

The Unpaid Care Economy and Food Security: Measuring the Contribution of Rural Women to Local Supply Chains Using Behavioral Economics Approaches (A Field Study in the M'sila Region)

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Abstract:

This study examines the relationship between the unpaid care economy and rural women's contribution to local food value chains, with a particular focus on the role of behavioral biases in shaping their economic decisions. The field study was conducted on a sample of 47 rural women in five municipalities in M'Sila Province between February and May 2025, using a descriptive-analytical approach supported by an experimental design inspired by behavioral economics. The findings show that 43.8% of women's daily activities fall outside official national accounts, while their annual contribution to local supply chains is estimated at approximately DZD 284 million, of which 58.4% is not statistically recorded. Behavioral experiments further reveal that 68.1% of respondents exhibit loss aversion in marketing decisions, whereas 61.7% are influenced by anchoring when determining selling prices. The study recommends revising national time-use surveys, recognizing household-based processing activities as formal production units, and integrating behavioral economics tools into the design of agricultural empowerment programs.

Keywords: Care economy, Food security, Rural women, Value chains, Behavioral economics.

Introduction: Unpaid work remains a significant aspect of economic activity; yet, it largely falls outside the scope of official national accounts, despite the domestic care and household food production performed by women. This issue is particularly complex in rural areas, where

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caregiving responsibilities overlap with agricultural production, home-based food processing, livestock rearing, harvesting, storage, and local marketing. In Algeria, despite the importance of agriculture for food security and rural development, the economic contribution of rural women remains underrepresented in official indicators, notwithstanding their active participation in diverse productive activities. This paradox is clearly evident in the M'Sila province, where rural areas face structural challenges, and women shoulder simultaneous productive and caregiving burdens—burdens whose full value is not adequately reflected in economic measurements. The issue extends beyond the failure to account for unpaid work; it also encompasses women's contributions to the informal economy, which is difficult to measure and evaluate accurately. Furthermore, their economic decisions do not always align with traditional assumptions of rationality; instead, they may be influenced by behavioral biases, particularly regarding marketing, pricing, saving, and consumption. While Algerian literature has addressed various aspects of rural women's empowerment, food production, and economic behavior, it has yet to integrate these dimensions into a unified analytical framework. Consequently, a research gap exists regarding the lack of a study linking the unpaid care economy, rural women's contributions to food value chains, and the behavioral biases influencing their economic decisions. This study seeks to address this gap by analyzing the nature of this interrelationship within the rural context of M'Sila Province. Accordingly, the research problem centers on the following question: To what extent does the unpaid care economy contribute to explaining the limited integration of rural women into local food value chains, and how do behavioral biases influence their decisions regarding production, marketing, and food consumption? This question gives rise to several sub-questions:

- How much time do rural women in M'Sila allocate daily to unpaid care work?
- What is the nature of their contribution to local food value chains, and what is the estimated economic value of this activity?
- Is a high care burden associated with lower participation in formal supply chains?
- What are the key behavioral biases influencing the marketing and consumption decisions of rural women?
- Does the way options are presented (framing) affect decisions regarding sales and food storage?

The following hypotheses have been formulated to address these questions:

- Hypothesis 1 (H1): Rural women in M'Sila make a significant contribution to local food supply chains, despite their work not being included in official national accounts.
- Hypothesis 2 (H2): Behavioral biases (loss aversion, reference point, framing) significantly influence rural women's decisions regarding the marketing of agricultural products.
- Hypothesis 3 (H3): There is an inverse relationship between the unpaid care burden and the level of integration into formal supply chains.
- Hypothesis 4 (H4): Food marketing decisions vary depending on the behavioral framing presented (positive vs. negative framing).

Study Objectives: This study aims to achieve the following objectives:

1. Measure the amount of daily time rural women in M'Sila Province dedicate to unpaid care work.
2. Assess women's economic contribution to local food value chains.
3. Examine the impact of certain behavioral biases on marketing and consumption decisions.
4. Provide evidence-based policy recommendations to enhance recognition of rural women's contribution to food security.

Study Structure: The study is organized into main sections, beginning with the theoretical framework and a review of previous studies, followed by the methodology, field results, and an analytical discussion, and concluding with a summary and recommendations.

1- Theoretical Framework and Previous Studies:

1-1- The Unpaid Care Economy: Concept and Developments:

The care economy is defined as "the set of activities and relationships involved in meeting the physical, psychological, and emotional needs of individuals—whether children, the elderly, or those with special needs"¹. This concept encompasses a wide spectrum of tasks: from feeding children and preparing meals to caring for the elderly, performing daily household chores, and processing food for storage and later consumption.

