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Sana Khan and Lucia Ferrone

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Time for Work, Time for Care: Maternal Employment and Early Childhood Nutrition in Ethiopia*

Sana Khan† Lucia Ferrone ‡

Abstract

Child undernutrition remains a major development challenge in sub-Saharan Africa, yet limited evidence exists on its relationship with maternal working hours and employment type. Using panel data from Ethiopia, this study applies the Mundlak approach to investigate these relationships. The analysis distinguishes between on-farm and off-farm employment and further separates off-farm work into wage employment, self-employment, and temporary labor. It also examines rural–urban and child-sex heterogeneity and explores food and non-food expenditure as potential pathways. The findings indicate that, although the estimated relationships are heterogeneous, associations between maternal employment hours and child nutritional outcomes are predominantly negative, particularly for HAZ. Maternal employment hours are more consistently associated with HAZ than with WHZ, especially in the combined and rural samples. Associations with on-farm employment are generally weak, whereas off-farm employment displays heterogeneous patterns across working hours, outcomes, and locations. The child-sex-specific estimates show more pronounced associations between maternal employment hours and HAZ for boys than for girls. The pathway analysis provides mixed evidence. Overall maternal employment hours do not consistently translate into higher household expenditure, while wage employment and self-employment are associated with higher food or non-food expenditure over some ranges of working hours. Because both expenditure measures are positively associated with HAZ, expenditure may represent a beneficial pathway for selected off-farm activities, although it does not fully explain the broader employment–nutrition relationship. The findings suggest that policies should focus not only on expanding women's employment opportunities but also on improving job quality and childcare support so that gains in women's economic participation are more likely to translate into improved child nutritional outcomes.

Keywords: Maternal employment, Time allocation, Child nutrition, Early childhood, Height-for-age z-score, Weight-for-height z-score, Ethiopia

JEL classification: D13, I12, I15, J22, O1

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†University of Florence, Department of Economics and Management, Italy. sana.khan@unifi.it

‡University of Florence, Department of Economics and Management, Italy. lucia.ferrone@unifi.it

1. Introduction

Nutritional status in early life is an important indicator of children's physical growth, health, and developmental well-being. It is commonly assessed through anthropometric indicators such as height-for-age and weight-for-height, which capture different dimensions of nutritional deprivation[1]. Despite global efforts to reduce childhood malnutrition, it remains a major public health challenge in low- and middle-income countries (LMICs). In 2020, approximately 149.2 million children under the age of five were stunted, while around 45.4 million were wasted globally (United Nations Children's Fund et al., 2021; United Nations Children's Fund, 2024). Poor nutrition during the early years of life can adversely affect children's physical development, cognitive abilities, school readiness, learning outcomes, and future earning potential, thereby increasing the risk of poor living standards later in life (Bhutta et al., 2013; Haddad, 2013; Hoddinott et al., 2013; Headey et al., 2018). Moreover, malnourished children are more vulnerable to morbidity and mortality and may experience adverse adult health outcomes, including reduced adult height, poor lipid profiles, higher blood glucose concentration, and increased risk of mental health problems (Victora et al., 2008). These adverse effects may also extend across generations, as undernourished children can transmit poor nutritional outcomes to the next generation (Black et al., 2013; Harris, 2014). Therefore, identifying the factors associated with both chronic and acute child malnutrition is essential for designing effective policy interventions. Existing studies identify several determinants of child malnutrition, including poverty, parental education, maternal employment, food hygiene, sanitation facilities, access to safe drinking water, and rural-urban residence (Pulok, Nasim-Us Sabah, & Enemark, 2016; Kim et al., 2017; Rashad & Sharaf, 2019; Jakaria, Bakshi, & Hasan, 2022).

One factor that has received increasing attention in recent years is maternal employment. As women's participation in the labor market continues to expand worldwide, maternal employment has become increasingly important in the child nutrition literature because mothers often play a central role in childcare, feeding practices, and overall household welfare. Over the last two decades, more than 306 million women entered the global labor force, and the female labor force participation rate reached approximately 39.2% in 2018, although it remained considerably lower than that of men (Verick, 2018; Winkler, 2022; The World Bank, 2022). Female labor force participation is projected to increase further, reaching around 45% by 2030 (Verick, 2018). These trends have intensified interest in understanding how maternal employment influences child nutritional outcomes. Theoretically, the relationship is ambiguous because maternal employment may affect child nutrition through two competing mechanisms: an income effect and a substitution effect. On the one hand, employment may increase household income, enabling greater investment in nutritious food, healthcare, childcare, and other resources that promote child well-being (Mark et al., 2012; Rashad & Sharaf, 2019; Hosen, Pulok, & Hajizadeh, 2023). On the other hand, employment may reduce the time mothers can devote to breastfeeding, meal preparation, direct childcare, and activities that support children's physical and cognitive development (Rivera-Pasquel, Escobar-Zaragoza, & González de Cosío, 2015; Rashad & Sharaf, 2019; Hosen, Pulok, & Hajizadeh, 2023). Maternal employment therefore involves a potential trade-off between the benefits of additional household resources and the costs of reduced maternal time. Understanding the relative importance of these competing

[1]Height-for-age z-score (HAZ) reflects chronic under nutrition and linear growth faltering, while weight-for-height z-score (WHZ) captures acute malnutrition or wasting.

mechanisms is essential for assessing how maternal employment shapes child nutritional outcomes and for designing policies that support both women's economic participation and child nutrition.

The relationship between maternal employment and child nutrition may further vary according to the type and location of employment, particularly when mothers engage in on-farm and off-farm activities[2]. This distinction is important because different forms of employment may influence child nutrition through different income- and time-allocation mechanisms. On-farm work may contribute directly to household food production and food availability, whereas off-farm employment may generate cash income that can be used to purchase food, healthcare, and other child-related resources. At the same time, both forms of employment may increase mothers' workload and reduce the time available for breastfeeding, food preparation, direct childcare, and other nurturing activities (Rivera-Pasquel, Escobar-Zaragoza, & González de Cosío, 2015). The overall nutritional effect therefore depends on the balance between employment-related resource gains and maternal time constraints. These issues are particularly relevant in sub-Saharan Africa, where women's employment is concentrated in agriculture, informal work, and other low-paid activities, while child undernutrition remains a persistent development challenge. Ethiopia provides an important context for examining these relationships because it combines a high prevalence of child undernutrition with substantial female labor force participation. According to the 2019 Ethiopia Mini Demographic and Health Survey, 37% of children under five were stunted and 7% were wasted (Ethiopian Public Health Institute & ICF, 2019). At the same time, Ethiopia's female labor force participation rate was estimated at 58.5%, compared with 78.6% for men (The World Bank Group, 2025)[3]. Despite the coexistence of high female employment and persistent child undernutrition, limited evidence exists on how maternal employment intensity and different forms of employment are associated with children's nutritional outcomes in Ethiopia. This study addresses this gap.

Against this background, the present study investigates the relationship between maternal employment intensity and child nutritional outcomes in Ethiopia using panel data. Specifically, the study addresses the following research questions:

1. How is maternal employment, measured by weekly work hours, associated with children's height-for-age z-scores (HAZ) and weight-for-height z-scores (WHZ) in Ethiopia?

2. Does the association between maternal employment and child nutritional outcomes differ by employment type and place of residence?

3. Does the association between maternal employment and child nutritional outcomes vary by child sex?

4. To what extent do household food and non-food expenditure help explain the relationship between maternal employment and child nutritional outcomes?

[2]On-farm employment generally refers to agricultural work, including crop and livestock production, while off-farm employment includes paid or self-employment outside agricultural production, such as wage work, services, trade, or small business activities.

[3]Ethiopia's female labor force participation rate is above the global average of 51.1%, but remains below the Sub-Saharan African average of 65%.

The contribution of this study is fourfold. First, it contributes to the relatively limited empirical literature on maternal employment and child nutritional outcomes in Sub-Saharan Africa, with a particular focus on Ethiopia. Although the relationship between maternal employment and child nutrition has been widely examined in other developing regions, evidence from Ethiopia remains scarce. This study therefore provides context-specific evidence from a low-income country where child undernutrition continues to be an important policy concern.

Second, the study employs nationally representative panel data from the Ethiopian Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA), covering the 2018/2019 and 2021/2022 survey rounds. The panel structure allows the analysis to account for unobserved time-invariant heterogeneity. The main estimation strategy uses the Mundlak (1978) correlated random effects approach, which relaxes the restrictive assumptions of the conventional random effects model by allowing individual-specific effects to correlate with observed covariates. The robustness of the findings is further assessed by comparing the results with fixed-effects estimates.

Third, the study extends the literature by focusing on the intensive margin of maternal employment. Rather than examining employment participation alone, it analyzes mothers' weekly working hours, allowing the relationship between maternal employment and child nutritional outcomes to vary with work intensity. By modeling employment hours flexibly, the analysis accounts for the possibility that the benefits and costs of maternal employment differ across levels of labor supply.

Fourth, the study distinguishes between different forms of maternal employment. It separates on-farm and off-farm employment and further disaggregates off-farm work into wage employment, self-employment, and temporary labor. This provides a more comprehensive understanding of how different employment arrangements are associated with children's nutritional outcomes. In addition, the study examines whether these relationships vary across rural and urban areas and by child sex and explores household food and non-food expenditure as potential pathways linking maternal employment to child nutritional outcomes. Together, these contributions provide evidence that can inform policies aimed at promoting women's economic participation while supporting improvements in child nutrition.

2. Theoretical and conceptual framework

2.1. Theoretical background

Economic theories of household behavior provide an important framework for understanding how families allocate labor, income, and resources and how these decisions may influence investments in child human capital. These theories offer different perspectives on the role of maternal employment in shaping children's nutritional outcomes. The traditional benchmark is the unitary household model[4], most prominently associated with Becker (1991). This framework provides a foundation for understanding how maternal employment may affect household resources and child-related investments. However, subsequent theoretical developments have relaxed the assumption of unified household preferences through bargaining models, including both cooperative and non-cooperative formulations. These models recognize that

[4]The model assumes that the household operates as a single decision-making entity maximizing a common utility function. Under this framework, labor supply choices and child-related investments are determined by pooled preferences and resources.

household decisions may reflect the interaction of individual preferences, relative bargaining power, and strategic behavior between spouses[5], which may lead to different implications for the allocation of resources toward child investments.

2.2. Unitary household model

The unitary household model provides the traditional framework for analyzing household decisions regarding labor allocation, consumption, and investments in children. In this framework, the household is assumed to act as a single decision-making unit with common preferences, maximizing a joint utility function. Consider a simple theoretical setting in which each household consists of a husband, a wife, and two children: one boy and one girl. Household decisions regarding consumption and investments in children are made over time. In each period, the parents maximize a utility function defined over consumption (C^p) and the human capital of their children, denoted by (H_b) for the boy and (H_g) for the girl:

$$U\ (C^p, H_b, H_g) \tag{1}$$

Utility maximization is subject to a budget constraint[6] and a child human capital production function:

$$\max U\ (C^p, H_b, H_g) \tag{2}$$

Subject to:

$$C^p = w_i\, l_i + Y_j - i_b - i_g \tag{3}$$

$$H_{b,g} = f\left[(T_i - l_i), i_{b.g}\right] \tag{4}$$

Where Y_j in Equation (3) represents the father's labor income together with any additional non-labor income present in the household. To keep the framework simple, possible wage effects on the father's labor supply[7] are not explicitly modeled. The wage received by the mother, (w_i) is assumed to depend on labor market conditions (J_i) and her individual characteristics (X_i), such that $w_i = w_i\,(J_i, X_i)$.

The mother chooses the employment option that provides the highest wage. Given this wage, the household determines her optimal labor supply, denoted by (l_i). The mother's total available time (T_i) is allocated between paid employment and childcare activities, with time not allocated to market work assumed to be devoted to childcare. Consequently, child human capital evolves as a function of maternal time inputs[8] and financial investments. Monetary investments are child-specific and are represented by (i_b) for the boy child and (i_g) for the girl child.

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[5]These approaches suggest that labor allocation and child investment decisions may differ depending on the underlying intra-household decision structure.

[6]The household budget constraint reflects the economic limitations affecting investments in child nutrition. Aggregate household consumption does not necessarily capture expenditures that directly support children's physical growth and long-term human capital development.

[7]Male wages are considered fixed in this analysis. This assumption reflects the relatively stable pattern of male labor force participation over time, particularly when compared with the increase in female labor force participation.

[8]Maternal time allocated to childcare is assumed to benefit both children simultaneously.

Accordingly, the reduced-form expressions for child human capital can be written as:

$$H_b = b(\rho_i, \rho_h, J_i, X_i, Y_j) \quad (5)$$

$$H_g = g(\rho_i, \rho_h, J_i, X_i, Y_j) \quad (6)$$

Where $\rho_i = (\partial H / \partial i)$ denotes the marginal return to financial investments, and $\rho_h = (\partial H / \partial h)$ represents the marginal return to maternal time allocation.

Although the unitary household model provides a useful benchmark for understanding the relationship between maternal employment, resource allocation, and child human capital investments, it relies on the assumption that household members share common preferences and make decisions as a single unit. This assumption may overlook differences in individual preferences, resources, and decision-making power between spouses. To account for these aspects of household behavior, subsequent models introduce bargaining frameworks in which household decisions are determined through interactions between spouses and may depend on their relative bargaining positions.

2.3. Bargaining household models

The framework can be extended by allowing household decisions to be determined through bargaining between spouses, either in a non-cooperative or cooperative setting. In a non-cooperative household model, each adult makes individual decisions regarding labor supply, personal consumption, and investments in child nutrition. Household outcomes are therefore the result of separate optimization decisions made by the mother and the father. Under this framework, child nutrition therefore depends on the father's monetary contributions as well as the mother's monetary investments and time inputs devoted to childcare.

In contrast, a cooperative household model assumes that spouses make joint decisions, but the allocation of household resources depends on their relative bargaining power. This decision-making process can be viewed as a two-stage framework. In the first stage, the mother (i) decides whether to participate in the labor market and determines her level of labor supply. In the second stage, the mother (i) and father (j) bargain over the allocation of total household resources between consumption and child-related investments.

The bargaining process can be represented through a cooperative Nash bargaining framework (collaborative model), similar to the collective household model proposed by Chiappori (1992). In this setting, each parent's bargaining weight depends on factors such as individual characteristics, relative income, employment opportunities, and alternative utilities. Maternal employment may therefore influence child nutrition through two related mechanisms: by increasing household resources and by strengthening the mother's bargaining position within the household. The household maximization problem can then be expressed as a bargaining problem between the mother and the father:

$$\max \ (U_i(C_i^m, H_b, H_g) - V_i)\gamma_i \quad (7)$$

$$(U_j(C_j^m, H_b, H_g) - V_j)\gamma_j \quad (8)$$

$$C_i^m + C_j^m = w_i l_i + Y_j - i_b - i_g \quad (9)$$

$$H_{b,g} = f\left[(T_i - l_i), i_{b.g}\right] \quad (10)$$

Where γ_i and γ_j represent the bargaining weights of the mother and father, respectively, while V_i and V_j denote their alternative utilities. These bargaining weights and alternative utilities may depend on each parent's individual characteristics, employment opportunities, and relative income.

This framework highlights women's bargaining power as an additional mechanism through which maternal employment may influence child nutritional outcomes. If mothers place greater importance on child nutrition than fathers, an increase in maternal income may lead to higher investments in children's food, health, and care. In a non-cooperative setting, this effect operates through the mother's control over her own resources, whereas in a cooperative setting, higher maternal earnings may improve her bargaining position and influence household resource allocation toward child-related needs.

2.4. Implications of the theoretical model

The theoretical framework suggests that maternal employment may influence child nutritional outcomes through competing income and time-allocation mechanisms. The budget constraint and child human capital production function imply that increases in maternal employment opportunities ($\mathbf{J_i}$) and maternal wages ($\mathbf{w_i}$) may enhance household resources and enable greater investments in children. These investments may include food, healthcare, and other inputs that contribute to child nutrition and human capital development. In addition, bargaining models suggest that maternal employment may influence child outcomes by improving women's bargaining position within the household, potentially affecting the allocation of resources toward child-related needs. However, maternal employment may also reduce the time available for childcare, feeding, food preparation, and health-related activities. As mothers allocate more time to market work, households face a trade-off between the additional resources generated through employment and the potential reduction in maternal time inputs. Therefore, the overall effect of maternal employment on child outcomes remains theoretically ambiguous and depends on whether increased financial investments can compensate for reductions in childcare time.

The theoretical framework further implies that the effects of maternal employment may vary according to the type of work performed. On-farm employment, particularly when conducted near the household, may be more compatible with childcare responsibilities compared with off-farm employment that requires mothers to work away from home. Similarly, differences in working conditions, employment stability, and flexibility may influence whether maternal employment enhances or constrains child nutrition. This provides a theoretical justification for distinguishing between on-farm and off-farm employment in the empirical analysis. The relationship between maternal employment and child outcomes may also differ across children. If households allocate resources, care, or nutritional investments differently between boys and girls, maternal employment may have heterogeneous effects by child sex. This motivates the analysis of gender-specific differences in child nutritional outcomes. Furthermore, because the relative importance of income gains and time constraints may vary with employment intensity, the relationship between maternal working hours and child nutrition may be non-linear rather than uniformly positive or negative.

Overall, the theoretical framework indicates that maternal employment may generate both benefits and potential costs for child nutritional outcomes. While employment can improve child nutrition through increased household resources and enhanced maternal bargaining power, it may also negatively affect outcomes through reductions in maternal care time. The conceptual framework below summarizes these competing mechanisms and illustrates how they are examined in this study.

2.5. Conceptual framework of the study

Figure 1 presents the conceptual framework developed in this study to examine the relationship between maternal employment and child nutritional outcomes in Ethiopia. Building on the theoretical framework, the study identifies two main pathways[9] through which maternal employment may influence child nutrition. The first is the time-allocation pathway, which captures changes in maternal time available for childcare, feeding, and other care-related activities. The second is the household expenditure pathway, which reflects how employment-related income and resources may affect investments in food, healthcare, and other inputs relevant for child development.

Maternal employment is classified into two main categories: on-farm work and off-farm employment. On-farm work is primarily examined in rural areas, where agricultural activities represent an important source of household livelihood and may also influence food availability (Doss, Meinzen-Dick, Quisumbing, & Theis, 2018; Sibhatu & Qaim, 2018). Off-farm employment, including wage employment, self-employment, and temporary labor, is analyzed separately in rural and urban areas because employment opportunities, returns to work, market access, and childcare arrangements may differ across locations (Van den Broeck & Kilic, 2019; Mutsami , Maina, & Khonje , 2025).

