Courant Research Centre
'Poverty, Equity and Growth in Developing and Transition Countries: Statistical Methods and Empirical Analysis'

Georg-August-Universität Göttingen
(founded in 1737)

Discussion Papers

No. 251

Mothers' status, food price shock and Child Nutrition in Karnataka

Debosree Banerjee and Stephan Klasen

August 2018

Platz der Göttinger Sieben 5 · 37073 Goettingen · Germany
Phone: +49-(0)551-3921660 · Fax: +49-(0)551-3914059

Email: crc-peg@uni-goettingen.de Web: http://www.uni-goettingen.de/crc-peg

Mothers' status, food price shock and Child Nutrition in Karnataka

Debosree Banerjee, Stephan Klasen[1]

August, 2018

Abstract

Women's empowerment is increasingly put forth as a mean to promote child development. However, little empirical research has evaluated the pathways of women empowerment leading to it. This paper uses a household survey conducted in Karnataka, South India to explore the impact of female status on child anthropometric indicators aged below 11 years when food price shock occurs. We distinguish between exogenous status and endogenous status of women and argue that both are important to capture intrahousehold dimensions of women's empowerment. Endogenous status in our study is measured by mothers' work status and her time spent with children. Exogenous status is captured by a composite index constructed with parental educational gap, mother's age at marriage and years of marriage. Our finding suggests that endogenous status, measured by time reduces incidence of underweight, wasting and improves BMI significantly, but it is insignificant to affect weight for age scores. In the case of weight for age scores exogenous status becomes a significant determinant. Similarly, work which is another proxy for endogenous status has a positive impact on BMI and helps reducing incidence of wasting, but when considered together with time and exogenous status the significance vanishes. Time still remains significant to impact BMI, underweight and wasting. We therefore conclude that mothers' status, measured by time is more important to improve child nutritional status. Finally, our result suggests that the joint effect of time and exogenous variables are particularly crucial to improve child nutrition in households that are affected by a shock.

Keywords: Mothers' time and work, Child nutrition, Food price shock

JEL codes: I12, J13, J22, J13

Acknowledgements: We thank the German Research Foundation (DFG) for financial support via FOR2432 for this research.

[1] Banerjee: DFG research Unit FOR2432/1, University of Göttingen, Germany; Klasen: Department of Development Economics, University of Göttingen, Germany

I. Introduction

There is no consensus on a single definition of the widely employed term women's status. It has been associated with women's autonomy, empowerment and position in society and family (Mason 1986, 1993; Sen and Batliwala 2000; Pasternak, Ember, and Ember 1997; Smith et.al, 2003) and all of them can individually and jointly capture different aspects of women's status. Therefore, for a study explaining women's status it is especially important to clearly state what is meant by women's status. Our study defines women's status in terms of their endogenous power defined by their work status and her choice of time investments in child nourishment and exogenous power determined by an index of exogenous bargaining variables.

Our study aims to investigate the impact of women's status on children's nutritional attainments. Women with low educational attainments, lower income opportunities and relatively lower status in the community tend to have lower status in the household as well, which in turn affects the quality of care given to their children. Since women play a major role in maintaining household food security (Quisumbing et al. 1995) and household health environments (Hoddinott 1997), lower women's status reduces their decision making power in health and nutritional issues which then affects household's health outcomes. Therefore, understanding child health attainments requires an understanding of women's status in the household. In this paper, the relationship between women's status and child nutritional status are discussed with special emphasis on the time she invests in her children, her work status and her relative power position defined by exogenous variables. Analysing such relationships are crucial not because it brings to the forefront the issue of women empowerment, but also because it draws attention towards an important source of children's human capital accumulation. Failure to achieve adequate nutritional status of children would have dangerous consequences for their future developments. Hence, identifying the impact of women's status on child nutrition facilitates interventions by policy makers targeting women and child development.

This study sets out to answer following questions: First, if women's status an important determinant of child nutritional status, what are the pathways through which it operates? We explore three possible pathways- mother's time allocation for child care, her work status and an exogenously determined index of power of mothers. Since, time allocation is not the only endogenous variable which impacts child outcomes, mother's work status can also influence child nutrition; this study discusses the joint as well as individual effects of these variables. The extensive body of literature shows that mothers are increasingly engaged in paid labour force. Working mothers are unwilling to leave the labour market due to the income gains which creates potential conflicts between household responsibilities and employment[2], esp. if other childcare options (such as publicly provided child care) are not available or affordable. If time is crucial for children's health it is worthwhile to explore how time allocation by working mothers affects their children's nutritional status. However, in our estimation of the impact of time on nutrition we encounter the problem of indignity which we control by using instrumental variable analysis. Second, we also explore the importance of mothers' status when a food price shock occurs. In other words, our study also attempts to investigate the impacts of mothers' status on child nutrition when food price shock occurs and compare the same without incidence of shock.

Our results indicate that while endogenous status measured by mothers' time investment in children is significantly important for child nutrition, exogenous status does not always appear with significant

[2] Sivakami (1997) in her study discusses that that working women in India spend on average 1.7 hours less than the non-working women in childcare activities.

impact. Food price shock is on the other hand impact child nutrition negatively in all estimations. Comparing the households with and without shock experience, we find that mothers' status becomes more crucial to improve child nutrition especially during shocks.

In the section II we develop a conceptual framework for our research objectives. Section III describes the data, variable and descriptive strategy: section IV discusses our estimation strategy; section V provides a description of the estimation results; finally section VI concludes the study.

II. Conceptual framework:

Child Nutrition in India

Despite an unprecedented growth of the Indian economy during the last two decades, the proportion of underweight children has not improved much. According to National Family Health Surveys prevalence of underweight has reduced by 0.68 percentage points from NFHS-3(2005-06) to NFHS-4(2015-16). Overall, there has been a 16% decrease in the underweight prevalence among children below 5 years (NITI Aayog, 2016). Proportion of underweight children among children under 5 years has stagnated in states like Maharashtra, Goa, Karnataka, Uttar Pradesh and Rajasthan. However, reductions are observed in Himachal Pradesh (by 41.9%), Meghalaya, Mizoram, Arunachal Pradesh (by 40%), Tripura (by 39%) and Manipur (by 37.8%). Findings from NFHS-4 also highlight that there has been an overall increase in the levels of severe wasting to 7.5%. The level of severe wasting has increased in most of the States. The states which have witnessed a decrease in the level of severe wasting are Meghalaya, Madhya Pradesh, Tripura, Delhi, Himachal Pradesh, Bihar, Mizoram, Nagaland, Tamil Nadu and Jharkhand. States/UTs with the highest incidence of severe wasting are Daman & Diu (11.9%), Jharkhand (11.4%), Dadra & Nagar Haveli (11.4%), Karnataka (10.5%), Gujarat (9.5%) and Goa (9.5%). Interestingly, some of these states like Karnataka, Gujarat, and Maharashtra have witnessed a higher economic boom, but could not achieve much on their nutritional front (NITI Aayog, 2016). This clearly indicates the connection between growth and nutrition might not be as strong as it is thought to be (Deaton and Dreaze, 2009; Klasen, 2002; Vollmer et al, 2014). It further motivates our study to take up Karnataka as a special case which is relatively a better performing state with lower nutritional achievements of children.

Time allocation and child nutrition

We argue that mother's time allocation for child nourishment is a function of household demand function and depends on how individuals in the household reach a consensus about her time allocation. Considering the issue of women's time constraints, we further argue that women with lower status are likely to be more time constrained and cannot devote sufficient time for her children. Essentially, it is a consequence of placing a lower value of child care activities compared to her other domestic activities such as cooking, fetching water, fuel gathering and/or even her income generating activities. This is certainly not the case with men who are responsible primarily for income generating activities. This means women face higher time constraint than men. Also, this becomes even more crucial because men, in most cases, cannot substitute women for their care giving activities, and other options, such as publicly or privately provided childcare are unavailable or unaffordable (Engle, Menon, and Haddad 1999; Hobcraft 2000).

