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

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

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

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

Selected Paper prepared for presentation at the 2023 Agricultural & Applied Economics Association Annual Meeting, Washington DC; July 23-25, 2023

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

Astewale Bimr Melaku [a, *], Matin Qaim [b, c], Bethelhem Legesse Debela [a]

[a] *Department of Agricultural Economics and Rural Development, University of Goettingen, Goettingen, Germany*
[b] *Center for Development Research (ZEF), University of Bonn, Bonn, Germany*
[c] *Institute for Food and Resource Economics, University of Bonn, Bonn, Germany*

Abstract

Agri-food value chain transformations have been underway in the developing world during the past few decades. One important feature is that the sector creates substantial employment opportunities, especially for women. Whether these opportunities would be beneficial to important welfare outcomes, including child nutrition, is unclear. Using primary household survey data from Ethiopia, we investigate the effect of mothers' floricultural employment on the nutrition outcomes of children aged 0 – 5 years. OLS results indicate that mothers' employment in floriculture is associated with lower levels of height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ). We use an endogenous switching regression approach to account for unobservable factors that determine the likelihood of mothers' employment and retention in floriculture as well as the nutrition outcomes. Corresponding results suggest that mothers' employment in floriculture can negatively influence child nutrition. We find 0.75 and 0.99 standard deviations lower HAZ and WAZ, respectively, among children of women working in the sector compared to the counterfactual case that the mothers did not work in the sector. Furthermore, we explore multiple underlying factors of child undernutrition as potential pathways for this relationship.

Keywords: Women Employment, Child Nutrition, Agri-food Value Chains, Floriculture, Ethiopia

1. Introduction

Agri-food value chain (AVC) transformations have been underway in the developing world during the past few decades (Barrett *et al.*, 2022). An important feature is that agri-food exports from developing countries have shifted from traditional agricultural commodities (e.g., cotton, coffee, cocoa) to high-value fresh agricultural products (e.g., fruits, vegetables, cut flowers). Such shifts have been important to African countries in terms of addressing key poverty reduction and development goals. In particular, share of the continent's high-value agriculture (HVA) exports to total agri-food exports is the largest in the developing world preceding Asia and Latin America (van den Broeck *et al.*, 2016).

One interesting feature of HVA for African countries and elsewhere in developing countries is that it creates new job opportunities, mainly for low-skilled laborers (Cramer *et al.*, 2018; Barrett *et al.*, 2022). Global AVCs usually require integration of various actors (horizontal and vertical

[*] Corresponding author. Email address: astewale.melaku@uni-goettingen.de.

coordination) to achieve economies of scale and meet quality and safety standards – which per se amplify the demand for additional labor inputs. Labor participation in producing countries can happen mainly in two forms – i) integration of smallholder farmers into agri-food value chains mainly via contract farming contract-farming arrangements mainly depend on setups where smallholders supplying farm products to export chains either directly or via their respective cooperatives based on agreements made prior to start of production (Maertens *et al.*, 2012; van den Broeck *et al.*, 2017; Ton *et al.*, 2018); or ii) directly hiring of low-skilled labor in agri-food value chain firms which is more common in the HVA sub-sector (van den Broeck *et al.*, 2017; Barrett *et al.*, 2022). New job opportunities in HVA are often especially important for women from poor population segments. Women constitute up to 90% of labor force participation through direct employment, especially the horticulture sector (van den Broeck *et al.*, 2018). For example, women employees make up about 85% in the Ethiopian horticulture, 75% in the Kenyan and Ugandan floriculture, 65% in the Zambian vegetables sectors (Maertens & Swinnen, 2012; van den Broeck *et al.*, 2018; Barrett *et al.*, 2022). Most of them are employed in larger agri-food firms. The increasing employment of women in agri-food firms is of high relevance for development policy and research, as such employment can be associated with important household and individual level welfare effects, including child nutrition.

Child undernutrition, which is still one of most prominent development challenges, is a form of malnutrition caused by inadequate consumption of food and/or frequent illness, leading to poor health and other long-term negative welfare outcomes (Smith & Haddad, 2015). Child malnutrition in general attributes 35% of deaths among children under 5 years of age and together with maternal undernutrition, it contributes to 11% of the global burden of diseases (WHO, 2014). In cognizant of this development challenge and its multifaceted consequences, the World Health Assembly (WHA) in 2012 set a total of six global nutrition targets[1] to be achieved by 2025 (WHO, 2014). Likewise, the United Nations General Assembly in 2015 endorsed a plan of ending all forms of malnutrition among children under 5 years of age by 2030 as part of the Sustainable Development Goals (SDGs) and achieving the WHA targets by 2025 (United Nations, 2015). Recent forecasts show that these global child nutrition targets could not be attained as pledged, despite some reductions in the proportion of undernourished children in recent years (UNICEF/ WHO/ World Bank, 2019, 2021). For example, three-quarters of countries are off-track towards achieving the target of reducing prevalence of stunting among children under five years of age (UNICEF/ WHO/ World Bank, 2021). As a result of such insufficient progresses towards achieving global nutrition targets, a review by WHO and UNICEF in 2018 suggested extending the WHA targets by five years to 2030 (WHO/ UNICEF, 2018). Moreover, recent joint malnutrition estimates by UNICEF/ WHO/ World Bank (2021) show that nearly 150 million (22% of all) and 45 million (6.7% of all) children, respectively, are exposed to either severe or moderate stunting and wasting globally. Two-fifths and a quarter of these children affected by stunting and wasting, respectively, lived in

[1] WHA's six targets include: reduction of stunting among children under 5 years of age by 40%, reduction of anemia among women of reproductive age by 50%, reduction of low birth weight by 30%, keeping overweight not to increase, increase exclusive breastfeeding by 50%, and keep prevalence of child wasting below 5% WHO (2014).

Africa. This makes the continent the second largest contributor to the global stunting and wasting prevalence next to Asia.

Child nutritional outcomes can be influenced by women's employment decisions via multiple mechanisms, including changes in income, time allocation, and intra-household bargaining power (Debela *et al.*, 2021). Without useful simplifications, this relationship is rather complex (Leslie, 1988), and hence exploring these potential linkages in differentiated ways can provide important insights. Investigation of this relationship is especially important in the HVA sector due to different reasons. First, while massive employment opportunities for women in HVA are important for favorable welfare outcomes (e.g., women empowerment and income aspects), the question of whether the quality of these jobs might lead to unintended social consequences is not undebatable (van den Broeck *et al.*, 2018; Blasis, 2020). Second, employment in commercial farms/firms in HVA tend to have specific features in terms of physical exertion and working conditions (e.g., working for long-hours in high temperatures and excessive use of chemical inputs) (Headey & Masters, 2021). This implies that employment conditions in HVA sector might affect child nutritional outcomes differently than employment in other sectors. Third, the empirical evidence linking mothers' direct employment in this particular sector with child nutrition is scarce. Overall, as HVA exports are booming in many African countries, better understanding of the welfare implications of this particular sector is vital for the design of policies and development interventions.

The literature investigating the relationship between participation in HVA or AVCs in general and welfare outcomes is largely focused on contract-farming schemes (Hernández *et al.*, 2007; Schipmann & Qaim, 2010; Rao & Qaim, 2011; Barrett *et al.*, 2012; Michelson, 2013; Bellemare & Novak, 2017; Mishra *et al.*, 2018; Meemken & Bellemare, 2020; Debela *et al.*, 2022; Ruml *et al.*, 2022). The major gap in these studies is that most of them focus on direct implications (e.g., income or yield effects) of AVCs and evaluation of more indirect effects (e.g., child nutrition) is very limited. A few exceptions include studies that examined the influence of participation in AVCs on food security (Bellemare & Novak, 2017) and diets and child nutrition (Debela *et al.*, 2022). Yet, contract-farming, which all of the above studies are about, is only one of the ways through which individuals or households could participate in AVCs. Even though, labor market participation of individuals is also very important aspect of AVCs and more importantly for the HVA sub-sector, it has received less attention in the literature (Maertens *et al.*, 2012). Few studies that analyzed employment participation in AVCs and its welfare implications include (Barron & Rello, 2000; McCulloch & Ota, 2002; Maertens, 2009; Maertens *et al.*, 2011; Maertens & Verhofstadt, 2013; van den Broeck & Maertens, 2015; van den Broeck *et al.*, 2017; van den Broeck *et al.*, 2018). Only three of them (Maertens & Verhofstadt, 2013; van den Broeck & Maertens, 2015; van den Broeck *et al.*, 2018), considered more indirect welfare effect (i.e., food security, fertility and child education enrolment) as main outcomes. However, child nutritional outcomes have not been addressed by any of those studies mentioned in the direct employment participation scheme. Our study contributes to filling this literature gap. This study is unique in the sense that it analyzes the effects of women's employment in HVA on child nutrition. Particularly, the study focuses on women's employment in the Ethiopian floriculture sector and its implications on anthropometric outcomes of under-five children. Child nutritional indicators used in this study are height-for-age z-scores (HAZ) and weight-for-age z-scores (WAZ).

The remainder of this paper is organized as follows. Section 2 provides conceptual framework, whereas section 3 presents the data along with summary statistics. In section 4, the econometric approaches used in this paper are provided. Empirical results are presented and discussed in section 5. Section 6 concludes.