Through the time-allocation pathway, maternal employment may reduce the time available for childcare, breastfeeding, food preparation, feeding practices, and health-seeking activities. These time constraints may negatively affect child nutrition, particularly among younger children who require intensive care and regular feeding (Johnston et al., 2018; Komatsu, Malapit, & Theis, 2018). In rural areas, mothers engaged in agricultural activities may experience seasonal time constraints during periods of planting and harvesting. Similarly, off-farm employment may reduce maternal care time when work requires commuting, longer working hours, or fixed schedules outside the household (Komatsu, Malapit, & Theis, 2018; Sangwan & Kumar, 2021). In urban settings, the effect may depend on the availability of alternative childcare arrangements and support networks.

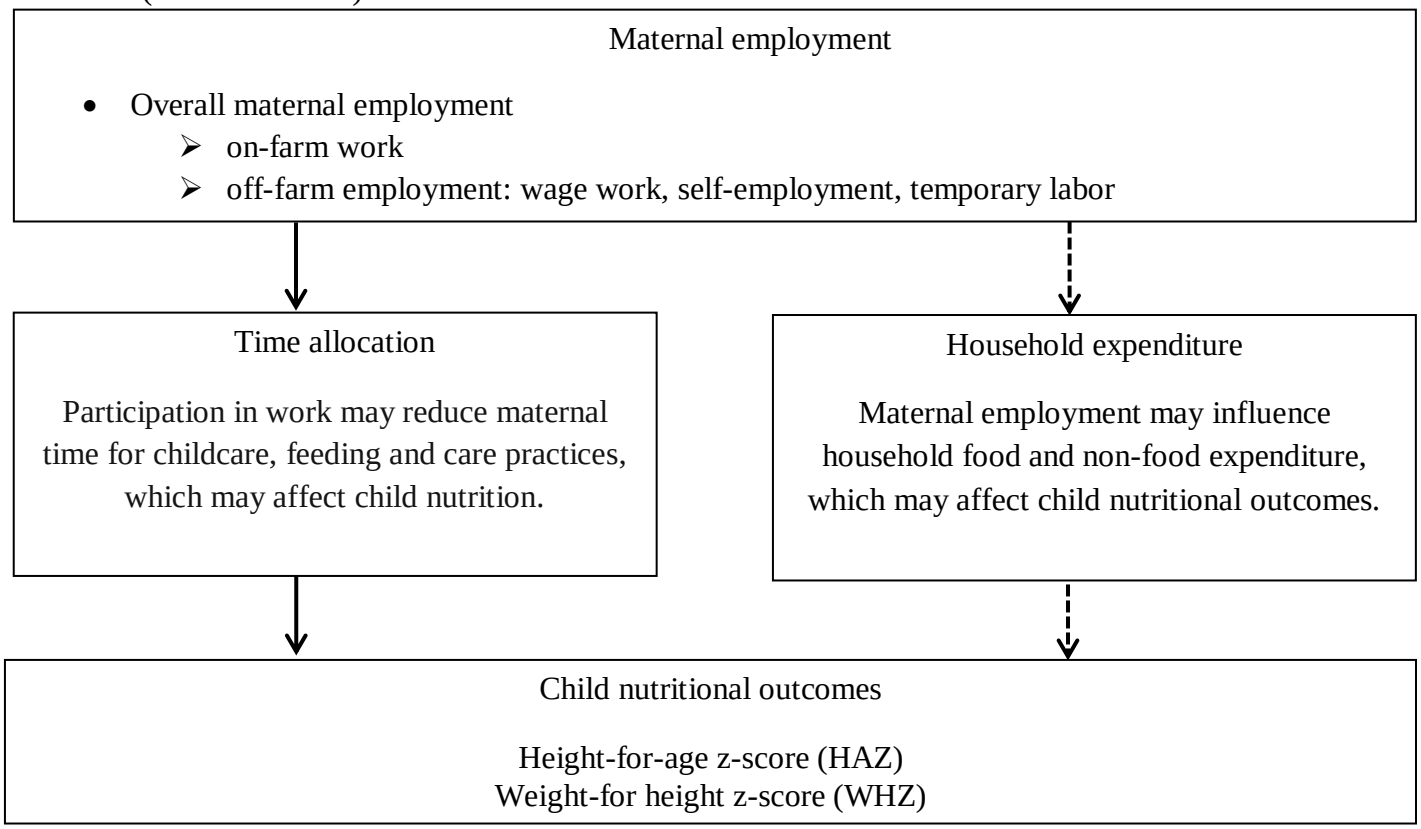
Through the household expenditure pathway, maternal employment may improve child nutrition by increasing household resources and influencing spending patterns. Additional income generated from maternal work may enable households to allocate more resources toward food and non-food expenditures. Higher food expenditure may improve the quantity, quality, and diversity of children's diets, while non-food expenditure may support child health through investments in healthcare, hygiene, clothing, transportation, education, and other essential needs. However, the strength of this pathway depends on the stability and adequacy of employment income. The conversion of maternal earnings into child-related investments may

[9]Income and women's bargaining power are recognized as important theoretical channels, but they are not directly examined in this study.

also differ between rural and urban households due to variations in food prices, market access, household needs, and living costs (Quisumbing et al., 2021; Masters, Finaret, & Block , 2022).

In this study, child nutritional outcomes are measured using height-for-age z-score (HAZ) and weight-for-height z-score (WHZ). The conceptual framework therefore links maternal employment to child nutrition by highlighting the potential trade-off between the benefits of increased household resources and the costs associated with reduced maternal time inputs. It also emphasizes that these mechanisms may differ across employment types and between rural and urban contexts. This distinction is important for understanding how employment opportunities can contribute to improved child nutrition when supported by adequate childcare arrangements, stable income opportunities, and household food security.

Figure 1: Conceptual framework of the relationship between maternal employment and child nutritional outcomes (HAZ and WHZ).



Notes: The solid lines indicate the main time-allocation pathway through which maternal employment may influence child nutritional outcomes, measured by HAZ and WHZ, while the dotted lines indicate the indirect household expenditure pathway examined in the analysis.

3. Data & methods

3.1. Data source

The empirical analysis uses data from the World Bank's Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) for Ethiopia. The LSMS-ISA is a nationally representative household survey that provides detailed information on a wide range of socioeconomic characteristics, including household composition, consumption expenditures, income-generating activities, agricultural

production, asset ownership, and individual time use. The survey also collects anthropometric measurements for children, allowing the analysis of child nutritional outcomes. The availability of time-use information for household members is particularly important for this study, as it enables an examination of the relationship between maternal employment and the allocation of time between market work and childcare activities.

This study uses two waves of the Ethiopian LSMS-ISA, collected in 2018/2019 and 2021/2022. As the survey follows the same households across rounds, the data provide a household panel structure that allows changes in maternal employment and child nutritional outcomes to be examined over time. The analysis focuses on children aged 0–60 months who can be matched with their mothers. The final analytical sample consists of 6,325 child-year observations, including 3,725 observations from the 2018/2019 wave and 2,600 observations from the 2021/2022 wave, representing 3,243 unique mothers.

3.2. Measurement of variables

3.2.1. Dependent variables: measurement of child nutritional outcomes

The two main anthropometric indicators[10] used in this study to measure child nutritional status are the height-for-age z-score (HAZ) and the weight-for-height z-score (WHZ). These indicators are constructed according to the World Health Organization (WHO) Child Growth Standards (World Health Organization, 2006). They serve as the primary outcome variables for assessing child growth and nutritional well-being. In general, HAZ and WHZ are continuous indicators and typically range between −6 and +6 standard deviations. A child with HAZ below −2 standard deviations is classified as stunted, while a child with WHZ below −2 standard deviations is classified as wasted (World Health Organization, 2006; Hosen, Pulok, & Hajizadeh, 2023).

HAZ[11] measures a child's linear growth relative to a well-nourished reference population of the same age and sex. It is calculated as follows:

$$\boldsymbol{HAZ_i = \frac{H_i - M}{SD}} \quad \textbf{(11)}$$

where $\boldsymbol{H_i}$ denotes the observed height of child $\boldsymbol{i}$, $\boldsymbol{M}$ represents the median height of the WHO reference population for children of the same age and sex, and $\boldsymbol{SD}$ is the corresponding standard deviation.

WHZ[12] measures a child's body weight relative to a well-nourished reference population of the same height and sex. It is calculated as follows:

$$\boldsymbol{WHZ_i = \frac{W_i - M}{SD}} \quad \textbf{(12)}$$

where $\boldsymbol{W_i}$ denotes the observed weight of child $\boldsymbol{i}$, $\boldsymbol{M}$ represents the median weight-for-height of the WHO reference population for children of the same height and sex, and $\boldsymbol{SD}$ is the corresponding standard deviation.

[10] Anthropometric indicators are expressed in standard deviation units, or z-scores, relative to the WHO reference population.

[11] A negative mean HAZ within a population indicates that children, on average, fall below the median height of the WHO reference group.

[12] A negative mean WHZ within a population indicates that children, on average, fall below the median weight-for-height of the WHO reference group.

The selection of HAZ and WHZ as outcome variables is motivated by their complementary ability to capture different dimensions of child nutritional status. HAZ is widely recognized as an important indicator of long-term child health and nutritional well-being and is commonly used to monitor progress in reducing chronic undernutrition (UNICEF, 2013; Headey et al., 2015). As a measure of linear growth, HAZ reflects cumulative nutritional conditions experienced during pregnancy and early childhood (Shively, 2017). Therefore, it is particularly relevant for examining the longer-term effects of maternal employment through changes in caregiving time, household resource allocation, and access to food and health-related input (World Health Organization, 2006; Victora, de Onis, Hallal, Blössner, & Shrimpton, 2010). WHZ complements HAZ by capturing children's short-term and acute nutritional status. Unlike HAZ, which reflects cumulative growth deficits, WHZ is more responsive to recent changes in food availability, illness, and household conditions (World Health Organization, 2006; Welthungerhilfe, Concern Worldwide,and Institute for International Law of Peace and Armed Conflict, 2025). Including WHZ allows this study to examine whether maternal employment is associated not only with long-term growth outcomes but also with immediate nutritional conditions. Since body weight responds more rapidly than height to changes in feeding practices, illness, and daily care arrangements, WHZ provides an important measure for identifying short-run pathways through which maternal time constraints and household resource allocation may influence child well-being (Girma & Genebo, 2002).

3.2.2. Independent variable: measurement of maternal labor supply

The main explanatory variable in this study is maternal labor supply, measured through mothers' participation in income-generating activities and the time allocated to work. The LSMS-ISA provides detailed information on maternal work activities, including both on-farm agricultural work and off-farm employment during the seven days preceding the survey. Off-farm employment is further classified into three categories: (i) wage employment, (ii) self-employment, including own-account work and participation in household enterprises, and (iii) temporary labor, including casual and part-time work. The primary measure of maternal labor supply is the number of hours mothers spent working during the seven days preceding the survey. Working hours are measured for total maternal employment and separately for on-farm work, off-farm employment, and the different categories of off-farm activities. This continuous measure captures the intensity of maternal labor supply and allows the analysis to examine how variations in work intensity may influence child nutritional outcomes through changes in maternal time allocation and household resource availability. As a robustness check, the study also considers binary measures of maternal employment status. The overall employment indicator equals one if the mother participated in any income-generating activity during the reference period and zero otherwise. Additional binary indicators are constructed separately for on-farm work, off-farm employment, and each off-farm employment category, taking the value of one when the mother engaged in the respective activity during the seven days preceding the survey.

4. Empirical strategy

4.1. Econometric specification

This study examines the relationship between maternal employment and child nutritional outcomes using child-level panel data. The dependent variable, denoted by $\boldsymbol{CN_{imt}}$, represents the nutritional outcome

of child ($\boldsymbol{i}$), born to mother ($\boldsymbol{m}$), observed at time ($\boldsymbol{t}$). Child nutritional outcomes are measured alternatively using height-for-age z-score (HAZ) and weight-for-height z-score (WHZ). The basic econometric specification is expressed as follows:

$$CN_{imt} = \beta_0 + \beta_1 E_{mt} + \beta_2 {E^2}_{mt} + \beta_3 {E^3}_{mt} + \beta'_4 C_{it} + \beta_5 M_{mt} + \beta'_6 X_{ht} + \beta_7 X_{jt} + \theta_t + \tau_i + \varepsilon_{imt} \quad (13)$$

where $\boldsymbol{E_{mt}}$ represents maternal employment hours of mother ($\boldsymbol{m}$) at time ($\boldsymbol{t}$). The squared and cubic terms of maternal employment hours, ${\boldsymbol{E^2}}_{\boldsymbol{mt}}$ and ${\boldsymbol{E^3}}_{\boldsymbol{mt}}$ are included to capture potential non-linear relationship between maternal labor supply intensity and child nutritional outcomes. This specification allows the effect of maternal employment to vary across different levels of work intensity. For example, moderate levels of maternal employment may improve child nutrition through additional household resources while having limited effects on childcare time, whereas higher levels of employment may increase time constraints and reduce maternal care inputs.

The vector $\boldsymbol{C_{it}}$ includes child-level characteristics, specifically child age in months and its square term. The vector $\boldsymbol{M_{mt}}$ includes maternal characteristics, represented by mother's age. The vector $\boldsymbol{X_{ht}}$ includes household-level characteristics, including household size, female-headed household status, the presence of at least one non-working adult female in the household and food and non-food expenditure. The vector $\boldsymbol{X_{jt}}$ captures environmental factors, including exposure to weather shocks. The term $\boldsymbol{\theta_t}$ denotes survey-year fixed effects, controlling for time-specific factors common across survey rounds. The term $\boldsymbol{\tau_i}$ represents child fixed effects, which control for all time-invariant observed and unobserved characteristics of children and their households. The inclusion of child fixed effects removes bias arising from unobserved characteristics that remain constant over time, while $\boldsymbol{\varepsilon_{imt}}$ denotes the idiosyncratic error term. Standard errors are clustered at the household level to account for within-household correlation and shared shocks affecting children in the same household.

The empirical analysis proceeds in several steps. First, the relationship between overall maternal employment hours and child nutritional outcomes is estimated. Second, maternal employment is separated into on-farm and off-farm activities to examine whether different employment types are associated with different nutritional outcomes. On-farm employment is analyzed only for rural households, where agricultural activities represent an important component of maternal work. Overall employment and off-farm employment are examined for the full sample and separately for rural and urban households. Finally, off-farm employment is further disaggregated into wage employment, self-employment, and temporary labor to investigate whether different forms of off-farm work have heterogeneous associations with child nutrition.

4.2. Correlated random effects model: Mundlak approach

A key econometric concern in this study is that maternal employment may be correlated with unobserved characteristics that also influence child nutritional outcomes. These characteristics may include parental preferences, ability, motivation, or stable household factors that remain constant over time. If these time-invariant unobserved factors are correlated with maternal employment, estimates may be biased. A fixed effects estimator provides one approach to address this concern and is therefore used as a robustness check in this study. However, it is not adopted as the main specification for two reasons. First, the panel

consists of only two survey waves, and fixed effects estimates rely only on within-child variation among children observed in both periods. Since a considerable share of children is observed in only one wave, fixed effects estimation excludes these observations and substantially reduces the available sample. Second, because maternal labor supply is measured over a short reference period, fixed effects estimates may be sensitive to measurement error in employment hours.

Accordingly, this study employs the correlated random effects model based on the Mundlak approach (Mundlak, 1978) as the main specification. It extends the random effects model by including the time averages of time-varying explanatory variables. This allows the unobserved individual-specific component to be correlated with observed characteristics. By incorporating these averages, the model separates the time-varying component of maternal employment from persistent differences across children, mothers, and households. The intuition behind the Mundlak approach is that households with similar average levels of maternal employment and household characteristics are compared while accounting for differences in their time-invariant unobserved characteristics. In this context, the inclusion of Mundlak terms reduces potential bias arising from stable factors that jointly influence maternal employment decisions and child nutritional outcomes.

The Mundlak approach has important advantages in this setting. It is more efficient than the conventional fixed effects estimator when within variation is limited relative to between variation, which is particularly relevant in short panels with only two survey waves. In addition, the joint significance of the time-average variables can be used to assess whether the conventional random effects assumption is violated. If these time-average terms are jointly significant, this suggests that unobserved individual-specific effects are correlated with the explanatory variables and that the correlated random effects specification is more appropriate than a standard random effects model (Wooldridge, 2019).

The Mundlak specification is written as follows:

$$CN_{imt} = \beta_0 + \beta_1 E_{mt} + \beta_2 {E^2}_{mt} + \beta_3 {E^3}_{mt} + \beta'_4 C_{it} + \beta_5 M_{mt} + \beta'_6 X_{ht} + \beta_7 X_{jt} + \beta_8 \tilde{E}_m + \beta_9 \tilde{M}_m + \beta'_{10} \tilde{X}_h + \beta_{11} \tilde{X}_j + \theta_t + \tau_i + \varepsilon_{imt} \quad (14)$$

where all variables are defined as in the basic specification. The individual-specific component in the Mundlak specification captures time-invariant unobserved heterogeneity. The additional Mundlak terms, $\tilde{E}_m$, $\tilde{M}_m$, $\tilde{X}_h$, and $\tilde{X}_j$, represent the time averages of maternal employment hours, maternal characteristics, household characteristics, and environmental factors, respectively. These Mundlak terms account for potential correlation between observed explanatory variables and time-invariant unobserved heterogeneity. Standard errors are clustered at the household level. The coefficients are interpreted as associations between maternal employment and child nutritional outcomes rather than causal effects. Although the Mundlak approach controls for time-invariant unobserved heterogeneity, it cannot fully address bias arising from unobserved factors that vary over time. Therefore, the estimated relationships are interpreted cautiously.

