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Determinants of Gender Inequality in the Paid-Unpaid Labor Balance: A Tree-Based Analysis of Employed Iranian Time-Use Data

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Original Article

Abstract

Background and Aim: Gender inequalities in the Paid-Unpaid Labor Balance (P-ULB) within the family sphere can lead to delayed marriage, decreased fertility rates, and a diminished quality of marital satisfaction. The main objective of this study is to examine the distribution of this balance among employed men and women in Iranian households and to identify the key socio-demographic determinants influencing it.

Data and Method: The P-ULB indicator is operationalized as the ratio of daily time allocated to paid versus unpaid labor. The Classification and Regression Tree (CART) machine learning algorithm was employed to model the P-ULB indicator into categorical outcomes (paid-dominant vs. unpaid-dominant). The CART model was applied to a sample of 9,296 employed individuals, comprising 7,962 men (85.6%) and 1,334 women (14.4%), extracted from the Iranian Time-Use Survey (2019–2020). Covariates included age group, children's age status, marital status, day type, socio-economic status, and internet use.

Findings: The results indicate that employed women shoulder a disproportionate burden of unpaid labor (50.4% falling into the unpaid-dominant category), whereas employed men dedicate the vast majority of their time to paid labor (93.8% paid-dominant). With a tree classification accuracy of 74%, all analyzed covariates exerted a significant influence on the CART model for women, with the exception of internet usage with tree accuracy of 74%.

Conclusion: Gender gaps in time allocation for childcare and are deeply embedded in long-standing socio-cultural norms that dictate traditional female roles within the home and family. Mitigating these imbalances and advancing gender equity in Iran requires a synchronized approach involving macro-level policy interventions and progressive cultural shifts.

***Keywords*:** Unpaid Labor, Paid-Unpaid Labor Balance (P-ULB), Classification and Regression Trees (CART), Gender Inequality, Women.

Key Message: The discrepancy between the ideal and the empirical reality of gender inequality among employed Iranian men and women remains substantial. To foster an environment conducive to higher fertility intentions, structural changes are imperative, specifically increasing husbands' participation in unpaid domestic labor alongside expanding opportunities for women in formal paid employment.

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Introduction

Gender inequality in the division of paid and unpaid labor remains one of the most persistent forms of inequality globally, affecting both developed and developing nations (Charmes, 2019). While paid labor is conceptually distinct, unpaid labor—encompassing domestic and care work performed without monetary compensation to maintain a household—eludes a singular definition despite being widely acknowledged (UN Women, 2018; Jung & O'Brien, 2017). Deep-seated traditional gender roles, which cast men as primary breadwinners and women as caregivers, continue to labor market structures and the unequal distribution of unpaid work (Aastha, 2024). Despite significant progress in women's educational attainment and economic involvement, this gendered division endures, thereby altering the balance between paid and unpaid activities and reinforcing the cycles of inequality (UN Women, 2020).

Globally, women remain primarily responsible for household unpaid labor, devoting an average of 3–6 hours daily compared to men's 0.5–2 hours (Seedat & Rondon, 2021). This disparity intensifies significantly post-marriage, as evidenced by cross-national data showing that married women perform substantially more non-market work: 33 hours weekly in the U.S. (56% more than men), 47 hours in India (8 times more), and 28 hours in China (3 times more), while simultaneously engaging in fewer paid work hours than their male counterparts (Gottlieb et al., 2024). This pattern persists within OECD countries, where women's total work burden exceeds men's by 25 minutes daily—a gap largely explained by their disproportionate unpaid labor contributions as men continue to dominate paid work hours (OECD, 2024). According to Iranian time-use data from 2014–2015, a pronounced gendered division of labor remains manifest, with women spending an average of 6 hours and 32 minutes per day on unpaid labor (five times more than men, who contributed only 1 hour and 14 minutes), while men devoted ten times more time to paid activities than women (5 hours and 53 minutes compared to 35 minutes) (Torabi, 2020a). This suppressed level of female economic participation is reflected in Iran's ranking of 143rd among 146 countries in the Global Gender Gap Report (2025), underscoring a critical imperative for fundamental reforms in legislation, workplace culture, and policymaking frameworks to address this profound inequality (World Economic Forum, 2025).

In Iran, quantitative and qualitative studies consistently confirm the resilience of a gendered division of domestic roles (Baderi Manesh & Sadeghi Fasaei, 2015; Sadeghi Fasaei &

Mirhosseini, 2016; Mehrabani, 2017; Torabi, 2020b), even amidst significant transformations in other family structures (Aghajanian & Thompson, 2013; Torabi et al., 2013; Torabi et al., 2015). Achieving substantive gender equity requires directly addressing the marked asymmetry in how men and women allocate their time to paid and unpaid labor. Studying the paid and unpaid labor balance (P-ULB) at a national level, particularly among employed individuals, is crucial for understanding contemporary Iranian family dynamics. Time-Use Surveys (TUS), which collect data from time diaries, offer the most effective method for measuring unpaid labor (Ervin et al., 2022). This focus moves beyond conventional discussions of wage gaps to reveal a less visible but critical dimension of gender stratification.

While previous research utilizing Iranian TUS has established factors like education, employment, and the number of children as correlates of separate paid and unpaid work domains (Torabi, 2020a, 2020b; Ghazi Tabatabaei & Mehri, 2013a, 2013b, 2019), a critical research gap remains: no study has yet examined the determinants of the combined P-ULB itself. To address this gap, our study leverages Classification and Regression Trees (CART)—a non-parametric machine learning technique—using the latest Iranian Time-Use Survey (2019–2020). This approach allows us to identify the determinants of participation in paid versus unpaid work and to analyze how these factors differ by gender, thereby moving beyond the limitations of traditional regression methods (Aastha, 2024; Gupta & Pattanaik, 2025; Ghazi Tabatabaei & Mehri, 2013a, 2013b, 2019; Torabi, 2020a, 2020b). Additionally, the current study seeks to answer the following questions: 1) How is the paid and unpaid labor distributed between working men and women? 2) Which of the covariates play an influential role in this balance? 3) What socio-demographic characteristics do employed individuals who are more heavily engaged in either paid or unpaid labor possess?

Literature Review and Theoretical Considerations

A comprehensive synthesis of global TUS research reveals persistent and universal gender disparities in the division of labor. Women consistently bear a disproportionate burden of unpaid work, performing 75% of such labor and dedicating, on average, 3.2 times more hours to it than men (Charmes, 2019). This unequal distribution exacerbates time poverty and restricts women's access to the formal labor market, thereby acting as a critical structural barrier to socio-economic equality worldwide.