2. Conceptual framework

A comprehensive conceptual framework for child nutrition developed by UNICEF (1990) and subsequent modifications (Engle *et al.*, 1999; Smith & Haddad, 2015) encompass three levels of child undernutrition determinants with multiple hierarchical as well as horizontal relationships among each other (see part of Figure 1 connected with solid lines). These causes of child undernutrition include immediate, underlying and basic determinants which manifest themselves

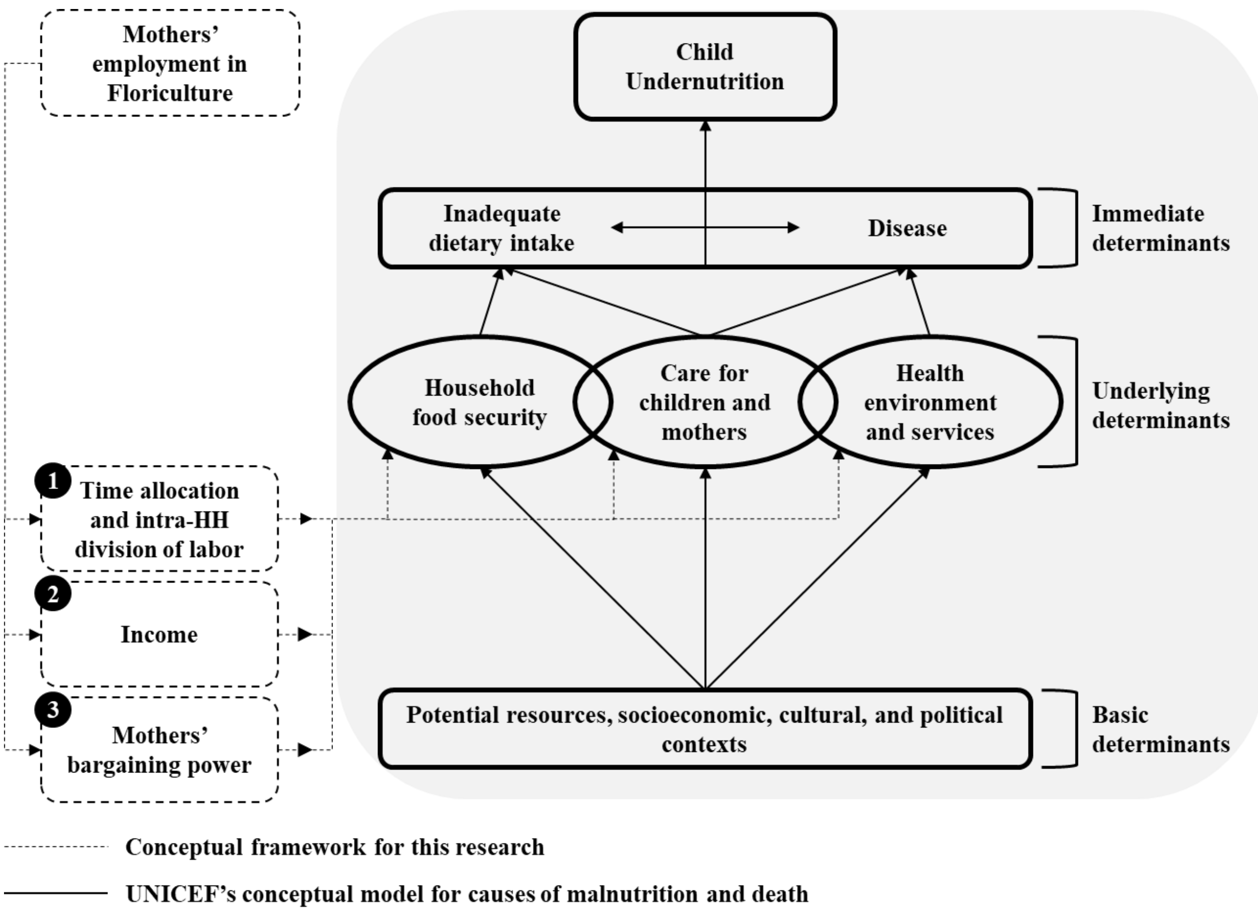

Figure 1: Conceptual framework linked with a comprehensive child nutrition conceptual model adapted from (UNICEF, 1990).

at the individual, household and broader geographical levels, respectively. Immediate determinants include individuals' dietary intake and health status which are interlinked to each other. Underlying level determinants incorporate food security, mother- and child-care, healthy environment and access to health. Finally, basic determinants include resources available at communal or country levels where political, sociocultural, and economic factors influence the way these resources are utilized. AVCs are directly linked mainly to the underlying causes of child nutrition (i.e., food security, care and healthy living environments) and ultimately influence child nutritional status in several ways, including through women' employment in agri-food value chains (Fan & Pandya-Lorch, 2012b, 2012a; Hammond & Dubé, 2012; Headey *et al.*, 2012; IFPRI, 2012; Kadiyala *et al.*, 2014; Smith & Haddad, 2015; Gillespie & van den Bold, 2017). Women employment is an important aspect in the AVCs mainly due to: i) dominance of women in the sector's labor composition, especially via direct employment (Maertens & Swinnen, 2012; Baumüller *et al.*, 2020; Barrett *et al.*, 2022); and ii) women's employment strong linkages with child nutritional status (Leslie, 1988; Glick & Sahn, 1998; Oddo *et al.*, 2018; Debela *et al.*, 2021). Major elements through which women's employment may affect child nutritional status can be clustered into three main pathways: 1) time allocation and intra-household division of labor, 2) changes in income, and 3) shifts in women's bargaining power (Gillespie & van den Bold, 2017; Debela *et al.*, 2021). As shown in Figure 1 (the part that is plotted with dotted lines), mothers' employment, via the three main pathways, influence underlying determinants of child undernutrition which are identified by the UNICEF's comprehensive model. This categorization of pathways is provided for simplicity and it is important to note that there is overlap of and interaction between multiple channels through which women's employment could be linked to child nutrition (Leslie, 1988).

2.1 Changes in income

Existing empirical evidence shows that participation in global agri-food value chains through labor markets is associated with higher household income (McCulloch & Ota, 2002; Maertens & Swinnen, 2012; Herrmann, 2017; Bottazzi *et al.*, 2018; van den Broeck *et al.*, 2018), especially for the poorest segment of households (McCulloch & Ota, 2002; van den Broeck *et al.*, 2018). This is also in line with a research finding that agriculture in general can reduce poverty mainly among the poorest segments of populations (Christiaensen *et al.*, 2011). Income gains from AVCs may have positive nutritional impacts in areas characterized by higher incidence of food insecurity and early stages of structural transformation (Headey & Masters, 2021). Specifically, women's income from labor participation in agri-food value chains might influence child nutrition via changes in household income and its composition. Such income shifts induced by wage employment might lead to increased household food consumption (Bottazzi *et al.*, 2018). The positive income effect on food consumption may depend on whether the rate of rise in food prices is lower than the rate of wage increment (van den Broeck *et al.*, 2018). In addition, income gains from AVCs might increase other nutrition-relevant investments (including health and social services) (Gillespie & van den Bold, 2017).

2.2 Changes to women's time use and intra-household division of labor

Changes in women's time use pattern is one of the vital links between women's participation in AVCs through wage work and child nutritional status. It has a direct influence on the quality of childcare. Evidence from the time use literature shows that increase in women's wage hours results in sizable reduction of their time spent on childcare (e.g., socioemotional interaction, food preparation, other physical care and leisure hours) (Glick, 2002; Burroway, 2017; Chari *et al.*, 2019). In such cases, mothers rely on substitute childcare which generally includes other household members, government financed childcare or market-based options (Oddo *et al.*, 2018). Due to unavailability and unaffordability of the latter two options in developing countries, other household members usually serve as replacement in the absence of the mother which leads to change in intra-household division of labor (McGuire *et al.*, 1990; Burroway, 2017; Oddo *et al.*, 2018; Chari *et al.*, 2019). Thus, increase in child care hours by other household member caregivers might offset reductions in maternal time for childcare (Johnston *et al.*, 2018). Yet, the quality of care by substitutes for maternal time is often lower compared to what would have been provided by the mother (Popkin, 1980; Glick, 2002; Burroway, 2017). The reason is that childcare involves activities that can only be done effectively by the mother such as interactions relevant to child's socioemotional and cognitive development. Physical care activities (e.g., feeding and cleaning) on the other hand can be delivered by other household members or care providers as well (Baydar *et al.*, 1999). Specific to the HVAs sub-sector in urban setups, women's employment might reduce dietary quality and duration of child breastfeeding since the sector requires prolonged hours of mothers' stay away from home leaving their children in the care of others(Leslie, 1988; Glick & Sahn, 1998; Glick, 2002; Nankinga *et al.*, 2019; Headey & Masters, 2021).

2.3 Shift in women's bargaining power

Women's labor participation in AVCs can increase share of their income to total household income which will strengthen women's position in decision-making processes (Barrientos & DeJong, 2006). In addition, women employment create opportunities for women to interact and maintain networks with other women, men and their supervisors, thereby enabling them to exchange ideas and experiences (Atkin, 2009). Such exposures to non-household environments are associated with certain aspects of women empowerment such as developing negotiation skills, building self-confidence and adopting lessons learnt from others' experiences. As a result, employed women may develop stronger bargaining power vis-a-vis their spouses, more importantly, in favor of investments relevant to child nutrition and health (Glick, 2002; Barrientos & DeJong, 2006; Gillespie & van den Bold, 2017).

3. Data and summary statistics

3.1 Survey description

We use a household survey data collected by the authors using Computer-Assisted Personal Interviews (CAPI) during May – August 2022 in selected neighborhoods of two of the largest floriculture clusters of Ethiopia – Batu and Bishoftu areas (see Figure 2). We selected Batu and Bishoftu cities for our study since majority of flower farms and corresponding employees are residing inside and in the outskirts of these cities. According to Ethiopian Ministry of Agriculture

(MoA), these clusters account for about half of employment opportunities created and export value generated by the floriculture sector in Ethiopia[2].