Several robustness checks are conducted to examine whether the findings are sensitive to alternative specifications. First, the Mundlak models are re-estimated using binary indicators of maternal employment instead of employment hours. This allows the analysis to assess whether results depend on measuring maternal labor supply as an intensive margin (hours worked) or an extensive margin (employment

participation). These specifications are estimated for overall employment, on-farm employment, off-farm employment, and different categories of off-farm work. Second, the Mundlak models are estimated using a restricted sample of children observed in both survey waves. This balanced panel specification excludes children with only one observation and examines whether the results remain consistent when the analysis is restricted to children with repeated observations over time. Third, fixed effects models are estimated as an additional robustness check. While the Mundlak approach is preferred as the main specification because it retains time-invariant variables and allows correlation between observed covariates and unobserved heterogeneity, fixed effects provide a stricter control for time-invariant characteristics. Comparing fixed effects estimates with the main Mundlak results helps assess whether the findings are sensitive to the choice of estimator and the measurement of maternal employment.

4.3. Heterogeneity analysis

Child sex is an important dimension along which the relationship between maternal employment and nutritional outcomes may vary. Maternal employment can affect household resources, caregiving time, and intra-household allocation, but these changes may not translate into the same nutritional effects for girls and boys. Therefore, this study conducts a heterogeneity analysis by estimating separate Mundlak regression models for girl and boy children. The objective is to examine whether the association between maternal employment and child nutrition varies by child sex. Separate estimates are reported for both height-for-age z-score (HAZ) and weight-for-height z-score (WHZ).

4.4. Pathway linking maternal employment to child nutritional outcomes

This study further examines household expenditure as a potential pathway through which maternal employment may influence child nutritional outcomes. Existing studies on women's employment and nutrition commonly explore mechanisms by testing whether employment affects intermediate household-level outcomes, such as income, consumption expenditure, food sources, production diversity, bargaining power, or time allocation, and then assessing whether these channels are associated with nutritional outcomes (Debela, Gehrke , & Qaim, 2021; Mutsami , Maina, & Khonje, 2025). Following this approach, the present study focuses specifically on the expenditure pathway. Maternal employment may increase household resources and thereby improve a household's ability to purchase food, health-related goods, and other basic necessities that contribute to child health and nutrition. However, rather than using overall household expenditure as a single aggregate measure, this study distinguishes between food and non-food expenditure in order to better capture the different ways through which household spending may affect child nutritional status.

Food expenditure is expected to represent a more direct nutrition-related channel, as higher spending on food may improve the quantity, quality, and diversity of food available to children. In contrast, non-food expenditure may capture a broader welfare and health environment, including spending on items such as health care, hygiene, clothing, transport, schooling, and other household needs that may indirectly influence child growth and nutritional status. To account for differences in household size and composition, both food and non-food expenditures are measured per adult equivalent using the survey's adult-equivalent scale. Specifically, annual food consumption expenditure and annual non-food consumption expenditure are divided by the number of adult equivalents in the household. The logarithm of each expenditure measure is

then used in the empirical analysis to reduce skewness and allow the coefficients to be interpreted in proportional terms. Therefore, the mechanism analysis focuses on log food expenditure per adult equivalent and log non-food expenditure per adult equivalent as intermediate channels linking maternal employment to child nutritional outcomes.

To examine this pathway empirically, the analysis proceeds in two steps. First, Mundlak regression models are estimated using log food expenditure per adult equivalent and log non-food expenditure per adult equivalent as dependent variables. These models examine whether maternal employment is associated with household spending patterns, holding all other controls constant. The analysis is conducted for different measures of maternal employment, including overall maternal employment, on-farm employment, off-farm employment, and specific types of off-farm work. Second, food and non-food expenditure are included in the child nutrition models to examine whether these expenditure measures are associated with height-for-age z-score (HAZ) and weight-for-height z-score (WHZ). This allows the study to assess whether household expenditure may operate as an indirect channel between maternal employment and child nutritional outcomes. Based on the conceptual framework, a positive association is expected if maternal employment increases household spending and if such spending improves children's nutritional status. Food expenditure may be particularly relevant for access to adequate and diverse diets, while non-food expenditure may support the wider health and care environment. However, because HAZ and WHZ capture different dimensions of nutrition, the expenditure pathway may not operate in the same way across both outcomes or across all types of maternal employment.

5. Results

5.1. Descriptive statistics

Table 1 reports descriptive statistics on the linear growth outcomes of children under five in Ethiopia across the 2019 and 2022 survey waves. The statistics are presented by the sex of the child and maternal employment status, including different types of maternal work. When observations from both waves are considered together, the average height-for-age z-score (HAZ) was −1.796, while 48% of children under five were classified as stunted. The mean HAZ improved from −1.92 in 2019 to −1.61 in 2022, whereas the prevalence of stunting declined from 51% to 43% over the same period. Nutritional outcomes also varied by child sex. Across the two survey waves, male children had a lower mean HAZ than female children, at −1.86 and −1.72, respectively. Similarly, 49% of male children were stunted compared with 46% of female children. These differences were statistically significant when both waves were considered together and in the 2019 survey wave. In 2022, however, the differences by child sex in HAZ and stunting were not statistically significant. When maternal employment was measured using overall employment status, children of employed mothers had an average HAZ of −1.82 and a stunting rate of 49%, compared with a mean HAZ of −1.79 and a stunting rate of 47% among children whose mothers were not employed. The differences in HAZ and stunting were not statistically significant, either across the two survey waves or within the individual survey years. Differences were more evident when maternal employment was classified by type of work. Children whose mothers participated in on-farm work had an average HAZ of −1.96, compared with −1.74 among children whose mothers did not undertake on-farm work. The corresponding stunting rates were 53% and 47%, respectively. These differences were statistically significant when both survey waves were considered together. The differences were not statistically

significant in 2019 but became statistically significant in 2022. In 2022, children whose mothers worked on-farm had a mean HAZ of −1.90 and a stunting rate of 53%, compared with −1.53 and 41%, respectively, among children whose mothers did not participate in on-farm work.

For off-farm employment, children whose mothers worked off-farm had an average HAZ of −1.56 and a stunting rate of 43%, whereas children whose mothers did not work off-farm had an average HAZ of −1.85 and a stunting rate of 49%. These differences were statistically significant when the two waves were considered together. Although no statistically significant differences were observed in 2019, both HAZ and stunting differed significantly by maternal off-farm employment status in 2022. In that year, the mean HAZ was −1.31 among children whose mothers worked off-farm, compared with −1.70 among children whose mothers did not. The corresponding stunting rates were 37% and 46%. Similar differences were observed for maternal wage employment. Across the two survey waves, children whose mothers worked for wages had a mean HAZ of −1.37 and a stunting rate of 39%, compared with −1.83 and 49%, respectively, among children whose mothers did not engage in wage work. These differences were statistically significant. The differences were not statistically significant in 2019 but became statistically significant in 2022. In 2022, the average HAZ was −1.09 among children of mothers engaged in wage employment and −1.67 among children of mothers not engaged in wage employment. Their corresponding stunting rates were 32% and 45%. For maternal self-employment, the differences in children's HAZ and stunting were not statistically significant when both survey waves were considered together or when the years were examined separately. Across the two waves, children whose mothers were self-employed had an average HAZ of −1.72 and a stunting rate of 48%, compared with −1.81 and 48%, respectively, among children whose mothers were not self-employed. Similarly, no statistically significant differences in HAZ or stunting were observed according to maternal participation in temporary work.

Table 1: Linear growth outcomes of children under five in Ethiopia, 2019–2022

	Both waves		**2019**		**2022**	
	Height-for-age z-score	Stunted	Height-for-age z-score	Stunted	Height-for-age z-score	Stunted
Children <5 years	-1.796 (2.09)	0.48 (0.50)	-1.92 (2.08)	0.51 (0.50)	-1.61 (2.08)	0.43 (0.49)
By child sex						
Male child	-1.86 (0.04)	0.49 (0.01)	-1.99 (0.05)	0.54 (0.01)	-1.66 (0.64)	0.44 (0.02)
Female child	-1.72 (0.04)	0.46 (0.01)	-1.84 (0.05)	0.48 (0.01)	-1.55 (0.68)	0.42 (0.02)
p-value	0.021**	0.007***	0.043**	0.003***	0.204	0.440
By overall maternal employment						
Employed	-1.82 (0.05)	0.49 (0.01)	-1.94 (0.06)	0.52 (0.01)	-1.64 (0.07)	0.45 (0.02)
Not employed	-1.79 (0.04)	0.47 (0.01)	-1.92 (0.05)	0.51 (0.01)	-1.61 (0.06)	0.43 (0.02)
p-value	0.584	0.171	0.759	0.520	0.785	0.248
By maternal on-farm work						
On-farm work	-1.96 (0.06)	0.53 (0.01)	-1.99 (0.06)	0.53 (0.02)	-1.90 (0.10)	0.53 (0.02)
No on-farm work	-1.74 (0.04)	0.47 (0.01)	-1.89 (0.05)	0.51 (0.01)	-1.53 (0.05)	0.41 (0.01)
p-value	0.001***	0.000***	0.293	0.279	0.001***	0.000***
By maternal off-farm work						

Off-farm work	-1.56 (0.07)	0.43 (0.02)	-1.81 (0.10)	0.49 (0.02)	-1.31 (0.10)	0.37 (0.02)
No off-farm work	-1.85 (0.03)	0.49 (0.01)	-1.95 (0.04)	0.52 (0.01)	-1.70 (0.53)	0.46 (0.01)
p-value	0.000***	0.002***	0.219	0.498	0.000***	0.002***
By maternal wage work						
Wage work	-1.37 (0.12)	0.39 (0.03)	-1.67 (0.16)	0.45 (0.04)	-1.09 (0.15)	0.32 (0.04)
No wage work	-1.83 (0.03)	0.49 (0.01)	-1.94 (0.04)	0.52 (0.01)	-1.67 (0.05)	0.45 (0.01)
p-value	0.000***	0.000***	0.109	0.125	0.000***	0.002***
By maternal self-employment						
Self-employed	-1.72 (0.09)	0.48 (0.02)	-1.93 (0.13)	0.54 (0.03)	-1.45 (0.14)	0.39 (0.03)
Not self-employed	-1.81 (0.03)	0.48 (0.01)	-1.93 (0.04)	0.51 (0.01)	-1.64 (0.05)	0.44 (0.01)
p-value	0.342	0.729	0.974	0.429	0.216	0.243
By maternal temporary work						
Temporary work	-1.51 (0.29)	0.39 (0.07)	-1.49 (0.74)	0.50 (0.15)	-1.52 (0.31)	0.35 (0.08)
No temporary work	-1.81 (0.03)	0.48 (0.01)	-1.93 (0.04)	0.51 (0.01)	-1.62 (0.05)	0.44 (0.01)
p-value	0.331	0.179	0.467	0.920	0.775	0.286

Notes: For the full sample of children under five, standard deviations are reported in parentheses. For comparisons by child sex and maternal employment categories, standard errors of the group means are reported in parentheses. The reported p-values are based on two-sample t-tests of equality of means between the respective groups. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.10$

Table 2 focuses on acute nutritional outcomes among children under five, measured by weight-for-height z-scores (WHZ) and the prevalence of wasting. The estimates are reported for both survey waves together and separately for 2019 and 2022, with further comparisons by the sex of the child and different categories of maternal employment. Across the two waves, the average WHZ was approximately zero, while 12% of children were classified as wasted. The mean WHZ changed slightly from 0.02 in 2019 to −0.03 in 2022, whereas the prevalence of wasting declined from 14% to 11%. Differences were observed by the sex of the child. Across both waves, male children had a lower mean WHZ than female children, at −0.05 and 0.05, respectively. Wasting was also more prevalent among male children, at 13%, compared with 11% among female children. Both differences were statistically significant. The same pattern was found in 2019, when boys had a lower WHZ and a higher wasting rate than girls. However, neither WHZ nor wasting differed significantly by the sex of the child in 2022. For overall maternal employment, children of employed mothers had a mean WHZ of −0.05, compared with 0.04 among children whose mothers were not employed. This difference was statistically significant at the 10% level when both waves were considered together. The prevalence of wasting was 12% in both groups, and the difference was not statistically significant. No significant differences in either outcome were observed within the separate 2019 and 2022 survey waves. More noticeable differences appeared for maternal on-farm work. Across both waves, children whose mothers worked on-farm had a lower mean WHZ of −0.14, compared with 0.06 among children whose mothers did not participate in on-farm activities. The corresponding wasting rates were 14% and 12%, respectively. The WHZ difference was statistically significant at the 1% level, while the difference in wasting was significant at the 10% level. In 2019, only the difference in WHZ was statistically significant. In 2022, the differences in both WHZ and wasting were significant at the 10% level.

For off-farm employment, the difference in WHZ across both waves was not statistically significant. However, wasting was less prevalent among children whose mothers worked off-farm, at 9%, compared with 13% among children whose mothers did not. In 2019, children of mothers engaged in off-farm work had a higher mean WHZ of 0.24, compared with −0.02 among the comparison group. Their wasting

prevalence was also lower, at 9% compared with 14%. Both differences were statistically significant in 2019, whereas no significant differences were found in 2022. The results for wage employment show no statistically significant differences in either WHZ or wasting. Across both waves, children whose mothers engaged in wage work had a mean WHZ of 0.05 and a wasting rate of 11%, compared with approximately zero and 12%, respectively, among children whose mothers did not engage in wage work. The differences also remained statistically insignificant in both 2019 and 2022. For maternal self-employment, children of self-employed mothers had a lower wasting rate of 8%, compared with 13% among children whose mothers were not self-employed. This difference was statistically significant across both waves. In 2019, children of self-employed mothers also had a higher mean WHZ and a lower prevalence of wasting, and both differences were statistically significant. No statistically significant differences were observed in 2022. Finally, maternal temporary employment was not linked to statistically significant differences in WHZ. Across both waves, wasting was reported for 4% of children whose mothers engaged in temporary work, compared with 12% among children whose mothers did not. This difference was significant at the 10% level. However, no significant differences in either WHZ or wasting were observed within the separate survey years.

Table 2: Acute malnutrition outcomes of children under five in Ethiopia, 2019–2022

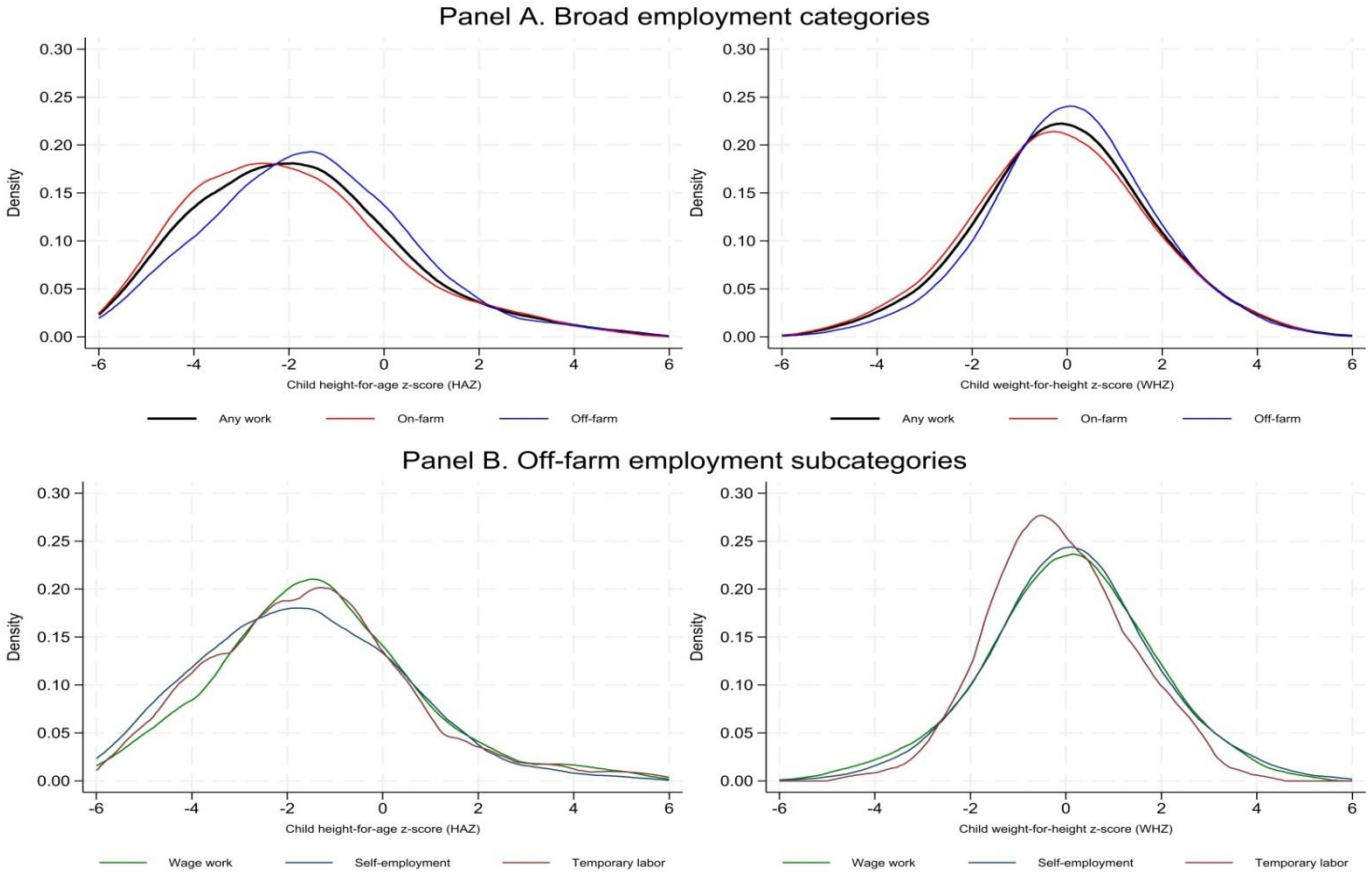
	Both waves		**2019**		**2022**	
	Weight-for-height z-score	Wasted	Weight-for-height z-score	Wasted	Weight-for-height z-score	Wasted
Children <5 years	-0.00 (1.78)	0.12 (0.33)	0.02 (1.88)	0.14 (0.34)	-0.03 (1.68)	0.11 (0.31)
By child sex						
Male child	-0.05 (0.04)	0.13 (0.01)	-0.07 (0.05)	0.15 (0.01)	-0.02 (0.05)	0.11 (0.01)
Female child	0.05 (0.04)	0.11 (0.01)	0.11 (0.05)	0.12 (0.01)	-0.03 (0.05)	0.11 (0.01)
p-value	0.049**	0.021**	0.012**	0.005***	0.935	0.811
By overall maternal employment						
Employed	-0.05 (0.04)	0.12 (0.01)	-0.02 (0.05)	0.13 (0.01)	-0.09 (0.06)	0.12 (0.01)
Not employed	0.04 (0.04)	0.12 (0.01)	0.05 (0.05)	0.14 (0.01)	0.03 (0.05)	0.09 (0.01)
p-value	0.078*	0.830	0.298	0.190	0.110	0.213
By maternal on-farm work						
On-farm work	-0.14 (0.04)	0.14 (0.01)	-0.13 (0.06)	0.14 (0.01)	-0.15 (0.08)	0.13 (0.02)
No on-farm work	0.06 (0.03)	0.12 (0.01)	0.09 (0.04)	0.13 (0.01)	0.01 (0.04)	0.09 (0.01)
p-value	0.000***	0.058*	0.004***	0.481	0.075*	0.071*
By maternal off-farm work						
Off-farm work	0.09 (0.06)	0.09 (0.01)	0.24 (0.09)	0.09 (0.01)	-0.04 (0.08)	0.09 (0.02)
No off-farm work	-0.02 (0.03)	0.13 (0.01)	-0.02 (0.04)	0.14 (0.01)	-0.02 (0.04)	0.11 (0.01)
p-value	0.112	0.004***	0.015**	0.002***	0.768	0.618
By maternal wage work						
Wage work	0.05 (0.09)	0.11 (0.02)	0.15 (0.14)	0.10 (0.02)	-0.04 (0.13)	0.12 (0.03)
No wage work	-0.00 (0.03)	0.12 (0.01)	0.01 (0.04)	0.14 (0.01)	-0.02 (0.04)	0.11 (0.01)
p-value	0.600	0.516	0.373	0.189	0.885	0.486
By maternal self-employment						
Self-employed	0.14 (0.08)	0.08 (0.01)	0.29 (0.11)	0.08 (0.02)	-0.06 (0.11)	0.09 (0.02)
Not self-employed	-0.01 (0.03)	0.13 (0.01)	-0.01 (0.04)	0.14 (0.01)	-0.02 (0.04)	0.11 (0.01)
p-value	0.100	0.007***	0.016**	0.008***	0.768	0.363
By maternal temporary work						