Analysis of Iran's TUS data from 2008–2009 has yielded critical insights into the determinants of time allocation, focusing particularly on educational attainment and

childbearing. Salehi-Isfahani and Taghvatalab (2019) demonstrated that higher education significantly alters the time-use patterns of married women. Concurrently, the impact of childbearing on gender inequality has remained a major focus of demographic inquiry. Ghazi Tabatabaei and Mehri (2013a), utilizing couple-level data extracted from the TUS, investigated the effects of the number of dependent children under 7 years old). Complementing this, Ghazi Tabatabaei and Mehri (2013b) compared the total workload (the sum of paid and unpaid labor) of employed and unemployed married women relative to their number of dependent children. Their research quantified the "double burden" borne by employed mothers, demonstrating that they work 1 to 3 hours more per day than their unemployed counterparts. A pivotal finding from their study indicates that this total workload burden decreases as the number of dependent children increases, suggesting that employed women with larger families either contract their paid employment hours or that unpaid domestic demands reach a point of saturation.

Subsequent analysis of Iranian TUS data from 2014–2015 further elucidates these persistent gendered divisions of labor, which remain heavily shaped by family life cycle stages and educational variables. Torabi (2020a) illustrated that the traditional pattern of male breadwinning and female homemaking remains dominant across various stages of family life. The study found that the intensity and temporal fluctuations of time dedicated to unpaid work differ significantly by gender, indicating that deeply ingrained gender norms frequently override countervailing socio-economic factors. The role of education as a pivotal moderating variable was further explored by Torabi (2020b), whose findings indicate that a woman's higher educational attainment significantly reduces her own time while marginally increasing her spouse's contribution. Conversely, a husband's education level correlates positively with both his own and his wife's engagement in housework. However, the profound burden of childrearing on this gendered division is starkly highlighted by Ghazi Tabatabaei and Mehri (2019). Their research demonstrates that an increase in the number of small children (aged seven and under) significantly elevates the total workload (both paid and unpaid) of urban employed women, whereas men's total workload remains almost unchanged.

While the existing Iranian literature effectively documents these gender disparities, it simultaneously highlights that although specific micro-level factors can mitigate inequalities, deeply entrenched structural norms and asymmetrical care responsibilities remain the primary barriers to equity in paid and unpaid labor distribution. Moreover, these prior studies are fundamentally constrained by a critical methodological limitation: they almost

universally analyze paid and unpaid work within separate, isolated statistical models. This siloed analytical approach represents a significant weakness, as it precludes a direct understanding of the dynamic balance and explicit trade-offs between these two domains. Consequently, conventional models fail to reveal how unique combinations of covariates simultaneously influence an individual's overall work portfolio. By leveraging the Classification and Regression Trees (CART) framework, the current study directly bridges this empirical lacuna. The CART method is uniquely capable of uncovering complex, non-linear interactions and multi-tier decision paths within a comprehensive set of covariates. This approach allows for the precise identification of specific socio-demographic profiles—such as the intricate interplay between education and the number of children—that define whether an individual is "paid-dominant" (engaged primarily in market work) or "unpaid-dominant" (bearing the primary burden of domestic labor), thereby moving beyond mere description to provide a mechanistic explanation of labor allocation in Iran.

Sociologists define gender inequality as the systemic differences in status, power, and prestige between women and men across groups, communities, and broader societies (Giddens, 2007). Explaining these disparities and the persistence of rigid gender roles requires an integrative synthesis of sociological and economic frameworks, each operating at distinct macro and micro levels of analysis. The foundational micro-level theories explaining individual, economic, and social variables are presented below.

Micro-level explanations for gender inequality in domestic labor prominently feature the Relative Resources approach and the Time Availability perspective. The Relative Resources approach (Blood & Wolfe, 1960) posits that spouses act as rational agents who utilize their socio-economic resources—such as income and educational attainment—to bargain their way out of undesirable domestic labor. Because housework is frequently devalued relative to market-based paid employment, individuals leverage their personal resources to minimize their domestic burden. Empirical evidence suggests that a woman's share of housework correlates negatively with her own income and education, but can correlate positively with her husband's education (Shelton & John, 1996). However, this theory is grounded in the principle that economic resources and direct time investment in paid work are the primary operational determinants; the explanatory power of auxiliary variables like general socio-economic status is significantly attenuated or entirely eliminated when income and direct market work hours are controlled, as the latter constitute the true mechanisms of marital bargaining power (Brines, 1993).

Parallel to this, the time availability perspective posits that gendered differences in housework are a direct function of the temporal constraints individuals face due to non-household activities, specifically formal paid employment. The core principle is a zero-sum time trade-off: increased hours dedicated to external market activities necessarily reduce the remaining time available for domestic labor (Hiller, 1984; Coverman, 1985; England & Farkas, 1986). Within this perspective, time allocation is often modeled as a joint, utility-maximizing household decision. This view aligns closely with the New Home Economics and family microeconomics frameworks (Schultz, 1974), which conceptualize domestic choices, including fertility behavior, as rational calculations designed to maximize collective household utility. This economic theory similarly predicts a positive correlation between the number of dependent children and the total volume of domestic labor. Empirical studies generally validate this perspective, demonstrating that time spent on housework is negatively correlated with market employment hours and positively correlated with the number of children, though the magnitude and elasticity of these relationships diverge sharply between men and women (Shelton & John, 1996; Davis & Greenstein, 2004). Despite the robustness of these theories, a key limitation persists: the enduring, disproportionate share of domestic labor borne by women—even amidst rapidly rising female labor force participation—strongly points to the enduring influence of socio-cultural gender norms that go beyond purely economic or rational time-based calculations.

Gender Equity Theory (McDonald, 2000) introduces the concept of a "disjunction between individual-oriented and family-oriented institutions." This framework posits that while advanced societies have achieved high levels of gender egalitarianism within individual-oriented institutions (such as higher education and the formal labor market), a parallel structural revolution has not occurred within family-oriented institutions. This asymmetric development creates a critical institutional disjunction: women, despite their extensive integration into universities and the formal economy, continue to bear the primary structural responsibility for domestic maintenance and childcare. The theory argues that increased fertility exacerbates this systemic inequality; the resulting increase in housework and child care demands falls disproportionately on employed women due to a persistent deficit in spousal domestic participation, ultimately reinforcing a highly gendered and unequal division of unpaid labor within the domestic sphere.

None of the aforementioned theoretical frameworks, when taken in isolation, can fully explain the multi-dimensional complexity of gender inequality. Consequently, an integrated

analytical framework that accounts for the interaction between distinct institutional levels offers the most robust explanatory power. To this end, the conceptual framework of the current study is integratively informed by Gender Equity Theory (McDonald, 2000), alongside the core tenets of the Relative Resources approach and the Time Availability perspective (Blood & Wolfe, 1960). Together, these theories provide a rigorous foundation for analyzing how the specified socio-demographic covariates collectively predict and determine the paid-unpaid labor burden among employed women and men. According to these theories the conceptual framework of this study is presented in Figure 1.