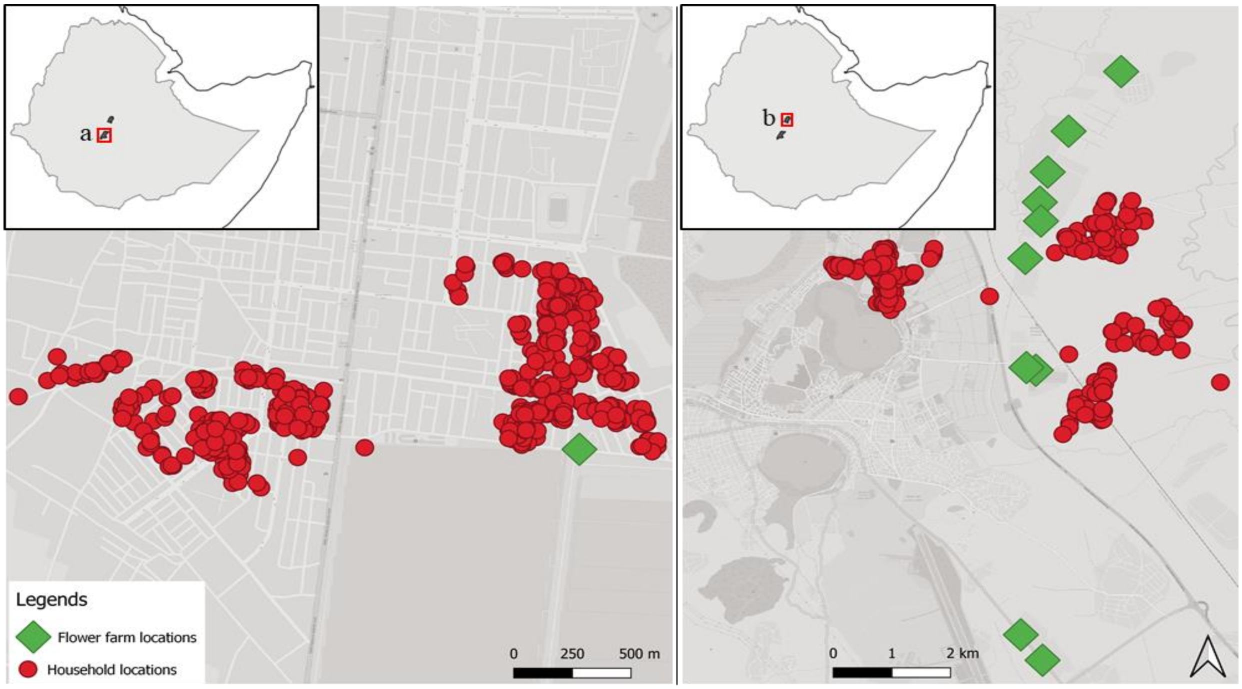

Figure 2: Households and flower farms locations in Batu (a) and Bishoftu (b) clusters

The study used clustered random sampling as a sampling strategy. Since identifying workers and non-workers of the flower farms in the study areas was difficult, sampling frame was prepared by undertaking a census of households in the selected areas. The procedure had two steps. First, we held discussions with local authorities to identify kebeles (i.e., lowest government administration unit) and then sub-kebeles in which we could get sufficient number of floricultural employees, thereby reducing sample imbalance. We then conducted listing of all households dwelling in these sub-kebeles with a criterion of at least one ever-married woman member within the age range of 18 – 49 years. Second, we selected a random sample of 770 households proportionate to the size of the sub-kebele clusters where the full list was prepared for. Households are categorized into two groups depending on mothers' participation in floriculture employment. The sample group with mothers employed in floriculture consists of 361 households, while the sample group with mothers not employed in floriculture has 409 households. Sample households had a total of 512 children below the age of five – with a total of 180 from mothers participating in floriculture employment and 332 children from non-participating mothers. Our analysis in this study is based on 512 observations which only includes households with at least one child member within the age of 0 – 5 years.

[2] Authors calculation based on a survey of flower farms and the 2021/22 annual report by the Ethiopian MoA indicate that the two clusters contribute 52 and 53% employment opportunities created and exported quantity (net weight) of cut-flowers, respectively.

The household survey contains information at the household, individual woman and child levels. Household level data is composed of modules on household demographic characteristics, education, labor participation, food and non-food consumption expenditures, food security, dietary intake patterns, housing and assets, incomes, credit and savings, and crop and livestock. Woman level data include health, subjective well-being, time use and individual dietary diversity while child level information include health, anthropometric measures and dietary diversity.

3.2 Key variables

Child undernutrition: Our primary outcome of interest is child nutritional status measured as child HAZ and WAZ. We focus more on HAZ in the results section as it measures long-term changes in malnutrition. HAZ is a measure of height in standard deviation units relative to the same age and sex of children in a reference healthy population defined by WHO (2006). Likewise, WAZ measures body weight relative to the same sex and age of reference group. The common cutoff for HAZ and WAZ reflecting stunting and underweight among children, respectively, is –2 standard deviations (i.e., two standard deviations below the reference median) (Headey & Masters, 2021).

Mother's labor participation in floriculture: Our main independent variable is mother's current employment status in the floriculture sector. It is measured as a dummy variable which is equal to 1 if the child's mother is employed in a cut-flower farm, and 0 otherwise. For mothers employed in floriculture, our data include number of floricultural work hours in 24 hours as well as seven days preceding the interview time. In addition, we include wage- and self-employment hours during past 24 hours and seven days prior to the interview day for all women included in our sample. To account for relatively long-term labor participation patterns, we include number of floricultural, and non-floricultural wage- and self-employment months in the 12 months prior to the interview date as independent variables.

Pathway and control variables: To explore potential pathways, we examine the association between the main outcome of interest and immediate inputs to child nutrition. To do so, we make use of information on household income; women's time-use; household head's time use and labor participation; other household members labor participation; duration of breastfeeding; dietary quality[3] and habits[4];share of women's wage income to total household income[5]; and level of women's involvement in nutrition-relevant decision makings[6]. Moreover, we also include

[3] We use household dietary diversity scores (HDDS) and individual dietary diversity scores (IDDS) measured in number of food groups consumed out of maximum of 12 and 8 food groups, respectively (as in FAO (2013); Anne Swindale and Paula Bilinksy (2006)). The first one is used as a proxy for quality of diet consumed by households, while the later corresponds to children's diet quality.

[4] In order to understand intra-household differences in diet diversity patterns, we asked respondents about whether children, women or men consume more diverse foods than others.

[5] This variable is calculated as the ratio of any wage income (from informal and formal employments including in the floriculture sector) earned by the main woman 12 months preceding the interview time to total income generated by the respective household during the same period.

[6] As part of our measures to proxy women's bargaining weight, we use self-reported women's level of involvement in decision making of nutrition-relevant expenditures including minor household expenditures (such as food and other consumables), child health and education, asset ownership and sales. The variable is measured in a scale of 0 (No

information on other child nutrition determinants at different levels, i.e. child age and sex; mother's age, height, education and migration status; household head's religion and education; and household characteristics, such as living conditions and distance to basic facilities.

3.3 Summary statistics

We present descriptive statistics for our main outcome variables (HAZ and WAZ) and women's employment status. Likewise, we provide brief highlights on potential pathways as well as major control variables. 416 (54%) of main respondent women in our data have at least one child under the age of 5 years. As shown in Figure 3, 38% of these mothers are employed in floriculture, while 43% of them are unemployed and mainly responsible for domestic work and childcare activities. The rest 9 and 10% of the mothers are mainly involved in non-floriculture wage employment and self-employment, respectively. Table 1 provides mean and standard deviation of all variables used

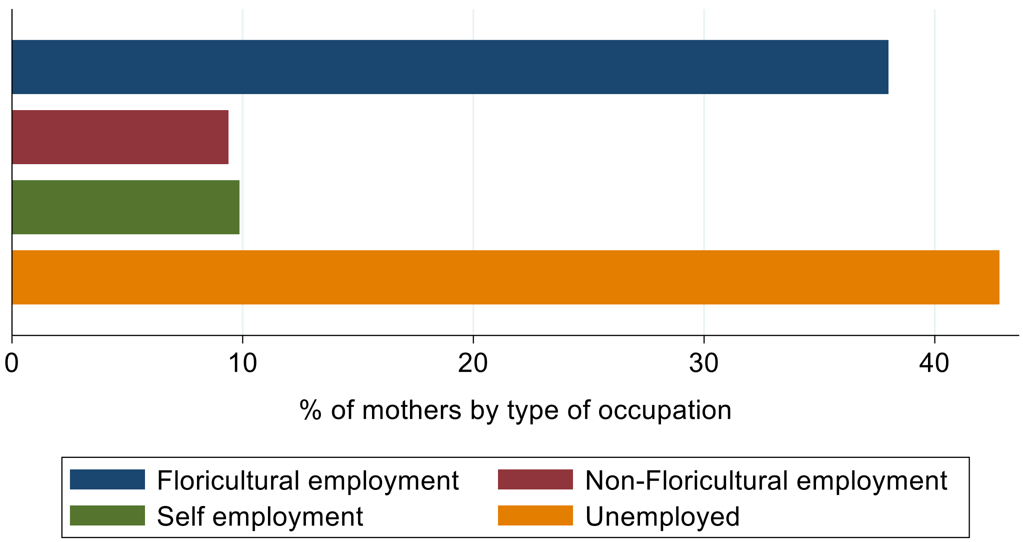

Figure 3: Share of mothers by type of occupation (total number of mothers = 416)

in our analysis and the differences between means of two sample groups. The table also provides t-test results for each variable to determine whether the differences between the two groups are significant. Grouping of the sample is based on whether the main woman (mother of a given child in our sample) in the household participates in floricultural employment at the time of the survey or not. The average household in the data is made up of 4.5 members and headed by a household head aged about 34 years and educated only for 1.9 years on average. And 38.6% of household heads are Ethiopian Orthodox Christian, 33.5% are Protestant, and 27.9% are Muslim.

Our full sample consists of 512 children aged 0 – 59 months and an average child is 29.4 months old. The average HAZ and WAZ of children in the sample are –1.3 and –0.8, respectively. The proportions of children that are stunted and underweight (i.e., with HAZ and WAZ below –2) are 30% and 14%, respectively. When disaggregating the sample by employment status, children from

input), 1 (Input into some decisions), 2 (Input into most decisions), 3 (Input into all decisions), and 4(Solely decided by the woman).

mothers who are employed in floriculture have significantly lower average HAZ and WAZ compared to children with mothers not employed in flower farms.

The average mother is about 28 years old, and about 55% of women have rural-to-urban migration background. Similar to the case of household heads, an average main woman in the household is poorly educated with mean schooling years of 1.7. Women who are employed in floriculture tend to have less years of education compared to those who are not employed in the sector. The share of women's wage income to total household income generated 12 months past the interview date is 17%. This proportion is significantly higher among women work in floriculture with a 37% share, exceeding those who are not working in floriculture by about 31%. Women employed in floriculture face time scarcity for non-income-generating activities, i.e. they spent less hours in self-care and maintenance (1.3 hours (8%)), child care (1.8 hours (49%)), and domestic work and family care (4.3 hours (42%)) compared to non-participating women in 24 hours prior to the interview time. On the other hand, they spent about 6.2(925%) and 40.5(770%) more hours in wage employment compared to their counterparts during 24 hours and 7 days prior to the interview time, respectively.

In our sample, the average household consumed 8.1 food groups. Households in with floriculture employment non-participating women have consumed more diverse foods compared to households with participating women. The average child consumed 3.6 food groups. We observe no significant difference between the two sample groups. As shown in Table 1, 44 % households reported that children eat more diverse foods. On the other hand, households also reported that adult men (11%) and women (6%) household members consume more diverse foods. Our data suggests that majority of women tend to get fully involved in all nutrition-relevant decision-making areas (minor household expenditures, child health and education, and asset control). Less than 2% of women reported that they don't have any inputs to decision makings of both expenditure types. There are no major differences between the two groups in women's influence in the aforementioned decision makings.

