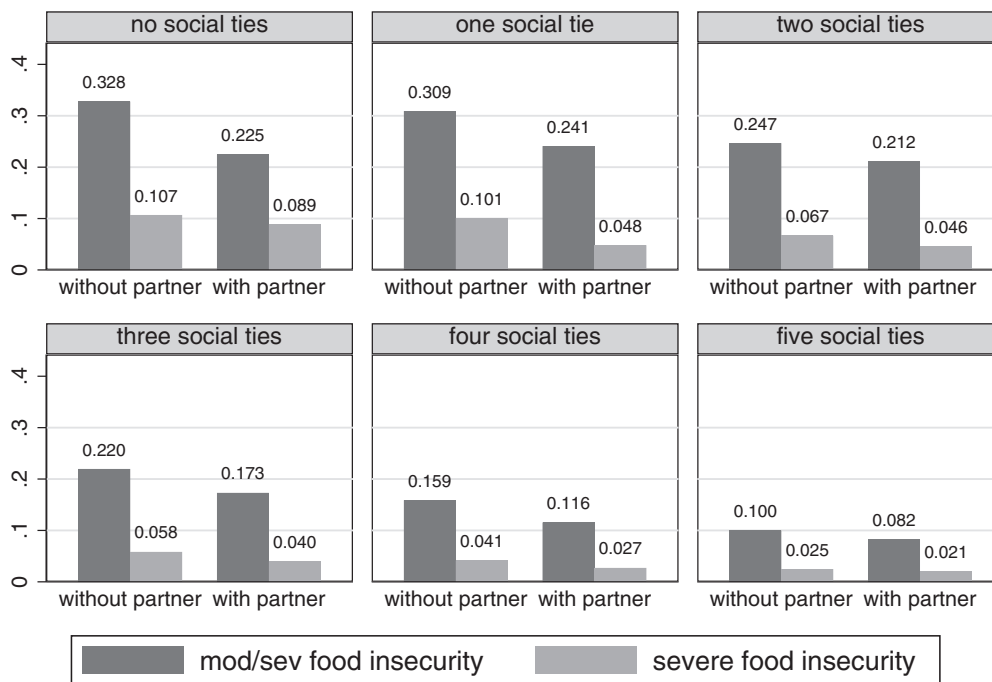**5% significance level.

FIGURE 1 Changes in food insecurity prevalence by number of social ties. The data presented in the figures use statistical survey weights. The food insecurity column, Y-axis, corresponds to the percentage of the population that experiences moderate or severe food insecurity. As a reference, in the total sub-sample of woman-headed households, 11.8% and 16.8% of the households, with and without a partner respectively, experience moderate/severe or severe food insecurity.

not have a partner. This finding suggests that woman-headed households without a partner would benefit more from having social ties. Additionally, this could suggest that having a partner can act as a substitute for social ties, to some extent, in the context of food insecurity.

The food insecurity marital status disparity tends to decrease as the number of social ties increases. However, the decreasing trend has an exception when there are three social ties. In this sense, food security prevalence and marital status disparity decrease in terms of food insecurity as the number of social ties increases; yet, both follow a different pattern.

As observed, households without a partner show a higher prevalence of food insecurity. We selected five social ties that have a low correlation level among them. As the number of selected social ties increases, households, with and without a partner, decrease the prevalence of food insecurity. As a result, households without social ties experience close to three times more food insecurity than households with the selected five social ties. As the number of selected social ties increases, food insecurity in households without a partner decreases strongly, from 32.8% for those without social ties to 10% for those with five ties, compared with households with a partner, which suggests that having a partner can be considered as a sort of social tie.

TABLE 3 Probit estimation marginal effects.

	Restricted model		Full model	
	Marginal effect	SE	Marginal effect	SE
Age household head, years			−0.002**	(0.000)
Zone, 0 = rural, 1 = urban			0.030**	(0.006)
Income category				
Medium income			−0.066**	(0.007)
High income			−0.106**	(0.007)
Household head education				
High school			−0.044**	(0.005)
College			−0.091**	(0.007)
Graduate school			−0.142**	(0.025)
Type of social ties				
Marital status, 0 = no partner, 1 = with a partner	−0.033**	(0.005)	−0.037**	(0.005)
Help to take care disable or children, 0 = no, 1 = yes	−0.008	(0.005)	−0.019**	(0.005)
Someone who can lend a car, 0 = no, 1 = yes	−0.079**	(0.005)	−0.060**	(0.005)
Tech advice, 0 = no, 1 = yes	−0.028**	(0.006)	−0.034**	(0.005)
Home repair help, 0 = no, 1 = yes	−0.008	(0.005)	−0.011**	(0.005)
Help with another language, 0 = no, 1 = yes	−0.052**	(0.004)	−0.020**	(0.004)
Number of children at the household				
One child			0.021**	(0.005)
Two children			0.039**	(0.007)
Three or more children			0.087**	(0.010)
Observations	29,203		29,203	

Note: Standard errors in parentheses.
**5% significance level.

