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Child nutritional status in Armenia: gender bias or sex differences?

A study on the influence of parental son preference on the indicators for child stunting and overweight

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Abstract

Child malnutrition is a global problem. Although Armenia performs relatively well compared to other developing countries, it still has large numbers of children under the age of 5 years who are either stunted or overweight. Previous research has found parental son preference to play an important role in child malnutrition in several Asian countries such as Bangladesh, China and India. Like these countries, Armenia is characterised by a patriarchal culture and a gender preference in favour of boys. However, this has not been studied in relation to child malnutrition in the country yet. Therefore, this quantitative study examines to what extent parental son preference can be associated with sex differences in child nutritional status in Armenia. It does so in the light of the nutrition transition theory and different parental investment theories. Data from the two most recent rounds of the Demographic and Health Survey in Armenia are used to perform both linear and quantile regression analyses with children's z-scores for height for age and weight for height as dependent variables, which are indicators for stunting and overweight respectively. The findings of this study show limited evidence for a role of parental son preference in sex differences in both the height for age and weight for height z-scores of Armenian children. Rather, demographic and socioeconomic factors are important in explaining differences in child nutritional status in the country.

Keywords: child nutritional status, stunting, overweight, nutrition transition, parental son preference, parental investment

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DHS	Demographic and Health Survey
FAO	Food and Agriculture Organisation
HAZ	Height for age z-score
ICF	Inner City Fund
MOH	Ministry of Health
NSS	National Statistical Service
UNICEF	United Nations Children’s Fund
VIF	Variance inflation factor
WHO	World Health Organisation
WFP	World Food Programme
WHZ	Weight for height z-score

1. Introduction

Child malnutrition, which is the general discrepancy between a child's dietary needs and what is actually consumed, is a global problem (Fox et al., 2016). In a recent study, the United Nations Children's Fund (UNICEF), World Health Organisation (WHO) and World Bank Group found that among the global number of children under the age of 5, the percentage of stunting is declining too slowly whereas the percentage of overweight is increasing (2019). 21.9% of all children were found to be stunted and 5.9% to be overweight. Both stunting, which reflects chronic undernutrition and refers to a low height for age, and overweight, which refers to a high weight for height, are indicators of malnutrition (WHO, 2010). Poor nutrition is especially problematic during early childhood because this has damaging consequences for health and development throughout the life course (Sharaf et al., 2019_a). For stunting, these consequences can include a weaker immune system, higher risk of mortality and morbidity, reduced physical ability, poor school performance and lower future employment opportunities as compared to well-nourished children (UNICEF, 2013). Furthermore, stunted children are prone to developing overweight and other chronic diseases in later life. This also applies to overweight children, who are likely to stay overweight into adulthood (WHO, n.d._a). Other consequences of overweight during childhood can include a higher risk of mortality and morbidity, behavioural and emotional difficulties, stigmatisation, poor socialisation and also poor school performance (WHO, 2016).

In Armenia, child malnutrition also is an important issue (Sargsyan, 2016). Although the country performs relatively well as compared to other developing countries, it still has large numbers of children under the age of 5 who are either stunted or overweight (Development Initiatives, 2019; World Food Programme [WFP] & UNICEF, 2016). This means that the country is faced with a double burden of malnutrition. This refers to the coexistence of undernutrition, which initially was the most common form of malnutrition in developing countries, and overweight, an increasing problem in these countries (WHO, n.d._b). Between 2000 and 2010, the percentage of stunted children in Armenia gradually rose from 16.7% to 19.3%. However, in 2015, this dropped already far below the current world average to 9.4%. During the same period, the percentage of overweight children remained stable at 15%, which is 2.5 times higher than the current world average (Inner City Fund [ICF], 2020).

A report by WFP and UNICEF (2016) has identified several factors that play a role in Armenian child nutritional status. At the child level, low birth weight, low rates of breastfeeding and age contribute to stunting. Among children under the age of 5, children aged 2 and 3 are most likely to be stunted. Furthermore, children with mothers who are educated on a secondary or lower level have a higher prevalence of stunting as compared to those whose mothers completed tertiary or higher education. Children are also more likely to be stunted if they are born within 2 years after a previous birth. At the household level, wealth is important, as households with higher wealth have greater access to food in both quantity and quality. Children who live in households below the poverty line are more likely to be stunted than children who live in households above it. However, household wealth was not found to play a role in overweight. Factors that do are again age of the child and educational level of the mother. Children aged 1 to 1.5 have a higher prevalence of overweight than other children under the age of 5. Concerning the education of a child's mother, the link with overweight appears to be opposite to that with stunting. Mothers with a tertiary or higher level of education have a higher prevalence of overweight children than mothers who completed only secondary education. Although the WFP and UNICEF report does not mention sex differences in child stunting and overweight, these have been described in a report by Development Initiatives (2019). As this report has found boys have a slightly higher prevalence of both stunting and overweight as compared to girls, sex of the child also is an important factor.

Another factor that has not been studied in relation with child nutritional status in Armenia so far is cultural gender preference. For several Asian countries, this factor has been shown to play an important role in child nutritional status as well (Kubo & Chaudhuri, 2016; Maitra & Rammohan, 2011; Mishra et al., 2004; Rahman, 2019). For example, Kubo and Chaudhuri found that in rural areas, Chinese girls under the age of 8 had a lower height for age and thus a higher risk of stunting than boys. They argue that this gender gap is due to son preference. These findings were confirmed for India by Mishra et al., who found evidence of gender discrimination for stunting and underweight in children under the age of 4. However, they state that the presence and extent of gender discrimination depend largely on the birth order of the child and the sex composition of its siblings. Additionally, Rahman studied the role of son preference in intrahousehold food distribution in Bangladesh. He concludes that son preference persists at all ages in Bangladesh and appears to be more prominent in higher income households than in poor or lower income households.

As in Bangladesh, China and India, cultural gender preference in favour of boys is also present in Armenia. Research has shown that in the case of having only one child, 32% of Armenian respondents would prefer a boy and 16% a girl (Yerevan State University Center for Gender and Leadership Studies, 2015). Furthermore, son preference is more widespread among men, as 45% of men would prefer a boy as compared to 26% of women. In Armenia, this son preference is associated with parents' expectations that sons will provide support and care in their old ages, whereas daughters will belong to their husbands' family after marriage (Guilmoto, 2013; The World Bank, 2015). On the other hand, besides being an issue of economic well-being, having a son is also an issue of pride. Carrying on the family name is perceived as being more important than material support. Therefore, pressure to have sons comes as much from personal preference as societal pressure due to the patriarchal culture in the country (Das Gupta, 2015). A striking manifestation of Armenian son preference can be found in the country's sex ratio at birth, which rose to high levels during the last decades. Within a context of declining fertility and rising availability of sex detection technologies, Armenian parents have increasingly adopted sex selection to ensure the birth of sons. Compared to the natural ratio of 1.05, which means 105 males per 100 females, the Armenian ratio peaked at 1.2 in 2000 and thereafter declined to 1.11 in 2018 (Statistical Committee of the Republic of Armenia, n.d.). Despite this decline, the current sex ratio at birth remains close to the ratios in China and India and thus among the highest in the world (The World Bank, 2016).

As Armenia is located in the Caucasus, between Eastern Europe and Central Asia, it is an interesting case from a cultural and demographic perspective. Previous research has focused on the gender bias in Armenia's sex ratio at birth and on sex differences in several domains of later life, such as health, education, labour market and politics, but information on childhood is lacking (e.g. Das Gupta, 2015; Khitarishvili, 2016; Meslé et al., 2007; The World Bank, 2015). However, child nutritional status in particular may be an area of interest, due to both the lifelong consequences of childhood malnutrition and the fact that research in other countries has proved parental son preference, which is also widespread in Armenia, to play a role in this (Kubo & Chaudhuri, 2016; Maitra & Rammohan, 2011; Mishra et al., 2004; Rahman, 2019; Sharaf et al., 2019_a; UNICEF, 2013). If child nutritional status in Armenia is indeed subject to a gender bias, this may partially predict or even explain sex differences in the aforementioned domains of later life. Although a study has found that it is Armenian boys who suffer from malnutrition more often and thus seem disadvantaged as compared to Armenian girls (Development Initiatives, 2019), this study did not consider the full distribution of malnutrition. This means that nothing is known about possible sex differences in the severity of malnutrition. Therefore, the aim of this study is to examine whether parental son preference is associated with child nutritional status in Armenia while taking into account the full distribution of malnutrition indicators. The focus lies on the indicators for both stunting and overweight, as these are the most frequent forms of malnutrition among children in the country. This study contributes to the existing literature on both childhood nutrition and parental son preference in Armenia by relating these topics to each other. Furthermore, most research that has thus far been conducted in other countries only takes into account the gender preference and characteristics of a child's mother. This study goes further by also including the preference of the father, since differences exist in the prevalence of son preference among Armenian men and women (Yerevan State University Center for Gender and Leadership Studies, 2015).

The research question that is central to this study is "*To what extent can parental son preference be associated with sex differences in child nutritional status in Armenia?*". In order to answer this question, five sub questions will be addressed: a) "What are the differences between Armenian boys and girls in terms of distribution of nutritional status?"; b) "Is parental son preference associated with child nutritional status?"; c) "Is there a difference between maternal son preference and paternal son preference in their association with child nutritional status?"; d) "What is the effect of the drivers of the nutrition transition on the associations between parental son preference and child nutritional status?"; e) "To what extent do the effects from sub question b), c) and d) differ between the indicators for stunting and overweight?".

This paper is structured as follows. First, the theoretical framework outlines the approaches used towards child nutritional status and parental son preference in Armenia, which are the nutrition transition and parental investment respectively. The hypotheses for the study are also derived from this part. This is followed by the research methodology, which describes the source of data, study sample, ethical issues, variables and way in which the study is conducted. Next, the data are described and analysed. Based on these results, the conclusion formulates an answer to the research question. Finally, the discussion reflects on the results, states the limitations of the study and provides recommendations for further research.

2. Theoretical background

2.1 Nutrition transition

Whether parental son preference is associated with child nutritional status cannot be viewed in isolation from the wider nutritional context in Armenia. A theory that can be applied to understand child nutritional status at the macro level, but also the micro level, is the nutrition transition. This nutrition transition concerns the shifts in the composition of human diets across time and space, which are reflected in subsequent nutritional outcomes such as average height and body composition (Popkin, 1993). As the nutrition transition has been found to be relevant regarding both child stunting and overweight (Kimenju & Qaim, 2016), this theory and its drivers in particular will be used to capture the broad Armenian context of nutrition and child nutritional status within which parental son preference operates.

The nutrition transition theory was developed by Popkin (1993). He states that human history is characterised by a series of changes in diets and nutritional outcomes (Popkin, 1998). These changes can be summarised into five broad patterns, which are characterised by different demographic, economic and social factors. The patterns that are most relevant for modern populations are shown in Figure 1 (Popkin, 2002, p. 95). Currently, but most populations have experienced a transition towards increased overweight and degenerative diseases or have already begun to react to this through behavioural changes. Whereas high-income countries shifted towards diets high in fat and increased overweight throughout the previous century, this shift occurred in most low- and middle-income countries only during the last decades but at a much faster pace (Drewnowski & Popkin, 1997; Popkin, 2003, 2006; Popkin et al., 2012). However, as subpopulations are characterised by different demographic, economic and social factors that underlie the nutrition transition, they can reside in different patterns (Haisma et al., 2006). This can lead to coexistence of undernutrition and overnutrition and thus a double burden of malnutrition within countries. Popkin et al. (2020) found that low- and middle-income countries continue to have a high double burden to date.

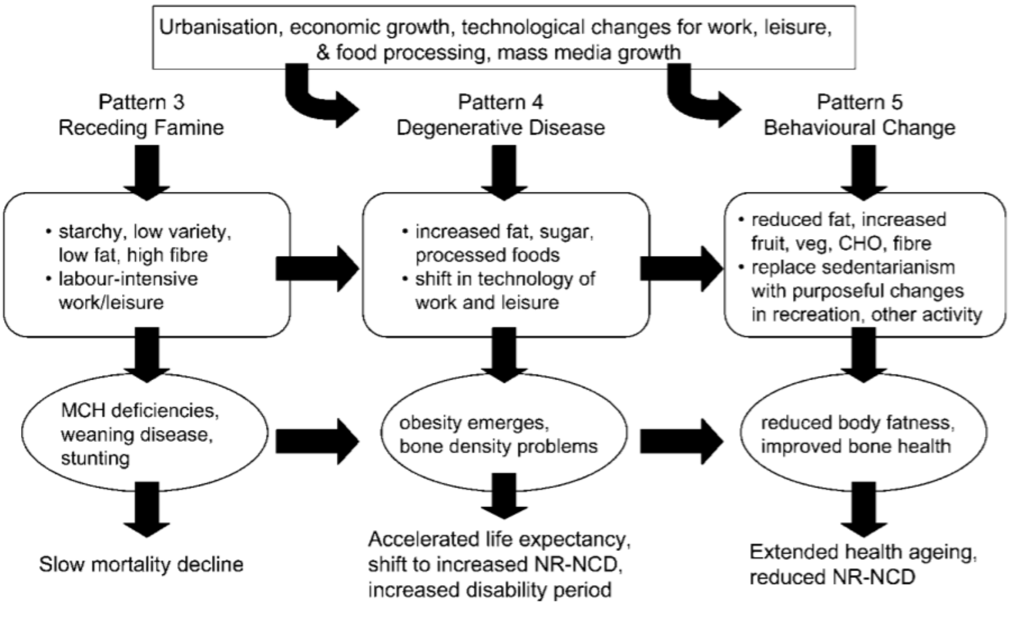

Figure 1 The last three stages of the nutrition transition (reprinted from Popkin, 2002, p. 95)

These shifts are also reflected in children's nutritional status, as the worldwide number of stunted children has been declining and that of overweight children increasing (UNICEF, WHO & World Bank Group, 2019). A study by Kimenju and Qaim (2016) provides evidence for an association between the nutrition transition and the nutritional status of children under the age of 5 in developing countries. Firstly, they found that child underweight and stunting decrease when countries move towards the later patterns of the nutrition transition. Although it may be argued that this effect would be less strong in younger children as they are either breastfed or provided with special child food, household food and dietary conditions certainly play an important role in child nutrition. However, the study led to mixed findings concerning child overweight. The authors therefore conclude that the association between the nutrition transition and overweight may be less pronounced in children than in adults, but that this does not mean that changing diets could not contribute to overweight in children who are supplied with sufficient food. Furthermore, at the end of last century Popkin et al. (1996) found an association between child stunting and overweight in four different countries that were undergoing the nutrition transition. More recent research also provides evidence that the double burden of malnutrition can occur not only in the same population, but in the same child as well. In their study on children under the age of 5 in low- and middle-income countries, Bates et al. (2017) found "stuntedoverweight" children to exist in every country included in their analysis, among which Armenia. They state that this cooccurrence of stunting and overweight may reflect a layer of child malnutrition that is the result of the rapid pace at which the nutrition transition is happening in these countries.

When Popkin developed his theory, he identified important demographic, economic and social factors that are associated with shifts in diets and subsequent nutritional outcomes (Popkin, 1993, 1998, 2001). These environmental factors underlie the biological and more proximate determinants of body composition and thus nutritional status (Popkin, 1995). First, regarding demographic factors, urbanisation has been found to be the most influential change. Furthermore, changes in income and patterns of work, the role of women in particular, have been defined as underlying socioeconomic shifts. Finally, dietary change has been associated with changes in knowledge and therefore, education also plays an important role. Income, employment and education are often related and together these factors make up socioeconomic status. The associations between these factors and nutritional status differ between contexts. Because Armenia is situated between Eastern Europe and Central Asia, both culturally and demographically, it is interesting to see how associations behave here.

2.1.1 Urbanisation

Urban populations have experienced and are experiencing the nutrition transition faster than populations living in rural areas (Hawkes et al., 2017). Several factors are responsible for urban-rural differences in diets and nutrition outcomes. For example, the areas differ in their food transportation and marketing systems, food availability and seasonal fluctuation, compatibility of jobs with home food preparation, away-from-home eating opportunities and heterogeneity of the population regarding diets (Popkin et al., 1995; Popkin, 1998). Furthermore, as most food in urban areas is purchased, income is a key factor in urban populations' diets. A study by Goryakin and Suhrcke (2014) found a link between urban residence and overweight among adults, especially women, in countries with different levels of economic development. Other research has found that these contrasts between urban and rural areas are more marked in low-income than in high-income countries (Popkin, 1998, 2001). Furthermore, in low- and middle-income countries, overweight among children under the age of 5 has been found to be more prevalent in urban than in rural areas, whereas this is the other way around for the prevalence of child stunting (Black et al., 2013). For Armenia, the WFP and UNICEF (2016) found that levels of both child stunting and overweight have been declining in rural areas between 2010 and 2014. However, during the same period, these levels have been increasing in children living in urban areas.

2.1.2 Income

Income is important in the nutrition transition because it allows or obstructs the purchase of goods and services that affect diet and nutritional outcomes (Popkin, 1998). Although the association with wealth at the country level has weakened over time, nutritional deficiency and excess remain related to income at the individual and household level. Higher incomes provide individuals and households with higher access to food, but this can be both nutritious food that contributes to a high quality of diets or calorie-dense, salty and sugary food that can undermine the quality of diets (Hawkes et al., 2017). In low income countries, income is positively associated with overweight. However, Monteiro et al. (2001) state that this may not be true for all developing countries, because their changing economic and social contexts lead to complex and dynamic patterns of determination of obesity. They found evidence for this in Brazil. Here, in less developed contexts, obesity in women is positively associated with income and negatively with education. In more developed contexts, only the association with education was found. Furthermore, overweight has been found to be evenly distributed among different economic subpopulations in middle-income countries, whereas a negative association exists between income and overweight in high-income countries (Ameye & Swinnen, 2019; Popkin, 1995). Concerning household income and child nutritional status in low- and middle-income countries, Black et al. (2013) found the stunting prevalence among children under the age of 5 to be 2.5 times higher in the poorest households as compared to the richest households. This negative association has been confirmed by more recent research (Bommer et al., 2019). Black et al. furthermore found that although the differences in child overweight between the poor and the rich were small in most of the included low- and middle-income countries, this prevalence tends to be higher among the richest households. These findings also seem to apply to Armenia, where child stunting has been found to be more prevalent in households below the poverty line than in those above it (WFP & UNICEF, 2016). However, there is no evidence for an association between household income and child overweight in this country. Therefore, in the light of the findings by Monteiro et al., it is interesting to look at the effects of education as well.

2.1.3 Employment

Especially important in the nutrition transition are changes in the roles of women regarding patterns of time allocation (Popkin, 1993). Formerly, and in many countries still today, women played a central role within the household and were responsible for unpaid tasks, such as food preparation, feeding of children, child monitoring and stimulation, managing hygiene and accessing health services (Komatsu et al., 2018). However, during the last decades, female participation in the labour force has increased moderately in Europe and Central Asia (The

World Bank, 2020). This can reduce both time available for and quality of household tasks but increase household income, which affects diets and subsequent nutritional outcomes. For example, Oddo et al. (2018) found increases in women’s employment to coincide with a decreasing prevalence of undernutrition and an increasing prevalence of overweight in women and children. The findings of a study by Burroway (2017) are more nuanced. She states that in her sample of developing countries, which includes Armenia, female employment itself is not associated with reduced child stunting, but certain occupational categories are. Furthermore, the effect of female employment on both stunting and overweight may depend on socioeconomic status as a whole. In developing countries, whether the food security situation of working women with a low socioeconomic status is alleviated or aggravated by their participation in the labour force largely depends on the set of resources and constraints they face (Semba & Bloem, 2008). On the other hand, Courtemanche (2009) found employment of females with a high socioeconomic status to be associated with child overweight, primarily through its influence on child monitoring and nutrition. However, a study among European countries indicates that neither child calorie intake nor physical activity are related to mothers’ employment status, irrespective of socioeconomic status (Gwozdz et al., 2013). Armenia remains conservative regarding expectations of male and female roles in its society (Asian Development Bank, 2015; Yerevan State University Center for Gender and Leadership Studies, 2015). Female participation in the labour force is still lower than male participation, as women are expected to prioritise the family and children over their careers. Furthermore, it is expected that men provide for their families and earn more than women. In 2018, only 47.2% of the female population aged 15 to 75 participated in the labour force, compared to 68.8% of men (Statistical Committee of the Republic of Armenia, 2019).

2.1.4 Education

Due to increased education and rapid communication of information among populations worldwide, information about diet and health is now widespread (Popkin, 1993). Education influences diets and nutritional outcomes through factors such as health literacy and accurate decision making. Haram et al. (2015) found that among women aged 15 to 49, each additional year of schooling increases the probability of being overweight up to the end of primary schooling, after which each additional year of schooling decreases this probability. However, as the nutrition transition progresses and access to diets that are high in fat and sugar increases, the association between education and overweight becomes a negative linear association. This is in line with the findings of a study by Monteiro et al. (2001), who define education as a protective factor for obesity. Furthermore, the association between education and nutritional status is affected by income. For example, mothers with a lower level of education are less able to obtain information about child stunting and are more likely to have stunted children as compared to mothers with higher education (WHO, 2018). The latter is also associated with a low income, because even when mothers know what is adequate and nutritious food, their ability to afford this plays an important role in the actual consumption of their children. Among European children, low parental education is found to be associated with intakes of calorie-dense, sugary and fatty food, whereas high parental education is associated with low-sugar and low-fat food (Fernández-Alvira et al., 2012). However, also when it comes to child overweight, parental education and income cannot be assumed to operate independently from each other. In

Armenia, mothers who have attained secondary or lower education have a higher prevalence of stunted children as compared to mothers who have completed tertiary or higher education (WFP & UNICEF, 2016). On the other hand, the latter were found to have a higher prevalence of overweight children than the former.

2.1.5 Diet

Shifts in all of these factors have been found to be associated with shifts in diets, which are in turn associated with nutritional outcomes such as stunting and overweight. Regarding the diet of young children, exclusive breastfeeding during the first 6 months is recommended (WHO, 2020). Thereafter, they should be introduced to adequate and nutritious complementary foods. Previous research has identified several dietary characteristics that contribute to either child stunting or overweight. According to Headey et al. (2018), an association exist between stunting and a low intake of animal sourced foods in children in developing countries. Consumption of a single type is less beneficial than multiple types of these foods. In addition, they found stunting to be related to a low intake of grains, legumes, tubers and fruits. Child overweight, on the other hand, is related to consumption of unhealthy foods that are high in fats, salts and sugars (UNICEF, 2019). Poskitt (2014) furthermore argues that the way these foods are used as part of a diet is important, as they often replace fibres, vegetables and fruits. Both child stunting and overweight are thus influenced by dietary diversity. According to the WHO (2008), starting when they become 6 months, children should receive foods from at least four important food groups each day to achieve minimum dietary diversity. These include grains, roots and tubers, legumes and nuts, dairy products, flesh foods, eggs, vitamin A rich fruits and vegetables, and other fruits and vegetables. While not much is known about food consumption among Armenian children, UNICEF Armenia (n.d.$_a$, n.d.$_b$, n.d.$_c$) has developed important recommendations. Although breastfeeding remains important, children aged 6 months and older should also eat grains, animal foods such as eggs, meat and fish, vegetables and fruits every day. When children become 9 months, they can also be served potatoes, legumes and small amounts of oil and at age 1, they can eat the same things as the rest of the household. As children grow older, the portions of complementary foods should increase.

2.2 Son preference

Parental preference for children of a particular gender remains a matter of both practical and theoretical concern (Yong Lee & Marwell, 2013). The definition of gender preference is the difference between the value of sons and the value of daughters. This value of a child should be considered at both the individual level, as a broad range of resources that parents receive or supply because they have a child, and at the societal level, as the functions of a child in the family, kinship system and society. The latter is especially important in non-western countries, where the value of a child is rarely based on the relationship between this child and its parents only. This also applies to Armenia, where the value of a child and subsequent parental son preference are based upon both personal well-being and societal pressure due to the country's patriarchal culture (Das Gupta, 2015; Guilmoto, 2013; The World Bank, 2015).

A theoretical framework that has devoted attention to parental gender preference is formed by the parental investment approaches (Yong Lee & Marwell, 2013). These approaches focus on differential parental investment in children based on their sex and thus are concerned with parents' supply. Whereas parents also receive comfort, which includes old age support, social esteem, such as maintenance of the family name, and affect because they have children (Nauck & Klaus, 2007), parents' supply refers to resources of children's interest that parents control such as nutrition, health care and education but also parental time. During early childhood, parents' supply is ubiquitous, as young children are very much dependent on their parents and their resources. Most societies are organised in a way that parents' resources determine their children's standard of living, both during childhood and in later life. This also applies to nutrition, as malnutrition during childhood has damaging consequences throughout the life course (UNICEF, 2013). Furthermore, anthropometric measurements such as height and weight have been found useful in assessing investment in children. These can reveal differences in the nutritional status of sons and daughters that may be the result of differential parental investment (Cronk, 1991). Therefore, this study will consider parental son preference and the role it might play in child nutritional status from a parental investment perspective.