4. Econometric approach

We begin our econometric analysis using OLS regression models which take the following form:

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

where N_i is a nutritional status of i^{th} child measured in terms of HAZ and WAZ, L_i is a dummy variable indicating that mother of i^{th} child is employed in the floriculture sector, $\boldsymbol{X_i}$ is a vector of explanatory variables – including child, mother and household level characteristics (i.e. child age and sex; mother's age, height, education and migration status; household head's education and religion; and household characteristics, such as household size, living conditions and distance to basic facilities), and μ_i is the disturbance term. One drawback in using the OLS approach for the data at hand is that mother's employment (L_i) may not be exogenous since women's decision to participate in floriculture employment might be based on individual self-selection.

In order to account for possible selection-based endogeneity, we adopt an endogenous switching regression (ESR) model, which is a two-stage parametric approach, following Di Falco *et al.* (2011); Kabunga *et al.* (2012) and Manda *et al.* (2019). In the first stage, a probit model of selection into treatment is estimated; while the second stage estimates outcome equations for each group by including corresponding inverse mills ratios estimated from the first stage as additional regressors (Maddala, 1983; Fuglie & Bosch, 1995). Resulting from a utility maximization function, the selection stage is a dichotomous choice model estimating women's probability to work in a flower farm:

$$L_i = \boldsymbol{Z_i\gamma} + u_i \textit{ (floricultural labor participation decision function)} \quad (2)$$

where $\boldsymbol{Z_i}$ is a vector of explanatory variables for the participation decision function and u_i is an error term with mean zero and variance σ_u^2. In the second stage, we use a switching-regression model where two separate equations are specified for women working in floriculture (3a) and those who do not (3b):

$$N_{1i} = \boldsymbol{X_{1i}\beta_1} + \varepsilon_{1i} \textit{ if } L_i = 1 \textit{ (outcome equation for floricultural labor participants)} \quad (3a)$$

$$N_{2i} = \boldsymbol{X_{2i}\beta_2} + \varepsilon_{2i} \textit{ if } L_i = 0 \textit{ (outcome equation for floricultural labor participants)} \quad (3b)$$

The error terms in equations (2), (3a) and (3b) are assumed to have a joint normal distribution with the following variance-covariance matrix:

$$cov(\varepsilon_1, \varepsilon_2, u) = \begin{bmatrix} var(\varepsilon_1) & cov(\varepsilon_1, \varepsilon_2) & cov(\varepsilon_1, \varepsilon_u) \\ cov(\varepsilon_2, \varepsilon_1) & var(\varepsilon_2) & cov(\varepsilon_2, \varepsilon_u) \\ cov(\varepsilon_u, \varepsilon_1) & cov(\varepsilon_u, \varepsilon_2) & var(u) \end{bmatrix} = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{1u} \\ \sigma_{21} & \sigma_2^2 & \sigma_{2u} \\ \sigma_{u1} & \sigma_{u2} & 1 \end{bmatrix} \quad (4)$$

σ_u^2 can be assumed to be qual to one since coefficients in model (2) are estimable only up to a scale factor (Di Falco *et al.*, 2011; Kabunga *et al.*, 2012). Since the error term in the selection equation (2) is correlated with the error terms in equations (3a) and (3b), the expected values of truncated error terms (i.e. ε_1 and ε_2) are non-zero as specified below:

$$E(\varepsilon_{1i}|L_i = 1) = \sigma_{1u}\frac{\emptyset(\boldsymbol{Z_i\gamma})}{\Phi(\boldsymbol{Z_i\gamma})} = \sigma_{1u}\lambda_{1i} \quad (5a)$$

$$E(\varepsilon_{2i}|L_i = 0) = \sigma_{2u}\frac{\emptyset(\boldsymbol{Z_i\gamma})}{\Phi(\boldsymbol{Z_i\gamma})} = \sigma_{2u}\lambda_{2i} \quad (5b)$$

where $\emptyset(.)$ and $\Phi(.)$denote probability density and cumulative density function of the standard normal distribution, respectively; λ_{1i} and λ_{2i} are corresponding invers mill ratios evaluated at $\boldsymbol{Z_i\gamma}$ (Fuglie & Bosch, 1995). If the covariance terms σ_{1u} and σ_{2u} (coefficients of λ_{1i} and λ_{2i}, respectively) are nonzero, it is an indication of selection bias (Di Falcon 2011). Along with explanatory variables in stage-two (i.e., $\boldsymbol{X_{1i}}$ **and** $\boldsymbol{X_{2i}}$), including the estimated terms λ_{1i} and λ_{2i} in regressions of equation (3a) and (3b), respectively, corrects for potential selectivity bias (Willis & Rosen, 1979). Following Lokshin and Sajaia (2004), the ESR model can be simultaneously estimated using full-information ML method (FIML) approach which yields efficient and consistent estimates.

In addition to nonlinearity generated by the selection model, use of one or more instruments is important for the model to be correctly identified (Di Falco *et al.*, 2011; Kabunga *et al.*, 2012;

Manda *et al.*, 2019). Addressing this exclusion restriction requires at least one variable that determines the dichotomous choice in the first stage but not the outcome variable in the second stage. For this reason, our field team held focus group discussions (FGDs) with several flower farm managers and workers, and local community leaders to understand what determines women's probability of getting employed in flower farms. According the information gathered, flower farms select flower farm workers on a daily basis. Every morning a group of interested women gather around the entrance of a given flower farm where recruiters pick a required number of women from those potential candidates depending on availability of spots. On this basis, we find that the important factors that determine the likelihood of women's employment and/or retention in floriculture are – i) prior information on floriculture employment opportunities and working conditions; and ii) recommendation from other women who are already working in flower farms. In line with this, we use women's connection with floriculture workers[7] and village-level women's floricultural employment density [8] (relative to all women between the age of 18 – 49 years) as instruments. The former variable measures the number of respondent's friends and/or relatives who are(is) working in floriculture. The selected instrumental variables are hence excluded from equation (3a) and (3b). Previous empirical studies use similar instruments including social connection or networks, employment density, and share of neighbors as well as having a friend with similar choices (Coates *et al.*, 2004; Kassie *et al.*, 2014; Dolislager *et al.*, 2019; Abro *et al.*, 2022; Di Marcantonio *et al.*, 2022). These variables are strong predictors of women participation and/or retention in floriculture employment and do not directly correlate with child nutritional outcomes. We assess the admissibility of instruments by undertaking falsification test, as in Di Falco *et al.* (2011) and Nunn and Wantchekon (2011). Results in Table A1 confirm that the instruments are significantly related with women's participation in floriculture employment but not with the nutrition outcomes of children from mothers who are not employed in floriculture.

An important feature of ESR model is that it can be used to compare child nutritional outcome for actual floriculture labor participants and non-participants with their corresponding counterfactuals. Average treatment effect on the treated (ATT) (equation (6c)) can be calculated as the difference between expected nutritional outcome of actual floricultural employment participants (equation (6a)) and their counterfactuals (equation (6b)) as shown below.

$$E(N_{1i}|L_i = 1) = \boldsymbol{X_{1i}\beta_1} + \sigma_{1u}\lambda_{1i} \text{ (Expected value for actual floricultural labor participants)} \quad (6a)$$

$$E(N_{2i}|L_i = 1) = \boldsymbol{X_{1i}\beta_2} + \sigma_{2u}\lambda_{1i} \text{ (Expected value if actual workers did not participate, i.e. counterfactuals)} \quad (6b)$$

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

[7] For each respondent who is currently employed in floriculture, we use a value calculated by deducting her current connection size from the connection size she had before joining a flower farm.

[8] For the sampling purpose, we conducted census (full listing) of households with at least one woman member in the age range of 18 – 49 years who are/were married. The full-listing also included few questions aimed at getting some basic information of every household including occupation of each woman (e.g., floriculture employment, other private employment, public sector employment, house wife, studying.). This provides us population level information about women's occupation in our sample areas. We, therefore, leverage this information to calculate village-level ratio of women working in floriculture (floricultural employment density). Population level floricultural employment density is calculated as the total number of women who are employed in floriculture divided by the total population of women in a given village.

Similarly, we can calculate the average treatment effect on the untreated (ATU) (equation (7c) as the difference between expected nutritional outcome of actual non-participants of floricultural employment (equation (7a)) and their counterfactual (equation (7b)).

$$E(N_{2i}|L_i = 0) = \boldsymbol{X_{2i}\beta_2} + \sigma_{2u}\lambda_{2i} \quad \textit{(Expected value for non-participants of floricultural employment)} \qquad (7a)$$

$$E(N_{1i}|L_i = 0) = \boldsymbol{X_{2i}\beta_1} + \sigma_{1u}\lambda_{2i} \quad \textit{(Expected value if non-participants decided to work in floriculture, i.e. counterfactuals)} \qquad (7b)$$

$$ATU = \quad E(N_{1i}|L_i = 0) - E(N_{2i}|L_i = 0) = \quad \boldsymbol{X_{2i}(\beta_1 - \beta_2)} + (\sigma_{1u} - \sigma_{2u})\lambda_{2i} \qquad (7c)$$

5. Results and discussion

Main results

Table 2 and 3 report the results from OLS and ESR regressions, respectively. OLS estimates show negative and statistically significant association between child nutritional outcomes (HAZ and WAZ) and women participation in floriculture employment. These relationships hold at 5% level of significance after controlling for important child, mother and household level characteristics. Our preferred OLS specifications are model (5) for the HAZ and model (10) for the WAZ since they control for a wide range of factors. The results indicate that employment of women in floriculture is associated with lower levels of HAZ and WAZ by 0.4 and 0.3 standard deviations, respectively. The respective deviations, from the overall means, in percentage terms are 31% for HAZ and 39% for WAZ. As the estimates from OLS regression do not account for potential endogeneity linked with self-selection, we now turn to our main regression output using the endogenous switching regression (ESR).

