zef
Center for
Development Research
University of Bonn

ZEF-Discussion Papers on
Development Policy No. 336

Astewale Bimr Melaku, Matin Qaim and Bethelhem Legesse Debela

Maternal employment in high-value agriculture and child nutrition: Evidence from the Ethiopian cut-flower industry

Bonn, December 2023

Astewale Bimr Melaku, Matin Qaim and Bethelhem Legesse Debela, Maternal employment in high-value agriculture and child nutrition: Evidence from the Ethiopian cut-flower industry, ZEF – Discussion Papers on Development Policy No. 336, Center for Development Research, Bonn, December 2023, pp. 31.

ISSN: 1436-9931

Published by:
Zentrum für Entwicklungsforschung (ZEF)
Center for Development Research
Genscherallee 3
D – 53113 Bonn
Germany
Phone: +49-228-73-1861
Fax: +49-228-73-1869
E-Mail: zef@uni-bonn.de
www.zef.de

The authors:

Astewale Bimr Melaku, Department of Agricultural Economics and Rural Development, University of Goettingen. Contact: astewale.melaku@uni-goettingen.de.

Matin Qaim, Center for Development Research (ZEF); Institute for Food and Resource Economics, University of Bonn. Contact: mqaim@uni-bonn.de.

Bethelhem Legesse Debela, Department of Agricultural Economics and Rural Development, University of Goettingen. Contact: bdebela@uni-goettingen.de.

Acknowledgments

This study was funded by The German Research Foundation (DFG) through grant number DE 3315/1-1. The authors thank Zewdu Ayalew Abro for support during the data collection process. They also thank Liesbeth Colen who provided valuable inputs on an earlier version of this paper.

Abstract

In many countries of the Global South, agri-food supply chains are transforming rapidly. One important feature of this transformation is growth in certain high-value agricultural subsectors, such as horticulture and cut-flowers for export. Growth in high-value agriculture often creates new employment opportunities, especially for women. More employment can lead to higher rural incomes, but the broader implications for social welfare are not yet sufficiently understood. Here, we use survey data from Ethiopia to investigate the effects of women's employment in floriculture on child nutrition, focusing on children aged 0-5 years. We develop and estimate endogenous switching regressions to account for possible endogeneity. Our results suggest that maternal employment in floriculture negatively affects child height-for-age and weight-for-age z-scores (HAZ and WAZ). Exploration of the underlying mechanisms reveals that floriculture employment may influence time allocation, dietary quality, income, and female financial autonomy. Maternal employment is negatively associated with time spent on childcare and consumption of animal-sourced foods.

Keywords: Women employment, Child nutrition, Agri-food value chains, Floriculture, Africa, Ethiopia

JEL Codes: C24; J43; N57; Q18

1. Introduction

Agri-food supply chains are experiencing profound transformations in many countries of the Global South (Barrett *et al.*, 2022). One important feature of these transformations is a shift from more traditional agricultural commodities to high-value products, such as fruits, vegetables, and cut-flowers for export. This is particularly notable in Africa. The share of fresh high-value agricultural exports in total agri-food exports is higher in Africa than it is in Asia or Latin America (van den Broeck *et al.*, 2016). Such agri-food system transformations can have important implications for poverty reduction and rural development (van den Broeck *et al.*, 2016; Feyaerts *et al.*, 2020).

Global supply chains for fresh high-value products are often organized differently than traditional agricultural supply chains, which can affect rural income and employment opportunities (Feyaerts *et al.*, 2020; Barrett *et al.*, 2022). For rural households, participation in high-value supply chains is generally conceivable in two forms, either through contracts between export companies and smallholder farmers or through direct employment by larger agri-food companies (Maertens *et al.*, 2012; van den Broeck *et al.*, 2017; Barrett *et al.*, 2022). Depending on policy regulations, quality requirements, and smallholder farmers' access to required knowledge and production technology, the direct employment channel is more commonly observed in African export sectors and can significantly influence local labor markets for low-skilled workers (Maertens *et al.*, 2012; Feyaerts *et al.*, 2020). Especially in the horticultural sector, women are often preferred as workers. In many African countries, women constitute up to 90% of the labor force employed by horticultural export companies (van den Broeck *et al.*, 2018).

Rising employment of women by agri-food companies can have various welfare implications for women themselves, as well as for their children and families. Previous research showed that women's employment can influence child nutrition via multiple mechanisms, including changes in income, time allocation, and gendered decision-making (Debela *et al.*, 2021). Here, we investigate the effects of maternal employment by agri-food companies on child nutrition, as well as some of the underlying mechanisms, using primary survey data from Ethiopia.

Child undernutrition is still one of the most prominent development challenges in many low- and middle-income countries (Global Nutrition Report, 2022). Despite some improvements over the last 20 years, the numbers and proportions of undernourished children remain high. Recent estimates suggest that 22% (150 million) of all children are stunted and almost 7% (45 million) are wasted (UNICEF/ WHO/ World Bank, 2021). Two-fifths of the children affected by stunting and one-quarter of the children affected by wasting live in Africa. A better understanding of how child nutrition may be influenced by women's employment in high-value agriculture is important from development research and policy perspectives.

Previous studies have analyzed the effects of high-value agri-food sector trends on rural households' welfare. Much of this research looks at smallholder farmers participating in high-value supply chains through contracts (e.g., Barrett *et al.*, 2022; Debela *et al.*, 2022; Ruml *et al.*, 2022). Participation through direct employment by agri-food companies has received much less attention up till now (Maertens *et al.*, 2012). A few studies investigate the effects of such employment on household income, including research in Kenya (McCulloch & Ota, 2002) and Senegal (Maertens *et al.*, 2011; van den Broeck *et al.*, 2017). Beyond income, most of these studies do not analyze social welfare implications for children or other individual household members. One study examines the influence of employment in agri-food companies on household food security (van den Broeck *et al.*, 2018). Another study investigates possible implications for child education (Maertens & Verhofstadt, 2013). We are not aware of any studies analyzing effects of women's employment by agri-food sector companies on child nutritional outcomes, as we do here.

In particular, we look at women working in Ethiopia's cut-flower export industry, which has been growing significantly in recent years. We use household- and individual-level survey data collected in the vicinities of major cut-flower farms. Endogenous switching regressions with instrumental variables are developed to estimate effects of local women's employment in these cut-flower farms on child anthropometric indicators, such as height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ).

The remainder of this article is organized as follows. Section 2 provides a conceptual framework, whereas section 3 presents the study setting and details of the data collection. In section 4, the econometric approaches are explained. Results are presented and discussed in section 5. Section 6 concludes.

2. Conceptual framework

Common frameworks of child nutrition distinguish between three levels of determinants of undernutrition, namely immediate, underlying, and basic determinants (UNICEF, 1990; Smith & Haddad, 2015), as shown in Figure 1. Immediate determinants include individuals' dietary intake and health status. Underlying determinants involve food security, care for mothers and children, and access to health services. Finally, basic determinants include resources available at local or national levels, as well as socioeconomic, cultural, and political factors.

Trends in agri-food supply chains enter this framework mainly through their potential effects on the underlying causes of child nutrition (Smith & Haddad, 2015; Gillespie & van den Bold, 2017; Headey & Masters, 2021). Here, we are particularly interested in the mechanisms related to mothers' employment in the floriculture industry (Figure 1). Maternal employment may affect child nutritional status through three main pathways, namely changes in (1) time allocation and intra-household division of labor, (2) income, and (3) women's financial autonomy and intra-household bargaining power (Gillespie & van den Bold, 2017; Debela *et al.*, 2021). These pathways are not independent and other factors may also play a role (Leslie, 1988). Nevertheless, a focus on some of the main pathways is useful for empirical analysis. These pathways are explained in more details in the following.