The decision to allocate time by mothers depends on how they view their child care activities. If child care is seen as a consumption good, by investing more time in children, mothers could receive direct utility. If child care is seen as an investment good for future income, then also increase in time investments by mothers with current period increases their utility in future period in terms of higher income received by their children. While consumption and investment motives of child care are purely altruistic in nature, if time for children is viewed as a substitution good for mothers' income possibilities and higher positive utility is derived from income earned in the current period, then there is a possibility that mothers' pecuniary motives will outweigh the altruistic motives of child care. However, the pecuniary motive might reduce time allocation by mothers, but alternatively it increases the scope to invest more in children's human capital development. The ultimate effect of mothers' time would depend on a complex interplay of labour force participation, time allocation and income.

Mothers' work and child nutrition

There is a substantial body of literature investigating role of women's employment on child nutrition. Most of these studies used anthropometric indicators such as, height for age and weight for age, weight for height, against international standards. Some studies use daily nutrient intakes to capture the nutritional status of children. However, no broad conclusion emerges from these studies on the effect of maternal employment on child nutrition.

For example, on the positive impacts Wolfe and Behrman, 1982 in Nicaragua finds that mothers who work in informal sector have slightly taller children than those who do not work. The result, however, does not hold for formal sector's female workers. Chutikal, 1986 finds in Thailand while in formal sector maternal employment is associated with higher height for age for children, the same does not hold true for informal sector workers. This finding is consistent with the fact that sometimes formal sector provides child care support to its workers. There are evidences of negative impacts as well. For example, Soekirman, 1985 finds a significant negative effect of maternal work only for children of mothers who work more than 40 hours a week and earn less than the minimum wage. Glick and Sahn, 1998, after controlling for mother's income, finds that predicted maternal employment hours (formal and informal) hours in urban Guinea had statistically equal negative effects on child height. Kumar, 1977 in rural Indian context, reported that Mothers who work in the field are likely to have malnourished children relative to mothers who are engaged in income earning activities at home, indicating that along with employment, types of employment matters for child nutrition. Popkin, 1980, on the other hand, finds no significant difference in nutritional status of children of mothers who works from home and who work outside home in the Philippines. Engle and Pederson 1989, in urban Guatemala finds negative impact maternal work for women who work as domestic workers for long hours and were very low paid. Therefore, hours of work and remuneration are two key variables important for child nutrition for working mothers. Again, there are evidences suggesting that at very young age, maternal work can have a negative impact on child nutrition as in early moths children need intense attention from their mothers. Haggerty, 1981 for Haiti as well as Engle and Pedersen, 1989 for Guatemala find that for children below 1 year maternal employment has negative effects on child nutrition, however for higher age the effect becomes positive.

These studies vary significantly with the method employed in the measurement of the impacts of mother's work on child nutrition and health. Also, they vary significantly with the types of controls they used in their estimations and socioeconomic background of the samples they chose to study. It is therefore not surprising that they also differ with respect to the magnitude and the signs of the estimated impacts of maternal work.

Exogenous status and child nutrition

We distinguish between women's exogenous and endogenous status. Women's exogenous status in our study is measured by the exogenous variables improving women status in the household. Intrahousehold factors used to calculate the index of exogenously determined index of women's status are mothers' age at marriage, parental years of education difference and years of marriage. These variables capture the channel that leads to improved women's status exogenously. These are combined into one single index using factor analysis to generate a gender index of exogenous women's status. Construction of such a gender index is not new. For example, studies by Kishor, 1999, 2000; Mason and Smith, 1999; Adato et al. (2000); Wolff, Blancb & Gage, 2000; Yount (1999) & Kabeer, 1999; Smith et.al, 2003) constructed a gender index to capture different dimensions of women's empowerment. Alkire et.al, 2013 constructed the Women's Empowerment in Agriculture Index (WEAI) to measure empowerment, agency, and inclusion of women in the agricultural sector. The index comprises two sub indexes. The first includes empowerment in decisions about agricultural production, access to and decision making power about productive resources, control of use of income, leadership in the community, and time allocation. The second sub index measures the percentage of women whose achievements are compared to the men in the households and, for women who are not equal, the relative empowerment gap with respect to the male in the household. While these studies have examined the index of women's decision making power to reach higher status, our primary focus is on maintaining the exogeneity of the index to the household decision making process. In other words, time allocation and work in our study attempt to proxy for the endogenous status and the index described above captures exogenous women's status. Few studies have used variables such as resources brought to the marriage, resources of the families of the spouses, inherited assets, and welfare receipts (Quisumbing and Maluccio 2003; Thomas, Frankenberg, and Sikoki 1999; Agarwal 1997) to capture exogenously determined women's status. Due to data limitation on these variables our index includes only mothers' age at marriage, parental years of education difference and years of marriage.

Food price hike and child nutrition

There is a large literature examining the impact of economic shocks on welfare in general, but impact on children has been relatively less studied. Few studies such as Yamano et al. (2005), Hoddinott and Kinsey (2001), Hoddinott (2006) established a negative relationship between economic shocks measured by agricultural shock, climate shocks and child health outcomes in Sub-Saharan countries. There are few more studies that could not establish any relationship between shock and child outcomes (e.g. Strauss et al., 2002).

Food price shock affects child anthropometric indicators by affecting both dietary quality and quantity. Household facing food price hike either reduces the food quantity in severe situation or compromises with quality to ensure accessibility by everyone. He and persistent food inflation emerged as a major concern in India, particularly after the drought in 2009. Food inflation reached its peak in late 2009 when it crossed 20%. In a country like India, where still more than 20% of the population live below the poverty line and consumes food below the subsisting level, sustained high food inflation has significant welfare implications. This makes it even more imperative to understand its causes and consequences under nutrition in India. Initially food inflation was attributed to poor agricultural performance, drought and its persistent negative effects and inefficient trade policies (Chand 2010; Nair and Eapen 2012). However, even after improvement in food production and introduction of set of macro policies to improve rural livelihood condition problem still persisted, which then calls for further understanding of the problem.

Hypotheses

As per the above discussion, we test the following hypothesis in our study.

First, time allocation by mothers positively affects children's anthropometric indicators, particularly when shock occurs

Second work has a positive impact on child anthropometry, particularly when shock occurs

Third, the exogenous status index has a positive impact on child anthropometric indicators

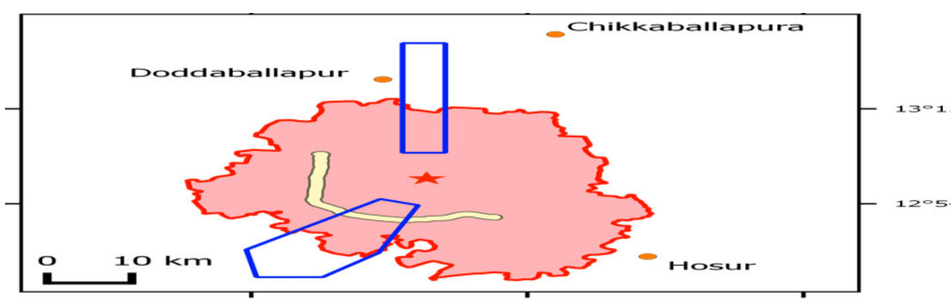
Fourth, food price shock negatively affects child anthropometry