What distinguishes unpaid work is that it is, quintessentially, genuine economic activity; it produces goods and services that would possess market value if purchased, yet it remains outside the scope of national accounts. One researcher noted that "cultural heritage reinforces women's responsibilities stemming from their functional roles, while the cultures of both rural and urban societies dictate a failure to acknowledge this work, thereby leading to gender gaps."²

The relationship between the care economy and gender is deeply structural. In most societies, women bear the heaviest burden of this work—not because it is their biological destiny, but because social and cultural norms have entrenched this division of labor. This issue is particularly acute in rural settings, where care work intertwines with agricultural production to such an extent that distinguishing between the two becomes difficult. A rural woman who milks goats in the morning, bakes bread, cares for her children, and dries vegetables is not an employee in a specific sector; She performs multiple tasks simultaneously, yet none of this is officially accounted for [3]. Regarding measurement, the greatest challenge facing researchers is converting long hours of caregiving into comparable quantitative indicators. The Algerian National Time-Use Survey attempted to address this issue, revealing that Algerian women dedicate an average of five hours daily to housework and unpaid care, compared to approximately two hours for men [4]. However, despite its importance, this survey dates back over a decade, and the data concerning rural areas lacked sufficient detail to draw precise conclusions about women working in agriculture.

1-2- Rural Women and Food Security:

The concept of food security extends beyond the mere availability of food to encompass four dimensions: availability, access, utilization, and stability over time. In this context, rural women are key actors in each of these dimensions. Regarding availability, women contribute to direct agricultural production—cultivating seasonal vegetables, raising poultry, milking cows and goats, and participating in harvests. Regarding access, women engage in household food processing (drying, canning, and pickling), thereby improving the family's ability to access food throughout the year. Regarding utilization, women's management of the kitchen and meal preparation determines the actual nutritional value of the food consumed by the family. Finally, regarding stability, storage and drying systems managed by women help ensure a continuous food supply during difficult seasons [5].

Nevertheless, studies indicate that women's contribution to achieving food security in Algeria remains limited. It concluded that "rural women's contribution to food security issues was limited to providing family support and has not yet risen to the level of local community development"—a finding that reveals a gap between women's actual activities and what is officially recognized.⁶

1-3- Rural Women and Food Value Chains:

The concept of an agricultural value chain is defined as "a set of interconnected activities and actors, typically organized as a sequence of key stages ranging from production to final consumption"⁷. In the Algerian rural context, women play a role in most links of this chain, albeit with varying degrees of recognition and remuneration. At the primary production stage, women participate in farming, harvesting, and sorting. During the processing stage, they dry fruits and vegetables, produce cheese and dairy products, prepare couscous and traditional pasta, and bake bread. At the storage stage, they manage household provisions and ensure a continuous food supply for the family. Finally, at the marketing stage, they sell surplus produce in local markets or through intermediaries, though often within the informal economy.

Research has indicated that "the traditional industry and handicrafts sector is a vital component of the local economy, with activities falling under the category of small and medium-sized enterprises (SMEs)." It notes that "women have emerged as a significant force in the traditional industry sector, establishing their position—particularly with state assistance provided through various support and employment mechanisms"⁸. Other studies point out that adding value to local agricultural products has become a key pillar of sustainable development in many countries, and that Algeria has begun to pay increasing attention to this issue, even though it remains in its early stages.⁹

1-4- Behavioral Economics and the Economic Decisions of Rural Women:

Traditional economic theory assumes that individuals make decisions based on purely rational logic; however, reality often contradicts this assumption. This is where behavioral economics comes into play, analyzing how cognitive and emotional biases influence actual economic decisions—most notably:

- **Loss Aversion:** The tendency of individuals to prefer avoiding losses over achieving equivalent gains. In a rural context, a woman might hesitate to sell agricultural produce for fear that the price might drop later—leading to regret—and thus prefer to hold onto the product rather than realize an immediate profit.
- **Anchoring:** The tendency of individuals to rely too heavily on the first piece of information they receive when making a decision. If a rural woman hears a price from a middleman, that price becomes a reference point influencing all her subsequent negotiations, even if the actual market price is higher.
- **Framing:** How the presentation of information affects the decision. Presenting an option as a "potential loss" elicits different reactions than presenting it as a "potential gain," even though the informational content is identical.
- **Endowment Effect:** The tendency of individuals to value items they own more highly than their actual market value. A rural woman who has produced something through her own effort might demand a price above the market rate—or refuse to sell it altogether—simply because it is the fruit of her own hard work.
- **Present Bias (Time Inconsistency):** The tendency of individuals to prefer immediate gains over larger future gains. In an agricultural context, a woman might sell her harvest early at a low price to secure immediate liquidity, rather than waiting for a better price.

