Solo Struggle: Material Deprivation among Single-Parent Households in Türkiye

Fulden Komuryakan

Department of Econometrics, Faculty of Economics and Administrative Sciences, Bandırma Onyedi Eylül University, Balıkesir, Türkiye

ORCID: 0000-0002-4034-513X

fkomuryakan@bandirma.edu.tr

Received: 11 July 2025: Accepted: 22 January 2026

Summary: Single-parent households, particularly those led by women, face elevated levels of material deprivation. This study examines material deprivation among women-headed single-parent households in Türkiye using panel data from the Statistics on Income and Living Conditions (2018–2021) and employs censored fixed-effects quantile regression to capture distributional heterogeneity. A material deprivation index is constructed to reflect the distinct challenges faced by these households, thereby addressing a notable gap in the literature. The results reveal that the effects of sociodemographic characteristics, such as age, education, and employment status, vary substantially across the material deprivation distribution. In particular, older, less-educated, unemployed, or retired women tend to be more affected at medium-high and high levels of deprivation. These results highlight the necessity of tailored policy interventions that consider the heterogeneity of deprivation experiences among single mothers, especially those experiencing the most severe forms of deprivation.

Keywords: poverty; material deprivation; single-parent households; mothers; quantile regression

JEL: I32; J12; C23

1. Introduction

Poverty is generally understood as the inability to achieve a reasonable standard of living and often reflects individuals' perceptions of their position relative to others in society. Adam Smith defined poverty as encompassing "not only commodities which are indispensably necessary for the support of life, but whatever the custom of the country renders it indecent for creditable people, even the lower orders, to do without" (Christopher Whelan, Richard Layte, and Bertrand Maître 2002). In this sense, poverty is shaped not only by financial constraints but also by societal expectations and norms (Stein Ringen 1985). From this perspective, poverty represents a lack of socially perceived necessities (Joanna Mack and Stewart Lansley 1985), a definition widely accepted in the literature (Tim Callan, Brian Nolan, and Christopher T. Whelan 1993).

Material deprivation refers to the inability to acquire goods and services and/or to participate in activities that are common or socially necessary due to insufficient economic resources. It represents a key dimension of poverty, capturing aspects of disadvantage that income measures alone may overlook (Alessio Fusco, Anne-Catherine Guio, and Eric Marlier 2010). The assessment of material deprivation relies on collective societal judgments about which goods and activities are considered essential for maintaining a minimally acceptable standard of living, regardless of individual preferences or financial means (Elena Bárcena-Martín, B. Lacomba, Ana Isabel Moro-Egido, and Salvador Pérez-Moreno 2014). In this way, measures of material deprivation serve as a complement to absolute poverty metrics, offering a more nuanced and comprehensive understanding of poverty (Romina Boarini and Marco M. d'Ercole 2006). Recognizing this broader perspective, the European Commission formally adopted material deprivation as a standard indicator in 2009, emphasizing the importance of relative access to basic necessities within a given society (Aysenur Acar, Bulent Anil, and Seyfettin Gursel 2017).

Over the past five decades, one of the most significant changes in family structures across industrialized countries has been the increase in single-parent households, the majority of which are led by women (Yekaterina Chzhen and Jonathan Bradshaw 2012). Extensive research demonstrates that these households face a disproportionately high risk of material deprivation, with women-headed households experiencing particularly acute vulnerabilities, largely due to the compounded effects of caregiving responsibilities, limited labor market access, weaker social protection, and economic disadvantage (Elena Calegari, Enrico Fabrizi, and Chiara Mussida 2024). Given these structural risks, understanding how material deprivation manifests among such households is both empirically and policy-relevant.

This study addresses that need by examining material deprivation among women-headed single-parent households in Türkiye, a context where poverty remains prevalent despite continued policy interventions. Utilizing panel data from 2018 to 2021, the research develops a tailored material deprivation index specific to this household type and applies censored panel quantile regression to assess how socioeconomic, demographic, and health-related factors differentially influence material deprivation across its distribution.

2. Literature review

Single parent households, defined as families in which a parent resides with their dependent child or children without a spouse or partner, face a complex set of challenges that hinder economic advancement and social mobility (Salvatore Morelli, Brian Nolan, Juan C. Palomino, and Philippe V. Kerm 2022). A substantial body

of research shows that single parenthood is strongly associated with an increased risk of falling below the poverty line (Esra Karapınar Kocağ 2023) and with elevated levels of material deprivation (Mohamed I. Ajwad Kenneth Simler, Mehtabul Azam, Basab Dasgupta, Misha Bonch-Osmolovskiy, and Irena Topinska 2013; Bárcena Martín et al. 2014; Selçuk Bedük 2018; Boarini and d'Ercole 2006; Francesco Figari 2012; Björn Halleröd, Daniel Larsson, David Gordon, and Veli-Matti Ritakallio 2006; Sabine Israel and Dorothee Spannagel 2019; Ruud Muffels and Didier Fouarge 2004; Chiara Mussida, Maria L. Parisi, and Nicola Pontarollo 2023; Geranda Notten and Anne-Catherine Guio, 2016; Pim Verbunt and Anne-Catherine Guio 2019; Whelan, Layte, and Maître, 2002; Christopher T. Whelan and Bertrand Maître 2012). These households are more likely to lack access to essential durable goods and to experience persistent difficulties in meeting financial obligations (Ajwad et al. 2013), a pattern observed across a wide range of national contexts (Bedük 2018). In addition, children living in single parent households consistently exhibit higher levels of material deprivation, reinforcing the intergenerational transmission of disadvantage (Antonio L. Pérez Corral and Almudena Moreno Mínguez 2022).

Gender plays a critical role in shaping these outcomes. Numerous studies find that women-headed households experience higher levels of material deprivation than their male counterparts, even after accounting for differences in employment status and income (Ajwad et al. 2013; Bedük 2018; Enrico Fabrizi, Chiara Mussida, and Maria L. Parisi 2025; Figari 2012; Halleröd et al. 2006; Marc Hooghe, Chloé De Grauwe, and Dieter Stiers 2025; Muffels and Fouarge 2004). This pattern is closely related to the broader concept of the feminization of poverty, which emphasizes the structural inequalities that disproportionately affect women (Muffels and Fouarge 2004). Changes in women's socio demographic circumstances often generate more severe economic consequences than comparable changes for men. The intersection of gender and single parenthood further exacerbates these economic challenges, as single mothers must balance both caregiving responsibilities and financial survival, often with minimal institutional support.

Despite this extensive evidence, much of the existing literature incorporates single parenthood primarily as a control variable within broader analytical frameworks. This practice can obscure the specific mechanisms through which deprivation operates in single-parent households. One notable exception is Chzhen and Bradshaw (2012), that directly examine single-parent households and document elevated risks of income poverty and material deprivation, particularly among children. Similar patterns are reported across high income countries, including the United States (USA), Canada, Australia, Japan, and European Union (EU) member states (Aya Abe 2006; Kurt J. Bauman 1999; Heather Boushey, Chauna Brocht, Bethney Gundersen, and Jared Bernstein 2001; Rob J. Bray 1998; John Engeland and Roger Lewis 2004; Panos Tsakloglou and Fotis Papadopoulos 2013). The evidence further indicates that children in women-headed single-parent households face especially high risks of deprivation and adverse outcomes (Amie Bostic 2023; Yuan-Chiao Lu, Regine Walker, Patrick Richard, and Mustafa Younis 2020; Wendy Pyper 2002). Consequently, the literature underscores the importance of prioritizing single-parent households in poverty alleviation strategies, with particular attention to women-headed families (Chzhen and Bradshaw 2012). Despite the well-documented link between gender and material deprivation, policies aimed at mitigating material

deprivation often fail to account for these gendered dimensions, leaving many single-parent households at a heightened risk of economic insecurity (Israel and Spannagel 2019; Calegari, Fabrizi, and Mussida 2024).

Building on this focus, the present study examines the case of Türkiye, a middle-income country with distinct institutional settings, where poverty remains a persistent challenge despite ongoing policy efforts. Although various ministries and institutions have implemented poverty prevention policies, and there has been a slight decline in poverty rates over time, it remains significantly higher compared to developed countries. Statistical data further highlight this disparity: while the percentage of individuals living below 50% of median equivalized disposable income is 11.67% in OECD countries, the corresponding figure in Türkiye is notably higher at 17.2% (OECD 2019).

Within this broader context of persistent poverty, household composition plays an important role in shaping vulnerability. Single-parent households constitute a relatively small but socially vulnerable segment of households in Türkiye. According to the Turkish Statistical Institute (TurkStat 2022), single-parent households accounted for approximately 7.5% of all households in 2014, with 1.5% headed by men and 6.1% headed by women. Over time, the prevalence of single-parent families has increased gradually. By 2021, single-parent households represented 10.1% of all households, of which 2.3% were headed by men and 7.8% by women. The majority of single-parent households are headed by women, and between 2014 and 2021 their share increased by approximately 1.7 percentage points, compared with a much smaller increase of 0.8 percentage points among men-headed single-parent households. Demographic developments such as rising ages at first marriage, increasing female labor force participation, and ongoing changes in family formation are expected to further affect household composition in the coming years. Together, these trends underscore the growing policy relevance of understanding material deprivation among women-headed single-parent households in the Turkish context.

Despite these concerning statistics, research on material deprivation in Türkiye remains limited, underscoring the need for a more comprehensive analysis. Existing studies range from descriptive analyses of deprivation indicators (Tony Fahey 2007; Mehmet A. Karadağ 2013) to multidimensional poverty and social exclusion frameworks (Nuran Bayram, Firat Bilgel, and Nazan Gonul B. 2010, Nuran Bayram, Neslihan Sam, Serpil Aytaç, and Mustafa Aytaç, 2012; Karadağ Mehmet A. and Bedriye Saraçoğlu 2015; Hasan Tekgüç and Bengi Akbulut 2022), which rely on cross-sectional data. Other contributions estimate the likelihood of deprivation (Acar, Anil, and Gursel 2017; Zübeyde Karcı and Nuran Bayram Arlı 2018; Murat Turgut 2021; Mehmet S. Uğur 2023) or construct composite indices to assess living standards (Öznur Özdamar, Zeliha S. Kılınç, and Eleftherios Giovanis 2021; Şeyda Ünver and Ömer Alkan 2020). Among these studies, only Uğur (2023) explicitly examines single-parent households and finds that they are 21.8% more likely to experience both income poverty and material deprivation. Similarly, Selçuk Gemicioğlu (2022) shows that single-parent households face the highest risk of financial hardship relative to other family types. However, no existing study focuses exclusively on single-parent households, whether headed by women or men, with a specific emphasis on material deprivation.

Focusing on Türkiye is therefore policy relevant for several reasons. Türkiye is a middle-income country characterized by persistent poverty, pronounced gender inequalities, and relatively limited public support for

work family reconciliation (OECD 2019). These structural features are shared by many emerging and transition economies, as documented in comparative research on material deprivation (Boarini and d'Ercole 2006; Chzhen and Bradshaw 2012). Moreover, single-parent households, particularly those headed by women, face elevated risks of material deprivation in institutional contexts marked by limited labor market attachment and fragmented social protection systems (Israel and Spannagel 2019; Calegari, Fabrizi, and Mussida 2024). Evidence from Türkiye may therefore help inform broader discussions on gendered poverty and social policy in environments with similar structural characteristics.