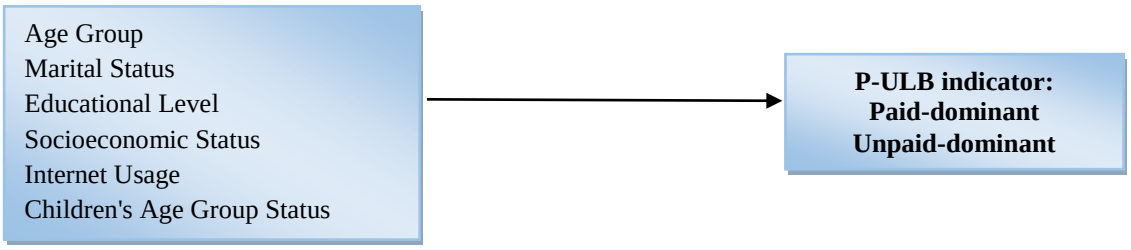

Figure 1- Conceptual Framework of the Study

Methods and Data

The Classification and Regression Tree (CART) framework, introduced by Breiman et al. (2017), is a robust machine learning methodology constructed through recursive binary partitioning of data, a process that yields an easily interpretable decision tree (Timofeev, 2004). A decision tree analysis framework is built upon several key components: a categorical dependent (outcome) variable, a set of independent (predictor) variables, a learning dataset for model training, and a testing dataset for validation. This structure is supplemented by prior probabilities, which indicate the baseline likelihood of each outcome, and a cost matrix that defines the penalties associated with misclassification errors.

In prior research, the CART method has been frequently applied to classify categorical outcomes, particularly within fertility and demographic studies (Bagheri & Saadati, 2015; 2019; Saadati & Bagheri, 2020). In the present study, since the Paid-Unpaid Labor Balance (P-ULB) indicator is operationalized as a binary categorical variable, CART is employed to classify it based on a selected set of covariates. The International Classification of Activities for Time-Use Statistics (ICATUS) is a globally standardized framework developed by the United Nations for categorizing human activities within Time-Use Surveys (TUS). The overall

objective of implementing the TUS is to identify the patterns of time use and the average duration of activities performed by the urban population based on ICATUS parameters, thereby examining shifts in these behavioral patterns. The target population of this survey encompasses all individuals aged 15 years and older residing in households within urban areas of the country during the autumn and winter of 2019, and the spring and summer of 2020, extracted from the third phase of the Iranian Time-Use Survey of the Statistical Centre of Iran.

All activities performed by individuals during a 24-hour period are classified into nine main groups according to ICATUS guidelines. Out of the 16,128 households and 41,784 individuals aged 15 and older sampled in the 2019–2020 TUS, a subsample of 23,382 ever-married individuals—comprising 12,380 men (52.9%) and 11,002 women (47.1%) —was selected. Within this sub-sample, 9,296 individuals were employed; the reported employment rates within the text were 64.3% (7,962) for men and 12.1% (1,334) for women.

This study specifically analyzes the balance between two ICATUS categories: Group 1 (code 1), representing Paid Employment and related activities, and Group 2 (codes 3 and 4), encompassing unpaid domestic services and care services for household and family members. Volunteer work (code 5 in ICATUS) was excluded from the analysis. The dependent variable is derived from the ratio of daily time (measured in minutes) dedicated to paid versus unpaid activities, designated as the P-ULB index. From this continuous P-ULB variable, a binary categorical indicator was constructed. P-ULB indicator values exceeding 1 indicate that the duration of paid activities is greater than unpaid activities (Paid-dominant), whereas values falling below 1 reflect a higher volume of unpaid labor relative to paid employment (Unpaid-dominant).

Given the research focus on the effects of unpaid labor within the structural framework of the "double burden" of paid and unpaid work, the analytical population of interest was restricted exclusively to employed individuals. Therefore, the decision tree modeling is conducted solely for the 9,296 employed household heads and their spouses, comprising 7,962 men and 1,334 women.

The primary objective of the present study is to evaluate the impact of covariates—such as age group, marital status, day type of data collection, children's age group status, socio-economic status, and internet usage—on the P-ULB indicator among employed women and men utilizing CART modeling. The household socio-economic status variable was constructed

by synthesizing four distinct variables, including three economic indicators: type of dwelling (apartment = 1, non-apartment = 2), dwelling ownership status (other/free/organizational = 1, renter = 2, owner = 3), and the number of household appliances (one point allocated for every two additional appliances, ranging from 1 to 11); alongside one social indicator: educational attainment (ranging from illiterate = 1 to PhD = 9). Due to the unavailability of direct income data in the TUS, dwelling characteristics and appliance accumulation served as the proxy economic factors for constructing this socio-economic index. Cumulative scores for each individual ranged from 4 to 25. This composite variable was subsequently categorized into three socio-economic strata: low (4–11), medium (11–18), and high (18–25), and was utilized as a covariate in the primary analysis, though all individual components were evaluated within the descriptive phase.

Findings

This section begins with a descriptive analysis, which delineates the average daily time allocated by employed men and women across the nine main ICATUS activity groups, the frequency distribution of selected covariates, the amount of paid and unpaid labor, and the distribution of the P-ULB indicator by gender. Furthermore, the results of chi-square tests and comprehensive cross-tabulations of the P-ULB indicator by gender are presented. In the subsequent CART analysis section, the classification trees for the P-ULB indicator among women and men, their corresponding misclassification matrices, and Key Findings 1 to 8 derived from the classification tree for working women are presented.

1). Descriptive Analysis

Figure 2 displays the doughnut graph of the average daily time spent by employed individuals, alongside a gender-disaggregated breakdown for employed men and women, classified by the nine primary ICATUS activity categories. ICATUS categories 2, 5, and 6 are omitted from this figure because their values fell below the 0.5% threshold. Figure 2a indicates that, on average, employed individuals allocated 29.56% of their daily time to paid activities (7 hr 6 min) and 6.50% to unpaid labor—comprising 5.26% dedicated to domestic chores (1 hr 15 min) and 1.24% to care-related activities (18 min). Disaggregating by gender, employed men spent 31.39% of their average daily time on paid activities (7 hr 32 min) and 4.26% on unpaid activities, which includes 3.22 % for domestic labor (47 min) and 1.04% for care activities (15 min), respectively (Figure 2b). Conversely, employed women dedicated 18.69% of their daily time to paid activities (4 hr 29 min) and 19.54% to unpaid labor, split

between 17.14% for domestic duties (4 hr 7 min) and 2.40% for care services (35 min), as illustrated in Figure 2c. Employed men dedicate approximately 3 hours more to paid labor (representing a 1.68-fold increase), whereas employed women dedicate approximately 3 hours more to unpaid labor (a 4.59-fold increase), demonstrating that employed women systematically contract their market activities to accommodate heightened domestic responsibilities.