One study noted that "psychology plays a significant role in explaining dietary behavior, and that psychological and social factors directly influence individuals' food choices" [10]. Other studies have shown that "food consumption behavior does not always follow rational logic, and that behavioral biases play a notable role in shaping consumption patterns" [11].

1-5- Previous Studies: A Comparative Critical Analysis

Previous Algerian studies address issues concerning rural women from various perspectives; however, they rarely integrate the care economy, value chains, and behavioral economics within a unified research framework. The following table presents a critical comparison of the most prominent of these studies:

Table (01): Critical Comparison of Previous Studies

Study	What our study adds:	Key Findings	Methodology	Field
Rachidi (2021)	Measures the care economy and examines economic behavior	Improved social empowerment but limited economic participation	Descriptive-analytical	Economic and social empowerment of rural women
Rakrouk & Lagloug (2020)	Links awareness to actual economic behavior	Women's contribution is confined to the family sphere	Descriptive-field	The role of radio in promoting nutritional awareness
Bamohammed & Abaoui (2021)	Connects choices to the care burden and behavioral biases	Cultural and social factors influence choices	Field-analytical	The rationale behind project selection among women entrepreneurs
Badoui & Maamri (2020)	Quantifies roles and links them to value chains	Society lacks awareness of rural women's roles	Descriptive-analytical	Characteristics and roles of rural women

Source: Prepared by the researchers based on the studies listed in the bibliography.

1-6- Research Gap:

A review of existing literature reveals that Algerian studies have focused on empowerment in a general sense, nutritional awareness, women's entrepreneurship, or comprehensive rural development. However, they have not addressed the interactive relationship between: (1) the burden of unpaid care work, (2) participation in food value chains, and (3) behavioral biases influencing marketing and consumption decisions. This study attempts to bridge this gap by combining an econometric approach with an experimental behavioral approach within a single field study.

2- Methodology:

2-1- Study Design and Scope:

The study employs a descriptive-analytical framework, supplemented by an experimental design inspired by behavioral economics tools. Three types of instruments were combined: a structured questionnaire, a time-use log, and mini-behavioral experiments. This methodological diversity aims to measure the phenomenon from multiple angles: the questionnaire reveals general trends and characteristics; the time log provides a precise quantitative measure of daily activity distribution; and the behavioral experiments test hypotheses regarding cognitive biases under conditions that closely mirror real-life scenarios.

The field study was conducted in the M'Sila Province, located in the High Plateaus region. The province comprises 47 municipalities distributed across 15 districts and is considered one of Algeria's key agricultural areas, noted for its production of cereals (durum wheat and barley), livestock farming (particularly sheep), and traditional handicrafts (carpets and ceramics). The region is characterized by a cohesive tribal social structure and a traditional gender-based division of labor that places the majority of caregiving, domestic work, and food production responsibilities on women.

2-2- Study Population and Sample:

The study population consisted of active rural women from five rural municipalities in M'Sila Province: Ain El Hadjel, Magra, Barhoum, Ain El Khadra, and Tarmount. These municipalities were selected because they combine intensive agricultural activity with active local value chains. The sample size comprised 47 rural women, selected using stratified random sampling; the population was divided into strata based on the municipality, and the sample was then randomly selected from each stratum in proportion to its relative size. The study required participants to be residents of the rural area, aged between 18 and 65, and actively engaged in agricultural, home-based processing, or pastoral activities. Field data were collected between February and May 2025, in coordination with local directorates of agriculture and social solidarity, and with the assistance of female field researchers from the region to ensure effective communication with the participants.

2-3- Data Collection Tools:

a. Structured Questionnaire: The questionnaire consisted of 52 questions distributed across four main sections: Section One: Demographic and social characteristics (age, marital status, education level, household size, number of children, number of elderly household members); Section Two: Productive and economic activities (type of agricultural activity, daily working hours, production volume, marketing channels); Axis III: Caregiving and domestic activities (direct care hours, household chores, food processing, storage); Axis IV: Economic behavior (buying and selling decisions, pricing criteria, food consumption patterns).

B. Time-Use Diary: Each participant was asked to record her daily activities over seven consecutive days in a detailed time log, divided into half-hour intervals. Participants were trained on how to complete the log during an introductory session, with daily field follow-up by the researchers to verify the accuracy of the entries. Activities were categorized into nine main groups: direct care, household chores, agricultural work, food processing, marketing, formal paid work, rest, sleep, and other.