Figure 1 illustrates how food insecurity prevalence changes across the number of social ties; however, it also assumes that all the selected social ties lead to similar effects on food insecurity. In Section 3.2 we use a set of probit models to analyze the effect of each of the selected five social ties, considering the marital status, on food insecurity. In this way, we will be able to identify the social tie that is associated with the largest effect in food insecurity prevalence.

3.2 | Probit results

Table 3 presents the results of the marginal effects for two different probit models. The restricted model only considers the five selected social ties and marital status to estimate their effect on the probability of experiencing food insecurity. Marital status is included in the restricted model since for our analysis we considered it as a intra-household social tie. The full model includes an extended set of variables to control for household head age, and categorical variables for zone, household income, and number of children. We estimated restricted and full models for robustness purposes and to set boundaries to the estimation results. The full model estimation would show the upper limit, while the restricted estimation would show the lower limit of the marginal effects. Therefore, later on for the mediation analysis, we keep the restricted model estimates since it controls for a wider set of variables and provides a more conservative estimation.

Table 3 includes the full and restricted marginal effects after probit estimations. In the full model, comparing to low-income households (omitted category), controlling for additional variables, it shows that medium-income households have 6.6% less prevalence of food insecurity, while high-income households have 10.6% less prevalence of food insecurity. Comparing households without children, having a child increases the probability of experiencing food insecurity by 2.1%. Regarding within social ties, having a partner decreases the probability of experiencing food insecurity in 3.7%. Finally, between types of social ties, having someone who can lend a car decreases the probability of experiencing food insecurity by 6.0% (the largest social tie effect) while having someone who can help in home repairs decreases the probability of experiencing food insecurity in 1.1%s (the smallest social tie effect).

In Table 3, the result from the restricted model estimation shows a decrease of up to 3.2% in terms of marginal effects of the social ties variables. For instance, having someone who can help with another language decreases the probability of experiencing food insecurity in 5.2% in the restricted model and 2.0% in the full model. Having someone who can take care of disable member or children or someone who can help with home repairs is significant in the full model, while
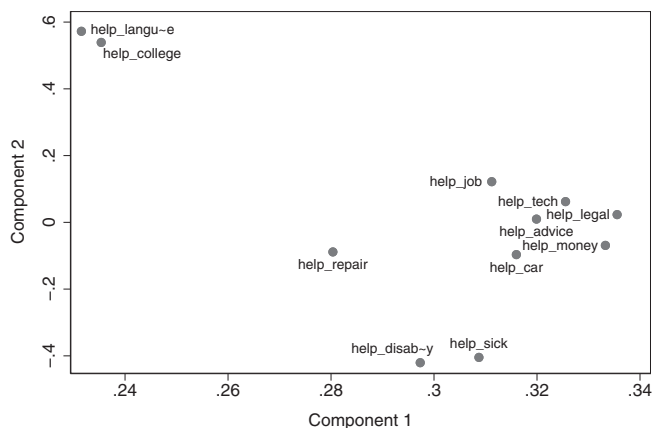
FIGURE 2 Component loadings. The figure corresponds to the plot of the components, details in Table A2 of supporting information. Each point corresponds to a social tie, which is listed in Table 2. Most of social ties are concentrated in the upper left corner and lower right corner.

the estimated parameter is not different from zero to help in the restricted model.

Therefore, consistently, full and restricted marginal effect estimations, after probit, show that having someone who can lend a car is the social tie that is associated with the largest decrease in food insecurity prevalence. Moreover, having someone to help in home repairs is not associated with a significant effect in terms of food insecurity prevalence. Finally, as the number of children increases, the prevalence of food insecurity also increases.