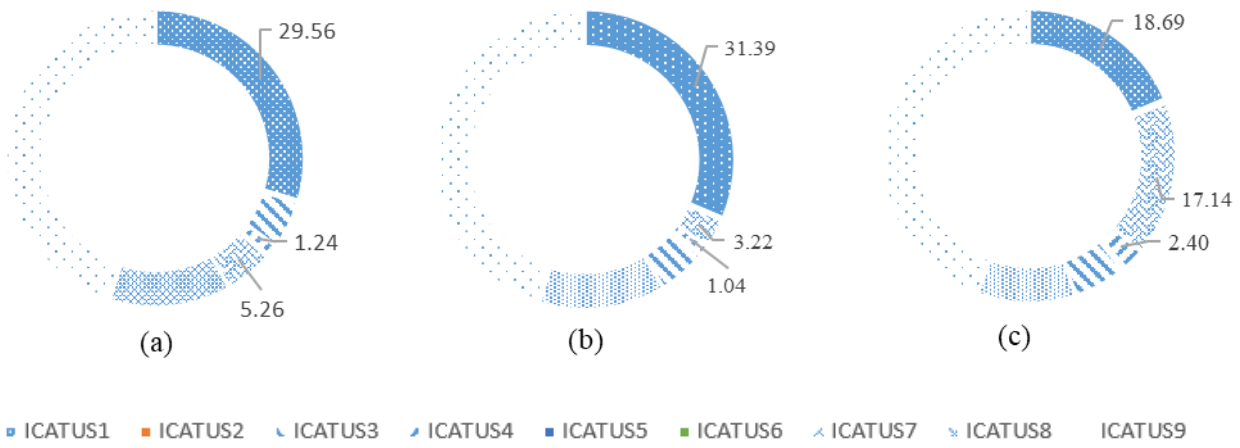

Figure 2- Doughnut Graph of Average Daily Time Spent by Study Population and Gender, Employed Individuals (a), Employed Men (b) and Employed Women

The age of children was operationalized as a categorical variable comprising: childless, households with at least one child in each age range (0–6 years, 7–12 years, 13–18 years, and 19 years or older), and an "other" category. Given that the presence of young children influences the division of unpaid labor among employed individuals (Ghazi Tabatabaei & Mehri, 2013a, 2013b; Gottlieb et al., 2024), a distinct analytical category isolating these young children alongside older age groups (7 years and above) was separated from the baseline "other" category. Consequently, the refined "other" category for the children's age variable now encompasses households with children aged 7 years or older across various age groups, excluding children aged 6 years and under.

Table 1 presents the frequency distribution of selected study covariates, the amount of paid and unpaid labor, and the calculated P-ULB index disaggregated by gender. Generally, across a standard 24-hour cycle, men dedicate more hours to market-based paid work than women, while women allocate substantially more hours to non-market unpaid work than men. The

empirical reality that employed women execute a higher volume of unpaid labor relative to paid employment over a 24-hour period highlights the disproportionate burden of household responsibilities and work-related pressures they experience, leading to work-family conflict. Men were predominantly concentrated within the 35–55 age group (59.9%), while women were primarily clustered between the ages of 25 and 45 (68.3%). The behavioral patterns of paid and unpaid labor among men follow a diminishing trend and a U-shaped trajectory, respectively, with the sole exception of the youngest age group (ages 15–25). Employed men aged 15–25 have the highest average ratio of paid to unpaid work compared to all other age groups (a 9.74-fold ratio). Beyond this baseline, the ratio systematically decreases until age 55, after which it undergoes a secondary expansion to 7.69 times, confirming a classic U-shaped pattern. In contrast, the pattern for women follows a U-shaped trajectory for paid labor and an inverse decreasing trend for unpaid labor. Employed women aged 15–25 similarly exhibit the highest P-ULB index among the female sample (1.11 times). This ratio steadily declines until age 55, followed by a relatively modest subsequent increase to 1.04 times. Among employed men, the temporal gap between hours of paid and unpaid work fluctuates significantly across age groups, reaching a nearly tenfold disparity at its peak. In comparison, employed women display no substantial variation in the absolute gap between hours dedicated to paid versus unpaid labor across different age groups, maintaining a nearly equal, symmetrical time allocation between both spheres daily.

Approximately 98% of the male participants and 87% of the female participants were married. Married men engage in a higher amount of paid employment compared to their divorced or widowed counterparts, while their absolute contribution to unpaid labor is lower. Consequently, employed married men exhibit a higher P-ULB ratio (7.43 times) relative to divorced or widowed men (4.57 times). However, divorced or widowed employed women show a significantly higher P-ULB ratio (1.54 times) compared to their married female counterparts.

Over 80% of data collection occurred on working days. On average, the amount of unpaid labor performed by both genders is higher during weekends, whereas paid work remains highly prevalent on formal working days. Employed men dedicate approximately 8.33 times more hours to paid work than to unpaid labor on working days. In sharp contrast, women allocate 1.04 times more time to paid work relative to unpaid labor on working days, a ratio that drops to 0.57 times on weekends.

Table 1. *Distribution and Paid-Unpaid Labor Balance (P-ULB) of Covariates by Gender*

Covariates	Male				Female			
	Percent	Paid Labor (min)	Unpaid Labor (min)	P-ULB	Percent	Paid Labor (min)	Unpaid Labor (min)	P-ULB
Age Group								
15–25	1.6	455.6	46.8	9.74	3.7	285.9	258.3	1.11
25–35	24.9	472	62.5	7.55	26.5	279.5	291.8	0.96
35–45	36.6	466.4	63.5	7.35	41.8	274.5	290.1	0.95
45–55	23.3	433.7	62.7	6.92	19.7	244.1	266.6	0.92
55 and older	13.6	407.3	52.9	7.69	8.2	260.5	249.7	1.04
Marital Status								
Married	98.4	452.3	60.8	7.43	86.7	259.4	291.4	0.89
Divorced & Widowed	1.6	430.7	94.2	4.57	13.3	332.7	216	1.54
Data Collection Day Type								
Working Day	82.4	481.4	57.8	8.33	83.3	287.8	275.7	1.04
Weekends	17.6	314.4	78.1	4.03	16.7	175.8	309.7	0.57
Children's Age Group Status								
Childless	15.3	441.6	56.8	7.77	17.8	303.7	220.4	1.38
With children ≤ 6 years	15.9	478.6	65.2	7.34	11.5	255.1	303.2	0.84
With children 7–12 years	9.4	455.7	58.14	7.84	10.6	277.6	294.5	0.94
With children 13–18 years	6.5	430.3	66.5	6.47	9.2	268.5	286.2	0.94
With children ≥ 19 years	15.6	459.8	55	8.35	17.7	263.3	270.1	0.98
With children ≤ 6 & older	18.8	449.5	63.8	7.04	14.8	251.7	316.7	0.79
Others	18.4	439.3	64.5	6.81	18.4	259.2	300	0.86
Educational Level								
Illiterate	5.2	417.8	53.9	7.75	6.7	282.8	263.5	1.07
Primary	20.7	446.3	55	8.12	14.1	268.9	266.2	1.01
Secondary & High School	23.6	471.7	53.4	8.83	12.5	327.4	277.6	1.18
Diploma	26.5	480.5	58.9	8.15	20.8	279.8	294.7	0.95
University	24	413.4	79	5.23	45.9	246.4	283.7	0.87
Socioeconomic Status								
Low	5.3	466.3	60.1	7.76	6.4	281.3	269.8	1.04
Middle	82.3	450.8	61.4	7.34	79	270.7	279.6	0.97
High	12.4	453.2	61.6	7.35	14.6	255.1	296	0.86
Internet Use								
Yes	85.2	455.6	62.2	7.32	88.7	269.7	282.2	0.96
No	14.8	431	56.5	7.63	11.3	264	275.2	0.96
Total Sample Size (N)	**7,962**	—	—	—	**1,334**	—	—	—

Note. P-ULB = Paid-Unpaid Activity Balance. Grand Total *N* = 9,296.