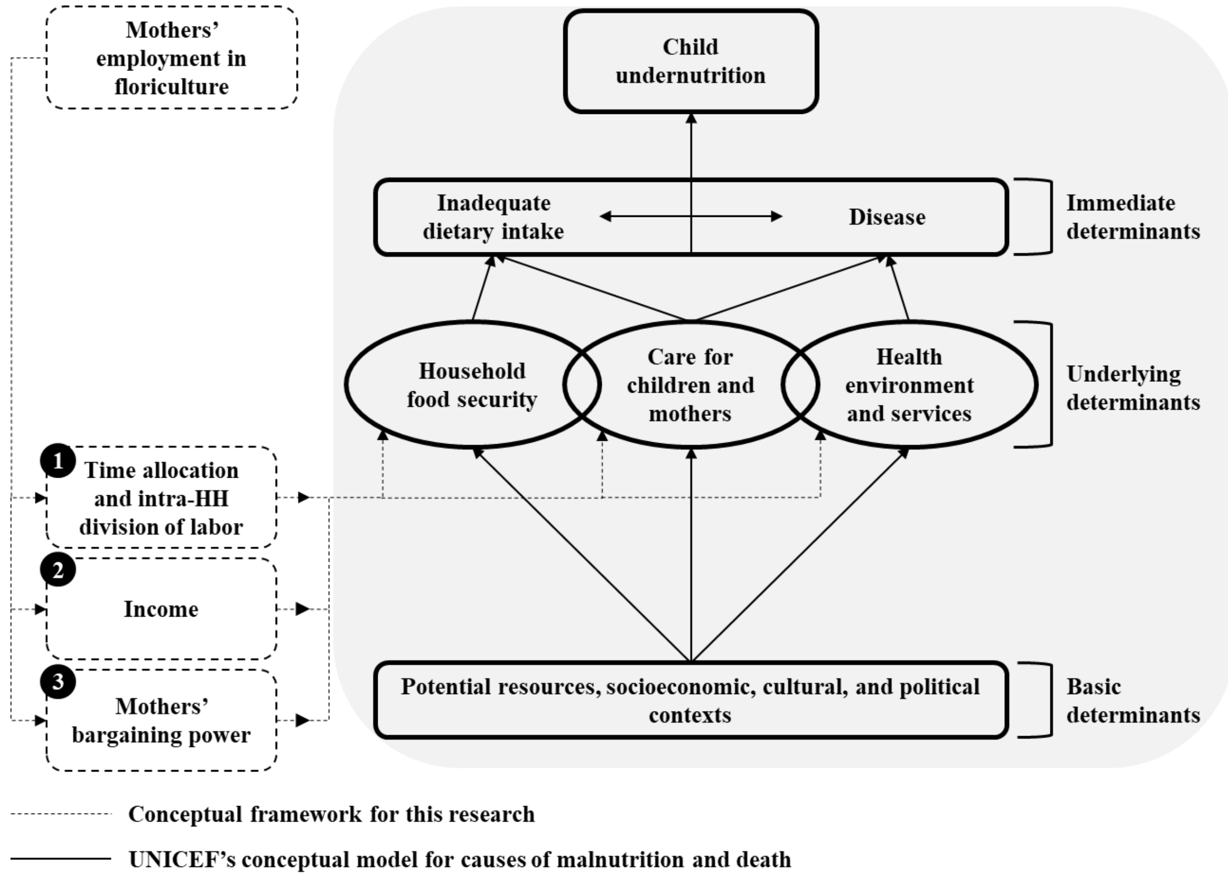

Figure 1: Conceptual framework linked with comprehensive child nutrition model adapted from (UNICEF, 1990).

Women's time use and intra-household division of labor. Employment by agri-food companies will likely change women's time use, which, in turn, can affect time available for food preparation and childcare and thus child nutritional status. Studies show that increases in women's employment can result in sizable reductions in their time spent on childcare (Glick, 2002; Burroway, 2017; Chari *et al.*, 2019). In such cases, mothers rely on substitute childcare, which can generally include other household members, government-financed childcare, or market-based options (Oddo *et al.*, 2018). Due to the unavailability and unaffordability of the latter two options for most households in rural Africa, other household members usually serve as replacement in the absence of the mother, leading to changes in the intra-household division of labor (McGuire *et al.*, 1990; Burroway, 2017; Oddo *et al.*, 2018; Chari *et al.*, 2019). Increases in childcare time by other household members might offset reductions in maternal time for childcare (Johnston *et al.*, 2018). However, the quality of childcare may potentially suffer (Popkin, 1980; Glick, 2002; Burroway, 2017). For instance, employment of mothers might reduce the frequency and quality of breastfeeding and child diets (Leslie, 1988; Glick & Sahn, 1998; Glick, 2002; Headey & Masters, 2021).

Income. Empirical evidence shows that women's employment by agri-food companies can contribute to higher household incomes, especially in the poorest population segments (McCulloch & Ota, 2002; Bottazzi *et al.*, 2018; van den Broeck *et al.*, 2018). Income gains may lead to increases in household expenditures on food, sanitation, and health and thus improvements in child nutritional status (Gillespie & van den Bold, 2017; Bottazzi *et al.*, 2018; Headey & Masters, 2021).

Women's financial autonomy and bargaining power. Women's employment by agri-food companies can increase the share of women's income in total household income. Evidence suggests that the share of women's income can strengthen women's financial autonomy and bargaining position in intra-household decision-making (Barrientos & DeJong, 2006). In addition, women's employment may create opportunities for women to interact with others and maintain networks outside of the household, thereby enabling them to exchange ideas and experiences (Atkin, 2009). Such exposure can be associated with certain aspects of women's empowerment, such as developing negotiation skills, building self-confidence, and adopting lessons learnt by others. Women's empowerment can lead to higher investments in child nutrition and health and positive nutritional outcomes (Glick, 2002; Barrientos & DeJong, 2006; Gillespie & van den Bold, 2017; Quisumbing & Doss, 2021).

3. Study setting and data collection

Expansion of horticultural exports has been one of the key priorities of Ethiopia's strategy for boosting export income, job creation, and foreign direct investment. Ethiopia's horticultural export sector covers about 11,000 hectares of land and has created job opportunities for nearly 200,000 people (EHPEA, 2019). Horticultural exports are dominated by the cut-flower industry; Ethiopia is the second-largest exporter of flowers in Africa. Cut-flowers account for over 80% of the export value generated by the horticultural sector in Ethiopia (MoA, 2022). The number of active flower farms in the country has increased from only five in 2003 to 73 in 2019 (Gebreeyesus, 2015; EHPEA, 2019). In the 2021/22 fiscal year, Ethiopia exported nearly 120,000 tons of flowers at a value of USD 508 million (MoA, 2022).

We planned a survey of rural households, which we carried out from May to August 2022 in two of the largest floriculture clusters in Ethiopia, namely Batu and Bishoftu.[1] Households were selected using a multi-stage sampling strategy. First, we held discussions with local authorities to identify kebeles (i.e., lowest government administration units) with high cut-flower activities within the two study sites of Batu and Bishoftu. Then, within these kebeles, the sub-kebeles in which large numbers of floricultural employees reside were selected. Within the relevant sub-kebeles, censuses of all households were prepared. The relevant population for our study are all households living in the sub-kebeles with at least one ever-married woman within the age range of 18-49 years. Based on the census lists, we stratified households into two groups, those with and without a mother working in floriculture. Then, we randomly selected households from both groups proportionate to the size of the sub-kebeles. A total of 770 households were sampled, including 361 and 409 households with and without a mother working in floriculture, respectively. However, not all of these households had children under five years of age, which is the key target group for our child nutritional analysis. Sample households had a total of 512 children under five – 180 children from mothers working in floriculture and 332 children from mothers not working in this sector. Our analysis is based on these 512 observations of children aged 0-5 years.

The survey contains information at household and individual levels for children and their mothers. Household-level data include demographic characteristics, education, labor market participation, food consumption, food and non-food expenditures, housing conditions, incomes, and asset ownership. Child-level data include health conditions, anthropometric measures, and dietary diversity, while mother-level data include employment details, time use, and dietary diversity.

[1] Based on a survey of flower farms and government statistics (MoA, 2022), we estimate that the two clusters account for 52% of the employment opportunities and 53% of the exported quantities of Ethiopia's cut-flower sector.

4. Approaches of data analysis

4.1 Econometric models

Our empirical analysis uses regression models of the following general type:

$$N_i = \alpha_0 + \alpha_2 L_i + \boldsymbol{X_i \alpha_3} + \mu_i \quad (1)$$

where N_i is the nutritional status of child i (HAZ or WAZ, which we estimate in separate models), L_i is a dummy variable indicating whether or not child i's mother is employed in the floriculture sector, $\boldsymbol{X_i}$ is a vector of control variables – including child, mother, household, and contextual characteristics – and μ_i is a random error term. We are particularly interested in the coefficient α_2, which – if the model is properly specified – captures the effect of maternal employment in floriculture on child nutrition.

