To Work or Not to Work? Child Stunting and Maternal Labour Supply in South Africa

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Abstract

Stunting is the most significant form of childhood malnutrition in South Africa. Childhood malnutrition is one of the leading cause of morbidity and mortality in young children. Mothers or a female adult in a household are mainly primary caregivers of children, especially if they need to be cared for at home. The study examines how stunting levels in children affect female labour force participation (FLFP). Data from the South African National Income Dynamics Panel Study (NIDS) was used. The preliminary univariate probit model result after controlling for the women's individual and household characteristics, it was observed that at a 5% level of significance there is a negative relationship between childhood stunting and FLFP. To improve maternal labour supply, the result indicates that policies towards reducing stunting in children will be of importance.

Keywords: Stunting, malnutrition, South Africa, labour supply, female Labour Supply

Introduction

Nutrition as a public health concern has increasingly gained recognition owing to its potential impact on health-related quality-of-life, both at the individual and societal levels (Asfaw, 2006; Lenoir-Wijnkoop et al., 2011; Friel, 2017). Stunting which refers to growth faltering or too short for one's age (Waterlow,1974; DeBoer et al., 2012, Martorell & Young, 2012), remains a significant leading nutritional disorder that affects mostly children below the age of five globally (Leroy & Frongillo, 2019) and in South Africa (Labadarios et al., 2008; Shisana et al., 2013). Since 1990, the global trend in stunting prevalence has decreased. The global number of children affected declined from about 39.7% in 1990 to 26.7% in 2010 (De Onis, Blossner & Borghi, 2012). In 2018, it decreased to an estimated rate of 21.9% (United Nations Children's Emergency Fund, UNICEF, 2019). In Africa, the rate was stagnant at approximately 40% between 1990 and 2010, which further decreased to roughly 30% in 2018 (UNICEF, (2019).

Shisana et al. (2013) comparing the National Food Consumption Survey-Fortification Baseline (NFCS-FB-I) of 2005 to the South African National Health and Nutrition Examination Survey (SANHANES, 2012) for children aged 1-3years, 4-6years, found that stunting increased from 23.5% (2005) to 26.5% (2012) amongst children aged one to three years, and decreased from 16.4% (2005) to 11.9% (2012) amongst children aged four to six years. Also, based on a report by Statistics South Africa (Stats SA, 2017) using the South African Demographic and Health Survey (DHS) data of 2016, of all the children below five years roughly 27% were stunted with the general increase amongst children aged between 1 and 3years. The highest rate of stunting was prevalent in male children (30%) than female children (25%) (Stats SA, 2017). It is generally noted that stunting is associated with poverty and poor socioeconomic and environmental conditions (Keino et al., 2014; De Onis & Branca, 2016).

Stunting is also associated with functional damage to the brain, resulting in a delay in the development of cognitive functions as well as permanent cognitive impairments (Kar, Rao, & Chandramouli, 2008). A direct outcome of the effect of stunting on cognition is a reduction in learning ability in school (Dewey & Begum, 2011; De Onis et al., 2013). Even though the direct cost of medical care ascribed to childhood stunting is well-known, little is known about its indirect costs (Elia, 2009). In particular, very little is known, primarily in the context of

developing countries about the influence of childhood stunting on maternal[1] labour force participation (MLFP). The limited understanding of the relationship between childhood stunting and MLFP is particularly true in the South African context.

In South Africa, female labour force participation rate (FLFPR), which was historically low as a result of apartheid policies, has increased substantially over the past two decades (Leibbrandt et al., 2010). While the participation rate for men rose by 10% between 1993 and 2008, that of women rose by 38% (Leibbrandt, Woolard, & De Villiers, 2009). Many factors may account for the feminisation of the South African labour force (LF) which includes amongst others the increase female educational levels, loss of male employment, low birth rates as well as higher number of female-headed households (Kingdon & Knight, 2008; Kabeer, 2012; Festus et al., 2015). Despite the increase in FLFP, the rate of male labour force participation still exceeds their female counterparts (Ackermann & Velelo, 2013). This is shown in table 1 below, where the rate of FLFP is lower than that of men for both 2018 and 2019 quarter 2 (Q2, April-June) and even lower than the national rate in both years respectively (Stats SA, 2019).