Temporary work	-0.13 (0.18)	0.04 (0.03)	0.21 (0.38)	0.00 (0.00)	-0.23 (0.21)	0.05 (0.04)
No temporary work	0.00 (0.03)	0.12 (0.00)	0.02 (0.04)	0.14 (0.01)	-0.02 (0.04)	0.10 (0.01)
p-value	0.592	0.076*	0.736	0.188	0.431	0.275

Notes: For the full sample of children under five, standard deviations are reported in parentheses. For comparisons by child sex and maternal employment categories, standard errors of the group means are reported in parentheses. The reported p-values are based on two-sample t-tests of equality of means between the respective groups. *** p < 0.01, ** p < 0.05, and * p < 0.10

Figure 2 illustrates the kernel density distributions of children's nutritional outcomes across different categories of maternal employment. Panel A compares broad employment categories, including any work, on-farm work, and off-farm work, while Panel B distinguishes between wage work, self-employment, and temporary labor within off-farm employment. In each panel, the left-hand graph presents the distribution of height-for-age z-scores (HAZ), whereas the right-hand graph shows the distribution of weight-for-height z-scores (WHZ). In Panel A, the distributions suggest that children whose mothers were engaged in off-farm work generally had more favorable HAZ outcomes than those whose mothers worked on-farm, whereas differences in WHZ across the broad employment categories were relatively small. In Panel B, the distributions for wage work, self-employment, and temporary labor show only limited variation.

Figure 2: Kernel density distributions of child nutritional outcomes by maternal employment type



Notes: Panel A compares broad maternal employment categories: any work, on-farm work, and off-farm work. Panel B compares off-farm employment subcategories: wage work, self-employment, and temporary labor. The left column presents child height-for-age z-score (HAZ), while the right column presents child weight-for-height z-score (WHZ).

Together with the descriptive results in Tables 1 and 2, Figure 2 provides preliminary evidence of differences in child nutritional outcomes across maternal employment types. Further descriptive information is provided in Appendix Tables A1-A3. These descriptive comparisons do not account for other factors that may influence child nutrition. The following section presents the regression results after controlling for relevant child, maternal, household, and regional characteristics[13].

5.2. Mundlak regression estimates

Table 3 presents the Mundlak regression estimates for the relationship between maternal weekly employment hours and children's height-for-age z-scores (HAZ) and weight-for-height z-scores (WHZ). The models are estimated for the combined sample and separately for the rural and urban subsamples. All specifications include controls for child, maternal, household, and regional characteristics, together with survey-year fixed effects and the relevant Mundlak terms. Tables 3 and 4 examine the relationship between maternal weekly employment hours and child nutritional outcomes, while the extensive margin, measured using binary indicators of maternal employment participation, is examined separately as a robustness check.

Panel A reports the estimates for overall maternal employment hours, defined as the total number of hours worked across all employment activities, including on-farm and off-farm work. For HAZ, the linear, squared, and cubic terms are statistically significant in both the combined and rural samples and have alternating signs. Considered jointly, these coefficients indicate that the relationship between overall maternal employment hours and child linear growth varies across different levels of working time. In the urban sample, only the linear term is negative and statistically significant at the 10% level, while the squared and cubic terms are statistically insignificant. For WHZ, none of the overall-employment-hours terms is statistically significant in the combined, rural, or urban samples.

Panel B presents the estimates for maternal on-farm working hours, which are reported only for the rural sample. The linear coefficient is negative and statistically significant at the 10% level for HAZ, whereas the squared and cubic terms are statistically insignificant. None of the on-farm-hours terms is significantly associated with children's WHZ.

Panel C reports the estimates for maternal off-farm working hours. For HAZ, no statistically significant relationship is observed in the combined or urban samples. In the rural sample, however, the linear coefficient is negative and statistically significant at the 5% level, while the cubic term is significant at the 10% level. Taken together, these estimates provide some evidence that the relationship between off-farm working hours and child HAZ varies across the range of working hours in rural areas. For WHZ, the off-farm-hours terms are statistically insignificant in the combined and urban samples. In the rural sample, the squared and cubic terms are statistically significant at the 10% level and have opposite signs, suggesting a nonlinear pattern across different levels of off-farm working hours.

[13] Appendix Table A1 reports summary statistics for the variables used in the analysis, Appendix Table A2 presents transitions in mothers' employment status between the 2019 and 2022 survey rounds, and Appendix Table A3 provides additional information on maternal labor force participation and average weekly hours worked across employment categories and survey years.

Overall, the results in Table 3 provide stronger evidence of variation in the relationship between maternal working hours and child HAZ, particularly in rural areas, while the evidence for WHZ is more limited. Because the linear, squared, and cubic terms form a single polynomial specification, their coefficients should be interpreted jointly rather than as separate effects.

Table 3: Maternal working hours by employment type and child nutritional outcomes: Mundlak estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.047***	-0.055***	-0.033*	-0.004	0.005	-0.016
	(0.012)	(0.017)	(0.020)	(0.011)	(0.015)	(0.017)
Work hours squared	0.001***	0.002***	0.001	-0.000	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Work hours cubed	-0.000***	-0.000***	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	-0.038*	n.a	n.a	0.010	n.a
		(0.022)			(0.020)	
On-farm hours squared	n.a	0.001	n.a	n.a	-0.001	n.a
		(0.001)			(0.001)	
On-farm hours cubed	n.a	-0.000	n.a	n.a	0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	-0.011	-0.064**	0.006	-0.005	0.037	-0.020
	(0.016)	(0.033)	(0.019)	(0.013)	(0.024)	(0.015)
Off-farm hours squared	-0.000	0.002	-0.001	0.000	-0.002*	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Off-farm hours cubed	-0.000	-0.000*	0.000	-0.000	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. The full estimation results are provided in Appendix Table A4-A9. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, ex posure to at least one weather shock, and survey-year fixed effects.

Table 4 extends the analysis by examining hours worked in specific types of maternal off-farm employment, namely wage work, self-employment, and temporary labor. The models estimate the relationships between hours worked in each employment category and children's HAZ and WHZ for the combined sample and separately for the rural and urban subsamples. All specifications include the same controls, survey-year fixed effects, and Mundlak terms as those reported in Table 3. Maternal wage-work hours are not significantly associated with child HAZ in the combined, rural, or urban samples. For WHZ, however, the linear, squared, and cubic terms are statistically significant in both the combined and urban samples and display alternating signs. Taken together, these coefficients indicate that the relationship between maternal wage-work hours and WHZ is nonlinear in these samples. No statistically significant association between wage-work hours and WHZ is observed in the rural sample.

For maternal self-employment, the findings differ by nutritional outcome and place of residence. In the rural sample, the linear coefficient for self-employment hours is negative and statistically significant at the 5% level for HAZ, whereas the squared and cubic terms are insignificant. No significant relationship with HAZ is observed in the combined or urban samples. For WHZ, the linear term is positive and statistically significant at the 5% level in the rural sample, while the squared term is negative and significant at the 10% level. These estimates provide some evidence of a nonlinear relationship between maternal self-employment hours and WHZ in rural areas. The corresponding coefficients are statistically insignificant in the combined and urban samples. For maternal temporary-work hours, the linear coefficient is positive and statistically significant at the 5% level for HAZ in the rural sample, while the squared and cubic terms are statistically insignificant. No statistically significant coefficients are observed for HAZ in the combined or urban samples. Temporary-work hours are also not significantly associated with WHZ in any of the three samples.

Overall, the results in Table 4 show that the relationship between maternal off-farm working hours and child nutritional outcomes differs across employment types, nutritional measures, and rural and urban locations. The clearest polynomial pattern is observed for wage-work hours and WHZ in the combined and urban samples, while the statistically significant estimates for self-employment and temporary labor are concentrated mainly in the rural sample. Since the polynomial coefficients must be interpreted jointly, the predicted relationships for the combined sample are presented in Figure 3.

Table 4: Maternal working hours in specific off-farm employment types and child nutritional outcomes: Mundlak estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	-0.008	-0.080	-0.010	-0.049**	-0.054	-0.053**
	(0.027)	(0.106)	(0.029)	(0.023)	(0.074)	(0.026)
Wage hours squared	-0.000	0.003	-0.000	0.002*	0.001	0.002*
	(0.001)	(0.005)	(0.001)	(0.001)	(0.003)	(0.001)
Wage hours cubed	0.000	-0.000	0.000	-0.000*	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	-0.030	-0.081**	0.000	0.017	0.065**	-0.009
	(0.022)	(0.041)	(0.026)	(0.017)	(0.029)	(0.021)
Self-employment hours squared	0.000	0.002	-0.000	-0.000	-0.002*	0.001

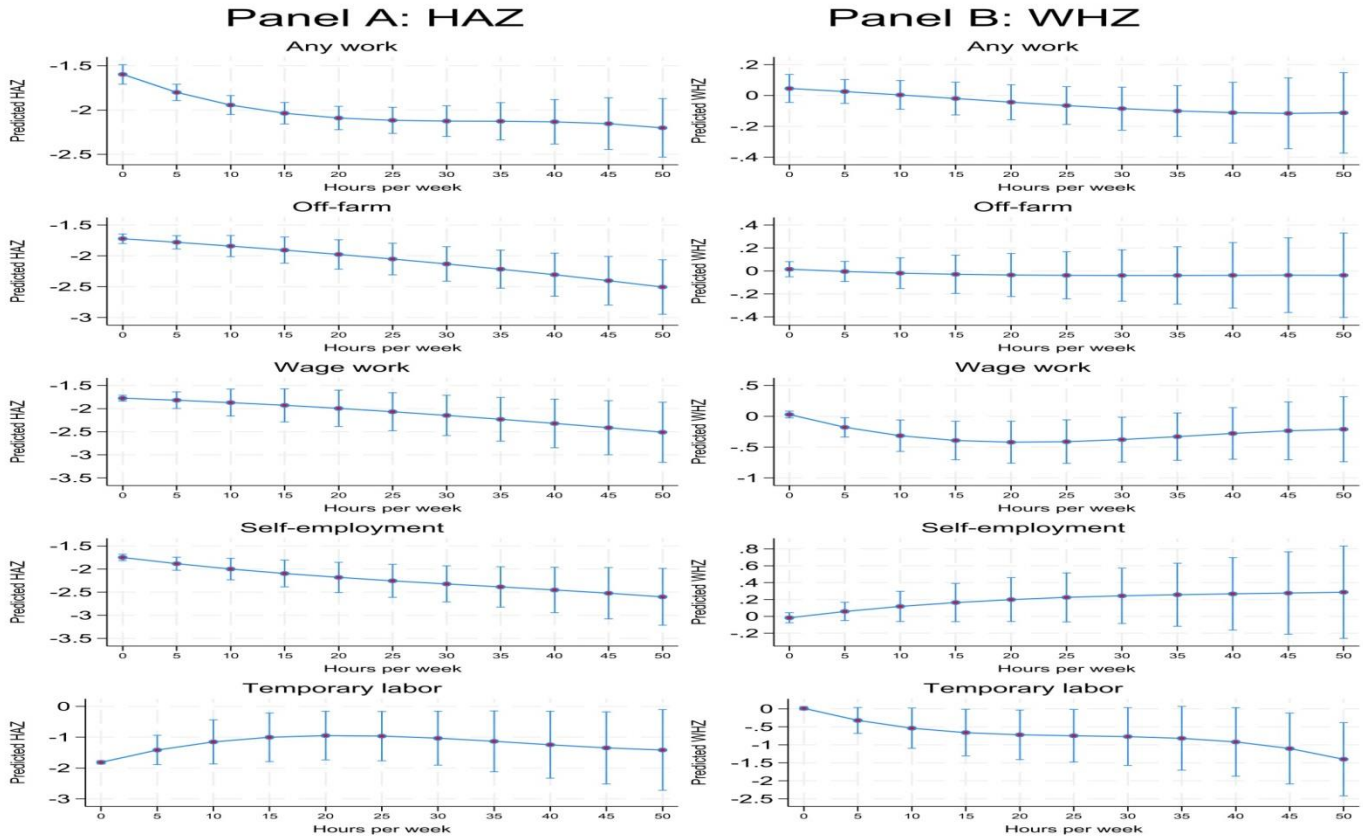
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Self-employment hours cubed	-0.000	-0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	0.095	0.389**	-0.032	-0.081	-0.201	-0.002
	(0.076)	(0.177)	(0.092)	(0.057)	(0.145)	(0.059)
Temporary labor hours squared	-0.003	-0.018	0.003	0.003	0.006	-0.000
	(0.004)	(0.012)	(0.005)	(0.003)	(0.010)	(0.003)
Temporary labor hours cubed	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. The full estimation results are provided in Appendix Table A4-A9. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Figure 3 presents the predicted height-for-age z-scores (HAZ) and weight-for-height z-scores (WHZ) across different levels of maternal weekly employment hours for the combined sample. The predictions are based on the polynomial Mundlak specifications reported in Tables 3 and 4 and reflect the joint implications of the linear, squared, and cubic terms. Predicted HAZ generally declines as maternal employment hours increase for overall employment, off-farm work, wage employment, and self-employment. In contrast, the predicted relationship for temporary labor is nonlinear, with HAZ initially increasing and subsequently declining at higher levels of working time. These patterns indicate that the association between maternal employment intensity and child linear growth differs across employment categories and levels of working time. The predicted WHZ profiles generally display smaller changes across maternal working hours, although a clearer nonlinear pattern is observed for wage employment. Predicted WHZ increases gradually with self-employment hours and declines with temporary-labor hours, but these estimates become increasingly imprecise at higher levels of working time. The widening confidence intervals toward the upper end of the hours distribution indicate that these predictions are less precise and should therefore be interpreted cautiously. Overall, Figure 3 complements the regression estimates by showing the shape of the predicted relationships, which cannot be inferred from the individual polynomial coefficients alone. The corresponding predictions for the rural and urban subsamples are presented in Appendix Figures B1 and B2, respectively[14].

[14]The on-farm predictions are reported only for the rural sample because the corresponding specifications are estimated only for rural households.

Figure 3: Predicted child height-for-age (HAZ) z-score and weight-for-height (WHZ) z-score by maternal employment hours and employment type, combined sample



5.3. Robustness checks

Several robustness checks are conducted to assess whether the main findings are sensitive to alternative measures of maternal employment, estimation methods, and sample restrictions. First, the weekly employment-hours variables are replaced with binary indicators of maternal employment participation. This specification examines the extensive margin of maternal employment rather than variation in the number of hours worked. Second, the models are estimated using the standard fixed-effects estimator instead of the Mundlak approach. Finally, the Mundlak models are re-estimated after excluding children who were observed in only one survey round.

Table 5 presents the results using binary indicators of maternal employment participation. Overall maternal employment is negatively and significantly associated with child HAZ in the combined and urban samples, while no significant relationship is observed for WHZ. On-farm employment is negatively associated with HAZ in the rural sample, whereas off-farm employment is negatively associated with HAZ in the combined and urban samples. These findings are broadly consistent with the main results in showing that the statistically significant associations are more frequently observed for HAZ than for WHZ, although the direction and significance of the estimates vary across employment measures and categories. The results for specific forms of off-farm employment are more varied. Wage employment is negatively associated with HAZ in the urban sample, while self-employment is positively associated with WHZ in the combined sample. Temporary labor is positively associated with HAZ in the combined and rural samples and

negatively associated with WHZ in the combined and rural samples. These differences suggest that employment participation and working hours capture distinct dimensions of maternal labor supply and may therefore produce different associations across employment categories and nutritional outcomes.