Estimating the models in equation (1) with OLS can show relevant associations, but the estimate for α_2 could be biased because the decision to participate in floriculture employment is based on self-selection such that L_i is possibly endogenous. To account for possible self-selection bias, we use an endogenous switching regression (ESR) approach with instrumental variables (Di Falco *et al.*, 2011). In a first stage, a probit model for selection into floriculture employment is estimated as follows:

$$L_i = \boldsymbol{Z_i \gamma} + u_i \quad (2)$$

where $\boldsymbol{Z_i}$ is a vector of explanatory variables for the participation decision function, including at least one valid instrument. In a second stage, the outcome equation is estimated for both groups – children with and without mothers in floriculture employment – including inverse mills ratios calculated from the first stage as additional regressors:

$$N_{1i} = \boldsymbol{X_{1i} \beta_1} + \varepsilon_{1i} \textit{ if } L_i = 1 \quad (3a)$$

$$N_{2i} = \boldsymbol{X_{2i} \beta_2} + \varepsilon_{2i} \textit{ if } L_i = 0 \quad (3b)$$

Since the error term in the selection equation (2) is expected to be correlated with the error terms in the outcome equations (3a) and (3b), the expected values of the truncated error terms (i.e. ε_1 and ε_2) are non-zero, as specified below:

$$E(\varepsilon_{1i}|L_i = 1) = \quad \sigma_{1u}\frac{\emptyset(\boldsymbol{Z_i\gamma})}{\Phi(\boldsymbol{Z_i\gamma})} = \quad \sigma_{1u}\lambda_{1i} \tag{4a}$$

$$E(\varepsilon_{2i}|L_i = 0) = \quad -\sigma_{2u}\frac{\emptyset(\boldsymbol{Z_i\gamma})}{1-\Phi(\boldsymbol{Z_i\gamma})} = \quad \sigma_{2u}\lambda_{2i} \tag{4b}$$

where $\emptyset(.)$ and $\Phi(.)$ denote probability density and cumulative density function of the standard normal distribution, respectively. λ_{1i} and λ_{2i} are the corresponding inverse mill ratios evaluated at $\boldsymbol{Z_i\gamma}$ (Fuglie & Bosch, 1995). If the coefficients of λ_{1i} and λ_{2i} are nonzero, this is an indication of selection bias (Di Falco *et al.*, 2011). Including the estimated terms λ_{1i} and λ_{2i} in regression equations (3a) and (3b), respectively, corrects for potential selection bias (Willis & Rosen, 1979). Following Lokshin and Sajaia (2004), we estimate the ESR model simultaneously using the full-information maximum likelihood (FIML) approach, which yields efficient and consistent estimates.

An important feature of ESR models is that they can be used to calculate average treatment effects on the treated (ATT) and average treatment effects on the untreated (ATU). ATT is calculated as the difference between expected nutritional outcomes of children with mothers employed in floriculture (equation 5a) and expected nutritional outcomes of their counterfactuals (equation 5b):

$$E(N_{1i}|L_i = 1) = \boldsymbol{X_{1i}\beta_1} + \sigma_{1u}\lambda_{1i} \tag{5a}$$

$$E(N_{2i}|L_i = 1) = \boldsymbol{X_{1i}\beta_2} + \sigma_{2u}\lambda_{1i} \tag{5b}$$

$$ATT = \quad E(N_{1i}|L_i = 1) - E(N_{2i}|L_i = 1) = \quad \boldsymbol{X_{1i}(\beta_1 - \beta_2)} + (\sigma_{1u} - \sigma_{2u})\lambda_{1i} \tag{5c}$$

Similarly, ATU is calculated as the difference between expected nutritional outcomes of children with mothers not employed in floriculture (equation 6a) and expected nutritional outcomes of their counterfactuals (equation 6b):

$$E(N_{2i}|L_i = 0) = \boldsymbol{X_{2i}\beta_2} + \sigma_{2u}\lambda_{2i} \tag{6a}$$

$$E(N_{1i}|L_i = 0) = \boldsymbol{X_{2i}\beta_1} + \sigma_{1u}\lambda_{2i} \tag{6b}$$

$$ATU = \quad E(N_{1i}|L_i = 0) - E(N_{2i}|L_i = 0) = \quad \boldsymbol{X_{2i}(\beta_1 - \beta_2)} + (\sigma_{1u} - \sigma_{2u})\lambda_{2i} \tag{6c}$$

4.2 Instrumental variables

Unbiased estimation of ATT and ATU from the ESR coefficients requires at least one valid instrument for maternal employment in floriculture in equation (2). To identify suitable instruments in the local context, we conducted focus group discussions (FGDs) with several flower farm managers and workers, as well as with community leaders to understand what determines women's probability of being employed in flower farms. According to the information from these FGDs, women employed for the manual work are selected by flower farm officers on a daily basis. Every morning at a specific time, women interested in getting work gather at the entrance of the flower farms where officers pick the number of workers needed. Women who show up on a regular basis will be highly likely to get selected. Women showing up for the first time have a better chance of being picked when being recommended by another woman already working on the flower farm. Hence, knowing women already working on flower farms is expected to increase the likelihood of own entry and employment significantly.

Based on this information, we identified two instruments for use in our ESR analysis. First, we use the share of women employed in floriculture at the village level, calculated as the number of women employed divided by the total female village residents between 18 and 49 years of age. These numbers are taken from the sub-kebele censuses that we conducted for random selection of survey households.[2] Second, we use individual women's connection to other floriculture workers, measured as the number of personal friends and/or relatives working in floriculture before the woman herself joined a flower farm.[3] The use of instruments related to village or individual social networks has become common in the empirical literature, as informal social networks are important mechanisms of information flow (Coates *et al.*, 2004; Kassie *et al.*, 2014; Dolislager *et al.*, 2021; Abro *et al.*, 2022; Di Marcantonio *et al.*, 2022).

We tested these two instruments for relevance and exogeneity, using the falsification test explained in Di Falco *et al.* (2011) and Nunn and Wantchekon (2011). Results in Table A1 in the appendix confirm that both instruments are significantly correlated with women's floriculture employment. At the same time, the instruments are not significantly correlated with child nutrition outcomes for the subsample of mothers not employed in floriculture, suggesting that there is no effect through mechanisms other than maternal floriculture employment.

4.3 Exploring potential mechanisms

In addition to estimating the effects of maternal floriculture employment on child nutritional outcomes, we are also interested to better understand the underlying mechanisms. Due to data limitations, this analysis is explorative: we only look at relevant associations instead of fully identifying the various pathways. The analysis of mechanisms builds on the conceptual framework described above.

---

[2] In addition to full household lists, the censuses also captured a few basic details for each household, including women's occupation.

[3] Women's connection to other floriculture workers is a categorical variable with values 0 (none), 1 (1-2 persons) and 2 (3 or more persons).

First, we investigate associations between women's floriculture employment, time allocation, and intra-household division of labor. We focus particularly on maternal time for childcare and other domestic tasks and to what extent possible reductions in childcare time by mothers are offset by time spent on childcare by their spouses. In addition, we analyze associations between maternal floriculture employment, household and child-level diet quality, and breastfeeding practices.[4] Second, we analyze associations between women's floriculture employment and household income. Finally, we examine associations between floriculture employment and the share of women's wage income to total household income as a proxy of women's financial autonomy and intra-household bargaining power. This share is calculated over a period of 12 months. These associations are analyzed with simple regression models (similar to those in equation 1, only with different dependent variables), controlling for child, mother, household, and contextual characteristics.

4.4 Measuring key variables

Our main outcome of interest is child nutrition, which we measure in terms of child height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ). HAZ is the most common anthropometric indicator of long-term child nutrition, whereas WAZ is another common weight-based measure of child nutrition (WHO, 2006; Headey & Masters, 2021). Children with a HAZ below -2 are classified as stunted, children with a WAZ below -2 are classified as underweight.

Our main explanatory variable of interest is women's current employment in the floriculture sector. We refer to mothers of children below the age of five, as our analysis uses data from child-mother pairs. Maternal employment in floriculture is measured through a dummy variable that takes a value of one if the child's mother was employed by a cut-flower farm at the time of the survey, and zero otherwise. For mothers employed in floriculture, we also have data on the time spent on floriculture work during the last work day and during the last seven days prior to the interview.[5] Most women in the floriculture sector do not only work on cut-flower farms for a few days but for longer periods of time. We also collected data on the number of months worked in floriculture and other activities during the last 12 months prior to the interview.