Against this background, this study aims to contribute to the literature by focusing exclusively on women-headed single-parent households, a group persistently shown to face heightened economic vulnerability yet rarely analyzed as a distinct unit. Although prior research confirms that single-parent households, particularly those led by women, experience higher levels of material deprivation, most studies treat household structure merely as a control variable rather than developing analytical frameworks tailored to this family type. This practice limits a detailed understanding of the structural disadvantages these families face. Addressing this gap, the present study constructs a material deprivation index specifically for women-headed single-parent households, thereby offering a more accurate representation of their deprivation dynamics. In addition, it constitutes the analysis of material deprivation in Türkiye based on panel data covering the period from 2018 to 2021, which allows for the examination of time varying effects and unobserved individual heterogeneity that cannot be captured using cross-sectional approaches. Methodologically, the study employs a censored panel quantile regression model to estimate the effects of socioeconomic, demographic, and health related factors across the full distribution of the material deprivation index, which is left censored at zero. By capturing heterogeneous effects that mean-based models typically obscure, particularly among the most severely deprived households, the study advances the empirical understanding of gendered poverty and provides a more robust evidence base for the design of effective and targeted social policies.

3. Data

Statistics on Income and Living Conditions (SILC) provides comparable and comprehensive data on income, poverty, social exclusion, housing, labor force, education, and health since 2004 for the EU as well as some of the non-EU countries. The main aim of compiling SILC data is to examine income distribution in society, determine living conditions, and analyze concepts such as social exclusion and poverty both in cross-sectional and panel data contexts. Since SILC is compiled under the regulation determined by Eurostat, it is an internationally comparable data set for the countries where it is collected. Currently, SILC is compiled in all EU countries and 11 non-EU countries containing Türkiye (Heike Wirth and Klaus Pforr 2022).

This study analyzes the Turkish SILC (TR-SILC) panel data, compiled by the TurkStat and collected regularly since 2006. However, while TR-SILC data has been consistently gathered since 2006, the panel component is only available in 4-year periods, meaning continuous household-level data from 2006 onward is unavailable. At the time of this study, the most recent TR-SILC panel data covered the period 2018–2021. Therefore, to provide up-to-date insights while accounting for unobservable heterogeneity, the analysis is based on the TR-SILC 2018–2021 panel dataset. Households classified as nuclear families consisting of a

single parent and child(ren) are identified based on the survey question regarding household type. From this group, only single-parent households where the household head is a woman are selected for analysis.

The total number of distinct women-headed single-parent households in the sample is 1,167 over the four-year period. Due to the rotational design of the TR-SILC, households are observed for a minimum of one year and a maximum of four consecutive years, resulting in an unbalanced panel. Specifically, 423, 797, 1,164, and 1,166 household–year observations are available for 2018, 2019, 2020, and 2021, respectively. Among the 1,167 households, 193 participated in the survey for one year, 427 for two years, 282 for three years, and 265 for four years. The final sample consists of 2,953 observations, each corresponding to a household–year unit drawn from women-headed single-parent households.

4. Methodology

To analyze material deprivation in women-headed single-parent households, a material deprivation index is constructed instead of using count or probability-based dependent variables commonly found in the literature. This approach is expected to provide a more comprehensive measure while ensuring comparability within the sample. The index is then modeled using explanatory variables at both the individual and household levels. Given that the material deprivation index is censored at zero and that the effects of explanatory variables are expected to vary across its distribution, a censored panel quantile regression model is adopted. This method is particularly suitable for addressing three key challenges: (1) censoring in the dependent variable, (2) heterogeneous effects across the deprivation distribution, and (3) unobservable heterogeneity in panel data. By employing this approach, the analysis is expected to provide deeper insights into the determinants of material deprivation beyond mean-based models.

4.1. Model

4.1.1. Dependent variable

Eurostat determined nine items to measure material deprivation within the scope of the Europe 2020 strategy: (1) paying rent, mortgage, or utility bills as planned in the last 12 months (2) keeping the home adequately warm (3) facing unexpected expenses (4) eating protein at least three days on a regular week (5) going on a holiday with all members of the household for a week in a year (6) owning a color TV (7) an automatic washing machine (8) a car (except for business purposes) (9) a telephone.

Based on these items, the material deprivation index is calculated to create a deprivation measure aligned with the broader understanding of poverty, defined as the household's inability to maintain a minimally acceptable lifestyle due to insufficient resources (Tomas Zelinsky 2012). The focus is on forced and generalized deprivation, rather than material deprivation resulting from other factors or limitations affecting only specific aspects of life (Whelan and Maître 2012). The material deprivation index is calculated as follows:

$$D_{it} = \frac{\sum_{j=1}^{J} w_{jt} I_{jit}}{\sum_{j=1}^{J} w_{jt}} * 100, \quad (1)$$

where D_{it} represents the material deprivation index while j represents the items explained above (Muffels and Fouarge 2004). The subscript i denotes the households, while t represents the year. w_{jt} indicates the

weight of item j in the year t, and I_{jit} is the indicator variable that takes the value of 1 in the case of affording the item and 0 in the case of not being able to afford it due to material deprivation.

Consistent with the majority of studies in the literature (e.g., Figari 2012; Björn Halleröd 1998; Halleröd et al. 2006; Muffels and Fouarge 2004; Ingemar J. Sevä and Daniel Larsson 2015), this study applies prevalence weighting when calculating the material deprivation index for women-headed single-parent households. An alternative approach is the equal (or counting) weighting method proposed by Peter Townsend (1979), which assigns identical weights, typically a value of 1, to each item regardless of context. However, this method is considered restrictive, as it fails to reflect differences in household needs or the inherently relative nature of material deprivation (Meghnad Desai and Anup Shah 1988). Given the limitations of equal weighting, this study adopts the prevalence weighting method, which is defined as follows:

$$w_{jt} = \frac{\sum_{i=1}^{N} \sum_{t=1}^{T} I_{jit}}{N*T}. \quad (2)$$

In prevalence weighting, each item is assigned a weight based on the proportion of households that can afford it. Items that are unaffordable to only a small share of households receive higher weights, as their lack signals greater deprivation. Accordingly, when a household is unable to afford such an item, its material deprivation score increases more substantially, reflecting the fact that it lacks an item considered commonplace by most households. This underscores that the household does not meet a widely attainable standard, while the majority does.

Prevalence weighting thus offers a more formal and generalizable approach to capturing material deprivation, as it accounts not only for the objective inability to afford an item but also for the relative or perceived deprivation. Specifically, a household's material deprivation score rises as the proportion of households possessing an item that it lacks increases. This is consistent with Walter G. Runciman's (1966) notion of relative deprivation, wherein deprivation is felt more acutely when others are demonstrably better off.

Under a material deprivation index constructed using prevalence weighting, deprivation is defined as the inability to afford what most other households can due to financial constraints. Consequently, if a household's situation remains unchanged while the conditions of other households improve, its material deprivation increases. In contrast, if all households improve at the same rate, the item weights and thus the material deprivation index remain stable. This implies that a household's material deprivation level is relative to the broader societal context, and thus it is econometrically more appropriate to analyze groups of households that are likely to exhibit similar consumption preferences (Desai and Shah 1988).

The material deprivation index takes a value between 0 and 100 ($D_{it} \in [0,100[$), where lower values indicate that households are able to afford the specified items, and higher values reflect greater levels of deprivation relative to others. A value of 0 implies that a household can afford all nine items, making their deprivation level unobservable within the scope of the index. Consequently, the index is left-censored at zero, as it fails to capture underlying differences in welfare among households at this boundary due to an unobserved latent variable representing deprivation (Halleröd 1998; Halleröd et al. 2006; Muffels and Fouarge 2004; Sevä and Larsson 2015).

4.1.2. Explanatory variables

The material deprivation index is estimated using explanatory variables from TR-SILC at both individual and household levels. The explanatory variables are categorized into seven groups: (1) *Demographic characteristics of the household head:* Includes age (three binary variables: 24 years old or younger, between 25 and 64 years old, and 65 years old or older), marital status (five binary variables: married, single, widowed, divorced, or separated), and education (years of schooling completed). These factors are expected to significantly influence material deprivation, as younger, unmarried, and less-educated household heads may face higher risks of deprivation. (2) *Employment status of the household head:* Categorizes whether the household head is an employee, self-employed, unemployed, retired, or out of the labor force (engaged in an internship or continuing education, disabled or unable to work, responsible for household chores/childcare, or other inactive statuses) using five binary variables. Employment status is expected to be correlated with material deprivation, as employed individuals generally have greater financial stability. (3) *Demographic characteristics of household:* Includes the number of preschool children (aged 5 years or younger) and the number of children aged 6 to 15 years, as these factors may influence resource allocation and financial constraints. (4) *Economic status of household:* Includes key financial indicators such as the ratio of working individuals in the household, the natural logarithm of the minimum monthly net income required for the household to sustain itself, and the natural logarithm of per capita household income. The latter is calculated by dividing the household's annual real income, adjusted for the Consumer Price Index (2003 = 100) using a 12-month moving average from TurkStat, by the OECD modified equivalence scale. The scale assigns a weight of 1 to the first adult in the household, 0.5 to each additional adult aged 14 years and above, and 0.3 to each child aged 13 years and below. (5) *Residential status:* Captures housing conditions by categorizing households as homeowners, tenants, or those in other living arrangements using three binary variables. Housing stability is expected to be linked to material deprivation. (6) *Health status of household:* Measures the overall health condition of household members by calculating the ratio of individuals aged 15 and above who reported their general health as "very good" or "good" in the general health survey. Poor health conditions may negatively impact the ability to work and meet material needs. (7) *Time-specific effects:* Includes year-specific binary variables to control for temporal changes and macroeconomic factors that might influence material deprivation. The selection of these explanatory variables is based on their theoretical and empirical relevance in material deprivation research, ensuring a comprehensive analysis of the factors contributing to material deprivation.

4.2. Estimation

The material deprivation model is estimated using the censored panel quantile regression method, which provides comprehensive and robust results by accounting for unobservable heterogeneity and capturing heterogeneous effects across the distribution while considering censoring in panel data. Since fixed effects models do not specify the correlation between individual effects and explanatory variables, censored quantile regression with fixed effects is applied. Antonio F. Galvao, Carlos Lamarche, and Luiz R. Lima (2013) is the first study estimating the censored panel quantile regression with fixed effects. They propose 2- and 3-step estimators which are modified versions of Yanlin Tang, Huixia J. Wang, Xuming He, and Zhongyi Zhu

(2012) and Victor Chernozhukov and Han Hong (2002) for panel data. The minimization problem proposed in Galvao, Lamarche, and Lima (2013) is formulated as follows:

$$Q_{y_{it}}(q|x_{it},\alpha_i,c) = \frac{1}{NT}\sum_{i=1}^{N}\sum_{t=1}^{T}\rho_q(y_{it}-\alpha_i-x_{it}'\beta)\,1(\pi_0(x_{it},\alpha_i,c_1)>1-q), \quad (3)$$

where $q \in (0,1)$ is the quantile level of interest, x_{it} is the explanatory variables, β is the parameters, α_i constant term containing the fixed effects and ρ is the quantile loss function defined in Roger Koenker and Gilbert Bassett (1978). $\pi_0(x_{it},\alpha_i,c)$ is the propensity score function expressed as follows:

$$\pi_0(x_{it},\alpha_i,c) = P(\delta_{it}=1|x_{it},\alpha_i,c) = P(\varepsilon_{it} > -\alpha_i - x_{it}'\beta + c_1|x_{it},\alpha_i,c), \quad (4)$$

where $\delta_{it} = 1(y_{it}^* > c)$ is the censoring probability that takes the value of 1 if the dependent variable is observable and otherwise 0. With the estimation of this propensity score function, the informative subset is defined in the first step of the estimator. More precisely, the first step of the 2- and 3-step estimators consists of selecting an informative subset from the panel data by estimating probability models. After defining the informative subset, the Fixed Effect Quantile Regression (FE-QR) estimator proposed by Kengo Kato, Antonio F. Galvao, and Gabriel V. Montes-Rojas (2012) is applied and robust results throughout the quantiles are obtained.