Table 5: Maternal employment participation and child nutritional outcomes: Mundlak estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work (1/0)	-0.486***	-0.423	-0.612***	-0.034	-0.156	0.042
	(0.174)	(0.266)	(0.229)	(0.141)	(0.232)	(0.166)
Panel B: On-farm employment						
On-farm work (1/0)	n.a	-0.464*	n.a	n.a	-0.137	n.a
		(0.258)			(0.240)	
Panel C: Off-farm employment						
Off-farm work (1/0)	-0.418*	-0.364	-0.498**	0.013	0.079	-0.038
	(0.236)	(0.567)	(0.252)	(0.171)	(0.378)	(0.192)
Panel D: Specific off-farm employment						
Wage work (1/0)	-0.571	-0.413	-0.665*	-0.344	-0.994	-0.215
	(0.359)	(1.359)	(0.351)	(0.251)	(0.777)	(0.256)
Self-employment work (1/0)	-0.461	-0.602	-0.420	0.363*	0.519	0.236
	(0.287)	(0.593)	(0.315)	(0.219)	(0.349)	(0.278)
Temporary labor work (1/0)	1.185**	1.665***	1.004	-0.778*	-1.559***	-0.543
	(0.507)	(0.382)	(0.654)	(0.440)	(0.395)	(0.546)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment dummy variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Tables 6 and 7 report the results obtained using the fixed-effects estimator[15]. In Table 6, the linear, squared, and cubic terms for overall maternal employment hours remain statistically significant for HAZ in the combined and rural samples and retain the alternating signs observed in the main Mundlak estimates. This provides further support for a nonlinear relationship between overall maternal employment hours and child HAZ. For WHZ, the linear and squared terms for overall maternal employment hours are statistically

[15]Appendix Table A10 shows the effects of maternal employment participation on child height for age z-score and weight for height z-score using fixed effects estimates

insignificant across all samples, while the cubic term is weakly significant only in the rural sample. For on-farm employment, none of the linear, squared, or cubic terms is statistically significant for either HAZ or WHZ in the rural sample. Although the linear HAZ coefficient remains negative, the weakly significant association observed in the main Mundlak estimates is no longer statistically significant under the fixed-effects specification. For off-farm employment, the HAZ coefficients are also statistically insignificant across the combined, rural, and urban samples. However, the linear, squared, and cubic terms for WHZ are statistically significant in the rural sample and retain alternating signs, broadly supporting the nonlinear pattern found in the main analysis.

Table 6: Maternal employment hours and child nutritional outcomes: fixed-effects estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.073**	-0.117***	-0.018	0.027	0.040	0.011
	(0.030)	(0.042)	(0.039)	(0.027)	(0.037)	(0.037)
Work hours squared	0.003**	0.005***	0.001	-0.001	-0.003	-0.000
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Work hours cubed	-0.000**	-0.000***	-0.000	0.000	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	-0.076	n.a	n.a	0.049	n.a
		(0.048)			(0.053)	
On-farm hours squared	n.a	0.003	n.a	n.a	-0.004	n.a
		(0.003)			(0.003)	
On-farm hours cubed	n.a	-0.000	n.a	n.a	0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	0.018	-0.078	0.035	0.014	0.122**	-0.010
	(0.031)	(0.064)	(0.033)	(0.027)	(0.056)	(0.031)
Off-farm hours squared	-0.001	0.003	-0.002	-0.000	-0.005*	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Off-farm hours cubed	0.000	-0.000	0.000	-0.000	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	Yes	yes	yes	yes	yes
Maternal characteristics	yes	Yes	yes	yes	yes	yes
Household characteristics	yes	Yes	yes	yes	yes	yes
Region-specific shocks	yes	Yes	yes	yes	yes	yes
Year fixed effects	yes	Yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

The fixed-effects estimates for specific types of off-farm employment provide weaker evidence than the main Mundlak estimates. As shown in Table 7, the wage-work and self-employment terms are statistically insignificant across the different samples and nutritional outcomes. By contrast, temporary-labor hours display a significant nonlinear relationship with WHZ in the rural sample. In the urban sample, only the cubic term is weakly significant, while the linear and squared terms are statistically insignificant. Overall, these results indicate that the relationship between overall maternal employment hours and child HAZ is relatively robust to the choice of estimator, whereas the findings for on-farm work and specific forms of off-farm employment are more sensitive to the estimation method.

Table 7: Maternal working hours in specific off-farm employment types and child nutritional outcomes: fixed-effects estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	-0.015	-0.131	0.009	-0.042	-0.079	-0.047
	(0.062)	(0.302)	(0.061)	(0.053)	(0.125)	(0.059)
Wage hours squared	0.000	0.005	-0.000	0.001	0.007	0.001
	(0.002)	(0.016)	(0.002)	(0.002)	(0.008)	(0.003)
Wage hours cubed	0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	-0.003	-0.103	0.020	0.047	0.131	0.011
	(0.041)	(0.079)	(0.046)	(0.037)	(0.083)	(0.043)
Self-employment hours squared	-0.000	0.003	-0.001	-0.000	-0.004	0.001
	(0.002)	(0.004)	(0.002)	(0.001)	(0.004)	(0.002)
Self-employment hours cubed	0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	0.151	-0.076	0.214	0.027	-0.404***	0.009
	(0.151)	(0.216)	(0.187)	(0.115)	(0.104)	(0.105)
Temporary labor hours squared	-0.005	0.007	-0.010	0.000	0.026***	0.004
	(0.007)	(0.014)	(0.009)	(0.005)	(0.007)	(0.005)
Temporary labor hours cubed	0.000	-0.000	0.000	-0.000	-0.000***	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	Yes	yes	yes	yes	yes
Maternal characteristics	yes	Yes	yes	yes	yes	yes
Household characteristics	yes	Yes	yes	yes	yes	yes
Region-specific shocks	yes	Yes	yes	yes	yes	yes
Year fixed effects	yes	Yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Tables 8 and 9 restrict the sample to children observed in both survey rounds. This restriction examines whether the findings are affected by the inclusion of children for whom no within-child variation over time is available. In Table 8, the linear, squared, and cubic terms for overall maternal employment

hours are statistically significant for HAZ in the combined, rural, and urban samples. Their alternating signs are consistent with the nonlinear pattern found in the main analysis. None of the corresponding terms is statistically significant for WHZ. For on-farm employment, the linear, squared, and cubic terms are statistically insignificant for both HAZ and WHZ in the rural sample. For off-farm employment, the linear term is negative and weakly significant for HAZ in the combined sample, while the corresponding estimates are insignificant in the rural and urban samples. None of the off-farm-hours terms is statistically significant for WHZ in the combined, rural, or urban samples. Taken together, the restricted-sample results in Table 8 continue to support the nonlinear relationship between overall maternal employment hours and child HAZ, whereas the evidence for WHZ remains limited.

Table 8: Maternal employment hours and child nutritional outcomes: Mundlak estimates excluding children observed only once

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.064***	-0.059**	-0.075***	0.002	-0.011	0.019
	(0.020)	(0.028)	(0.029)	(0.016)	(0.023)	(0.023)
Work hours squared	0.002***	0.002*	0.002**	-0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Work hours cubed	-0.000***	-0.000**	-0.000**	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	-0.051	n.a	n.a	-0.005	n.a
		(0.036)			(0.033)	
On-farm hours squared	n.a	0.002	n.a	n.a	-0.001	n.a
		(0.002)			(0.002)	
On-farm hours cubed	n.a	-0.000	n.a	n.a	0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	-0.041*	-0.073	-0.032	0.012	0.058	-0.001
	(0.024)	(0.052)	(0.028)	(0.019)	(0.040)	(0.020)
Off-farm hours squared	0.001	0.002	0.001	-0.000	-0.002	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Off-farm hours cubed	-0.000	-0.000	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	Yes	yes	yes	yes	yes
Maternal characteristics	yes	Yes	yes	yes	yes	yes
Household characteristics	yes	Yes	yes	yes	yes	yes
Region-specific shocks	yes	Yes	yes	yes	yes	yes
Year fixed effects	yes	Yes	yes	yes	yes	yes
Mundlak variables	yes	Yes	yes	yes	yes	yes
Observations	1,374	660	714	1,345	649	696

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed

household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Table 9 presents the results for specific types of off-farm employment after restricting the sample to children observed in both survey rounds. For wage employment, none of the linear, squared, or cubic terms is statistically significant for HAZ in the combined, rural, or urban samples. For WHZ, however, the linear, squared, and cubic terms are statistically significant in the urban sample and retain alternating signs. This result is consistent with the nonlinear relationship between wage-work hours and WHZ found for the urban sample in the main analysis. The corresponding wage-work estimates are statistically insignificant for WHZ in the combined and rural samples. For self-employment, the linear term is negative and statistically significant for HAZ in both the combined and rural samples, while the higher-order terms are insignificant. This provides additional support for the negative rural association observed in the main results, although the relationship also becomes significant in the combined sample under the restricted specification. For WHZ, the linear self-employment term is positive and weakly significant only in the combined sample, while all corresponding terms are insignificant in the rural and urban samples. Thus, the nonlinear rural WHZ pattern found in the main analysis is not preserved in the restricted sample. For temporary labor, the linear, squared, and cubic terms are statistically significant for HAZ in the rural sample and display alternating signs, indicating a nonlinear relationship. No significant relationship with HAZ is found in the combined or urban samples. For WHZ, temporary-labor hours display a significant nonlinear pattern in the combined sample, with significant linear, squared, and cubic terms. In the rural sample, the linear and squared terms are statistically significant and have opposite signs, while the cubic term is insignificant. None of the temporary-labor terms is statistically significant for WHZ in the urban sample.

Table 9: Maternal working hours in specific off-farm employment types and child nutritional outcomes: Mundlak estimates excluding children observed only once

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	-0.020	-0.007	-0.023	-0.053	-0.163	-0.062*
	(0.038)	(0.357)	(0.036)	(0.034)	(0.154)	(0.034)
Wage hours squared	-0.000	0.000	0.000	0.002	0.012	0.002*
	(0.001)	(0.020)	(0.001)	(0.001)	(0.009)	(0.001)
Wage hours cubed	0.000	-0.000	0.000	-0.000	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	-0.067**	-0.122*	-0.044	0.046*	0.056	0.035
	(0.034)	(0.066)	(0.042)	(0.026)	(0.056)	(0.029)
Self-employment hours squared	0.002	0.004	0.001	-0.001	-0.001	-0.001
	(0.001)	(0.003)	(0.002)	(0.001)	(0.003)	(0.001)
Self-employment hours cubed	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	0.046	0.457***	-0.025	-0.145**	-0.399***	-0.076
	(0.089)	(0.096)	(0.093)	(0.066)	(0.132)	(0.076)
Temporary labor hours squared	-0.002	-0.024***	0.001	0.006*	0.017*	0.004
	(0.004)	(0.007)	(0.005)	(0.003)	(0.010)	(0.005)
Temporary labor hours cubed	0.000	0.000***	-0.000	-0.000**	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Child characteristics	yes	Yes	yes	yes	yes	yes
Maternal characteristics	yes	Yes	yes	yes	yes	yes
Household characteristics	yes	Yes	yes	yes	yes	yes
Region-specific shocks	yes	Yes	yes	yes	yes	yes
Year fixed effects	yes	Yes	yes	yes	yes	yes
Mundlak variables	yes	Yes	yes	yes	yes	yes
Observations	1,374	660	714	1,345	649	696

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Overall, the robustness checks provide broad support for the main finding that overall maternal employment hours are nonlinearly associated with child HAZ. In the restricted sample, this pattern is observed in the combined, rural, and urban samples. The evidence for WHZ remains comparatively limited and is concentrated in selected forms of off-farm employment. However, the results for on-farm work and specific off-farm employment categories vary across alternative employment measures, estimators, and sample restrictions. These findings should therefore be interpreted with appropriate caution.

5.4. Heterogeneity by child sex

To examine whether the relationship between maternal employment hours and child nutritional outcomes varies by child sex, separate Mundlak models are estimated for girls and boys. The models are estimated for the combined sample and separately for the rural and urban subsamples. Tables 10 and 11 present the results for height-for-age z-scores (HAZ), while Tables 12 and 13 report the corresponding results for weight-for-height z-scores (WHZ). Because the models include linear, squared, and cubic terms, the polynomial coefficients are interpreted jointly where more than one term is statistically significant.

Table 10 presents the estimates for overall, on-farm, and off-farm maternal employment hours and child HAZ. For girls, the linear coefficient for overall maternal employment hours is negative and statistically significant in the combined sample, while the squared and cubic terms are statistically insignificant. None of the overall-employment-hours terms is statistically significant for girls in the rural or urban samples. For boys, the linear, squared, and cubic terms for overall maternal employment hours are statistically significant in both the combined and rural samples and display alternating signs. Considered jointly, these coefficients indicate a nonlinear relationship between overall maternal employment hours and boys' HAZ in the combined and rural samples. None of the corresponding terms is statistically significant for boys in the urban sample. For on-farm employment, none of the linear, squared, or cubic terms is statistically significant for girls in the rural sample. Among boys, the linear coefficient is negative and statistically significant at the 10 percent level, whereas the squared and cubic terms are statistically insignificant. This provides limited evidence of a negative association between maternal on-farm hours and boys' HAZ in rural areas. For off-farm employment, none of the employment-hours terms is statistically significant for girls in the combined, rural, or urban samples. Among boys, all three terms are statistically insignificant in the combined sample. In the rural sample, the linear coefficient is negative and statistically

significant at the 10 percent level, while the squared and cubic terms are insignificant. In the urban sample, the squared and cubic terms are statistically significant at the 10 percent level and have opposite signs, whereas the linear term is insignificant. These estimates provide some evidence of a nonlinear relationship between maternal off-farm hours and boys' HAZ in urban areas.

Table 10: Maternal employment hours and child height-for-age z-score by child sex: Mundlak estimates

	Girls			Boys		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.036**	-0.031	-0.039	-0.056***	-0.078***	-0.018
	(0.017)	(0.023)	(0.028)	(0.017)	(0.023)	(0.026)
Work hours squared	0.001	0.001	0.001	0.002***	0.003***	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Work hours cubed	-0.000	-0.000	-0.000	-0.000**	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	-0.019	n.a	n.a	-0.055*	n.a
		(0.031)			(0.031)	
On-farm hours squared	n.a	0.001	n.a	n.a	0.002	n.a
		(0.001)			(0.001)	
On-farm hours cubed	n.a	-0.000	n.a	n.a	-0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	-0.023	-0.054	-0.015	0.003	-0.068*	0.030
	(0.023)	(0.044)	(0.028)	(0.022)	(0.041)	(0.024)
Off-farm hours squared	0.000	0.002	-0.000	-0.000	0.002	-0.002*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Off-farm hours cubed	-0.000	-0.000	0.000	0.000	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	2,246	1,229	1,017	2,392	1,344	1,048

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Table 11 further disaggregates maternal off-farm employment into wage work, self-employment, and temporary labor. Maternal wage-work hours are not significantly associated with HAZ for either girls or boys in the combined, rural, or urban samples. For self-employment, the linear coefficient is negative and

statistically significant at the 10 percent level for girls in the combined sample, while the squared and cubic terms are insignificant. None of the self-employment-hours terms is statistically significant for girls in the rural or urban samples. Among boys, the self-employment-hours terms are statistically insignificant in the combined sample. In the rural sample, the linear coefficient is negative and statistically significant at the 10 percent level, whereas the squared and cubic terms are insignificant. In the urban sample, the squared and cubic terms are statistically significant at the 10 percent level and have opposite signs, while the linear term is insignificant. This provides some evidence of a nonlinear relationship between maternal self-employment hours and boys' HAZ in urban areas. The estimates for temporary labor also show different patterns across the sex-specific samples. None of the linear, squared, or cubic terms is statistically significant for girls in the combined, rural, or urban samples. For boys, however, all three terms are statistically significant in the combined and urban samples and display alternating signs. Taken together, these coefficients indicate a nonlinear relationship between maternal temporary-labor hours and boys' HAZ in the combined and urban samples. None of the temporary-labor-hours terms is statistically significant for boys in the rural sample.

Table 11: Maternal working hours in specific off-farm employment types and child height-for-age z-score by child sex: Mundlak estimates

	Girls			Boys		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	0.000	-0.071	0.013	-0.009	-0.113	-0.021
	(0.044)	(0.130)	(0.049)	(0.031)	(0.166)	(0.033)
Wage hours squared	-0.000	0.002	-0.001	-0.000	0.005	-0.000
	(0.002)	(0.006)	(0.002)	(0.001)	(0.007)	(0.001)
Wage hours cubed	-0.000	-0.000	0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	-0.049*	-0.048	-0.038	-0.009	-0.090*	0.046
	(0.028)	(0.053)	(0.034)	(0.030)	(0.049)	(0.035)
Self-employment hours squared	0.001	0.001	0.001	-0.000	0.002	-0.002*
	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Self-employment hours cubed	-0.000	-0.000	-0.000	0.000	-0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	0.052	0.504	-0.031	0.184**	0.255	0.256**
	(0.129)	(0.352)	(0.130)	(0.076)	(0.178)	(0.108)
Temporary labor hours squared	-0.001	-0.026	0.003	-0.009*	-0.008	-0.018**
	(0.006)	(0.024)	(0.007)	(0.005)	(0.012)	(0.007)
Temporary labor hours cubed	-0.000	0.000	-0.000	0.000*	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	2,246	1,229	1,017	2,392	1,344	1,048

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its

square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Table 12 reports the results for overall, on-farm, and off-farm maternal employment hours and child WHZ. For girls, none of the overall-employment-hours terms is statistically significant in the combined or rural samples. In the urban sample, the linear coefficient is negative and statistically significant at the 10 percent level, while the squared and cubic terms are insignificant. For boys, none of the linear, squared, or cubic terms for overall maternal employment hours is statistically significant in the combined, rural, or urban samples. Thus, the results provide little evidence of a relationship between overall maternal employment hours and boys' WHZ. Maternal on-farm employment hours are not significantly associated with WHZ for either girls or boys in the rural sample. None of the linear, squared, or cubic terms is statistically significant for either group. For off-farm employment, the results vary across child sex and location. Among girls, the squared and cubic terms are statistically significant at the 10 percent level in the combined sample and have opposite signs, while the linear term is insignificant. Taken together, these estimates provide some evidence of a nonlinear relationship between maternal off-farm hours and girls' WHZ in the combined sample. In the urban sample, the linear, squared, and cubic terms are all statistically significant at the 10 percent level and display alternating signs, indicating a nonlinear relationship between maternal off-farm hours and girls' WHZ. None of the corresponding terms is statistically significant for girls in the rural sample. Among boys, the off-farm-hours terms are statistically insignificant in the combined and urban samples. In the rural sample, the squared and cubic terms are statistically significant at the 5 percent level and have opposite signs, while the linear coefficient is insignificant. These estimates provide evidence of a nonlinear relationship between maternal off-farm hours and boys' WHZ in rural areas.