[4] We use household dietary diversity scores (HDDS) with a maximum of 12 food groups and child dietary diversity scores (CDDS) with a maximum of seven food groups to characterize household and individual diet quality (FAO (2013); Swindale & Bilinsky (2006)).

[5] Data on time spent in general wage-employment and self-employment activities during the last 24 hours and seven days were collected from all women in the sample.

5. Results and discussion

5.1 Summary statistics

Table 1 shows descriptive statistics for a number of nutrition and socioeconomic variables for the whole sample of children and for children and households with and without mothers employed in floriculture.

Additional variables are shown in Table A2 in the appendix. The average child in our sample is 29.5 months old and has a HAZ and WAZ of –1.3 and –0.8, respectively. Around 30% of the children are stunted and 14% are underweight, pointing at widespread child undernutrition. Strikingly, children with mothers employed in floriculture have significantly lower HAZ and WAZ than children with mothers not employed in floriculture.

Table 1: Summary statistics

	Full sample (1)		Mother not working in floriculture (2)		Mother working in floriculture (3)		Mean difference (3)-(2)
	Mean	SD	Mean	SD	Mean	SD	
Child HAZ-score	-1.252	1.447	-1.084	1.459	-1.561	1.376	-0.476***
Child WAZ-score	-0.761	1.212	-0.669	1.145	-0.932	1.313	-0.263**
Child is female	0.471	0.500	0.497	0.501	0.422	0.495	-0.075
Child age in months	29.469	17.005	29.774	17.134	28.906	16.797	-0.869
Mother's height in cm	157.586	6.218	158.105	6.230	156.629	6.097	-1.476**
Mother's age	27.820	5.374	28.645	5.803	26.300	4.072	-2.345***
Mother years of education	1.729	0.850	1.848	0.811	1.508	0.879	-0.341***
Mother migrated from a rural place	0.551	0.498	0.446	0.498	0.744	0.437	0.299***
Household head's Age	33.586	7.259	35.136	7.456	30.728	5.912	-4.408***
Household size	4.514	1.284	4.684	1.375	4.200	1.027	-0.484***
Mother's 24 hours time use:							
Self-care, maintenance and social	14.934	2.764	15.390	2.633	14.092	2.809	-1.298***
Child care	3.036	3.016	3.673	3.194	1.861	2.229	-1.812***
Domestic work and family care	8.569	4.414	10.086	4.127	5.772	3.462	-4.314***
Floricultural wage employment	2.528	4.169	0.000	0.000	7.192	3.988	7.192***
Any wage employment	2.976	4.335	0.690	2.346	7.192	3.988	6.502***
Share of mother's	0.170	0.234	0.059	0.162	0.375	0.208	0.316***

wage income to total HH income							
Household diet diversity score (HDDS) (0-12)	8.086	1.511	8.455	1.485	7.406	1.310	-1.049***
Child diet diversity (0-7)	2.742	1.220	2.783	1.275	2.667	1.109	-0.116
N	512		332		180		512

SD: standard deviations; HH: household. HH income per capita is measured in thousands of Ethiopian Birr (ETB). We collected time use data on primary and secondary (if any) activities performed during 24 hours prior to the interview. Following (Alkire et al., 2013), we calculated mother's time allocated for each activity as a sum of total time if the activity was reported as primary and 50% if secondary. * p < 0.1, ** p < 0.05, *** p < 0.01.

As shown in Figure 2, 38% of all the mothers in our sample are employed in floriculture, 43% of are not employed, while the rest are employed in other sectors or pursue self-employed activities. Women employed in floriculture spend much more of their daily time on wage employment and less time on childcare and domestic work than other women (Table 1). Households with women employed in floriculture have lower dietary diversity and a higher share of female wage income than households without women employed in horticulture. These relationships are analyzed in more detail below, controlling for possible confounding factors.

5.2 Effects of maternal floriculture employment on child nutrition

Table 2 shows simple OLS estimates of equation (1) with HAZ and WAZ as dependent variables. The results reveal that maternal employment in floriculture is negatively associated with child nutritional status also after controlling for other relevant characteristics. However, as discussed above, OLS may lead to biased estimates if floriculture employment is endogenous.

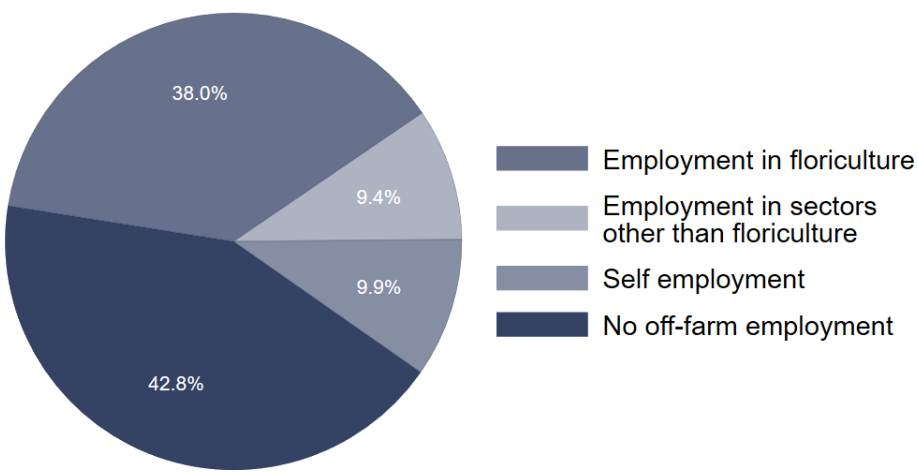

Figure 2: Share of mothers by type of occupation (total number of mothers = 416)

Results from the ESR model are shown in Table A3 in the appendix. Statistical tests lead to rejection of the null hypothesis that floriculture employment is exogenous, so the ESR approach that accounts for endogeneity is preferred for interpretation of actual effects. Based on the ESR coefficient estimates, we calculated expected values of child nutritional status under actual and counterfactual conditions and the ATTs and ATUs, as explained in equations (5a-c) and (6a-c) above. Results are shown in Table 3. The ATT for HAZ is –0.75, meaning that mothers' floriculture employment reduces child HAZ by 0.75 standard deviations, after controlling for confounding factors. The ATT for WAZ is also negative and statistically significant, suggesting that mothers' floriculture employment worsens child nutritional status considerably. The ATTs evaluate effects for the subsample of children with mothers actually employed in floriculture. If mothers not employed in floriculture would take up such employment, the nutrition effects on their children would even be worse, as indicated by the large negative ATUs for both anthropometric indicators in Table 3.

Table 2. Associations between maternal employment in floriculture and child nutrition (OLS regressions)

	Child HAZ				
	(1)	(2)	(3)	(4)	(5)
Panel A					
Mother works in floriculture (1/0)	-0.476***	-0.464***	-0.396**	-0.414**	-0.440**
	(0.130)	(0.127)	(0.171)	(0.182)	(0.186)
Child level controls	No	Yes	Yes	Yes	Yes
Mother level controls	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Distance controls	No	No	No	No	Yes
Observations	512	512	512	512	512
R^2	0.025	0.105	0.170	0.189	0.190
	Child WAZ				
	(6)	(7)	(8)	(9)	(10)
Panel B					
Mother works in floriculture (1/0)	-0.263**	-0.266**	-0.185	-0.257*	-0.315**
	(0.116)	(0.117)	(0.142)	(0.147)	(0.149)
Child level controls	No	Yes	Yes	Yes	Yes
Mother level controls	No	No	Yes	Yes	Yes
Household level controls	No	No	No	Yes	Yes
Distance controls	No	No	No	No	Yes
Observations	512	512	512	512	512
R^2	0.011	0.031	0.102	0.135	0.147

Robust standard errors in parentheses. A full list of control variables is shown in Table A3 in the appendix. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 3. Expected mean values of child nutritional outcomes and average treatment effects of maternal employment

Panel A				
Sub-sample/ Outcome	Child HAZ			
	Decision to work in floriculture		Treatment effects	
	Working	Not working	ATT	ATU
Mother is employed	-1.557	-0.806	-0.751***	
in floriculture *(N=180)*	(0.051)	(0.046)	(0.041)	
Mother is not employed	-2.079	-1.084		-0.995***
in floriculture *(N=332)*	(0.058)	(0.035)		(0.051)
Panel B				
Sub-sample/ Outcome	Child WAZ			
	Decision to work in floriculture		Treatment effects	
	Working	Not working	ATT	ATU
Mother is employed	-0.930	-0.503	-0.427***	
in floriculture *(N=180)*	(0.047)	(0.037)	(0.045)	
Mother is not employed	-1.539	-0.669		-0.870***
in floriculture *(N=332)*	(0.053)	(0.026)		(0.051

Calculations based on endogenous switching regression (ESR) model estimates as shown in Table A3 in the appendix. ATT: average treatment effect on the treated; ATU: average treatment effect on the untreated. Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5.3 Potential mechanisms

We now examine potential mechanisms of the negative child nutrition effects of maternal employment in floriculture, using simple regression models with different dependent variables, as explained above.