III. Data, Variables, Descriptive Statistics

Data

Our data were collected from a survey conducted in the rural, urban interface of Bangalore in October, 2016 and March, 2017. Two transects were defined in the research. The Northern transect (N-transect) is a rectangular stripe of 5 km width. The Northern transect (N-transect) is a rectangular strip of 5 km wide and 50 km length, as shown in Figure 1. The lower part of this transects cuts into urban Bangalore, and the upper part contains rural villages. The Southern transect (S-transect) is a polygon covering a total area of ca. 300 km2. Then village list was constructed using Bhuvan 2D map of ISRO in both transects. Altogether, there were 93 villages and urban units in the N-transect and 98 in the S-transect defining the populations. In order to draw a stratified random sample from these populations, households were chosen as the stratification unit[3]. From each of these transects 600 households were selected randomly using stratified random sampling. From these households we analyse 574 children with age<11 whose anthropometric measures were noted down by the field investigators (for more details see Hoffmann et.al, 2017)

Figure 1: Sampling



Source: Hoffmann et.al, 2017

Dependent variables

Our sample consists of children and adolescents of age under 11. For children, anthropometric measures are typically based on height and weight and most standard indicators are height for age, weight for age and weight for height. Low height for age is referred to as stunting and low weight for height as wasting and low weight for age as underweight. Among these stunting is often thought to be a consequence of long term nutritional deprivation since birth, whereas wasting is more a consequence of immediate adverse conditions. On the other hand, low weight for age, representing underweight is a more appropriate anthropometric indicator for children as both stunted and wasted children are likely to fall

[3] This was preferred over administrative units because the classification of administrative units differs in the urban part of transect, which is under Bangalore city administration, and is sub-divided into various wards. Since urban wards are much bigger than rural administrative villages, this would cause inconsistencies in the same sampling frame.

in the category of underweight (Deaton and Dreaze, 2009). In our study we analyse four dependent variables: Weight for age z score (WAZ) and BMI categories (bcat) which is calculated from the age group between 2 and 10, incidence of underweight and wasting. -3<WAZ<-2 and WAZ<-3 is referred as moderate underweight and severe underweight respectively. Bcat is a categorical variables for children aged between 2 to 10 (Cole et. al, 2005, 2007) which take set of values {1,2, 3, -1, -2, -3} for obese, overweight, normal weight, grade 1 thinness, grade 2 thinness and grade 3 thinness, respectively. -3 <bcat<-2 and bcat<-3 is referred as moderate wasting and severe wasting respectively. Our study focuses on incidence of moderate plus severe underweight and wasting. Thus incidence of underweight in our study is defined by WAZ<-2 and wasting is defined by bcat<-2. Our data shows the prevalence of underweight (WAZ<-2) is around 24% and wasting (bcat<-2) 20.8%. Clearly, these numbers point to the extremely poor nutritional status of children in our study villages. An important point to be discussed here is BMI is generally used to capture the anthropometry of adults. However, Cole et. al, 2005, 2007 proposed cutoffs to provide internationally comparable prevalence rate of thinness in children and adolescents aged 2 to 18 years[4]. We focus on their proposed measurement to measure incidence of wasting and BMI of children.

A detailed description of our dependent variable is presented in the appendix in Table A. The table shows that gender difference exists only in underweight and wasting. It also shows that children in households reporting to have experienced food price shocks are nutritionally worse off than the children in household without food price shocks.

Independent variables

We examine the impact of mothers' time, work, the exogenously determined gender index, and incidence of food price shock on child anthropometry. Time is measured in terms of hours spent by mothers with their children. The Index is constructed using exogenously determined bargaining variables: mothers' age at marriage, years of marriage and the education gap from her husband in years. While the higher age at the time of marriage and years of marriage increase women power in the family, lower educational attainments than her husband reduces her power. With these three variables we constructed a gender index using factor analysis, which in our study captures the exogenously determined gender index of women's status. Finally, food price shock is measured by a dummy which takes 1 if any household have experienced food price shock in last 12 months[5]. One might be concerned with the degree of correlation between these variables. For example, as the gender index can affect mother's time as lower status of women could act as an impediment for mothers to spend more quality time with their children as empowered mothers are likely to participate more in the labour force. Similarly, food price shock can increase mother's time with their children due to lower dietary quality and resulting adverse health conditions among children. However, at this point we cannot assert such causation and propose to examine the only association between these three variables using a correlation matrix in Table1. Table 1 asserts the direction of association as we conjectured, but none of the correlations are very high. These allow us to use these variables together later in our estimations.

---

[4] BMI data were obtained from nationally representative surveys of children in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States. The thinness cutoffs correspond to equivalent adult BMI cutoff points endorsed by WHO of 16, 17, and 18.5 kg/m2. Theses cutoffs together provide definitions of grade 1, 2, 3 thinness in children and adolescents.

[5] Food price shocks are self reported shocks. This is possible that depending on the social economic status of the household same price have might have affected different households differently. That might be explaining why households in same locality are differently affected by food price changes. Also, it is possible that households engaged in food production have not suffered the shock.

Table1: Correlation between time index and food price shock

	Food price shock	Time	Index	Work
Food price shock	1			
Time	0.16	1		
Index	0.10	0.09	1	
Work	0.13	0.11	0.12	1

Looking at mothers' time allocation we find significant gender discrimination. On average, time allocation for daughters is 8 hours and for sons is 7 hours and the difference is significant at less than 10%. In Table 1 we also find that time allocated by mothers is significantly higher (at less than 1%) in households that have experienced food price shock (around 9 hours) than in the households without any food price shock experience (around 7 hours). This indicates lower nutritional and health status of children due to food price shock[6] necessitates higher time allocation by mothers. We additionally find that working mothers invest more time in children (1.7 hours more) which is opposite to our expectation. Further investigating the households we find that households which are not affected by food price shock, mothers' work status does not generate significant difference in the time allocated in children. However, food price shock makes mothers, especially working mothers, invest significantly more time in children to mitigate the shock effects. Working mothers probably can exercise a higher bargaining power over the time allocation in children and other household responsibilities than the nonworking mothers, making it possible for them to invest more time when food price shock occurs. This may explain why working mothers, on average, invest more time in children.

Table 2: Time allocation by mothers

	All	Shock=1	Shock=0	
Work	8.5	10.22	5.85	4.37***
No work	6.8	7.4	6.19	1.21**
Diff	1.74***	2.82***	-0.34	
Diff-in-diff				3.16***

Note: *** is significant at less than 1%; ** is significant at less than 5%; * is significant at less than 10%

Figure2 below plots the kernel density function of the gender index for daughters and sons separately. It shows that the distributions do not vary much. Mean of exogenous gender index of mothers is around 19 for both girls and boys. However, gender index for working mothers is significantly higher (mean is around 20) than that of non-working mothers (mean is around 19).

[6] Food price shock can affect negatively dietary quality and quantity which further affects children's health and nutritional status.

Figure2: Kernel density functions of index for child gender and by work status of mothers