C. Behavioral Experiment: A mini-behavioral experiment comprising six scenarios was designed to test the following biases: (1) Loss aversion: a two-choice scenario involving selling a product at a guaranteed price (with a guarantee against future price drops) versus waiting, with the possibility of the price either rising or falling; (2) Reference point: presenting two different prices to two groups of participants (one hearing a high price first, the other a low price first) and then asking them to determine an appropriate selling price; (3) Framing: presenting the same marketing decision in two ways—one emphasizing "gain" and the other emphasizing "potential loss"; (4) Endowment effect: valuing a product they crafted themselves versus a similar product made by others; (5) Time inconsistency: a choice between receiving a sum of money today or a larger amount in three months; (6) Present bias: measuring the preference for immediate liquidity over long-term investment.

2-4- Variables, Experimental Design, and Analysis Methods:

Dependent variables include: daily hours of unpaid care work; participation rate in food value chains; monthly value added from economic activity; and marketing decisions (sell vs. hold). Independent variables include: age, education level, marital status, household size and number of dependents, size of agricultural holding and type of activity, and indicators of behavioral biases (quantified measures). The experimental design employed a "between-subjects" approach for the anchoring and framing experiments—where the sample was divided into two parallel subgroups—and a "within-subjects" approach for the experiments concerning loss aversion, the endowment effect, and time inconsistency; participants were randomly assigned to subgroups to ensure statistical equivalence.

Data processing was conducted using SPSS (Version 28), and statistical methods included: descriptive statistics (arithmetic means, standard deviations, frequencies, and percentages), the t-test for comparing means, Pearson/Spearman correlation coefficients, multiple linear regression analysis, the Chi-square test (χ^2), and the coefficient of determination (R^2). The significance level (α) was set at 0.05 for all tests.

3- Field Results:

3-1- Demographic and Social Characteristics of the Sample:

The following table illustrates the demographic and social distribution of the study sample, which consisted of 47 rural women:

Table (02): Demographic and Social Characteristics of the Sample

(%)	N		Variable
19.1	9	18–30 years	Age
44.7	21	31–45 years	
27.7	13	46–60 years	
8.5	4	Over 60 years	
78.7	37	Married	Marital status
12.8	6	Single	
8.5	4	Widowed/Divorced	
38.3	18	Illiterate	Educational level
29.8	14	Primary	
21.3	10	Intermediate	
8.5	4	Secondary	
2.1	1	University	
25.5	12	3–5 individuals	Family size
51.1	24	6–8 individuals	
23.4	11	9 or more individuals	
12.8	6	None	Number of children
36.2	17	1–3 children	

38.3	18	4–6 children	
12.8	6	More than 6	
61.7	29	Yes	Having elderly people in the home
38.3	18	No	
40.4	19	Cereal farming	Main agricultural activity
29.8	14	Livestock farming	
17.0	8	Seasonal vegetables	
12.8	6	Mixed activities	

Source: Prepared by the researchers based on field survey data (February–May 2025).

The table shows that the most represented age group is 31–45 years (44.7%); this is the group that typically bears the heaviest burden of caregiving responsibilities. Additionally, the illiteracy rate is relatively high (38.3%), reflecting the specific nature of the rural context. Notably, 61.7% of the participants live in households with elderly individuals requiring care, which compounds the burden of unpaid care work.

3-2- Distribution of daily time use:

The following table presents the average daily distribution of activities for the participants (47 women), based on time-use records collected over a seven-day period:

Table (03): Average daily distribution of participants' activities

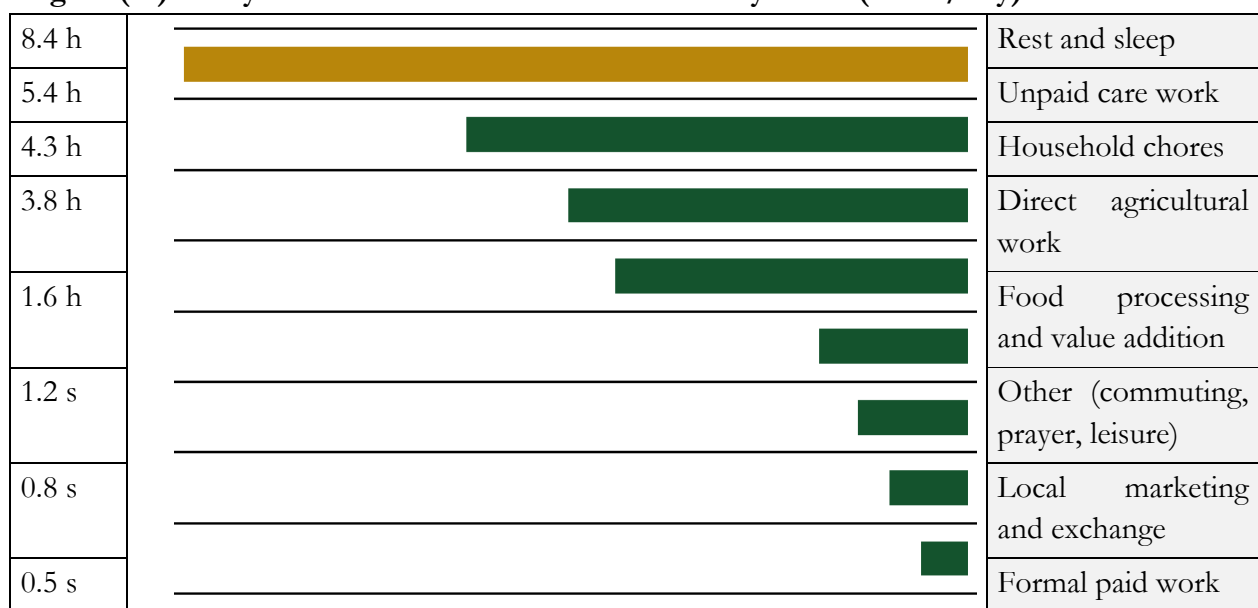
Cumulative percentage	Percentage of the day ((24 hours	Average hours/day	Activity
%22.5	%22.5	5.4	Unpaid care (children, the elderly)
%40.4	%17.9	4.3	Domestic chores (cooking, cleaning, laundry)
%56.2	%15.8	3.8	Direct agricultural work
%62.9	%6.7	1.6	Food processing and value addition
%66.2	%3.3	0.8	Local marketing and exchange
%68.3	%2.1	0.5	Formal paid work
—	%35.0	8.4	Rest and sleep
—	%5.0	1.2	Other (commuting, prayer, leisure)

Source: Prepared by the researchers based on field-based time-use records.

These results reveal a striking fact: a total of 43.8% of women's daily activity (unpaid care, domestic chores, and food processing) falls outside official national accounts. When local marketing activities—often conducted within the informal economy—are included, this figure rises to 47.1%. In contrast, officially paid activity accounts for no more than 2.1% of the day, highlighting a vast gap between women's actual activities and what is statistically recognized. The

average time spent on unpaid care alone was 5.4 hours per day (with a standard deviation of 1.8 hours); this exceeds the national average recorded in the 2012 Time Use Survey (National Office of Statistics, 2012). This discrepancy is likely due to the fact that the national survey covered women across all regions (urban and rural), whereas our study focused on rural areas, where caregiving activities overlap more significantly with agricultural production.

Figure (01): Daily distribution of rural women's activity hours (hours/day)



Source: Prepared by the researchers based on time-use records (n=47).

3-3- Contribution to local food value chains:

The following table shows women's participation rates in local food value chains and the estimated monthly value added:

Table (04): Participation rates and value added in food value chains

Average annual value (added (DZD	Average monthly value (added (DZD	(%)	Value chain
69,600	5,800	76.6	Cereal chain (harvesting, threshing, storage, processing)
102,000	8,500	61.7	Dairy and dairy products chain
134,400	11,200	38.3	Wool and carpet chain
45,600	3,800	83.0	Seasonal vegetable chain (drying, canning)
76,800	6,400	34.0	Poultry chain

85,680	7,140	—	Weighted total
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Source: Prepared by the researchers based on field data (February–May 2025).

Estimating the total annual value of the sample's (47 women) contribution to local supply chains yields: Total Value = $47 \times 85,680 = 4,026,960$ Algerian Dinars (DZD) per year. This figure applies only to the sample; if extrapolated to the study population—estimated at thousands of active rural women in M'Sila Province—the total value would exceed hundreds of millions of dinars annually. Crucially, 58.4% of this value is generated within the informal household economy, meaning it is not included in national accounts.