Time allocation. We start with models where mothers' daily allocations of time to various activities are used as dependent variables. Results are shown in Table 4. As can be seen, mothers employed in floriculture spend significantly fewer hours in childcare, domestic work and family care, and self-care and maintenance than mothers not employed in floriculture. These negative effects are large. The 2.1 hours per day that mothers employed in floriculture spend less in childcare are equivalent to a reduction of almost 70% relative to the sample mean value. The 4.9 hours per day that they spend less in domestic work and family care are equivalent to a reduction of more than 50%.

Table 4. Maternal employment in floriculture and time use

Panel A	Mother's time use (hours per day)				
	Childcare	Domestic work and family care	Self-care and maintenance	Floriculture wage employment	Any wage employment
Mother works in floriculture (1/0)	-2.057***	-4.878***	-2.295***	6.818***	6.827***
	(0.356)	(0.515)	(0.369)	(0.371)	(0.412)
Mother level controls	Yes	Yes	Yes	Yes	Yes
Household level controls	Yes	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes	Yes
Observations	512	512	512	512	512
R^2	0.239	0.344	0.192	0.695	0.625
Panel B	Spouse's time use (hours per day)				
	Childcare	Domestic work and family care	Self-care and maintenance		
Mother works in floriculture (1/0)	0.454**	0.435	-0.081		
	(0.223)	(0.273)	(0.366)		
Mother level controls	Yes	Yes	Yes		
Household level controls	Yes	Yes	Yes		
Distance controls	Yes	Yes	Yes		
Observations	498	498	498		
R^2	0.088	0.078	0.081		

OLS regression results with robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

In Panel B of Table 4, we show models with time allocation of the mothers' spouse as dependent variables, in order to see whether sharing of tasks can make up for the mothers' lower involvement at home. The results suggest that spouses increase their daily time spent on childcare by 0.45 hours if the mother is employed in floriculture, but this increase is insufficient to fully make up for the reduction of maternal childcare time. The other estimates for changes in spouse time allocation are statistically insignificant. We conclude that maternal employment in floriculture is associated with significant less total time spent on childcare and domestic work, which could explain the negative child nutrition effects.

Breastfeeding and dietary quality. Less time of mothers spent on childcare and domestic work may be associated with shorter periods of breastfeeding, which we tested. The results in Table A4 in the appendix suggest that the periods of breastfeeding and exclusive breastfeeding for infants and small children are not significantly associated with maternal floriculture employment. However, due to the mothers' long daily periods of absence from home, the quality and frequency of breastfeeding may potentially be affected. Unfortunately, our data do not capture quality and frequency of breastfeeding.

For older children, solid foods and their composition and diversity become more relevant. Table 5 shows models with dietary diversity scores as dependent variables. Maternal employment in floriculture is negatively associated with household dietary diversity, but not with individual child dietary diversity. The dietary diversity scores only count the total number of different food groups consumed. When focusing on individual food groups, we find that children with mothers employed in floriculture are significantly more likely to consume vitamin A rich fruits and vegetables and significantly less likely to consume animal-sourced foods (ASF). Hence, some changes in child dietary practices seem to occur through maternal employment in floriculture. Previous research with child nutrition data from various countries shows that ASF consumption is significantly related to higher HAZ and lower rates of child stunting (Headey *et al.*, 2018).

Table 5. Maternal employment in floriculture and dietary diversity

	Household level	Individual child level				
	(1) HDDS	(2) Child DDS	(3) Legumes/ nuts	(4) Vitamin A rich fruits and vegetables	(5) Other fruits and vegetables	(6) Animal-sourced foods
Mother works in floriculture (1/0)	-0.139***	0.021	0.128	0.496**	0.203	-0.694***
	(0.019)	(0.046)	(0.196)	(0.217)	(0.233)	(0.199)
Child level controls	No	Yes	Yes	Yes	Yes	Yes
Mother level controls	Yes	Yes	Yes	Yes	Yes	Yes
Household level controls	Yes	Yes	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	512	463	463	463	463	463
Pseudo R^2	0.023	0.023	0.208	0.117	0.236	0.218

Regression results with robust standard errors in parentheses. Models in columns (1) and (2) estimated with Poisson and in columns (3) to (7) with probit specifications. For the model in column (7), animal-sourced foods (ASF) are combined into one group, because >95% of the children did not consume meat/organ meat or sea foods. The negative association between mothers employment and child ASF consumption is mainly driven by lower consumption of milk and milk products. Since about 97% of the children aged 6-59 months have consumed grains/ roots/ tubers, we did not estimate a separate model for this food group. * p < 0.1, ** p < 0.05, *** p < 0.01.

Income. We also examine a possible income mechanism. Results in Table A5 suggest that maternal employment in floriculture is not significantly associated with per capita household income for the sample as a whole. However, when we split the sample into income terciles we find positive and significant effects for the poorest households. For households in the poorest tercile, maternal floriculture employment is associated with a 33% increase in per capita income, whereas for the middle and upper terciles, the effects remain insignificant. These findings are consistent with prior research showing that participation in high-value supply chains is often economically beneficial for the poorest households in particular (McCulloch & Ota, 2002; Christiaensen *et al.*, 2011; van den Broeck *et al.*, 2018).

Women's financial autonomy and bargaining power. Finally, we examine a possible association between maternal employment in floriculture and female financial autonomy and bargaining power, proxied by the share of women's wage income in overall household income. Results from a Tobit model show a significantly positive relationship (Table 6). For women employed in floriculture, this employment raises their wage income share by 25 percentage points, suggesting a considerable improvement in female financial autonomy. This higher female financial autonomy as such might lead to higher investments into child nutrition and health. However, given that the overall effect of maternal employment on child nutrition is negative, the negative time allocation effect seems to dominate a possible positive female financial autonomy effect.

Table 6. Maternal employment in floriculture and intra-household bargaining power

	Share of mother's wage income in total household income		
	(1)	(2)	(3)
	Tobit coefficient	Marginal effect for censored sample	Marginal effect for truncated sample
Mother works in floriculture (1/0)	0.780***	0.331***	0.253***
	(0.057)	(0.022)	(0.015)
Mother level controls	Yes	Yes	Yes
Household level controls	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes
Observations	512	273	239
Pseudo R^2	0.821		

A Tobit specification was used because the dependent variable (women's income share) is left censored at zero (53% have zero values). Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

6. Conclusion and policy implications

Whether maternal employment improves or worsens child nutritional status has been a long-standing research question with mixed empirical results (Rashad & Sharaf, 2019; Debela et al., 2021). Various mechanisms can influence this relationship, and the role of these mechanisms seems to depend on the particular context. Studies investigating the effects of maternal employment on child nutrition in connection with high-value agri-food supply chains have been lacking up till now. In this article, we have addressed this research gap by looking at the effects of maternal employment in the floriculture sector on child nutritional outcomes in Ethiopia.

Estimates from endogenous switching regressions, which account for potential self-selection bias, indicate that maternal employment in cut-flower farms has negative effects on child nutrition. We find that such employment reduces child HAZ by 0.75 and child WAZ by 0.43 standard deviations, which are large negative net effects.

We have also explored possible underlying mechanisms and found that maternal employment in floriculture is negatively associated with the time mothers spend on childcare, domestic work, and family care. Mothers' time spent on childcare is reduced by almost 70%. Spouses of mothers employed in floriculture spend somewhat more time on childcare, but this increase is insufficient to fully substitute for the mothers' absence. Maternal employment in floriculture is negatively associated with household dietary diversity and with the likelihood of the child consuming animal-sourced foods. Maternal employment in floriculture seems to increase total household income only for the poorest households, but it increases the share of women's wage income in total household income. A larger relative contribution to household income likely increases female financial autonomy and intra-household bargaining power. In general, higher female financial autonomy can lead to positive child nutrition effects (Glick, 2002; Barrientos & DeJong, 2006; Gillespie & van den Bold, 2017; Quisumbing & Doss, 2021). However, here this potential positive partial effect on child nutrition seems to be outweighed by the negative partial effect through less maternal time available for childcare and domestic work.