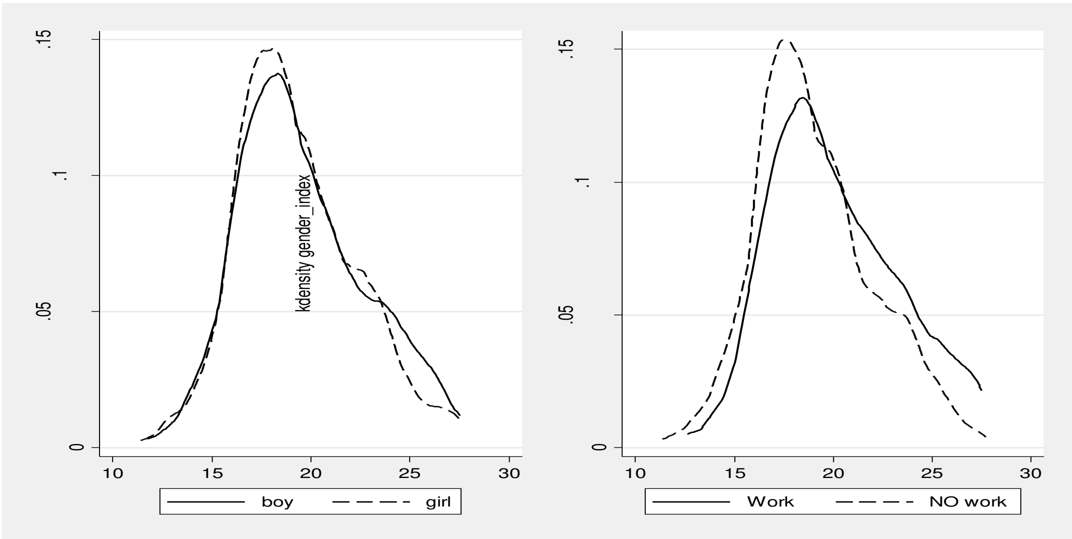


Table 3 discusses the summary statistics of other variables used in the study. It shows the proportion of working mothers is around 35%. 53% of the households in our sample have experienced a food price shock. Average age of children is 6.6 years and 51 % of them are male child, providing a gender balance in our sample. The average size of the household is 5 and dividing the households in five wealth Quintiles, we find on average these households belong to control 2. The wealth quintile is formed from a wealth index constructed from households' possession of durable and non durable assets, living conditions and household head education level. The number of children per mother is around 2 and mothers' age at first birth is 16, also their age at first marriage is 16. Average years of mothers' education are 8.04 years and that of fathers' is 7.9 years, but parental education gap is insignificant. A parental average year of marriage is 8.6 years.

Table2: Descriptive Statistics

Variable	Mean	Std. Dev.	Variable	Mean	Std. Dev.
Dependent variables			Independent variables		
WAZ	-0.96	1.83	Time	7.4	7.05
bcat	-0.48	1.26	Index	17.37	6.99
Moderate plus severe underweight	0.24	0.43	Food price shock	0.53	0.50
Moderate plus severe wasting	0.20	0.40	Working mothers	0.35	0.48
Index variables			Other variables		
Mothers' age at marriage	16.72	6.75	Age	6.64	2.66
Mother' years of marriage	8.6	7.09	Child sex (m=1)	0.51	0.50
Parental education gap (yrs)	-0.35	3.66	Hh mem no.	5.6	2.31
Mothers' education (yrs)	8.04	4.376	No. of living child	2	0.72
Fathers' education (yrs)	7.9	4.46	Mothers' age at first birth	16.75	8.34
			Wealth quintile	2.74	1.44

IV. Estimation strategy

This section provides details on our estimation strategy, identifying the determinants of time allocated by mothers and the impacts of time, index and food price shock on child anthropometric indicators: WAZ, bcat, the incidence of underweight and wasting. Hence, we are interested in estimating the following model:

$$N_{ij} = \alpha_0 + \alpha_1 T_{ij} + \alpha_2 I_{ij} + \alpha_3 FP_j + \alpha_4 X_{ij} + €_{ij} \ldots(1)$$

Where N_{ij} is the anthropometric indicators of child *i* in the *jth* household, T_{ij} is the hours spent with child i by mother and I_{ij} is the gender index of the mother of the *ith* child in the *jth* household. FP is the food price shock dummy, and *X* is a set of exogenous variables. The α's are the parameters to be estimated; and € is unobserved error terms.

OLS estimates of the parameters in the equation (1) are likely to be biased. In particular, time allocation by mothers is likely to be determined by a range of unobserved variables (e.g. health knowledge, intrahousehold decision-making) that might also affect anthropometric outcomes. If those unobserved variables correlate positively with anthropometric indicators as well as with time allocation, OLS estimates of α_1 in equation (1) are biased, since part of the estimated effect of time allocation on anthropometric indicators can be attributed to these unmeasured variables. Therefore, we need to account for potential endogeneity (from omitted variable bias) using instrumental variables.

Identification

We use fathers' years education and the proportion of working women in the village as instruments in our analysis. We base our first IV on the hypothesis that the higher the education of the father, the higher the awareness of the importance of mothers' time allocation for child nourishment, which then positively affects time investments by mothers. Also, higher education level of the father implies higher income opportunities for the household which then reduces the need for mothers' labour force participation facilitating her time allocation in children. Second IV, on the other hand, captures the empowerment level of women in the community as a whole. Higher labour force participation by women in the community indicates higher bargaining status, which then impacts positively mothers' time investments in children. Our data shows in 10.59% villages, women labour force participation is zero and interestingly in these villages, women, on average, spend 6.04 hours with their children, whereas in villages with positive labour force participation by women, mothers could invest around 7.07 hours. This difference is significant at less than 10% level.

The model that considers potential endogeneity of mothers' time investments can be specified as the following two stage models.

First Stage:

$$T_{ij} = \delta_0 + \delta_1 z_{ij} + \delta_2 X_{ij} + n_{it} \ldots\ldots(2)$$

Second Stages:

$$N_{ij} = \alpha_0 + \alpha_1 \hat{T}_{ij} + \alpha_2 I_{ij} + \alpha_3 FP_j + \alpha_4 X_{ij} + €_{ij} \ldots(1)$$

Where, $\hat{T}$ is the time, z is our set of instruments, and δ's are parameters to be estimated; and n are random error terms.

V. Results

In this section we present our estimation results. Total number of observations is 574 who are aged below 11. Table3 presents the OLS estimates of the determinants of endogenous status variables: mothers' time and work status, which also serve as the first stage of our regression. Model 1-3 presents the estimation of mothers' time and model 4 shows the estimation result of mothers' work.

Model1 controls only for the exogenous characteristics of mothers. Model 2 additionally controls for the impacts of gender index, food price shock and the instruments. Model3 controls for mother's work status, index and food shock along with the exogenous characteristics. In model 1 we find that child age is negatively associated with mothers' time as younger children need higher time and attention from their mothers. We also observe that there is a gender bias against sons as they seem to receive lower time than the daughters. It could be because mothers spend more time with daughters as they do housework together.

Age at first birth increases time with children as relatively higher age during the first birth indicates higher status of women in the family. However, if number of children is increased then time resources are thinly spread. This explains why number of living children exerts a negative impact in almost all the models. Finally, if a household belongs to a lower wealth quintile it reduces the availability of mothers' time as they might be investing some of their time in income generating activities for the household.

The gender index on the other hand has a negative impact on time with Model 2 showing the higher exogenous status allows women to increase leisure time, reducing available time for children. In Model 3, after controlling for mothers' work, significance of index disappears and work appears with a significantly positive impact on time. Food price shock increases time investments by mothers. It could be because of adverse health and nutritional consequences associated with lower dietary quality and quantity available to children, which in turn requires their mothers to invest more time in children. Both instruments used in the study, fathers' education and proportions of working women in the village, are significant and appearing with the expected signs.

Model 4 reports the estimation results of determinants of mothers work and shows that the variables which have significant and positive impacts on work status are proportion of working women in village and age of child. The proportion of working women in the community correlates positively with female mobility and autonomy and increases probability of mothers' work force participation. Again, young children require more time from mothers, therefore, as age of child increases mothers could avail more time to participate in the work force.