In terms of household composition, 15.3% of men and 17.8% of women were childless, while over 30% of both groups had at least one child aged 6 or below years old, either alone or alongside older children. Specifically, 15.9% of men and 11.5% of women have exclusively one or more children aged 6 or under; 15.9% of men and 19.8% of women have children in the 7–18 age range; and 15.6% of men and 17.7% of women reside with one or more children aged 19 or older. Employed fathers with at least one child aged 6 or under execute the highest amount of paid work (7 hours and 59 minutes) and the absolute lowest amount of unpaid work (1 hour and 7 minutes) per day. Conversely, employed men with at least one child aged 19 or above manifest the highest absolute P-ULB ratio (8.35). On the other hand, employed mothers without children perform the highest amount of paid work (5 hours and 4 minutes) and the lowest amount of unpaid work (3 hours and 40 minutes) among all maternal categories, resulting in the highest maternal ratio of paid to unpaid work (1.38). The lowest amount of paid employment among mothers is observed among those with at least one child under the age of 6, accompanying children (5 hours and 17 minutes), who also show the lowest ratio of paid to unpaid work (0.79) and a corresponding highest ratio of unpaid to paid work (1.26).

Educational stratification indicates that most men held high school diplomas (26.5%), whereas the majority of women possessed a university-level education (45.9%). Baseline illiteracy rates stood at 5.2% for men and 6.7% for women, whereas 24.0% of men and 45.9% of women held formal higher education degrees. As the educational attainment of employed men increases, their ratio of paid to unpaid work hours rises continuously until the secondary and high school level, after which this rate contracts for individuals holding a diploma or higher. The peak value of this ratio is observed among employed men with secondary and high school education (8.83 times), while the lowest baseline is related to university graduates (5.23 times).

Among employed men, the peak duration of daily paid work is tied to those holding a high school diploma (8 hours), while the maximum unpaid labor investment is found among university graduates (1 hour and 19 minutes). Similarly, the highest and lowest P-ULB values for working women belong to those with secondary and high school education (7.18) and university graduates (0.87), respectively. The trend trajectory of an increasing ratio dedicated exclusively to unpaid work also exists for employed women up to the diploma level.

Regarding socio-economic positioning, employed men (7.76 times) and employed women (1.04 times) characterized by low socio-economic status have the highest ratio of paid to

unpaid labor. This ratio systematically diminishes for both employed men and women as their socio-economic status climbs. Active internet usage was reported by 85.2% of men and 88.7% of women. Operational internet usage does not induce a substantial shift in the P-ULB ratio for employed women (remaining steady at 0.96). In contrast, men's P-ULB index was substantially higher among those who do not utilize the internet (7.63).

Table 2 shows the chi-square test results of the P-ULB indicator by gender. As shown in Table 2, 82.6% of males are paid-dominant, whereas 52.9% of females are unpaid-dominant. The statistical association between paid-dominant and unpaid-dominant states differs significantly between employed men and women ($p < 0.001$). Consequently, subsequent analyses of this variable should be conducted separately by gender-segregated modelling.

Table 2. *P-ULB Indicator Balance by Gender*

Variable	Male		Female		Chi-square (χ^2) (p-value)
	Frequency	Percentage	Frequency	Percentage	
Paid-dominant	6,580	82.6%	628	47.1%	829.853 (< 0.001**)
Unpaid-Dominant	1,382	17.4%	706	52.9%	

*Note: ** Significant at the 0.01 level (2-tailed).*

Table 3 presents the cross-tabulation of the P-ULB indicator with selected covariates by gender, restricting inclusion exclusively to statistically significant factors. The most striking and consistent finding across the entire table is the profound gender disparity in the division of daily activities. For every single covariate category, the vast majority of men (almost over 90%) fall into the paid-dominant category. In contrast, women remain almost evenly split between the unpaid-dominant and paid-dominant categories, indicating a much heavier and more universal burden of unpaid work for women, irrespective of their other circumstances.

For both women and men, significant statistical associations ($p < 0.001$) were observed between the P-ULB indicator, the day type of data collection, and the children's age group status. However, within the gender-segregated samples, only educational attainment showed a significant association with this indicator among employed men, whereas marital status and the absolute number of household appliances demonstrated significant associations with the outcome indicator among employed women ($p < 0.01$)

Table 3. *Crosstab of P-ULB Indicator and Studied Covariates (Significant)*

Variable / Covariate	Paid-Unpaid Activity Balance (%)			
	Male		Female	
	Unpaid-dominant	Paid-dominant	Unpaid-dominant	Paid-dominant
Marital Status				
Married	6.1	93.9	52.8	47.2
Divorced or Widowed	7.3	92.7	34.5	65.5
Chi-square (χ^2)	*0.266*		*20.668*	
p-value	*0.606*		*< 0.001***	
Data Collection Day Type				
Weekends	4.9	95.1	47.7	52.3
Working Day	12.1	87.9	63.7	36.3
Chi-square (χ^2)	*104.416*		*18.953*	
p-value	*< 0.001***		*< 0.001***	
Children's Age Group Status				
Childless	6.0	94.0	37.8	62.2
With children ≤ 6 years	5.5	94.5	52.6	47.4
With children 7–12 years	4.7	95.3	50.4	49.6
With children 13–18 years	8.3	91.7	50.8	49.2
With children ≥ 19 years	4.7	95.3	47.9	52.1
With children ≤ 6 years & older children	6.9	93.1	58.4	41.6
Others	7.4	92.6	56.9	43.1
Chi-square (χ^2)	*17.979*		*25.073*	
p-value	*0.003***		*< 0.001***	
Educational Level				
Illiterate	5.3	94.7	43.3	56.7
Primary	5.7	94.3	52.1	47.9
Secondary & High School	5.8	94.2	44.3	55.7
Diploma	5.3	94.7	51.3	48.7
University	8.1	91.9	52.1	47.9
Chi-square (χ^2)	*16.556*		*5.309*	
p-value	*0.002***		*0.259*	

*Note: * Significant at the 0.05 level; ** Significant at the 0.01 level (2-tailed).*

The day type of data collection (chi-square = 104.416, $p< 0.001$) constitutes a significant determinant of the P-ULB indicator for men. This pattern operates similarly for women but manifests less pronouncedly, indicating that male roles are also influenced by the day types. The difference between a weekend and a formal working day is highly significant for women (chi-square = 18.953, $p < 0.000$). On working days, a much higher percentage of women (63.7%) are classified as unpaid-dominant compared to weekends (47.7%), likely because formal paid labor is not in session, shifting the focus back to unpaid domestic tasks. For employed women, the children's age group (chi-square = 25.073, $p < 0.001$) represents another significant factor. Childless women are the most likely to be paid-dominant (62.2%). The presence of children—specifically highly dependent young ones aged 6 and under—pushes a majority of women into the unpaid-dominant category (52.6% for those with exclusively one or more children aged 6 and under, and 58.4% for those with at least one child aged 6 and under accompanying with older children).