Different approaches to parental investment exist. First, evolutionary biologists such as Hamilton, Clark and Wells have focused mostly parental investment in relation to natural selection. On the other hand, the idealist approach takes into account the cultural aspect of investment that is inherent to parental investment in humans, whereas the influence of parental conditions on parental investment are central to the materialist approach.

2.2.1 Evolutionary biological approaches to parental investment

The evolutionary biological approaches are concerned with reproductive costs and benefits of male and female offspring and assume that parents want to optimise their access to the benefits (Hrdy, 1990). Both Hamilton (1967) and Clark (1978) explained how natural selection might favour gender bias in voluntary parental investment. While their ideas are essentially the same, Hamilton has focused on mates, whereas Clark has paid attention to resources. If offspring of one sex tend to compete with their siblings or parents for mates or resources, this increases the costs of rearing offspring of this sex. Therefore, natural selection will favour production of the other and less competitive sex. This is referred to as local mate competition or local resource competition. On the other hand, if offspring of one sex tend to help their siblings or parents by attracting or obtaining mates or resources, their costs decrease and natural selection will favour production of this cheaper and more helpful sex. This is called local mate enhancement or local resource enhancement. Such situations in which offspring of one sex is cheaper or more expensive to produce and rear are not only common in animals, but also in human societies. For example, in Armenia, daughters will belong to their husbands' family after marriage. Therefore, family ties are the strongest among male kin. In terms of both mates and resources, parents are dependent on their sons rather than daughters (Das Gupta, 2013). Therefore, sons can be seen as the more helpful sex and may have lower costs of producing and rearing as compared to daughters. This may explain subsequent son preference in the country.

Another evolutionary biological point of view that has been directly related to investment through nutrition is provided by Wells (2003). His ideas can be combined with those of Clark (1978) to provide a parental nutritional investment perspective to son preference. Wells used parent-offspring conflict theory as established by Trivers (1974). His theory is also concerned with reproductive costs and benefits of offspring but perceives offspring as having an active role in the relationship and interaction with their parents. As they attempt to maximise their own reproductive success, they may want more investment than the level that would maximise their parents' fitness. On the other hand, parents are equally related to all of her offspring and thus, all else being equal and when no son preference is present, maximise their fitness by equal investment in all of them. Therefore, offspring and parents will compete over the amount of resources that should be invested in the offspring. According to Wells, human birth weight and maternal nutritional status can be considered as the outcomes of mother-offspring conflict during pregnancy. During this period, the fetus gains an indication of the mother's ability to provide the investment it requires, whereas the mother gains an indication of the viability of the fetus. After birth, the most important form of human parental material investment in offspring is nutrition. This is necessary for their maintenance, growth and somatic development, which are all related to the reproductive success of offspring of both sexes. Wells argues that mother-offspring conflict over breastfeeding and length of the interbirth interval are particularly important determinants of this. Whereas offspring will maximise their reproductive success by prolonging breastfeeding, the mother will maximise her fitness by weaning her offspring earlier, regaining her fertility and producing the next offspring (Fewtrell et al., 2020). Furthermore, Wells considers parental resources to be finite. Therefore, whether offspring have young siblings and their birth order also play a role in parent-offspring conflict about nutritional investment, as offspring gain less from reproductive fitness of their siblings than parents do. Offspring thus try to maximise their reproductive success by seeking more than their fair share of resources at the expense of those of their siblings, which is called sibling rivalry.

2.2.2 Idealist and materialist approaches to parental investment

As the evolutionary biological approaches to parental investment do not only apply to humans but also to other mammals, they do not explicitly specify the cultural factors that may cause parents to prefer a child of one gender over a child of the other gender. However, human parental investment is often culturally based (Sparks, 2011). Complementary to the original biological approach therefore are both the idealist and materialist approaches to parental investment (Cronk, 1991). The idealist approach is based on the idea that parents' valuations of sons and daughters are cultural constructs and thus not reducible to reproductive costs and benefits. Guilmoto (2013) has found that in Armenia, son preference is indeed often subsumed under the notion of "Armenian mentality", which is shaped by the country's patriarchal culture. However, thus far, little support has been found for this idealist point of view in general, as parents' stated and culturally determined preferences often do not fit their actual behaviour. The way that parents behave towards their sons and daughters has been found to fluctuate in response to their context (Hrdy, 1990). On the other hand, the materialist approach states that parents are rational actors who prefer a son or daughter as the result of weighing their economic costs and benefits. As these costs and benefits may differ between parents in different demographic and socioeconomic circumstances, this approach takes into account context in an indirect way. For example, The World Bank (2016) states that 71% of Armenian parents living in rural areas have a preference for sons as compared to 46% in urban areas. Furthermore, lower socioeconomic status has been found to be related to a high intensity of son preference in the country (Guilmoto, 2013).

3. Conceptual framework and hypotheses

This study envisions child nutritional status as the interplay of factors at the macro and micro level, which is depicted in the conceptual framework in Figure 2. At the macro level, but also the micro level, the nutrition transition and its drivers, the most important of which are urbanisation, income, employment, education and diet, are associated with child nutritional status (Kimenju and Qaim, 2016). This forms the broad context in which parental son preference operates. At the micro level, parental son preference is reflected in differential parental investment in sons and daughters. The ideas by Hamilton (1967) explain parental son preference from an evolutionary biology point of view. Furthermore, Wells (2003) provides information on parent-offspring conflict mechanisms that underlie parental nutritional investment. In combining their ideas, a link between parental son preference and differential nutritional investment is established on the micro level. On the other hand, the idealist and materialist approaches to parental investment can also be linked to the macro level context (Cronk, 1991). Whereas the idealist approach mostly focuses on the role of culture, the materialist approach assumes that parental son preference is based on economic costs and benefits of children and thus related to parents' conditions. These conditions can be traced back to the drivers of the nutrition transition, which indicates that it is indeed important to take these drivers into account.

Based on the conceptual framework and the literature discussed, several hypotheses can be drawn up. First, based on local resource enhancement or competition and the idealist approach to parental investment, parental son preference is expected to be positively associated with the nutritional status of boys and negatively associated with the nutritional status of girls. However, based on the nutrition transition and the materialist approach to parental investment, this association will be influenced by urbanisation, income, employment, education and diet.

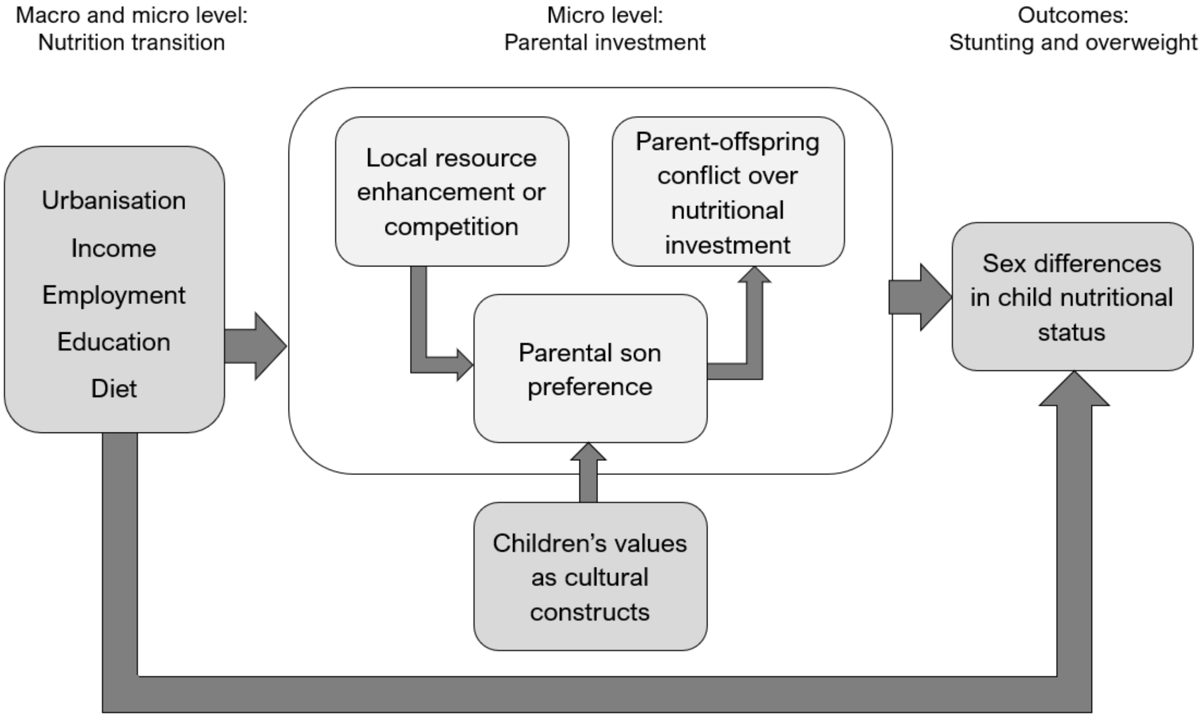

Figure 2 Conceptual model for understanding sex differences in child stunting and overweight

As son preference is found to be higher in rural areas than in urban areas in Armenia, urbanisation is expected to negatively affect the association between parental son preference and child nutritional status. Furthermore, income, employment and education are also expected to negatively affect this association, as son preference is higher among Armenian parents with a low socioeconomic status. Therefore, the following hypotheses are tested in this study:

> H1: Parental son preference is positively associated with the nutritional status of Armenian boys, but negatively with the nutritional status of Armenian girls
>
> H2: Urbanisation, income, employment and education all negatively affect the association between parental son preference and the nutritional status of Armenian children

4. Data and methodology

4.1 Dataset and sample

To be able to provide an answer to the research question described, a quantitative and cross-sectional study is conducted. It is based on secondary data from the two most recent rounds of the Demographic and Health Survey (DHS) held in Armenia, which are that of 2010 and 2015-2016. For this study, these datasets are combined into one. The DHS is a large, international and nationally representative household survey that provides data for a wide range of indicators on population, health and nutrition (The DHS Program, n.d.$_a$). In Armenia, the country's National Statistical Service (NSS) and the Ministry of Health (MOH) are responsible for the implementation of these surveys. In both 2010 and 2015-2016, data was collected during visits to the selected households by 13 teams, consisting of both female and male interviewers, a field editor, a health investigator and a team supervisor (NSS, MOH & ICF, 2012, 2017).

The DHS consists of several questionnaires, such as the Household Questionnaire, the Biomarker Questionnaire, the Woman's Questionnaire and the Man's Questionnaire. These questionnaires were adapted to reflect the population and health issues that are relevant to Armenia (NSS, MOH & ICF, 2012, 2017). First, the Household Questionnaire was conducted with one member of each household and used among others to list all members of the household, to identify women and men that were eligible for an individual interview and to collect information on the socioeconomic status of the household. Furthermore, in 2010, the Household Questionnaire also recorded anthropometric measures of all children under the age of 5, a role that was taken over by a separate Biomarker Questionnaire in 2015. The Woman's Questionnaire and Man's Questionnaire were used to obtain additional information on subsamples of women and men aged 15 to 49. In addition to background characteristics, these questionnaires cover different health topics. For women, these also include child health.

The data on relevant variables were obtained through all four questionnaires and matched for each child that is included in the sample of this study. The studied population consists of all Armenian children in early childhood, thus under the age of 5 years, that are living in a household with both of their parents. Both parents have to be present in the household to be able to determine possible differences between maternal son preference and paternal son preference and whether these differ in their association with child nutritional status. Therefore, the sample of this study consists of all Armenian children, under the age of 5 and living with both of their parents, that were included in the DHS of 2010 or 2015-2016. This resulted in a sample size of 1,124 children. Both rounds of the DHS are based on a representative probability sample of Armenian households (NSS, MOH & ICF, 2012, 2017).

4.2 Weights

DHS data should be weighted, because the samples are often based on unequal probability of selection to expand the number of households, women and men available for certain areas or subpopulations (The DHS Program, n.d.$_b$). This also applies to the surveys in Armenia in both 2010 and 2015-2016 (NSS, MOH & ICF, 2012, 2017). Weights are thus needed as adjustment factors to produce a proper representation of the entire Armenian population. Furthermore, weights that are calculated because of the sample design also correct for different response rates. For DHS data, different weights are available based on different sample selections, the most important of which are household weights, individual weights for women and individual weights for men. As in this study, children are the units of analysis, the individual weights for women are used (The DHS Program, n.d.$_{c}$). All descriptive statistics and regression analyses that are included in this study are based on these weights, unless indicated otherwise.

4.3 Ethical considerations

Primary ethical issues concerning data collection and processing have been dealt with by the institutions responsible for the DHS, both in general and specifically in Armenia. The DHS Program maintains strict standards for protecting the privacy of respondents and household members in all of its surveys (The DHS Program, n.d.$_{d}$). The survey procedures and questionnaires are reviewed and approved by the ICF Institutional Review Board. This Board also reviewed the country-specific survey protocols. Regarding data processing, respondents' data files are identified by a series of numbers, such as household number and individual number. After processing, these files are destroyed and numbers are randomly reassigned.

Furthermore, the goal of the DHS Program is to produce high-quality data. This is achieved through policies for editing, imputation and weights, which result in data files that accurately reflect the populations studied (The DHS Program, n.d.$_{e}$). In addition, a report that specifically assessed the quality of data on maternal and child health and nutrition in DHS survey has found that these data are generally of very high quality (Pullum, 2008).

As this study deals with the DHS data as secondary data, an issue that has to be addressed is data management. Important aspects of this are storage and protection. Therefore, The DHS Program has set up conditions of use for its datasets (The DHS Program, n.d.$_{f}$). These include that users may not share the datasets with others without consent of The DHS Program, data files should be kept in a secure location, data should be treated as confidential, data should not be used for marketing or commercial venture and users should submit a copy of reports or publications resulting from the data files. These conditions are guaranteed in this study.

4.4 Operationalisations and variables

As indicators for stunting and overweight in Armenian children, the z-scores of height for age (HAZ) and weight for height (WHZ) are used as dependent variables respectively. These are analysed in two separate models. Both HAZ and WHZ are continuous variables that are normally distributed and based on the WHO Child Growth Standards. A child is considered to be stunted when its height for age is more than 2 standard deviations below the WHO median (WHO, 2010). Moreover, a child is classified as being overweight if its weight for height is more than 2 standard deviations above the WHO median. Following studies on children under the age of 5 by De Onis et al. (2010) and Rachmi et al. (2016), this study also takes into account children who are at risk of becoming stunted or overweight. These are children whose height for age is more than 1 standard deviation below the WHO median and whose weight for height is more than 1 standard deviation above the WHO median respectively. Although the WHO Child Growth Standards are designed to assess children worldwide, regardless of ethnicity, socioeconomic status and type of feeding (WHO Multicentre Growth Reference Study Group, 2006), the z-scores that are based on these external standards are compared to z-scores that use the medians of the sample, which are based on Armenian children only. This is done to check the external validation of the WHO Child Growth Standards in Armenia.

The independent variables of interest are the sex of the child, maternal son preference, paternal son preference, the difference between maternal and paternal son preference and the interactions between the sex of the child and these different measures of son preference. The sex of a child is a dummy variable that can be derived directly from the dataset. The value 0 indicates that a child is a girl, whereas 1 is used for a boy. The measures for both maternal son preference and paternal son preference are constructed on the basis of three questions that are included in the surveys for individual men and women. These questions are "What is the ideal number of children?", "What is the ideal number of boys?" and "What is the ideal number of girls?". Based on the answers to these questions, dummy variables are computed for mothers and fathers separately. These equal 1 if a parent's ideal number of boys is higher than the ideal number of girls, indicating son preference, and 0 otherwise. This approach has been used in several previous studies (e.g. Clark, 2000; Dasgupta, 2016; Sharaf et al, 2019$_b$). Furthermore, this study includes a categorical variable that indicates the difference between maternal and paternal son preference, which is based on both the dummy variable for maternal son preference and the dummy variable for paternal son preference. It comprises the categories "both parents do not have a son preference", which is indicated with value 0, "both parents do have a son preference", "only the mother has a son preference" and "only the father has a son preference". Finally, interaction terms between the sex of the child and maternal son preference, the sex of the child and paternal son preference, and the sex of the child and the difference between maternal and paternal son preference are included. Whereas the coefficient belonging to the sex of the child indicates the sex difference in HAZ and WHZ, the coefficients of these interactions show whether son preference plays a role in this gender bias. These different variables capturing son preference and their interactions with the sex of the child will be used in separate models.

In addition, the drivers of the nutrition transition are added as independent variables of interest to determine their effects on the relationship between parental son preference and child nutritional status. These have been discussed in the theoretical framework and include urbanisation, income, employment, education and diet. Urbanisation is measured with a dummy variable for the type of place of household residence, which equals 0 for households living in a rural area and 1 for households living in an urban area. Furthermore, income is based on the household wealth index included in the dataset. This variable is categorical, as the wealth index ranges from "poor" to "middle" to "rich", with "poor" being the reference category and thus equal to 0. As female employment plays an important role in the nutrition transition, a measure of whether mothers are employed is also included. This dummy variable is equal to 0 if a mother is currently unemployed or 1 if she is currently employed. Education is indicated by a dummy variable as well, which equals 0 if a mother has completed secondary education at most or 1 if she has completed at least tertiary education. Lastly, diet is included as dietary diversity because this plays an important role in both child stunting and overweight. The measure for dietary diversity is based on the food groups that are part of minimum child dietary diversity according to the WHO (2008). Based on questions from the women's survey, it is measured if children ate foods belonging to these groups during the last 24 hours before the survey. First, consumption of grains, roots and tubers is based on the questions "Did the child eat bread, rice, noodles or other food made from grains?" and "Did the child eat potatoes, cassava or other tubers?", whereas consumption of legumes and nuts is based on the question "Did the child eat food made from beans, peas, lentils or nuts?" only. The question "Did the child eat cheese, yoghurt or other milk products?” was used to measure whether a child consumed dairy products. Furthermore, the food group flesh food is based on the questions “Did the child eat meat (such as beef, pork, lamb, chicken, etc.)?”, “Did the child eat liver, kidney heart or other meat organs?” and “Did the child eat fish or shell fish?”. If the child ate eggs is simply based on the question “Did the child eat eggs?”. Finally, consumption of fruits and vegetables that are rich in vitamin A is measured using the questions “Did the child eat red sweet pepper, or pumpkin, carrot or squash that are yellow or orange inside?” and “Did the child eat mangoes, papayas or other vitamin A fruits?”, whereas consumption of other fruits and vegetables is based on the questions “Did the child eat any dark green leafy vegetables (such as spinach, parsley, savoy cabbage, lettuce, mustard, turnip, beetroot greens, broccoli, etc.)?” and “Did the child eat any other fruits?”. When a food group is based on two or more questions, a child is considered as having consumed food from this group when at least one question is answered positively. As minimum dietary diversity is met when children receive foods from eat least four of these food groups each day, a dummy variable is constructed that equals 0 if a child ate food from less than 4 food groups or 1 if a child ate food from at least four food groups.

Lastly, several control variables are included. These are based on the parental investment perspective by Wells (2003) as discussed in the theoretical framework. He found that the birth weight of a child, maternal nutritional status, breastfeeding, whether offspring have young siblings and if so, the length of the interbirth interval and their birth order are all associated with parental nutritional investment. Birth weight is a continuous variable that can be derived directly from the dataset. The same applies to maternal nutritional status, which is measured using the BMI of the mother. The other factors are included as either dummy or categorical variables. To measure breastfeeding, two variables are included. First, the moment the mother started breastfeeding is included as a categorical variable and can have the values “immediately after birth”, which is the reference category and thus equal to 0, “within a day after birth” and “more than one day after birth”. In addition, whether a child is still breastfed is indicated with a dummy variable. This dummy variable equals 0 when a child is not breastfed anymore or 1 when a child is still breastfed. As a proxy for whether a child has young siblings, a dummy variable is constructed which has a value of 0 if no other children under the age of 5 are present in the household, but a value of 1 if there are. Their birth order is included as a categorical variable which consists of the categories “first child”, which is the reference category and thus equal to 0, “second child” and “third or more child”. A categorical variable on birth interval, based on a possible previous birth, is used to measure the length of this interval. This variable equals 0 when a mother did not have a birth prior to the birth of the child included in the sample, 1 when she did have another birth 24 months or less prior to the birth of this child and 2 when she had another birth more than 24 months prior to the birth of this child. Finally, control variables that have not been discussed in the theoretical framework but that are taken into account as standard demographic control variables are the age of the child in years, the age of the mother in years and the age of the father in years. Whereas the age of the child is a categorical variable ranging from 0 to 5 years, the ages of both parents are continuous variables.

4.5 Analytical methods

First, descriptive statistics are calculated based on the data. After the description of the sample, the external validity of the HAZ and WHZ based on the standards of the WHO is checked and the HAZ and WHZ are discussed for boys and girls separately. Next, in order to analyse the associations between the sex of the child, parental son preference and child nutritional status, both multivariate linear regression and quantile regression are run. Linear regression is run first to get to know the associations that are being studied. It considers the average association across the distribution of the dependent variable as a whole. In addition, quantile regression is often used in research on (child) nutritional status, as it addresses the possible heterogeneous association across the different percentiles of the dependent variable (see e.g. Block et al., 2012; Fenske et al., 2013; Gayawan et al., 2019; Gebremariam et al., 2018; Payande et al., 2013; Sharaf et al., 2019$_a$; Sharaf et al., 2019$_b$; Sweeney et al., 2013). For this study, this means that quantile regression takes care of the fact that children may respond differently to the factors underlying their nutritional status, depending on their location in the HAZ and WHZ distributions. Therefore, unlike linear regression, in which the attention is on averages, quantile regression considers the tails of the distribution. Besides overcoming statistical loss of information and possible heteroscedasticity problems, this has benefits from a policy perspective as these children are at the highest risks of malnutrition. Both regression methods are used to see if quantile regression, at 10th, 25th, 50th, 75th and 90th percentiles, indeed is a better fit to the data than linear regression.

Furthermore, several different model specifications are run to test the hypotheses. To examine possible sex differences in child nutritional status, linear regression equations, (1) and (2), are estimated. Quantile regression equations, (3) and (4), are used to check whether these sex differences change across the distributions of HAZ and WHZ. In these equations, μ represents a certain percentile of the distribution of HAZ or WHZ for child i.

$$(1)\ HAZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_4 X_i + u_i$$

$$(2)\ WHZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_4 X_i + u_i$$

$$(3)\ Q_{HAZi}(\mu \mid \text{sex of child, } X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_4(\mu)X_i + u_i$$

$$(4)\ Q_{WHZi}(\mu \mid \text{sex of child, } X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_4(\mu)X_i + u_i$$

According to equation (1) to (4), the HAZ or WHZ of child i is determined by its sex and X, which is a vector of the control variables as based on the parental investment perspective by Wells plus the standard demographic control variables of the age of the child, mother and father. Together, these equations form the first model, which is used to examine the associations between the sex of the child and child nutritional status. A second model is used to determine the role of parental son preference plays in these possible sex differences. This second model thus examines whether gender bias exist in child nutritional status. Again, both linear regression equations, (5) and (6), and quantile regression equations, (7) and (8), are estimated:

(5) $HAZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_2 \text{son preference}_i + \beta_3 \text{sex child}_i * \text{son preference}_i + \beta_4 X_i + u_i$

(6) $WHZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_2 \text{son preference}_i + \beta_3 \text{sex child}_i * \text{son preference}_i + \beta_4 X_i + u_i$

(7) $Q_{HAZi}(\mu \mid \text{sex child, son preference}, X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_2(\mu)\text{son preference}_i + \beta_3(\mu)\text{sex child}_i * \text{son preference}_i + \beta_4(\mu)X_i + u_i$

(8) $Q_{WHZi}(\mu \mid \text{sex child, son preference}, X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_2(\mu)\text{son preference}_i + \beta_3(\mu)\text{sex child}_i * \text{son preference}_i + \beta_4(\mu)X_i + u_i$

In these equations, the HAZ or WHZ of child i is not only determined by its sex and vector of control variables X, but also by son preference of its parents and the interaction between its sex and son preference of its parents. Son preference either represents (a) son preference of the mother of child i, (b) son preference of its father or (c) the difference between son preference of its mother and father. Finally, equation (9) to (12) form the third model, which determines the effects of the drivers of the nutrition transition on the associations between the sex of the child, parental son preference and child nutritional status in both linear and quantile models:

(9) $HAZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_2 \text{son preference}_i + \beta_3 \text{sex child}_i * \text{son preference}_i + \beta_4 NT_i + \beta_5 X_i + u_i$

(10) $WHZ_i = \beta_0 + \beta_1 \text{sex child}_i + \beta_2 \text{son preference}_i + \beta_3 \text{sex child}_i * \text{son preference}_i + \beta_4 NT_i + \beta_5 X_i + u_i$

(11) $Q_{HAZi}(\mu \mid \text{sex child, son preference}, X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_2(\mu)\text{son preference}_i + \beta_3(\mu)\text{sex child}_i * \text{son preference}_i + \beta_4(\mu)NT_i + \beta_5(\mu)X_i + u_i$

(12) $Q_{WHZi}(\mu \mid \text{sex child, son preference}, X) = \alpha(\mu) + \beta_1(\mu)\text{sex child}_i + \beta_2(\mu)\text{son preference}_i + \beta_3(\mu)\text{sex child}_i * \text{son preference}_i + \beta_4(\mu)NT_i + \beta_5(\mu)X_i + u_i$

In these equations, the drivers of the nutrition transition are added as determinants of the HAZ of WHZ for child i through the vector of its drivers NT. More specifically, this includes variables that proxy urbanisation, income, employment, education and child diet for child i.