Table 3: Determinants of time and work

VARIABLES	(1) Time	(2) Time	(3) Time	(4) Work
Index		-0.16***	-0.07	0.005
		(0.046)	(0.056)	(0.005)
Food shock		1.58**	1.42**	0.04
		(0.677)	(0.692)	(0.053)
Work			3.37*	
			(1.848)	
Prop. working mothers in village		4.31**		0.93***
		(1.682)		(0.045)
Fathers' years of education		0.37***		-0.01
		(0.084)		(0.006)
Age	-0.69***	-0.62***	-0.72***	0.02**
	(0.117)	(0.118)	(0.128)	(0.007)
Child sex(m=1)	-1.33***	-1.32***	-1.33***	-0.01
	(0.432)	(0.406)	(0.425)	(0.032)
Hh mem no	-0.24*	-0.28**	-0.25**	-0.01
	(0.134)	(0.136)	(0.122)	(0.010)
No living children	-0.85**	-0.15	-0.80*	0.01
	(0.392)	(0.381)	(0.431)	(0.034)
Age at first birth	0.26***	0.26***	0.29***	0.00
	(0.039)	(0.042)	(0.052)	(0.004)
Wealth quintile	-0.71**	-0.34	-0.35	-0.02
	(0.279)	(0.262)	(0.261)	(0.017)
Constant	13.34***	8.31***	11.27***	-0.02
	(1.317)	(1.860)	(1.526)	(0.111)
Observations	574	574	574	574
R-squared	0.212	0.279	0.216	0.259

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1, Model 3 is an instrumental variable regression and endogeneity of mothers' work is controlled by proportion of working women in village and fathers' years of education and F-stat=223

Effects of status and shock on weight for age scores (WAZ) and incidence of underweight

In Table4 we present the results of determinants of weight for age z scores (WAZ). Our interest variables are mothers' time, work, the gender index and food price shocks. Model 5-8 estimate the impacts of these variables on WAZ and Model9-10 presents the estimation results for incidence of underweight, using a linear probability model. As explained before we look at moderate plus severe incidence of underweight[7].

Result of the instrumental variable analysis shows that in Model 5 when we do not control for the effects of the status index, work and food shocks time impacts positively WAZ. However, in model 6 once we additionally control for the index, significance of time disappears. Price shock and index are seen to affect WAZ significantly with expected signs. Model 7 controls for work, index and food shock and we could not establish any impact of work on WAZ. Model8 furthermore controls for all exogenous endogenous status variables. When considered together, exogenous status seems to impact WAZ

[7] Mothers' status and food price shocks do not impact significantly incidence of severe underweight among children.

significantly, but not the endogenous variables. In the absence of the index (exogenous status), time (endogenous status) becomes significant. On the contrary, for underweight dummy we find time significantly reduces incidence of underweight, while the index does not have any significant impact on it.

Food price shock on the other hand always found to have a detrimental impact on child nutrition measured in terms of WAZ and incidence of underweight.

Table 4: Instrumental variable analysis of determinants of WAZ

VARIABLES	(5) WAZ	(6) WAZ	(7) WAZ	(8) WAZ	(9) Underweight	(10) Underweight
Time	0.12*	0.07		0.05	-0.02*	-0.03**
	(0.063)	(0.053)		(0.057)	(0.012)	(0.013)
Work			0.51	0.35		0.05
			(0.414)	(0.486)		(0.098)
Index		0.07***	0.06***	0.07***	-0.00	-0.00
		(0.022)	(0.020)	(0.021)	(0.004)	(0.004)
Food shock	-0.32*	-0.34**	-0.27*	-0.33**	0.14***	0.14***
	(0.172)	(0.152)	(0.146)	(0.151)	(0.041)	(0.042)
Age	0.05	-0.01	-0.06**	-0.03	-0.00	-0.01
	(0.056)	(0.050)	(0.030)	(0.055)	(0.010)	(0.012)
Child sex(m=1)	0.17	0.11	0.01	0.08	-0.05	-0.06
	(0.213)	(0.189)	(0.166)	(0.192)	(0.047)	(0.048)
Hh mem no	0.05	0.06	0.05	0.06	-0.01	-0.01
	(0.048)	(0.048)	(0.045)	(0.048)	(0.010)	(0.010)
No living children	0.14	-0.03	-0.10	-0.06	0.01	0.00
	(0.129)	(0.126)	(0.126)	(0.123)	(0.027)	(0.026)
Age at first birth	-0.02	-0.04**	-0.02	-0.04*	0.01	0.01
	(0.015)	(0.019)	(0.014)	(0.020)	(0.004)	(0.004)
Wealth quintile	0.11	0.07	0.07	0.09	-0.02	-0.01
	(0.078)	(0.062)	(0.056)	(0.063)	(0.017)	(0.017)
Constant	-2.61***	-2.26**	-1.60***	-2.15**	0.40**	0.42**
	(1.008)	(0.880)	(0.506)	(0.859)	(0.193)	(0.195)
Observations	574	574	576	574	574	574
R-squared	-0.167	-0.027	0.016	-0.009	-0.085	-0.106
First stage						
F-stat :Time	9.2	11.30	221.59	11.30	11.30	11.30
F-stat :work				223.62		223.62

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1, VIF test of multicollinearity are all below 10 indicating absence of multicollinearity.

Table 5 estimates additionally controls for work-time interaction and shock index interaction. For WAZ results remain similar to that in the Table 4. Endogenous status (work and time and work interacted with time) still remain insignificant. Exogenous gender index, however, positively affects WAZ. However, looking at Incidence of underweight we find the index becomes insignificant and endogenous status measured by time, work and interaction of work-time have a significant impact on underweight. While time and work reduces the incidence of underweight, for working more mothers' time leads to higher underweight, counteracting the effect of working alone on underweight. In all the models food price shock negatively affect child nutrition measured by WAZ or Underweight dummy. Also shock and index interaction does not have any significant impact on WAZ and Underweight.

Table5: Interaction of work and time and shock and index

VARIABLES	(11) WAZ	(12) WAZ	(13) Underweight	(14) Underweight
Time	0.10	0.09	-0.07**	-0.06**
	(0.116)	(0.110)	(0.029)	(0.029)
Work	1.12	0.97	-0.51**	-0.49*
	(1.266)	(1.181)	(0.262)	(0.252)
Work*time	-0.11	-0.09	0.08**	0.08**
	(0.164)	(0.155)	(0.038)	(0.037)
Index	0.07***	0.05**	-0.01	-0.00
	(0.022)	(0.024)	(0.005)	(0.005)
Food shock	-0.30*	-1.06**	0.11**	0.24**
	(0.159)	(0.469)	(0.051)	(0.112)
Index*shock		0.04		-0.01
		(0.027)		(0.006)
Age	-0.02	-0.02	-0.01	-0.01
	(0.063)	(0.062)	(0.017)	(0.016)
Child sex(m=1)	0.08	0.06	-0.05	-0.05
	(0.193)	(0.188)	(0.056)	(0.056)
Hh mem no	0.08	0.08	-0.02	-0.02
	(0.061)	(0.058)	(0.014)	(0.014)
No living children	-0.05	-0.05	-0.00	-0.00
	(0.126)	(0.130)	(0.032)	(0.032)
Age at first birth	-0.04*	-0.04	0.01	0.01
	(0.023)	(0.023)	(0.006)	(0.006)
Wealth quintile	0.08	0.07	-0.01	-0.01
	(0.066)	(0.066)	(0.022)	(0.022)
Constant	-2.70*	-2.22*	0.82**	0.74**
	(1.455)	(1.348)	(0.374)	(0.370)
Observations	574	574	574	574
R-squared	-0.055	-0.029	-0.550	-0.514
First stage F-stat				
Time	8.55	8.28	8.55	8.28
Work	159.83	155.74	159.83	155.74
Work*time	12.43	12.15	12.43	12.15

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1; VIF test of multicollinearity are all below 10 indicating absence of multicollinearity.

Robustness check with BMI category and wasting

Table 6 presents the estimation results for bcat and wasting (moderate plus severe) for the children aged 2 to 10 years. Our sample size is 537. Looking at the endogenous status variables, time and work, we find that if considered separately time and work positively affects BMI categories and reduces incidence of wasting among children aged under 11. However, when considered together significance of work does not survive, but time still significantly improves child nutrition, measured by bcat and wasting. The exogenous status index is always insignificant. Food price shock has a negative impact on bcat and wasting.