Table 1: Narrow and Expanded Labour Market Status by Gender

Labour Market Status	Male (%)		Female(%)		Total(%)	
Narrow Definition	Q2 2018	Q2 2019	Q2 2018	Q2 2019	2018	2019
Unemployment Rate	25.3	27.1	29.5	31.3	27.2	29.0
Employed/Absorption ratio	48.9	48.3	37.3	36.7	43.1	42.4
Labour Force Participation Rate	65.5	66.2	52.9	53.5	59.1	59.8
Expanded Definition						
Unemployment Rate	33.7	35.0	41.2	42.5	37.2	38.5
Employed/Absorption ratio	48.9	48.3	37.3	36.7	43.1	42.4
Labour Force Participation Rate	73.7	74.3	63.4	64.0	68.5	69.1

Source: Stats SA (2019), Quarterly Labour Force Survey, Q2

Given the country's high and persistent rates of childhood stunting, its direct effect on child health and the low level of FLFP, it is critical to explore the relationship between childhood stunting and FLFP. This study addresses this by answering the research question; How does high and persistent childhood stunting affect FLFP in South Africa? We hypothesised that the

[1] Maternal as used in this paper refers to women in the reproductive age (Ramakrishnan et al., 2012; Shukla et al., 2013). As such, maternal and female will be used interchangeably.

high rates of childhood stunting contribute to the low level of FLFP. The rest of the paper is organised along the following lines; the next section presents the literature review; this is followed by the data, analytical framework, results and discussions, and conclusion.

Literature Review

The neoclassical static theory of labour supply (LS) assumes that an individual's LS decision is based on a dichotomous choice between market work and leisure (Apps, 2003; Rapoport, Sofer & Solaz, 2011). As such, household production activities are subsumed within leisure time which is very broad (Benhabib, Rogerson & Wright, 1991; Mincer, 1962; Becker 1965). Mincer (1962) study on labour force participation (LFP) of married women which is a pioneer work on female labour supply (FLS) discredited the broad use of leisure time. Mincer (1962); Becker (1965) noted that an individual may not be doing market work but uses his/her non-market time to produce both goods and services which provides utility to the household.

Gender theorists proposed that in the labour market, the trade-off between a female's decision to participate involves choosing between paid work and unpaid household work which include inter alia caring labour (Mincer, 1962; Becker, 1965; Becker, 1981; Folbre,1995). Although fathers' time with children has increased in recent decades, research shows that mothers still do more child-related work at home, regardless of their work status and that fathers do not alter their time with children to make up for the time that mothers spend at work (Cawley & Liu, 2012). Other studies, for example, Jaumotte (2003) also showed that if the opportunity cost of working is lower or the elasticity of FLS to wages is greater than that of household production, then work will be preferred. Nevertheless, the decision to participate in the labour market has important implications for income distribution.

Individuals who do not participate in the labour market may not have direct access to wages (Braunstein, 2009; Schonfeldt et al, 2013). Access to direct income is very important particularly in the collective household models since individuals with direct access to economic resources will have more bargaining power as compared to those who do not contribute directly to the total income of the household (Agarwal, 1997; Basu, 2001). Therefore, consumption vectors, financial resources as well as well-being will be distributed in the contributor's favour (Blundell, Chiappori, & Meghir, 2005; Braunstein, 2009). As such, if a woman's contribution to household income is substantial, the distribution of household resources is more likely to be

skewed towards her (Braunstein, 2009), which leads to increase in her welfare which may spill over to her children (Schonfeldt et al, 2013).

Prolonged child malnutrition reduces the LS of their primary caregivers as a result of higher caring needs of the child (Ranis & Stewart, 2005; Spiess & Dunkelberg, 2009). Powers (1999) also noted that if the cost of childcare depends on the characteristics of the child, caregivers with higher childcare cost and therefore higher reservation wages are less likely to work. This greatly affects women particularly in areas with powerful cultural norms that assign women the principal responsibility of taking care of sick members of the household (Lewis & Lewis, 1977; Carpenter, 1980, Frijters et al., 2008; Spiess & Dunkelberg, 2009). Breslau et al. (1982) and Gould (2004) noted that the presence of a malnourished child in a household could also lead to an opposite effect on caregiver's work activity. The caregiver is faced with an additional financial burden due to health care requirements for the child and therefore may choose to enter the workforce or increase working hours (Cidav, Marcus & Mandell, 2012). Although LS may increase additional cost is incurred in the form of forgone leisure time or home production.