5. Results

5.1 Descriptive statistics

Out of the 1,124 children in the initial sample, both HAZ and WHZ values were missing for 99 of them. In addition, for 8 other children only HAZ was missing, whereas for 16 other children no WHZ was available. This is the result of children not being present or being ill at the time of the survey or parents refusing height and weight measurements (NSS, MOH & ICF, 2012, 2017). In addition, concerning the independent variables of interest and the control variables, the value for whether the mother is employed was missing for 1 child. Furthermore, the values for birth weight were missing for 11 children. For 28 children the moment their mothers started breastfeeding was unknown, whereas for 5 children no value for interbirth interval was available. Because these numbers of missing values are quite small compared to the total sample size and none of these missing values were related to the dependent or independent variables of interest, their total was removed from the initial sample. Moreover, for 393 of the remaining number of 956 children dietary diversity was unknown, which is due to the fact that the survey questions about complementary feeding were only asked regarding the youngest child living with the mother. These missing values are related to whether the mother is employed, whether the child is still breastfed, if other children under the age of 5 are present in the household, birth order, interbirth interval and lastly the age of the child, mother and father. The missing values on this dummy variable were replaced using multiple logistic regression imputation. In all 10 imputations, the distributions of observed, imputed and combined or completed values differ as can be seen in Appendix A. This might be because different dietary recommendations apply to younger and older children and the imputed values mainly belong to older children. In addition, the BMI of the mother was not measured during the DHS of 2010. This explains the largest part of the 344 missing values on this variable. Furthermore, these missing values are related to HAZ, dietary diversity, the birth weight of the child, the moment the mother started breastfeeding, if other children under the age of 5 are present in the household and both the age of the mother and father. As the BMI of the mother is a continuous variable, its missing values were replaced using mean imputation. The distributions of observed and combined or completed values for the BMI of the mother are included in Appendix A.

Table 1 presents the summary statistics of HAZ and WHZ, including the 10th, 25th, 50th, 75th and 90th percentiles that are used in the quantile regression analyses. These summary statistics show that on average, Armenian children are slightly shorter and heavier when compared to the WHO Child Growth Standards. Their mean HAZ is -0.36, which indicates that they are 0.36 standard deviation shorter than the reference population used by the WHO. Furthermore, they are 0.69 standard deviation heavier than this reference population, as their mean WHZ is 0.69. Besides, 13.32% of the children in the sample are stunted, whereas 13.80% are overweight. Only 4.83% are both stunted and overweight. An additional 18.56% of the children are at risk of becoming stunted, compared to 26.13% for at risk of becoming overweight.

Table 1 Summary statistics of HAZ and WHZ

Variable	N	0.10	0.25	0.50	0.75	0.90	Mean	SD	Min.	Max.
HAZ	933.38	-2.24	-1.30	-0.38	0.53	1.48	-0.36	1.58	-5.98	5.77
WHZ	933.38	-0.95	-0.05	0.69	1.51	2.35	0.69	1.41	-3.97	4.95

Notes: N is included as the weighted number of observations

Of the 956 children in the sample, 47.68% are girls and 52.32% are boys. Furthermore, son preference occurred in 20.35% of their mothers as compared to 35.41% of their fathers. Concerning the difference between maternal and paternal son preference, for 9.50% of the children the son preference of mother and father overlap, whereas in 53.75% of the cases both parents do not have a son preference. Only the mother or only the father prefers sons in the remaining 10.84% and 25.91% of the cases respectively. In addition, as for the drivers of the nutrition transition, 55.06% of the children are living in urban areas. 44.88% of the children are living in poor households, 15.91% in middle households and 39.21% in rich households when it comes to wealth. Only 18.07% of the children have a mother who is currently working. Furthermore, 44.76% of the mothers had completed secondary education at most, compared to 55.24% who had finished at least tertiary education. Finally, 48.03% of the children did meet the recommended minimum dietary diversity. The summary statistics of HAZ and WHZ for each category of the independent variables of interest are shown in Table 2.

Table 2 Summary statistics of HAZ and WHZ per category of the independent variables

		HAZ				**WHZ**			
Variable	**N**	**Mean**	**SD**	**Min.**	**Max.**	**Mean**	**SD**	**Min.**	**Max.**
Sex child									
Girl	445.00	-0.22	1.55	-5.96	4.70	0.53	1.44	-3.93	4.95
Boy	488.38	-0.49	1.60	-5.98	5.77	0.83	1.37	-3.97	4.78
Maternal son preference									
No	743.45	-0.38	1.56	-5.98	5.77	0.67	1.37	-3.97	4.78
Yes	189.92	-0.29	1.63	-5.51	4.35	0.74	1.57	-3.90	4.56
Paternal son preference									
No	602.88	-0.29	1.62	-5.98	5.77	0.63	1.39	-3.93	4.64
Yes	330.50	-0.49	1.50	-5.96	4.41	0.78	1.44	-3.97	4.95
Difference in son preference									
Both parents no son preference	501.66	-0.30	1.60	-5.98	5.77	0.64	1.35	-3.93	4.45
Both parents son preference	88.70	-0.36	1.58	-5.51	4.31	0.91	1.51	-3.43	4.95
Only maternal son preference	101.22	-0.23	1.68	-4.75	4.35	0.59	1.62	-3.90	4.64
Only paternal son preference	241.80	-0.54	1.47	-5.96	4.41	0.74	1.41	-3.97	4.78
Type of place of residence									
Rural	419.47	-0.44	1.73	-5.96	5.60	0.69	1.54	-3.97	4.95
Urban	513.90	-0.29	1.44	-5.98	5.77	0.68	1.30	-3.93	4.64
Household wealth									
Poor	418.91	-0.36	1.66	-5.96	5.60	0.64	1.52	-3.97	4.95
Middle	148.46	-0.43	1.74	-5.51	5.77	0.91	1.53	-3.36	4.56
Rich	366.01	-0.32	1.41	-5.98	4.75	0.65	1.21	-3.07	4.78
Mother working									
No	764.71	-0.38	1.56	-5.96	5.60	0.70	1.41	-3.97	4.95
Yes	168.67	-0.26	1.64	-5.98	5.77	0.65	1.41	-3.33	4.56
Mother educated									
Secondary level at most	417.75	-0.42	1.69	-5.98	5.77	0.63	1.55	-3.97	4.78
At least tertiary level	515.63	-0.31	1.48	-5.51	4.75	0.73	1.29	-3.93	4.95
Dietary diversity met									
No	485.08	-0.35	1.63	-5.98	5.77	0.65	1.41	-3.96	4.81
Yes	448.30	-0.37	1.52	-5.53	5.29	0.73	1.41	-3.74	4.87

Notes: N is included as the weighted number of observations

Concerning the control variables, birth weight ranges from 0.92 kilograms to 4.90 kilograms in the sample, with the mean and standard deviation being 3.14 kilograms and 0.45 kilograms respectively. The lowest observed value for BMI of the mother is 13.55. whereas the highest observed value is 47.71. The mean value of this variable is 24.14 with a standard deviation of 3.42. Furthermore, the moment the mother started breastfeeding was immediately after birth for 34.52% of the children, within a day after birth for 53.91% of them and more than a day after birth for the remaining 11.57% of them. 33.80% of the children were still breastfed at the time of the survey. In 53.64% of the cases, children are living in a household in which other children under the age of 5 are present. As for birth order, 42.39% of the children is the first child born to their mothers, 38.89% the second and 18.72% the third or more child. Of these children who are not the first child their mothers gave birth to, 17.64% was born within 24 months after the previous birth, whereas 39.96% was born more than 24 months after the previous birth. Finally, 20.96% of the children is aged 0 to 1, 17.38% is aged 1 to 2, 22.83% is aged 2 to 3, 20.52% is aged 3 to 4 and the remaining 18.31% is aged 4 to 5 years. Concerning the ages of their parents, the youngest mothers in the sample are aged 18 and the oldest aged 44, with the mean and standard deviation being 28 and 4.89 respectively. The fathers' ages range from 21 to 49. Their mean age is 32 with a standard deviation of 5.64.

5.2 External validity of HAZ and WHZ based on the WHO Child Growth Standards

In addition to the HAZ and WHZ as retrieved from the DHS, which are based on the WHO Child Growth Standards, z-scores have been calculated based on the sample of Armenian children itself. For each combination of sex and month of age, the median and standard deviation of both height and weight were calculated and incorporated into individual z-scores. The summary statistics of these Armenian variants of HAZ and WHZ are presented in Table 3. However, as the total sample size is 956, each of the 120 combinations of sex and month of age yielded only a small number of observations, which resulted in large standard deviations. The total sample may thus be too small to accurately calculate the HAZ and WHZ based on Armenian children. Therefore, the variants of HAZ and WHZ as provided by the DHS are used.

Table 3 Summary statistics of HAZ and WHZ based on the sample of Armenian children

Variable	**N**	**0.10**	**0.25**	**0.50**	**0.75**	**0.90**	**Mean**	**SD**	**Min.**	**Max.**
HAZ	933.38	-1.30	-0.52	0.00	0.52	1.34	0.00	0.98	-3.67	3.33
WHZ	933.38	-1.25	-0.51	0.00	0.63	1.42	0.05	0.99	-3.67	4.67

Notes: N is included as the weighted number of observations

5.3 Differences in HAZ and WHZ between boys and girls

As can be seen in Table 2, Armenian boys have a lower mean HAZ, but a higher mean WHZ than Armenian girls. Whereas on average, girls are 0.22 standard deviation shorter than the WHO reference population, boys are almost half a standard deviation shorter as compared to this reference population. Furthermore, boys are 0.83 standard deviation heavier than the WHO reference population, while this is 0.53 standard deviation for girls. Independent samples t-tests were conducted to test whether these differences in means among boys and girls are significant. For both HAZ ($t = 2.43$, $p = 0.02$) and WHZ ($t = -2.82$, $p = 0.01$), this is the case.

In addition, Table 2 shows that the distribution of HAZ seems to be wider among boys than among girls, as the scores range from -5.98 to 5.77 for the former and from -5.96 to 4.70 for the latter. On the other hand, the range of WHZ is slightly wider for girls, with a minimum of -3.93 and a maximum of 4.95, as compared to boys, whose scores fall between -3.97 to 4.78. The full distributions of HAZ and WHZ for both boys and girls are displayed in Figure 3 and Figure 4 respectively. These have been drawn up without using weights. First, Figure 3 shows that boys are represented on the negative side of the HAZ distribution more than girls, whereas this is the other way around for the positive side of the HAZ distribution. This corresponds to the percentages of children who are stunted or at risk of becoming stunted among boys and girls. Both of these are higher for boys, who make up 55.04% of the stunted children and 57.40% of the children who at risk. On the other hand, in Figure 4, it can be seen that for WHZ, there are more girls with negative scores than boys and more boys with positive scores than girls. Therefore, the number of overweight children consists of boys for 61.24%. However, the difference between boys and girls in terms of being at risk of becoming overweight is rather small. 50.28% of these children are boys, compared to 49.72% who are girls. Furthermore, to test whether the distributions of HAZ and WHZ are indeed different among boys and girls, Kolmogorov-Smirnov tests based on unweighted data were applied. These show that whereas the difference in the HAZ distribution was not found to be significant (D = 0.08, p = 0.11), the WHZ distribution does differ between boys and girls (D = 0.11, p = 0.01).

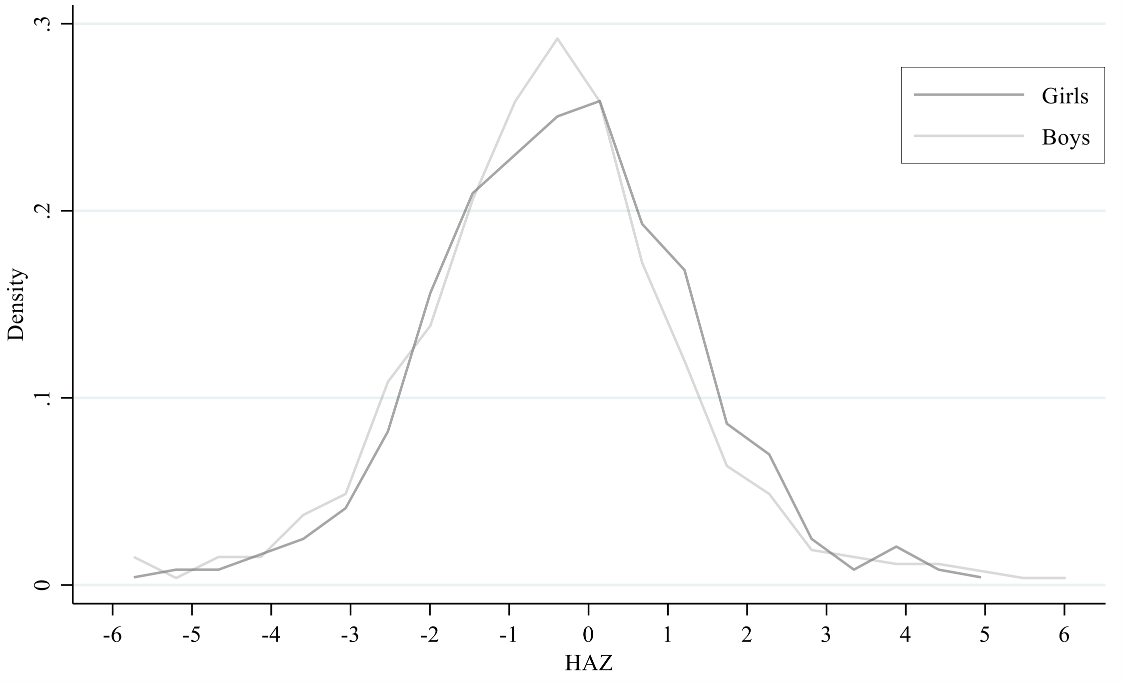

Figure 3 Distribution of HAZ for boys and girls

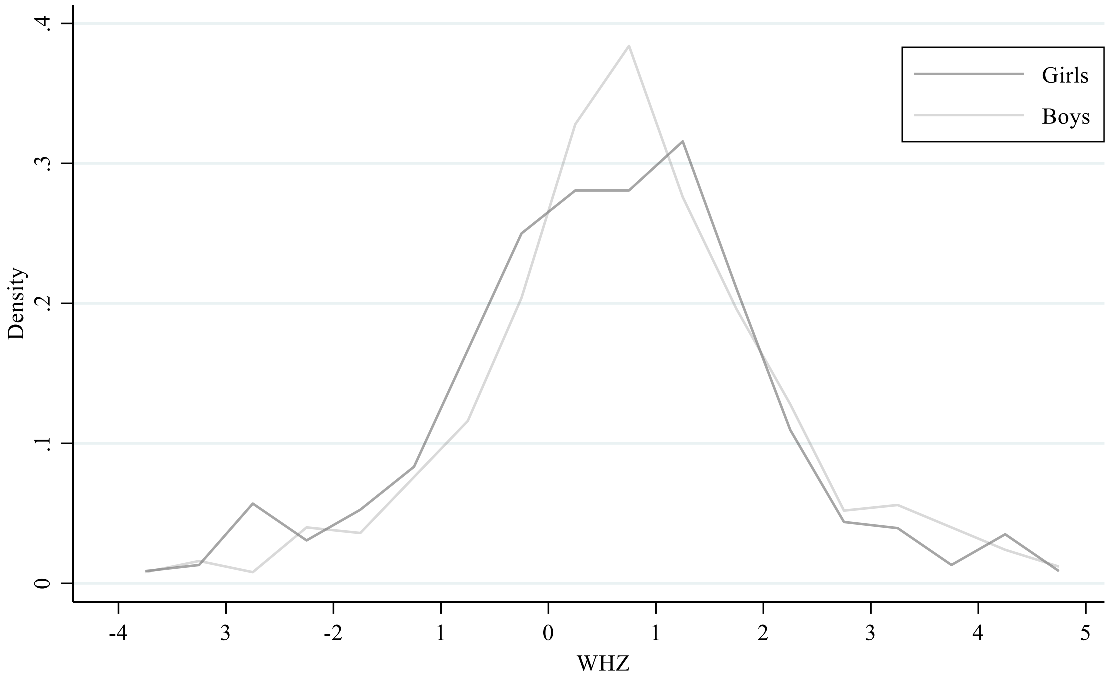

Figure 4 Distribution of WHZ for boys and girls

5.4 Regression analyses

As the independent variables of interest and control variables were found to be associated among each other, tests for multicollinearity were applied. However, as the age of the mother and the age of the father are strongly associated to each other and to almost all other independent and control variables, these two variables were left out of all models first. Thereafter, tests were conducted for the models as listed in the methodology. These show that multicollinearity is not an issue. The mean variance inflation factor (VIF) in each of the specifications of the first model is 1.65, compared to 1.59 in each of the specifications of the second model and 1.66 in each of the specifications of the third model. Furthermore, among all model specifications, the highest VIF was found to be equal to 3.60, which is still lower than the threshold value of 5. Therefore, all of the analyses include the control variables as specified in the methodology, except for the age of the mother and father. However, for the sake of brevity, the coefficients and standard errors of the control variables are not reported in any of the tables below. The tables including the full results of the analyses can be found in Appendix B.

Table 4 and Table 5 show the linear and quantile regression results of the first model for HAZ and WHZ respectively. In Table 4, the linear model shows that Armenian boys have a 0.35 standard deviation disadvantage as compared to girls when it comes to HAZ, ceteris paribus. This is in line with the result of the independent samples t-test, which also found the mean HAZ of boys to be significantly lower than that of girls. Consistent with the results of the linear model, the quantile model shows that there are sex differences across the whole HAZ distribution, although the difference is not significant at the 90th percentile. Furthermore, the size of the coefficient changes across the different quantiles. The HAZ disadvantage of boys is 0.40 standard deviation at the 10th percentile, 0.28 at the 25th percentile, 0.42 at the 50th percentile and 0.46 at the 75th percentile, ceteris paribus. As the coefficients are thus significant at the lowest percentiles of the quantile model, it can be stated that Armenian boys have a significantly higher risk of becoming and being stunted than Armenian girls, ceteris paribus.

Also in line with the result of the independent samples t-test for WHZ, the linear model in Table 5 shows that boys have a significantly higher WHZ than girls. Their WHZ is 0.26 standard deviations higher as compared to girls, ceteris paribus. Again, the quantile model provides evidence for sex differences across the whole WHZ distribution, although the difference is not significant at the 75th percentile. The WHZ advantage of boys is 0.38 standard deviation at the 10th percentile, 0.30 at the 25th percentile, 0.23 at the 50th percentile and 0.46 at the 90th percentile, ceteris paribus. Because the coefficient at the highest percentile of the quantile model is significant, Armenian boys can be said to have a significantly higher risk of being overweight than Armenian girls, ceteris paribus.

Table 4 Linear and quantile regression results of model 1 for HAZ

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Sex child (ref: girl)						
Boy	-0.35***	-0.40***	-0.28**	-0.42***	-0.46***	-0.22
	(0.11)	(0.11)	(0.12)	(0.09)	(0.09)	(0.16)
Constant	-1.46***	-4.77***	-2.78***	-1.35***	-0.10	0.59
	(0.52)	(0.62)	(0.59)	(0.48)	(0.39)	(0.85)
Observations	956	956	956	956	956	956
R^2	0.05	0.04	0.03	0.04	0.06	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table 5 Linear and quantile regression results of model 1 for WHZ

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Sex child (ref: girl)						
Boy	0.26**	0.38*	0.30**	0.23***	0.13	0.46***
	(0.11)	(0.20)	(0.13)	(0.09)	(0.13)	(0.16)
Constant	-0.42	-3.04***	-1.74***	-0.50	0.27	2.16**
	(0.55)	(0.94)	(0.59)	(0.41)	(0.62)	(0.89)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

In Table 6 and Table 7, the results of both linear and quantile regression of the second model are presented for both HAZ and WHZ respectively. The models include (a) maternal son preference, (b) paternal son preference or (c) the difference between maternal and paternal son preference. In Table 6, the coefficient of the sex of the child in the linear model including maternal son preference (a) shows that boys have a significantly lower HAZ than girls, namely 0.37 standard deviation, in the absence of maternal son preference, ceteris paribus. This also applies to the quantile model, where boys' HAZ disadvantage is 0.51 standard deviation at the 10th percentile, 0.36 at the 25th percentile, 0.45 at the 50th percentile and 0.44 at the 75th percentile, ceteris paribus. However, according to the linear model, the sex difference is not due to a gender bias, as the coefficient of the interaction between the sex of the child and maternal son preference is not significant. In contrast, this interaction term is significant at the 10th and 75th percentiles of the quantile model. At the 10th percentile, the HAZ of boys whose mothers do have a son preference is 0.41 standard deviation higher as compared to girls whose mothers do not have a son preference, ceteris paribus. When girls' mothers also prefer sons, boys have a HAZ that is again 0.11 (-0.51 plus the interaction effect 0.41) standard deviation lower than that of girls, ceteris paribus. Furthermore, at the 75th percentile, the HAZ of boys whose mothers do have a son preference is 0.45 standard deviation lower as compared to girls whose mothers do not have a son preference, ceteris paribus. In cases where the mothers of both boys and girls prefer sons, boys' HAZ is still lower, namely 0.89 (-0.44 plus the interaction effect -0.45) standard deviation, than that of girls, ceteris paribus.

The linear model including paternal son preference (b) does not show evidence for a significant sex difference in HAZ in the absence of son preference. It also does not support a gender bias, as the coefficient of the interaction between the sex of the child and paternal son preference is not significant. In the quantile model, both this difference and bias are significant at the 50th and 75th percentiles. In the absence of paternal son preference, boys' HAZ is 0.34 and 0.28 standard deviation lower than that of girls at the 50th and 75th percentiles respectively, ceteris paribus. Furthermore, at the 50th percentile, the HAZ of boys whose fathers do have a son preference is 0.38 standard deviation lower than that of girls whose fathers do not have a son preference, ceteris paribus. When the fathers of both boys and girls prefer sons, boys have a HAZ that is still lower as compared to girls, namely 0.72 (-0.34 plus the interaction effect -0.38) standard deviation, ceteris paribus. At the 75th percentile, boys whose fathers do have a son preference have a HAZ that is 0.50 standard deviation lower as compared to girls whose fathers do not have a son preference, ceteris paribus. When girls' fathers also prefer sons, the HAZ of boys is still 0.78 (-0.28 plus the interaction effect -0.50) standard deviation lower than that of girls, ceteris paribus.

Lastly, the results of the linear model including the difference between maternal and paternal son preference (c) do not show a significant sex difference nor gender bias in the absence of both maternal and paternal son preference. However, in this absence, the quantile model indicates that the HAZ of boys is significantly lower than that of girls. This HAZ disadvantage of boys is 0.42 standard deviation at the 10th percentile, 0.34 at the 25th percentile, 0.32 at the 50th percentile and 0.31 at the 75th percentile, ceteris paribus. Furthermore, the quantile model shows the coefficients of some of the interaction terms to be significant. At the 50th percentile, the HAZ of boys whose parents both have a son preference is 0.77 standard deviation lower as compared to girls whose parents both do not have a son preference, ceteris paribus. When both parents of both boys and girls prefer sons, boys' HAZ is still lower, namely 1.09 (-0.32 plus the interaction effect -0.77) standard deviation, than that of girls, ceteris paribus. Also at the 50th percentile, boys whose fathers only have a son preference have a HAZ that is 0.37 standard deviation lower as compared to girls whose parents both do not have a son preference, ceteris paribus. When only the fathers of both boys and girls prefer sons, boys' HAZ is 0.69 (-0.32 plus the interaction effect -0.37) standard deviation lower than that of girls, ceteris paribus. In addition, this coefficient of the interaction between the sex of the child and only paternal son preference is also significant at the 75th percentile. Boys whose fathers only have a son preference have a HAZ that is 0.50 standard deviation lower as compared to girls whose parents both do not have a son preference, ceteris paribus. In cases where both boys and girls only have fathers who prefer sons, the HAZ of boys is 0.81 (-0.31 plus the interaction effect -0.50) lower than that of girls, ceteris paribus. Finally, at the 90th percentile, the coefficient of the interaction between the sex of the child and only maternal son preference is significant. This means that boys whose mothers only have a son preference have a HAZ that is -1.44 standard deviation lower as compared to girls whose parents both do not have a son preference, ceteris paribus. In the case where both boys and girls have only mothers who prefer sons, the HAZ of boys is 1.68 (-0.24 plus the interaction effect -1.44) lower than that of girls, ceteris paribus. However, as already stated, this sex difference of -0.24 standard deviation at the 90th percentile is not found to be significant itself.