Table 6: Determinants of incidences wasting and bcat

VARIABLES	(15) bcat	(16) bcat	(17) bcat	(18) Wasting	(19) Wasting	(20) Wasting
Time	0.11***		0.09**	-0.03**		-0.02**
	(0.034)		(0.036)	(0.011)		(0.012)
work		0.72***	0.45		-0.14**	-0.07
		(0.269)	(0.310)		(0.067)	(0.082)
Index	0.02	0.01	0.02	-0.00	-0.00	-0.00
	(0.013)	(0.012)	(0.012)	(0.004)	(0.004)	(0.003)
Food shock	-0.34**	-0.21	-0.34**	0.12**	0.08**	0.11**
	(0.154)	(0.133)	(0.145)	(0.047)	(0.037)	(0.046)
Age	0.09**	0.02	0.07*	-0.02**	-0.01	-0.02**
	(0.035)	(0.029)	(0.035)	(0.011)	(0.009)	(0.011)
Child sex(m=1)	0.21	0.09	0.18	-0.07*	-0.04	-0.07*
	(0.135)	(0.117)	(0.136)	(0.039)	(0.033)	(0.040)
Hh mem no	0.04	0.03	0.05	-0.01	-0.01	-0.01
	(0.029)	(0.027)	(0.029)	(0.009)	(0.008)	(0.009)
No living children	-0.04	-0.13	-0.06	-0.00	0.02	0.00
	(0.105)	(0.090)	(0.100)	(0.033)	(0.030)	(0.032)
Age at first birth	-0.03**	-0.00	-0.03*	0.01**	0.00	0.01**
	(0.013)	(0.010)	(0.013)	(0.004)	(0.003)	(0.004)
Wealth quintile	0.04	0.01	0.05	-0.01	0.00	-0.01
	(0.059)	(0.046)	(0.058)	(0.017)	(0.014)	(0.017)
Constant	-1.83***	-0.89**	-1.74***	0.55***	0.30***	0.53***
	(0.547)	(0.374)	(0.534)	(0.157)	(0.100)	(0.155)
Observations	537	537	537	537	537	537
R-squared	-0.177	-0.055	-0.130	-0.127	-0.018	-0.102
First stage F-stat						
Time	13.14		13.14	13.14		13.14
Work		220.61	221.18		220.61	221.18

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

We also estimate the impacts of interactions of work-time and index-shock on BMI and incidence of wasting (in Table A3 in appendix). However, the interaction terms never appears to be significant. Effect of time on nutrition remains positive and significant for both bcat and wasting.

Importance of mothers' status to mitigate food price shock effects

Table 7 below compares the joint impact of endogenous and exogenous status of mothers on child anthropometry for households that have and have not experienced shock in the last year. We have reported the full regression results in Table A3 in Appendix. This table shows that without shock, the importance of women's status measured by the joint effect of time and the index is insignificant, but in households with shock experience the joint effects become significant to impact the incidence of underweight wasting, WAZ and bcat. The same does not hold true for work. Work and index jointly affect bcat only when food price shock occurs. Otherwise, it remains insignificant during shock.

Table 7: Joint effects of mothers' status variable with and without food price shock

	Time+index		Work+index	
	Shock=1	Shock=0	Shock=1	Shock=0
Underweight	-.029 (0.012)**	-0.01844(0.057)	-0.069(0.10)	0.00(0.99)
Wasting	-0.03(.0129)**	-0.0254(0.034)	-0.136(0.10)	.09(0.11)
WAZ	0.14(.052)***	0.178(0.278)	0.733(0..54)	0.53(0.67)
bcat	0.15(0.035)***	0 .057(0.124)	0.58 (0 .34)**	0.70(0.47)

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

Since table 7 shows that along with index, time is more important than work to influence children nutritional status, when shock occurs. Let us now explore how does time impact nutrition jointly with index for working and nonworking others separately when food price shock is experienced by the household. Table 8 presents the estimation results for the joint impacts. We find that for working mothers' time and index mostly has a positive impact on all anthropometric indicators, except for wasting. For non working mothers also we find significant impacts of time and index for wasting and bcat. However, impact sizes always remains higher for working mothers. Therefore, working mothers are able to reduce the negative shock effects more than the nonworking others.

Table 8: Impact of time and index for working and nonworking mothers when food price shock occurs

	work=1	Work=0
Underweight	-.049 (0.02)**	-0.014(0 .019)
Wasting	-.031(0.024)	-0.03(.018)**
WAZ	0.27(0.098)***	.009(0.08)
Bcat	0.18(0.08)**	0.13 (0.05)***

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

VI. Conclusion

In this paper, using a primary survey conducted in Karnataka, South India, we aim at explaining the relationship between child anthropometric indicators and women's status in the presence of a food price shock. We argue women's status could be endogenous to the household and it has an exogenous element determined by exogenous female characteristics. Endogenous status in our study is measured by mother's time allocation in children and her work status. Exogenous status on the other hand, is measured by an index constructed by mothers' marital age, years of marriage and spousal education gap. All these exogenous characteristics of the mother are likely to improve women's intrahousehold status exogenously.

We find that while time positively affects child anthropometry measured by the incidence of underweight wasting and BMI categories, it does not have any impact on WAZ scores of children. Work status on the other hand, is found to improve child anthropometry, measured by BMI and wasting, when considered independent of time. Controlling for both time and work makes time an important determinant of child anthropometry and work becomes insignificant. This shows that work affects child nutrition through time, i.e. time is the transmission channel for mothers' work through which it improves child nutrition, measured by BMI and wasting. Like time, for work also we could not establish any impact of work on WAZ scores. Exogenous status index, on the other hand, considered together with time and/or work, impacts child nutrition measured by WAZ only; and it fails to impact incidence of underweight, wasting or BMI. We therefore conclude that impact of endogenous and exogenous status of mothers on child anthropometry is highly sensitive to the indicator we select to measure child anthropometry.

Our study also shows that food price shock always has a detrimental effect on child nutrition. By separating the households with and without shock experience in Table 7, we observe that joint effect of time and index is significantly important to affect child anthropometric indicators when food price shock occurs. The same does not hold true for the joint effect of work and index. Without shock, none of the joint effects (time-index and work-index) exert any significant impact. We, therefore, conclude that mothers' time is more crucial than her work for children's nutritional attainments. Exogenous status index jointly functions better with mothers' time than with work. Considered alone, it can only ameliorate weight for age scores.

Reference:

Adato, M., B. de la Brière, D. Mindek, and A. Quisumbing. 2000. The impact of PROGRESA on women's status and intrahousehold relations. Final report. Food Consumption and Nutrition Division, International Food Policy Research Institute, Washington, D.C.

Agarwal, B. 1997. "Bargaining" and gender relationships: Within and beyond the household. *Feminist Economics* 3 (1): 1–51.

Alkire, Sabina, Ruth Meinzen-Dick, Amber Peterman, Agnes Quisumbing, Greg Seymour, and Ana Vaz. "The women's empowerment in agriculture index." *World Development* 52 (2013): 71-91.

Behrman, J. R., & Wolfe, B. L. (1987). How does mother's schooling affect family health, nutrition, medical care usage, and household sanitation?. *Journal of econometrics*, *36*(1-2), 185-204.

Chand, R. (2010). Understanding the nature and causes of food inflation. *Economic and Political Weekly*, 10-13.

Chutikul, S. (1986). Malnourished children: An economic approach to the causes and consequences in rural Thailand. East-West Population Institute Paper No. 102. Honolulu, HI: East-West Center.

Cole, T. J., Faith, M. S., Pietrobelli, A., & Heo, M. (2005). What is the best measure of adiposity change in growing children: BMI, BMI%, BMI z-score or BMI centile?. *European journal of clinical nutrition*, *59*(3), 419.

Cole, T. J., Flegal, K. M., Nicholls, D., & Jackson, A. A. (2007). Body mass index cut offs to define thinness in children and adolescents: international survey. *Bmj*, *335*(7612), 194.

Deaton, A., & Drèze, J. (2009). Food and nutrition in India: facts and interpretations. *Economic and political weekly*, 42-65.

Engle, P. L., & Pedersen, M. E. (1989). Maternal work for earnings and childrens nutritional status in urban Guatemala. *Ecology of food and nutrition*, *22*(3), 211-223.