In the first step of these estimators, δ_{it} might be estimated parametrically for the 3-step estimator while it might be estimated either parametrically or nonparametrically for the 2-step estimator. For the parametric estimation, Generalized Linear Models (GLM) developed by John A. Nelder and Robert W. M. Wedderburn (1972) could be adopted while Generalized Additive Models (GAM) developed by Jerome H. Friedman and Werner Stuetzle (1981) for the nonparametric ones.

Since the misidentification in the distribution and the link function of GLMs and GAMs leads to biased estimators and an increase in mean square errors, determining the distribution and the link function is a major decision in the GLMs and GAMs estimation process. The link functions for the binary generalized models as estimated in this study might be divided into symmetric and asymmetric based on their assumed distributions. In symmetric distributions such as logit (based on the logistic distribution with the link function $g_L(\pi) = ln\{\pi/1-\pi\}$ where π is the probability), the conditional probability of the dependent variable to take the value of 1 is symmetrically distributed around 0.5. Therefore, GLMs and GAMs based on the symmetric distributions are appropriate in the case of conditional probabilities symmetrically distributed between 0 and 1. When there is a significant disparity between the 0s and 1s and the probability approaches 1 quickly and sharply while approaches 0 slower, the models based on asymmetric link functions such as the complementary log-log (clog-log) (based on the Gompertz distribution with the link function $g_C(\pi) = ln\{-ln(1-\pi)\}$ where π is the probability) might provide better-fitted models because of its asymmetric nature (James W. Hardin and Joseph M. Hilbe 2018).

If the material deprivation index is weakly censored at approximately 20%, as anticipated in this study, the clog-log link function is expected to yield a better model fit and reduced bias. The model is therefore estimated using both symmetric and asymmetric link functions to evaluate empirical fit and robustness.

5. Findings

5.1. Descriptive statistics

Descriptive statistics of the dependent and explanatory variables are presented in Table 1 separately for each year and for the entire panel dataset to examine the temporal changes and macroeconomic factors. Additionally, Table 1 includes the average material deprivation index values for the binary variables.

[Table 1 about here]

Table 1 presents the material deprivation index, where values near 0 indicate lower deprivation and those near 100 signify higher deprivation. The index for women-headed single-parent households ranged from 21 to 24 between 2018 and 2021. The material deprivation index varies between 0 and 85.89 in the panel data and its average is 22.57. The slight decline in the material deprivation index, from approximately 23 in 2018 to 22 in 2021, suggests that temporal changes and macroeconomic factors, including the COVID-19 pandemic, had a limited impact on this measure. This may be attributed to the pre-existing financial vulnerability of women-headed single-parent households or to the delayed economic effects of the pandemic, which were felt after emergency social assistance programs had ended.

Demographic characteristics of household head

Table 1 illustrates that a small proportion of household heads (approximately 1%) are 24 years old or younger, and this percentage shows a slight upward trend towards 2021. Approximately 83% of household heads fall within the 25 to 64 age range, with a modest decrease noted. The ratio of household heads aged 65 years or older is approximately 17%, and this percentage appears to be on the rise.

The proportion of married household heads, representing a unique group rather than regular married couples, constitutes approximately 12% of the sample and has shown a slight decrease over the years. Meanwhile, the rate of single household heads hovers around 3%, indicating an upward trend. Widowed household heads constitute the highest proportion at 44%, showing a decrease. Rates for being divorced or separated are approximately 32% and 7%, respectively, both demonstrating an increasing trend.

The education variable indicates that the average number of years of education is approximately 6, showing a slight increase towards 2021. This aligns with the 5 years of compulsory education in Türkiye until 1997. Following the 1997 education reform, compulsory education was extended to 8 years, which likely contributed to the gradual increase in average educational attainment. Consequently, a significant number of household heads tend to conclude their education upon completing the compulsory education.

Employment status of household head

Table 1 indicates that around 22% of household heads are employees. Although this rate decreases from 2018 to 2020, it experiences an increase in 2021. The proportion of self-employed household heads is approximately 6%, showing a decline over the years. Unemployed and retired household heads make up around 3% and 9%, respectively. Notably, the majority of household heads, accounting for the highest rate at 59%, are out of the labor force, and this percentage appears to be on the rise. One notable effect of the pandemic observed in the dataset is the decline in self-employed household heads and the corresponding increase in individuals classified as out of the labor force. Given that self-employed individuals were among

those most severely affected by COVID-19 lockdowns and restrictions in Türkiye, this trend aligns with the broader economic impact of the pandemic.

Demographic characteristics of household

According to Table 1, the number of preschool children and the number of children aged between 6 and 15 in the household ranges from 0 to 4. It is more common for households to have children aged 6 to 15 than to have preschool-aged children.

Economic status of household

The proportion of working individuals in the household stands at 26%. Although these rates exhibit a decline from 2018 to 2020, there is an increase in 2021, reaching approximately the level observed in 2019. The logarithmic monthly minimum income required for the household's sustenance shows a consistent increase over the years, averaging at 8.3297. In contrast, the per capita income within the household appears to be on the rise, with an average of 9.9.

Residential status

Approximately 48% of households are homeowners, showing a consistent increase over the years. Meanwhile, the average rate of tenants is 36%, with a slight upward trend. The rate of households in lodging or other is approximately 16%, and this generally demonstrates a decreasing pattern.

Health status of household

The percentage of healthy individuals within households is 49%, and this rate shows an increasing trend.

Average material deprivation index

Average material deprivation index tends to decrease with age, as older household heads (≥ 65) experience lower deprivation compared to those aged 25–64. However, individuals younger than 25 face the highest material deprivation among all age groups. Among marital statuses, separated and divorced individuals experience the highest deprivation levels, while widows face lower deprivation. Employment status plays a crucial role, with unemployed individuals experiencing the highest deprivation, whereas retired and employed individuals face lower risks. Additionally, individuals out of the labor force and self-employed experience higher deprivation than employees. Housing status also matters, as homeowners face significantly lower deprivation compared to tenants.

5.2. Initial findings

Before estimating the material deprivation model, several preliminary analyses are conducted. First, the proportion of individuals who indicated an inability to afford the material deprivation items due to financial hardship is examined, along with the weights used to calculate the material deprivation index.

[Table 2 about here]

Table 2 reveal that needs such as going on a holiday and owning a car exhibit the highest deprivation rates, with around 67-68% of individuals being unable to afford these items. Conversely, owning a color TV and a telephone have the lowest deprivation rates, with nearly all individuals possessing these items. The weights, derived from the prevalence weighting methodology, reflect the relative importance of each item in the

material deprivation index. Items with lower deprivation ratios, such as owning a telephone and a washing machine, receive higher weights, signifying that their absence signals greater deprivation. In contrast, widely unaffordable items, such as going on a holiday, are assigned lower weights. This distribution of weights ensures that the index captures not just absolute deprivation but also the relative disadvantage experienced by households compared to broader societal standards.

Cronbach's Alpha coefficients, developed by Lee J. Cronbach (1951), are computed to assess the internal consistency of the selected items for measuring material deprivation. The coefficients for the nine selected items are 0.7278 (2018), 0.7242 (2019), 0.7085 (2020), and 0.7036 (2021), with a panel-level coefficient of 0.7124. As coefficients above 0.70 generally indicate acceptable reliability, these results suggest that the selected items are sufficiently correlated and effectively capture a common underlying construct of material deprivation.

Multicollinearity among the explanatory variables is assessed using the Variance Inflation Factor (VIF). The VIF values for most explanatory variables remain below 4, with a mean VIF of 3.33, indicating no significant multicollinearity concerns in the material deprivation model. To examine the statistical relationship between the material deprivation index and explanatory variables, the chi-square test is employed, and Harald Cramér's V statistic (1946) is calculated. The chi-square results confirm that a significant portion of the explanatory variables correlates with material deprivation at the 1% significance level. The Cramér's V values, exceeding 28% for all variables, further highlight the relevance of these explanatory variables in explaining material deprivation. The strongest associations are found with residential status, the number of preschool children in the household, and household head characteristics (unemployment, single status, and retirement).

Before estimating the material deprivation model using quantile regression, a diagnostic analysis is conducted for the mean-based model. (1) The F test is applied to examine unobservable heterogeneity in the panel data model, revealing a significant unit-specific effect (F-statistic: 7.66, $p = 0.000$). (2) The results of the Jerry A. Hausman (1978) test affirm that the fixed-effects estimator is consistent and efficient ($\chi^2 = 111.72$, $p = 0.000$). Following the estimation of the fixed-effect model, tests are conducted for heteroscedasticity, autocorrelation, and the distribution of panel error terms. (3) The Modified Wald test (William H. Greene 2003) detects the presence of heteroscedasticity (χ^2 = 2.6E+37, p = 0.000), a common occurrence in microeconometric analysis. (4) No significant autocorrelation is observed in the Alok Bhargava, Luisa Franzini, and Wiji Narendranathan (1982) Durbin-Watson and Badi H. Baltagi and Ping X. Wu (1999) LBI tests (DW = 1.6369, LBI = 2.4098). (5) Finally, the Kolmogorov-Smirnov test reveals that the distribution of panel error terms is non-Gaussian (KS statistic = 0.131, p = 0.000).

The findings suggest that the fixed-effect model at the mean exhibits limitations, including issues such as heteroscedasticity and a non-Gaussian distribution of error terms. Moreover, there is a likelihood that the effects of explanatory variables vary across the distribution of the material deprivation index. These observations prompt the adoption of quantile regression methodology, known for its robustness to heteroscedasticity and non-Gaussian distribution, allowing for a nuanced examination of heterogeneous effects across the material deprivation index. As quantile regression is particularly useful when coefficients

vary significantly across quantiles, the t-test and Frank Wilcoxon (1945) test are employed, revealing notable variations in coefficients across quantiles (see Table 3 for results). As a result, quantile regression is identified as the most appropriate approach for this study.

The final preliminary analysis concerns the censoring of the dependent variable. As mentioned, the material deprivation index is left-censored at zero, which can be expressed as:

$$D_{it} = \begin{cases} D_{it}^{*} > 0 \Rightarrow D_{it}^{*} = D_{it} \\ D_{it}^{*} \leq 0 \Rightarrow D_{it} = 0 \end{cases}, \quad (5)$$

where D_{it} is the observed dependent variable and D_{it}^{*} is the latent dependent variable. When the latent dependent variable is greater than zero, it is equal to the observed dependent variable, and the real values of the dependent variable are observed. However, if the latent dependent variable is less than or equal to zero, the observed dependent variable is censored at zero. As a result, the material deprivation index cannot be directly observed due to this censoring.