We estimated the ESR model using full information maximum likelihood (FIML) approach with robust standard errors. Model (1) and (4) of Table 3, respectively, present estimated coefficients of selection equations for the HAZ and WAZ regressions. The rest of specifications show estimates of separate functions for households with (models (2) and (5)) and without (models (3) and (6)) participation of the main woman in floricultural wage employment. Results of selection equations suggest that own age, education level, household head's age, and ownership of livestock are among the most important factors that determine women's participation in flower farm employment. Lower parts of Table 3 present estimated coefficients of the correlation terms, ρ0 and ρ1, where the latter is significantly different from zero at 5% level of significance (both in model (3) and (6)). Therefore, we reject the null hypothesis that sample selectivity is absent.

Following estimation of the ESR model parameters, we calculated expected values of child nutritional outcomes under actual and counterfactual conditions as presented in Table 4. The expected child HAZ and WAZ are, respectively, –1.56 and –0.93 for children of mothers actually employed in floriculture. In the counterfactual case, children of the employed mothers would have mean values of – 0.806 for HAZ and – 0.503 for WAZ if the mothers were not employed in floriculture. On the other hand, HAZ and WAZ for children of actual non-participating mothers are –1.08 and –0.67, respectively. Children of the non-participating mothers would have had an average of –2. 1 HAZ and –1.5 WAZ if the mothers were employed in the counterfactual case. To estimate the actual and hypothetical effect of mothers' employment on child nutrition, we calculate separate results for the two groups – with and without women's floricultural employment.

First, we estimate the average treatment effect on the treated (ATTs) for children with mothers working in flower farms. ATTs are calculated as the difference between expected nutritional outcomes of children from mothers who are actually employed in floriculture and the expected outcomes if the participating mothers had not worked in floriculture. The resulting ATTs are –0.75 (48%) and –0.427 (46%) standard deviations in HAZ and WAZ, respectively. These represent the magnitude of the effect of mothers' floricultural employment on child nutritional outcomes. The implication is that children from mothers that actually work in floriculture tend to have lower nutrition outcomes than their counterfactuals. Second, we calculate the average treatment effect on the untreated (ATU) for children of mothers who are not working in floriculture. The ATUs are calculated as the difference between child nutritional outcomes in the actual and counterfactual scenarios for the control group. Estimated ATUs are –0.99 (48%) and –0.67 (43%) standard deviations in HAZ and WAZ, respectively. These figures indicate that what would have been the size of reduction in HAZ and WAZ of children from mothers that are not working in floriculture if they decided to work in the sector. These findings are in line with previous research showing negative relationship between maternal off-farm employment and child nutritional outcomes in different contexts (Rashad & Sharaf, 2019; Debela *et al.*, 2021; Debela *et al.*, 2022).

Potential Mechanisms

The analysis now turns to an explorative approach to examine multiple mechanisms through which women's floricultural employment participation could affect child nutritional status. Although we do not conduct a comprehensive investigation of mechanisms due to methodological and data limitations, we focus on studying pathways that have higher potential in linking women's employment in floriculture and child nutritional outcomes. In line with our conceptual framework explained in section 2, we use multiple indicators as proxy for potential mechanisms. These indicators are grouped in to three, a) time allocation and intra-household labor division; b) income; and c) bargaining power. Specific variables investigated are: i) mother's and spouse's time-use, ii) intra-household division of labor, iii) intra-household dietary intake and diet habits, iv) duration of child breastfeeding period, v) income, and v) women's bargaining weight. Regression outputs for pathways analyses are presented in Table 5 – Table 11. The main predictor variable in all models is women's participation in floriculture wage employment. Depending on the distributional assumptions for the dependent (pathway) variables, we use OLS, probit, poisson, ordered probit, and tobit regressions to explore associations between the indicated variables. In all regression models, we include common controls (i.e., child, mother and household level, and distance controls) which are also used in the main models (Table 2 and 3).

Table 5 reports OLS regression estimates of the relationship between mothers' employment in floriculture and their own as well as household heads' time use. In addition to common controls, we include self-reported level of busyness[9] of mothers and spouses during the corresponding time use recall period. This helps us avoid potential bias in case the reference time use period would not be representative of one's usual time use patterns. The results suggest that floricultural employment of women is significantly and negatively associated with time spent in non-income-generating activities. Particularly, they spend less hours in self-care and maintenance; childcare; domestic work and family care. These are activities that could easily be combined with child care activities. Reduction of hours on the aforementioned activities are, respectively, 7%, 69%, and 56% compared to the overall corresponding means. Childcare is the most affected fraction of mothers' time, followed by domestic work and family care. Conversely, they spend significantly higher amount of time outside of home mainly driven by floricultural wage hours which leads to reduction in time for (inputs to) childcare activities. This is consistent with a study showing high intensity of maternal labor supply in off-farm work significantly reduces child HAZ (Debela *et al.*, 2021).

Interestingly, results suggest that household heads in households with floriculture employed mother spent 0.43 more hours (24% of the overall mean) for childcare activities. This is equivalent to only 18% of the decrease in floriculture-employed mothers' time for childcare. This increase in time for childcare by household heads, however, is not complemented with significant reduction in their time for own self-care, maintenance, and usual job activities.

Changes in the structure of intra-household division of labor is another link between mothers' employment and child nutrition. Table 6 shows that mothers employed in floriculture and their spouses have spent about 44 and 9 more wage hours a week, respectively. Overall, the results related to time use changes suggest that women employment in floriculture reduces mothers' time for child, family- and self-care activities. Fathers involvement in childcare relevant activities seem to increase without altering their time for own self-care and maintenance. But this increase is not sufficient enough to offset mothers' time reduction in similar activities. Therefore, inadequacy of quality of childcare, induced by limited availability of mothers' time or insufficient alternative childcare arrangements, might be one of the channels through which mothers' employment translates into negative child nutrition outcomes.

Mothers' employment usually limits their availability for making quality and frequent meals as well as child breastfeeding. In order to see whether this holds in our research context, we examine quality of diets, intra-household differences in dietary intakes and child breastfeeding patterns between households with mothers participating and non-participating in floriculture employment. In Table 7, we show that women's employment in floriculture is negatively associated to HDDS (see model (1)). Although this might be one potential pathway, it however does not translate into a similar relationship in the child IDDS regression (see model (2) of Table 7). The coefficient for maternal employment in floriculture is statistically insignificant. One possible explanation for this may be that adult household members in the households with floriculture employment

[9] Self-reported level of busyness for the mother and spouse in the 24 hours preceding the interview time is a categorical variable with values of 0 (rest day), 1 (less busy than usual), 2 (normal as usual) and 3 (more than usual).

participating women are probably consuming less diverse foods in order to maintain relatively better-quality diet for children.

Despite insignificant differences of child IDDS, analysis of child food consumption by disaggregating food groups suggests that differences exist among particular food groups. Children from floriculture employed mothers are less likely to consume animal source foods (ASFs) which is potentially offset by higher chance of switching to vitamin A rich fruit and vegetables. Furthermore, we asked mothers if dietary intakes differ for different groups of household members (in terms of age and gender). Corresponding results are provided in Table 8. As shown in model (3) of Table 8, adult male household members in households with floriculture working mothers are less likely to consume more diverse foods than children and female household members compared to adult men in households with non-participating women. We also checked whether mothers or spouses in the sample consume foods away from home. Our corresponding results suggest that mothers and their spouses in households with floriculture employed mothers are less likely to consume food away from home. Moreover, women's employment participation in floriculture is not significantly associated with changes in average meal frequency of both children under the age of five years as well as rest of household members. In general, one major takeaway seems to standout from our analyses in relation to dietary intake patterns and habits. Even though mothers' employment is associated with lower HDDS, child IDDS seem not to be influenced in the same way potentially due to the following reasons. First, households with mothers employed in floriculture maintain their children's diet quality by diversifying more into plant-based food groups in order to offset lack of ASF consumption. Second, mothers and their spouses in households with floriculture employment participating mothers are unlikely to consume food away from home. Third, spouses and/or adult male household members in households with mothers employed in floriculture, unlike their counterparts in households with non-participating mothers, are less likely to consume more diverse foods than the rest of their household members. Hence, an important factor that has a direct implication on the negative effect on HAZ due to floriculture employment is the reduction in ASF consumption translating to lower HAZ. This is in line with previous researches showing a positive relationship between animal source food consumption and child stunting (Headey *et al.*, 2018).

Next, we examine how mothers' employment influence duration of child breastfeeding and exclusive breastfeeding which are important risk factors of child undernutrition and mortality. We use recall data on total months of mothers' floricultural employment participation during the 12 months prior to the interview time as well as their entire life. The results are provided in Table 9. Our discussion of these results relies on the 12-months' recall period in order to avoid potential recall biases. The results show that longer period of women's floricultural work is slightly associated with reduced duration of child breastfeeding for children above the age of two years. However, WHO/ UNICEF (2003) recommends a minimum breastfeeding duration of two years. Hence, potential negative influence of mothers' floriculture employment on duration of child breastfeeding beyond two years of child age per se might not translate into lower levels of child nutrition. In the last two columns of Table 9, we do not find evidence that mothers' floricultural employment might influence the WHO (2001) recommended minimum exclusive breastfeeding duration of six months. Duration of mothers' floricultural employment does not seem to strongly influence duration of breastfeeding. However, given that mothers working in floriculture spend an average seven hours at work place, the quality and frequency of breastfeeding might be significantly affected. Hence, child breastfeeding might be one of the potential channels of the overall relationship. Our data, however, does not capture the quality and frequency of breastfeeding.

We also consider whether women's employment in floriculture is associated with a significant shift in households' income. As presented in Table 10, women employment and household income per capita have no statistically significant association in the full sample (see the first column of results). However, this does not hold when we examine the relationship among households in different income segments. Women's floricultural employment is associated with a significant increase in income per capita of households only for lowest income tercile group. This is consistent with prior works that AVCs in general have more important contribution to income of poorest households (McCulloch & Ota, 2002; Christiaensen *et al.*, 2011; van den Broeck *et al.*, 2018). However, the results do not suggest significant association between women's employment in floriculture and increase in income per capita for the middle and upper terciles. The direction of the coefficient for the third tercile suggests that contribution of women's floricultural wage to overall household income declines as households move to higher income segments. The income-pathway indicates that women's employment in floriculture can significantly increase household income only for the poorest households which may translate into some investments relevant to child nutrition. Since this is not reflected for the whole sample, the income pathway may have only slight role to influence child nutrition.