Table 6 Linear and quantile regression results of model 2 for HAZ

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	-0.37***	-0.51***	-0.36**	-0.45***	-0.44***	-0.22
	(0.13)	(0.16)	(0.14)	(0.11)	(0.11)	(0.22)
Maternal son preference (ref: no)						
Yes	0.26	-0.11	-0.44	0.26	0.41***	0.52
	(0.33)	(0.17)	(0.43)	(0.40)	(0.13)	(0.99)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.10	0.41*	0.59	-0.19	-0.45**	-0.30
	(0.37)	(0.25)	(0.49)	(0.43)	(0.22)	(1.02)
Constant	-1.53***	-4.51***	-2.56***	-1.48***	-0.19	-0.05
	(0.52)	(0.63)	(0.67)	(0.54)	(0.59)	(0.77)
Observations	956	956	956	956	956	956
R^2	0.05	0.05	0.04	0.04	0.06	0.06
Model (b)						
Sex child (ref: girl)						
Boy	-0.22	-0.31	-0.23	-0.34**	-0.28**	-0.17
	(0.15)	(0.21)	(0.17)	(0.15)	(0.12)	(0.24)
Paternal son preference (ref: no)						
Yes	0.04	0.11	0.06	0.16	0.07	-0.37
	(0.17)	(0.14)	(0.23)	(0.16)	(0.11)	(0.23)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.33	-0.12	-0.11	-0.38*	-0.50***	-0.03
	(0.24)	(0.25)	(0.30)	(0.20)	(0.16)	(0.42)
Constant	-1.47***	-4.86***	-2.75***	-1.56***	-0.06	0.91
	(0.53)	(0.76)	(0.62)	(0.41)	(0.44)	(0.87)
Observations	956	956	956	956	956	956
R^2	0.05	0.05	0.03	0.04	0.07	0.06

Table 6 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (c)						
Sex child (ref: girl)						
Boy	-0.24	-0.42^{*}	-0.34^{*}	-0.32^{**}	-0.31^{**}	-0.24
	(0.16)	(0.22)	(0.18)	(0.16)	(0.13)	(0.25)
Difference in son preference (ref: both no)						
Both son preference	0.46	-0.01	0.38	0.69^{***}	0.21	-0.29
	(0.37)	(0.239)	(0.73)	(0.22)	(0.34)	(0.24)
Only maternal son preference	0.13	-0.08	-0.52	0.02	0.36	1.75^{***}
	(0.47)	(0.24)	(0.33)	(0.31)	(0.41)	(0.50)
Only paternal son preference	-0.02	0.039	-0.00	0.12	0.06	-0.40^{*}
	(0.18)	(0.22)	(0.23)	(0.16)	(0.12)	(0.24)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.54	0.30	-0.25	-0.77^{**}	-0.48	0.23
	(0.43)	(0.38)	(0.81)	(0.34)	(0.36)	(0.62)
Boy * only maternal son preference	-0.00	0.31	0.70	-0.07	-0.33	-1.44^{**}
	(0.53)	(0.47)	(0.49)	(0.36)	(0.66)	(0.60)
Boy * only paternal son preference	-0.32	-0.15	-0.07	-0.37^{*}	-0.50^{***}	-0.03
	(0.27)	(0.32)	(0.32)	(0.21)	(0.17)	(0.50)
Constant	-1.53^{***}	-4.71^{***}	-2.74^{***}	-1.50^{***}	-0.16	0.73
	(0.52)	(0.68)	(0.68)	(0.54)	(0.47)	(0.83)
Observations	956	956	956	956	956	956
R^2	0.06	0.05	0.04	0.05	0.07	0.07

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

In Table 7, the coefficients of the sex of the child in both the linear and quantile model including maternal son preference (a) show that in the absence of maternal son preference, boys have a significantly higher WHZ than girls. This WHZ advantage is equal to 0.27 standard deviation in the linear model and to 0.41 at the 10th percentile, 0.24 at the 25th percentile, 0.24 at the 50th percentile and 0.51 at the 90th percentile of the quantile model, ceteris paribus. However, according to both the linear and quantile model, these sex differences are not the result of a gender bias. None of the coefficients of the interaction between the sex of the child and maternal son preference are significant.

The linear model including paternal son preference (b) does not show a significant sex difference. In contrast, at the 25th and 50th percentiles of the quantile model, the WHZ of boys is respectively 0.44 and 0.24 standard deviation higher than that of girls in the absence of paternal son preference, ceteris paribus. Both the linear and quantile model do not provide evidence for a gender bias. As in the model including maternal son preference, none of the coefficients of the interaction between the sex of the child and paternal son preference are significant.

Finally, the linear model including the difference between maternal and paternal son preference (c) demonstrates a significant sex difference. In the absence of both maternal and paternal son preference, boys' WHZ is 0.25 standard deviation higher than girls' WHZ, ceteris paribus. The quantile model also provides evidence for sex differences in WHZ in the absence of son preference in both parents. The WHZ advantage of boys is 0.45 standard deviation at the 10th, 0.37 at the 25th, 0.22 at the 50th and 0.47 at the 90th percentile, ceteris paribus. The sex difference found in the linear model is not due to a gender bias. It is only at the 25th percentile of the quantile model that a coefficient of the interaction between the sex of the child and the difference between maternal and paternal son preference is significant. Boys whose fathers only have a son preference have a WHZ that is 0.34 standard deviation lower as compared to girls whose parents both do not have a son preference, ceteris paribus. When only the fathers of both boys and girls prefer sons, the WHZ of boys is (0.37 plus the interaction effect -0.34) 0.03 standard deviation higher than that of girls, ceteris paribus.

Table 7 Linear and quantile regression results of model 2 for WHZ

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	0.27**	0.41***	0.24**	0.24***	0.15	0.51***
	(0.11)	(0.15)	(0.11)	(0.09)	(0.13)	(0.19)
Maternal son preference (ref: no)						
Yes	0.09	-0.17	-0.01	0.30	0.11	0.44
	(0.30)	(0.59)	(0.47)	(0.32)	(0.25)	(1.43)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.08	-0.06	0.18	-0.29	-0.07	-0.44
	(0.34)	(0.73)	(0.48)	(0.33)	(0.38)	(1.45)
Constant	-0.45	-3.20***	-1.56***	-0.55	0.09	1.76**
	(0.54)	(0.72)	(0.45)	(0.40)	(0.66)	(0.78)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05
Model (b)						
Sex child (ref: girl)						
Boy	0.21	0.30	0.44**	0.24***	0.09	0.32
	(0.13)	(0.27)	(0.20)	(0.08)	(0.17)	(0.20)
Paternal son preference (ref: no)						
Yes	0.06	0.06	0.26	0.02	0.11	0.12
	(0.16)	(0.21)	(0.19)	(0.15)	(0.17)	(0.25)
Sex child * son preference (ref: girl * no)						
Boy * yes	0.09	0.10	-0.32	-0.02	0.12	0.13
	(0.22)	(0.40)	(0.24)	(0.22)	(0.27)	(0.31)
Constant	-0.45	-3.15***	-2.02***	-0.53	0.26	1.98**
	(0.55)	(0.92)	(0.64)	(0.33)	(0.58)	(0.81)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05
Model (c)						
Sex child (ref: girl)						
Boy	0.25*	0.45***	0.37**	0.22***	0.16	0.47*
	(0.13)	(0.16)	(0.19)	(0.08)	(0.19)	(0.26)

Table 7 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Difference in son preference (ref: both no)						
Both son preference	0.26	-0.29	0.07	0.38	0.36	0.45
	(0.49)	(0.58)	(0.84)	(0.37)	(0.72)	(2.42)
Only maternal son preference	0.01	0.08	0.19	-0.23	0.02	2.23
	(0.38)	(0.93)	(0.57)	(0.24)	(0.25)	(2.23)
Only paternal son preference	0.02	0.08	0.32^{**}	-0.03	0.00	0.08
	(0.16)	(0.26)	(0.15)	(0.15)	(0.19)	(0.23)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.05	0.48	0.04	-0.49	0.08	-0.36
	(0.54)	(0.60)	(0.85)	(0.43)	(0.79)	(2.52)
Boy * only maternal son preference	-0.15	-0.78	-0.01	0.29	-0.44	-2.17
	(0.46)	(1.38)	(0.69)	(0.26)	(0.43)	(2.27)
Boy * only paternal son preference	0.05	-0.16	-0.34^{*}	0.09	-0.02	0.15
	(0.24)	(0.38)	(0.21)	(0.22)	(0.30)	(0.47)
Constant	-0.48	-3.16^{***}	-1.78^{***}	-0.42	0.29	1.90^{*}
	(0.54)	(0.74)	(0.57)	(0.32)	(0.68)	(0.98)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.05	0.03	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Finally, Table 8 and Table 9 present the results of linear and quantile regression of the third model, which includes the drivers of the nutrition transition, for HAZ and WHZ respectively. The models again include (a) maternal son preference, (b) paternal son preference or (c) the difference between maternal and paternal son preference. For the model including maternal son preference (a), in Table 8, the coefficient of type of place of residence in the linear model shows that children who live in urban areas have a significantly higher HAZ as compared to children who live in rural areas. This difference is 0.28 standard deviation, ceteris paribus. The same applies to the quantile model, where the HAZ advantage of urban children is 0.55 standard deviation at the 10th percentile, 0.44 at the 25th percentile, 0.38 at the 50th percentile and 0.22 at the 75th percentile, ceteris paribus. Furthermore, concerning household wealth, HAZ is significantly lower in children who live in rich households as compared to those who live in poor households according to the quantile model only. This difference is -0.38 standard deviation at the 10th percentile, -0.37 at the 25th percentile, -0.23 at the 50th percentile, -0.22 at the 75th percentile and -0.46 at the 90th percentile, ceteris paribus. The coefficients of maternal employment and maternal education are also significant in the quantile model only. At the 50th and 90th percentiles, the HAZ of children whose mothers are working is respectively 0.21 and 0.45 standard deviation higher as compared to those whose mothers are not working, ceteris paribus. In addition, at the 25th percentile, children whose mothers completed at least tertiary education have a HAZ that is 0.35 standard deviation higher than that of those whose mothers completed secondary education at most, ceteris paribus. Finally, the coefficients of dietary diversity are not significant in both the linear and quantile model. Concerning the effect of the drivers of the nutrition transition on a gender bias in HAZ, the significance of the interaction between the sex of the child and maternal son preference at the 75th percentile of the quantile model, as found in Table 6, disappeared after including the drivers of the nutrition transition. However, the 95% confidence intervals of its coefficients in Table 5 and Table 7 overlap, which means that the coefficients are not significantly different from each other.

The quantile model including paternal son preference (b) also finds significant effects of the type of place of residence on HAZ. The difference between children living in rural and urban areas is 0.64 standard deviation at the 10th percentile, 0.49 at the 25th percentile and 0.20 at the 50th percentile, ceteris paribus. The coefficient of children living in middle households is significant at the 25th percentile of the quantile model only, where the HAZ of these children is 0.41 standard deviation lower than that of children in poor households, ceteris paribus. Furthermore, also according to the quantile model, HAZ is significantly lower in children who live in rich households as compared to those who live in poor households. This difference is 0.36 standard deviation at the 10th percentile, 0.38 at the 25th percentile and 0.52 at the 90th percentile, ceteris paribus. One of the coefficients for maternal employment is significant in the quantile model. At the 90th percentile, the HAZ of children whose mothers are working is 0.35 standard deviation higher as compared to those whose mothers are not working, ceteris paribus. The effect of maternal education is also significant at one percentile of the quantile model only. At the 25th percentile, children whose mothers completed at least tertiary education have a HAZ that is 0.34 standard deviation higher than that of those whose mothers completed secondary education at most, ceteris paribus. In both the linear and quantile model, the coefficients of dietary diversity are not significant. Furthermore, regarding the effect of these drivers of the nutrition transition on a gender bias in HAZ, including these drivers does not change the effect of a gender bias when it comes to parental son preference. The interaction between the sex of the child and paternal son preference was found to be significant at the 50th and 75th percentiles in both Table 6 and Table 8. However, the 95% confidence intervals of its coefficients in Table 5 and Table 7 overlap, so these coefficients are not significantly different from each other.

Finally, according to the linear model including the difference between maternal and paternal son preference (c), children who live in urban areas have a HAZ that is 0.27 standard deviation higher as compared to children who live in rural areas, ceteris paribus. This advantage of urban children is furthermore 0.65 standard deviation at the 10th percentile, 0.51 at the 25th percentile and 0.24 at the 50th percentile of the quantile model, ceteris paribus. Concerning household wealth, the linear model finds that HAZ is significantly lower in children who live in middle households as compared to those who live in poor households. This difference is 0.30 standard deviation, ceteris paribus. The same applies to the quantile model, where the HAZ disadvantage of middle household children is 0.41 at the 25th percentile, ceteris paribus. The coefficients of children who live in rich households as compared to poor households are significant in the quantile model only. At the 25th, 75th and 90th percentiles, children who live in rich households have a HAZ that is respectively 0.39, 0.28 and 0.58 standard deviation lower, ceteris paribus. Furthermore, the coefficients of maternal employment and maternal education are significant in the quantile model only. At the 90th percentile, the HAZ of children whose mothers are working is 0.39 standard deviation higher as compared to those whose mothers are not working, ceteris paribus. In addition, at the 25th percentile, children whose mothers completed at least tertiary education have a HAZ that is 0.37 standard deviation higher than that of those whose mothers completed secondary education at most, ceteris paribus. Lastly, the coefficients of dietary diversity are again insignificant in both the linear and quantile model. Regarding the effect of the drivers of the nutrition transition on a gender bias in HAZ, including these drivers does not yield very different results in the model of difference between maternal and paternal son preference. Compared to Table 6, only the interaction between the sex of the child and both parents having a son preference at the 75th percentile became significant in Table 8. However, the 95% confidence intervals of its coefficients in Table 5 and Table 7 overlap, which means that the coefficients are not significantly different from each other.

Table 8 Linear and quantile regression results of model 3 for HAZ

Dependent variable HAZ	**Linear**			**Quantile**		
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	-0.37***	-0.65***	-0.32**	-0.41***	-0.47***	-0.33*
	(0.13)	(0.16)	(0.14)	(0.10)	(0.11)	(0.18)
Maternal son preference (ref: no)						
Yes	0.29	-0.15	0.04	0.54	0.37**	0.46
	(0.34)	(0.29)	(0.46)	(0.39)	(0.21)	(0.99)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.13	0.60*	0.38	-0.41	-0.34	-0.28
	(0.37)	(0.33)	(0.51)	(0.41)	(0.27)	(1.02)
Type of place of residence (ref: rural)						
Urban	0.28*	0.55***	0.44**	0.38***	0.22*	-0.07
	(0.16)	(0.19)	(0.19)	(0.11)	(0.12)	(0.24)
Household wealth (ref: poor)						
Middle	-0.29	-0.36	-0.32	-0.14	-0.16	-0.35
	(0.18)	(0.50)	(0.20)	(0.15)	(0.13)	(0.25)
Rich	-0.28	-0.38*	-0.37*	-0.23*	-0.22*	-0.46*
	(0.18)	(0.20)	(0.21)	(0.12)	(0.13)	(0.26)
Mother working (ref: no)						
Yes	0.14	-0.03	0.12	0.21*	0.18	0.45*
	(0.15)	(0.20)	(0.18)	(0.13)	(0.15)	(0.19)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.13	0.22	0.35**	0.16	0.07	-0.11
	(0.13)	(0.17)	(0.14)	(0.11)	(0.11)	(0.19)
Dietary diversity met (ref: no)						
Yes	-0.05	-0.18	-0.13	-0.03	-0.01	-0.17
	(0.15)	(0.21)	(0.17)	(0.12)	(0.15)	(0.22)
Constant	-1.61***	-4.59***	-2.18***	-1.52***	-0.24	0.53
	(0.52)	(0.73)	(0.60)	(0.46)	(0.51)	(0.67)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-
Model (b)						
Sex child (ref: girl)						
Boy	-0.22	-0.33	-0.05	-0.24*	-0.28*	-0.18
	(0.15)	(0.20)	(0.16)	(0.12)	(0.15)	(0.20)

Table 8 continued

Dependent variable HAZ	**Linear**			**Quantile**		
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Paternal son preference (ref: no)						
Yes	0.07	0.11	0.32	0.30*	0.07	-0.10
	(0.18)	(0.22)	(0.20)	(0.17)	(0.15)	(0.25)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.36	-0.37	-0.44	-0.54**	-0.53***	-0.38
	(0.24)	(0.31)	(0.28)	(0.21)	(0.20)	(0.38)
Type of place of residence (ref: rural)						
Urban	0.26	0.64***	0.49***	0.20*	0.14	-0.07
	(0.16)	(0.20)	(0.19)	(0.12)	(0.14)	(0.25)
Household wealth (ref: poor)						
Middle	-0.29	-0.42	-0.41**	-0.04	-0.01	-0.39
	(0.18)	(0.42)	(0.20)	(0.14)	(0.14)	(0.27)
Rich	-0.24	-0.36*	-0.38*	0.03	-0.18	-0.52**
	(0.18)	(0.21)	(0.21)	(0.13)	(0.14)	(0.27)
Mother working (ref: no)						
Yes	0.14	0.08	0.16	0.17	0.20	0.35*
	(0.15)	(0.21)	(0.15)	(0.11)	(0.14)	(0.21)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.14	0.24	0.34**	0.11	0.15	-0.14
	(0.13)	(0.17)	(0.14)	(0.10)	(0.11)	(0.19)
Dietary diversity met (ref: no)						
Yes	-0.03	-0.11	-0.13	0.02	0.05	-0.17
	(0.15)	(0.26)	(0.18)	(0.13)	(0.14)	(0.21)
Constant	-1.56***	-4.87***	-2.25***	-1.41***	-0.22	0.72
	(0.53)	(0.77)	(0.60)	(0.43)	(0.55)	(0.78)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-
Model (c)						
Sex child (ref: girl)						
Boy	-0.23	-0.46*	-0.11	-0.24*	-0.31**	-0.18
	(0.16)	(0.24)	(0.16)	(0.14)	(0.13)	(0.22)
Difference in son preference (ref: both no)						
Both son preference	0.46	0.17	0.46	0.76***	0.39	-0.16
	(0.37)	(0.61)	(0.37)	(0.22)	(0.34)	(0.29)
Only maternal son preference	0.10	-0.39	-0.24	0.03	0.33	1.47***
	(0.48)	(0.66)	(0.39)	(0.49)	(0.36)	(0.30)
Only paternal son preference	0.02	-0.06	0.29	0.13	0.10	0.02
	(0.18)	(0.26)	(0.23)	(0.17)	(0.18)	(0.27)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.54	0.14	-0.20	-0.75**	-0.67*	-0.25
	(0.44)	(0.65)	(0.46)	(0.29)	(0.37)	(0.56)
Boy * only maternal son preference	-0.07	0.72	0.47	-0.11	-0.21	-1.30***
	(0.53)	(0.73)	(0.48)	(0.53)	(0.50)	(0.41)
Boy * only paternal son preference	-0.38	-0.22	-0.51	-0.47**	-0.60***	-0.41
	(0.27)	(0.35)	(0.35)	(0.22)	(0.22)	(0.49)

Table 8 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Type of place of residence (ref: rural)						
Urban	0.27^{*}	0.65^{***}	0.51^{***}	0.24^{**}	0.18	-0.06
	(0.16)	(0.21)	(0.18)	(0.12)	(0.13)	(0.21)
Household wealth (ref: poor)						
Middle	-0.30^{*}	-0.41	-0.41^{*}	-0.09	-0.08	-0.40
	(0.18)	(0.51)	(0.23)	(0.13)	(0.13)	(0.26)
Rich	-0.25	-0.28	-0.39^{*}	-0.051	-0.28^{**}	-0.58^{***}
	(0.18)	(0.21)	(0.20)	(0.12)	(0.13)	(0.20)
Mother working (ref: no)						
Yes	0.12	-0.07	0.17	0.10	0.20	0.39^{*}
	(0.15)	(0.18)	(0.17)	(0.12)	(0.15)	(0.23)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.15	0.22	0.37^{***}	0.11	0.09	-0.07
	(0.13)	(0.20)	(0.14)	(0.10)	(0.10)	(0.17)
Dietary diversity met (ref: no)						
Yes	-0.04	-0.13	-0.10	0.029	-0.00	-0.12
	(0.15)	(0.29)	(0.17)	(0.11)	(0.17)	(0.20)
Constant	-1.63^{***}	-4.55^{***}	-2.34^{***}	-1.52^{***}	-0.45	0.73
	(0.52)	(0.80)	(0.59)	(0.50)	(0.53)	(0.73)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

In Table 9, the model including maternal son preference (a) shows that at the 10th percentile of the quantile model only, children who live in urban areas have a significantly lower WHZ than children who live in rural areas. This difference is -0.55 standard deviation, ceteris paribus. Concerning household wealth, significant effects are found in the quantile model only. At the 75th percentile, children who live in middle households have a WHZ that is 0.49 standard deviation higher as compared to those who live in poor households, ceteris paribus. In addition, at the 10th percentile, the WHZ of children who live in rich households is 0.44 standard deviation higher than that of children in poor households, ceteris paribus. The coefficients of maternal employment are not significant in both the linear and quantile model. Furthermore, at the 90th percentile of the quantile model, WHZ is 0.17 standard deviation lower in children whose mothers completed at least tertiary education as compared to children whose mothers completed secondary education at most, ceteris paribus. Finally, as in the models with HAZ as dependent variable, none of the coefficients of dietary diversity is significant. Including these drivers of the nutrition transition does not enhance a gender bias. As in Table 7, the interaction between the sex of the child and maternal son preference remains insignificant in both the linear and quantile model after adding these drivers.

The model including paternal son preference (b) also find a significant effect of living in urban as compared to rural areas at the 10th percentile of the quantile model only. Children who live in urban areas have a WHZ that is 0.50 standard deviation lower, ceteris paribus.

Furthermore, in the linear model, the coefficient of household wealth shows that children who live in middle households have a significantly higher WHZ as compared to those who live in poor areas. This difference is 0.27 standard deviation, ceteris paribus. The same applies to the quantile model, where the WHZ advantage of middle household children is 0.49 and 0.59 standard deviation at the 75th and 90th percentiles respectively, ceteris paribus. In addition, the difference in WHZ between children who live in rich and poor households is found to be significant at the 10th and 90th percentiles of the quantile model. At the 10th percentile, the WHZ of children in rich households is 0.50 standard deviation higher, whereas it is 0.42 standard deviation lower at the 90th percentile as compared to children in poor households, ceteris paribus. Lastly, the coefficients of maternal employment, maternal education and dietary diversity are all not significant in the linear model nor the quantile model. In addition, regarding the effect of the drivers of the nutrition transition on a gender bias in WHZ, it can be stated that including these drivers does not alter the effect of a gender bias when it comes to parental son preference. Whereas the interaction between the sex of the child and paternal son preference was not found to be significant in the linear model nor the quantile model in Table 7, it became significant at the 75th percentile of the quantile model in Table 9. However, the 95% confidence intervals of its coefficients in Table 6 and Table 8 overlap, which means that the coefficients are not significantly different from each other.

In the models including the difference between maternal and paternal son preference (c), the effect of type of place of residence is significant at the 10th percentile of the quantile model only, where WHZ is 0.37 standard deviation lower in children who live in urban areas as compared to those who live in a rural areas, ceteris paribus. Concerning household wealth, the linear model finds that WHZ is significantly higher in children who live in middle as compared to poor households. This difference is 0.28 standard deviation, ceteris paribus. Furthermore, this advantage of middle household children is found to be respectively 0.45 and 0.61 standard deviation at the 75th and 90th percentiles of the quantile model, ceteris paribus. The coefficients of maternal employment are not significant in the linear model nor the quantile model, whereas the coefficient of maternal education is significant at the 90th percentile only. Here, children whose mothers have completed at least tertiary education have a WHZ that is 0.17 standard deviation lower than that of children whose mothers finished secondary education at most, ceteris paribus. Lastly, whether children met dietary diversity does not have significant effects according to both the linear and quantile model. Regarding the effect of the drivers of the nutrition transition on a gender bias in HAZ, including these drivers makes the only significant interaction found in Table 7 disappear, as this interaction between the sex of the child and only paternal son preference at the 25th percentile is not significant anymore in Table 9. On the other hand, including these drivers also slightly enhances the effect of a gender bias. Compared to Table 7, both the interaction between the sex of the child and both parents having a son preference and the interaction between the sex of the child and only paternal son preference became significant at the 50th and 75th percentile respectively in Table 9. However, the 95% confidence intervals of all these changing coefficients in Table 6 and Table 8 overlap, which means that the coefficients are not significantly different from each other.