Table 12: Maternal employment hours and child weight-for-height z-score by child sex: Mundlak estimates

	Girls			Boys		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.016	0.001	-0.043*	0.010	0.007	0.010
	(0.014)	(0.019)	(0.023)	(0.015)	(0.020)	(0.025)
Work hours squared	0.001	-0.000	0.001	-0.001	-0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Work hours cubed	-0.000	0.000	-0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	-0.002	n.a	n.a	0.015	n.a
		(0.025)			(0.029)	
On-farm hours squared	n.a	-0.000	n.a	n.a	-0.002	n.a
		(0.001)			(0.001)	
On-farm hours cubed	n.a	0.000	n.a	n.a	0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	-0.028	0.020	-0.039*	0.020	0.046	-0.000
	(0.017)	(0.033)	(0.021)	(0.019)	(0.033)	(0.023)
Off-farm hours squared	0.001*	-0.000	0.001*	-0.001	-0.002**	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

Off-farm hours cubed	-0.000*	0.000	-0.000*	0.000	0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	2,193	1,216	977	2,322	1,313	1,009

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Table 13 presents the WHZ estimates for specific types of maternal off-farm employment. None of the wage-work-hours terms is statistically significant for either girls or boys in the combined, rural, or urban samples. For self-employment, none of the linear, squared, or cubic terms is statistically significant for girls in any of the samples. Among boys, however, the linear, squared, and cubic terms are statistically significant in the combined sample and display alternating signs. The same pattern is observed in the rural sample, where all three terms are statistically significant and retain alternating signs. Taken together, these coefficients indicate a nonlinear relationship between maternal self-employment hours and boys' WHZ in the combined and rural samples. None of the self-employment-hours terms is statistically significant for boys in the urban sample. For temporary labor, none of the linear, squared, or cubic terms is statistically significant for either girls or boys in the combined, rural, or urban samples. The results therefore provide little evidence of a relationship between maternal temporary-labor hours and WHZ in the sex-specific samples.

Table 13: Maternal working hours in specific off-farm employment types and child weight-for-height z-score by child sex: Mundlak estimates

	Girls			Boys		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	-0.044	-0.009	-0.045	-0.051	-0.190	-0.055
	(0.032)	(0.078)	(0.038)	(0.034)	(0.145)	(0.036)
Wage hours squared	0.002	-0.001	0.002	0.002	0.008	0.002
	(0.001)	(0.003)	(0.001)	(0.001)	(0.006)	(0.001)
Wage hours cubed	-0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	-0.016	0.043	-0.040	0.049**	0.067*	0.025
	(0.021)	(0.044)	(0.026)	(0.025)	(0.038)	(0.035)
Self-employment hours squared	0.001	0.000	0.001	-0.002*	-0.003**	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Self-employment hours cubed	-0.000	-0.000	-0.000	0.000*	0.000*	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	-0.102	-0.178	0.003	-0.053	-0.285	-0.079

	(0.097)	(0.265)	(0.085)	(0.085)	(0.194)	(0.065)
Temporary labor hours squared	0.005	-0.003	0.000	0.000	0.015	0.003
	(0.004)	(0.019)	(0.004)	(0.005)	(0.014)	(0.004)
Temporary labor hours cubed	-0.000	0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	2,193	1,216	977	2,322	1,313	1,009

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects.

Taken together, the sex-specific estimates display different patterns across child sex, employment type, nutritional outcome, and place of residence. For HAZ, the clearest nonlinear relationships are observed for boys, particularly for overall maternal employment hours in the combined and rural samples and for temporary-labor hours in the combined and urban samples. For WHZ, nonlinear relationships with off-farm employment hours are observed among urban girls and rural boys, while the relationship between self-employment hours and WHZ is concentrated among boys in the combined and rural samples. The estimates for on-farm work and wage employment are generally statistically insignificant for both girls and boys.

One possible interpretation is that the more pronounced patterns observed among boys reflect differences in how maternal employment-related changes in caregiving time and household resources affect girls and boys, particularly where parental preferences or intra-household resource allocation vary by child sex (Debela, Gehrke, & Qaim, 2021; Mutsami, Maina, & Khonje, 2025). However, this interpretation remains tentative because the analysis does not directly observe parental sex preferences, maternal bargaining power, or the allocation of food and care by child sex. Moreover, because the models are estimated separately for girls and boys, the observed differences should be interpreted as descriptive patterns rather than formal evidence that the estimated coefficients differ statistically by child sex.

5.5. Potential pathway: household food and non-food expenditure

One potential pathway through which maternal employment may be related to child nutritional outcomes is household expenditure. Maternal employment may increase household resources available for food and other necessities. At the same time, longer working hours may influence household production, meal preparation, and the allocation of household resources. The analysis therefore proceeds in two steps. First, Tables 14 and 15 examine whether maternal employment hours are associated with household food and non-food expenditure. Second, Table 16 examines whether food and non-food expenditure are associated with children's height-for-age z-scores (HAZ) and weight-for-height z-scores (WHZ). These

results provide suggestive evidence on the household expenditure pathway rather than a formal mediation analysis.

Table 14 presents the relationships between overall, on-farm, and off-farm maternal employment hours and household food and non-food expenditure. For overall maternal employment, the linear coefficient is negative and statistically significant for food expenditure in the combined sample, while the squared and cubic terms are insignificant. In the rural sample, only the cubic term is weakly significant, whereas none of the terms is significant in the urban sample. Because the linear and squared terms are insignificant in the rural sample, the isolated significance of the cubic term does not provide clear evidence of a stable nonlinear relationship. For non-food expenditure, the linear, squared, and cubic terms for overall maternal employment hours are statistically significant in the combined sample and display alternating signs. Considered jointly, these estimates indicate a nonlinear relationship between overall maternal employment hours and non-food expenditure. In the urban sample, the negative linear and positive squared terms are statistically significant, while the cubic term is insignificant, providing some evidence of nonlinearity. None of the corresponding terms is statistically significant in the rural sample. For on-farm employment, none of the linear, squared, or cubic terms is statistically significant for either food or non-food expenditure in the rural sample. The results therefore provide little evidence that maternal on-farm hours are associated with household expenditure. The results for off-farm employment differ from those for overall and on-farm employment. For food expenditure, the linear coefficient is positive and statistically significant at the 10 percent level in the combined sample, while the squared and cubic terms are insignificant. No significant relationship is observed in the rural or urban samples. For non-food expenditure, the linear, squared, and cubic terms are statistically significant in both the combined and rural samples and display alternating signs. These estimates indicate a nonlinear relationship between maternal off-farm hours and non-food expenditure in these samples. None of the off-farm-hours terms is statistically significant for non-food expenditure in the urban sample.

Table 14: Maternal employment hours and household food and non-food expenditure: Mundlak estimates

	Food expenditure			Non-food expenditure		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work hours	-0.009**	0.008	-0.006	-0.035***	0.000	-0.020**
	(0.004)	(0.006)	(0.006)	(0.006)	(0.007)	(0.009)
Work hours squared	0.000	-0.000	0.000	0.001***	0.000	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Work hours cubed	-0.000	0.000*	-0.000	-0.000***	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: On-farm employment						
On-farm hours	n.a	0.005	n.a	n.a	-0.007	n.a
		(0.008)			(0.010)	
On-farm hours squared	n.a	-0.000	n.a	n.a	0.001	n.a
		(0.000)			(0.000)	
On-farm hours cubed	n.a	0.000	n.a	n.a	-0.000	n.a
		(0.000)			(0.000)	
Panel C: Off-farm employment						
Off-farm hours	0.010*	0.018	0.002	0.029***	0.048***	0.007

	(0.005)	(0.012)	(0.006)	(0.007)	(0.012)	(0.008)
Off-farm hours squared	-0.000	-0.000	-0.000	-0.001***	-0.001***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Off-farm hours cubed	0.000	0.000	0.000	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	5,860	3,181	2,679	5,866	3,182	2,684

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. The on-farm specifications are estimated only for the rural sample. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects. Food and non-food expenditure are measured as the natural logarithm of expenditure per adult equivalent.

Table 15 further disaggregates off-farm employment into wage work, self-employment, and temporary labor. For wage employment, the linear, squared, and cubic terms are statistically significant for both expenditure measures in the rural sample and display alternating signs. Taken together, these coefficients indicate nonlinear relationships between maternal wage-work hours and both expenditure measures in rural households. None of the wage-work-hours terms is statistically significant in the combined or urban samples. For self-employment, the linear coefficient is positive and weakly significant for food expenditure in the combined sample, while the squared and cubic terms are insignificant. No statistically significant relationship with food expenditure is observed in the rural or urban samples. For non-food expenditure, the linear, squared, and cubic terms are statistically significant in the combined sample and display alternating signs, indicating a nonlinear relationship. In the rural sample, the positive linear and negative squared terms are statistically significant, while the cubic term is insignificant, providing some evidence of a nonlinear relationship. None of the self-employment-hours terms is statistically significant for non-food expenditure in the urban sample. For temporary labor, none of the employment-hours terms is statistically significant for food expenditure in the combined or urban samples. In the rural sample, the squared and cubic terms are statistically significant and have opposite signs, while the linear term is insignificant. These results provide suggestive evidence of a nonlinear relationship between temporary-labor hours and rural food expenditure. None of the temporary-labor-hours terms is statistically significant for non-food expenditure in the combined, rural, or urban samples.

Table 15: Maternal working hours in specific off-farm employment types and household food and non-food expenditure: Mundlak estimates

	Food expenditure			Non-food expenditure		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	0.006	0.069**	-0.004	0.011	0.115***	-0.016
	(0.008)	(0.027)	(0.009)	(0.013)	(0.043)	(0.015)
Wage hours squared	-0.000	-0.003**	0.000	-0.000	-0.004**	0.000

	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)
Wage hours cubed	-0.000	0.000**	-0.000	0.000	0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours	0.012*	0.017	0.005	0.031***	0.040***	0.016
	(0.007)	(0.014)	(0.008)	(0.008)	(0.013)	(0.011)
Self-employment hours squared	-0.000	-0.000	-0.000	-0.001***	-0.001**	-0.001
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Self-employment hours cubed	0.000	0.000	0.000	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Temporary labor hours	-0.004	0.044	-0.025	-0.004	0.046	-0.048
	(0.026)	(0.051)	(0.031)	(0.034)	(0.059)	(0.037)
Temporary labor hours squared	-0.000	-0.005*	0.001	-0.000	-0.003	0.002
	(0.001)	(0.003)	(0.002)	(0.002)	(0.005)	(0.002)
Temporary labor hours cubed	0.000	0.000**	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes
Observations	5,860	3,181	2,679	5,866	3,182	2,684

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Only the coefficients for the employment-hours variables are reported. All specifications include controls for child age in months and its square, mother's age, household size, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects. Food and non-food expenditure are measured as the natural logarithm of expenditure per adult equivalent.

Table 16 examines whether household food and non-food expenditure are associated with child nutritional outcomes. Food expenditure is positively and statistically associated with HAZ in the combined, rural, and urban samples. Non-food expenditure is also positively associated with HAZ in all three samples, although the strength of the statistical significance varies across location. These findings indicate that higher food and non-food expenditure are each associated with higher child HAZ across the combined, rural, and urban samples. The results for WHZ are less consistent. Food expenditure is not statistically significantly associated with WHZ in the combined, rural, or urban samples. Non-food expenditure is negatively associated with WHZ at the 10 percent level in the combined and rural samples, while the urban coefficient is statistically insignificant. Thus, the expenditure measures show a clearer relationship with HAZ than with WHZ.

Table 16: Household food and non-food expenditure and child nutritional outcomes: Mundlak estimates

	Food expenditure			Non-food expenditure		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Height-for-age z-score (HAZ)	0.439***	0.483***	0.408**	0.301***	0.271*	0.294**
	(0.121)	(0.175)	(0.163)	(0.096)	(0.147)	(0.119)
Observations	4,638	2,573	2,065	4,643	2,573	2,070
Weight-for-height z-score (WHZ)	-0.152	-0.150	-0.204	-0.144*	-0.217*	-0.062

	(0.107)	(0.154)	(0.147)	(0.085)	(0.127)	(0.108)
Observations	4,515	2,529	1,986	4,520	2,529	1,991
Child characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes
Region-specific shocks	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes
Mundlak variables	yes	yes	yes	yes	yes	yes

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. All specifications include controls for child age in months and its square, mother's age, household size, female-headed household status, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey-year fixed effects. Food and non-food expenditure are entered separately in the respective specifications and are expressed in natural logarithms per adult equivalent.

Taken together, the findings provide mixed evidence regarding household expenditure as a potential pathway linking maternal employment to child nutrition. In the combined sample, the negative linear coefficients for overall maternal employment hours in the food- and non-food-expenditure models, combined with the positive associations between both expenditure measures and HAZ, are consistent with a possible adverse expenditure pathway at some levels of maternal working hours. One possible explanation is that overall employment combines activities with different and potentially irregular income returns. Additional working hours may therefore not translate proportionately into resources available for household consumption and may also reduce the time available for home production, meal preparation, and childcare. However, the rural estimates do not show a clear or consistent relationship between overall maternal employment hours and either expenditure measure, even though the relationship between overall employment hours and HAZ is particularly evident in rural areas. This suggests that household expenditure does not fully explain the rural HAZ findings and that other pathways, including reduced maternal time for childcare and feeding, may also be relevant.

By contrast, several specifications for off-farm employment, wage work, and self-employment show positive linear coefficients for food or non-food expenditure, together in some cases with significant higher-order terms. This indicates that the relationship between these forms of employment and household expenditure varies across different levels of working hours rather than increasing uniformly. One possible explanation is that these activities are more likely to generate cash income that can be used to purchase food and other household necessities. Because both expenditure measures are positively associated with HAZ, these resource gains may represent a potentially beneficial pathway over some ranges of maternal working hours and may partly offset the consequences of reduced maternal time availability. Evidence of a corresponding pathway for WHZ is limited because food expenditure is not significantly associated with WHZ, while non-food expenditure is negatively associated with WHZ in the combined and rural samples. This negative association should not be interpreted as evidence that non-food spending worsens child nutrition, since such expenditure may reflect competing household needs or responses to illness and other shocks. Overall, household expenditure represents a possible pathway, but the findings do not establish a single or uniform expenditure pathway connecting maternal employment with child nutritional outcomes.

6. Discussion

This study examines the relationship between maternal employment intensity and child nutritional outcomes using panel data and the Mundlak approach. In addition to overall maternal working hours, the analysis distinguishes between on-farm and off-farm employment and further separates off-farm work into wage employment, self-employment, and temporary labor. This disaggregation allows the relationship between maternal employment and child nutrition to be examined beyond maternal employment participation alone[16]. It also examines whether the estimated relationships vary across rural and urban areas and by child sex, and explores household food and non-food expenditure as potential pathways. Overall, the findings indicate that the relationship between maternal employment and child nutrition varies according to working-hour intensity, employment type, nutritional outcome, and place of residence. Despite this heterogeneity, the estimated associations are predominantly negative, particularly for HAZ, although some employment types and ranges of working hours show different patterns.

Within this broader analytical framework, the main finding of the study is the nonlinear relationship[17] between overall maternal employment hours and child HAZ in the combined and rural samples. In the urban sample, the linear coefficient is negative, while the higher-order terms are statistically insignificant. In contrast, overall maternal employment hours are not significantly associated with WHZ. These findings suggest that maternal employment intensity is more consistently related to children's linear growth than to short-term weight relative to height. Employment-related changes in maternal time availability, feeding, childcare, healthcare use, and household resources may accumulate over time and therefore be more evident in HAZ than in WHZ. This nonlinear pattern can be most directly compared with the findings of Debela et al. (2021). Using panel data and the Mundlak estimator, they identify a nonlinear relationship between maternal off-farm working hours and child HAZ in rural Tanzania. Their results show a negative association at low levels of off-farm labor supply, a positive association at moderate levels, and another negative association at very high levels. In contrast, their estimates for on-farm employment are weaker and statistically insignificant. The present study similarly finds a nonlinear relationship between overall maternal employment hours and HAZ, particularly in the combined and rural samples. It also

[16]Most previous studies examine maternal employment at the extensive margin using a binary employment indicator. Debela et al. (2021) provide an important exception by examining working hours and distinguishing between on-farm and off-farm employment. The present study builds on this approach by considering both employment participation and work intensity and by further distinguishing among specific forms of off-farm work. These distinctions are policy-relevant because child nutritional outcomes may depend on working-hour intensity, flexibility, and employment conditions.

[17]The nonlinear patterns may reflect a changing balance between the potential resource benefits of maternal employment and the time constraints associated with work. Maternal employment may increase household income and women's control over resources, but longer working hours may also reduce the time available for childcare, feeding, meal preparation, and healthcare seeking. At some levels of working hours, additional resources may partly compensate for these time constraints. At lower or very high levels, however, the reduction in maternal time may outweigh the resource benefits. Moreover, additional income does not necessarily translate directly into improved child nutrition if employment returns are irregular, limited, or not allocated towards diverse and nutritious food. These interpretations remain suggestive because the polynomial estimates describe how the relationship changes across working hours but do not directly identify the underlying mechanisms.

provides some evidence of nonlinear relationships between rural off-farm hours and both HAZ and WHZ, as well as a weak negative association between on-farm hours and rural HAZ. The present analysis extends the work of Debela et al. (2021) by including both rural and urban households, examining WHZ in addition to HAZ, and distinguishing off-farm employment into wage work, self-employment, and temporary labor.

Beyond the closely comparable evidence from rural Tanzania, the stronger findings for HAZ are also broadly aligned with evidence from other settings. Jakaria et al. (2022) report an adverse relationship between maternal employment and child HAZ in Bangladesh after addressing the potential endogeneity of employment participation. Andrade and Gil (2023) find that maternal employment increases the probability of stunting in Ecuador, while reporting no statistically significant relationship with wasting. Hosen et al. (2023) similarly find an adverse relationship between maternal employment and child stunting in South Asia. However, these studies primarily examine binary employment participation and use instrumental-variable strategies, whereas the present study examines working-hour intensity and employment type within a panel-data Mundlak framework. The similarity therefore concerns the stronger relationship with indicators of linear growth rather than the magnitude or causal interpretation of the estimates. While these studies provide broader evidence on maternal employment participation, the employment-specific estimates from the present study further show that maternal work should not be treated as a homogeneous activity. On-farm hours are weakly and negatively associated with rural HAZ, while the significant off-farm results are concentrated in selected outcomes and locations. Rural off-farm hours show evidence of nonlinear relationships with HAZ and WHZ, wage-employment hours are nonlinearly associated with WHZ in the combined and urban samples, and rural self-employment hours are associated with both outcomes. For temporary-labor hours, the linear coefficient is positive and statistically significant for rural HAZ in the main specification, although this result is less stable across the robustness checks. These variations may reflect differences across employment types in income returns, flexibility, seasonality, workplace location, and maternal time requirements. Since these employment characteristics are not directly measured, they should be regarded as possible explanations rather than established mechanisms.