Since women-headed single-parent households are more likely to struggle to afford the nine selected material deprivation items, the material deprivation index is less likely to be close to zero. As a result, the censoring probability of the material deprivation index in this study might be asymmetrically distributed.

To identify the best-fitting estimator for the censoring probability, the overall censoring rate of the material deprivation index is computed. The average censoring rate is 17.38%, indicating weak censoring and a predominance of uncensored observations. This imbalance in the binary censoring indicator implies a skewed censoring probability, supporting the use of an asymmetric link function such as the clog-log.

Following these initial findings, the performance of the 2- and 3-step estimators is evaluated using GLM and GAM with symmetric (logit) and asymmetric (clog-log) link functions. Performance is assessed by the root mean square error (RMSE) of the final estimation step across quantiles. The results indicate that the clog-log link function outperforms the logit specification in both estimators, with the 2-step GAM-based clog-log estimator yielding the lowest RMSE across all quantiles. This estimator is therefore selected as the preferred specification. Detailed results are available upon request.

5.3. Regression results and discussion

The censored panel quantile regression results from the 2-step estimator with GAM based on the clog-log link function are presented in Table 3.

[Table 3 about here]

Demographic characteristics of household head

Age

Examining Table 3, it is evident that when the household head is 25 years or older, material deprivation tends to decrease in households with a low material deprivation index. Conversely, in households with medium and high material deprivation indices, having a household head older than 25 correlates with an increase in material deprivation. Specifically, within households experiencing medium and high levels of material deprivation, the presence of a household head aged 25 or older exacerbates the issue. This suggests that, for

such households, having a younger household head may be more advantageous in mitigating material deprivation.

The previous findings in the literature reveal that the relationship between material deprivation and age varies across countries. Although the coefficients vary by country, the general trend shows that material deprivation decreases as the household head gets older (Bárcena-Martín et al. 2014; Chzhen and Bradshaw 2012; Halleröd et al. 2006; Muffels and Fouarge 2004; Mussida, Parisi, and Pontarollo 2023; Sevä and Larsson 2015; Verbunt and Guio 2019; Whelan and Maître 2012). The Türkiye-specific findings are parallel to this as the risk of material deprivation decreases with increasing age (Karcı and Bayram Arlı 2018; Uğur 2023). This is related to the fact that as individuals get older, they tend to accumulate the resources and durable goods needed to make ends meet. According to Boarini and d'Ercole (2006), material deprivation decreases monotonically as individuals get older, while some forms of material deprivation increase among the elderly in some countries.

The findings of this study regarding the distribution of the material deprivation index among women-headed single-parent households align with existing literature but primarily for households experiencing low material deprivation. Specifically, in these households, material deprivation decreases as the household head gets older, indicating that older household heads may have more economic stability at lower deprivation levels. However, at higher levels of material deprivation, younger household heads face relatively lower material deprivation risks compared to older ones. Since previous studies primarily rely on mean-based regression models, they do not capture the distributional variations in how age influences material deprivation. In contrast, the quantile-based approach in this study shows that age effects vary significantly across the material deprivation distribution, highlighting the censored panel quantile regression model as a crucial tool for capturing these nuanced effects. Moreover, these findings might help explain why age-related material deprivation patterns differ across countries, as observed in Boarini and d'Ercole (2006). Cross-country differences in social security systems, labor market dynamics, and economic conditions likely contribute to variations in the relationship between age and material deprivation. By capturing these effects across quantiles, this study aims to provide deeper insights into the heterogeneity of material deprivation experiences among women-headed single-parent households.

The changing effect of age throughout the material deprivation distribution might be explained by the fact that in households with low material deprivation, as household head age increases, the probability of the household head having made investments and the probability of having economic security such as a retirement pension increases. In households with high material deprivation, these possibilities are low, and the fact that the head of the household is young increases the possibility of working and receiving support by following social security, thus reducing material deprivation.

Marital status

The results in Table 3 indicate that marital status influences material deprivation differently across quantiles, suggesting that the relationship between marital status and material deprivation is not uniform across the distribution. At low levels of deprivation, being widowed or single reduces material deprivation, with a stronger effect for widowed household heads. However, at medium deprivation levels, the protective effect

of being widowed weakens, while being single has a greater impact in reducing deprivation. In contrast, being divorced exacerbates material deprivation, particularly at medium and medium-high quantiles. At higher deprivation levels, being single remains more protective than being widowed.

The findings in the literature reveal that household head being divorced (Bedük 2018; Muffels and Fouarge 2004; Whelan, Layte, and Maître 2002; Whelan and Maître 2012), single (Muffels and Fouarge 2004), widow (Whelan and Maître 2012), or separated (Whelan, Layte, and Maître 2002; Whelan and Maître 2012) increases the material deprivation compared to being married. Boarini and d'Ercole (2006) state that in European countries, those who are widows, divorced, or single are more material deprived than others, while in countries such as the USA and Japan, married ones are more likely to experience material deprivation. On the other hand, Alessio Fusco (2010) finds that being married or widow reduces material deprivation. Chzhen and Bradshaw (2012) further determine that being single increases material deprivation while being divorced or a widow decreases it for single-parent households. Similar to the previous findings in the USA and Japan, findings on Türkiye indicate that the material deprivation of those who are single, widow, or divorced is lower than those who are married (Uğur 2023; Ünver and Alkan 2020).

The findings of this study for women-headed single-parent households align with previously observed trends in the USA, Japan, and Türkiye, as well as for single-parent households in general. Notably, the material deprivations of individuals who are single or widowed are consistently lower than those who are married. This finding could be explained by a decrease in household expenses or an increase in the likelihood of receiving social support and assistance. The fact that being divorced increases material deprivation is similar to the findings of Muffels and Fouarge (2004) and Bedük (2018). This might be due to the low amount of alimony that women receive from their divorced spouses or the irregular payment of alimony. Accordingly, although the parents are married, one of the parents does not reside in the household, increasing the level of material deprivation. In this case, material deprivation might be increasing as the household head cannot receive social support and assistance due to being married.

Education

Referring to Table 3, it is evident that material deprivation tends to decrease with higher levels of the household head's education. Notably, this reduction is more pronounced in households with low material deprivation. However, as material deprivation increases, the impact of the household head's education on material deprivation diminishes by almost half. Consequently, the reducing effect of education is more significant in households with low material deprivation.

Education is controlled in almost every material deprivation study in the literature. Previous findings reveal that material deprivation decreases as education increase (Bárcena-Martín et al. 2014; Bedük 2018; Boarini and d'Ercole 2006; Chzhen and Bradshaw 2012; Fusco 2010; Israel and Spannagel 2019; Muffels and Fouarge 2004; Mussida, Parisi, and Pontarollo 2023; Notten and Guio 2016; Sevä and Larsson 2015; Verbunt and Guio 2019; Whelan, Layte, and Maître 2002; Whelan and Maître 2012). The findings obtained for Türkiye are consistent with this, revealing that higher education reduces material deprivation (Bayram et al. 2010; Karcı and Bayram Arlı 2018; Uğur 2023; Ünver and Alkan 2020).

In addition to these previous findings obtained for the material deprivation at the mean, this study determines that a higher level of education reduces the material deprivation in women-headed single-parent households and this reducing effect is greater in households with low material deprivation. This might be because basic needs are more likely to be met in households with low material deprivation and the return of education becomes more prominent at this point. In such a case, the household head is more likely to have economic security and might be able to further reduce material deprivation with the return to education. On the other hand, in households with high material deprivation, the return to education might decline as economic security and access to basic needs are more likely to be limited.

Employment status of household head

Table 3 shows that the household head's employment status—whether as an employee or self-employed—reduces material deprivation, with the impact varying across the material deprivation distribution. Notably, being self-employed exhibits a more pronounced effect in households characterized by high material deprivation. The reducing effect of being an employee is less significant compared to being self-employed and is primarily observed in households with medium and medium-high material deprivation. Conversely, households where the household head is retired or unemployed experience an increase in material deprivation. The impact of a retired household head is more pronounced in households with low material deprivation, whereas unemployment significantly affects households across low-medium and medium material deprivation levels. Interestingly, being retired is associated with a greater increase in material deprivation compared to being unemployed. By revealing these heterogeneous effects across quantiles, the quantile regression approach provides a more comprehensive understanding of how employment status influences material deprivation at different levels, which would remain undetected in traditional mean-based analyses.

Findings in the literature reveal that material deprivation is higher in households with an unemployed household head, while it is lower if the household head is an employee or self-employed (Bedük 2018; Chzhen and Bradshaw 2012; Figari 2012; Fusco 2010; Halleröd et al. 2006; Muffels and Fouarge 2004; Notten and Guio 2016; Geranda Notten and Anne-Catherine Guio 2020; Whelan and Maître 2012). On the other hand, having the household head outside the labor force increases material deprivation (Chzhen and Bradshaw 2012; Figari 2012). In general, the retired household head seems to reduce the level of material deprivation (Fusco 2010; Notten and Guio 2016; 2020). The limited Türkiye-specific findings indicate that the unemployed are the group most at risk of material deprivation (Karcı and Bayram Arlı 2018; Özdamar, Kılınç, and Giovanis 2021; Uğur 2023).

The findings of this study for women-headed single-parent households are consistent with the literature, as it indicates that the household head being employee or self-employed reduces material deprivation. The fact that the household head is unemployed increases material deprivation. This is consistent with the decrease in the material deprivation of households that have a regular income with a certain economic security. On the other hand, the unemployed household head increases material deprivation as it brings economic uncertainty. The interesting finding of this study is about the retired household heads which are different from the literature. The observed increase in material deprivation among retired household heads highlights the

economic challenges faced by single-parent households led by retired women in Türkiye. This phenomenon underscores the economic insecurity that these households experience.

Demographic characteristics of household

Table 3 suggests that the number of children in the household appears to be insignificant for households with low and high material deprivation. However, for households with medium material deprivation, the presence of children seems to contribute to a slight reduction in material deprivation. The previous literature reveals that material deprivation generally increases with the increase in the resided number of children in the household, although a statistically significant effect is not observed in some countries (Bárcena-Martín et al. 2014; Bedük 2018; Boarini and d'Ercole 2006; Chzhen and Bradshaw 2012; Figari 2012; Fusco 2010; Halleröd et al. 2006; Muffels and Fouarge 2004; Notten and Guio 2020; Verbunt and Guio 2019; Whelan, Layte, and Maître 2002; Whelan and Maître 2012). Notten and Guio (2016) reveal an opposite finding and state that it reduces material deprivation in countries where the number of children under 18 years old in the household is statistically significant. Similarly, Notten and Guio (2020) find that material deprivation decreases in households where dependent children reside. The only study that controls the effect of the number of children in the household on material deprivation in Türkiye is Turgut (2021).

The analysis across the distribution of the material deprivation index in this study contributes to the literature by suggesting that the number of children may have an insignificant effect at both the lower and upper ends of the distribution. Additionally, for women-headed single-parent households, the results diverge from the general literature, except for Notten and Guio (2016; 2020), by indicating that the number of children reduces material deprivation in households with medium deprivation levels. This intriguing result could be attributed to official or private in-kind or cash aid, which may vary based on the number of children in the respective households. Additionally, alimony payments could play a significant role in reducing material deprivation, as they provide financial support directly tied to the presence of children in women-headed single-parent households. Factors such as child benefits, support programs, community solidarity, assistance activities, and the contributions of children to housework and household income, depending on their age, might further explain this finding.