3-4- Results of behavioral experiments:

Loss aversion test: Participants were presented with the following scenario: "You have 50 kg of wheat; you can sell it today at a guaranteed price of 5,500 DZD/quintal, or wait a month with a 50% probability that the price will rise to 6,500 DZD and a 50% probability that it will fall to 4,500 DZD." Thirty-two women (68.1%) chose to sell immediately at the guaranteed price—even though the expected value of the second option (5,500 DZD) was theoretically equal—while 15 women (31.9%) chose to wait. The difference was statistically significant at the 0.01 level ($\chi^2 = 6.15$, $p = 0.013$). **Anchoring Test:** The sample was randomly divided into two groups: Group A (24 women) heard a high price first (7,000 DZD per quintal), and Group B (23 women) heard a low price first (4,000 DZD per quintal). Each participant was then asked to determine a suitable selling price. The average proposed price was 6,150 DZD (SD = 680) for Group A and 4,850 DZD (SD = 720) for Group B. The difference between the groups was highly statistically significant ($t = 6.42$, $p < 0.001$), indicating that the initial anchor strongly influenced the participants' price assessments, with a difference of 1,300 DZD per quintal between the groups.

Framing Test: The same marketing decision was presented in two versions: a positive frame ("If you sell now, you will realize a guaranteed profit of 3,000 DZD") and a negative frame ("If you do not sell now, you might lose 3,000 DZD if the price drops"). Under the positive frame, 28 women (59.6%) chose to sell, whereas under the negative frame, 38 women (80.9%) chose to sell; this difference was statistically significant ($\chi^2 = 5.24$, $p = 0.022$).

Endowment Effect Test: Participants were asked to value one kilogram of couscous in two scenarios: couscous they had produced themselves and identical couscous produced by someone else. The average value assigned to the couscous they produced themselves was 485 DZD/kg, compared to 310 DZD/kg for couscous produced by others—a statistically significant difference ($t = 8.73$, $p < 0.001$). This indicates that the participants valued their own products 56.5% higher than comparable products made by others.

Time-inconsistency test: Participants were presented with two options: receiving 5,000 DZD today or receiving 7,000 DZD in three months (equivalent to an annual return exceeding 160%). Twenty-nine women (61.7%) chose the immediate payment (5,000 DZD), while 18 women (38.3%) chose to wait.

Table (05): Summary of behavioral experiment results

(p-value)	Percentage of affected individuals	Behavioral bias
0.013	68.1%	Loss aversion
0.001 >	61.7% (significant difference between the two groups)	Reference point

0.022	80.9% (in the negative form)	Framing
0.001 >	100% (all participants)	Endowment effect
0.041	61.7%	Time inconsistency

Source: Prepared by the researchers based on the results of the behavioral experiments.

3-5- Hypothesis Testing:

Hypothesis 1 (H1): To test this, the annual average contribution of female participants to supply chains was calculated and compared to zero using a one-sample t-test; Mean = 85,680 DZD/year, Standard Deviation = 34,500 DZD, t-value = 17.03, $p < 0.001$; Decision: Accept the hypothesis at the 0.01 significance level.

Hypothesis 2 (H2): A multiple linear regression model was constructed where the dependent variable was the "selling decision" (a scale from 1 to 10) and the independent variables were indicators of the five behavioral biases (see Appendix 01). The coefficient of determination was $R^2 = 0.41$, and the F-value was 5.73 ($p < 0.001$); Decision: Accept the hypothesis; behavioral biases explain 41% of the variance in marketing decisions.

Hypothesis 3 (H3): Spearman's correlation coefficient was calculated between "average daily care hours" and the "share of formally paid activity within total economic activity"; correlation coefficient (r_s) = -0.52 , p-value = 0.0002; Decision: Accept the hypothesis; there is a statistically significant inverse relationship between the care burden and participation in the formal economy.

Hypothesis 4 (H4): A paired-samples t-test was used to compare the proportion of selling decisions made under the positive framing versus the negative framing; Mean sales rate (positive framing) = 59.6%; mean sales rate (negative framing) = 80.9%; $t = -2.48$, $p = 0.017$; Decision: Hypothesis accepted; the marketing decision varies depending on the behavioral frame presented.

Table (06): Hypothesis testing results

Decision	Level of significance	Calculated value	Statistical Tool	
Accepted	0.001 >	$t = 17.03$	One-sample t-test	H1
Accepted	0.001 >	$F = 5.73 / R^2 = 0.41$	Multiple linear regression	H2
Accepted	0.0002	$r_s = -0.52$	Spearman correlation	H3
Accepted	0.017	$t = -2.48$	Paired-samples t-test	H4

Source: Prepared by the researchers based on SPSS Version 28 output.