Given the variation observed across employment types and locations, the robustness checks indicate that the principal finding concerning overall maternal employment and HAZ is the most consistent across alternative specifications. The association between overall maternal employment and HAZ is also evident at the extensive margin in the combined and urban samples, while the nonlinear hours-based pattern remains robust to the use of the fixed-effects estimator and to restricting the sample to children observed in both survey waves. By contrast, the evidence for WHZ remains comparatively limited. Overall maternal employment is generally not significantly associated with WHZ across the alternative specifications, while significant relationships are concentrated in selected employment types and locations and are not consistently reproduced across estimators and sample restrictions. The nonlinear relationship between overall maternal employment intensity and HAZ therefore appears to be the most robust finding, whereas the WHZ and detailed employment-type results should be interpreted more cautiously.

In addition to assessing the stability of the results across specifications, the analysis examines whether the estimated relationships vary by child sex. For HAZ, the most pronounced nonlinear relationships are observed for boys, particularly for overall maternal employment hours in the combined and rural samples and for temporary-labor hours in the combined and urban samples. For WHZ, nonlinear relationships with off-farm employment hours are observed among urban girls and rural boys, while the

association between self-employment hours and WHZ is concentrated among boys in the combined and rural samples. The HAZ patterns contrast with those reported by Debela et al. (2021), who find more favorable associations between maternal off-farm employment and girls' nutritional status at certain levels of working hours. These differences may reflect variation across settings in household resource allocation, caregiving arrangements, employment conditions, and women's bargaining power. However, these mechanisms are not directly observed in the present study. Moreover, because the models are estimated separately for girls and boys, the results should be interpreted as descriptive patterns rather than as formal evidence that the estimated coefficients differ statistically by child sex.

To examine whether household resources may partly explain the observed relationships between maternal employment and child nutrition, the analysis also considers food and non-food expenditure as potential pathways. The resulting estimates provide mixed evidence. Food and non-food expenditure are positively associated with HAZ across the combined, rural, and urban samples, suggesting that household consumption resources may be more relevant for children's long-term linear growth. By contrast, food expenditure is not significantly associated with WHZ, while non-food expenditure is negatively associated with WHZ in the combined and rural samples. The latter finding should not be interpreted as evidence that non-food expenditure adversely affects child nutrition, as such expenditure may reflect competing household needs or responses to illness and other shocks. Selected forms of off-farm employment show positive relationships with food or non-food expenditure over some ranges of working hours, which is consistent with a possible resource pathway through employment-generated income. However, overall maternal employment hours are not consistently associated with expenditure in the rural sample, despite the clear nonlinear relationship with rural HAZ. Household expenditure therefore does not appear to fully account for the main findings, and reduced maternal time for childcare, feeding, meal preparation, and health-seeking activities may also be relevant. This interpretation is consistent with Debela et al. (2021), who identify income, women's bargaining power, and time available for childcare as competing pathways. Overall, the expenditure pathway appears more relevant for HAZ than for WHZ, although the results should be interpreted as suggestive evidence rather than as a formal mediation analysis.

6.1. Study limitations

Several limitations should be considered when interpreting the findings. First, although the Mundlak and fixed-effects specifications help account for time-invariant unobserved heterogeneity, they cannot fully address time-varying unobserved factors that may be related to both maternal employment and child nutrition. Reverse causality also cannot be ruled out, since children's health and nutritional needs may influence whether mothers work and how many hours they allocate to employment. As the analysis does not rely on an external source of exogenous variation, the estimates should be interpreted as conditional associations rather than causal effects.

Second, maternal working hours are based on self-reported employment activities and may therefore contain measurement error, particularly where work schedules are irregular or seasonal. Previous research shows that labor-hour estimates can be sensitive to recall periods and survey design. The seven-day reference period used in the present study is likely to reduce the recall problems associated with longer reporting periods, but it may not eliminate errors in reported working hours (Arthi et al., 2018). Third, the panel contains only two survey waves, and not all children are observed in both periods. Although the

restricted-sample estimates provide additional support for the main HAZ finding, the limited number of survey waves restricts the study's ability to examine longer-term changes in maternal employment and child growth. Estimates at very high working hours and for less common employment categories may also be less precise because they are based on relatively few observations.

Finally, the pathway analysis focuses only on household food and non-food expenditure. It does not directly measure maternal childcare time, child-feeding practices, dietary diversity, morbidity, healthcare use, alternative caregivers, or women's control over employment income. Household expenditure may also not indicate whether resources are allocated to nutritionally diverse foods or towards other competing household needs. The pathway findings therefore do not establish formal mediation, and further research incorporating direct measures of maternal time allocation, income control, childcare arrangements, and child dietary intake would help clarify the mechanisms underlying the observed relationships.

7. Conclusion and recommendation

This study contributes to the literature on maternal employment and child nutrition by examining both maternal employment participation and weekly working hours using panel data from Ethiopia. The analysis distinguishes between overall, on-farm, and off-farm employment and further separates off-farm work into wage employment, self-employment, and temporary labor. It also examines variation across rural and urban areas and by child sex and explores household food and non-food expenditure as potential pathways linking maternal employment to child nutritional outcomes. The principal finding is that overall maternal employment hours are more consistently associated with child HAZ than with WHZ. The relationship with HAZ changes across working hours and is particularly evident in the combined and rural samples, whereas the evidence in urban areas is weaker. By contrast, overall maternal employment hours are not significantly associated with WHZ. The broader association between overall maternal employment and HAZ is also supported by the robustness analyses based on the extensive margin, fixed-effects estimation, and the restricted sample, although the employment-specific estimates are less consistent across these alternative specifications.

The results further indicate that on-farm and off-farm work should not be treated as equivalent forms of maternal employment. The evidence for on-farm employment is limited, with only a weak negative association between on-farm hours and rural HAZ and no significant relationship with WHZ. Overall, the findings do not indicate a clear or consistent relationship between on-farm working hours and child nutrition. This may reflect offsetting influences, as on-farm work can reduce maternal time available for childcare while also contributing to household food production and being relatively easier to combine with caregiving. However, these mechanisms are not directly examined in the present study. Off-farm employment shows more varied relationships across working hours, nutritional outcomes, and locations. Rural off-farm hours are associated with both HAZ and WHZ, although the relevant patterns differ across the two outcomes. Among specific forms of off-farm employment, wage hours are associated with WHZ in the combined and urban samples, self-employment hours are associated with both HAZ and WHZ in rural areas, and temporary-labor hours are positively associated with rural HAZ in the main specification. These differences may reflect variation across employment types in income stability, flexibility, workplace location, and the time mothers can allocate to childcare. Nevertheless, the employment-specific findings should be interpreted more cautiously because they are less consistently reproduced across the robustness checks.

The heterogeneity analysis by child sex indicates that the estimated relationships are not uniform across girls and boys. The most pronounced HAZ patterns are observed for boys, particularly for overall maternal employment hours in the combined and rural samples, while the WHZ patterns vary across child sex, employment type, and location. This may suggest that employment-related changes in maternal time, food allocation, caregiving, and household resources do not affect girls and boys in the same way. However, these explanations remain tentative because sex-specific resource allocation and caregiving are not directly measured. Moreover, the separate regressions do not formally establish that the estimated coefficients differ statistically by child sex.

The pathway analysis provides mixed evidence regarding household expenditure. Overall maternal employment hours do not consistently translate into higher food or non-food expenditure, whereas selected forms of off-farm employment, particularly wage work and self-employment, are associated with higher expenditure over some ranges of working hours. Since both food and non-food expenditure are positively associated with HAZ, expenditure may represent a beneficial pathway for selected off-farm activities. However, it does not fully explain the relationship between overall maternal employment hours and rural HAZ and provides limited evidence of a beneficial pathway for WHZ. The findings therefore point to a broader balance between employment-related resource gains and reductions in maternal time available for childcare, feeding, meal preparation, and health-seeking activities rather than to a single expenditure mechanism.

Taken together, the findings suggest that maternal employment is neither uniformly beneficial nor uniformly detrimental to child nutrition. Its relationship with nutritional outcomes depends on working-hour intensity, employment type, place of residence, and the balance between employment-related resource gains and maternal time constraints. Policies intended to promote women's employment should therefore move beyond labor-force participation alone and consider the conditions under which women work. Greater emphasis should be placed on creating stable and adequately remunerated employment with manageable and flexible working hours. Improving the quality and returns of rural employment may be particularly important, as additional working hours may generate limited nutritional benefits when employment generates low, irregular, or non-cash returns. Support for productive self-employment and locally accessible income-generating activities may also help women combine employment with childcare, provided that these activities offer sufficiently stable returns. Employment policies should also be coordinated with childcare and nutrition-sensitive support. Affordable and reliable childcare, maternity protection, flexible work arrangements, and greater sharing of caregiving responsibilities within households may reduce the conflict between maternal employment and childcare. At the same time, improving access to diverse and nutritious foods and strengthening women's control over employment income may help households translate employment-related resource gains into improved child nutrition. Policies should therefore aim to support women's economic participation without overlooking the time and care requirements of young children. Since the estimates represent conditional associations rather than causal effects, these policy implications should be interpreted cautiously and adapted to local employment, household, and caregiving conditions.

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Appendix A: Tables

Table A1: Descriptive statistics

		Standard deviation (SD)		
Variables	**Mean**	**Overall**	**Between**	**Within**
Child-level variables				
Height-for-age z-score (HAZ)	-1.80	2.09	2.05	0.63
Stunting (1/0)	0.48	0.50	0.49	0.16
Weight-for-height z-score (WHZ)	-0.00	1.8	1.78	0.51
Wasting (1/0)	0.12	0.33	0.32	0.10
Age in months	30.20	16.55	14.99	8.47
Child is female (1/0)	0.49	0.50	0.50	0.07
Mother-level variables				
Mother employed (1/0)	0.41	0.49	0.48	0.17
Mother worked on-farm (1/0)	0.27	0.44	0.44	0.13
Mother worked off-farm (1/0)	0.16	0.37	0.35	0.12
Mother wage work (1/0)	0.06	0.24	0.23	0.08
Mother self-employed work (1/0)	0.09	0.29	0.27	0.10
Mother temporary labor work (1/0)	0.01	0.10	0.10	0.04
Mother employed (hours)	10.60	17.53	16.93	6.01
Mother worked on-farm (hours)	5.30	11.50	11.49	3.18
Mother worked off-farm (hours)	5.33	15.09	14.41	5.15
Mother wage work (hours)	2.20	9.58	8.99	3.44
Mother self-employed work (hours)	2.93	11.75	11.35	3.87
Mother temporary labor work (hours)	0.20	2.48	2.15	1.20
Age of the mother (years)	29.83	6.39	6.34	1.36
Household-level variables				
Female-headed household (1/0)	0.18	0.38	0.38	0.07
Total expenditure per adult equivalent (log)	9.83	0.81	0.79	0.27
Food expenditure per adult equivalent (log)	9.51	0.80	0.78	0.29
Non-food expenditure per adult equivalent (log)	7.71	1.14	1.12	0.34
Non-working female adults (1/0)	0.22	0.42	0.41	0.13
Region-specific shock variable				
Exposure to weather shock (1/0)	0.16	0.36	0.36	0.12

Notes: Adult members refer to household members aged 15 years and above. “Non-working female adults” is an indicator variable equal to one if the household has at least one non-working adult female other than the mother, and zero otherwise. “Exposure to weather shock” is an indicator variable equal to one if the household experienced at least one weather shock, and zero otherwise.

Table A2: Transition matrix of mothers' work status Between Survey Rounds (Ethiopia 2019–2022)

Panel A: Broad work status transition

2019 status	2022 status		
	Not employed (%)	On-farm work (%)	Off-farm work (%)
Not employed	64.44	16.22	19.35
On-farm work	47.57	45.95	6.47
Off-farm work	45.06	3.70	51.23

Panel B: Detailed work status transition

2019 status	2022 status				
	Not employed (%)	On-farm work (%)	Wage work (%)	Self-employed work (%)	Temporary labor work (%)
Not employed	64.44	16.22	6.54	10.81	1.99
On-farm work	47.57	45.95	0.00	4.53	1.94
Wage work	36.92	3.08	52.31	4.62	3.08
Self-employed work	51.14	4.55	4.55	37.50	2.27
Temporary labor work	44.44	0.00	33.33	22.22	0.00

Notes: Percentages are calculated among mothers observed in both survey rounds, 2019 and 2022. Rows indicate mothers' work status in 2019, while columns indicate their work status in 2022. Panel A shows broad transitions between non-employment, on-farm work, and off-farm work. Panel B further disaggregates off-farm work into wage work, self-employment, and temporary labor work to show whether mothers remained in the same category, entered employment, exited employment, or moved across work categories between survey rounds. Values are row percentages.

Table A3: Maternal Labor Participation and Weekly Hours' worked (Ethiopia 2019–2022)

	All years	2019	2022
Mother employed (%)	42.20	42.78	41.35
Hours worked	10.89 (17.81)	11.57 (18.32)	9.89 (16.99)
On-farm work (%)	26.33	29.14	22.20
Hours worked	5.11 (11.34)	6.39 (12.88)	3.24 (8.27)
Off-farm work (%)	17.46	15.47	20.37
Hours worked	5.80 (15.62)	5.18 (15.13)	6.71 (16.27)
Wage work (%)	7.18	6.40	8.31
Hours worked	2.49 (10.26)	2.13 (9.59)	3.03 (11.15)
Self-employed work (%)	9.69	8.95	10.77
Hours worked	3.08 (11.94)	2.93 (11.78)	3.30 (12.16)
Temporary labor work (%)	1.20	0.69	1.95
Hours worked	0.22 (2.63)	0.13 (2.19)	0.35 (3.17)

Notes: Standard deviations are shown in parentheses. Hours worked refers to the average number of hours mother worked during the past seven days.

Table A4: Overall maternal employment hours and child nutritional outcomes: Mundlak estimates- full results

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Overall work hours	-0.047***	-0.055***	-0.033*	-0.004	0.005	-0.016
	(0.012)	(0.017)	(0.020)	(0.011)	(0.015)	(0.017)
Work hours squared	0.001***	0.002***	0.001	-0.000	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Work hours cubed	-0.000***	-0.000***	-0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age in months	-0.047***	-0.050***	-0.047***	0.001	0.000	0.001
	(0.010)	(0.014)	(0.015)	(0.009)	(0.013)	(0.013)
Child age squared	0.001***	0.001***	0.001***	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of mother (years)	0.005	0.002	0.009	-0.015	-0.026	0.013
	(0.027)	(0.031)	(0.049)	(0.021)	(0.026)	(0.032)
Household size (number)	0.167	0.077	0.219	0.076	0.165	-0.004
	(0.106)	(0.175)	(0.134)	(0.096)	(0.146)	(0.133)
Food expenditure per adult equivalent (log)	0.391***	0.472**	0.355**	-0.099	-0.061	-0.190
	(0.130)	(0.194)	(0.170)	(0.109)	(0.156)	(0.153)
Non-food expenditure per adult equivalent (log)	0.203**	0.162	0.199	-0.109	-0.175	-0.017
	(0.104)	(0.161)	(0.126)	(0.086)	(0.128)	(0.111)
Female-headed household (1/0)	0.369	1.872***	-0.287	0.234	-0.393	0.546
	(0.375)	(0.652)	(0.385)	(0.319)	(0.533)	(0.382)
Non-working female adults (1/0)	0.136	0.089	0.188	-0.239	-0.419	-0.136
	(0.226)	(0.358)	(0.293)	(0.199)	(0.319)	(0.263)
Exposure to weather shock (1/0)	-0.433*	-0.232	-0.879**	0.447**	0.442**	0.550*
	(0.233)	(0.263)	(0.437)	(0.181)	(0.224)	(0.324)
Survey year 2022	-0.031	0.009	0.015	-0.038	-0.192*	0.148
	(0.087)	(0.120)	(0.129)	(0.075)	(0.105)	(0.110)
Mundlak variables	yes	yes	yes	yes	yes	yes
Constant	-3.967***	-3.483***	-3.547***	-0.384	-0.176	-0.490
	(0.585)	(0.786)	(0.965)	(0.512)	(0.689)	(0.785)
R-squared	0.031	0.027	0.034	0.012	0.013	0.033
Observations	4,638	2,573	2,065	4,515	2,529	1,986
Joint test of Mundlak variables[a]	chi2 = 27.59 (p-value =0.001)	chi2 = 25.41 (p-value =0.001)	chi2 = 13.19 (p-value =0.105)	chi2 = 18.47 (p-value =0.018)	chi2 = 12.37 (p-value =0.136)	chi2 = 13.81 (p-value =0.087)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A5: Maternal on-farm employment hours and child nutritional outcomes: Mundlak estimates- full results

	Height-for-age z-score (HAZ)	Weight-for-height z-score (WHZ)
	Rural sample	
On-farm hours	-0.038*	0.010
	(0.022)	(0.020)
On-farm hours squared	0.001	-0.001
	(0.001)	(0.001)
On-farm hours cubed	-0.000	0.000
	(0.000)	(0.000)
Child age in months	-0.048***	0.000
	(0.014)	(0.013)
Child age squared	0.001***	0.000
	(0.000)	(0.000)
Age of mother (years)	0.010	-0.026
	(0.032)	(0.025)
Household size (number)	0.110	0.168
	(0.175)	(0.145)
Food expenditure per adult equivalent (log)	0.423**	-0.069
	(0.197)	(0.156)
Non-food expenditure per adult equivalent (log)	0.147	-0.180
	(0.162)	(0.128)
Female-headed household (1/0)	1.826***	-0.375
	(0.641)	(0.529)
Non-working female adults (1/0)	0.146	-0.422
	(0.360)	(0.320)
Exposure to weather shock (1/0)	-0.294	0.440**
	(0.267)	(0.222)
Survey year 2022	0.017	-0.197*
	(0.121)	(0.104)
Mundlak variables	yes	yes
Constant	-3.470***	-0.052
	(0.787)	(0.692)
R-squared	0.024	0.014
Observations	2,573	2,529
Joint test of Mundlak variables[a]	chi2 = 19.38 (p-value =0.013)	chi2 = 12.25 (p-value =0.140)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food

expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A6: Maternal off-farm employment hours and child nutritional outcomes: Mundlak estimates- full results