Economic status of household

Table 3 reveals that the ratio of working individuals in the household and income per capita are not significant for households experiencing low and high material deprivation. However, they contribute to a reduction in material deprivation for households with low-medium and medium levels of deprivation, uncovering significant differences across quantiles. Findings in the literature suggest that the number of working people in the household reduces material deprivation, as expected (Figari 2012; Fusco 2010; Notten and Guio 2016). The only study in Türkiye that examines the effect of the ratio of the working people in the household on material deprivation is Acar, Anil, and Gursel (2017). Their findings reveal that an additional number of working people in the household pushes the household above the country-specific limit, but is not high enough to overcome material deprivation.

The findings obtained from this study are consistent with the notion that an increase in the ratio of working individuals in the household correlates with improved household welfare, leading to a decrease in material

deprivation. The reason why the findings of this study differ from the findings of Acar, Anil, and Gursel (2017) might be that the analyzed sample is different.

The relationship between income and material deprivation is frequently examined in the literature, with findings consistently confirming that higher income is associated with lower material deprivation (Bárcena-Martín et al. 2014; Bedük 2018; Boarini and d'Ercole 2006; Fusco 2010; Halleröd et al. 2006; Israel and Spannagel 2019; Muffels and Fouarge 2004; Mussida, Parisi, Pontarollo 2023; Notten and Guio, 2016; Özdamar, Kılınç, and Giovanis 2021; Ünver and Alkan 2020; Whelan and Maître 2012). The findings of this study are consistent with the general literature; however, the insignificance of income at certain quantiles, a nuance revealed through a quantile-based approach, suggests that income alone may not be the sole or most critical factor in assessing poverty (Desai and Shah 1988). Given the ongoing discussion in the Multidimensional Poverty Literature regarding the conceptual relationship between income and material deprivation, this study recognizes that material deprivation is a multidimensional phenomenon, where income represents only one aspect. While income does not exhibit a uniformly strong effect across all levels of material deprivation, it remains a significant determinant at certain quantiles, reinforcing its role in shaping material deprivation.

Residential status

According to Table 3, being a homeowner reduces material deprivation, while being a tenant increases material deprivation in households with medium material deprivation. The effect of residential status appears to be insignificant at both the lower and upper ends of the material deprivation distribution. The previous findings in the literature reveal that home ownership reduces material deprivation (Boarini and d'Ercole 2006; Mussida, Parisi, Pontarollo 2023) while being tenants increases it (Bedük 2018; Fusco 2010; Notten and Guio 2016; 2020; Verbunt and Guio, 2019). The findings of Acar, Anil, and Gursel (2017) which is the only study that examines the relationship between home ownership and material deprivation in Türkiye, indicate that home ownership reduces material deprivation.

The findings of this study are consistent with the literature and further reveal that the negative effect of being a tenant is approximately 5 times greater than the positive effect of being a homeowner. This might be due to the fact that housing expenses are lower for homeowners than for renters. The finding that households being renters increases material deprivation might be due to reasons such as rent expenses, mobility problems, rent increases, and lack of rental assistance.

Health status of household

Table 3 shows that a higher ratio of healthy individuals in a household reduces material deprivation at medium deprivation levels, while no clear association is observed at the extremes of the material deprivation distribution. The studies in the literature examine the relationship between material deprivation and health by analyzing the health status of the household head and the number/ratio of healthy/unhealthy people. The previous findings reveal that the healthier household head and the high number/ratio of healthy people in the household reduce material deprivation and that individuals with chronic illnesses or disabilities in the household increase material deprivation (Bedük 2018; Boarini and d'Ercole 2006; Figari 2012; Fusco 2010; Israel and Spannagel 2019; Mussida, Parisi, Pontarollo 2023; Notten and Guio 2016; 2020; Verbunt and Guio

2019; Whelan and Maître 2012). Similarly, the Türkiye-specific findings reveal that as the health status improves, material deprivation decreases (Acar, Anil, and Gursel 2017; Karcı and Bayram Arlı 2018; Uğur 2023; Ünver and Alkan 2020).

The findings obtained in this study for women-headed single-parent households are consistent with the literature. This finding might be explained by the decrease in health expenditures as the number of healthy people in the household increases, and the increase in the possibility of additional income and labor force participation in households consisting of people who do not need additional care.

Year

The variables indicating years are statistically insignificant, suggesting that the temporal changes and macroeconomic factors, such as the COVID-19 pandemic had no detectable impact on material deprivation between 2018 and 2021. This aligns with the descriptive statistics in Table 1, where the material deprivation index shows only a slight decline from 23 to 22. One possible explanation is that temporary government assistance may have mitigated short-term effects, while the long-term consequences may not have emerged within the period covered by this study.

5.4. Robustness analysis and limitations

This section presents several robustness analyses conducted to verify the reliability of the main results and discuss the limitations of this study. Detailed results are omitted for brevity but are available upon request.

First, several robustness checks were conducted to examine the identification and stability of *marital-status* effects. The exogeneity of marital status was evaluated using the James Durbin (1954) and Wu–Hausman (De-Min Wu 1974; Hausman 1978) tests, implemented jointly and separately with lagged marital-status variables as instruments. The results indicate that marital status can be treated as exogenous in the estimated models. In addition, the models were re-estimated using widow, the modal marital status in the sample of women-headed single-parent households, as the reference category. The resulting estimates show that widowed household heads experience the lowest levels of material deprivation across the distribution, while married, divorced, and separated women are more deprived at both the lower and upper tails, and single women are relatively less deprived at the median and upper quantiles. In the context of women-headed single-parent households, marital status primarily reflects differences in legal and institutional attachment to a partner rather than conventional household composition, which helps explain why widows appear less deprived than legally married but non-co-resident women.

The stability of these patterns was further examined by restricting the sample to households observed for three or four consecutive years. Although some marital-status coefficients change in magnitude and statistical significance in this shorter and more balanced panel, this sensitivity is expected in a fixed-effects quantile regression framework, which relies on within-household variation and therefore provides less precise estimates for slowly changing characteristics such as marital status. Taken together, these checks indicate that the qualitative ordering and distributional patterns of marital-status effects are broadly stable, while estimates for marital status should be interpreted with appropriate caution given the short panel.

Second, the robustness of *labor-market* effects was assessed through a set of complementary specifications. Re-estimating the model using employee, the second most frequent employment category, as the reference group yields the same relative ordering and distributional heterogeneity as in the baseline specification, confirming that material deprivation differs systematically between economically active and inactive household heads and that the substantive conclusions are not driven by the choice of reference category. When log per-capita household income is excluded from the model, employment-status coefficients increase in magnitude, particularly at the median of the deprivation distribution, while their signs and relative ordering remain unchanged, indicating partial mediation through income and an independent association between labor-market status and material deprivation.

A remaining limitation concerns the reduced statistical precision of some labor-market coefficients at the lower and upper tails of the distribution. In particular, unemployment at Q10 and retirement at Q90 are sparsely represented and therefore the corresponding employment-status effects at Q10 and Q90 should be interpreted with caution.

6. Conclusion

Ending poverty remains one of the foremost goals of international institutions. The United Nations (UN) highlighted the elimination of extreme poverty and hunger as the first of its Millennium Development Goals (MDGs) in 2000, followed by its inclusion as Goal 1 of the 2015 Sustainable Development Goals (SDGs): "End poverty in all its forms, everywhere" (United Nations 2015). Parallel frameworks, such as the African Union's Agenda 2063 and the European Commission's Europe 2020 Strategy, have similarly emphasized poverty reduction as central to ensuring inclusive growth and well-being (European Commission 2010). Despite these global commitments, progress remains insufficient. For example, the Europe 2020 target of lifting 20 million people out of poverty and social exclusion was not met, underscoring the persistent nature of this multidimensional challenge (Notten and Guio 2020).

Against this backdrop, the present study focuses on material deprivation, a key non-monetary dimension of poverty that reflects the inability to afford goods and services deemed essential by prevailing societal standards. Extensive literature shows that material deprivation is disproportionately concentrated among single-parent households, particularly those headed by women. These households experience unique structural disadvantages due to the dual burden of caregiving and economic responsibility, reinforcing persistent gender-based inequalities.

To address this issue, this study analyzes women-headed single-parent households in Türkiye using TR-SILC panel data from 2018 to 2021. A material deprivation index is constructed using prevalence weighting, and its left-censoring at zero is accounted for through censored fixed-effects quantile regression. This framework allows for the examination of heterogeneity across the deprivation distribution while controlling for unobserved individual effects, thereby overcoming the limitations of traditional mean-based models.

By focusing exclusively on women-headed single-parent households, the analysis provides a tailored assessment of material deprivation dynamics that has received limited attention in the existing literature. The use of panel data enables the identification of time-varying effects and unobserved heterogeneity in the Turkish context.

The results reveal substantial variation in how socio-demographic and economic factors influence material deprivation across different levels of deprivation. Factors such as age, education, employment, and homeownership exhibit protective effects primarily at lower and medium levels of deprivation, while marital status, household composition, and health indicators display heterogeneous impacts throughout the distribution. Importantly, income, employment ratio, and residential status matter most for households facing medium deprivation, while macroeconomic trends appear to have no statistically significant effect during the study period.

Policy implications follow directly from these findings. Interventions must be tailored to the level of deprivation experienced. For households with low and low-medium deprivation, efforts should focus on supporting younger, less-educated, retired, or low-income women. In medium-deprivation households, attention is needed for older, divorced, unemployed, or tenant heads of household. For those experiencing high deprivation, targeted support for older and less-educated women is essential.

This study is expected to contribute to the literature by situating material deprivation within the broader discourse on gendered poverty. By focusing on the economic vulnerability of women-headed single-parent households, it underscores how structural gender inequalities intersect with single parenthood to exacerbate financial hardship. As highlighted in the literature, there is a pressing need for comprehensive policy frameworks that provide tailored support to single-parent households, such as work, family reconciliation measures, enhanced child allowances, and targeted tax credits (Israel and Spannagel 2019; Calegari, Fabrizi, and Mussida 2024). The findings of this study contribute to this discussion by demonstrating the necessity of policy interventions that account for varying levels of material deprivation within this group and by informing the design of more effective social policies. Such measures have the potential to improve the well-being of both mothers and children, strengthen household economic resilience, and curb the intergenerational transmission of poverty. In the context of Türkiye, where gender-based socioeconomic inequalities remain pronounced, these efforts are especially critical for alleviating material deprivation over the long term.

Statements

Ethics approval This study uses secondary data that contains no identifiable information about individuals in the survey.

Conflict of interest The author declares no potential conflicts of interest regarding the research, authorship, or publication of this study.

Funding This research received no specific grant from any funding agency, commercial, or not-for-profit sectors.

Data availability The data supporting the findings of this study are available from the Turkish Statistical Institute (https://www.tuik.gov.tr/Kurumsal/Mikro_Veri). However, access to these data is restricted, as they were used under license for this study and are not publicly available. Further information on obtaining the data and reproducing the analysis can be provided by the author upon request.