Table 9 Linear and quantile regression results of model 3 for WHZ

Dependent variable WHZ	**Linear**			**Quantile**		
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	0.27^{**}	0.33^{**}	0.25^{*}	0.25^{***}	0.25^{***}	0.28
	(0.11)	(0.17)	(0.13)	(0.09)	(0.09)	(0.19)
Maternal son preference (ref: no)						
Yes	0.09	-0.45	-0.05	0.25	0.02	0.52
	(0.31)	(0.31)	(0.57)	(0.36)	(0.24)	(1.61)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.08	0.32	0.16	-0.21	-0.08	-0.44
	(0.35)	(0.51)	(0.59)	(0.38)	(0.33)	(1.63)
Type of place of residence (ref: rural)						
Urban	-0.11	-0.55^{**}	-0.07	-0.02	-0.22	-0.04
	(0.14)	(0.23)	(0.19)	(0.12)	(0.16)	(0.22)
Household wealth (ref: poor)						
Middle	0.27	0.24	-0.06	0.16	0.49^{**}	0.46
	(0.16)	(0.27)	(0.19)	(0.15)	(0.20)	(0.30)
Rich	0.07	0.44^{*}	0.04	-0.01	-0.12	-0.37
	(0.16)	(0.25)	(0.20)	(0.14)	(0.18)	(0.25)
Mother working (ref: no)						
Yes	-0.02	0.01	-0.02	-0.04	0.09	0.24
	(0.13)	(0.18)	(0.12)	(0.12)	(0.14)	(0.22)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.08	0.29	0.19	0.05	-0.03	-0.17^{**}
	(0.12)	(0.18)	(0.13)	(0.09)	(0.11)	(0.08)
Dietary diversity met (ref: no)						
Yes	-0.02	-0.06	-0.11	-0.01	0.08	-0.04
	(0.16)	(0.20)	(0.17)	(0.13)	(0.17)	(0.29)
Constant	-0.46	-2.63^{***}	-1.65^{***}	-0.65	0.10	1.43
	(0.55)	(0.82)	(0.60)	(0.42)	(0.49)	(0.91)
Observations	956	956	956	956	956	956
R^2	0.07	-	-	-	-	-
Model (b)						
Sex child (ref: girl)						
Boy	0.21	0.25	0.39^{**}	0.26^{***}	0.12	0.17
	(0.13)	(0.22)	(0.16)	(0.09)	(0.13)	(0.19)
Paternal son preference (ref: no)						
Yes	0.05	-0.12	0.17	-0.04	-0.06	-0.06
	(0.16)	(0.24)	(0.18)	(0.17)	(0.16)	(0.20)
Sex child * son preference (ref: girl * no)						
Boy * yes	0.10	0.22	-0.22	0.03	0.37^{*}	0.50
	(0.22)	(0.35)	(0.22)	(0.23)	(0.21)	(0.33)
Type of place of residence (ref: rural)						
Urban	-0.11	-0.50^{**}	-0.07	-0.00	-0.18	-0.06
	(0.14)	(0.25)	(0.16)	(0.12)	(0.16)	(0.21)

Table 9 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Household wealth (ref: poor)						
Middle	0.27*	0.17	0.00	0.15	0.49**	0.59*
	(0.16)	(0.25)	(0.18)	(0.14)	(0.24)	(0.31)
Rich	0.07	0.50*	0.06	-0.02	-0.16	-0.42*
	(0.16)	(0.27)	(0.18)	(0.13)	(0.17)	(0.22)
Mother working (ref: no)						
Yes	-0.01	-0.01	0.01	-0.05	0.11	0.11
	(0.13)	(0.20)	(0.13)	(0.11)	(0.15)	(0.24)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.06	0.27	0.19	0.06	-0.09	-0.14
	(0.12)	(0.18)	(0.12)	(0.09)	(0.11)	(0.17)
Dietary diversity met (ref: no)						
Yes	0.01	-0.17	-0.11	-0.01	0.11	-0.06
	(0.16)	(0.23)	(0.16)	(0.13)	(0.17)	(0.28)
Constant	-0.45	-2.82***	-1.87***	-0.65	0.21	1.74*
	(0.56)	(0.87)	(0.60)	(0.40)	(0.50)	(0.91)
Observations	956	956	956	956	956	956
R^{2}	0.07	-	-	-	-	-
Model (c)						
Sex child (ref: girl)						
Boy	0.24*	0.40**	0.37**	0.22*	0.12	0.13
	(0.13)	(0.20)	(0.18)	(0.11)	(0.12)	(0.24)
Difference in son preference (ref: both no)						
Both son preference	0.26	-0.33	-0.01	0.41	0.33	0.14
	(0.49)	(0.40)	(1.02)	(0.26)	(0.55)	(2.50)
Only maternal son preference	0.0	-0.50	0.08	-0.25	-0.08	1.91
	(0.39)	(0.47)	(0.71)	(0.30)	(0.21)	(2.25)
Only paternal son preference	0.02	0.07	0.23	-0.10	-0.19	-0.07
	(0.16)	(0.34)	(0.18)	(0.16)	(0.14)	(0.21)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.07	0.54	0.07	-0.56*	0.02	0.17
	(0.53)	(0.48)	(1.03)	(0.34)	(0.60)	(2.54)
Boy * only maternal son preference	-0.12	-0.05	0.07	0.35	-0.01	-1.83
	(0.46)	(1.10)	(0.77)	(0.32)	(0.37)	(2.28)
Boy * only paternal son preference	0.07	-0.07	-0.27	0.15	0.45**	0.58
	(0.23)	(0.48)	(0.23)	(0.24)	(0.19)	(0.42)
Type of place of residence (ref: rural)						
Urban	-0.10	-0.37*	-0.10	-0.05	-0.24	-0.07
	(0.14)	(0.22)	(0.16)	(0.12)	(0.15)	(0.22)
Household wealth (ref: poor)						
Middle	0.28*	0.35	-0.03	0.17	0.45**	0.61*
	(0.16)	(0.23)	(0.16)	(0.13)	(0.22)	(0.35)
Rich	0.08	0.32	0.08	-0.01	-0.10	-0.39
	(0.16)	(0.26)	(0.17)	(0.13)	(0.16)	(0.25)
Mother working (ref: no)						
Yes	-0.01	0.05	0.00	-0.05	0.10	0.09
	(0.13)	(0.17)	(0.12)	(0.10)	(0.14)	(0.26)

Table 9 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Mother educated (ref: secondary level at most)						
At least tertiary level	0.05	0.29	0.15	0.06	-0.12	-0.17**
	(0.12)	(0.17)	(0.13)	(0.09)	(0.11)	(0.08)
Dietary diversity met (ref: no)						
Yes	0.01	-0.08	-0.11	-0.05	0.12	-0.04
	(0.16)	(0.21)	(0.16)	(0.13)	(0.19)	(0.34)
Constant	-0.48	-2.83***	-1.79***	-0.57	0.22	1.48
	(0.55)	(0.90)	(0.57)	(0.41)	(0.48)	(0.97)
Observations	956	956	956	956	956	956
R^2	0.07	-	-	-	-	-

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

6. Conclusion

This study examined to what extent parental son preference is associated with sex differences in child nutritional status, in terms of both height for age and weight for weight, in Armenia. To test this, quantitative analyses were performed based on the most recent DHS data for a sample of 956 Armenian children under the age of 5 years. Based on the linear and quantile regression results, it can be concluded that the study only found limited evidence for such associations.

First of all, as boys turned out to have a lower HAZ but a higher WHZ as compared to girls, it can be stated that sex differences in nutritional status exist among Armenian children. These sex differences are not only found on average using linear regression, but also across the distributions using quantile regression. It thus appears that boys have higher risks of becoming and being stunted and overweight than girls. Therefore, in Armenia, boys are more likely to experience both these types of malnutrition as compared to girls.

However, limited evidence is found for a role of parental son preference in these sex differences. At the part of the distribution that is related to being at risk of becoming or being stunted, only the interaction between the sex of the child and maternal son preference is associated with HAZ. The HAZ of boys whose mothers do have a son preference is higher as compared to girls whose mothers do not have a son preference, but lower when girls' mothers also have a preference for sons. However, the few other effects of the interaction between the sex of the child and son preference on HAZ are negative and furthermore appear at parts of the distribution that are not related to stunting. This applies to all different measures of son preference. Concerning WHZ, no effects of the interaction between the sex of the child and son preference exist at the part of the distribution that is related to being at risk of becoming or being overweight. This applies to all measures of son preference. Furthermore, at another part of the distribution, the interaction between the sex of the child and only paternal son preference is associated with WHZ. Boys who only have fathers who have a son preference have a lower WHZ as compared to girls whose parents both do not have a preference for sons, but slightly higher as compared to girls whose fathers also only have a preference for sons. These findings are not in line with the first hypothesis, as it was expected that parental son preference would be positively associated with the nutritional status of boys, but negatively with that of girls. In addition, maternal and paternal son preference do not differ in their associations with child nutritional, except for the one positive association that is found between maternal son preference and HAZ. Furthermore, son preference seems to play a bigger role in HAZ than in WHZ.

Finally, most drivers of the nutrition transition have a direct effect on child nutritional status in either the linear or quantile model or in both. Only maternal employment is not associated with WHZ, whereas dietary diversity has no effect on both HAZ and WHZ. However, despite these direct effects, including the drivers does not lead to major changes in the effects of parental son preference. Regarding both HAZ and WHZ, the coefficients of the interaction between the sex of the child and son preference change in significance and size, but not in direction. Furthermore, none of these changing coefficients is significantly different from the coefficients as found in the model without the drivers. This applies to all measures of son preference. These findings are thus not in line with the second hypothesis, as it was expected that urbanisation, income, employment and education would all negatively affect the association between parental son preference and child nutritional status.

7. Discussion

7.1 Reflection

This study finds limited evidence for a role of parental son preference in sex differences in the nutritional status of Armenian children. Therefore, sex differences in child nutritional status cannot be said to be due to a gender bias. Rather, demographic and socioeconomic factors are important in explaining differences in child nutritional status in the country.

In line with previous research by Development Initiatives (2019), which has found Armenian boys to have a slightly higher prevalence of both stunting and overweight as compared to Armenian girls, this study shows that boys have a lower HAZ and a higher WHZ both on average and across the distributions of these scores. This means that in Armenia, boys suffer from malnutrition, in terms of both stunting and overweight, more often and in more severe ways than girls. This cooccurrence of underweight and overweight seems contradictory at first. However, regarding stunting, previous research has found boys under the age of 5 to be characterised by "biological fragility", which means that their growth is more affected by nutritional deficiency, disease and other exposures than that of girls (Nshimyiryo et al., 2019). Furthermore, it is known that stunted children are prone to developing overweight in later life (UNICEF, 2013). This combination can explain why Armenian boys are more often and more severely stunted, but also more often and more severely overweight as compared to Armenian girls. In addition, another phenomenon that can be relevant is stuntedoverweight. This refers to children who are stunted and overweight at the same time, instead of subsequentially as described above. Previous research by Bates et al. (2017) has found these stuntedoverweight children to exist in Armenia. Taking into account both biological frailty and the findings of this study, it is possible that the majority of these children are boys rather than girls.

Furthermore, this study shows that besides sex, demographic and socioeconomic factors underlie differences in child nutritional status. The factors that are included in this study can be identified as drivers of the nutrition transition. Therefore, this study adds to the existing literature on factors that are important in the nutritional status of Armenian children and at the same time provides insight in how the drivers of the nutrition transition work in the Armenian context. First of all, this study finds that urbanisation has an important effect on stunting. Children who live in urban areas have a higher HAZ across the distribution of these scores than their rural counterparts, meaning that urbanisation is a protective factor when it comes to child stunting. This is in line with previous research by Black et al. (2013), who found that in developing countries, child stunting is less prevalent in urban than in rural areas. Furthermore, this finding indicates that in Armenia, urban populations are experiencing the nutrition transition at a faster pace than rural populations (Hawkes et al., 2017). In general, rural children are still characterised by nutritional deficiency, whereas urban children already moved past this pattern. However, on the other hand, this study finds no effect of urbanisation on overweight. This is not in line with the results by Black et al., as they found overweight to be more prevalent in urban than in rural areas. According to this study, child overweight remains a problem of equal size in both areas. This can be explained either by rural children increasingly moving towards the pattern characterised by overweight and obesity problems or by interrelations between the place of residence and the other drivers of the nutrition transition.

A second factor that is related to both stunting and overweight is household wealth. This study finds that children who live in middle and rich households have a lower HAZ at the parts of the distribution that are related to stunting than children who live in poor households, which means that household wealth is no protective factor. This is not in line with the results of previous research in both other countries and Armenia itself (Black et al., 2013; Bommer et al., 2019; WFP & UNICEF, 2016). These studies found the prevalence of stunting to be higher in poor households. The opposite findings of this study can be explained by interrelations between different socioeconomic factors. This also applies to the findings regarding the effect of household wealth on overweight. While previous research by Black et al. found the prevalence of overweight to be higher among the richest compared to the poorest households, this study finds that children who live in middle households have a higher WHZ, whereas those who live in rich households have a lower WHZ at the parts of the distribution that are related to overweight. This can be explained using the results of a previous study by Monteiro et al. (2001). They found that in less developed contexts, such as poor and middle households, overweight was positively associated with income and negatively associated with education. However, the association with income disappeared in more developed contexts, such as rich households, whereas the association with education remained.

Regarding maternal education, a third factor that is important in child stunting and overweight, the findings of this study confirm those by Monteiro et al. (2001). Children whose mothers have completed at least tertiary education have a lower WHZ at the parts of the distribution that are related to overweight than those whose mothers have completed secondary education at most. This means that maternal education is a protective factor when it comes to child overweight. Although this is not in line with previous research in Armenia (WFP & UNICEF, 2016), based on this study it is plausible that the mechanism described by Monteiro at al. also works for Armenian children. Furthermore, this study finds that maternal education also is a protective factor for child stunting, as children whose mothers have completed at least tertiary education have a higher HAZ at the parts of the distribution that are related to stunting as compared to those whose mothers have completed secondary education at most. This is in line with the results of previous research in both Armenia itself and other countries (Fernández-Alvira et al., 2012; WFP & UNICEF, 2016; WHO, 2018).

Lastly, this study finds no effects of maternal employment on both stunting and overweight. This can be explained in the light of previous research by Burroway (2017). She found that in developing countries, maternal employment itself is not associated with child nutritional status, but certain types of occupations are. However, this study only includes whether or not mothers were working, which can be why no effects are found.

Despite the evidence for the role of sex and demographic and socioeconomic factors in child nutritional status, this study finds only limited evidence for a role of parental son preference. This can be explained using the parental investment theories. A first explanation is related to the birth order of the Armenian children that are included the sample. The largest part of these children, namely 42.39%, are the first-born children to their mothers. When having their first child, parents still have the maximum of resources they can invest and do not have to divide these between their children, compared to parents who already have another child or multiple children and ceteris paribus. Therefore, they also do not have to choose between investment in their sons or daughters yet. It may thus be that son preference plays a bigger role when parents have multiple children of different sexes, compared to one child. For stunting, this has been confirmed by Raj et al. (2015) in several Asian countries. They found that having siblings increased girls' risk of stunting, whereas boys' risk of stunting was less affected by this. Furthermore, it may be that parental investment before birth is already more determining when it comes to child nutritional status than investment after birth. As becomes evident from the tables including the full results in Appendix B, the birth weight of Armenian children plays an important role in both HAZ and WHZ. The effect of this control variable is significant in all models, both on average and at most parts of the distributions of both scores. According to Wells (2003), birth weight can be seen as the outcome of in utero investment. In the light of the rising availability of sex detection technologies in Armenia, parental son preference may already have played a role in investment in children before they are even born. However, this is beyond the scope of this study, which is focused on the period of early childhood.

Besides these theoretical explanations, the study design and methods of analyses used may explain the limited findings regarding parental son preference. The studied children's ages range from 0 to 5 years, meaning that the time span between the moment their parents realised the sex of the child, either due to sex detection technologies or at birth, and the anthropometric measures recorded for the survey can be large. During this time span, many additional things can happen that influence parental son preference, child nutritional status or both. Although certain variables are included to control for this, for example birth order to control for the birth of an additional child, these are not exhaustive. Furthermore, this study uses both linear and quantile regression, which assume linearity. However, this might be too strong to assume for the data used in this study. The lack of significant effects for the interaction between the sex of the child and son preference, thus gender bias, is confirmed by multinomial logistic analyses, in which the possible outcomes are either being stunted, being at risk of becoming stunted or neither of these, or being overweight, being at risk of overweight or neither of these. In these analyses, of which the results are not included, none of these effects are found to be significant. These findings thus seem to be robust. Compositional effects may be at play, meaning that on average, the effects of the interactions are not strong enough.

7.2 Strengths and limitations

A major strength of this study is that it considers the full distributions of height for age and weight for height, which are the indicators of stunting and overweight respectively. Previous studies on child malnutrition in Armenia focused on the prevalence of malnutrition only but lacked attention for the severity of malnutrition. This study takes into account both. Another strength is the use of different measures for parental son preference. Previous research in other countries included the gender preference of mothers only. However, as are differences exist in the prevalence of son preference between Armenian men and women, this study does not only include maternal son preference, but also pays attention to paternal son preference.

In addition to these strengths of the study, there are limitations to be acknowledged. The first is related to the way parental son preference is measured. The DHS includes questions asked to both mothers and fathers on the ideal sex composition of their children, on which the measures for son preference included in this study are based. However, this approach is imperfect due to the strong normative pressure that exists in surveys (Guilmoto, 2013). This pressure may have encouraged respondents to assert legitimate opinions on their ideal number of children and their sex composition, which may not reflect their actual attitudes. Guilmoto furthermore states that with this type of questions, parents often opt for a neutral preference of one son and one daughter. This approach to measuring son preference might thus have affected the validity of this study. Second, the study did not include an explicit measure for the diets consumed by Armenian children aged 0 to 5 months. For all children, dietary diversity was used to proxy this. However, children in their first half year of life should not receive complementary foods yet but should be breastfed exclusively (UNICEF Armenia, n.d.$_a$). Although diet itself was not the main focus of this study, it might have been insightful to pay more attention to their scores on the variables for breastfeeding which were included as control variables.

7.3 Recommendations

The findings of this study have implications for Armenian policy makers. These show that certain groups of Armenian children have a lower HAZ or higher WHZ and thus may be vulnerable to stunting or overweight respectively. Therefore, based on this study, policies should specifically target boys, children in rural areas, children in middle and rich households and children whose mothers completed secondary education at most. These groups of children may be most at risk of experiencing the damaging and lifelong consequences that stunting and overweight during childhood entail, which should be prevented.

Furthermore, recommendations for future research can be drawn up based on this study. Although the study finds no evidence for a gender bias, this does not mean that no attention should be paid to gender inequality in relation to child nutritional status in Armenia. First of all, future research could focus on the prenatal period. As birth weight is an important factor in both HAZ and WHZ, it may be interesting to explore whether sex differences exist in parental investment before birth and subsequent outcomes and whether parental son preference plays a role in this. In addition, previous research found gender equality in adulthood and empowerment of women to improve nutrition for the entire household (Food and Agriculture Organisation [FAO], 2010). This could contribute to Armenian policies, as a focus on gender equality might thus enhance better nutrition in all vulnerable groups of children that this study identified. Therefore, additional research could be conducted to explore this link between gender equality in adulthood and child nutritional status in Armenia.

References

Ameye, H. & Swinnen, J. (2019). Obesity, income and gender: The changing global relationship. *Global Food Security, 23*, 267-281. doi: 10.1016/j.gfs.2019.09.003

Asian Development Bank (2015). *Armenia country gender assessment*. Mandaluyong City, Philippines: Asian Development Bank.

Bates, K., Gjonça, A. & Leone, T. (2017). Double burden or double counting of child malnutrition? The methodological and theoretical implications of stuntingoverweight in low and middle income countries. *Journal of Epidemiology and Community Health, 71*(8), 779-785. doi: 10.1136/jech-2017-209008

Black, R. E., Victora, C. G., Walker, S. P., Bhutta, Z. A., Christian, P., De Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., Uauy, R. & Maternal and Child Nutrition Study Group (2013). Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet, 382*(9890), 427-451. doi: 10.1016/S0140-6736(13) 60937-X

Block, S. A., Masters, W. A. & Bhagowalia, P. (2012). Does Child Undernutrition Persist Despite Poverty Reduction in Developing Countries? Quantile Regression Results. *Journal of Development Studies, 48*(12), 1699-1715. doi: 10.1080/00220388.2012.700399

Bommer, C., Vollmer, S. & Subramanian, S. V. (2019). How socioeconomic status moderates the stunting-age relationship in low-income and middle-income countries. *BMJ Global Health, 4*(1), 1-10. doi: 10.1136/ bmjgh-2018-001175

Burroway, R. (2017). Are all jobs created equal? A cross-national analysis of women’s employment and child malnutrition in developing countries. *Social Science Research, 67*(9), 1-13. doi: 10.1016/j.ssresearch.2017.07.003

Clark, A. B. (1978). Sex Ratio and Local Resource Competition in a Prosimian Primate. *Science, 201*(4351), 163-165. doi: 10.1126/science.201.4351.163

Clark, S. (2000). Son Preference and Sex Composition of Children: Evidence from India. *Demography, 37*(1), 95-108. doi: 10.2307/2648099

Courtemanche, C. (2009). Longer Hours and Larger Waistlines? The Relationship between Work Hours and Obesity. *Forum for Health Economics and Policy, 12*(2), 1-31. doi: 10.2202/1558-9544.1123

Cronk, L. (1991). Preferential parental investment in daughters over sons. *Human Nature, 2*(4), 387-417. doi: 10.1007/BF02692198

Das Gupta, M. (2015). *Missing girls in the South Caucasus countries: trends, possible causes, and policy options*. Policy Research Working Paper number 7236. Washington, DC: World Bank Group.

Dasgupta, S. (2016). Son Preference and Gender Gaps in Child Nutrition: Does the Level of Female Autonomy Matter? *Review of Development Economics, 20*(2), 375-386. doi: 10.1111/rode.12231

De Onis, M., Blossner, M. & Borghi, E. (2010). Global prevalence and trends of overweight and obesity among preschool children. *American Journal of Clinical Nutrition, 92*(5), 1257-1264. doi: 10.3945/ajcn.2010.29786

Development Initiatives (2019). Global Nutrition Report: Armenia Nutrition Profile. Retrieved on 15 April from https://globalnutritionreport.org/resources/nutrition-profiles/asia/western-asia/armenia/

Drewnowski, A. & Popkin, B. M. (1997). The Nutrition Transition: New Trends in the Global Diet. *Nutrition Reviews, 55*(2), 31-43. doi: 10.1111/j.1753-4887.1997.tb01593.x.

Fenske, N., Burns, J., Hothorn, T. & Rehfuess, E. A. (2013). Understanding Child Stunting in India: A Comprehensive Analysis of Socio-Economic, Nutritional and Environmental Determinants Using Additive Quantile Regression. *PLoS ONE, 8*(11), 1-16. doi: 10.1371/journal.pone.0078692

Fernández-Alvira, J. M., Mouratidou, T., Bammann, K., Hebestreit, A., Barba, G., Sieri, S., Reisch, L., Eiben, G., Hadjigeorgiou, C., Kovacs, E., Huybrechts, I. & Moreno, L. A. (2012). Parental education and frequency of food consumption in European children: the IDEFICS study. *Public Health Nutrition, 16*(3), 487-498. doi: 10.1017/S136898001200290X

Fewtrell, M. S., Mohd Shukri, N. H. & Wells, J. C. K. (2020). 'Optimising' breastfeeding: what can we learn from evolutionary, comparative and anthropological aspects of lactation? *BMC Medicine, 18*(4), 1-10. doi: 10.1186/s12916-019-1473-8

Fox, D., Erbele, P. & Fischer, P. R. (2016). Malnutrition. In Kamat, D. M. & Fischer, P. R. (eds.). *Textbook of Global Child Health* (p. 557-640). Elk Grove Village, IL: American Academy of Pediatrics.

Gayawan, E., Adebayo, S. B., Komolafe, A. A. & Akomolafe, A. A. (2017). Spatial Distribution of Malnutrition among Children Under Five in Nigeria: A Bayesian Quantile Regression Approach. *Applied Spatial Analysis and Policy, 12*, 229-254. doi: 10.1007/s12061-017-9240-8

Gebremariam, M. K., Arah, O. A., Lien, N., Naess, O., Ariansen, I. & Kjollesdal, M. K. (2018). Change in BMI Distribution over a 24-Year Period and Associated Socioeconomic Gradients: A Quantile Regression Analysis. *Obesity, 26*(4), 769-775. doi: 10.1002/oby.22133

Goryakin, Y. & Suhrcke, M. (2014). Economic Development, Urbanisation, Technological Change and Overweight: What Do We Learn from 244 Demographic and Health Surveys? *Economics and Human Biology, 14*, 109-127. doi: 10.1016/j.ehb.2013.11.003

Guilmoto, C. Z. (2013). *Sex imbalances at Birth in Armenia: Demographic evidence and analysis*. Report prepared for the United Nations Population Fund. Yerevan, Armenia: UNFPA.