The predominance of unpaid activities among women gradually decreases as the age of the children increases. Interestingly, men's labor balance is also affected by the number of children (chi-square = 17.979, $p = 0.003$), though to a much lesser extent than that of women. The percentage of working men exhibiting an unpaid-dominant pattern changes only slightly (ranging from 4.7% to 8.3%) across the categories of children's age groups. Specifically, the highest and lowest proportions of unpaid work are performed by fathers with children aged 13–18 and those with children aged 7–12 or 19 and older, respectively. Furthermore, the P-ULB index for men is significantly influenced by their educational attainment (chi-square =16.556, $p = 0.002$). A higher percentage of university-educated men allocate time to unpaid work daily compared to those at other educational levels (8.1%).

For employed women, marital status (chi-square = 20.668, $p < 0.001$) represents another significant factor. Married women (52.8%) are substantially more likely to have an unpaid-dominant labor pattern than divorced or widowed women (34.5%), who conversely exhibit a higher likelihood of being paid-dominant (65.5%). This suggests that marital status profoundly shapes women's economic roles

2). CART Analysis

The analysis reveals that the division of labor is deeply gendered and largely inflexible for men, whose role as primary earners (Paid-Dominant) remains consistent across almost all socio-demographic factors. Figure 3 displays the classification trees for the P-ULB indicator by

selected covariates among women. Since 93.8% of men performed more paid work than unpaid work, no variables emerged as significant predictors for them in the CART model; therefore, their results are not reported.

This overwhelming majority indicates that for virtually all employed men, paid work is the primary activity defining their daily time use. Their identity and role within the household are strongly tied to being the primary breadwinner. This pattern suggests that employed men primarily channel their time and energy into the economic sphere (the public world of work) while remaining largely absent from the domestic sphere (the private world of home and family care).

Table 4 presents the corresponding misclassification matrix, showing the accuracy of the CART model for women. The shaded cells in Table 4 indicate correct classifications, from which the model's accuracy rates were derived. These accuracy values can be formally calculated using Equation (1).

$$Accuracy = \frac{566+421}{1334} = 0.74 \quad (1)$$

A classification accuracy of 0.74 indicates that the P-ULB indicator for 74% of the women was correctly classified (implying a model misclassification rate of 26%).

Table 4. *Misclassification Matrix for Female's CART Model*

Observed Categories	Predicted Category		Total	Accuracy (%)
	Unpaid-dominant	Paid-dominant		
Unpaid-dominant	566	306	872	
Paid-dominant	41	421	462	
Total	**607**	**727**	**1,334**	**73.99%***

Note. CART = Classification and Regression Tree.
* Represents the overall model accuracy.

The results in Figure 3 indicate that the key influencing factors are children's age group status, marital status, data collection type, age group, and socioeconomic status. The primary variable positioned at the root of the decision tree is children's age group status, with 50.4% of employed women classified as unpaid-dominant. The following key findings can be extracted from the classification tree of working women's P-ULB indicator in Figure 3:

1. Widowed or divorced women without children, with children aged 6 years and older or others are more likely to engage in paid activities rather than unpaid ones.
2. Married women under 55 years old without children with children aged 6 years and older or others are more likely to engage in paid activities rather than unpaid ones.
3. Married women over 55 years old without children with children aged 6 years and older or others are more likely to engage in unpaid activities rather than paid ones.
4. Women with children under 6 years old (whether solely within this age range or in combination with other age ranges) are more likely to engage in unpaid activities rather than paid ones on weekends.
5. Widowed or divorced women with children under 6 years old (whether solely within this age range or in combination with other age ranges) are more likely to engage in paid activities rather than unpaid ones on workdays.
6. Married women with children under 6 years old (whether solely within this age range or in combination with other age ranges) who have a middle or high socioeconomic status are more likely to engage in unpaid activities rather than paid ones on workdays.
7. Married women over 45 years old with children under 6 years old (whether solely within this age range or in combination with other age ranges) and a low socioeconomic status are more likely to engage in unpaid activities rather than paid ones on workdays.
8. Married women under 45 years old with children under 6 years old (whether solely within this age range or in combination with other age ranges) and a low or middle socioeconomic status are more likely to engage in paid activities rather than unpaid ones on workdays.