These results have some broader policy implications. High-value, export-oriented agriculture can play important roles in terms of spurring economic growth and generating new employment opportunities in Africa, especially for women. While women's employment in emerging export-oriented sectors can lead to income gains and rising female financial autonomy, it can also have unintended side-effects, such as negative child nutrition outcomes. Such negative social effects need to be understood and avoided through appropriate policies and initiatives.

One relevant policy area is to improve women's working conditions through raising labor standards, including minimum wages, work-hour regulations, and preferential conditions for pregnant and lactating women. Improving the childcare options for mothers at or near the place of work may also be useful. Another relevant policy area is to change traditional gender roles so that typical women's tasks – such as childcare and domestic work – can be shared more equally between male and female household members. This is a longer-term endeavor, but will be needed to promote equitable development. Finally, broader policies to improve child nutrition are needed in settings where child undernutrition is still high. This can include education and awareness campaigns, feeding programs, and enhanced functioning of markets for nutritious foods, among other initiatives. Policy approaches always need to be well adapted to the local context.

7. Appendix

Table A1. Falsification test for instrumental variables

	Selection into floriculture employment	Mothers not working in floriculture	
		HAZ	WAZ
Share of floriculture-employed women	1.459***	-0.306	-0.082
	(0.278)	(0.415)	(0.322)
Women's connection to other floriculture workers	0.242***	-0.083	0.005
	(0.076)	(0.120)	(0.086)
Constant	-1.193***	-0.914***	-0.640***
	(0.148)	(0.186)	(0.143)
Wald test	38.758***		
F-stat.		0.595	0.033
Sample size	512	332	332

Robust standard errors in parentheses. The selection model is estimated with a probit specification, the HAZ and WAZ models with OLS. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: Summary statistics of all variables

	Full sample (1)		Main woman not working in floriculture (2)		Main woman working in floriculture (3)		Mean difference (3)-(2)
	Mean	SD	Mean	SD	Mean	SD	
Child HAZ-score	-1.252	1.447	-1.084	1.459	-1.561	1.376	-0.476^{***}
Child WAZ-score	-0.761	1.212	-0.669	1.145	-0.932	1.313	-0.263^{**}
Child is female	0.471	0.500	0.497	0.501	0.422	0.495	-0.075
Child age in months	29.469	17.005	29.774	17.134	28.906	16.797	-0.869
Duration of child breastfeeding (months)	19.229	10.882	19.411	11.244	18.894	10.205	-0.516
Duration of exclusive child breastfeeding	5.225	1.742	5.190	1.735	5.289	1.758	0.099
Mother's height in cm	157.586	6.218	158.105	6.230	156.629	6.097	-1.476^{**}
Total months of floricultural wage work by the main woman:							
During last 12 months	3.739	5.178	0.309	1.671	10.065	3.052	9.756^{***}
In her entire life	25.925	33.790	13.540	25.941	48.769	34.724	35.229^{***}
Mother's age	27.820	5.374	28.645	5.803	26.300	4.072	-2.345^{***}
Mother’s years of education	1.729	0.850	1.848	0.811	1.508	0.879	-0.341^{***}
Mother migrated from a rural place	0.551	0.498	0.446	0.498	0.744	0.437	0.299^{***}
Mother's non-floriculture occupation:							
Non-floriculture wage employment	0.094	0.292	0.145	0.352	0.000	0.000	-0.145^{***}
Self-employment	0.100	0.300	0.154	0.361	0.000	0.000	-0.154^{***}
Domestic work	0.455	0.498	0.702	0.458	0.000	0.000	-0.702^{***}
Mother had been working in floriculture	0.279	0.449	0.431	0.496	0.000	0.000	-0.431^{***}
Household head's age	33.586	7.259	35.136	7.456	30.728	5.912	-4.408^{***}
Household head’s religion:							
Orthodox Christian	0.387	0.487	0.419	0.494	0.328	0.471	-0.091^{**}
Protestant	0.334	0.472	0.241	0.428	0.506	0.501	0.265^{***}
Muslim	0.279	0.449	0.340	0.475	0.167	0.374	-0.174^{***}
Household size	4.514	1.284	4.684	1.375	4.200	1.027	-0.484^{***}
Livestock (1/0)	0.189	0.392	0.226	0.419	0.122	0.328	-0.104^{***}
Improved floor (1/0)	0.461	0.499	0.512	0.501	0.367	0.483	-0.145^{***}
Radio (1/0)	0.285	0.452	0.274	0.447	0.306	0.462	0.031
Water storage pit (1/0)	0.131	0.338	0.160	0.367	0.078	0.269	-0.082^{***}
HH distance to basic facilities in km:							
Distance to district admin	2.598	1.668	2.580	1.571	2.630	1.839	0.050

Distance to nearest health facility	1.207	1.111	1.178	1.075	1.261	1.176	0.083
Distance to nearest major food market	1.618	1.499	1.488	1.490	1.859	1.489	0.371***
Mother's 24 hour time use:							
Self-care, maintenance and social	14.466	2.885	15.113	2.611	13.272	2.991	-1.841***
Child care	3.102	3.040	3.700	3.209	1.997	2.334	-1.703***
Domestic work and family care	8.892	4.317	10.298	4.063	6.297	3.499	-4.001***
Floricultural wage employment	2.528	4.169	0.000	0.000	7.192	3.988	7.192***
Any wage employment	2.976	4.335	0.690	2.346	7.192	3.988	6.502***
HHH's 24 hours time use:							
Self-care, maintenance and social	13.178	2.908	13.259	3.058	13.029	2.61	-0.231
Child care	1.77	1.699	1.602	1.487	2.078	2.001	0.475
Domestic work and family care	2.422	2.012	2.277	1.843	2.689	2.273	0.412
HH income per capita	22407.510	21587.463	24040.207	25571.641	19396.091	10349.831	- 4644.116**
Share of mother's wage income to total HH income	0.170	0.234	0.059	0.162	0.375	0.208	0.316***
Household diet diversity score (HDDS) (0-12)	8.086	1.511	8.455	1.485	7.406	1.310	-1.049***
Child diet diversity (0-7)	2.742	1.220	2.783	1.275	2.667	1.109	-0.116
Share of floriculture employed women	0.424	0.213	0.387	0.198	0.492	0.222	0.105***
Women's connection to other floriculture workers (0-3)	0.701	0.765	0.620	0.742	0.850	0.787	0.230***
N	512		332		180		512

SD: standard deviations. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3. Child anthropometric outcomes: Endogenous switching regressions (ESR)

	HAZ			WAZ		
		Mother is employed in floriculture			Mother is employed in floriculture	
	(1)	(2)	(3)	(4)	(5)	(6)
	Selection	Yes	No	Selection	Yes	No
Child level controls:						
Child is female	-0.020	0.038	0.038	-0.049	-0.318*	0.170
	(0.196)	(0.193)	(0.146)	(0.194)	(0.181)	(0.116)
Child age	-0.001	-0.072***	-0.094***	0.001	-0.007	-0.031**
	(0.024)	(0.027)	(0.018)	(0.024)	(0.024)	(0.015)
Child age squared	0.000	0.001***	0.001***	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mother level controls:						
Mother's height in cm	0.014	0.063***	0.052***	0.015	0.062***	0.037***
	(0.017)	(0.017)	(0.012)	(0.018)	(0.018)	(0.009)
Mother's age	0.527**	-0.076	0.136	0.499**	-0.164	0.223**
	(0.230)	(0.249)	(0.107)	(0.239)	(0.223)	(0.094)
Mother's age squared	-0.009**	0.002	-0.002	-0.009**	0.003	-0.004**
	(0.004)	(0.004)	(0.002)	(0.004)	(0.004)	(0.001)
Mother years of education	-0.734***	-0.121	0.052	-0.705***	-0.148	0.038
	(0.143)	(0.108)	(0.106)	(0.142)	(0.102)	(0.103)
Mother migrated from a rural place	0.867***	0.355	0.151	0.872***	0.167	0.229*
	(0.217)	(0.276)	(0.150)	(0.220)	(0.259)	(0.132)
Non-floriculture wage employment (1/0)	-8.918***		-0.126	-8.941***		0.287
	(0.493)		(0.257)	(0.718)		(0.232)
Self-employment (1/0)	-6.888***		-0.071	-7.077***		0.006
	(0.628)		(0.195)	(0.462)		(0.171)
Mother had been working in floriculture (1/0)	-10.993***		-0.224	-11.094***		-0.153
	(0.865)		(0.198)	(1.181)		(0.222)
Household level controls:						
Household head's Age	-0.073***	-0.016	0.004	-0.072***	-0.015	-0.002
	(0.020)	(0.021)	(0.017)	(0.020)	(0.019)	(0.013)
HHH's religion (Ref. category: Orthodox Christian):						
Protestant	0.378	-0.257	0.078	0.433	-0.266	0.064
	(0.299)	(0.278)	(0.210)	(0.302)	(0.247)	(0.163)
Muslim	-0.793**	-1.073***	-0.137	-0.753**	-1.279***	-0.225
	(0.337)	(0.339)	(0.239)	(0.336)	(0.297)	(0.197)