References

Abe, Aya. 2006. Empirical Analysis of Relative Deprivation and Poverty in Japan. IPSS Discussion Paper Series No. 2005-07. Institute of Population and Social Security Research.

Acar, Aysenur, Bulent Anil, and Seyfettin Gursel. 2017. "Mismatch between Material Deprivation and Income Poverty: The Case of Turkey." *Journal of Economic Issues*, 51(3): 828–842.

Ajwad, Mohamed I., Kenneth Simler, Mehtabul Azam, Basab Dasgupta, Misha Bonch-Osmolovskiy, and Irena Topinska. 2013. Simulating Poverty in Europe: The Potential Contributions of Employment and Education to Reducing Poverty and Social Exclusion by 2020. Policy Research Working Paper No. 6660. World Bank.

Baltagi, Badi H., and Ping X. Wu. 1999. "Unequally Spaced Panel Data Regressions with AR(1) Disturbances." *Econometric Theory*, 15: 814–823. https://doi.org/10.1017/S0266466699156020.

Bárcena-Martín, Elena, B. Lacomba, Ana Isabel Moro-Egido, and Salvador Pérez-Moreno. 2014. "Country Differences in Material Deprivation in Europe." *Review of Income and Wealth*, 60(4): 802–820. https://doi.org/10.1111/roiw.12030

Bauman, Kurt J. 1999. "Extended Measures of Well-Being: Meeting Basic Needs." Current Population Reports, U.S. Census Bureau, 67–70.

Bayram, Nuran, Firat Bilgel, and Nazan Gonul B. 2012. "Social Exclusion and Quality of Life: An Empirical Study from Turkey." *Social Indicators Research*, 105(1): 109–120. https://doi.org/10.1007/s11205-010-9767-4

Bayram, Nuran, Neslihan Sam, Serpil Aytaç, and Mustafa Aytaç. 2010. "Yaşam Tatmini ve Sosyal Dışlanma (Life Satisfaction and Social Exclusion)." *İş, Güç: Endüstri İlişkileri ve İnsan Kaynakları Dergisi*, 12(4): 79–92. https://doi.org/10.4026/1303-2860.2010.0159.x

Bedük, Selçuk. 2018. "Understanding Material Deprivation for 25 EU Countries: Risk and Level Perspectives, and Distinctiveness of Zeros." *European Sociological Review*, 34(2): 121–137. https://doi.org/10.1093/esr/jcx089

Bhargava, Alok, Luisa Franzini, and Wiji Narendranathan. 1982. "Serial Correlation and the Fixed Effects Model." *Review of Economic Studies*, 49(4): 533–549. https://doi.org/10.2307/2297285

Boarini, Romina, and Marco M. d'Ercole. 2006. Measures of Material Deprivation in OECD Countries. OECD Social, Employment and Migration Working Papers No. 37. OECD Publishing. https://doi.org/10.1787/866767270205

Bostic, Amie. 2023. "Family, Work, Economy, or Social Policy: Examining Poverty among Children of Single Mothers in Affluent Democracies between 1985 and 2016." *Population Research and Policy Review*, 42(4): 42–59. https://doi.org/10.1007/s11113-023-09805-y

Boushey, Heather, Chauna Brocht, Bethney Gundersen, and Jared Bernstein. 2001. *Hardships in America: The Real Story of Working Families*. Washington, DC: Economic Policy Institute.

Bray, Rob J. 1998. Hardship in Australia: An Analysis of Financial Stress Indicators in the 1998–99 Australian Bureau of Statistics Household Expenditure Survey. Occasional Paper No. 4. Canberra: Australian Bureau of Statistics.

Calegari, Elena, Enrico Fabrizi, and Chiara Mussida. 2024. "State Dependence in Material and Social Deprivation in European Single-Parent Households." *Social Indicators Research*, 172: 481–498. https://doi.org/10.1007/s11205-024-03317-8

Callan, Tim, Brian Nolan, and Christopher T. Whelan. 1993. "Resources, Deprivation and the Measurement of Poverty." *Journal of Social Policy*, 22(2): 141–172. https://doi.org/10.1017/S0047279400019280

Chernozhukov, Victor, and Han Hong. 2002. "Three-Step Censored Quantile Regression and Extramarital Affairs." *Journal of the American Statistical Association*, 97(459): 872–882. https://doi.org/10.1198/016214502388618663

Chzhen, Yekaterina, and Jonathan Bradshaw. 2012. "Lone Parents, Poverty and Policy in the European Union." *Journal of European Social Policy*, 22(5): 487–506. https://doi.org/10.1177/0958928712456578

Cramér, Harald. 1946. *Mathematical Methods of Statistics*. Princeton, NJ: Princeton University Press.

Cronbach, Lee J. 1951. "Coefficient Alpha and the Internal Structure of Tests." *Psychometrika*, 16(3): 297–334. https://doi.org/10.1007/BF02310555

Desai, Meghnad, and Anup Shah. 1988. "An Econometric Approach to the Measurement of Poverty." *Oxford Economic Papers*, 40: 505–522. https://doi.org/10.1093/oxfordjournals.oep.a041868

Durbin, James. 1954. "Errors in Variables." *Revue de l'Institut International de Statistique*, 22(1–3): 23–32. https://doi.org/10.2307/1401917

Engeland, John, and Roger Lewis. 2004. "Exclusion from Acceptable Housing – Canadians in Core Housing Need." *Policy Research Initiative*, 7(2).

European Commission. 2010. Europe 2020: A European Strategy for Smart, Sustainable and Inclusive Growth. Brussels: European Commission.

Fabrizi, Enrico, Chiara Mussida, and Maria L. Parisi. 2025. "Material and Social Deprivation among One-Person Households: The Role of Gender." *Journal of Population Economics*, 38: 10. https://doi.org/10.1007/s00148-025-01084-5

Fahey, Tony. 2007. "The Case for an EU-Wide Measure of Poverty." *European Sociological Review*, 23(1): 35–47. https://doi.org/10.1093/esr/jcl018

Figari, Francesco. 2012. "Cross-National Differences in Determinants of Multiple Deprivation in Europe." *Journal of Economic Inequality*, 10(3): 397–418. https://doi.org/10.1007/s10888-010-9157-9

Friedman, Jerome H., and Werner Stuetzle. 1981. "Projection Pursuit Regression." Journal of the *American Statistical Association*, 76(376): 817–823. https://doi.org/10.1080/01621459.1981.10477729

Fusco, Alessio. 2010. The Relationship between Income and Multiple Deprivation in Luxembourg: A Longitudinal Analysis. Centre d'études de populations, de pauvreté et de politiques socio-économiques (CEPS/INSTEAD).

Fusco, Alessio, Anne-Catherine Guio, and Eric Marlier. 2010. "Characterizing the Income Poor and the Materially Deprived in European Countries." In Atkinson, Anthony B., and Eric Marlier, eds., *Income and Living Conditions in Europe*, 133–150. Luxembourg: Eurostat.

Galvao, Antonio F., Carlos Lamarche, and Luiz R. Lima. 2013. "Estimation of Censored Quantile Regression for Panel Data with Fixed Effects." *Journal of the American Statistical Association*, 108(503): 1075–1089. https://doi.org/10.1080/01621459.2013.818002

Gemicioğlu, Selçuk. 2022. "Hanehalkı Tipinin Yoksulluk ve Ekonomik Zorluk Çekme Riski Üzerindeki Etkisi (The Effect of Household Type on the Risk of Poverty and Economic Hardship)." *International Journal of Economics and Innovation*, 8(2): 121–142. https://doi.org/10.20979/ueyd.1072998

Greene, William H. 2003. *Econometric Analysis*. 5th ed. Upper Saddle River, NJ: Prentice Hall.

Halleröd, Björn. 1998. "Poor Swedes, Poor Britons: A Comparative Analysis of Relative Deprivation." In Andreß, Hans-Jürgen, ed., *Empirical Poverty Research in a Comparative Perspective*, 283–311. London: Routledge.

Halleröd, Björn, Daniel Larsson, David Gordon, and Veli-Matti Ritakallio. 2006. "Relative Deprivation: A Comparative Analysis of Britain, Finland and Sweden." *Journal of European Social Policy*, 16(4): 328–345. https://doi.org/10.1177/0958928706068272

Hardin, James W., and Joseph M. Hilbe. 2018. *Generalized Linear Models and Extensions*. 4th ed. College Station, TX: Stata Press.

Hausman, Jerry A. 1978. "Specification Tests in Econometrics." *Econometrica*, 46(6): 1251–1271. https://doi.org/10.2307/1913827

Hooghe, Marc, Chloé De Grauwe, and Dieter Stiers. 2025. "Gender Differences in Multidimensional Material Deprivation: A Comparative Analysis of the Role of Household Composition and Education Level." *Heliyon*, 11(11). https://doi.org/10.1016/j.heliyon.2025.e43455

Israel, Sabine, and Dorothee Spannagel. 2019. "Material Deprivation in the EU: A Multi-Level Analysis on the Influence of Decommodification and Defamilisation Policies." *Acta Sociologica*, 62(2): 152–173. https://doi.org/10.1177/0001699318778735

Karadağ, Mehmet A. 2013. "Recent Developments in Poverty Measurement in Turkey." United Nations Economic Commission for Europe Conference of European Statisticians, 1–12.

Karadağ, Mehmet A., and Bedriye Saraçoğlu. 2015. "Çok Boyutlu Yoksulluk Analizi: Türkiye-AB Karşılaştırması (Multidimensional Poverty Analysis: A Comparison of Turkey and EU)." *Amme İdaresi Dergisi*, 48(4): 129–159.

Karapınar Kocağ, Esra. 2023. "An Individual Level Investigation on the Relationship between Being a Single Parent and Poverty." *Uluslararası Anadolu Sosyal Bilimler Dergisi*, 7(2): 450–460. https://doi.org/10.47525/ulasbid.1272664

Karcı, Zübeyde, and Nuran Bayram Arlı. 2018. "Maddi Yoksunluğu Etkileyen Değişkenlerin Lojistik Regresyon Analizi ile Belirlenmesi (Determination of Variables Affecting Material Deprivation by Using Logistic Regression Analysis)." *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 23(3): 1039–1048.

Kato, Kengo, Antonio F. Galvao, and Gabriel V. Montes-Rojas. 2012. "Asymptotics for Panel Quantile Regression Models with Individual Effects." *Journal of Econometrics*, 170(1): 76–91. https://doi.org/10.1016/j.jeconom.2012.02.007

Koenker, Roger, and Gilbert Bassett. 1978. "Regression Quantiles." *Econometrica*, 46(1): 33–50. https://doi.org/10.2307/1913643

Lu, Yuan-Chiao, Regine Walker, Patrick Richard, and Mustafa Younis. 2020. "Inequalities in Poverty and Income between Single Mothers and Fathers." *International Journal of Environmental Research and Public Health*, 17(1). https://doi.org/10.3390/ijerph17010135

Mack, Joanna, and Stewart Lansley. 1985. *Poor Britain*. London: Allen and Unwin.