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Off-farm hours	-0.011	-0.064**	0.006	-0.005	0.037	-0.020
	(0.016)	(0.033)	(0.019)	(0.013)	(0.024)	(0.015)
Off-farm hours squared	-0.000	0.002	-0.001	0.000	-0.002*	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Off-farm hours cubed	-0.000	-0.000*	0.000	-0.000	0.000*	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age in months	-0.048***	-0.051***	-0.048***	0.001	0.001	0.001
	(0.010)	(0.014)	(0.015)	(0.009)	(0.013)	(0.013)
Child age squared	0.001***	0.001***	0.001***	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of mother (years)	0.008	0.005	0.006	-0.016	-0.028	0.014
	(0.027)	(0.032)	(0.049)	(0.021)	(0.026)	(0.032)
Household size (number)	0.192*	0.130	0.212	0.079	0.182	-0.005
	(0.109)	(0.177)	(0.136)	(0.095)	(0.143)	(0.133)
Food expenditure per adult equivalent (log)	0.399***	0.501**	0.355**	-0.097	-0.067	-0.184
	(0.132)	(0.197)	(0.172)	(0.109)	(0.155)	(0.152)
Non-food expenditure per adult equivalent (log)	0.202*	0.176	0.205	-0.112	-0.194	-0.017
	(0.105)	(0.162)	(0.126)	(0.086)	(0.129)	(0.111)
Female-headed household (1/0)	0.311	1.821***	-0.325	0.235	-0.413	0.541
	(0.383)	(0.692)	(0.390)	(0.321)	(0.551)	(0.383)
Non-working female adults (1/0)	0.183	0.192	0.215	-0.233	-0.383	-0.132
	(0.225)	(0.353)	(0.294)	(0.197)	(0.311)	(0.262)
Exposure to weather shock (1/0)	-0.476**	-0.263	-0.868*	0.439**	0.412*	0.546*
	(0.236)	(0.265)	(0.445)	(0.182)	(0.227)	(0.324)
Survey year 2022	-0.033	-0.002	0.015	-0.030	-0.159	0.144
	(0.087)	(0.119)	(0.129)	(0.075)	(0.104)	(0.110)
Mundlak variables	yes	yes	yes	yes	yes	yes
Constant	-3.867***	-3.398***	-3.525***	-0.383	-0.150	-0.504
	(0.590)	(0.801)	(0.969)	(0.514)	(0.695)	(0.785)
R-squared	0.030	0.026	0.035	0.011	0.011	0.034
Observations	4,638	2,573	2,065	4,515	2,529	1,986
Joint test of Mundlak variables[a]	chi2 = 29.24	chi2 = 29.01	chi2 = 13.05	chi2 = 18.56	chi2 = 11.99	chi2 = 13.59

	(p-value =0.000)	(p-value =0.000)	(p-value =0.110)	(p-value =0.017)	(p-value =0.152)	(p-value =0.093)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A7: Maternal wage employment hours and child nutritional outcomes: Mundlak estimates- full results

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Wage hours	-0.008	-0.080	-0.010	-0.049**	-0.054	-0.053**
	(0.027)	(0.106)	(0.029)	(0.023)	(0.074)	(0.026)
Wage hours squared	-0.000	0.003	-0.000	0.002*	0.001	0.002*
	(0.001)	(0.005)	(0.001)	(0.001)	(0.003)	(0.001)
Wage hours cubed	0.000	-0.000	0.000	-0.000*	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age in months	-0.047***	-0.048***	-0.048***	0.001	0.001	0.001
	(0.010)	(0.014)	(0.015)	(0.009)	(0.013)	(0.013)
Child age squared	0.001***	0.001***	0.001***	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of mother (years)	0.009	0.011	0.000	-0.016	-0.030	0.012
	(0.028)	(0.032)	(0.050)	(0.021)	(0.026)	(0.032)
Household size (number)	0.192*	0.139	0.215	0.077	0.163	-0.004
	(0.109)	(0.178)	(0.136)	(0.095)	(0.142)	(0.133)
Food expenditure per adult equivalent (log)	0.379***	0.451**	0.351**	-0.088	-0.041	-0.177
	(0.133)	(0.199)	(0.172)	(0.109)	(0.155)	(0.153)
Non-food expenditure per adult equivalent (log)	0.197*	0.157	0.198	-0.119	-0.173	-0.028
	(0.105)	(0.164)	(0.128)	(0.086)	(0.128)	(0.112)
Female-headed household (1/0)	0.301	1.738***	-0.321	0.226	-0.473	0.537
	(0.381)	(0.668)	(0.395)	(0.321)	(0.559)	(0.383)
Non-working female adults (1/0)	0.197	0.219	0.221	-0.238	-0.382	-0.140
	(0.225)	(0.355)	(0.293)	(0.196)	(0.308)	(0.260)
Exposure to weather shock (1/0)	-0.489**	-0.313	-0.868*	0.440**	0.446*	0.544*
	(0.237)	(0.266)	(0.448)	(0.182)	(0.228)	(0.326)
Survey year 2022	-0.035	0.013	0.008	-0.031	-0.161	0.140
	(0.087)	(0.120)	(0.130)	(0.074)	(0.104)	(0.110)
Mundlak variables	yes	yes	yes	yes	yes	yes
Constant	-3.911***	-3.361***	-3.579***	-0.394	-0.233	-0.495
	(0.586)	(0.795)	(0.967)	(0.511)	(0.692)	(0.784)

R-squared	0.029	0.023	0.033	0.012	0.011	0.035
Observations	4,638	2,573	2,065	4,515	2,529	1,986
Joint test of Mundlak variables[a]	chi2 = 21.58 (p-value =0.006)	chi2 = 21.73 (p-value =0.006)	chi2 = 9.16 (p-value =0.329)	chi2 = 20.51 (p-value =0.009)	chi2 = 15.04 (p-value =0.058)	chi2 = 14.40 (p-value =0.072)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A8: Maternal self-employment hours and child nutritional outcomes: Mundlak estimates- full results

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Self-employment hours	-0.030	-0.081**	0.000	0.017	0.065**	-0.009
	(0.022)	(0.041)	(0.026)	(0.017)	(0.029)	(0.021)
Self-employment hours squared	0.000	0.002	-0.000	-0.000	-0.002*	0.001
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Self-employment hours cubed	-0.000	-0.000	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age in months	-0.049***	-0.050***	-0.050***	0.001	0.001	0.001
	(0.010)	(0.014)	(0.015)	(0.009)	(0.013)	(0.013)
Child age squared	0.001***	0.001***	0.001***	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of mother (years)	0.009	0.008	0.003	-0.017	-0.029	0.009
	(0.027)	(0.031)	(0.050)	(0.021)	(0.025)	(0.032)
Household size (number)	0.199*	0.136	0.222	0.086	0.196	-0.002
	(0.108)	(0.177)	(0.136)	(0.095)	(0.142)	(0.133)
Food expenditure per adult equivalent (log)	0.383***	0.486**	0.330*	-0.107	-0.082	-0.195
	(0.131)	(0.196)	(0.172)	(0.109)	(0.156)	(0.152)
Non-food expenditure per adult equivalent (log)	0.214**	0.165	0.224*	-0.116	-0.199	-0.017
	(0.104)	(0.162)	(0.126)	(0.086)	(0.128)	(0.110)
Female-headed household (1/0)	0.385	1.892***	-0.260	0.232	-0.407	0.543
	(0.383)	(0.692)	(0.398)	(0.322)	(0.550)	(0.385)
Non-working female adults (1/0)	0.202	0.167	0.250	-0.222	-0.365	-0.122
	(0.227)	(0.355)	(0.297)	(0.197)	(0.310)	(0.261)
Exposure to weather shock (1/0)	-0.477**	-0.307	-0.823*	0.436**	0.411*	0.554*
	(0.236)	(0.266)	(0.443)	(0.182)	(0.225)	(0.322)

Survey year 2022	-0.042	0.001	0.004	-0.032	-0.154	0.145
	(0.087)	(0.119)	(0.130)	(0.074)	(0.103)	(0.110)
Mundlak variables	yes	yes	yes	yes	yes	yes
Constant	-3.968***	-3.438***	-3.538***	-0.398	-0.161	-0.531
	(0.589)	(0.798)	(0.969)	(0.514)	(0.694)	(0.787)
R-squared	0.029	0.025	0.032	0.011	0.012	0.033
Observations	4,638	2,573	2,065	4,515	2,529	1,986
Joint test of Mundlak variables[a]	chi2 = 24.29 (p-value =0.002)	chi2 = 28.31 (p-value =0.000)	chi2 = 8.97 (p-value =0.344)	chi2 = 19.24 (p-value =0.014)	chi2 = 12.72 (p-value =0.122)	chi2 = 13.07 (p-value =0.109)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A9: Maternal temporary labor employment hours and child nutritional outcomes: Mundlak estimates - full results

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Temporary labor hours	0.095	0.389**	-0.032	-0.081	-0.201	-0.002
	(0.076)	(0.177)	(0.092)	(0.057)	(0.145)	(0.059)
Temporary labor hours squared	-0.003	-0.018	0.003	0.003	0.006	-0.000
	(0.004)	(0.012)	(0.005)	(0.003)	(0.010)	(0.003)
Temporary labor hours cubed	0.000	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child age in months	-0.049***	-0.049***	-0.049***	0.001	0.001	0.001
	(0.010)	(0.014)	(0.015)	(0.009)	(0.013)	(0.013)
Child age squared	0.001***	0.001***	0.001***	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of mother (years)	0.009	0.017	-0.004	-0.016	-0.029	0.010
	(0.028)	(0.032)	(0.050)	(0.021)	(0.026)	(0.032)
Household size (number)	0.204*	0.145	0.223	0.084	0.175	0.003
	(0.109)	(0.178)	(0.136)	(0.095)	(0.142)	(0.133)
Food expenditure per adult equivalent (log)	0.359***	0.438**	0.327*	-0.095	-0.066	-0.193
	(0.133)	(0.198)	(0.172)	(0.109)	(0.156)	(0.153)
Non-food expenditure per adult equivalent (log)	0.201*	0.134	0.212*	-0.121	-0.189	-0.033
	(0.104)	(0.163)	(0.126)	(0.085)	(0.128)	(0.107)
Female-headed household (1/0)	0.375	1.793***	-0.265	0.227	-0.408	0.549
	(0.380)	(0.657)	(0.401)	(0.323)	(0.544)	(0.386)

Non-working female adults (1/0)	0.214	0.214	0.257	-0.225	-0.408	-0.126
	(0.226)	(0.357)	(0.297)	(0.197)	(0.309)	(0.261)
Exposure to weather shock (1/0)	-0.493**	-0.361	-0.819*	0.444**	0.429*	0.572*
	(0.237)	(0.267)	(0.444)	(0.182)	(0.225)	(0.322)
Survey year 2022	-0.049	-0.003	0.003	-0.033	-0.146	0.132
	(0.087)	(0.121)	(0.130)	(0.074)	(0.104)	(0.109)
Mundlak variables	yes	yes	yes	yes	yes	yes
Constant	-4.005***	-3.345***	-3.588***	-0.433	-0.247	-0.624
	(0.586)	(0.794)	(0.971)	(0.512)	(0.689)	(0.790)
R-squared	0.027	0.024	0.031	0.012	0.012	0.034
Observations	4,638	2,573	2,065	4,515	2,529	1,986
Joint test of Mundlak variables[a]	chi2 = 16.26 (p-value =0.039)	chi2 = 100.46 (p-value =0.000)	chi2 = 5.45 (p-value =0.709)	chi2 = 23.34 (p-value =0.003)	chi2 = 27.62 (p-value =0.001)	chi2 = 17.03 (p-value =0.029)

Notes: ***significant at 1% level; **significant at 5% level; *significant at 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. Household food and non-food expenditure is expressed in natural logarithms. [a]The reported test statistics for the joint significance of the Mundlak variables (time-averaged regressors) are based on the fully specified models in each panel, including all control variables.

Table A10: Maternal employment participation and child nutritional outcomes: fixed effects estimates

	Height-for-age z-score (HAZ)			Weight-for-height z-score (WHZ)		
	Combined sample	Rural	Urban	Combined sample	Rural	Urban
Panel A: Overall employment						
Overall work (1/0)	-0.408**	-0.404	-0.428*	-0.013	-0.135	0.039
	(0.184)	(0.272)	(0.246)	(0.159)	(0.262)	(0.190)
Panel B: On-farm employment						
On-farm work (1/0)	n.a	-0.357	n.a	n.a	-0.152	n.a
		(0.260)			(0.273)	
Panel C: Off-farm employment						
Off-farm work (1/0)	-0.355	-0.604	-0.303	0.016	0.302	-0.061
	(0.248)	(0.552)	(0.266)	(0.197)	(0.431)	(0.221)
Panel D: Specific off-farm employment						
Wage work (1/0)	-0.237	-0.253	-0.230	-0.615**	-0.870	-0.476
	(0.377)	(1.136)	(0.399)	(0.280)	(0.800)	(0.298)
Self-employment work (1/0)	-0.541*	-0.937	-0.397	0.531**	0.854**	0.341
	(0.304)	(0.585)	(0.328)	(0.245)	(0.383)	(0.308)
Temporary labor work (1/0)	1.214**	0.650	1.365*	-0.823	-1.024***	-0.472
	(0.541)	(0.474)	(0.733)	(0.505)	(0.377)	(0.623)
Child-level characteristics	yes	yes	yes	yes	yes	yes
Maternal characteristics	yes	yes	yes	yes	yes	yes
Household characteristics	yes	yes	yes	yes	yes	yes

Region-specific shock	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes
Observations	4,638	2,573	2,065	4,515	2,529	1,986

Notes: *** significant at the 1% level; ** significant at the 5% level; * significant at the 10% level. Robust standard errors, clustered at the household level, are shown in parentheses. n.a. indicates not applicable. On-farm employment is estimated only for the rural sample because on-farm work is not applicable in the urban sample. All specifications include controls for child age in months and its square, mother's age, household size, food and non-food expenditure in natural logarithms, female-headed household, the presence of at least one non-working adult female in the household, exposure to at least one weather shock, and survey year fixed effects.

Appendix B: Figures

Figure B1: Predicted child height-for-age (HAZ) z-score and weight-for-height (WHZ) z-score by maternal employment hours and employment type, rural sample

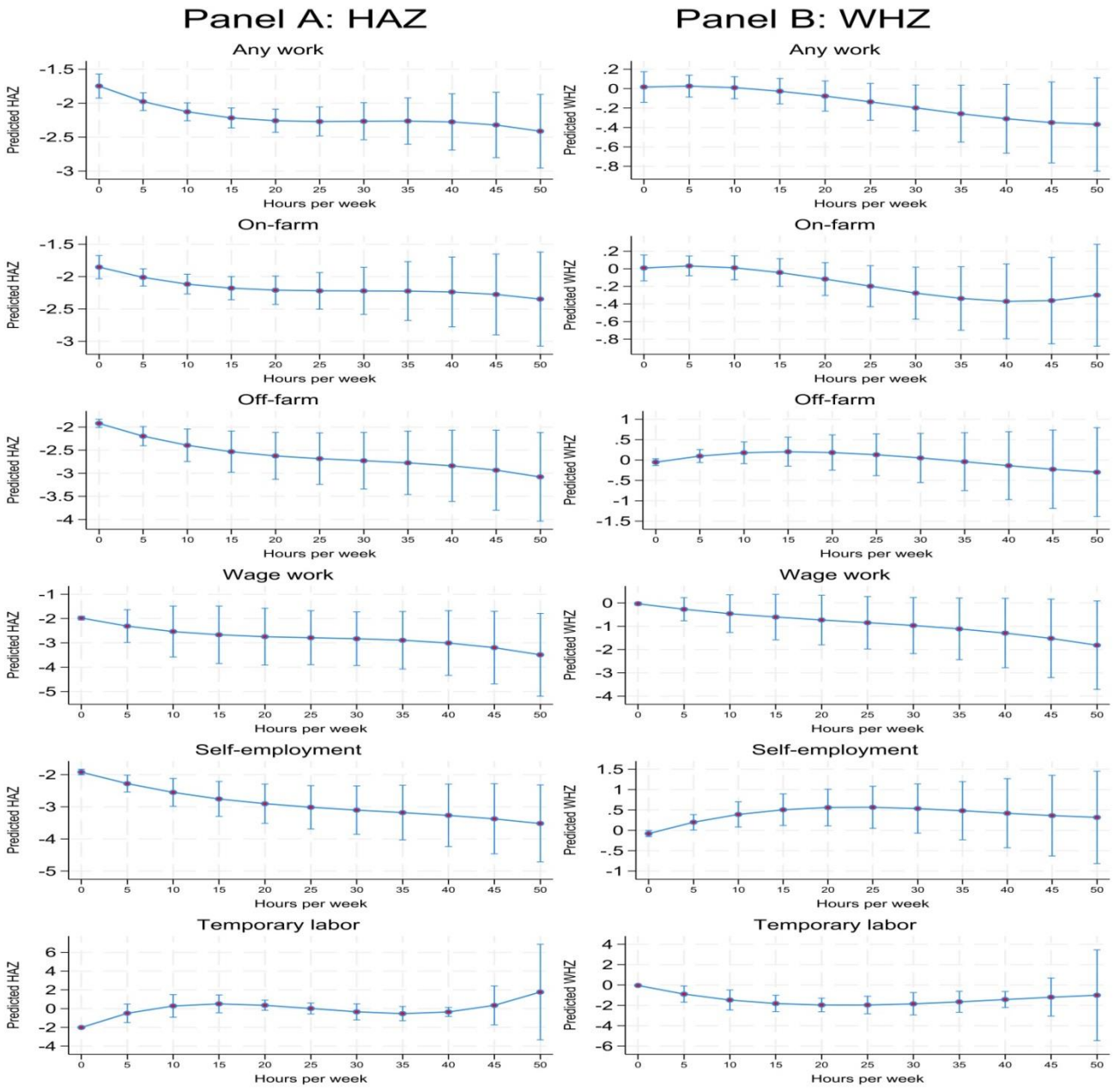


Figure B2: Predicted child height-for-age (HAZ) z-score and weight-for-height (WHZ) z-score by maternal employment hours and employment type, urban sample