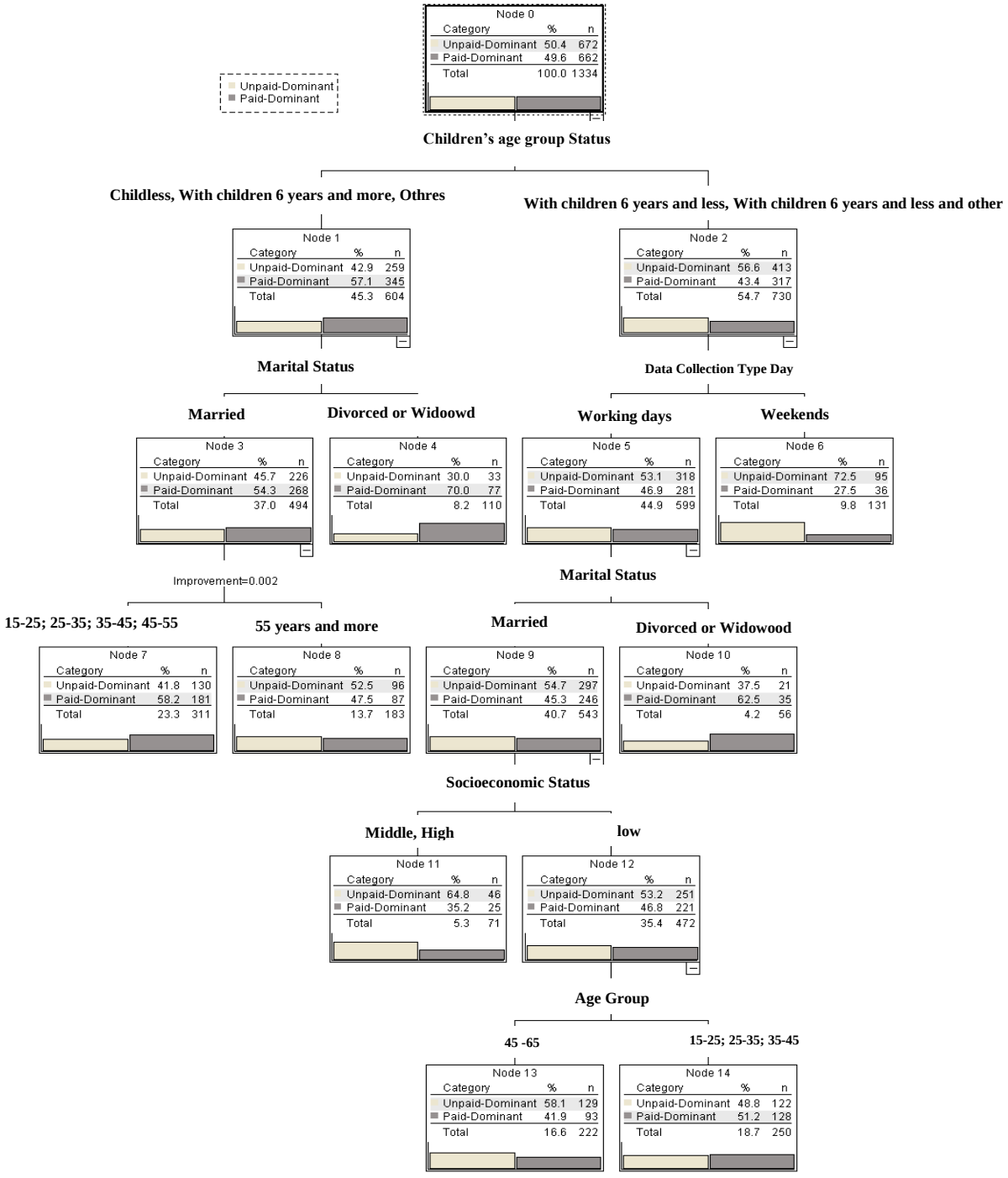

Figure 3. Classification Trees of P-ULB indicator for Female by Selected Covariates

Conclusion and Discussion

Based on the literature review and theorithical consideration, this study, recognizing gender inequality as both a cause and consequence of unbalanced unpaid labor. The results confirm significant gender disparities, with employed men spending 1.68 times more hours on paid work (7h 32min) and employed women spending 4.59 times more hours on unpaid domestic services (4h 7min). A notable international comparison reveals that while this imbalance is universal, its magnitude varies; the gap for Iranian women is larger than that for working women in the United States, who spend twice as many weekly hours on childcare and household work as men (Vega Varela & Moridi, 2024).

Based on traditional gender norms that designate women as primary caregivers and men as breadwinners, this study examines the division of labor in Iran, where only 10.8% of women are employed. The findings reveal a significant gap between evolving attitudes—where over 50% of Iranians hold intermediate gender views (Faizi, 2025)—and the reality of labor allocation, highlighting a persistent gendered imbalance. The CART analysis shows that employed men are predominantly engaged in paid work (93.8% paid-dominant), whereas employed women bear a disproportionate share of unpaid labor (50.4% unpaid-dominant). This creates a double burden for women who must manage both paid employment and extensive household duties. This pattern, which persists even in countries like the United States where 78% of women are in the labor force, demonstrates that social infrastructure worldwide still assumes maternal availability at home, thereby reinforcing traditional roles centered on male income generation (Hochschild & Machung, 2012).

This study reveals a strong, traditional division of labor among Iranian men, with 93.8% being paid-dominant and spending 5 to 10 times more hours on paid than unpaid work. This pattern was so uniform across various age, marital, and socioeconomic groups that no covariates emerged as significant predictors in the CART analysis for men's P-ULB indicator, indicating that their household contribution remains almost exclusively financial. This finding contrasts with previous research, such as Ghazi Tabatabai and Mehri (2019), which found that factors like the number of small children, the presence of adult children, home appliances, internet access, and college education were statistically associated with the time men devoted to unpaid labor and childcare.

This study indicates that employed women's age is a key variable influencing their P-ULB indicator, showing a shift from paid-dominance in younger years (ages 15–25) toward unpaid-dominance in mid-adulthood, followed by a near-balance (P-ULB ≈ 1.04) after age 55. This trend is corroborated by the CART analysis, which shows that women under 45 perform

more paid work, while those over 45 engage predominantly in unpaid labor. This pattern finds support in Ghazi Tabatabai and Mehri (2019), who identified an age over 60 as a predictor for increased unpaid domestic work, and in Charmes (2019), who documented that young women in the UK and the US spend more time in paid work and less in unpaid care than older adults. While this pattern varies by country, elderly women's unpaid contributions remain high, even exceeding adult levels in nations like Japan and Italy, often due to grandparental childcare. However, these findings contrast with research by Aastha (2024) in India, which showed a consistent decrease in time spent on unpaid work as women's age increases.

Marital status was another influential factor in the women's CART analysis, revealing a clear divergence: divorced and widowed women were paid-dominant, engaging in 1.54 times more paid than unpaid labor, whereas married women performed more unpaid work, registering a ratio of only 0.89 times as much paid as unpaid labor. This finding is consistent with Charmes (2019), who reported that in countries such as Algeria, Tunisia, Tanzania, Ethiopia, Turkey, and Costa Rica, divorced women generally increase their time in paid work, whereas married women often reduce it or leave the labor force entirely.

Another influential covariate affecting the P-ULB indicator is children's age group status. Univariate analysis shows that childless women allocate the most daily time to paid work and the least to unpaid work (P-ULB ratio = 1.38), a result confirmed by the CART analysis for childless women. However, a significant gender gap persists, as they still perform 3.9 times more unpaid work and 1.45 times less paid work than childless men. This pattern is consistent with the findings of Torabi (2020a), who also reported that women spend the least amount of time on household responsibilities during the pre-parental stage.

Univariate and CART analyses indicate that the presence of children, particularly at least one child aged six or younger, shifts employed women's P-ULB indicator strongly toward unpaid-dominance. This finding is echoed by Verma (2025), who identifies this shift as a critical "motherhood penalty," wherein increased care demands reinforce traditional roles, often leading mothers to reduce paid work. This unequal division is widespread; the Gender Equity Policy Institute (2024) in the United States reports that mothers do 2.1 times more home and family work than fathers. This pattern is confirmed in India and the United States by Vega Varela and Moridi (2024), who found that mothers with young children perform 1.6 to 2.4 times more childcare and housework than fathers. Further quantifying this shift, Ghazi Tabatabai and Mehri (2019) showed that as the number of small children increases, employed women's time devoted to paid labor significantly decreases while their unpaid work time

increases substantially, conclusively demonstrating that a higher number of small children intensifies women's unpaid labor burden at the direct expense of their paid labor.