Morelli, Salvatore, Brian Nolan, Juan C. Palomino, and Philippe V. Kerm. 2022. "The Wealth (Disadvantage) of Single-Parent Households." *Annals of the American Academy of Political and Social Science*, 702(1): 188–204. https://doi.org/10.1177/00027162221123448

Muffels, Ruud, and Didier Fouarge. 2004. "The Role of European Welfare States in Explaining Resources Deprivation." *Social Indicators Research*, 68: 299–330. https://doi.org/10.1023/B:SOCI.0000033576.40499.99

Mussida, Chiara, Maria L. Parisi, and Nicola Pontarollo. 2023. "Severity of Material Deprivation in Spanish Regions and the Role of the European Structural Funds." *Socio-Economic Planning Sciences*, 88: 101651. https://doi.org/10.1016/j.seps.2023.101651

Nelder, John A., and Robert W. M. Wedderburn. 1972. "Generalized Linear Models." *Journal of the Royal Statistical Society: Series A*, 135(3): 370–384. https://doi.org/10.2307/2344614

Notten, Geranda, and Anne-Catherine Guio. 2016. The Impact of Social Transfers on Income Poverty and Material Deprivation. Discussion Paper No. 16/17.

Notten, Geranda, and Anne-Catherine Guio. 2020. At the Margin: By How Much Do Social Transfers Reduce Material Deprivation in Europe? Eurostat Statistical Working Papers. https://doi.org/10.2785/79558

OECD. 2019. *Society at a Glance 2019: OECD Social Indicators*. Paris: OECD Publishing. https://doi.org/10.1787/soc_glance-2019-en

Özdamar, Öznur, Zeliha S. Kılınç, and Eleftherios Giovanis. 2021. "Türkiye'de İşsizliğin Ekstra Maliyeti ve İşsizlik Ödeneklerinin Maddi Yoksunluk Üzerine Etkisi (Extra Costs of Unemployment in Turkey

and the Effect of Unemployment Benefits on Material Deprivation)." *İzmir İktisat Dergisi*, 36(3): 535–554. https://doi.org/10.24988/ije.202136303

Pérez-Corral, Antonio L., and Almudena Moreno Mínguez. 2022. "Single-Parent Families, Educational Gradient, and Child Deprivation: The Cases of Italy and Spain." *Child Indicators Research*, 15: 1821–1846. https://doi.org/10.1007/s12187-022-09931-7

Pyper, Wendy. 2002. "Falling Behind." Perspectives on Labour and Income, *Statistics Canada*, 3(7): 17–23.

Ringen, Stein. 1985. "Toward a Third Stage in the Measurement of Poverty." *Acta Sociologica*, 28(2): 99–113. https://doi.org/10.1177/000169938502800203

Runciman, Walter G. 1966. *Relative Deprivation and Social Justice: A Study of Attitudes to Social Inequality in Twentieth-Century England*. London: Routledge and Kegan Paul.

Sevä, Ingemar J., and Daniel Larsson. 2015. "Are the Self-Employed Really That Poor? Income Poverty and Living Standard among Self-Employed in Sweden." *Society, Health & Vulnerability*, 6(1): 26148. https://doi.org/10.3402/vgi.v6.26148

Tang, Yanlin, Huixia J. Wang, Xuming He, and Zhongyi Zhu. 2012. "An Informative Subset-Based Estimator for Censored Quantile Regression." *TEST*, 21: 635–655. https://doi.org/10.1007/s11749-011-0266-y

Tekgüç, Hasan, and Bengi Akbulut. 2022. "A Multidimensional Approach to the Gender Gap in Poverty: An Application for Turkey." *Feminist Economics*, 28(2): 119–151. https://doi.org/10.1080/13545701.2021.2003837

Townsend, Peter. 1979. *Poverty in the United Kingdom*. London: Penguin Books.

Tsakloglou, Panos, and Fotis Papadopoulos. 2013. "Poverty, Material Deprivation and Multi-Dimensional Disadvantage during Four Life Stages: Evidence from the ECHP." In *Poverty and Social Exclusion in Europe*. Cheltenham: Edward Elgar Publishing. https://doi.org/10.4337/9781781009710.00009

Turgut, Murat. 2021. "Türkiye'nin Maddi Yoksunluk Oranındaki Değişimin İncelenmesi (An Investigation of the Change in the Severe Material Deprivation Rate of Turkey)." *International Journal of Financial Economics and Banking Practices*, 2(1): 63–108.

Turkish Statistical Institute (TurkStat). 2022. Statistics on Family, 2021. TurkStat Bulletin No. 45632. https://data.tuik.gov.tr/Bulten/Index?p=Istatistiklerle-Aile-2021-45632

Uğur, Mehmet S. 2023. "Türkiye için Gelir Yoksulluğu ve Maddi Yoksunluğun Belirleyicileri: Çok Durumlu Probit Modeli (The Determinants of Income Poverty and Material Deprivation for Turkey: Multinomial Probit Model)." *Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 16(1): 224–240. https://doi.org/10.25287/ohuiibf.1177542

United Nations. 2015. Transforming Our World: The 2030 Agenda for Sustainable Development. New York: United Nations.

Ünver, Şeyda, and Ömer Alkan. 2020. "Türkiye'de Bireylerin Maddi Yoksunluk Durumlarını Etkileyen Faktörlerin Modellenmesi (Modelling of the Factors Affecting the Material Deprivation Status of Individuals in Turkey)." *Business & Management Studies: An International Journal*, 8(2): 1334–1370. https://doi.org/10.15295/bmij.v8i2.1457

Verbunt, Pim, and Anne-Catherine Guio. 2019. "Explaining Differences Within and Between Countries in the Risk of Income Poverty and Severe Material Deprivation: Comparing Single and Multilevel Analyses." *Social Indicators Research*, 144(2): 827–868. https://doi.org/10.1007/s11205-018-2021-1

Whelan, Christopher T., Richard Layte, and Bertrand Maître. 2002. "Multiple Deprivation and Persistent Poverty in the European Union." *Journal of European Social Policy*, 12(2): 91–105. https://doi.org/10.1177/0952872002012002101

Whelan, Christopher T., and Bertrand Maître. 2012. "Understanding Material Deprivation: A Comparative European Analysis." *Research in Social Stratification and Mobility*, 30(4): 489–503. https://doi.org/10.1016/j.rssm.2012.05.001

Wilcoxon, Frank. 1945. "Individual Comparisons by Ranking Methods." *Biometrics Bulletin*, 1(6): 80–83. https://doi.org/10.2307/3001968

Wirth, Heike, and Klaus Pforr. 2022. "The European Union Statistics on Income and Living Conditions after 15 Years." *European Sociological Review*, 38(5): 832–848. https://doi.org/10.1093/esr/jcac024

Wu, De-Min. 1974. "Alternative Tests of Independence Between Stochastic Regressors and Disturbances: Finite Sample Results." *Econometrica*, 42(3): 529–546. https://doi.org/10.2307/1911789

Zelinsky, Tomas. 2012. "Changes in Relative Material Deprivation in Regions of Slovakia and the Czech Republic." *Panoeconomicus*, 59(3): 335–353. https://doi.org/10.2298/PAN1203335Z

Tables

Table 1. Descriptive statistics

	2018		2019		2020		2021		Panel		Panel
	Mean / Ratio	Min. – Max.	Mean / Ratio	Min. – Max.	Mean / Ratio	Min. – Max.	Mean / Ratio	Min. – Max.	Mean / Ratio	Min. – Max.	Average Material Deprivation Index
Material deprivation index	23.2631 (18.5417)	0-72.9	22.8082 (18.0726)	0-73.04	22.7662 (17.8642)	0-85.59	21.9494 (17.5515)	0-71.88	22.5712 (17.8913)	0-85.89	-
Demographic characteristics of household head											
Age											
Age ≤ 24	0.0028 (0.0526)	0-1	0.0093 (0.0953)	0-1	0.0082 (0.0902)	0-1	0.0115 (0.1065)	0-1	0.0088 (0.0934)	0-1	36.1345
25 ≤ Age ≤ 64	0.8563 (0.3512)	0-1	0.82 (0.3848)	0-1	0.8268 (0.3786)	0-1	0.8154 (0.3882)	0-1	0.8253 (0.3798)	0-1	23.1341
Age ≥ 65	0.1409 (0.3484)	0-1	0.1707 (0.3766)	0-1	0.165 (0.3713)	0-1	0.1731 (0.3785)	0-1	0.1659 (0.3721)	0-1	19.0521
Marital status											
Married	0.1215 (0.3272)	0-1	0.1418 (0.3491)	0-1	0.1291 (0.3355)	0-1	0.1115 (0.315)	0-1	0.1253 (0.3311)	0-1	22.7734
Single	0.0304 (0.1719)	0-1	0.0274 (0.1635)	0-1	0.0369 (0.1886)	0-1	0.0428 (0.2024)	0-1	0.0359 (0.1861)	0-1	17.3849
Widow	0.4751 (0.5001)	0-1	0.4588 (0.4987)	0-1	0.4426 (0.497)	0-1	0.4296 (0.4953)	0-1	0.446 (0.4972)	0-1	20.6599
Divorced	0.3122 (0.464)	0-1	0.282 (0.4503)	0-1	0.3248 (0.4685)	0-1	0.3441 (0.4753)	0-1	0.32 (0.4666)	0-1	24.6171
Separated	0.0608 (0.2392)	0-1	0.09 (0.2863)	0-1	0.0666 (0.2495)	0-1	0.072 (0.2585)	0-1	0.0728 (0.2599)	0-1	27.4955
Education											
Last completed degree*	5.8564 (5.4738)	0-16	5.7805 (5.3324)	0-16	5.8812 (5.2211)	0-16	6.1147 (5.3425)	0-16	5.9316 (5.3157)	0-16	-
Employment status of household head											
Employee	0.2431 (0.4295)	0-1	0.2134 (0.41)	0-1	0.2 (0.4)	0-1	0.2378 (0.4259)	0-1	0.2205 (0.4146)	0-1	19.5514
Self-employed	0.0635 (0.2443)	0-1	0.0732 (0.2606)	0-1	0.0584 (0.2346)	0-1	0.0511 (0.2203)	0-1	0.0599 (0.2374)	0-1	23.8454
Unemployed	0.0359	0-1	0.032	0-1	0.0346	0-1	0.0302	0-1	0.0329	0-1	34.0427