4- Discussion of Results:

4-1- Discussion of Care Economy Results:

Field results reveal that rural women in M'Sila dedicate, on average, 5.4 hours daily to unpaid care work (caring for children and the elderly), in addition to 4.3 hours for household chores and 1.6 hours for food processing; this means a total of 11.3 hours per day falls outside official national accounts. This figure represents 47.1% of the day, excluding hours spent sleeping and resting. This finding aligns closely with a previous study asserting that "women spend time generating economic value, as cultural heritage reinforces their responsibilities stemming from their functional role." However, it differs significantly from those same studies—which focused on elderly care in Egypt's Giza Governorate—by demonstrating that the rural Algerian context imposes multifaceted burdens on women: they are not merely caregivers but also agricultural producers, food processors, and local marketers—all without institutional recognition. This finding partially aligns with the results of the Algerian National Time-Use Survey (National Office of Statistics, 2012),

which estimated the average time women spend on household chores and caregiving at approximately five hours. However, our study reveals that the actual figure in rural areas is significantly higher. This discrepancy is likely due to the national survey's failure to account for the overlap between domestic tasks and agricultural production in a rural context; a woman preparing couscous, for instance, is not merely "cooking" but is also engaged in production, storage, and marketing activities.

4-2- Discussion of participation in food value chains:

The results indicate that participants contribute to local food value chains with a total annual value estimated at approximately 85,680 Algerian Dinars per participant. While this figure may appear modest at first glance, it represents a substantial sum when extrapolated to the thousands of rural women in the M'Sila province alone. Crucially, 58.4% of this value is generated within the non-market household economy, meaning it is excluded from national accounts and is not factored into the agricultural sector's contribution to the Gross Domestic Product (GDP). This finding aligns with a previous study indicating that "agricultural value chains in Algeria still suffer from poor organization and a lack of recognition for informal actors"¹³; it also concurs with observations made by others that, while "the traditional crafts sector falls within the scope of small and medium-sized enterprises (SMEs)," much of this activity actually takes place within an informal framework.¹⁴

These results raise a fundamental question: if rural women's contribution to food value chains is so significant, why is it not formally recognized? The answer lies in the fact that the national statistical system continues to employ traditional definitions of economic production that exclude household production intended primarily for family consumption—even though a substantial portion of this output circulates through informal local exchange networks.

4-3- Discussion of Behavioral Biases:

Loss Aversion (68.1%): The high prevalence of loss aversion among female participants explains a key reason why rural women are reluctant to market their products through formal channels. A woman who hesitates to sell—fearing a subsequent drop in price—prefers to retain the product for household consumption; this reduces the supply available in the formal market and reinforces the informal nature of women's economic activity. This result is consistent with a previous study on the impact of behavioral biases on the financial decisions of investors in Tiaret Province (2022), which showed that loss aversion strongly influences economic decisions even among educated individuals¹⁵; however, the fundamental difference is that rural women in M'Sila do not make stock market investment decisions, but rather make decisions... ..daily livelihood issues that affect their food security and that of their families.

Anchoring (a difference of 1,300 DZD/quintal): Anchoring represents one of the most critical behavioral biases in a rural context, as it implies that rural women are influenced by the initial price quoted by a commercial intermediary—even if that price is far below the product's true value. Given the limited access to market information among rural women in M'Sila, the intermediary becomes the sole source of pricing data, thereby gaining immense bargaining power. This finding aligns with a previous study on the impact of behavioral concepts on food consumption, which demonstrated that individuals are influenced by initial information to a degree exceeding theoretical expectations.¹⁶

Framing (80.9% influenced by negative framing): The variation in sales decisions based on how the option is presented (a 21.3 percentage-point difference between the two framings)

demonstrates that rural women in M'Sila—like anyone else—are susceptible to the framing effect. This implies that public policies designed to address women's fear of loss (e.g., "If you do not market your product now, it may spoil, and you will lose its value") could be more effective than policies that appeal solely to the logic of gain.

The Endowment Effect (56.5% increase in valuation): This bias is one of the study's key findings. Rural women value products they have crafted themselves at more than 50% above their actual market value. This partially explains why some women refuse to sell their products despite high prices: their emotional and sentimental attachment to the product makes them feel that selling it undervalues their efforts.

4-4- The relationship between the caregiving burden and formal integration:

The results revealed a significant inverse relationship ($r_s = -0.52$) between daily caregiving hours and the rate of formal economic activity. This means that every additional hour spent on caregiving reduces a woman's chances of integrating into the formal economy. The intuitive explanation is that the day has limited hours; every hour dedicated to caregiving is an hour taken away from paid production or formal marketing. However, a deeper explanation goes beyond the issue of available time to the question of mental energy. A woman who cares for children and the elderly while performing household chores all day exists in a state of constant exhaustion; this leaves her no capacity for the strategic thinking required to develop her economic venture or negotiate better prices. She sells her goods quickly at whatever price is available, lacking the time or energy to seek alternatives.