Finally, Table 11 reports estimated association between women's employment in floriculture and their bargaining weight proxied by share of their wage income to overall household income and their level of involvement in decision makings relevant for child nutrition. Our dependent variable, share of women's wage income to household income, is censored from below at zero (i.e., about 53% of observations have zero and the rest have positive values) since not all women are participating in wage employment. Hence, we use tobit model to estimate the effect of women's employment in floriculture on share of women's wage income to household income. Particularly, the last column of Table 11 provides the marginal effect of women's floricultural employment on the outcome variable for households with women who have positive wage income. The estimated coefficient is positive and statistically significant. For women with positive wage income during the 12 months prior to the interview time, being employed in floriculture raised the share of their wage income to household income by about 18%. Our survey also includes questions on the level of women's participation in decision making of nutrition-relevant issues partly as measure of their bargaining position in the household. The results are shown in Table 11 (model (1), (2) and (3)). There is a statistically significant coefficient for the decision making in minor household expenditures, and ownership and sale of assets. However, it is important to note that women reported that they either fully participate (88%) or solely decide (86%) in the aforementioned two decision making areas. The result on the bargaining effect seems to suggest that women working in floriculture sector contribute more to the income pool of the household. In addition, decision making among floriculture working women is slightly higher compared to women not employed in floriculture although no strong relationship is observed. Given the fact that the overall effect of employment on child nutrition is negative, our findings suggest that the time allocation linkage seem to have outweighed the positive bargaining linkage.

6. Conclusion

Whether maternal employment will improve or worsen child nutritional status has been a long-standing research question, and evidence shows that empirical results are mixed since several factors are at play (Leslie, 1988; Tucker & Sanjur, 1988; Bamji & Thimayamma, 2000; Mugo, 2012; Burroway, 2017; Rashad & Sharaf, 2019). Studies investigating such indirect relationships, especially in the AVC sector are limited. This paper contributes to filling this gab by examining the link between mothers' employment and child nutritional outcomes (measured in child HAZ and WAZ) in the context of commercial cut-flower farms in Ethiopia.

OLS estimates show negative and statistically significant associations between women's participation in floriculture employment and child nutritional outcomes (HAZ and WAZ). These negative associations hold after controlling for important child, mother and household-level characteristics. In order to account for potential selection-based endogeneity, we have used an ESR model, a two-stage parametric approach. ESR estimates also indicate that maternal employment in floriculture has a negative effect on child nutritional status. Corresponding results, calculated as ATT for children from mothers working in flower farms are –0.75 for HAZ and –0.43 for WAZ. For the sample group with mothers that do not participate in floriculture employment, their children's nutritional status would have declined by 0.99 and 0.87 standard deviations for HAZ and WAZ (calculated as ATU), respectively, if the mothers had decided to work in flower farms.

We also explored for several pathways that could mediate these declines in child nutritional status. Results show that mothers' employment in floriculture is associated with a significant decline in their time spent for self-care, maintenance, household chores and childcare activities as a result of increased wage hours. Our findings suggest that spouses of women employed in floriculture spend more time on childcare activities, but without significant alteration of their time for own self-care, maintenance, and social activities. Patterns of intra-household dietary intakes also show interesting results. While households with main women working in floriculture tend to consume less diverse food groups, this is not accompanied with changes in overall children's diet diversity. A potential explanation might be that women's employment in floriculture shaped intra-household dietary patterns in such a way that: i) children's diet quality was maintained by diversifying into more plant-based diets; and ii) adult men's consumption kept similar to rest of household members in terms of eating more diverse foods and away from home. Potential reasons for such shifts in dietary patterns might be associated with affordability of foods, especially animal source foods, and scarcity of mothers' time for meal preparation. Results also suggest that duration and quality of child breastfeeding might be reduced as a result of women's involvement in floricultural employment, especially observed for children beyond two years age. In relation to the income status, we observe that women's floricultural employment might be more beneficial only to the poorest segment of household, while this might not hold for better off households. Finally, our results show that women's share of income in their households increase as a result of their participation in floricultural employment. This increase in income contribution of women coupled with women's traditional role in meal planning and preparation might have helped them shape intra-household dietary patterns in favor of children. In general, the results of the pathways suggest that maternal time constraint and children's consumption of less animal source food among potentially contribute to the negative nutrition outcome while maternal bargaining weight measured in terms of income share could potentially have positive contribution. Overall, the negative pathway might have outweighed the relationship.

Overall, these findings suggest that - while high-value agriculture plays key roles in terms of generating export earnings and new employment opportunities – more policy and development efforts are needed to reduce the risk of unintended social outcomes, such as increases in child undernutrition. These effects could be mitigated by addressing underlying factors of child undernutrition, for instance, by adopting several policy measures including setting minimum wage; incentivizing pregnant and lactating women to reduce working hours or delay working in physically demanding works; provision and subsidizing of childcare facilities nearby working places; providing nutrition education at work places. However, such policy and development measures require careful understanding of underlying factors and their complex interactions, and need to be finetuned to local contexts. More rigorous investigations, for example, using randomized control trial (RCT) designs with long-term follow-up would be rather helpful. This would help evaluating causal relationships by conducting comprehensive investigation of important mechanisms, thereby developing a more rounded understanding on how such opportunities translate into unintended welfare outcomes and what policy measures or coping mechanisms would be more effective and viable.

Table 1: Summary Statistics.

	Full sample (1)		Main woman not working in floriculture (2)		Main woman working in floriculture (3)		Mean difference (2)-(3)
	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	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 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***
HHH'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 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	2.450	4.017	0.036	0.490	6.903	3.856	-6.867***
Any wage employment	2.858	4.167	0.666	2.246	6.903	3.856	-6.237***
Self-reported level of busyness in the last 24 hours:							
Rest day	0.033	0.179	0.024	0.154	0.050	0.219	-0.026
Less busy than usual	0.129	0.335	0.114	0.319	0.156	0.363	-0.041
Normal as usual	0.766	0.424	0.792	0.406	0.717	0.452	0.076*
More busy than usual	0.072	0.259	0.069	0.254	0.078	0.269	-0.009
HHH's 24 hours time use:							
Self-care, maintenance and social	12.844	3.542	12.940	3.643	12.667	3.351	0.273
Child care	1.770	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**
Self-reported level of busyness in the last 24 hours:							
Rest day	0.136	0.343	0.151	0.359	0.109	0.312	0.043
Less busy than usual	0.132	0.339	0.117	0.322	0.160	0.368	-0.043
Normal as usual	0.681	0.466	0.685	0.465	0.674	0.470	0.011
More busy than usual	0.050	0.218	0.046	0.210	0.057	0.233	-0.011
Labor participation based on 7-days recall							
Mother's wage hours	19.510	25.537	5.262	14.456	45.789	20.109	-40.527***
Spouse's wage hours	34.801	26.156	32.642	27.552	38.783	22.906	-6.142**
Other HH members' wage hours	2.707	11.912	2.940	12.173	2.278	11.435	0.662
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***
HH 7-days food expenditure per capita	280.668	136.793	305.277	148.252	235.278	97.888	69.999***
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
Who eats more diverse food in the HH?							
Children eat more diverse (1/0)	0.443	0.497	0.404	0.491	0.517	0.501	-0.113**
Women eat more diverse (1/0)	0.061	0.239	0.063	0.244	0.056	0.230	0.008
Men eat more diverse (1/0)	0.111	0.315	0.145	0.352	0.050	0.219	0.095***
Average daily meal frequency:							
Child meal frequency	3.807	1.203	3.753	1.158	3.906	1.280	-0.153
Adult meal frequency	2.982	0.506	2.982	0.472	2.983	0.564	-0.001
In the last 7 days:							
Special/feast day(s) (1/0)	0.180	0.384	0.202	0.402	0.139	0.347	0.063*
Meal(s) shared to non HH-members (1/0)	0.396	0.490	0.449	0.498	0.300	0.460	0.149***
Food consumption in the past 24 hours was:							
Less than usual	0.100	0.300	0.072	0.259	0.150	0.358	-0.078***

About usual	0.885	0.320	0.910	0.287	0.839	0.369	0.071**
More than usual	0.016	0.124	0.018	0.133	0.011	0.105	0.007
Women's decision making involvement in:							
No input	0.020	0.139	0.012	0.109	0.033	0.180	-0.021*
Input into some decisions	0.049	0.216	0.036	0.187	0.072	0.260	-0.036*
Input into most decisions	0.055	0.228	0.054	0.227	0.056	0.230	-0.001
Input into all decisions	0.596	0.491	0.614	0.487	0.561	0.498	0.053
Solely decided by the woman	0.281	0.450	0.283	0.451	0.278	0.449	0.005
Child health and education:							
No input	0.016	0.124	0.015	0.122	0.017	0.128	-0.002
Input into some decisions	0.057	0.231	0.054	0.227	0.061	0.240	-0.007
Input into most decisions	0.039	0.194	0.024	0.154	0.067	0.250	-0.043**
Input into all decisions	0.795	0.404	0.795	0.404	0.794	0.405	0.001
Solely decided by the woman	0.094	0.292	0.111	0.315	0.061	0.240	0.050*
Asset ownership and sale:							
No input	0.012	0.108	0.012	0.109	0.011	0.105	0.001
Input into some decisions	0.047	0.212	0.048	0.214	0.044	0.207	0.004
Input into most decisions	0.041	0.199	0.030	0.171	0.061	0.240	-0.031*
Input into all decisions	0.850	0.358	0.861	0.346	0.828	0.379	0.034
Solely decided by the woman	0.051	0.220	0.048	0.214	0.056	0.230	-0.007
N	512		332		180		512

sd: standard deviations. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 2. Child anthropometric outcomes: OLS regression with robust standard errors.