Gwozdz, W., Sousa-Poza, A., Reisch, L. A., Ahrens, W., Eiben, G., Fernandéz-Alvira, J. M., Hadjigeorgiou, C., De Henauw, S., Kovács, E., Lauria, F., Veidebaum, T., Williams, G. & Bammann, K. (2013). Maternal employment and childhood obesity - A European perspective. *Journal of Health Economics, 32*(4), 728-742. doi: 10.1016/j.jhealeco.2013.04.003

Haisma, H., Coward, W. A., Visser, G. H., Vonk, R., Wells, J. C. K, Wright, A. & Victora, C. G. (2006). Socio-economic and environmental factors influence energy utilization in Brazilian brest-fed infants. *Journal of Nutrition, 136*(11), 2945-2951. doi: 10.1093/jn/136.11.2945

Hamilton, W. D. (1967). Extraordinary Sex ratios. *Science, 156*(3774), 477-488. doi: 10.1126/science.156.3774.477

Haram, J., Salinas, D. & Baker, D. P. (2015). Non-linear education gradient across the nutrition transition: mothers' overweight and the population education transition. *Public Health Nutrition, 18*(17), 3172-3182. doi: 10.1017/S1368980015001640

Hawkes, C., Harris, J. & Gillespie, S. (2017). *Changing diets: Urbanisation and the nutrition transition*. In International Food Policy Research Institute, *2017 Global Food Policy Report*. Washington, DC: International Food Policy Research Institute, 34-41. doi: 10.2499/9780896292529_04

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

Hrdy, S. B. (1990). Sex Bias in Nature and in History: A Late 1980s Reexamination of the "Biological Origins" Argument. *American Journal of Physical Anthropology, 33*(11), 25-37. doi: 10.1002/ajpa.1330330504

ICF (2020). The DHS Program STATcompiler. Retrieved on 16 April 2020 from https://www.statcompiler.com/en/

Khitarishvili, T. (2016). *Gender dimensions of inequality in the countries of Central Asia, South Caucasus and Western CIS*. Levy Economics Institute Working Paper number 858. Retrieved on 22 February 2020 from http://www.levyinstitute.org/publications/gender-dimensions-of-inequality-in-the-countries-of-central-asia-south-caucasus-and-western-cis

Kimenju, S. C. & Qaim, M. (2016). The nutrition transition and indicators of child malnutrition. *Food Security, 8*, 571-583. doi: 10.1007/s12571-016-0566-x

Komatsu, H., Malapit, H. J. L. & Theis, S. (2018). Does women's time in domestic work and agriculture affect women's and children's dietary diversity? Evidence from Bangladesh, Nepal, Cambodia, Ghana, and Mozambique. *Food policy, 79*(8), 256-270. doi: 10.1016/j.foodpol.2018.07.002

Kubo, M. & Chaudhuri, A. (2017). Gender Gap in Health Status of Children in the Context of One-Child Policy in China: Is it Sibling Rivalry or Son Preference? *Journal of Family and Economic Issues, 38*(2), 204-217. doi: 10.1007/s10834-016-9506-3

Maitra, P. & Rammohan, A. (2011). The link between infant mortality and child nutrition in India: is there any evidence of gender bias? *Journal of the Asia Pacific Economy, 16*(1), 81-110. doi: 10.1080/13547860.2011.539405

Meslé, F., Vallin, J. & Badurashvili, I. (2007). A sharp increase in sex ratio at birth in the Caucasus. Why? How? In Attané, I. & Guilmoto, C. (eds.), *Watering the Neighbour's Garden: The Growing Demographic Female Deficit in Asia*. Paris, France: CiCRed, 73-88.

Mishra, V., Roy, T. K. & Retherford, R. D. (2004). Sex Differentials in Childhood Feeding, Health Care, and Nutritional Status in India. *Population and Development Review, 30*(2), 269-295. doi: 10.1111/j.1728-4457.2004.013_1.x

Monteiro, C. A., Conde, W. L. & Popkin, B. M. (2001). Independent Effects of Income and Education on the Risk of Obesity in the Brazilian Adult Population. *Journal of Nutrition, 131*(3), 881-886. doi: 10.1093/jn/131.3.881S

National Statistical Service (Armenia), Ministry of Health (Armenia) & ICF (2012). *Armenia Demographic and Health Survey 2010*. Calverton, MD: National Statistical Service, Ministry of Health & ICF.

National Statistical Service (Armenia), Ministry of Health (Armenia) & ICF (2017). *Armenia Demographic and Health Survey 2015-16.* Rockville, MD: National Statistical Service, Ministry of Health and ICF.

Nauck, B. & Klaus, D. (2007). The Varying Value of Children: Empirical Results from Eleven Societies in Asia, Africa and Europe. *Current Sociology, 55*(4), p. 487-503. doi: 10.1177/0011392107077634

Nshimyiryo, A., Hedt-Gauthier, B., Mutaganzwa, C., Kirk, C. M., Ndayisaba, A., Mubiligi, J., Kateera, F. & El-Khatib, Z. (2019). Risk factors for stunting among children under five years: a cross-sectional population-based study in Rwanda using the 2015 Demographic and Health Survey. *BMC Public Health, 19*(175), 1-10. doi: 10.1186/s12889-019-6504-z

Oddo, V. M., Surkan, P. J., Hurley, K. M., Lowery, C., De Ponce, S. & Jones-Smith, J. C. (2018). Pathways of the association between maternal employment and weight status among women and children: Qualitative findings from Guatemala. *Maternal and Child Nutrition, 14*(1), 1-10. doi: 10.1111/mcn.12455

Payande, A., Tabesh, H., Shakeri, M. T., Saki, A. & Safarian, M. (2013). Growth Curves of Preschool Children in the Northeast of Iran: A Population Based Study Using Quantile Regression Approach. *Global Journal of Health Science, 5*(3), 9-15. doi: 10.5539/gjhs.v5n3p9

Popkin, B. M. (1993). Nutritional Patterns and Transitions. *Population and Development Review, 19*(1), 138-157. doi: 10.2307/2938388

Popkin, B. M. (1998). The nutrition transition and its health implications in lower-income countries. *Public Health Nutrition, 1*(1), 5-21. doi: 10.1079/PHN19980004

Popkin, B. M. (2001). Nutrition in transition: The global nutrition challenge. *Asia Pacific Journal of Clinical Nutrition, 10*(Supplement), S13-S18. doi: 10.1046/j.1440-6047.2001.0100s1S13.x

Popkin, B. M. (2002). An overview on the nutrition transition and its health implications: the Bellagio meeting. *Public Health Nutrition, 5*(1), 93-103. doi: 10.1079/PHN2001280

Popkin, B. M. (2003). The Nutrition Transition in the Developing World. *Development Policy Review, 21*(5-6), 581-597. doi: 10.1111/j.1467-8659.2003.00225.x

Popkin, B. M. (2006). Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. *American Journal of Clinical Nutrition, 84*(2), 289-298. doi: 10.1093/ajcn/84.1.289

Popkin, B. M., Adair, L. S. & Wen Ng, S. (2012). The Global Nutrition Transition: The Pandemic of Obesity in Developing Countries. *Nutrition Reviews, 70*(1), 3-21. doi: 10.1111/j.1753-4887.2011.00456.x.

Popkin, B. M., Corvalan, C. & Grummer-Strawn, L. M. (2020). Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet, 395*(10217), 65-74. doi: 10.1016/S0140-6736(19)32497-3

Popkin, B. M., Paeratakul, S., Zhai, F. & Ge, K. (1995). A Review of Dietary and Environmental Correlates of Obesity With Emphasis on Developing Countries. *Obesity Research, 3*(Supplement 2), S145-S153. doi: 10.1002/j.1550-8528.1995.tb00457.x.

Popkin, B. M., Richards, M. E. & Montiero, C. A. (1996). Stunting is Associated with Overweight in Children of Four Nations That Are Undergoing the Nutrition Transition. *Journal of Nutrition, 126*(12), 3009-3016. doi: 10.1093/jn/126.12.3009

Poskitt, E. M. E. (2014). Childhood obesity in low- and middle-income countries. *Paediatrics and International Child Health, 34*(4), 239-249. doi: 10.1179/2046905514Y.0000000147

Pullum, T. W. (2008). *An Assessment of the Quality of Data on Health and Nutrition in the DHS Surveys, 1993-2003*. Methodological Reports number 6. Calverton, MD: Macro International Inc.

Rachmi, C. N., Agho, K. E. & Baur, L. A. (2016). Stunting, Underweight and Overweight in Children Aged 2.0-4.9 Years in Indonesia: Prevalence Trends and Associated Risk Factors. *PLoS ONE, 11*(5), 1-17. doi: 10.1371/journal.pone.0154756

Rahman, A. (2019). Cultural Norms and Son Preference in Intrahousehold Food Distribution: A Case Study of Two Asian Rural Economies. *Review of Income and Wealth, 65*(2), 415-461. doi: 10.1111/roiw.12356

Raj, A., McDougal, L. P. & Silverman, J. G. (2015). Gendered Effects of Siblings on Child Malnutrition in South Asia: Cross-sectional Analysis of Demographic and Health Surveys from Bangladesh, India and Nepal. *Maternal and Child Health Journal, 19*(1), 217-226. doi: 10.1007/s10995-014-1513-0

Sargsyan, S., Movsesyan, Y., Melkumova, M. & Babloyan, A. (2016). Child and Adolescent Health in Armenia: Experiences and Learned Lessons. *Journal of Pediatrics, 177, Supplement*, 21-34. doi: 10.1016/j.jpeds.2016.04.038

Semba, R. D. & Bloem, M. W. (2008). *Nutrition and Health in Developing Countries*. Totowa, NJ: Humana Press.

Sharaf, M. F., Mansour, E. I. & Rashad, A. S. (2019$_a$). Child Nutritional Status in Egypt: A Comprehensive Analysis of Socioeconomic Determinants using a Quantile Regression Approach. *Journal of Biosocial Science, 51*(1), 1-17. doi: 10.1017/S0021932017000633

Sharaf, M. F., Rashad, A. S. & Mansour, E. I. (2019$_b$). Son Preference and Child Under Nutrition in the Arab Countries: Is There a Gender Bias against Girls? *Middle East Development Journal, 11*(2), 199-219. doi: 10.1080/17938120.2019.1664837

Sparks, C. S. (2011). Parental Investment and Socioeconomic Status Influences on Children's Height in Honduras: An Analysis of National Data. *American Journal of Human Biology, 23*(1), 80-88. doi: 10.1002/ajhb.21104

Statistical Committee of the Republic of Armenia (2019). *Women and Men in Armenia*. Retrieved on 2 June 2020 from https://armstat.am/file/article/gender_2019.pdf

Statistical Committee of the Republic of Armenia (n.d.). *Armenia in figures, 1998-2019*. Retrieved on 5 March 2020 from https://www.armstat.am/en/?nid=81&pthid=demo&year=&submit=Search

Sweeney, S., Davenport, F. & Grace, K. (2013). Combining insights from quantile and ordinal regression: Child malnutrition in Guatemala. *Economics & Human Biology, 11*(2), 164-177. doi: 10.1016/j.ehb.2012.06.001

The DHS Program (n.d.$_a$). Demographic and Health Survey (DHS). Retrieved on 2 April 2020 from https://dhsprogram.com/What-We-Do/Survey-Types/DHS.cfm

The DHS Program (n.d.$_b$). Analysing DHS Data. Retrieved on 17 June 2020 from https://dhsprogram.com/data/Guide-to-DHS-Statistics/Analyzing_DHS_Data.htm

The DHS Program (n.d.$_c$). Using Datasets for Analysis. Retrieved on 17 June 2020 from https://www.dhsprogram.com/data/Using-Datasets-for-Analysis.cfm

The DHS Program (n.d.$_d$). Protecting the Privacy of DHS Survey Respondents. Retrieved on 17 April 2020 from https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm

The DHS Program (n.d.$_e$). Data Quality and Use. Retrieved on 17 April 2020 from https://dhsprogram.com/data/Data-Quality-and-Use.cfm

The DHS Program (n.d.$_f$). Datasets Terms of Use. Retrieved on 17 April 2020 from https://dhsprogram.com/Data/terms-of-use.cfm

The World Bank (2015). *Exploring the phenomenon of missing girls in the South Caucasus*. Health, nutrition, and population global practice knowledge brief. Washington, DC: World Bank Group.

The World Bank (2016). *Armenia Country Gender Assessment 2016*. Poverty and Equity Global Practice Working Paper number 113990. Washington, DC: World Bank Group.

The World Bank (2020). Labor force participation rate, female (% of female population ages 15+) (modelled ILO estimate) – Europe and Central Asia. Retrieved on 2 June 2020 from https://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS?locations=Z7

Trivers, R. L. (1974). Parent-Offspring Conflict. *American Zoologist, 14*(1), 249-264. doi: 10.1093/icb/14.1.249

UNICEF (2013). *Improving Child Nutrition: The Achievable Imperative for Global Progress*. Retrieved on 5 April 2020 from https://www.unicef.org/nutrition/files/Nutrition_Report_final_lo_res_8_April.pdf

UNICEF (2019). *Protecting Children's Right to a Healthy Food Environment*. Retrieved on June 7 from https://www.unicef.nl/files/Advocacy-brief-healthy-food-enviro-final.pdf

UNICEF Armenia (n.d.$_a$). Feeding of 6-8 month old children. Retrieved on June 8 2020 from https://www.babycef.am/hy/childcare-health/nutrition-starting-solid-foods?term=14

UNICEF Armenia (n.d.$_b$). Nutrition for children aged 9-11 months. Retrieved on June 8 2020 from https://www.babycef.am/hy/child%20nutrition/solid-foods-baby-menu?term=14

UNICEF Armenia (n.d.$_c$). Feeding 1-2 year old children. Retrieved on June 8 2020 from https://www.babycef.am/hy/child%20nutrition/solid-foods-toddlers?term=14

UNICEF, WHO & World Bank Group (2019). *Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates. Key findings of the 2019 edition*. Retrieved on 15 April 2020 from https://www.who.int/nutgrowthdb/jme-2019-key-findings.pdf?ua=1

Wells, J. C. K. (2003). Parent-Offspring Conflict Theory, Signaling of Need, and Weight Gain in Early Life. *The Quarterly Review of Biology, 78*(2), 169-202. doi: 10.1086/374952

WFP & UNICEF (2016). *Armenia Comprehensive Food Security, Vulnerability and Nutrition Analysis (CFSVNA)*. Retrieved on 15 April 2020 from https://www.wfp.org/publications/armenia-comprehensive-food-security-vulnerability-nutrition-analysis-cfsvna-march-2016

WHO (2008). *Indicators for assessing infant and young child feeding practices: conclusions of a consensus meeting held 6-8 November 2007 in Washington D.C., USA.* Geneva, Switzerland: World Health Organisation.

WHO (2010). *Nutrition Landscape Information System (NLIS) country profile indicators: interpretation guide*. Retrieved on 15 April 2020 from https://apps.who.int/iris/bitstream/handle/10665/44397/9789241599955_eng.pdf?sequence=1&isAllowed=y

WHO (2016). *Report of the Commission on Ending Childhood Obesity*. Geneva, Switzerland: World Health Organisation.

WHO (2018). *Reducing stunting in children: equity considerations for achieving the Global Nutrition Targets 2025.* Geneva, Switzerland: World Health Organisation.

WHO (2020). Infant and young child feeding. Retrieved on 8 June 2020 from https://www.who.int/news-room/fact-sheets/detail/infant-and-young-child-feeding

WHO (n.d.$_a$). Why does childhood overweight and obesity matter? Retrieved on 25 May 2020 from https://www.who.int/dietphysicalactivity/childhood_consequences/en/

WHO (n.d.$_b$). Double burden of malnutrition. Retrieved on 16 April 2020 from https://www.who.int/nutrition/double-burden-malnutrition/en/

WHO Multicentre Growth Reference Study Group (2006). *WHO Child Growth Standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. Methods and development.* Geneva, Switzerland: World Health Organisation.

Yerevan State University Center for Gender and Leadership Studies (2015). *Gender Barometer Survey. Armenia. A sociological survey*. Retrieved on 15 April 2020 from http://www.ysu.am/files/Gender%20Barometer.Armenia.English.pdf

Yong Lee, S. & Marwell, G. (2013). *A General Theory of Gender Preferences for Children*. Retrieved on 5 March 2020 from https://www.semanticscholar.org/paper/A-General-Theory-of-Gender-Preferences-For-Children-Lee-Marwell/d5f29c0d39f3884b3d9138a1d072057debbb0e08

Appendix A: Goodness of imputations

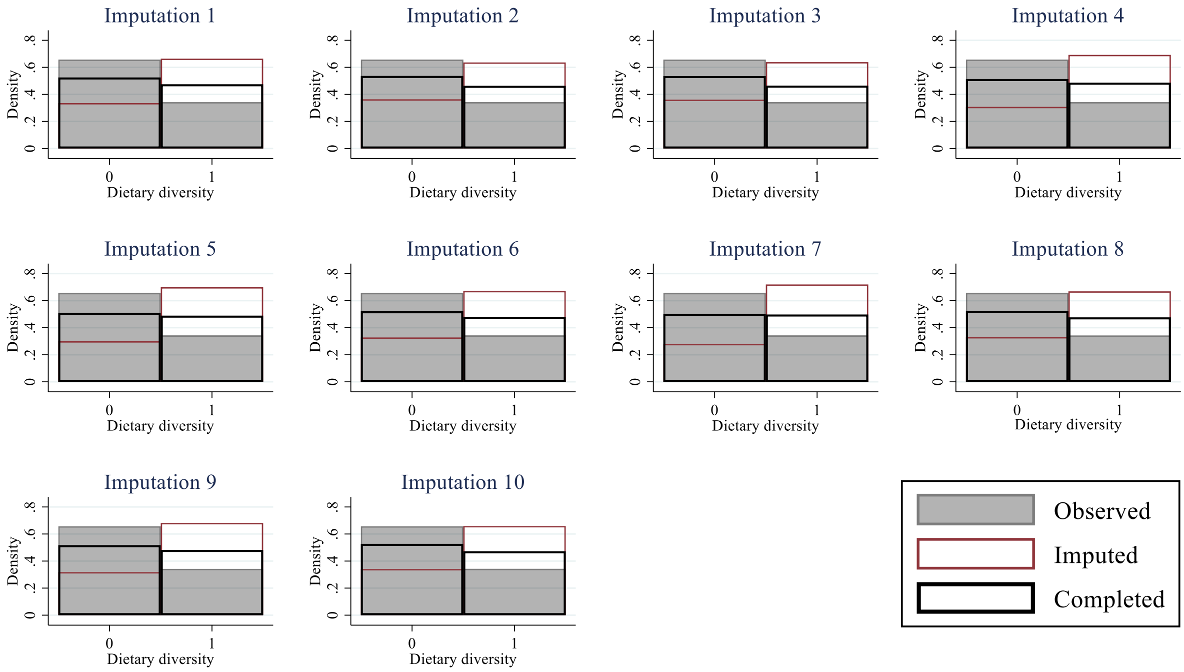

Figure A.1 Distribution of observed, imputed and completed values for dietary diversity

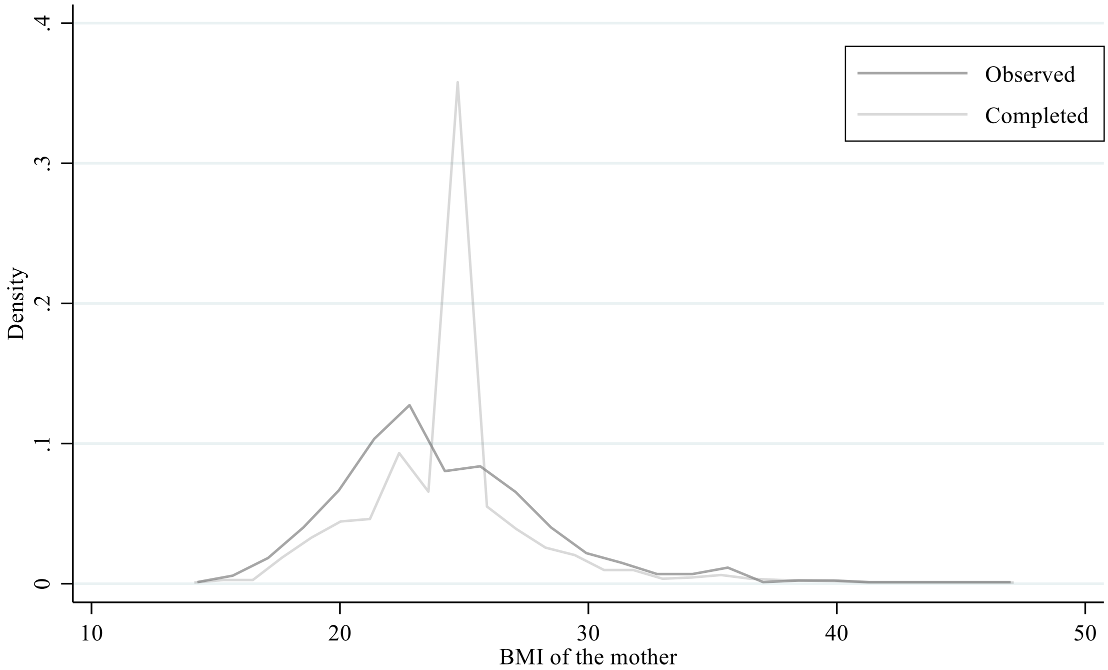

Figure A.2 Distribution of observed and completed values for BMI of the mother

Notes: The distribution of imputed values is not included here, because mean imputation was used. All imputed values are thus equal to the mean of the observed values, which is 24.14.

Appendix B: Regression results including control variables

Table B.1 Full linear and quantile regression results of model 1 for HAZ

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Sex child (ref: girl)						
Boy	-0.35***	-0.40***	-0.28**	-0.42***	-0.46***	-0.22
	(0.11)	(0.11)	(0.12)	(0.09)	(0.09)	(0.16)
Birth weight	0.50***	0.73***	0.52***	0.53***	0.50***	0.52**
	(0.13)	(0.13)	(0.17)	(0.09)	(0.12)	(0.22)
BMI of the mother	-0.00	0.03**	0.02*	-0.00	-0.02**	-0.04**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.12	0.12	0.02	-0.02	-0.32***	-0.38**
	(0.12)	(0.12)	(0.11)	(0.15)	(0.08)	(0.17)
More than a day after birth	0.013	0.44*	0.04	-0.00	-0.26	-0.12
	(0.19)	(0.26)	(0.30)	(0.15)	(0.16)	(0.44)
Still breastfed (ref: no)						
Yes	-0.03	-0.68***	-0.47**	-0.04	0.20	0.89***
	(0.16)	(0.15)	(0.20)	(0.14)	(0.15)	(0.34)
Other children under the age of 5 (ref: no)						
Yes	0.03	0.19	-0.05	-0.17*	-0.06	-0.18
	(0.12)	(0.15)	(0.15)	(0.10)	(0.08)	(0.22)
Birth order (ref: first child)						
Second child	-0.17	-0.33*	-0.39**	-0.27***	-0.12	-0.33
	(0.14)	(0.19)	(0.18)	(0.10)	(0.09)	(0.20)
Third or more child	0.17	0.15	-0.17	-0.01	0.15	0.44
	(0.17)	(0.24)	(0.20)	(0.16)	(0.16)	(0.37)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.09	0.06	-0.10	-0.02	0.05	0.42*
	(0.18)	(0.149)	(0.163)	(0.144)	(0.297)	(0.216)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.16	-0.02	-0.27	-0.16	-0.41**	0.23
	(0.22)	(0.18)	(0.24)	(0.18)	(0.18)	(0.52)
2 years	0.17	-0.30	-0.15	0.02	0.50***	0.64
	(0.22)	(0.18)	(0.28)	(0.19)	(0.19)	(0.46)
3 years	-0.21	-0.40**	-0.31	-0.35**	-0.23	0.10
	(0.21)	(0.20)	(0.30)	(0.16)	(0.25)	(0.43)
4 years	-0.30	-0.45	-0.30	-0.25	-0.48***	-0.29
	(0.20)	(0.28)	(0.25)	(0.18)	(0.18)	(0.48)
Constant	-1.46***	-4.77***	-2.78***	-1.35***	-0.10	0.59
	(0.52)	(0.62)	(0.59)	(0.48)	(0.39)	(0.85)
Observations	956	956	956	956	956	956
R^2	0.05	0.04	0.03	0.04	0.06	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table B.2 Full linear and quantile regression results of model 1 for WHZ