4-5- Comparison of Results with Previous Studies and Policy Implications:

Our study's findings align with a previous study noting that "rural women's economic participation is ineffective despite their informal role in many economic activities"¹⁷; however, we go further by offering a behavioral explanation for this phenomenon. We find that low formal participation stems not only from structural constraints—such as limited education and a lack of funding—but also from behavioral biases that cause women themselves to hesitate to engage with formal channels. Our results also concur with another study observing that cultural and social factors influence the logic behind a female entrepreneur's choice of venture, yet we introduce a new dimension: the burden of caregiving restricts the scope of choice available to women, while behavioral biases shape how they utilize this already limited margin¹⁸. Our findings diverge from another study on a fundamental point: whereas the latter concluded that "rural women's contribution to food security issues was limited solely to family support roles"¹⁹, our study demonstrates that women's contributions extend beyond the family framework to encompass entire local value chains. What appears to be merely "family contribution" is, in reality, part of a broader, unrecognized production system. The study's findings propose a dual approach to assessing rural women's contribution to food security: First, an econometric approach, which entails revisiting national time-use surveys to reflect the overlap between domestic chores and agricultural production in rural contexts, and establishing "satellite national accounts" to quantify the value of household food production and incorporate it into the agricultural sector's contribution to GDP. Second, a behavioral economics approach, which involves utilizing behavioral tools—such as "nudges"—when designing agricultural empowerment programs; rather than offering rural women generic advice on marketing, messages could be crafted to address their behavioral biases and facilitate better economic decision-making—for instance, by presenting price

information from multiple sources simultaneously to avoid the "anchoring effect," or by framing sales offers to appeal to loss aversion rather than the desire for gain.

Conclusion: Study Findings and Recommendations:

The study demonstrates that the unpaid care economy is a critical factor shaping the economic activity of rural women in M'Sila Province, and that their actual contribution to local food value chains far exceeds what official statistics indicate. The study reached the following key conclusions:

- 43.8% of women's daily activity falls outside official national accounts, with unpaid care work averaging 5.4 hours per day;
- The annual value added by women's contributions to local supply chains is estimated at approximately 85,680 DZD per participant, with 58.4% of this value remaining statistically unrecorded;
- 68.1% of female participants demonstrate a clear aversion to loss in marketing decisions;
- The reference point strongly influences pricing, with a 1,300 DZD/quintal difference observed between the two experimental groups;
- A significant inverse relationship ($r_s = -0.52$) exists between the caregiving burden and participation in the formal economy;
- Framing affects sales decisions, resulting in a 21.3 percentage-point difference between positive and negative framing scenarios.

This study demonstrates that understanding the economic activity of rural women requires an integrated approach combining econometrics (to measure the scale of contribution) and behavioral economics (to understand decision-making processes). Rural women are neither purely rational economic actors nor passive victims of structural conditions; rather, they are genuine economic agents making decisions amidst multiple constraints—including time, information, and social norms—as well as cognitive biases that affect them just as they do any other individual.

Recommendations:

Statistical Policy Level:

1. Update the National Time-Use Survey (the last version dates back to 2012), paying special attention to the rural context and including detailed activity categories that distinguish between purely domestic chores and household food production.
2. Establish sub-national accounts to quantify the value of household food production and food processing as part of the agricultural sector's contribution to the Gross Domestic Product (GDP).
3. Extend the scope of the 2024 General Census of Agriculture (Ministry of Agriculture and Rural Development, 2024) to include unregistered female-led production units in rural areas.

Development Policy Level:

4. Recognize household processing activities (drying, canning, cheese-making) as small-scale production units and establish a legal framework allowing them to market products through formal channels without complex requirements.
5. Create supported local value chains linking rural female producers to urban markets, while providing transport and storage services that reduce the time burden on women.
6. Develop micro-financing programs tailored to the time constraints of rural women, featuring flexible repayment schedules that account for agricultural seasons.

Applied Behavioral Economics Level:

7. Employ "nudge" tools in agricultural empowerment programs—such as presenting price information from multiple sources simultaneously to avoid the "reference point" effect, and using marketing messages that appeal to women's aversion to loss rather than the desire for gain. 8.

Linking agricultural training programs with behavioral economic literacy, enabling rural women to identify and correct their behavioral biases.

9. Establishing mobile-based price information platforms that provide real-time market prices, thereby reducing women's reliance on commercial intermediaries as their sole source of information.

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