According to the women's CART analysis, the P-ULB indicator for working women shifts to paid-dominance when all children are over the age of seven, as the reduced need for intensive childcare allows paid work to dominate their daily time use (Ghazi Tabatabai & Mehri, 2019). This transition is consistent with findings that women's time on housework peaks when the youngest child is of preschool age and decreases linearly as children grow older (Torabi, 2020a). This pattern is broadly confirmed by Charmes (2019), though exceptions exist in countries like South Africa and Belgium, where the presence of a young child increases women's paid work. A key driver behind this trend is the high opportunity cost of childbearing, as analyzed by Razeghi-Nasrabad et al. (2021), where direct costs for housing, food, and transportation rise with children's age, and education expenses create a U-shaped financial burden (Lino et al., 2017). Consequently, escalating financial pressures, particularly for children over six as noted by Kashen et al. (2023), compel women to engage more in paid activities. This shifts their labor balance toward paid-dominance and contributes to a reduction in the desired number of children, a phenomenon well-documented in demographic literature (Ghazi Tabatabai & Mehri, 2019; Torabi, 2020b).

A composite measure of socioeconomic status was also an influential covariate in the women's CART model. Univariate analysis shows that only women of low socioeconomic status under 45 years old favored paid-dominance, while those of middle and high status engaged in more unpaid work relative to paid work. This finding is similar to the results of Charmes (2019) for China and Ghana, where women's paid work declines with rising income quartiles. However, contrasting evidence from the same source for South Africa and Argentina indicates that women's paid work increases with higher income quartiles, suggesting that their employment is both a key determinant of household living standards and more socially accepted in affluent households. Furthermore, Charmes (2019) notes that women's unpaid work generally decreases with higher income in countries like South Africa and China, but exhibits more complex patterns in Argentina and Ethiopia. It can be concluded that for middle- and high-income women, the "concerted cultivation" of children, along with managing larger homes, more possessions, and numerous children's activities, becomes a time-intensive form of unpaid labor that skews their labor balance toward unpaid activities.

Simply being a woman is linked to spending more time on unpaid childcare and having lower earnings, and the lack of public support for child-rearing often makes it a rational economic decision for mothers to step away from paid work (Landivar et al., 2023; Stanfors et

al., 2019). Addressing this deep-rooted gender inequality demands effective policies and, more profoundly, a fundamental reevaluation of social norms and institutions. This reevaluation must manifest through a multifaceted approach: first, challenging the gendered division of labor by redistributing unpaid care work; second, deconstructing patriarchal norms through a deeper understanding of harmful masculinities; and third, transforming the narrative of gender equality by actively engaging boys and men as agents of change. These efforts must be supported by gender-responsive policies—such as flexible work arrangements, parental leave, and anti-discrimination measures—alongside a broader cultural offensive. Ultimately, all stakeholders must collaborate in these sustained efforts to transform gender relations, ensuring progress is both significant and lasting.

One limitation of this study is that the findings cannot be generalized to the rural population, as the study only had access to time-use statistics for urban residents. Furthermore, time-use survey data are unable to capture the intensity of work for employed individuals; although employed individuals might dedicate less time to housework, the intensity of their work is may be much higher—a dimension that time-use data cannot adequately measure. Moreover, the inability to conduct a paired or household-level analysis of the labor balance indicator within a single household constitutes another limitation, given that these balances are inherently interdependent for couples. Additionally, the lack of predictor variables related to the spouses of the participants, which could undoubtedly be influential, remains an omission. Finally, due to the unavailability of individual current income data, individual assets (such as type of dwelling, dwelling ownership status, and the number of household appliances) were used as a proxy to construct socioeconomic status. Consequently, the results pertaining to socioeconomic status should be analyzed and interpreted with caution.

Ethical Considerations

Compliance with Ethical Guidelines

This study utilized secondary data from the Statistical Centre of Iran. Consequently, direct interaction with human participants was not required, and individual informed consent was not applicable. The researchers strictly adhered to all ethical guidelines, ensuring data confidentiality and citation accuracy throughout the study.

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Authors' Contributions

Mahsa Saadati: Data analysis, Writing – original draft, Writing – review & editing.

Arezoo Bagheri: Data analysis, Writing – original draft, Writing – review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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عوامل تعیین‌کننده نابرابری جنسیتی در تعادل کار با و بدون دستمزد: مدل درختی شاغلان داده‌های گذران وقت ایرانی

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مقالهٔ پژوهشی

چکیده

زمینه و هدف: نابرابری‌های جنسیتی در توازن کار با و بدون دستمزد (P-ULB) در حیطه خانواده می‌تواند به تأخیر در ازدواج، کاهش نرخ باروری و کاهش کیفیت رضایت زناشویی منجر شود. هدف مقاله حاضر، بررسی تقسیم‌بندی این تعادل در میان مردان و زنان شاغل در خانوارهای ایرانی و همچنین شناسایی عوامل مؤثر بر آن است.

روش و داده‌ها: شاخصP-ULB به عنوان مقدار زمان تخصیص‌یافته روزانه به کار با دستمزد به کار بدون دستمزد تعریف می‌شود. روش یادگیری ماشین درخت طبقه‌بندی و رگرسیون (CART) برای مدل‌سازی این شاخص (غالباً با و بدون دستمزد) استفاده می‌شود. این مدل بر روی ۹۲۹۶ نفر شامل ۷۹۶۲ مرد (۸۵/۶٪) و ۱۳۳۴ زن (۱۴/۴٪) شاغل در داده‌های گذران وقت ایران در سال‌های ۲۰۱۹–۲۰۲۰ با استفاده از پیش‌بین‌های گروه سنی، وضعیت سن فرزندان، وضعیت تأهل، نوع روز آمارگیری، وضعیت اقتصادی–اجتماعی و استفاده از اینترنت برازش یافت.

یافته‌ها: نتایج نشان می‌دهد که زنان شاغل سهم نامتناسبی از کار بدون دستمزد (۵۰/۴٪ غالباً کار بدون دستمزد) و مردان شاغل زمان بیشتری را به کار با دستمزد اختصاص می‌دهند (۹۳/۸٪ غالباً کار با دستمزد). تمامی پیشبین‌ها به جز استفاده از اینترنت، بر مدل CART زنان تأثیرگذار بودند و یافته دقت مدل برازش ۷۴٪ بود.

بحث و نتیجه‌گیری: شکاف جنسیتی در زمان صرف‌شده برای مراقبت از فرزندان و کارهای خانگی، ریشه در هنجارهای دیرینه فرهنگی و اجتماعی دارد که نقش مناسب زنان را در خانه و خانواده تعریف می‌کند. تغییرات سیاستی و تحولات فرهنگی برای تعدیل مسئولیت‌های خانگی و پیشبرد برابری جنسیتی در ایران ضروری است.

واژگان کلیدی: کار بدون دستمزد، توازن کار با و بدون دستمزد (P-ULB)، درخت طبقه‌بندی و رگرسیون (CART)، نابرابری جنسیتی، زنان.

پیام اصلی: شکاف بین آرمان و واقعیت در زمینه نابرابری جنسیتی در بین مردان و زنان شاغل ایرانی بسیار بزرگ است. برای افزایش تمایل زنان به فرزندآوری، تغییرات معناداری در زمینه افزایش سهم همسران در کارهای بدون دستمزد و مشارکت بیشتر زنان در کارهای با دستمزد باید اتفاق افتد.

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