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Sex child (ref: girl)						
Boy	0.26**	0.38*	0.30**	0.23***	0.13	0.46***
	(0.11)	(0.20)	(0.13)	(0.09)	(0.13)	(0.16)
Birth weight	0.37***	0.73***	0.53***	0.29***	0.27**	-0.10
	(0.12)	(0.18)	(0.12)	(0.09)	(0.14)	(0.15)
BMI of the mother	-0.00	-0.03	-0.00	0.01	0.03	0.02
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.03)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.19	-0.12	-0.01	-0.23**	-0.26**	-0.38
	(0.11)	(0.23)	(0.12)	(0.11)	(0.13)	(0.25)
More than a day after birth	-0.48***	-0.30	-0.14	-0.38**	-0.75***	-1.15***
	(0.15)	(0.27)	(0.24)	(0.17)	(0.20)	(0.31)
Still breastfed (ref: no)						
Yes	-0.19	0.09	-0.27**	-0.12	-0.27	-0.23
	(0.14)	(0.24)	(0.13)	(0.12)	(0.17)	(0.25)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.01	0.11	0.11	0.08	0.24
	(0.11)	(0.21)	(0.12)	(0.09)	(0.14)	(0.21)
Birth order (ref: first child)						
Second child	-0.05	0.11	0.01	-0.02	-0.08	-0.05
	(0.12)	(0.22)	(0.13)	(0.11)	(0.16)	(0.24)
Third or more child	-0.32**	-0.90***	-0.35**	-0.30***	-0.19	-0.41
	(0.15)	(0.30)	(0.14)	(0.11)	(0.18)	(0.27)
Interbirth interval (ref: no prior birth)						
24 months or less	0.10	0.16	0.06	0.22**	0.02	0.08
	(0.16)	(0.31)	(0.23)	(0.11)	(0.17)	(0.22)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.38**	0.84***	0.29	0.24	0.17	0.18
	(0.16)	(0.25)	(0.21)	(0.15)	(0.21)	(0.29)
2 years	0.03	0.11	0.01	0.08	-0.10	-0.07
	(0.18)	(0.34)	(0.28)	(0.16)	(0.23)	(0.27)
3 years	0.05	0.31	0.07	-0.05	-0.21	0.35
	(0.20)	(0.37)	(0.23)	(0.19)	(0.20)	(0.36)
4 years	0.02	0.53	-0.12	-0.33*	-0.00	0.24
	(0.18)	(0.35)	(0.22)	(0.17)	(0.24)	(0.29)
Constant	-0.42	-3.04***	-1.74***	-0.50	0.27	2.16**
	(0.55)	(0.94)	(0.59)	(0.41)	(0.62)	(0.89)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table B.3 Full linear and quantile regression results of model 2 for HAZ

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
(a) Maternal son preference						
Sex child (ref: girl)						
Boy	-0.37***	-0.51***	-0.36**	-0.45***	-0.44***	-0.22
	(0.13)	(0.16)	(0.14)	(0.11)	(0.11)	(0.22)
Maternal son preference (ref: no)						
Yes	0.26	-0.11	-0.44	0.26	0.41***	0.52
	(0.33)	(0.17)	(0.43)	(0.40)	(0.13)	(0.99)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.10	0.41*	0.59	-0.19	-0.45**	-0.30
	(0.37)	(0.25)	(0.49)	(0.43)	(0.22)	(1.02)
Birth weight	0.51***	0.74***	0.52***	0.52***	0.49***	0.60***
	(0.13)	(0.14)	(0.16)	(0.11)	(0.13)	(0.20)
BMI of the mother	-0.00	0.03*	0.01	-0.00	-0.02	-0.03**
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.11	0.05	0.11	0.01	-0.36***	-0.23
	(0.12)	(0.14)	(0.14)	(0.13)	(0.10)	(0.19)
More than a day after birth	0.01	0.29	0.11	0.06	-0.32***	0.00
	(0.19)	(0.26)	(0.22)	(0.15)	(0.12)	(0.40)
Still breastfed (ref: no)						
Yes	-0.04	-0.79***	-0.46**	0.00	0.17	0.86***
	(0.16)	(0.18)	(0.21)	(0.16)	(0.16)	(0.30)
Other children under the age of 5 (ref: no)						
Yes	0.02	0.14	-0.04	-0.21*	-0.05	-0.06
	(0.12)	(0.16)	(0.16)	(0.11)	(0.09)	(0.21)
Birth order (ref: first child)						
Second child	-0.18	-0.32*	-0.34*	-0.21*	-0.15	-0.28
	(0.14)	(0.19)	(0.19)	(0.13)	(0.12)	(0.21)
Third or more child	0.16	0.15	-0.10	0.06	0.16	0.59*
	(0.17)	(0.22)	(0.24)	(0.17)	(0.18)	(0.35)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.08	0.08	-0.13	-0.00	-0.03	0.43
	(0.18)	(0.20)	(0.16)	(0.15)	(0.31)	(0.28)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.16	-0.28	-0.23	-0.09	-0.36*	0.37
	(0.21)	(0.18)	(0.26)	(0.18)	(0.20)	(0.48)
2 years	0.18	-0.42	-0.13	0.08	0.52**	0.68
	(0.22)	(0.27)	(0.28)	(0.23)	(0.21)	(0.42)
3 years	-0.22	-0.54**	-0.26	-0.30*	-0.15	0.21
	(0.21)	(0.23)	(0.31)	(0.18)	(0.23)	(0.37)
4 years	-0.29	-0.54*	-0.29	-0.17	-0.41**	-0.26
	(0.19)	(0.28)	(0.27)	(0.19)	(0.19)	(0.43)
Constant	-1.53***	-4.51***	-2.56***	-1.48***	-0.19	-0.05
	(0.52)	(0.63)	(0.67)	(0.54)	(0.59)	(0.77)

Table B.3 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Observations	956	956	956	956	956	956
R^2	0.05	0.05	0.04	0.04	0.06	0.06
(b) Paternal son preference						
Sex child (ref: girl)						
Boy	-0.22	-0.31	-0.23	-0.34**	-0.28**	-0.17
	(0.15)	(0.21)	(0.17)	(0.15)	(0.12)	(0.24)
Paternal son preference (ref: no)						
Yes	0.04	0.11	0.06	0.16	0.07	-0.37
	(0.17)	(0.14)	(0.23)	(0.16)	(0.11)	(0.23)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.33	-0.12	-0.11	-0.38*	-0.50***	-0.03
	(0.24)	(0.25)	(0.30)	(0.20)	(0.16)	(0.42)
Birth weight	0.49***	0.71***	0.55***	0.51***	0.43***	0.42**
	(0.13)	(0.15)	(0.17)	(0.09)	(0.11)	(0.20)
BMI of the mother	-0.00	0.04**	0.02	0.00	-0.02	-0.04
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.11	0.09	0.03	-0.04	-0.23**	-0.37**
	(0.12)	(0.13)	(0.14)	(0.14)	(0.09)	(0.17)
More than a day after birth	0.01	0.42	0.10	-0.12	-0.28**	-0.20
	(0.19)	(0.26)	(0.30)	(0.14)	(0.14)	(0.24)
Still breastfed (ref: no)						
Yes	-0.03	-0.64***	-0.45**	0.06	0.25	0.68**
	(0.16)	(0.20)	(0.21)	(0.15)	(0.16)	(0.31)
Other children under the age of 5 (ref: no)						
Yes	0.03	0.19	-0.07	-0.11	-0.07	-0.17
	(0.12)	(0.16)	(0.16)	(0.10)	(0.08)	(0.19)
Birth order (ref: first child)						
Second child	-0.16	-0.32	-0.32*	-0.16*	-0.01	-0.10
	(0.14)	(0.21)	(0.18)	(0.10)	(0.09)	(0.20)
Third or more child	0.18	0.21	-0.12	-0.02	0.23	0.67**
	(0.17)	(0.26)	(0.22)	(0.17)	(0.14)	(0.34)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.08	0.06	-0.13	-0.12	0.17	0.40
	(0.18)	(0.14)	(0.17)	(0.14)	(0.26)	(0.25)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.15	-0.04	-0.25	-0.09	-0.43**	0.26
	(0.22)	(0.21)	(0.27)	(0.18)	(0.21)	(0.45)
2 years	0.19	-0.27	-0.13	0.15	0.51**	0.58
	(0.22)	(0.25)	(0.30)	(0.18)	(0.20)	(0.44)
3 years	-0.18	-0.42*	-0.22	-0.28*	-0.15	0.25
	(0.21)	(0.25)	(0.30)	(0.15)	(0.24)	(0.38)
4 years	-0.29	-0.38	-0.30	-0.14	-0.42**	-0.26
	(0.20)	(0.30)	(0.27)	(0.16)	(0.19)	(0.43)

Table B.3 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Constant	-1.47***	-4.86***	-2.75***	-1.56***	-0.06	0.91
	(0.53)	(0.76)	(0.62)	(0.41)	(0.44)	(0.87)
Observations	956	956	956	956	956	956
R^2	0.05	0.05	0.03	0.04	0.07	0.06
(c) Difference in son preference						
Sex child (ref: girl)						
Boy	-0.24	-0.42*	-0.34*	-0.32**	-0.31**	-0.24
	(0.16)	(0.22)	(0.18)	(0.16)	(0.13)	(0.25)
Difference in son preference (ref: both no)						
Both son preference	0.46	-0.01	0.38	0.69***	0.21	-0.29
	(0.37)	(0.239)	(0.73)	(0.22)	(0.34)	(0.24)
Only maternal son preference	0.13	-0.08	-0.52	0.02	0.36	1.75***
	(0.47)	(0.24)	(0.33)	(0.31)	(0.41)	(0.50)
Only paternal son preference	-0.02	0.039	-0.00	0.12	0.06	-0.40*
	(0.18)	(0.22)	(0.23)	(0.16)	(0.12)	(0.24)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.54	0.30	-0.25	-0.77**	-0.48	0.23
	(0.43)	(0.38)	(0.81)	(0.34)	(0.36)	(0.62)
Boy * only maternal son preference	-0.00	0.31	0.70	-0.07	-0.33	-1.44**
	(0.53)	(0.47)	(0.49)	(0.36)	(0.66)	(0.60)
Boy * only paternal son preference	-0.32	-0.15	-0.07	-0.37*	-0.50***	-0.03
	(0.27)	(0.32)	(0.32)	(0.21)	(0.17)	(0.50)
Birth weight	0.50***	0.77***	0.52***	0.51***	0.47***	0.47**
	(0.13)	(0.16)	(0.16)	(0.11)	(0.11)	(0.20)
BMI of the mother	-0.00	0.03***	0.02	0.00	-0.02*	-0.03*
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.09	0.08	0.14	-0.04	-0.30***	-0.37*
	(0.12)	(0.15)	(0.14)	(0.13)	(0.08)	(0.20)
More than a day after birth	0.01	0.34	0.08	-0.12	-0.34**	-0.12
	(0.19)	(0.25)	(0.23)	(0.14)	(0.15)	(0.29)
Still breastfed (ref: no)						
Yes	-0.04	-0.78***	-0.44**	0.03	0.23	0.74**
	(0.16)	(0.18)	(0.21)	(0.14)	(0.17)	(0.32)
Other children under the age of 5 (ref: no)						
Yes	0.02	0.15	-0.02	-0.11	-0.07	-0.19
	(0.12)	(0.15)	(0.16)	(0.09)	(0.07)	(0.19)
Birth order (ref: first child)						
Second child	-0.18	-0.28	-0.29	-0.15	-0.08	-0.23
	(0.14)	(0.20)	(0.18)	(0.10)	(0.09)	(0.19)
Third or more child	0.15	0.24	-0.11	-0.03	0.23	0.44
	(0.17)	(0.23)	(0.21)	(0.14)	(0.16)	(0.29)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.06	0.07	-0.15	-0.16	0.24	0.51**
	(0.18)	(0.20)	(0.17)	(0.13)	(0.27)	(0.24)
More than 24 months	-	-	-	-	-	-

Table B.3 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Age of the child (ref: 0 years)						
1 year	-0.15	-0.26	-0.20	-0.10	-0.36*	0.17
	(0.21)	(0.24)	(0.27)	(0.17)	(0.21)	(0.39)
2 years	0.20	-0.41	-0.10	0.15	0.52**	0.53
	(0.22)	(0.26)	(0.28)	(0.19)	(0.22)	(0.43)
3 years	-0.19	-0.56**	-0.17	-0.29*	-0.10	0.14
	(0.21)	(0.28)	(0.30)	(0.15)	(0.24)	(0.34)
4 years	-0.29	-0.50*	-0.22	-0.19	-0.36*	-0.39
	(0.19)	(0.27)	(0.28)	(0.15)	(0.21)	(0.40)
Constant	-1.53***	-4.71***	-2.74***	-1.50***	-0.16	0.73
	(0.52)	(0.68)	(0.68)	(0.54)	(0.47)	(0.83)
Observations	956	956	956	956	956	956
R^2	0.06	0.05	0.04	0.05	0.07	0.07

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table B.4 Full linear and quantile regression results of model 2 for WHZ

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
(a) Maternal son preference						
Sex child (ref: girl)						
Boy	0.27^{**}	0.41^{***}	0.24^{**}	0.24^{***}	0.15	0.51^{***}
	(0.11)	(0.15)	(0.11)	(0.09)	(0.13)	(0.19)
Maternal son preference (ref: no)						
Yes	0.09	-0.17	-0.01	0.30	0.11	0.44
	(0.30)	(0.59)	(0.47)	(0.32)	(0.25)	(1.43)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.08	-0.06	0.18	-0.29	-0.07	-0.44
	(0.34)	(0.73)	(0.48)	(0.33)	(0.38)	(1.45)
Birth weight	0.37^{***}	0.75^{***}	0.51^{***}	0.29^{***}	0.27^{*}	-0.11
	(0.12)	(0.17)	(0.10)	(0.09)	(0.14)	(0.20)
BMI of the mother	-0.00	-0.02	-0.01	0.02	0.03	0.02
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.18	-0.17	0.01	-0.22^{**}	-0.26^{*}	-0.28
	(0.11)	(0.16)	(0.10)	(0.11)	(0.15)	(0.27)
More than a day after birth	-0.48^{***}	-0.35	-0.18	-0.37^{**}	-0.74^{***}	-1.07^{***}
	(0.15)	(0.23)	(0.21)	(0.16)	(0.18)	(0.30)
Still breastfed (ref: no)						
Yes	-0.19	0.07	-0.29^{***}	-0.12	-0.20	-0.04
	(0.13)	(0.20)	(0.10)	(0.11)	(0.18)	(0.21)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.03	0.13	0.10	0.09	0.20
	(0.11)	(0.16)	(0.11)	(0.09)	(0.14)	(0.23)
Birth order (ref: first child)						
Second child	-0.06	0.09	-0.03	-0.02	-0.06	0.01
	(0.12)	(0.19)	(0.11)	(0.11)	(0.15)	(0.27)
Third or more child	-0.32^{**}	-1.05^{***}	-0.37^{***}	-0.28^{***}	-0.16	-0.36
	(0.15)	(0.33)	(0.12)	(0.11)	(0.18)	(0.32)
Interbirth interval (ref: no prior birth)						
24 months or less	0.10	0.18	0.12	0.22^{**}	0.02	0.04
	(0.16)	(0.32)	(0.16)	(0.11)	(0.21)	(0.20)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.39^{**}	0.77^{***}	0.26	0.25^{*}	0.23	0.18
	(0.16)	(0.24)	(0.20)	(0.14)	(0.22)	(0.26)
2 years	0.04	0.07	-0.04	0.10	-0.08	0.11
	(0.18)	(0.27)	(0.27)	(0.15)	(0.25)	(0.24)
3 years	0.05	0.39	0.06	-0.04	-0.14	0.54
	(0.20)	(0.41)	(0.22)	(0.18)	(0.22)	(0.39)
4 years	0.02	0.50^{**}	-0.12	-0.30^{*}	0.04	0.43
	(0.18)	(0.25)	(0.21)	(0.16)	(0.22)	(0.29)
Constant	-0.45	-3.20^{***}	-1.56^{***}	-0.55	0.09	1.76^{**}
	(0.54)	(0.72)	(0.45)	(0.40)	(0.66)	(0.78)

Table B.4 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05
(b) Paternal son preference						
Sex child (ref: girl)						
Boy	0.21	0.30	0.44**	0.24***	0.09	0.32
	(0.13)	(0.27)	(0.20)	(0.08)	(0.17)	(0.20)
Paternal son preference (ref: no)						
Yes	0.06	0.06	0.26	0.02	0.11	0.12
	(0.16)	(0.21)	(0.19)	(0.15)	(0.17)	(0.25)
Sex child * son preference (ref: girl * no)						
Boy * yes	0.09	0.10	-0.32	-0.02	0.12	0.13
	(0.22)	(0.40)	(0.24)	(0.22)	(0.27)	(0.31)
Birth weight	0.37***	0.78***	0.48***	0.28***	0.22	-0.07
	(0.12)	(0.21)	(0.15)	(0.07)	(0.14)	(0.16)
BMI of the mother	-0.00	-0.03	0.00	0.01	0.04**	0.02
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.19*	-0.12	-0.01	-0.22**	-0.26*	-0.44*
	(0.12)	(0.23)	(0.13)	(0.10)	(0.15)	(0.26)
More than a day after birth	-0.49***	-0.37	-0.18	-0.38***	-0.73***	-1.22***
	(0.15)	(0.30)	(0.20)	(0.14)	(0.22)	(0.32)
Still breastfed (ref: no)						
Yes	-0.19	0.14	-0.14	-0.13	-0.18	-0.20
	(0.14)	(0.25)	(0.14)	(0.10)	(0.17)	(0.16)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.00	0.07	0.11	-0.03	0.15
	(0.11)	(0.19)	(0.12)	(0.08)	(0.14)	(0.230)
Birth order (ref: first child)						
Second child	-0.06	0.19	-0.01	-0.02	-0.01	0.03
	(0.12)	(0.21)	(0.13)	(0.09)	(0.17)	(0.25)
Third or more child	-0.32**	-0.95***	-0.34**	-0.31***	-0.12	-0.27
	(0.15)	(0.32)	(0.15)	(0.09)	(0.18)	(0.35)
Interbirth interval (ref: no prior birth)						
24 months or less	0.10	0.03	0.07	0.23**	-0.02	0.12
	(0.16)	(0.27)	(0.22)	(0.09)	(0.21)	(0.18)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.38**	0.86***	0.36	0.25*	0.09	0.25
	(0.16)	(0.28)	(0.24)	(0.14)	(0.23)	(0.22)
2 years	0.03	0.22	0.15	0.10	-0.17	-0.11
	(0.18)	(0.35)	(0.29)	(0.15)	(0.24)	(0.21)
3 years	0.04	0.39	0.27	-0.04	-0.26	0.28
	(0.20)	(0.38)	(0.26)	(0.18)	(0.20)	(0.32)
4 years	0.02	0.55*	0.06	-0.32*	-0.06	0.17
	(0.17)	(0.32)	(0.25)	(0.17)	(0.23)	(0.25)

Table B.4 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Constant	-0.45	-3.15***	-2.02***	-0.53	0.26	1.98**
	(0.55)	(0.92)	(0.64)	(0.33)	(0.58)	(0.81)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.04	0.03	0.05
(c) Difference in son preference						
Sex child (ref: girl)						
Boy	0.25*	0.45***	0.37**	0.22***	0.16	0.47*
	(0.13)	(0.16)	(0.19)	(0.08)	(0.19)	(0.26)
Difference in son preference (ref: both no)						
Both son preference	0.26	-0.29	0.07	0.38	0.36	0.45
	(0.49)	(0.58)	(0.84)	(0.37)	(0.72)	(2.42)
Only maternal son preference	0.01	0.08	0.19	-0.23	0.02	2.23
	(0.38)	(0.93)	(0.57)	(0.24)	(0.25)	(2.23)
Only paternal son preference	0.02	0.08	0.32**	-0.03	0.00	0.08
	(0.16)	(0.26)	(0.15)	(0.15)	(0.19)	(0.23)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.05	0.48	0.04	-0.49	0.08	-0.36
	(0.54)	(0.60)	(0.85)	(0.43)	(0.79)	(2.52)
Boy * only maternal son preference	-0.15	-0.78	-0.01	0.29	-0.44	-2.17
	(0.46)	(1.38)	(0.69)	(0.26)	(0.43)	(2.27)
Boy * only paternal son preference	0.05	-0.16	-0.34*	0.09	-0.02	0.15
	(0.24)	(0.38)	(0.21)	(0.22)	(0.30)	(0.47)
Birth weight	0.37***	0.76***	0.49***	0.26***	0.31**	-0.15
	(0.12)	(0.18)	(0.13)	(0.04)	(0.15)	(0.24)
BMI of the mother	-0.00	-0.03	-0.00	0.01*	0.02	0.03
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.18	-0.17	0.02	-0.25***	-0.27*	-0.32
	(0.12)	(0.15)	(0.12)	(0.10)	(0.15)	(0.28)
More than a day after birth	-0.47***	-0.14	-0.18	-0.41***	-0.66***	-1.13***
	(0.15)	(0.24)	(0.18)	(0.13)	(0.20)	(0.28)
Still breastfed (ref: no)						
Yes	-0.20	0.21	-0.21*	-0.13	-0.25	-0.12
	(0.14)	(0.25)	(0.12)	(0.09)	(0.18)	(0.28)
Other children under the age of 5 (ref: no)						
Yes	0.11	-0.10	0.07	0.10	0.11	0.21
	(0.11)	(0.18)	(0.11)	(0.08)	(0.15)	(0.22)
Birth order (ref: first child)						
Second child	-0.07	0.12	-0.07	-0.05	-0.09	0.03
	(0.12)	(0.22)	(0.11)	(0.08)	(0.17)	(0.26)
Third or more child	-0.34**	-0.89***	-0.36***	-0.30***	-0.23	-0.33
	(0.15)	(0.24)	(0.13)	(0.09)	(0.17)	(0.32)
Interbirth interval (ref: no prior birth)						
24 months or less	0.11	0.29	0.13	0.23**	0.06	0.04
	(0.16)	(0.21)	(0.19)	(0.10)	(0.23)	(0.27)
More than 24 months	-	-	-	-	-	-

Table B.4 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Age of the child (ref: 0 years)						
1 year	0.38^{**}	1.03^{***}	0.34	0.28^{**}	0.11	0.10
	(0.16)	(0.31)	(0.22)	(0.12)	(0.23)	(0.37)
2 years	0.02	0.30	0.07	0.08	-0.03	-0.02
	(0.18)	(0.35)	(0.29)	(0.13)	(0.24)	(0.28)
3 years	0.03	0.54	0.21	-0.03	-0.24	0.41
	(0.20)	(0.42)	(0.23)	(0.17)	(0.23)	(0.41)
4 years	0.01	0.68^{**}	-0.00	-0.31^{**}	-0.03	0.33
	(0.18)	(0.31)	(0.23)	(0.15)	(0.24)	(0.39)
Constant	-0.48	-3.16^{***}	-1.78^{***}	-0.42	0.29	1.90^{*}
	(0.54)	(0.74)	(0.57)	(0.32)	(0.68)	(0.98)
Observations	956	956	956	956	956	956
R^2	0.06	0.09	0.05	0.05	0.03	0.05

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table B.5 Full linear and quantile regression results of model 3 for HAZ

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	-0.37***	-0.65***	-0.32**	-0.41***	-0.47***	-0.33*
	(0.13)	(0.16)	(0.14)	(0.10)	(0.11)	(0.18)
Maternal son preference (ref: no)						
Yes	0.29	-0.15	0.04	0.54	0.37**	0.46
	(0.34)	(0.29)	(0.46)	(0.39)	(0.21)	(0.99)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.13	0.60*	0.38	-0.41	-0.34	-0.28
	(0.37)	(0.33)	(0.51)	(0.41)	(0.27)	(1.02)
Type of place of residence (ref: rural)						
Urban	0.28*	0.55***	0.44**	0.38***	0.22*	-0.07
	(0.16)	(0.19)	(0.19)	(0.11)	(0.12)	(0.24)
Household wealth (ref: poor)						
Middle	-0.29	-0.36	-0.32	-0.14	-0.16	-0.35
	(0.18)	(0.50)	(0.20)	(0.15)	(0.13)	(0.25)
Rich	-0.28	-0.38*	-0.37*	-0.23*	-0.22*	-0.46*
	(0.18)	(0.20)	(0.21)	(0.12)	(0.13)	(0.26)
Mother working (ref: no)						
Yes	0.14	-0.03	0.12	0.21*	0.18	0.45*
	(0.15)	(0.20)	(0.18)	(0.13)	(0.15)	(0.19)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.13	0.22	0.35**	0.16	0.07	-0.11
	(0.13)	(0.17)	(0.14)	(0.11)	(0.11)	(0.19)
Dietary diversity met (ref: no)						
Yes	-0.05	-0.18	-0.13	-0.03	-0.01	-0.17
	(0.15)	(0.21)	(0.17)	(0.12)	(0.15)	(0.22)
Birth weight	0.50***	0.70***	0.50***	0.50***	0.52***	0.72***
	(0.13)	(0.16)	(0.14)	(0.10)	(0.13)	(0.18)
BMI of the mother	-0.00	0.03	0.00	-0.01	-0.02	-0.05***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.11	0.03	0.06	-0.03	-0.36***	-0.20
	(0.12)	(0.16)	(0.15)	(0.11)	(0.11)	(0.16)
More than a day after birth	-0.03	0.33	-0.01	-0.17	-0.32	-0.02
	(0.19)	(0.24)	(0.20)	(0.14)	(0.25)	(0.29)
Still breastfed (ref: no)						
Yes	-0.03	-0.62***	-0.55***	0.12	0.15	0.68***
	(0.17)	(0.18)	(0.20)	(0.12)	(0.17)	(0.21)
Other children under the age of 5 (ref: no)						
Yes	0.03	0.21	-0.07	-0.14	-0.06	-0.13
	(0.12)	(0.15)	(0.14)	(0.10)	(0.10)	(0.15)
Birth order (ref: first child)						
Second child	-0.2	-0.26	-0.39**	-0.21*	-0.19*	-0.15
	(0.14)	(020)	(0.16)	(0.11)	(0.10)	(0.18)
Third or more child	0.17	0.21	-0.21	0.03	0.22	0.56**
	(0.17)	(0.21)	(0.17)	(0.15)	(0.19)	(0.23)