Both the traditional neoclassical theory of LS and the household production model predict that the presence of a stunted child in a household will negatively affect a woman's LFP as it will raise the woman's reservation wage or price of non-market time as a result of increased medical expenditure or caring time for the child's health. This relationship is expected to be particularly strong amongst adults (of the working-age population) with stunted children in their household. However, investigating the impact of stunting on maternal labour supply (MLS) is complicated by potential reversed causality and endogeneity problems. This shows ambiguity in the relationship and as such remains an empirical problem.

Many studies that investigated child nutrition and FLS (such as Glick & Sahn, 1998; Klesges et al., 1991; Fertig et al., 2009; Cawley & Liu, 2012; Datar, Nicosia & Sihier, 2014) looked at it from the angle of maternal work impacting on child nutrition. These studies suggested that maternal employment reduces maternal time to care for children which negatively affects their child's nutritional status. On the other hand, the employment status of a caregiver, for instance, the mother, can also impact positively on a child's nutritional status. Maternal employment can increase a household's income and improve a household's welfare. Thus, allowing households to escape from poverty and the threat of food insecurity (Negash et al., 2015; Rashad & Sharaf, 2019). These bi-directional relationships between child stunting and FLFP are likely to lead to

the endogeneity of malnutrition in a LS/LFP equation. Thus, the overall effect of stunting on LFP is, a priori, ambiguous. As such, predicting the direction of the relationship between child stunting and FLFP is not obvious, as the net effect of stunting will depend on which effect dominates. This study contributes to the literature by estimating the effect of child stunting on MLS.

Data source and variables

The data used was obtained from the National Income Dynamics Study (NIDS) panel. NIDS is the first nationally representative panel dataset of South African households, meant to track changes in the welfare of South Africans over time (Chinhema et al., 2016). The survey employs a stratified, two-stage cluster sample design. Stage one of the design included the selection of 400 primary sampling units (PSUs) from Statistic South Africa's Master Sample of 3000 PSUs in 2003 (Leibbrandt, Woolard & De Villiers, 2009). Information at the household and individual levels were collected by administering household and individual questionnaires[2]. This study made use of the most recent data which is wave5, 2017.

The main independent variable was the presence of a stunted child in a household; children with height/length-for-age Z-score (HAZ) <-2 standard deviation (SD) below the WHO Child Growth Standards median were categorised as stunted (WHO, 2006, 2007; Babu et al., 2016; Rachmi et al., 2016)[3]. A dummy variable was created with one representing the presence of a stunted child and zero otherwise. The key outcome variable FLFP is a dichotomous variable which takes one if the woman is in the labour force and zero otherwise. For the analysis, we used the internationally acceptable definition of LFP by the International Labour Organisation (ILO) and the South African government which is the narrow definition (Altman, 2003, Dinkelman & Pirouz, 2003; Oosthuizen & Bhorat, 2005). However, given that prior research (Kingdon & Knight, 2004; Oosthuizen & Bhorat, 2005) suggested that the broad definition of LFP is appropriate for South Africa it was used to check for robustness. LFP at the extensive margin was used. The other covariates are; grant from the government (as a proxy for non-labour income), location (rural/urban)[4], education (≥12 years of schooling), age, marital

[2] For more information about the data visit www.nids.uct.za.
[3] The NIDS data collects height and age of children.
[4] The NIDS data has for categories of location rural, tribal, urban and urban informal areas. In this analysis, the rural and tribal areas were grouped to form one category called rural areas, while the urban and urban informal areas were jointly classified as urban areas for simplification and international comparison.

status[5], self-accessed health (SAH)[6] was used as a proxy for health measures of the woman, race[7], presence of an employed male and household size. Table A.1 in the appendix provides description of the dummy variables used.

The sample was restricted to women aged 18-52years. The reason for this is that these women are within the reproductive and labour market age. Asian/Indian and White women were not included in the analysis due to their small sample size. The NIDS panel data set was analysed using STATA 14.0 statistical software. Although the data was analysed at an individual level we also controlled for some household characteristics. The Survey ('Svy') command was used to adjust for clustering (enumeration areas) and sampling weights.