Engle, P., P. Menon, and L. Haddad. 1999. Care and nutrition: Concepts and measurement. *World Development* 27 (8): 1309–1337.

Glick, P., & Sahn, D. E. (1998). Maternal labour supply and child nutrition in West Africa. *Oxford Bulletin of Economics and Statistics*, *60*(3), 325-355.

Government of India (2016). All India survey of higher education (2015-16), Ministry of Human Resource Development of Higher Education, New Delhi

Government of Karnataka (2016). Men and Women in Karnataka 2015-16, Directorate of Economics and Statistics, Bangalore

Haggerty, P. A. (1981). *Women's work and child nutrition in Haiti* (Doctoral dissertation, Massachusetts Institute of Technology).

Hobcraft, J. 2000. The consequences of female empowerment for child well-being: A review of concepts, issues, and evidence in a post-Cairo context. In *Women's empowerment and demographic processes,* ed. H. Presser and G. Sen. Oxford: Oxford University Press.

Hoddinott, J. (2006). Shocks and their consequences across and within households in rural Zimbabwe. Journal of Development Studies, 42, 301–321.

Hoddinott, J. 1997. Water, health, and income: A review. Food Consumption and Nutrition Division Discussion Paper 25. International Food Policy Research Institute, Washington, D.C.

Hoddinott, J., & Kinsey, B. (2001). Child growth in the time of drought. Oxford Bulletin of Economics and Statistics, 63, 409–436.

Hoffmann, E.M.; Jose, M.; Nölke, N.; Möckel, T. Construction and Use of a Simple Index of Urbanisation in the Rural–Urban Interface of Bangalore, India. *Sustainability* 2017, *9*, 2146.

Kabeer, N. 1999. Resources, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change* 30 (3): 435–464.

Kishor, S. 1999. Women's empowerment and contraceptive use in Egypt. Paper presented at the Annual Meetings of the Population Association of America, March, New York.

Kishor, S. 2000. Empowerment of women in Egypt and links to the survival and health of their infants. In *Women's empowerment and demographic processes,* ed. H. Presser and G. Sen. Oxford: Oxford University Press.

Klasen, S. 2002. Malnourished and surviving in South Asia, better nourished and dying young in Africa: What can explain this puzzle? Sonderforschungsbereich 386: Analyse Diskreter Strukturen. Discussion Paper 214. University of Munich, Department of Economics, Munich, Germany.

Kumar, S. K. 1977. "Composition of economic constraints in child nutrition: Impact of maternal incomes and employment in low income households," Ph.D. Thesis, Cornell University.

Mason, K. 1986. The status of women: Conceptual and methodological issues in demographic studies. *The Eastern Sociological Society* 1 (2): 284–300.

Mason, K., and H. Smith. 1999. Female autonomy and fertility in five Asian countries. World Bank, Washington, D.C. Photocopy.

Mason, K.. 1993. The impact of women's position on demographic change during the course of development. In *Women's position and demographic change,* ed. N. Federici, K. Mason, and S. Sogner. Oxford: Clarendon Press.

Nair, S. R., & Eapen, L. M. (2012). Food price inflation in India (2008 to 2010): A commodity-wise analysis of the causal factors. *Economic and Political Weekly*, 46-54.

Nourishing India – National Nutritionalstrategy (2016), NITI Aayog, Government of India

Pasternak, B., C. Ember, and M. Ember. 1997. *Sex, gender, and kinship: A cross-cultural perspective. Upper Saddle River,* N.Y., U.S.A.: Prentice Hall.

Popkin, B. M. (1980). Time allocation of the mother and child nutrition. *Ecology of food and nutrition*, *9*(1), 1-13.

Quisumbing, A. R., L. R. Brown, H. Sims Feldstein, L. Haddad, and C. Peña. 1995. *Women: The key to food security.* Food Policy Report. Washington, D.C.: International Food Policy Research Institute.

Quisumbing, A., and J. Maluccio. 2003. Resources at marriage and intrahousehold allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economies and Statistics* 65 (3). 283–328.

Sen, G., and S. Batliwala. 2000. Empowering women for reproductive rights. In *Women's empowerment and demographic processes,* ed. H. Presser and G. Sen. Oxford: Oxford University Press.

Sivakami, S. (1997). Female Work Participation and Child Health: an Investigation in Rural Tamil Nadu, *India Health Transition Review*, 7(1):21-32

Smith, L. C., Ramakrishnan, U., Ndiaye, A., Haddad, L., & Martorell, R. (2003). The Importance of Women's Status for Child Nutrition in Developing Countries: International Food Policy Research Institute (IFPRI) Research Report Abstract 131. Food and Nutrition Bulletin, 24(3), 287-288.

Soekirman. (1985). *The Effect of Maternal Employment on Nutritional Status of Infants from Low-income Households in Central Java (Indonesia)*. University Microfilms.

Strauss, J., Beegle, K., Dwiyanto, A., Herawati, Y., Pattinasarany, D., Satriawan, E., Sikoki, B., Sukamdi, Witoelar, F., 2002. Indonesian Living Standards Three Years After the Crisis: Evidence from the Indonesia Family Life Survey. Unpublished Working Paper, RAND, Santa Monica, CA.

Thomas, D., E. Frankenberg, and B. Sikoki. 1999. The measurement of power and its implications for understanding intrahousehold decisionmaking. Prepared for the 1999 Population Association of America meetings, March 25–27, New York.

Vollmer, S., Harttgen, K., Subramanyam, M. A., Finlay, J., Klasen, S., & Subramanian, S. V. (2014). Association between economic growth and early childhood undernutrition: evidence from 121 Demographic and Health Surveys from 36 low-income and middle-income countries. The lancet global health, 2(4), e225-e234.

Wolff, B., A. Blanc, and A. Gage. 2000. Who decides? Women's status and negotiation of sex in Uganda. *Culture, Health & Sexuality* 2 (3): 303–322.

Yamano T, Jayne TS. Measuring the impact of working-age adult mortality on small-scale farm households in Kenya. World Development. 2004; 32(1):91–119

Yount, K. 1999. Persistent inequalities: Women's status and differentials in the treatment of sick boys and girls: Case study of Minia, Egypt. Ann Arbor, Mich., U.S.A.: University of Michigan Dissertation Services.

Appendix

TableA: Gender discrimination in anthropometric indiators

		All	Work=1	Work=0	diff	Food price shock=1	Food price shock=0	diff
	Boys	-0.95	-1.2	-.81	(**)	-1.08	-.791	
	Girls	-0.97	-.775	-1.07		-.96	-.97	
WAZ	diff							
	Boys	-0.43	-.5	-0.39		-.55	-.29	(*)
	Girls	-0.52	-.44	-0.57		.-51	-.53	
bcat	diff							
	Boys	.27	.33	0.17	(***)	.278	.18	(*)
	Girls	.23	.28	0.26		.32	.21	(*)
Underweight (moderate+severe)	diff			(**)				
	Boys	0.18	.20	0.23		.19	.16	
	Girls	.227	.21	.167		.254	.20	
Wasting(moderate+severe)	diff			(*)				

Note: *** p<0.01, ** p<0.05, * p<0.1

Figure A: Kernel density function of time allocated by mothers by child gender, mothers' work status and by food price shock dummies