	(0.1863)		(0.1762)		(0.1835)		(0.1713)		(0.1783)		
Retired	0.1188 (0.324)	0-1	0.0854 (0.2796)	0-1	0.0881 (0.2836)	0-1	0.0855 (0.2798)	0-1	0.0904 (0.2868)	0-1	13.1356
Out of labor force	0.5387 (0.4992)	0-1	0.596 (0.4911)	0-1	0.6189 (0.4859)	0-1	0.5954 (0.4911)	0-1	0.5963 (0.4907)	0-1	24.3582
Demographic characteristics of household											
Number of children (age ≤ 5)*	0.1077 (0.3967)	0-3	0.1342 (0.4354)	0-3	0.1045 (0.3807)	0-4	0.1043 (0.3621)	0-3	0.1114 (0.3897)	0-4	-
Number of children (6 ≤ age ≤ 15)*	0.4724 (0.7811)	0-3	0.4451 (0.7516)	0-4	0.3965 (0.7086)	0-4	0.3681 (0.6937)	0-4	0.4074 (0.7234)	0-4	-
Economic status of household											
Working individuals (%)*	0.2898 (0.2724)	0-1	0.2689 (0.2726)	0-1	0.2434 (0.2725)	0-1	0.267 (0.273)	0-1	0.2624 (0.273)	0-1	-
Lowest monthly income*	8.08 (0.5209)	6.91 – 10.82	8.2364 (0.4922)	6.91 – 10.82	8.3502 (0.4898)	4.61 – 11.51	8.4668 (0.4702)	6.91 – 11.29	8.3297 (0.5037)	4.61 – 11.51	-
Income per capita*	9.6287 (0.7546)	7.38 – 12.58	9.748 (0.7174)	7.14 – 12.62	9.9114 (0.7445)	6.9 – 13.22	10.0843 (0.6751)	7.28 – 13.11	9.8966 (0.7349)	6.9 – 13.2	-
Residential status											
Homeowner	0.4558 (0.4987)	0-1	0.4802 (0.50)	0-1	0.4815 (0.5)	0-1	0.4734 (0.4996)	0-1	0.4755 (0.4995)	0-1	17.722
Tenant	0.3591 (0.4804)	0-1	0.3582 (0.4799)	0-1	0.3607 (0.4804)	0-1	0.3629 (0.4811)	0-1	0.3607 (0.4803)	0-1	28.9903
Lodging / other	0.1851 (0.3889)	0-1	0.1616 (0.3684)	0-1	0.1578 (0.3647)	0-1	0.1637 (0.3702)	0-1	0.1638 (0.3703)	0-1	22.5129
Health status of household											
Healthy individuals (%)*	0.4754 (0.3204)	0-1	0.475 (0.3237)	0-1	0.5073 (0.3328)	0-1	0.5004 (0.3253)	0-1	0.494 (0.327)	0-1	-
Number of observations	423		797		1164		1166		2953		

Notes: Min. is the minimum value; max. is the maximum value.
Standard deviations are in parentheses.
* represents continuous variables; others are binary.

Table 2. Ratios and weights of material deprivation items

	2018		2019		2020		2021		Panel	
	Ratio	Weight	Ratio	Weight	Ratio	Weight	Ratio	Weight	Ratio	Weight
Item 1: Paying rent, mortgage, or utility bills as planned in the last 12 months	0.1464	0.9166	0.1402	0.9115	0.1578	0.9186	0.146	0.9084	0.1476	0.9138
Item 2: Keeping the home adequately warm	0.3232	0.8012	0.2912	0.8113	0.2859	0.8056	0.2826	0.8101	0.2957	0.8071
Item 3: Facing unexpected expenses	0.4945	0.6547	0.4726	0.6695	0.4723	0.6701	0.4473	0.6731	0.4717	0.6669
Item 4: Eating protein at least three days on a regular week	0.4448	0.6517	0.4954	0.6366	0.4887	0.627	0.4453	0.6391	0.4685	0.6386
Item 5: Going on a holiday with all members of the household for a week in a year	0.6823	0.397	0.6829	0.3975	0.6711	0.4015	0.6757	0.3958	0.6780	0.398
Item 6: Owning a color TV	0.0028	0.994	0.0092	0.9921	0.0082	0.9948	0.0031	0.9946	0.0058	0.9939
Item 7: Owning an automatic washing machine	0.0359	0.9828	0.0122	0.9856	0.0133	0.9891	0.0083	0.9889	0.0142	0.9866
Item 8: Owning a car (except for business purposes)	0.4779	0.656	0.4817	0.6595	0.4723	0.6707	0.4891	0.6584	0.4802	0.6612
Item 9: Owning a telephone	0.0111	0.9965	0.0046	0.998	0.0051	0.9983	0.0031	0.9984	0.005	0.9978

Table 3. Censored panel quantile regression results

	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90
	Low MD		Low-medium MD		Medium MD	Medium-high MD		High MD	
Demographic characteristics of household head									
Age									
Age ≤ 24 (reference)									
25 ≤ Age ≤ 64	-2.8705***	-2.8705***	-2.887***	-2.7916***	11.2661***	7.2587***	7.2351***	7.2254***	7.2142***
	(0.2796)	(0.3292)	(0.3227)	0.0378	(0.0007)	(0.0749)	(0.2482)	(0.2936)	(0.2231)
Age ≥ 65	-2.8565***	-2.8565***	-2.8745***	-2.7866***	11.2676***	7.2594***	7.2359***	7.2259***	7.2035***
	(0.2709)	(0.3113)	(0.3125)	0.0454	(0.0014)	(0.0757)	(0.2553)	(0.3034)	(0.2326)
Marital status									
Married (reference)									
Single	-0.172**	-0.58623*	-0.5981**	-0.207***	-1.8221***	-3.2734***	-5.0052***	-6.1863***	-5.0173***
	(0.07)	(0.3137)	(0.2834)	0.0361	(0.0134)	(0.0983)	(0.1566)	(0.4173)	(0.1287)
Widow	-3.1886***	-3.6029***	-3.6053***	-2.9967***	-1.8477***	-1.904***	-3.6235***	-4.8011***	-3.6208***
	(0.254)	(0.1646)	(0.117)	0.1123	(0.0083)	(0.0938)	(0.1302)	(0.3385)	(0.1079)
Divorced	0.0472	0.0472	0.0264	0.0243	0.0036**	0.02	1.2***	0.0212	1.1902
	(0.0615)	(0.0767)	(0.1265)	0.0172	(0.0018)	(0.0246)	(0.2965)	(0.0696)	(0.2896)
Separated	0.0382	0.0382	0.0176	0.019	-0.0006	0.0147	0.0148	0.0174	0.0282
	(0.0361)	(0.0466)	(0.1109)	0.0166	(0.0013)	(0.0255)	(0.0571)	(0.0481)	(0.0469)
Education									
Last completed degree	-0.736***	-0.736***	-0.7364***	-0.6959***	-0.015***	-0.3421***	-0.3437***	-0.3442***	-0.3442***
	(0.0106)	(0.0138)	(0.0107)	0.0116	(0.0004)	(0.0047)	(0.0217)	(0.0254)	(0.0197)
Employment status of household head									
Employee	0.0422	0.0422	0.0446	-0.0735	-0.0671***	-0.1632***	-0.1444	-0.1389	-0.1389
	(0.0644)	(0.0824)	(0.0703)	0.0455	(0.0033)	(0.0495)	(0.2299)	(0.2628)	(0.2028)
Self-employed	-3.2583***	-3.6726***	-3.6726***	-3.0739***	-1.9388***	-1.9778***	-3.6887***	-3.6842***	-3.6842***
	(0.3152)	(0.1439)	(0.1106)	0.1109	(0.0149)	(0.1038)	(0.1431)	(0.1524)	(0.1139)
Unemployed	0.0155	0.0155	0.0194	0.0364*	0.0414***	0.0449	0.0486	0.2273***	0.2273***
	(0.0347)	(0.0461)	(0.0437)	0.0212	(0.0027)	(0.0325)	(0.0421)	(0.1111)	(0.0832)
Retired	5.8313***	5.8313***	5.8434***	5.566***	0.2414***	5.4754***	5.5056***	5.5134***	5.5134***

	(0.3288)	(0.4224)	(0.3745)	0.0611	(0.0054)	(0.0725)	(0.359)	(0.4215)	(0.3224)
Our of labor force (reference)									
				Demographic characteristics of household					
Number of children	-0.0148	-0.0148	-0.0134	-0.0044	-0.0086**	-0.0132	-0.0234	-0.0188	-0.0188
(age ≤ 5)	(0.0356)	(0.0467)	(0.049)	0.0247	(0.0038)	(0.0358)	(0.0348)	(0.0386)	(0.0299)
Number of children	-0.0049	-0.0049	-0.0048	-0.0014	-0.006**	-0.005	-0.0132	-0.0099	-0.0099
(6 ≤ age ≤ 15)	(0.0172)	(0.0231)	(0.0281)	0.0145	(0.0029)	(0.0105)	(0.0194)	(0.0225)	(0.0169)
				Economic status of household					
Working individuals (%)	-0.1381	-0.1381	-0.1379	-0.0571	-0.0692***	-0.0545	-0.0982	-0.1081	-0.1081
	(0.1211)	(0.1557)	(0.1359)	0.0449	(0.0077)	(0.0718)	(0.249)	(0.2368)	(0.1768)
Lowest monthly income	0.0119	0.0119	0.0092	0.0003	0.0011	0.0007	-0.0028	-0.0041	-0.0041
	(0.0235)	(0.0282)	(0.0317)	0.0178	(0.0015)	(0.0059)	(0.0192)	(0.0212)	(0.0163)
Income per capita	-0.0256	-0.0256	-0.0232	-0.0138***	-0.0129***	-0.008	-0.0095	-0.0095	-0.0094
	(0.0224)	(0.0277)	(0.0308)	0.0041	(0.0009)	(0.0282)	(0.0175)	(0.0218)	(0.0163)
Residential Status									
Homeowner	0.0156	0.0156	0.0347	-0.0084	-0.0183***	-0.0202	0.0519	0.057	0.057
	(0.0986)	(0.1261)	(0.2516)	0.0353	(0.002)	(0.0251)	(0.1589)	(0.1986)	(0.1478)
Tenant	-0.0359	-0.0359	-0.0146	-0.0164	0.0518***	0.0334	0.0536	0.056	0.056
	(0.0496)	(0.0668)	(0.1659)	0.0281	(0.0055)	(0.0488)	(0.1386)	(0.1652)	(0.1228)
Lodging / other (reference)									
				Health status of household					
Healthy individuals (%)	-0.006	-0.006	-0.0084	-0.0044	-0.0049***	-0.0046	-0.0159	-0.0166	-0.0166
	(0.0221)	(0.0266)	(0.0231)	0.0093	(0.0019)	(0.0124)	(0.0264)	(0.0308)	(0.0247)
				Year					
2018	-0.0113	-0.0113	-0.0149	-0.0169	-0.0097*	-0.0161	-0.0138	-0.0152	-0.0152
	(0.022)	(0.0245)	(0.0255)	0.0244	(0.0058)	(0.031)	(0.0205)	(0.0238)	(0.0183)
2019	0.0038	0.0038	0.0032	-0.0003	-0.0004	0.0001	-0.0012	-0.0016	-0.0016
	(0.0104)	(0.0137)	(0.0154)	0.0082	(0.0011)	(0.0063)	(0.0114)	(0.0141)	(0.011)
2020	0.0045	0.0045	0.0033	0.0005	0.0011	0.001	0.0013	0.0012	0.0012
	(0.0075)	(0.0101)	(0.009)	0.0054	(0.001)	(0.0037)	(0.0095)	(0.0113)	(0.0088)
2021 (reference)									

	Heterogeneity across quantiles							
	Q10-Q20	Q20-Q30	Q30-Q40	Q40-Q50	Q50-Q60	Q60-Q70	Q70-Q80	Q80-Q90
t test	-28.948	-2.9279	-2.9279	95.161	-40.746	-12.216	-26.054	55.22
	[0.0000]	[0.0035]	0.003496	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Wilcoxon (1945) test	1.478	50.806	401.456	435.086	948	84.282	2.307	412.810
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]

Notes: MD denotes material deprivation.

$^{***}p<0.01$, $^{**}p<0.05$, $^{*}p<0.1$.

Powell (1991) standard errors are in parentheses.

Test statistic probabilities are in square brackets.

Longitudinal survey weights are not applied, given the nonlinear fixed-effects quantile regression framework and the absence of a standard approach for incorporating such weights in censored short panels.