	Child HAZ					Child WAZ				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Main woman works in floriculture	-0.476***	-0.464***	-0.396**	-0.414**	-0.440**	-0.263**	-0.266**	-0.185	-0.257*	-0.315**
	(0.130)	(0.127)	(0.171)	(0.182)	(0.186)	(0.116)	(0.117)	(0.142)	(0.147)	(0.149)
Child level controls:										
Child is female		0.087	0.044	0.044	0.039		0.024	-0.014	-0.018	-0.031
		(0.123)	(0.118)	(0.119)	(0.120)		(0.107)	(0.103)	(0.103)	(0.103)
Child age		-0.093***	-0.089***	-0.082***	-0.083***		-0.026*	-0.024*	-0.016	-0.018
		(0.015)	(0.015)	(0.015)	(0.015)		(0.013)	(0.013)	(0.013)	(0.013)
Child age squared		0.001***	0.001***	0.001***	0.001***		0.000	0.000	0.000	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			0.053***	0.056***	0.055***			0.042***	0.046***	0.045***
			(0.010)	(0.010)	(0.010)			(0.009)	(0.009)	(0.009)
Mother's age			0.191**	0.167*	0.173*			0.191**	0.172**	0.186**
			(0.080)	(0.088)	(0.090)			(0.079)	(0.081)	(0.082)
Mother's age squared			-0.003**	-0.003**	-0.003**			-0.003**	-0.003**	-0.003**
			(0.001)	(0.001)	(0.001)			(0.001)	(0.001)	(0.001)
Mother years of education			0.053	0.048	0.031			0.070	0.055	0.003
			(0.073)	(0.075)	(0.077)			(0.067)	(0.069)	(0.073)
Mother migrated from a rural place			0.060	0.098	0.082			0.149	0.147	0.106
			(0.127)	(0.135)	(0.137)			(0.110)	(0.114)	(0.116)
Non-floriculture wage employment			0.062	0.020	0.019			0.356*	0.324*	0.347*
			(0.220)	(0.231)	(0.235)			(0.182)	(0.187)	(0.193)
Self-employment			0.006	0.003	0.001			-0.014	0.021	0.031
			(0.181)	(0.188)	(0.188)			(0.149)	(0.157)	(0.157)
Mother had been working in floriculture			-0.112	-0.110	-0.121			-0.050	-0.070	-0.117
			(0.151)	(0.151)	(0.153)			(0.126)	(0.127)	(0.129)
Household level controls:										
Household head's Age				0.006	0.007				-0.002	-0.002
				(0.014)	(0.014)				(0.010)	(0.010)
HHH's religion (Ref. category: Orthodox Christian):										
Protestant				-0.017	-0.044				0.066	-0.057
				(0.153)	(0.173)				(0.131)	(0.144)
Muslim				-0.332**	-0.351*				-0.411***	-0.486***
				(0.160)	(0.190)				(0.138)	(0.166)
Household size				0.047	0.045				0.080	0.066
				(0.065)	(0.067)				(0.053)	(0.053)

Livestock				0.017	0.025				0.025	0.069
				(0.167)	(0.168)				(0.155)	(0.157)
Improved floor				0.190	0.160				0.230**	0.164
				(0.127)	(0.134)				(0.111)	(0.116)
Radio				0.118	0.124				0.129	0.156
				(0.128)	(0.127)				(0.120)	(0.119)
Water storage pit				0.257	0.260				0.062	0.081
				(0.198)	(0.200)				(0.159)	(0.158)
Distance to district admin:	No	No	No	No	Yes	No	No	No	No	Yes
Distance to nearest health facility:	No	No	No	No	Yes	No	No	No	No	Yes
Distance to nearest major food market:	No	No	No	No	Yes	No	No	No	No	Yes
Observations	512	512	512	512	512	512	512	512	512	512
R^2	0.025	0.105	0.170	0.189	0.190	0.011	0.031	0.102	0.135	0.147

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

Table 3. Child anthropometric outcomes: ESR with robust standard errors.

	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	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. * p < 0.1, ** p < 0.05, *** p < 0.01. Distances are measured in log of km.

Table 4. Expected mean values of child nutritional outcomes.

Sub-sample/ Outcome	Child HAZ				Child WAZ			
	Decision to work in floriculture		Treatment effects		Decision to work in floriculture		Treatment effects	
	Working	Not working	ATT	ATU	Working	Not working	ATT	ATU
Mother is employed in floriculture *(N=180)*	-1.557	-0.806	-0.751*** (0.041)		-0.93	-0.503	-0.427*** (0.045)	
Mother is not employed in floriculture *(N=332)*	-2.079	-1.084		-0.995*** (0.051)	-1.539	-0.669		-0.87*** (0.051)

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5. Pathway 1: Mother's and spouse's time use. OLS regression with robust standard errors.

	Mother's 24 hours time use					Spouse's 24 hours time use		
	Self-care and maintenance	Child care	Domestic work and family care	Flori wage employment	Any wage employment	Self-care and maintenance	Child care	Domestic work and family care
Main woman works in floriculture	-1.834***	-2.189***	-5.402***	6.642***	6.807***	-0.053	0.425**	0.409
	(0.355)	(0.345)	(0.496)	(0.352)	(0.365)	(0.360)	(0.214)	(0.259)
Self-reported level of busyness in the last 24 hours: (Ref. category: Rest day)								
Mother								
Less busy than usual	-1.470*	-1.687**	-1.596	2.903***	3.661***			
	(0.776)	(0.746)	(1.135)	(0.933)	(0.840)			
Normal as usual	-2.491***	-1.986***	-2.850***	4.137***	5.140***			
	(0.678)	(0.647)	(1.028)	(0.848)	(0.733)			
More busy than usual	-3.001***	-2.674***	-2.756**	4.661***	5.563***			
	(0.744)	(0.692)	(1.132)	(0.870)	(0.773)			
Spouse								
Less busy than usual						-2.398***	-0.100	-0.428
						(0.567)	(0.379)	(0.435)
Normal as usual						-3.278***	-1.183***	-1.730***
						(0.445)	(0.254)	(0.297)
More busy than usual						-3.288***	-1.066***	-1.895***
						(0.502)	(0.361)	(0.401)
Mother level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	512	512	512	512	512	498	498	498
R^2	0.183	0.270	0.393	0.726	0.681	0.217	0.170	0.190

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

Table 6. Pathway 2: intra-household division of labor. OLS regression with robust standard errors.

	Number of wage employment hours based on 7-days labor participation recall		
	Mother	Spouse	Other HH members
Main woman works in floriculture	44.258***	9.202***	0.150
	(2.104)	(3.379)	(1.600)
Mother level controls:	Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes
Observations	512	499	512
R^2	0.728	0.108	0.088

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

Table 7. Pathway 3a: Floriculture employment and diet diversity.

	Diet diversity scores	Food groups consumed by children					
	(1) HDDS	(2) Child DDS	(3) Grains/ roots/ tubers	(4) Legumes/ nuts	(5) Vitamin A rich fruit and vegetables	(6) Other fruit and Vegetables	(7) ASF
Main woman works in floriculture	-0.134***	0.027	0.660	0.144	0.520**	0.233	-0.704***
	(0.019)	(0.046)	(0.484)	(0.197)	(0.219)	(0.239)	(0.199)
In the last 7 days:							
Special/feast day(s) (1/0)	-0.019						
	(0.018)						
Meal(s) shared to non HH-members (1/0)	0.045***						
	(0.014)						
Food consumption in the past 24 hours was:							
(Ref. category: Less than usual)							
About usual		0.156**	0.917**	0.076	0.671**	0.492*	0.125
		(0.064)	(0.453)	(0.233)	(0.263)	(0.279)	(0.252)
More than usual		0.061	0.000	0.531	0.168	0.486	-0.450
		(0.159)	(.)	(0.613)	(0.653)	(0.693)	(0.563)
Child level controls:	No	Yes	Yes	Yes	Yes	Yes	Yes
Mother level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	512	463	425	463	463	463	463
Pseudo R^2	0.024	0.024	0.426	0.210	0.128	0.246	0.220

Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. Distances are measured in log of km. Estimates are from poisson (model (1) and (2)); and probit (model (3) - (8)) models. Animal source foods include Milk and milk products, eggs, flesh/organ meat and sea foods. We use aggregate of ASF in our analysis because >95% of children in our sample did not consume meat/organ meat as well as sea foods. Hence, the strong negative association between mothers employment and child ASF consumption is mainly driven by consumption of milk and milk products.

Table 8. Pathway 3b: Floriculture employment and intra-household dietary patterns.

	Who eats more diverse food in the HH?			Who eats away from home most of the times?		Average daily meal frequency of:	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Under 5 children	Female members	Male members	Main woman	Spouse of main woman	Under 5 children	Above 5 HH members
Main woman works in floriculture	-0.060	-0.254	-0.533**	-0.492**	-0.379**	-0.009	-0.000
	(0.183)	(0.278)	(0.230)	(0.218)	(0.177)	(0.043)	(0.019)
Child level controls:	Yes	No	No	No	No	Yes	No
Mother level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	512	512	512	512	499	512	512
Pseudo R^2	0.173	0.167	0.124	0.082	0.067	0.009	0.002

Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. Distances are measured in log of km. Estimates are from probit (model (1) - (5)) and poisson (model (6) and (7)) models. The dependent variables used in this regression outputs table are not based on recall information for specific time frame, rather they reflect the general dietary habits of households and are assumed to provide complementary information to individual as well as HH dietary diversity data.

Table 9. Pathway 3c: Floriculture employment and duration of child breastfeeding.

	Duration of breast feeding in number of months				Duration of exclusive breast feeding in number of months	
	(1) Child age 7-23 months	(2) Child age 24-59 months	(3) Child age 7-23 months	(4) Child age 24-59 months	(5) Child age 0-59 months	(6) Child age 0-59 months
Total months of floricultural wage work by the main woman:						
During last 12 months	0.059	-0.231*			-0.019	
	(0.059)	(0.132)			(0.021)	
In her entire life			0.005	-0.035*		-0.002
			(0.008)	(0.018)		(0.002)
Child level controls:	Yes	Yes	Yes	Yes	Yes	Yes
Mother level controls:	Yes	Yes	Yes	Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes	Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes	Yes	Yes	Yes
Observations	152	310	152	310	511	511
R^2	0.676	0.162	0.674	0.165	0.193	0.193

Robust standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. Distances are measured in log of km. Estimates are from OLS models. Since one of the children in our sample is adopted and current parents didn't know duration of (exclusive) breastfeeding, hence the information for that child is not included in the analysis.

Table 10. Pathway 4: Floriculture employment and Income.

	Log of HH income per capita	Income tercile groups		
		First tercile	Second tercile	Third tercile
Main woman works in floriculture	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 to district admin:	Yes	Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes	Yes
Observations	512	171	171	170
R^2	0.189	0.411	0.752	0.419

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

Table 11. Pathway 5: Floriculture employment and mothers bargaining weight.