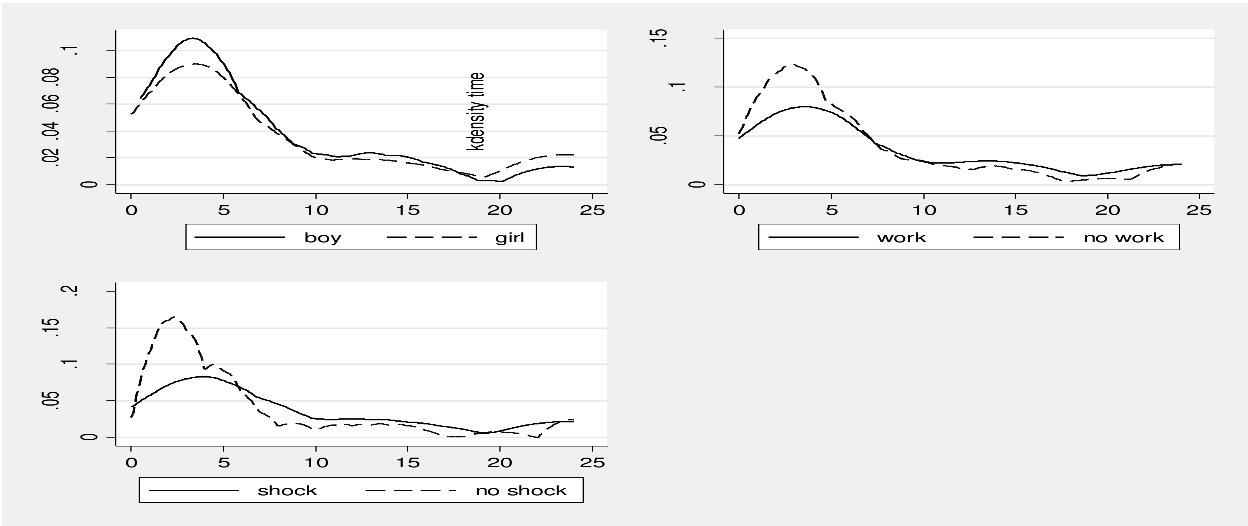


Table A1: OLS estimates of determinants of child anthropometry

VARIABLES	(1') WAZ	(2') WAZ	(3') underweight	(4') underweight	(5') bcat	(6') bcat	(7') wasting	(8') wasting
Time	-0.00		-0.00		0.02		-0.00	
	(0.010)		(0.003)		(0.010)		(0.003)	
Work		0.02		0.07*		0.01		0.01
		(0.155)		(0.037)		(0.111)		(0.035)
Index	0.06***	0.06***	0.00	0.00	0.01	0.01	-0.00	-0.00
	(0.021)	(0.021)	(0.004)	(0.004)	(0.012)	(0.012)	(0.004)	(0.004)
Food shock	-0.21	-0.23	0.10***	0.09***	-0.17	-0.15	0.07**	0.07*
	(0.156)	(0.153)	(0.035)	(0.034)	(0.124)	(0.126)	(0.035)	(0.036)
Age	-0.05*	-0.05*	0.01	0.01	0.04	0.03	-0.01	-0.01
	(0.030)	(0.029)	(0.007)	(0.007)	(0.029)	(0.030)	(0.009)	(0.009)
Child sex(m=1)	0.01	0.01	-0.02	-0.02	0.12	0.10	-0.04	-0.04
	(0.164)	(0.163)	(0.037)	(0.034)	(0.115)	(0.115)	(0.034)	(0.033)
Hh mem no	0.04	0.04	-0.00	-0.00	0.03	0.03	-0.00	-0.00
	(0.044)	(0.044)	(0.008)	(0.008)	(0.027)	(0.028)	(0.008)	(0.008)
No living children	-0.08	-0.09	0.02	0.02	-0.09	-0.11	0.01	0.02
	(0.129)	(0.129)	(0.026)	(0.027)	(0.089)	(0.087)	(0.029)	(0.029)
Age at first birth	-0.02	-0.02	-0.00	-0.00	-0.01	-0.00	0.00	0.00
	(0.014)	(0.015)	(0.003)	(0.003)	(0.010)	(0.010)	(0.003)	(0.003)
Wealth quintile	0.03	0.04	-0.00	0.00	-0.03	-0.04	0.01	0.01
	(0.048)	(0.048)	(0.012)	(0.013)	(0.040)	(0.039)	(0.013)	(0.012)
Constant	-1.36***	-1.42***	0.12	0.08	-0.77**	-0.60*	0.26**	0.23**
	(0.460)	(0.435)	(0.100)	(0.081)	(0.379)	(0.360)	(0.104)	(0.099)
Observations	574	574	574	574	537	537	537	537
R-squared	0.032	0.032	0.020	0.026	0.016	0.011	0.015	0.015

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

Table A2: Interaction effect of work time and index-shock on bcat and wasting

VARIABLES	bcat	Wasting
Time	0.12**	-0.03*
	(0.061)	(0.021)
Work	1.11	-0.26
	(0.701)	(0.225)
Work* time	-0.09	0.03
	(0.091)	(0.031)
Index	0.01	-0.00
	(0.014)	(0.004)
Food shock	-0.72**	0.16
	(0.365)	(0.118)
Index*shock	0.02	-0.00
	(0.020)	(0.006)
Age	0.06*	-0.02*
	(0.034)	(0.011)
Child sex(m=1)	0.16	-0.06
	(0.138)	(0.040)
Hh mem no	0.06*	-0.01
	(0.032)	(0.010)
No living children	-0.07	0.00
	(0.099)	(0.032)
Age at first birth	-0.02*	0.01**
	(0.013)	(0.004)
Wealth quintile	0.06	-0.01
	(0.058)	(0.017)
Constant	-1.89***	0.61***
	(0.724)	(0.206)
Observations	537	537
R-squared	-0.122	-0.104
First stage F-stat		
Time	8.84	8.84
Work	161.72	161.72
Work*time	12.90	12.90

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1

Table A3: Effect of time and index without and with food price shock

VARIABLES	uw	uw	wt	wt	WAZ	WAZ	bcat	bcat
Time	-0.02*	-0.02*	-0.03**	-0.03**	0.07	0.06	0.11***	0.11***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.053)	(0.052)	(0.034)	(0.034)
Index	-0.00	0.00	-0.00	-0.00	0.07***	0.06***	0.02	0.01
	(0.004)	(0.004)	(0.004)	(0.003)	(0.022)	(0.022)	(0.013)	(0.012)
Food shock	0.14***		0.12**		-0.34**		-0.34**	
	(0.041)		(0.047)		(0.152)		(0.154)	
Age	-0.00	-0.00	-0.02**	-0.03**	-0.01	-0.00	0.09**	0.09**
	(0.010)	(0.011)	(0.011)	(0.011)	(0.050)	(0.050)	(0.035)	(0.036)
Child sex(m=1)	-0.05	-0.05	-0.07*	-0.07*	0.11	0.10	0.21	0.21
	(0.047)	(0.047)	(0.039)	(0.039)	(0.189)	(0.188)	(0.135)	(0.134)
Hh mem no	-0.01	-0.00	-0.01	-0.01	0.06	0.05	0.04	0.04
	(0.010)	(0.009)	(0.009)	(0.009)	(0.048)	(0.048)	(0.029)	(0.029)
No living children	0.01	0.00	-0.00	-0.00	-0.03	-0.02	-0.04	-0.03
	(0.027)	(0.027)	(0.033)	(0.033)	(0.126)	(0.129)	(0.105)	(0.105)
Age at first birth	0.01	0.01	0.01**	0.01**	-0.04**	-0.04**	-0.03**	-0.03**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.019)	(0.019)	(0.013)	(0.012)
Wealth quintile	-0.02	-0.03	-0.01	-0.02	0.07	0.10	0.04	0.07
	(0.017)	(0.018)	(0.017)	(0.018)	(0.062)	(0.062)	(0.059)	(0.060)
Constant	0.40**	0.45**	0.55***	0.60***	-2.26**	-2.42***	-1.83***	-2.01***
	(0.193)	(0.203)	(0.157)	(0.161)	(0.880)	(0.894)	(0.547)	(0.549)
Observations	574	574	537	537	574	574	537	537
R-squared	-0.085	-0.090	-0.127	-0.132	-0.027	-0.030	-0.177	-0.185

Note: Robust standard errors are in parenthesis; *** p<0.01, ** p<0.05, * p<0.1