3.3 | PCA results

After testing for the social ties effect on the probability of food insecurity, we were interested in analyzing how different these social ties were. Table A1 of supporting information shows the correlation matrix of the social ties variables. Eight out fifty-five non-diagonal correlations are more than 0.4, then, they can be classified as highly correlated variables. The purpose of PCA is to see whether social ties could be grouped, in other words if few components can incorporate most of the variability from the 11 social ties studied. Therefore, the first question is to identify the number of components (or groups). Since they have eigenvalues higher than one, Table A2 of supporting information shows that two components capture most of the variability of the 11 social ties. Specifically, the first two components captures 50.5% of the variability of the 11 social ties (see "Cumulative" variable in Table A2 of supporting information).

Figure 2 shows the component loading, also summarized in Table A3 of supporting information. The first component, component 1, focuses on what we called "Economic social ties," which includes having someone to help find a job, who can lend money and a car, who can provide legal and general advice, and tech support. Then, the second component, component 2, focuses on "Educational social ties," such as having someone with a college degree and someone that

can help with languages. Finally, having someone that can help with children or sick people has similar weights; however, they are not strongly related to neither component 1 nor component 2.

We also analyzed how the socio-demographic variables are associated with each of the two components, component 1 (PC1) and component 2 (PC2). As seen in Table 4, the economic component, component 1, is associated with economic and educational characteristics, while marital status and the number of children do not show significant effects. The educational component, component 2, is also associated with income and educational characteristics; however, they have a smaller magnitude. Moreover, the educational component is also associated with marital status and the number of children. In summary, economic and educational components are associated with household income and household head characteristics, while marital status and number of children only for educational components.

Finally, we use the Kaiser–Meyer–Olkin (KMO) to measure the sampling adequacy, which in this case is 0.87. The KMO takes values from 0 to 1. The larger the values, the more appropriate it is to rely on the PCA for that particular dataset. There are not data-driven cut-off values for the KMO; however, values between 0.80 and 0.89 can be classified as meritorious. Therefore, in our case, KMO supports the use of PCA.

4 | DISCUSSION

The findings of this study first highlight the significant influence that marital status can have on household's food insecurity. Consistent with previous research (Magaña-Lemus et al., 2016), we found that household heads without a partner are more prevalent to be food insecure than their counterparts. This difference may be related to the sharing of economic resources and social ties within partners, which could provide a safety net in times of financial hardship. The dynamics and distribution of responsibilities in couple households may contribute to greater economic stability and better access to adequate food. In women-headed household this could be relevant, as there is evidence that suggests that when the female spouse has control of household finances, a greater percentage of the household income goes to food, health, and education (Duflo & Udry, 2004).

Public policies to target food security and nutrition disparities need to be a priority (HLPE, 2023). Our results also reveal a disparity in the extent of social ties among woman-headed households with and without a partner. This could be attributed to the supportive dynamics in couple relationships, which often provides an environment conducive to the establishment and maintenance of interpersonal relationships. These findings are consistent with previous research (Hurlbert & Acock, 1990) that has documented that marital status can act as facilitating factors for building social ties. We also found a decreasing in food insecurity in woman-headed households, regardless of marital status, when increases the number of the social ties. These results underscore the inherent importance of the social ties as a valuable resource in mitigating the prevalence of food insecurity, acting as a source of emotional, economic, and

TABLE 4 Principal component regressions.

	PC1		PC2	
	Coefficient	SE	Coefficient	SE
Marital status, 0 = no partner, 1 = with a partner	0.026	(0.029)	−0.088**	(0.015)
Age household head, years	−0.001	(0.001)	0.0003	(0.001)
Number of children at the household	0.016	(0.014)	−0.107**	(0.007)
Income category				
Medium income	0.463**	(0.038)	0.158**	(0.020)
High income	0.713**	(0.035)	0.316**	(0.018)
Education household head				
High school	0.416**	(0.030)	0.351**	(0.015)
College	0.842**	(0.039)	0.793**	(0.020)
Graduate school	1.067**	(0.099)	0.933**	(0.052)
Type of household				
Urban	−0.160**	(0.036)	0.214**	(0.019)
Regions category				
North	0.211**	(0.039)	−0.006	(0.020)
Center	0.356**	(0.035)	−0.020	(0.018)
South	0.269**	(0.038)	0.129**	(0.020)
Constant	−0.776**	(0.076)	−0.524	(0.040)
Observations	29,346		29,346	

Note: Standard errors in parentheses. PC1 refers to component 1 or economic components, while PC2 refers to component 2 or educational component.
**5% significance level.

informational support that contributes to adaptation and resilience in the food security, which is an aspect that should be considered in the design of intervention strategies and public policies.