Household size	-0.023	-0.051	0.079	-0.006	0.070	0.045
	(0.104)	(0.120)	(0.079)	(0.103)	(0.116)	(0.057)
Livestock (1/0)	-0.680***	0.088	-0.119	-0.645**	-0.504	0.204
	(0.252)	(0.284)	(0.201)	(0.258)	(0.335)	(0.157)
Improved floor (1/0)	-0.725***	0.149	0.055	-0.737***	0.060	0.171
	(0.222)	(0.199)	(0.173)	(0.224)	(0.205)	(0.132)
Radio (1/0)	0.347	0.385**	-0.031	0.388*	0.461**	-0.000
	(0.223)	(0.185)	(0.160)	(0.222)	(0.194)	(0.142)
Water storage pit (1/0)	-0.222	-0.183	0.385	-0.238	0.020	0.075
	(0.329)	(0.353)	(0.234)	(0.350)	(0.342)	(0.188)
Log of HH distance to basic facilities in km:						
Distance to district admin	-1.909***	-0.308	-0.182	-1.784***	-0.591	-0.769*
	(0.698)	(0.658)	(0.533)	(0.686)	(0.587)	(0.434)
Distance to nearest health facility	1.508**	-0.900	-0.198	1.265*	-1.252*	0.014
	(0.692)	(0.722)	(0.540)	(0.677)	(0.675)	(0.438)
Distance to nearest major food market	1.320***	1.078**	0.261	1.414***	1.323***	0.302
	(0.498)	(0.483)	(0.333)	(0.502)	(0.433)	(0.277)
Instruments:						
Share of floriculture employed-women	3.916***			3.775***		
	(0.771)			(0.776)		
Women's connection to other floriculture workers	0.538***			0.531***		
	(0.151)			(0.154)		
Constant	-7.729*	-9.648**	-10.253***	-7.481	-7.513*	-8.952***
	(4.572)	(4.452)	(2.401)	(4.761)	(4.154)	(2.068)
ρ1		0.458**			0.372**	
		(0.218)			(0.175)	
ρ0			0.267			0.147
			(0.216)			(0.372)
chi2	97.575***			78.519***		
Observations	512	180	332	512	180	332

Robust standard errors in parentheses. Distances are measured in log of km.* p < 0.1, ** p < 0.05, *** p < 0.01.

Table A4. Maternal time spent in floriculture employment and duration of breastfeeding

	Duration of breast feeding (months)		Duration of exclusive breast feeding (months)	
	(1) Child age 7-23 months	(2) Child age 7-23 months	(3) Child age 0-59 months	(4) Child age 0-59 months
Months spent by mother in floricultural employment:				
During last 12 months	0.059		-0.019	
	(0.059)		(0.021)	
In her entire life		0.005		-0.002
		(0.008)		(0.002)
Child level controls	Yes	Yes	Yes	Yes
Mother level controls	Yes	Yes	Yes	Yes
Household level controls	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes
Observations	152	152	511	511
R^2	0.676	0.674	0.193	0.193

OLS results with robust standard errors in parentheses. Since one of the children in our sample is adopted and current parents did not know duration of breastfeeding, this one observation was excluded for these model estimates. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A5. Maternal employment in floriculture and household income

	Per capita income (log)	Results by income tercile		
		First tercile	Second tercile	Third tercile
Mother works in floriculture (1/0)	0.027	0.329***	0.008	-0.088
	(0.091)	(0.105)	(0.040)	(0.107)
Mother level controls	Yes	Yes	Yes	Yes
Household level controls	Yes	Yes	Yes	Yes
Distance controls	Yes	Yes	Yes	Yes
Observations				
Households with mothers working in floriculture	180	53	81	46
Households with mothers not working in floriculture	332	118	90	332
Total	512	171	171	170
R^2	0.189	0.411	0.752	0.419

OLS regression results with robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

References

Abro, Z., Kassie, M., Tiku, H.A., Taye, B., Ayele, Z.A. & Ayalew, W. (2022) The impact of beekeeping on household income: evidence from north-western Ethiopia. *Heliyon*, 8(5), e09492. Available from: https://doi.org/10.1016/j.heliyon.2022.e09492.

Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G. & Vaz, A. (2013) The Women's Empowerment in Agriculture Index. *World Development*, 52, 71–91. Available from: https://doi.org/10.1016/j.worlddev.2013.06.007.

Atkin, D. (2009) Working for the Future: Female Factory Work and Child Health in Mexico. *Unpublished Manuscript, Yale University, 150*.

Barrett, C.B., Reardon, T., Swinnen, J. & Zilberman, D. (2022) Agri-food Value Chain Revolutions in Low- and Middle-Income Countries. *Journal of Economic Literature*, 60(4), 1316–1377. Available from: https://doi.org/10.1257/jel.20201539.

Barrientos, A. & DeJong, J. (2006) Reducing Child Poverty with Cash Transfers: A Sure Thing? *Development Policy Review*, 24(5), 537–552. Available from: https://doi.org/10.1111/j.1467-7679.2006.00346.x.

Bottazzi, P., Crespo, D., Bangura, L.O. & Rist, S. (2018) Evaluating the livelihood impacts of a large-scale agricultural investment: Lessons from the case of a biofuel production company in northern Sierra Leone. *Land Use Policy*, 73, 128–137. Available from: https://doi.org/10.1016/j.landusepol.2017.12.016.

Burroway, R. (2017) Are all jobs created equal? A cross-national analysis of women's employment and child malnutrition in developing countries, 67, 1–13. Available from: https://doi.org/ 10.1016/j.ssresearch.2017.07.003.

Chari, A.V., Glick, P., Okeke, E. & Srinivasan, S.V. (2019) Workfare and infant health: Evidence from India's public works program. *Journal of Development Economics*, 138, 116–134. Available from: https://doi.org/10.1016/j.jdeveco.2018.12.004.

Christiaensen, L., Demery, L. & Kuhl, J. (2011) The (evolving) role of agriculture in poverty reduction—An empirical perspective. *Journal of Development Economics*, 96(2), 239–254. Available from: https://doi.org/10.1016/j.jdeveco.2010.10.006.

Coates, D., Humphreys, B.R., Kane, J. & Vachris, M.A. (2004) “No significant distance” between face-to-face and online instruction: evidence from principles of economics. *Economics of Education Review*, 23(5), 533–546. Available from: https://doi.org/10.1016/j.econedurev.2004.02.002.

Debela, B.L., Gehrke, E. & Qaim, M. (2021) Links between Maternal Employment and Child Nutrition in Rural Tanzania. *American Journal of Agricultural Economics*, 103(3), 812–830. Available from: https://doi.org/10.1111/ajae.12113.

Debela, B.L., Ruml, A. & Qaim, M. (2022) Effects of contract farming on diets and nutrition in Ghana. *Applied Economic Perspectives and Policy*, 44(2), 911–929. Available from: https://doi.org/10.1002/aepp.13204.

Di Falco, S., Veronesi, M. & Yesuf, M. (2011) Does Adaptation to Climate Change Provide Food Security? A Micro-Perspective from Ethiopia. *American Journal of Agricultural Economics*, 93(3), 829–846. Available from: https://doi.org/10.1093/ajae/aar006.

Di Marcantonio, F., Havari, E., Colen, L. & Ciaian, P. (2022) Do producer organizations improve trading practices and negotiation power for dairy farms? Evidence from selected EU countries. *Agricultural Economics*, 53(S1), 121–137. Available from: https://doi.org/10.1111/agec.12730.