	Mother's level of involvement in decision making of:				Share of mother's wage income to total HH income		
	(1) Minor HH expenditures	(2) Child health and education	(3) Asset ownership and sale		(4) Coefficient of the tobit model	(5) Marginal effects for the censored sample	(6) Marginal effects for the truncated sample
Main woman's floriculture employment months in the last 12 months:	0.029**	0.017	0.038**				
	(0.014)	(0.015)	(0.016)				
Main woman works in floriculture					0.780***	0.331***	0.253***
					(0.057)	(0.022)	(0.015)
Mother level controls:	Yes	Yes	Yes		Yes	Yes	Yes
Household level controls:	Yes	Yes	Yes		Yes	Yes	Yes
Distance to district admin:	Yes	Yes	Yes		Yes	Yes	Yes
Distance to nearest health facility:	Yes	Yes	Yes		Yes	Yes	Yes
Distance to nearest major food market:	Yes	Yes	Yes		Yes	Yes	Yes
Observations	512	512	512		512	512	512
Pseudo R^2	0.070	0.116	0.072	0.821	0.586		

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Distances are measured in log of km. Estimates in model (1)-(3) are from Ordered probit models. In these models, we are using women's employment participation in floriculture during the 12 months prior to the interview time a main predictor variable since it might better explain their level of exposure to the outside of household environments compared to a binary indicator (1/0) of whether a woman is working in floriculture at the time of the interview. Model (4) - (6) are based on tobit approach. Tobit model is more appropriate here because the dependent variable, women's income share, is left censored at zero, where about 53% of observations have zero values and the rest have positive values. Model (4) presents tobit model coefficients (for the latent variable). Model (5) and (6), respectively, marginal effects of employment participation on women's income share for the censored and truncated samples respectively.

7. Appendix

Table A1. Falsification test.

	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	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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Selection model is estimated using probit model. OLS is used for the sub-sample regression.

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.

Anne Swindale and Paula Bilinksy (2006) Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (Version 2).

Atkin, D. (2009) Working for the Future: Female Factory Work and Child Health in Mexico. Available from: https://www.mit.edu/~atkin/Women%20in%20Manufacturing_old.pdf.

Bamji, M.S. & Thimayamma, B. (2000) Impact of women's work on maternal and child nutrition. *Ecology of Food and Nutrition*, 39(1), 13–31. Available from: https://doi.org/10.1080/03670244.2000.9991602.

Barrett, C.B., Bachke, M.E., Bellemare, M.F., Michelson, H.C., Narayanan, S. & Walker, T.F. (2012) Smallholder Participation in Contract Farming: Comparative Evidence from Five Countries. *World Development*, 40(4), 715–730. Available from: https://doi.org/10.1016/j.worlddev.2011.09.006.

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.

Barron, M.A. & Rello, F. (2000) The impact of the tomato agroindustry on the rural poor in Mexico. *Agricultural Economics*, 23(3), 289–297. Available from: https://doi.org/10.1111/j.1574-0862.2000.tb00280.x.

Baumüller, H., Braun, J. von, Admassie, A., Badiane, O., Baraké, E. & Börner, J. et al. (2020) *From Potentials to Reality: Transforming Africa's Food Production*.

Baydar, N., Greek, A. & Gritz, R.M. (1999) Young mothers' time spent at work and time spent caring for children. *Journal of Family and Economic Issues*.

Bellemare, M.F. & Novak, L. (2017) Contract Farming and Food Security. *American journal of agricultural economics*, 99(2), 357–378. Available from: https://doi.org/10.1093/ajae/aaw053.

Blasis, F. de (2020) Global horticultural value chains, labour and poverty in Tanzania. *World Development Perspectives*, 18, 100201. Available from: https://doi.org/10.1016/j.wdp.2020.100201.

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.

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.

Cramer, C., Di John, J. & Sender, J. (2018) High Value Agricultural Exports in Ethiopia.

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 Saweda & Sauer, C. et al. (2019) Youth agrifood system employment in developing countries: a gender-differentiated spatial approach.

Engle, P.L., Menon, P. & Haddad, L. (1999) Care and Nutrition: Concepts and Measurement. *World Development*, 27(8), 1309–1337. Available from: https://doi.org/10.1016/S0305-750X(99)00059-5.

Fan, S. & Pandya-Lorch, R. (2012a) *Reshaping agriculture for nutrition and health*. International Food Policy Research Institute: Washington, D.C.

Fan, S. & Pandya-Lorch, R. (2012b) *Reshaping agriculture for nutrition and health*. International Food Policy Research Institute: Washington, D.C.

FAO (2013) Guidelines for measuring household and individual dietary diversity.

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.

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.

Hammond, R.A. & Dubé, L. (2012) A systems science perspective and transdisciplinary models for food and nutrition security. *Proceedings of the National Academy of Sciences of the United States of America*, 109(31), 12356–12363. Available from: https://doi.org/10.1073/pnas.0913003109.

Headey, D., Chiu, A. & Kadiyala, S. (2012) Agriculture's role in the Indian enigma: help or hindrance to the crisis of undernutrition? *Food Security*, 4(1), 87–102. Available from: https://doi.org/10.1007/s12571-011-0161-0.

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.

Hernández, R., Reardon, T. & Berdegué, J. (2007) Supermarkets, wholesalers, and tomato growers in Guatemala. *Agricultural Economics*, 36(3), 281–290. Available from: https://doi.org/10.1111/j.1574-0862.2007.00206.x.

Herrmann, R.T. (2017) Large-Scale Agricultural Investments and Smallholder Welfare: A Comparison of Wage Labor and Outgrower Channels in Tanzania. *World Development*, 90, 294–310. Available from: https://doi.org/10.1016/j.worlddev.2016.10.007.

IFPRI (2012) Reshaping Agriculture for Nutrition and Health.

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.

Kabunga, N.S., Dubois, T. & Qaim, M. (2012) Yield Effects of Tissue Culture Bananas in Kenya: Accounting for Selection Bias and the Role of Complementary Inputs. *Journal of Agricultural Economics*, 63(2), 444–464. Available from: https://doi.org/10.1111/j.1477-9552.2012.00337.x.

Kadiyala, S., Harris, J., Headey, D., Yosef, S. & Gillespie, S. (2014) Agriculture and nutrition in India: mapping evidence to pathways. *Annals of the New York Academy of Sciences*, 1331, 43–56. Available from: https://doi.org/10.1111/nyas.12477.

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*. 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.

Maddala, G. (1983) Limited Dependent and Qualitative Variables in Econometrics.

Maertens, M. (2009) Horticulture exports, agro-industrialization, and farm-nonfarm linkages with the smallholder farm sector: evidence from Senegal. *Agricultural Economics*, 40(2), 219–229. Available from: https://doi.org/10.1111/j.1574-0862.2009.00371.x.

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. & Swinnen, F.J. (2012) Gender and Modern Supply Chains in Developing Countries. *Journal of Development Studies*, 48(10), 1412–1430. Available from: https://doi.org/10.1080/00220388.2012.663902.

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.

Manda, J., Alene, A.D., Tufa, A.H., Abdoulaye, T., Wossen, T. & Chikoye, D. et al. (2019) The poverty impacts of improved cowpea varieties in Nigeria: A counterfactual analysis. *World Development*, 122, 261–271. Available from: https://doi.org/10.1016/j.worlddev.2019.05.027.

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.

Meemken, E.-M. & Bellemare, M.F. (2020) Smallholder farmers and contract farming in developing countries. *Proceedings of the National Academy of Sciences of the United States of America*, 117(1), 259–264. Available from: https://doi.org/10.1073/pnas.1909501116.

Michelson, H.C. (2013) Small Farmers, NGOs, and a Walmart World: Welfare Effects of Supermarkets Operating in Nicaragua. *American Journal of Agricultural Economics*, 95(3), 628–649. Available from: https://doi.org/10.1093/ajae/aas139.

Mishra, A.K., Kumar, A., Joshi, P.K. & D'Souza, A. (2018) Impact of contract farming on yield, costs and profitability in low-value crop: evidence from a low-income country. *Australian*

Journal of Agricultural and Resource Economics, 62(4), 589–607. Available from: https://doi.org/10.1111/1467-8489.12268.
Mugo, M.G. (2012) Impact of Parental Socioeconomic Status on Child Health Outcomes in Kenya**. *African Development Review*, 24(4), 342–357. Available from: https://doi.org/10.1111/1467-8268.12003.
Nankinga, O., Kwagala, B. & Walakira, E.J. (2019) Maternal employment and child nutritional status in Uganda. *PloS One*, 14(12), e0226720. Available from: https://doi.org/10.1371/journal.pone.0226720.
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.
Rao, E.J. & Qaim, M. (2011) Supermarkets, Farm Household Income, and Poverty: Insights from Kenya. *World Development*, 39(5), 784–796. Available from: https://doi.org/10.1016/j.worlddev.2010.09.005.
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.
Schipmann, C. & Qaim, M. (2010) Spillovers from modern supply chains to traditional markets: product innovation and adoption by smallholders. *Agricultural Economics*, 41(3-4), 361–371. Available from: https://doi.org/10.1111/j.1574-0862.2010.00438.x.
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.
Ton, G., Vellema, W., Desiere, S., Weituschat, S. & D'Haese, M. (2018) Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? *World Development*, 104, 46–64. Available from: https://doi.org/10.1016/j.worlddev.2017.11.015.
Tucker, K. & Sanjur, D. (1988) Maternal employment and child nutrition in Panama.
UNICEF (1990) Strategy for improved nutrition of children and women in developing countries.
UNICEF/ WHO/ World Bank (2019) Levels and trends in child malnutrition.
UNICEF/ WHO/ World Bank (2021) Levels and trends in child malnutrition.
United Nations (2015) Transforming our world: the 2030 Agenda for Sustainable Development.

van den Broeck, G. & Maertens, M. (2015) Female employment reduces fertility in rural Senegal. *PloS One*, 10(3), e0122086. Available from: https://doi.org/10.1371/journal.pone.0122086.

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 (2001) Report of the expert consultation of the optimal duration of exclusive breastfeeding, Geneva, Switzerland, 28-30 March 2001. Available from: https://apps.who.int/iris/bitstream/handle/10665/67219/who_nhd_01.09.pdf.

WHO (2014) Comprehensive implementation plan on maternal, infant and young child nutrition.

WHO/ UNICEF (2003) Global strategy for infant and young child feeding.

WHO/ UNICEF (2018) The Extension of the 2025 Maternal, Infant and Young Child Nutrition Targets to 2030.

Willis, R.J. & Rosen, S. (1979) Education and Self-Selection. *Journal of Political Economy*, (vol. 87, no 5, pt. 2).