Our results show that the type of social ties is relevant since they lead to different effects on food insecurity prevalence. Beyond marital status, technology assistance, as well as the availability of someone who can lend a car are relevant determinants that are significantly associated with reduced food insecurity. Technology assistance for woman-head households can help them to be more connected and take better advantage of technology to improve their quality of life. Similarly, having the possibility of asking someone to lend a car reflects social ties that facilitate access to resources, such as employment and food/goods procurement centers. As for home repair support and someone to take care of children, although their effects are not as pronounced as in the previous cases, they also help mitigate food insecurity. These linkages can expand the range of labor and educational opportunities, which in turn impacts economic and food stability.

Using probit marginal effects, we found that variables such as the number of children in the household, single-parent household, and low income were found to have a significant association with the prevalence of food insecurity. The finding about having an increasing number of children is linked to higher food insecurity prevalence highlights the importance of considering the additional economic demands of raising and caring for multiple children. The influence of being a single-parent household on food insecurity suggests that the lack of

a joint income may result in increased financial vulnerability, as there are no shared resources to buffer against economic hardship. On the other hand, low income emerged as a prominent predictor of food insecurity, corroborating the relationship between socioeconomic status and access to adequate food. Finally, by using PCA, our research has shed light on the relation between socioeconomic and demographic determinants and economic and education social ties components, while marital status is significant only in the latter.

5 | CONCLUSIONS AND POLICY RECOMMENDATIONS

In this study, we examined the relationship between social ties and food insecurity through a case study of women-headed households in Chile. We distinguished between intra-household and among-household social ties. Intra-household social ties correspond to relationships and interactions between members of the same household, as it is having a partner. Among-household social ties refer to the interactions with other households, such as having someone to take care of disable or children, lend money, or provide legal help. We found that social ties can be associated with relevant changes in food insecurity.

In relation to intra-household social ties, we found that low-income woman-headed households without a partner and with children experience the highest level of food insecurity. As expected, the

more children, the higher the food insecurity level, recognizing that determinants at home, such as household income, household head education, and having children, do play a relevant role on household food security status; we argue that social-related determinants also need to be taken into consideration.

In relation to among-households social ties, our results show that women-headed households without social ties experience close to three times more food insecurity than households with the selected five social ties. This trend is stronger in households without a partner, which suggests that having a partner can be considered as a sort of social tie. However, the importance of having a partner in food insecurity status tends to decrease as the number of social ties increases, but there is an exception with three social ties.

From a set of 11 social ties plus marital status, we were able to assess individual social ties. We found that having someone who can lend a car leads to a larger effect in food security, close to 6.0%. This finding could be used as evidence of potential new benefits to support public policies promoting the improvement transportation services, as new or improve routes and affordable public transport could aid reductions of food insecurity, especially among vulnerable populations that lack access to private transport, markets, and affordable and nutritious food.

Using a unique dataset that includes information to analyze the effect on food security status of households with intra-household and among-household social ties, our results show that isolated low-income women headed households, especially without partners, experience a higher prevalence of food insecurity. These results add to a plethora of studies demonstrating why public policy should target the most vulnerable population segment.

For this study, we have focused on social ties for the household head; however, other household members can also have social ties. For instance, a partner or other household member can help to provide stronger social ties. In this sense, a partner can provide help within the household (e.g., cooking, food shopping, or taking care of children) and among households making stronger social ties connections. The household member may also condition the type of social ties. Further research is needed to analyze the relation between household members and social ties. This study has exemplified the importance of including the FIES questionnaire and social ties variables in a socio-economic nationwide survey as it is the CASEN in Chile.

Our findings highlight the importance of considering social ties in the food security discourse. Households are not isolated entities and, to some extent, can mitigate food insecurity through connections with other households. While our data set allows us to distinguish among 11 types of social ties, our analysis is limited to household-head social ties. Thus, the challenge lies in continuing to analyze the interaction between social ties and other household members, along with their potential effects on food security. Moreover, while our findings offer insights into the pre-pandemic landscape, future research may consider the evolution of social ties during the COVID-19 pandemic. Understanding how this crisis has impacted social ties and their subsequent influence on food security can help to develop effective interventions for vulnerable population segments.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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ENDNOTES

[1] http://digitallibrary.un.org/record/195568

[2] https://digitallibrary.un.org/record/4014951?ln=en&v=pdf

[3] https://digitallibrary.un.org/record/4014951?ln=en&v=pdf

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.