Dolislager, M., Reardon, T., Arslan, A., Fox, L., Liverpool-Tasie, S. & Sauer, C. et al. (2021) Youth and Adult Agrifood System Employment in Developing Regions: Rural (Peri-urban to Hinterland) vs. Urban. *Journal of Development Studies*, 57(4), 571–593. Available from: https://doi.org/10.1080/00220388.2020.1808198.

EHPEA (2019) *Overview Of The Horticulture Sector - EHPEA*. Available from: https://ehpea.org/overview-of-the-sectors-growth/ [Accessed 21 May 2023].

FAO (2013) Guidelines for measuring household and individual dietary diversity. Available from: https://www.fao.org/3/i1983e/i1983e00.pdf.

Feyaerts, H., van den Broeck, G. & Maertens, M. (2020) Global and local food value chains in Africa: A review. *Agricultural Economics*, 51(1), 143–157. Available from: https://doi.org/10.1111/agec.12546.

Fuglie, K.O. & Bosch, D.J. (1995) Economic and Environmental Implications of Soil Nitrogen Testing: A Switching-Regression Analysis. *American Journal of Agricultural Economics*, 77(4), 891–900. Available from: https://doi.org/10.2307/1243812.

Gebreeyesus, M. (2015) Firm adoption of international standards: evidence from the Ethiopian floriculture sector. *Agricultural Economics*, 46(S1), 139–155. Available from: https://doi.org/10.1111/agec.12203.

Gillespie, S. & van den Bold, M. (2017) Agriculture, Food Systems, and Nutrition: Meeting the Challenge. *Global Challenges (Hoboken, NJ)*, 1(3), 1600002. Available from: https://doi.org/10.1002/gch2.201600002.

Glick, P. (2002) Women's Employment and its Relation to Children's Health and Schooling in Developing Countries: Conceptual Links, Empirical Evidence, and Policies. *SSRN Electronic Journal*. Available from: https://doi.org/10.2139/ssrn.424101.

Glick, P. & Sahn, D.E. (1998) Maternal labour supply and child nutrition in West Africa. *Oxford Bulletin of Economics and Statistics*, 60(3), 325–355. Available from: https://doi.org/10.1111/1468-0084.00103.

Global Nutrition Report (2022) Global Nutrition Report. Available from: https:// globalnutritionreport.org/reports/2022-global-nutrition-report/.

Headey, D., Hirvonen, K. & Hoddinott, J. (2018) Animal Sourced Foods and Child Stunting. *American Journal of Agricultural Economics*, 100(5), 1302–1319. Available from: https://doi.org/10.1093/ajae/aay053.

Headey, D.D. & Masters, W.A. (2021) *Agriculture and undernutrition*, Washington, DC. Available from: https://doi.org/10.2499/9780896293830_10.

Johnston, D., Stevano, S., Malapit, H.J., Hull, E. & Kadiyala, S. (2018) Review: Time Use as an Explanation for the Agri-Nutrition Disconnect: Evidence from Rural Areas in Low and Middle-Income Countries. *Food Policy*, 76, 8–18. Available from: https://doi.org/10.1016/j.foodpol.2017.12.011.

Kassie, M., TEKLEWOLD, H., Marenya, P., Jaleta, M. & Erenstein, O. (2014) Production Risks and Food Security under Alternative Technology Choices in Malawi: Application of a Multinomial

Endogenous Switching Regression. *Journal of Agricultural Economics*, 66(3), 640–659. Available from: https://doi.org/10.1111/1477-9552.12099.

Leslie, J. (1988) Women's Work and Child Nutrition in the Third World. *World Development*, 16(11), 1341–1362. Available from: https://doi.org/10.4324/9780429268656-2.

Lokshin, M. & Sajaia, Z. (2004) Maximum Likelihood Estimation of Endogenous Switching Regression Models. *The Stata Journal: Promoting communications on statistics and Stata*, 4(3), 282–289. Available from: https://doi.org/10.1177/1536867X0400400306.

Maertens, M., Colen, L. & Swinnen, J.F.M. (2011) Globalisation and poverty in Senegal: a worst case scenario? *European Review of Agricultural Economics*, 38(1), 31–54. Available from: https://doi.org/10.1093/erae/jbq053.

Maertens, M., Minten, B. & Swinnen, J. (2012) Modern Food Supply Chains and Development: Evidence from Horticulture Export Sectors in Sub-Saharan Africa. *Development Policy Review*, 30(4), 473–497. Available from: https://doi.org/10.1111/j.1467-7679.2012.00585.x.

Maertens, M. & Verhofstadt, E. (2013) Horticultural exports, female wage employment and primary school enrolment: Theory and evidence from Senegal. *Food Policy*, 43, 118–131. Available from: https://doi.org/10.1016/j.foodpol.2013.07.006.

McCulloch, N. & Ota, M. (2002) Export Horticulture and Poverty in Kenya.: Working Paper 174. Brighton: Institute for Development Studies at the University of Sussex.

McGuire, J.S., Popkin, B.M. & Vittas, D. (1990) *Helping women improve nutrition in the developing world*. The World Bank.

MoA (2022) *Annual Performance Report 2021/22: Ethiopian Ministry of Agriculture*.

Nunn, N. & Wantchekon, L. (2011) The Slave Trade and the Origins of Mistrust in Africa. *American Economic Review*, 101(7), 3221–3252. Available from: https://doi.org/10.1257/aer.101.7.3221.

Oddo, V.M., Surkan, P.J., Hurley, K.M., Lowery, C., Ponce, S. de & Jones-Smith, J.C. (2018) Pathways of the association between maternal employment and weight status among women and children: Qualitative findings from Guatemala. *Maternal & Child Nutrition*, 14(1). Available from: https://doi.org/10.1111/mcn.12455.

Popkin, B.M. (1980) Time allocation of the mother and child nutrition. *Ecology of Food and Nutrition*, 9(1), 1–14. Available from: https://doi.org/10.1080/03670244.1980.9990579.

Quisumbing, A.R. & Doss, C.R. (2021) Gender in agriculture and food systems. *Handbook of Agricultural Economics*, 5, 4481–4549. Available from: https://doi.org/10.1016/bs.hesagr.2021.10.009.

Rashad, A.S. & Sharaf, M.F. (2019) Does maternal employment affect child nutrition status? New evidence from Egypt. *Oxford Development Studies*, 47(1), 48–62. Available from: https://doi.org/10.1080/13600818.2018.1497589.

Ruml, A., Ragasa, C. & Qaim, M. (2022) Contract farming, contract design and smallholder livelihoods. *Australian Journal of Agricultural and Resource Economics*, 66(1), 24–43. Available from: https://doi.org/10.1111/1467-8489.12462.

Smith, L.C. & Haddad, L. (2015) Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. *World Development*, 68, 180–204. Available from: https://doi.org/10.1016/j.worlddev.2014.11.014.

Swindale, A. & Bilinsky, P. (2006) Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (Version 2). Available from: https:// www.fantaproject.org/sites/default/files/resources/HDDS_v2_Sep06_0.pdf.

UNICEF (1990) Strategy for improved nutrition of children and women in developing countries. Available from: https://digitallibrary.un.org/record/227230?ln=en.

UNICEF/ WHO/ World Bank (2021) Levels and trends in child malnutrition. Available from: https://www.who.int/publications/i/item/9789240025257.

van den Broeck, G., Swinnen, J. & Maertens, M. (2017) Global value chains, large-scale farming, and poverty: Long-term effects in Senegal. *Food Policy*, 66, 97–107. Available from: https://doi.org/10.1016/j.foodpol.2016.12.003.

van den Broeck, G., Swinnen, J.F.M. & Maertens, M. (2016) Global Value Chains, Large-Scale Farming, and Poverty: Long-Term Effects in Senegal. *SSRN Electronic Journal*. Available from: https://doi.org/10.2139/ssrn.2828093.

van den Broeck, G., van Hoyweghen, K. & Maertens, M. (2018) Horticultural exports and food security in Senegal. *Global Food Security*, 17, 162–171. Available from: https://doi.org/10.1016/j.gfs.2017.12.002.

WHO (2006) Child Growth Standards. Available from: https://www.who.int/tools/child-growth-standards.

Willis, R.J. & Rosen, S. (1979) Education and Self-Selection. *Journal of Political Economy*, 87(5, Part 2), S7-S36. Available from: https://doi.org/10.1086/260821.