Table B.5 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Interbirth interval (ref: no prior birth)						
24 months or less	-0.08	-0.05	-0.14	-0.12	0.05	0.38*
	(0.18)	(0.23)	(0.16)	(0.14)	(0.26)	(0.21)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.13	-0.05	-0.41	-0.12	-0.35*	0.34
	(0.21)	(0.28)	(0.27)	(0.16)	(0.20)	(0.34)
2 years	0.21	-0.15	-0.28	0.12	0.46**	0.79***
	(0.22)	(0.28)	(0.28)	(0.18)	(0.22)	(0.28)
3 years	-0.20	-0.32	-0.50*	-0.31**	-0.21	0.21
	(0.21)	(0.35)	(0.30)	(0.16)	(0.23)	(0.27)
4 years	-0.28	-0.23	-0.47	-0.11	-0.41**	-0.29
	(0.20)	(0.29)	(0.30)	(0.16)	(0.19)	(0.29)
Constant	-1.61***	-4.59***	-2.18***	-1.52***	-0.24	0.53
	(0.52)	(0.73)	(0.60)	(0.46)	(0.51)	(0.67)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-
Model (b)						
Sex child (ref: girl)						
Boy	-0.22	-0.33	-0.05	-0.24*	-0.28*	-0.18
	(0.15)	(0.20)	(0.16)	(0.12)	(0.15)	(0.20)
Paternal son preference (ref: no)						
Yes	0.07	0.11	0.32	0.30*	0.07	-0.10
	(0.18)	(0.22)	(0.20)	(0.17)	(0.15)	(0.25)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.36	-0.37	-0.44	-0.54**	-0.53***	-0.38
	(0.24)	(0.31)	(0.28)	(0.21)	(0.20)	(0.38)
Type of place of residence (ref: rural)						
Urban	0.26	0.64***	0.49***	0.20*	0.14	-0.07
	(0.16)	(0.20)	(0.19)	(0.12)	(0.14)	(0.25)
Household wealth (ref: poor)						
Middle	-0.29	-0.42	-0.41**	-0.04	-0.01	-0.39
	(0.18)	(0.42)	(0.20)	(0.14)	(0.14)	(0.27)
Rich	-0.24	-0.36*	-0.38*	0.03	-0.18	-0.52**
	(0.18)	(0.21)	(0.21)	(0.13)	(0.14)	(0.27)
Mother working (ref: no)						
Yes	0.14	0.08	0.16	0.17	0.20	0.35*
	(0.15)	(0.21)	(0.15)	(0.11)	(0.14)	(0.21)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.14	0.24	0.34**	0.11	0.15	-0.14
	(0.13)	(0.17)	(0.14)	(0.10)	(0.11)	(0.19)
Dietary diversity met (ref: no)						
Yes	-0.03	-0.11	-0.13	0.02	0.05	-0.17
	(0.15)	(0.26)	(0.18)	(0.13)	(0.14)	(0.21)

Table B.5 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Birth weight	0.49***	0.67***	0.43***	0.49***	0.39***	0.69***
	(0.13)	(0.17)	(0.15)	(0.09)	(0.13)	(0.19)
BMI of the mother	-0.00	0.03	0.01	-0.02	-0.02	-0.04**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.11	0.03	0.01	-0.07	-0.18	-0.22
	(0.12)	(0.16)	(0.15)	(0.13)	(0.11)	(0.18)
More than a day after birth	-0.04	0.46*	0.03	-0.30**	-0.22	-0.09
	(0.19)	(0.25)	(0.23)	(0.13)	(0.20)	(0.34)
Still breastfed (ref: no)						
Yes	-0.02	-0.42*	-0.51**	0.07	0.31**	0.62***
	(0.16)	(0.22)	(0.20)	(0.14)	(0.16)	(0.23)
Other children under the age of 5 (ref: no)						
Yes	0.04	0.26	-0.11	-0.04	-0.07	-0.18
	(0.12)	(0.19)	(0.15)	(0.10)	(0.10)	(0.18)
Birth order (ref: first child)						
Second child	-0.18	-0.20	-0.36**	-0.17	-0.02	-0.12
	(0.14)	(0.24)	(0.16)	(0.10)	(0.11)	(0.20)
Third or more child	0.19	0.20	-0.21	0.09	0.39**	0.49*
	(0.17)	(0.26)	(0.20)	(0.15)	(0.18)	(0.29)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.08	-0.01	-0.19	-0.15	0.10	0.36
	(0.18)	(0.21)	(0.18)	(0.17)	(0.26)	(0.22)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.13	0.08	-0.31	-0.08	-0.27	0.12
	(0.22)	(0.3)	(0.25)	(0.18)	(0.23)	(0.35)
2 years	0.22	-0.09	-0.28	0.17	0.56**	0.63**
	(0.23)	(0.29)	(0.30)	(0.18)	(0.26)	(0.31)
3 years	-0.17	-0.35	-0.42	-0.28*	-0.04	0.06
	(0.22)	(0.36)	(0.28)	(0.16)	(0.27)	(0.30)
4 years	-0.28	-0.19	-0.41	-0.10	-0.31	-0.41
	(0.20)	(0.31)	(0.27)	(0.16)	(0.23)	(0.32)
Constant	-1.56***	-4.87***	-2.25***	-1.41***	-0.22	0.72
	(0.53)	(0.77)	(0.60)	(0.43)	(0.55)	(0.78)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-
Model (c)						
Sex child (ref: girl)						
Boy	-0.23	-0.46*	-0.11	-0.24*	-0.31**	-0.18
	(0.16)	(0.24)	(0.16)	(0.14)	(0.13)	(0.22)

Table B.5 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Difference in son preference (ref: both no)						
Both son preference	0.46	0.17	0.46	0.76***	0.39	-0.16
	(0.37)	(0.61)	(0.37)	(0.22)	(0.34)	(0.29)
Only maternal son preference	0.10	-0.39	-0.24	0.03	0.33	1.47***
	(0.48)	(0.66)	(0.39)	(0.49)	(0.36)	(0.30)
Only paternal son preference	0.02	-0.06	0.29	0.13	0.10	0.02
	(0.18)	(0.26)	(0.23)	(0.17)	(0.18)	(0.27)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.54	0.14	-0.20	-0.75**	-0.67*	-0.25
	(0.44)	(0.65)	(0.46)	(0.29)	(0.37)	(0.56)
Boy * only maternal son preference	-0.07	0.72	0.47	-0.11	-0.21	-1.30***
	(0.53)	(0.73)	(0.48)	(0.53)	(0.50)	(0.41)
Boy * only paternal son preference	-0.38	-0.22	-0.51	-0.47**	-0.60***	-0.41
	(0.27)	(0.35)	(0.35)	(0.22)	(0.22)	(0.49)
Type of place of residence (ref: rural)						
Urban	0.27*	0.65***	0.51***	0.24**	0.18	-0.06
	(0.16)	(0.21)	(0.18)	(0.12)	(0.13)	(0.21)
Household wealth (ref: poor)						
Middle	-0.30*	-0.41	-0.41*	-0.09	-0.08	-0.40
	(0.18)	(0.51)	(0.23)	(0.13)	(0.13)	(0.26)
Rich	-0.25	-0.28	-0.39*	-0.051	-0.28**	-0.58***
	(0.18)	(0.21)	(0.20)	(0.12)	(0.13)	(0.20)
Mother working (ref: no)						
Yes	0.12	-0.07	0.17	0.10	0.20	0.39*
	(0.15)	(0.18)	(0.17)	(0.12)	(0.15)	(0.23)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.15	0.22	0.37***	0.11	0.09	-0.07
	(0.13)	(0.20)	(0.14)	(0.10)	(0.10)	(0.17)
Dietary diversity met (ref: no)						
Yes	-0.04	-0.13	-0.10	0.029	-0.00	-0.12
	(0.15)	(0.29)	(0.17)	(0.11)	(0.17)	(0.20)
Birth weight	0.50***	0.68***	0.43***	0.49***	0.47***	0.69***
	(0.13)	(0.17)	(0.15)	(0.10)	(0.14)	(0.19)
BMI of the mother	-0.00	0.02	0.00	-0.0	-0.02	-0.05***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.09	0.00	0.11	-0.04	-0.17	-0.23
	(0.12)	(0.16)	(0.15)	(0.11)	(0.11)	(0.18)
More than a day after birth	-0.04	0.35	0.00	-0.20	-0.26	-0.03
	(0.20)	(0.29)	(0.20)	(0.14)	(0.21)	(0.37)
Still breastfed (ref: no)						
Yes	-0.03	-0.61***	-0.54***	0.07	0.23	0.63***
	(0.17)	(0.21)	(0.18)	(0.14)	(0.15)	(0.24)
Other children under the age of 5 (ref: no)						
Yes	0.03	0.21	-0.09	-0.06	-0.08	-0.16
	(0.12)	(0.16)	(0.14)	(0.10)	(0.10)	(0.17)

Table B.5 continued

Dependent variable HAZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Birth order (ref: first child)						
Second child	-0.19	-0.23	-0.39**	-0.16	-0.07	-0.18
	(0.14)	(0.21)	(0.17)	(0.11)	(0.10)	(0.18)
Third or more child	0.17	0.27	-0.24	0.05	0.33**	0.48*
	(0.17)	(0.24)	(0.17)	(0.15)	(0.16)	(0.26)
Interbirth interval (ref: no prior birth)						
24 months or less	-0.06	0.05	-0.10	-0.17	0.17	0.41*
	(0.18)	(0.27)	(0.16)	(0.15)	(0.24)	(0.22)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	-0.13	-0.07	-0.33	-0.07	-0.17	0.09
	(0.21)	(0.29)	(0.26)	(0.17)	(0.24)	(0.34)
2 years	0.23	-0.17	-0.23	0.19	0.65***	0.69**
	(0.22)	(0.28)	(0.29)	(0.19)	(0.25)	(0.30)
3 years	-0.18	-0.39	-0.42	-0.28*	0.01	-0.02
	(0.21)	(0.41)	(0.29)	(0.16)	(0.25)	(0.29)
4 years	-0.27	-0.28	-0.43	-0.13	-0.23	-0.38
	(0.20)	(0.32)	(0.28)	(0.16)	(0.23)	(0.33)
Constant	-1.63***	-4.55***	-2.34***	-1.52***	-0.45	0.73
	(0.52)	(0.80)	(0.59)	(0.50)	(0.53)	(0.73)
Observations	956	956	956	956	956	956
R^2	0.06	-	-	-	-	-

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).

Table B.6 Full linear and quantile regression results of model 3 for WHZ

Dependent variable WHZ	**Linear**			**Quantile**		
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Model (a)						
Sex child (ref: girl)						
Boy	0.27**	0.33**	0.25*	0.25***	0.25***	0.28
	(0.11)	(0.17)	(0.13)	(0.09)	(0.09)	(0.19)
Maternal son preference (ref: no)						
Yes	0.09	-0.45	-0.05	0.25	0.02	0.52
	(0.31)	(0.31)	(0.57)	(0.36)	(0.24)	(1.61)
Sex child * son preference (ref: girl * no)						
Boy * yes	-0.08	0.32	0.16	-0.21	-0.08	-0.44
	(0.35)	(0.51)	(0.59)	(0.38)	(0.33)	(1.63)
Type of place of residence (ref: rural)						
Urban	-0.11	-0.55**	-0.07	-0.02	-0.22	-0.04
	(0.14)	(0.23)	(0.19)	(0.12)	(0.16)	(0.22)
Household wealth (ref: poor)						
Middle	0.27	0.24	-0.06	0.16	0.49**	0.46
	(0.16)	(0.27)	(0.19)	(0.15)	(0.20)	(0.30)
Rich	0.07	0.44*	0.04	-0.01	-0.12	-0.37
	(0.16)	(0.25)	(0.20)	(0.14)	(0.18)	(0.25)
Mother working (ref: no)						
Yes	-0.02	0.01	-0.02	-0.04	0.09	0.24
	(0.13)	(0.18)	(0.12)	(0.12)	(0.14)	(0.22)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.08	0.29	0.19	0.05	-0.03	-0.17**
	(0.12)	(0.18)	(0.13)	(0.09)	(0.11)	(0.08)
Dietary diversity met (ref: no)						
Yes	-0.02	-0.06	-0.11	-0.01	0.08	-0.04
	(0.16)	(0.20)	(0.17)	(0.13)	(0.17)	(0.29)
Birth weight	0.36***	0.66***	0.46***	0.29***	0.32***	0.05
	(0.12)	(0.20)	(0.14)	(0.09)	(0.10)	(0.18)
BMI of the mother	-0.00	-0.03	-0.00	0.01	0.03**	0.03
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.17	-0.09	0.00	-0.15	-0.25**	-0.38
	(0.12)	(0.16)	(0.12)	(0.11)	(0.12)	(0.27)
More than a day after birth	-0.48***	-0.30	-0.19	-0.32**	-0.65***	-1.07***
	(0.15)	(0.27)	(0.19)	(0.16)	(0.13)	(0.32)
Still breastfed (ref: no)						
Yes	-0.18	0.05	-0.20	-0.10	-0.23*	-0.06
	(0.13)	(0.20)	(0.14)	(0.12)	(0.14)	(0.24)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.06	0.08	0.10	0.11	-0.05
	(0.12)	(0.17)	(0.12)	(0.10)	(0.11)	(0.19)
Birth order (ref: first child)						
Second child	-0.05	0.12	-0.03	0.00	-0.27**	-0.03
	(0.13)	(0.23)	(0.13)	(0.11)	(0.11)	(0.21)
Third or more child	-0.30*	-0.72**	-0.29*	-0.25**	-0.40***	-0.13
	(0.15)	(0.31)	(0.17)	(0.12)	(0.13)	(0.27)

Table B.6 continued

Dependent variable WHZ	**Linear**			**Quantile**		
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Interbirth interval (ref: no prior birth)						
24 months or less	0.11	0.12	0.11	0.18	0.14	0.01
	(0.17)	(0.25)	(0.25)	(0.12)	(0.15)	(0.20)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.39**	0.84***	0.38	0.29*	0.17	0.40*
	(0.17)	(0.28)	(0.24)	(0.16)	(0.20)	(0.24)
2 years	0.03	0.06	0.15	0.10	-0.07	0.21
	(0.19)	(0.30)	(0.29)	(0.17)	(0.15)	(0.24)
3 years	0.05	0.40	0.19	-0.01	-0.13	0.50*
	(0.21)	(0.37)	(0.26)	(0.19)	(0.21)	(0.29)
4 years	0.03	0.59**	-0.00	-0.26	-0.15	0.51
	(0.19)	(0.29)	(0.25)	(0.19)	(0.20)	(0.32)
Constant	-0.46	-2.63***	-1.65***	-0.65	0.10	1.43
	(0.55)	(0.82)	(0.60)	(0.42)	(0.49)	(0.91)
Observations	956	956	956	956	956	956
R^2	0.07	-	-	-	-	-
Model (b)						
Sex child (ref: girl)						
Boy	0.21	0.25	0.39**	0.26***	0.12	0.17
	(0.13)	(0.22)	(0.16)	(0.09)	(0.13)	(0.19)
Paternal son preference (ref: no)						
Yes	0.05	-0.12	0.17	-0.04	-0.06	-0.06
	(0.16)	(0.24)	(0.18)	(0.17)	(0.16)	(0.20)
Sex child * son preference (ref: girl * no)						
Boy * yes	0.10	0.22	-0.22	0.03	0.37*	0.50
	(0.22)	(0.35)	(0.22)	(0.23)	(0.21)	(0.33)
Type of place of residence (ref: rural)						
Urban	-0.11	-0.50**	-0.07	-0.00	-0.18	-0.06
	(0.14)	(0.25)	(0.16)	(0.12)	(0.16)	(0.21)
Household wealth (ref: poor)						
Middle	0.27*	0.17	0.00	0.15	0.49**	0.59*
	(0.16)	(0.25)	(0.18)	(0.14)	(0.24)	(0.31)
Rich	0.07	0.50*	0.06	-0.02	-0.16	-0.42*
	(0.16)	(0.27)	(0.18)	(0.13)	(0.17)	(0.22)
Mother working (ref: no)						
Yes	-0.01	-0.01	0.01	-0.05	0.11	0.11
	(0.13)	(0.20)	(0.13)	(0.11)	(0.15)	(0.24)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.06	0.27	0.19	0.06	-0.09	-0.14
	(0.12)	(0.18)	(0.12)	(0.09)	(0.11)	(0.17)
Dietary diversity met (ref: no)						
Yes	0.01	-0.17	-0.11	-0.01	0.11	-0.06
	(0.16)	(0.23)	(0.16)	(0.13)	(0.17)	(0.28)

Table B.6 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Birth weight	0.36***	0.81***	0.50***	0.30***	0.26**	0.08
	(0.12)	(0.21)	(0.13)	(0.09)	(0.11)	(0.20)
BMI of the mother	-0.00	-0.05	-0.00	0.01	0.04**	0.02
	(0.02)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.18	-0.13	-0.06	-0.15	-0.25**	-0.37
	(0.12)	(0.18)	(0.12)	(0.11)	(0.10)	(0.28)
More than a day after birth	-0.48***	-0.32	-0.17	-0.31*	-0.64***	-1.03***
	(0.15)	(0.33)	(0.17)	(0.16)	(0.15)	(0.32)
Still breastfed (ref: no)						
Yes	-0.18	0.05	-0.18	-0.09	-0.23*	-0.19
	(0.14)	(0.20)	(0.14)	(0.12)	(0.14)	(0.21)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.04	0.05	0.11	0.08	-0.02
	(0.12)	(0.20)	(0.12)	(0.10)	(0.12)	(0.18)
Birth order (ref: first child)						
Second child	-0.05	0.12	-0.01	-0.00	-0.22*	-0.13
	(0.12)	(0.26)	(0.12)	(0.11)	(0.12)	(0.22)
Third or more child	-0.29*	-0.75**	-0.27*	-0.25**	-0.31**	-0.15
	(0.16)	(0.30)	(0.17)	(0.11)	(0.14)	(0.28)
Interbirth interval (ref: no prior birth)						
24 months or less	0.10	0.08	0.09	0.17	0.10	0.14
	(0.17)	(0.26)	(0.23)	(0.12)	(0.14)	(0.22)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.38**	0.88***	0.38*	0.26	0.18	0.48**
	(0.17)	(0.27)	(0.23)	(0.17)	(0.23)	(0.22)
2 years	0.02	0.14	0.19	0.08	-0.20	0.05
	(0.19)	(0.33)	(0.26)	(0.17)	(0.15)	(0.25)
3 years	0.04	0.44	0.27	-0.04	-0.18	0.39
	(0.21)	(0.37)	(0.25)	(0.20)	(0.21)	(0.37)
4 years	0.02	0.68**	0.02	-0.28	-0.26	0.45
	(0.19)	(0.29)	(0.23)	(0.19)	(0.22)	(0.36)
Constant	-0.45	-2.82***	-1.87***	-0.65	0.21	1.74*
	(0.56)	(0.87)	(0.60)	(0.40)	(0.50)	(0.91)
Observations	956	956	956	956	956	956
R^2	0.07	-	-	-	-	-
Model (c)						
Sex child (ref: girl)						
Boy	0.24*	0.40**	0.37**	0.22*	0.12	0.13
	(0.13)	(0.20)	(0.18)	(0.11)	(0.12)	(0.24)

Table B.6 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Difference in son preference (ref: both no)						
Both son preference	0.26	-0.33	-0.01	0.41	0.33	0.14
	(0.49)	(0.40)	(1.02)	(0.26)	(0.55)	(2.50)
Only maternal son preference	0.0	-0.50	0.08	-0.25	-0.08	1.91
	(0.39)	(0.47)	(0.71)	(0.30)	(0.21)	(2.25)
Only paternal son preference	0.02	0.07	0.23	-0.10	-0.19	-0.07
	(0.16)	(0.34)	(0.18)	(0.16)	(0.14)	(0.21)
Sex child * son preference (ref: girl * both no)						
Boy * both son preference	-0.07	0.54	0.07	-0.56*	0.02	0.17
	(0.53)	(0.48)	(1.03)	(0.34)	(0.60)	(2.54)
Boy * only maternal son preference	-0.12	-0.05	0.07	0.35	-0.01	-1.83
	(0.46)	(1.10)	(0.77)	(0.32)	(0.37)	(2.28)
Boy * only paternal son preference	0.07	-0.07	-0.27	0.15	0.45**	0.58
	(0.23)	(0.48)	(0.23)	(0.24)	(0.19)	(0.42)
Type of place of residence (ref: rural)						
Urban	-0.10	-0.37*	-0.10	-0.05	-0.24	-0.07
	(0.14)	(0.22)	(0.16)	(0.12)	(0.15)	(0.22)
Household wealth (ref: poor)						
Middle	0.28*	0.35	-0.03	0.17	0.45**	0.61*
	(0.16)	(0.23)	(0.16)	(0.13)	(0.22)	(0.35)
Rich	0.08	0.32	0.08	-0.01	-0.10	-0.39
	(0.16)	(0.26)	(0.17)	(0.13)	(0.16)	(0.25)
Mother working (ref: no)						
Yes	-0.01	0.05	0.00	-0.05	0.10	0.09
	(0.13)	(0.17)	(0.12)	(0.10)	(0.14)	(0.26)
Mother educated (ref: secondary level at most)						
At least tertiary level	0.05	0.29	0.15	0.06	-0.12	-0.17**
	(0.12)	(0.17)	(0.13)	(0.09)	(0.11)	(0.08)
Dietary diversity met (ref: no)						
Yes	0.01	-0.08	-0.11	-0.05	0.12	-0.04
	(0.16)	(0.21)	(0.16)	(0.13)	(0.19)	(0.34)
Birth weight	0.36***	0.63***	0.51***	0.29***	0.27***	0.15
	(0.12)	(0.21)	(0.13)	(0.09)	(0.09)	(0.21)
BMI of the mother	-0.00	-0.03	-0.01	0.01	0.04**	0.02
	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)	(0.03)
Start of breastfeeding (ref: immediately)						
Within a day after birth	-0.18	-0.12	0.00	-0.18*	-0.25**	-0.32
	(0.12)	(0.17)	(0.12)	(0.11)	(0.10)	(0.29)
More than a day after birth	-0.46***	-0.19	-0.11	-0.39**	-0.58***	-0.10***
	(0.15)	(0.26)	(0.18)	(0.15)	(0.15)	(0.33)
Still breastfed (ref: no)						
Yes	-0.18	0.13	-0.24	-0.11	-0.24*	-0.17
	(0.14)	(0.22)	(0.15)	(0.11)	(0.13)	(0.25)
Other children under the age of 5 (ref: no)						
Yes	0.11	0.01	0.05	0.08	0.11	-0.02
	(0.12)	(0.18)	(0.13)	(0.10)	(0.12)	(0.21)

Table B.6 continued

Dependent variable WHZ	**Linear**	**Quantile**				
		0.10	**0.25**	**0.50**	**0.75**	**0.90**
Birth order (ref: first child)						
Second child	-0.06	0.13	-0.04	-0.03	-0.21^{*}	-0.14
	(0.12)	(0.21)	(0.13)	(0.11)	(0.11)	(0.23)
Third or more child	-0.31^{**}	-0.75^{***}	-0.32^{*}	-0.23^{**}	-0.36^{***}	-0.08
	(0.16)	(0.29)	(0.16)	(0.12)	(0.13)	(0.26)
Interbirth interval (ref: no prior birth)						
24 months or less	0.11	0.19	0.14	0.17	0.08	0.08
	(0.17)	(0.26)	(0.22)	(0.12)	(0.14)	(0.22)
More than 24 months	-	-	-	-	-	-
Age of the child (ref: 0 years)						
1 year	0.38^{**}	0.96^{***}	0.34	0.27^{*}	0.15	0.45
	(0.17)	(0.29)	(0.24)	(0.15)	(0.21)	(0.28)
2 years	0.02	0.12	0.13	0.09	-0.19	0.07
	(0.19)	(0.35)	(0.28)	(0.16)	(0.16)	(0.30)
3 years	0.03	0.43	0.23	0.02	-0.16	0.36
	(0.21)	(0.34)	(0.25)	(0.19)	(0.22)	(0.36)
4 years	0.02	0.67^{**}	0.01	-0.26	-0.23	0.46
	(0.19)	(0.32)	(0.25)	(0.17)	(0.22)	(0.41)
Constant	-0.48	-2.83^{***}	-1.79^{***}	-0.57	0.22	1.48
	(0.55)	(0.90)	(0.57)	(0.41)	(0.48)	(0.97)
Observations	956	956	956	956	956	956
R^2	0.07	-	-	-	-	-

Notes: Robust standard errors in parentheses. ***99% significance level ($p < 0.01$), **95% significance level ($p < 0.05$), *90% significance level ($p < 0.10$).