Analytical Framework

This study used the standard participation model developed from the conventional neoclassical labour supply theory. The specification of the model follows the ideas from Sprague (1994) and Blundell and MaCurdy (1999). It should be noted that the neoclassical model of labour supply originates from Hicks (1946) consumer behaviour model. In accordance with Hicks formulation MLS is derived from a general model of consumer demand in which a fixed endowment of a commodity (time, T) is divided into two parts - one part for sale in the labour market and the other for direct consumption. Based on this, time (T) is divided between hours worked (h) and leisure (L), where L incorporates all non-market use of time (including home production). Hence, the woman is faced with a time constraint, T = h + L.

The model also assumes that she possesses a well-behaved utility function (U) that is defined over her consumption of commodities, C (it is assumed throughout the analysis that the relative price of C is constant, therefore, C represents a Hicksian composite commodity), vector of observed characteristics(X) and her hours of work, h. This can be expressed as,

$$U = f(C, X, h, \mu) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

[5] In NIDS there are five categories married and living with partner were categorised as married, while widow/widower, divorce or separated and never married were classified as single.
[6] In NIDS SAH has five categories Excellent, very good and good were grouped to indicate good health, while fair and poor were grouped to indicate poor health.
[7] There are four racial groups in South Africa: Africans (indigenous blacks), Coloured's (mixed ancestry), Asians/Indians (Indian ancestry) and Whites.

Where: X = individual characteristics (for instance, age and marital status)

μ = unobserved characteristics

The woman is also assumed to have a budget constraint, whereby the amount of money she has to spend on consumption expenditure (C) must be equal to the sum of income she received from labour and non-labour incomes (sum of asset and unearned income). This is expressed as;

$$pC = wh + N \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . (2)$$

where: w = wage rate (assumed fixed)

N = non labour income

p = price of the composite commodity.

Consumption and LS decisions can be thought of as complementary behaviours whereby the woman selects C > 0 and h ≥ 0 that maximises her utility (1) subject to the budget constraint (2). The resulting first-order conditions take the form;

$$U_c, C, X, h, \mu = \lambda \text{ and}$$
$$U_h, C, X, h, \mu \geq \lambda w \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (3)$$

Where λ is the marginal utility of income. The marginal rate of substitution between hours of work and the consumption of commodities is the ratio of these marginal utilities in (3). If the inequality in equation (3) holds strictly then the woman is not working (h=0) and L=T.

The woman's reservation wage, w_r is the slope of an indifference curve between commodity consumption and hours of work evaluated at h = 0. The wage, w_r, is such that $U_h, N, X, T, \mu \geq \lambda w_r$ below which the woman will not work and as such, the demand for leisure increases. Thus, the decision rule is that the woman will participate in the labour market if, the expected market wage offered (w_i) is greater than w_r. This is shown in equation (4) below

$$w_i \leq w_r = no\ participation$$
$$w_i > w_r = participation \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots (4)$$

The first wage (w_i) in (4) pertains to the market demand function while the second (w_r) refers to the individual's LS function (Killingsworth & Heckman, 1986). w_r which reflects the marginal rate of substitution between consumption and leisure which depends on non-labour income and personal characteristics such as tastes, marital status, race, age, the health status of the individual, ages and number of children, and child's nutritional status or health (Sprague, 1994). It can be written as:

$$w_r = W^* (M_i, N_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots .. (5)$$

Where M_i is a vector of observed characteristic and N_i is an unobserved parameter which summarises tastes. On the other hand, the market wage offered to the woman depends on human capital and personal characteristics such as education, work experience, age and unobserved parameters reflecting innate ability (Sprague, 1994). This is written as:

$$w_i = W(Z_i, \varepsilon_i) \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots . (6)$$

Where Z_i, is a vector of observed characteristics and ε_i the unobserved parameters reflecting innate ability. The formulation in (5) abstracts from institutional factors such as union membership and the industry or occupation type for the time being. Reason being that these factors affect wages and in the participation exercise the wage model cannot be used since the institution the woman will work is unknown at the time she is making her decision to participate in the labour market (Sprague, 1994). Theoretically, if we combine the explanatory variables in (5) and (6) the woman's LFP model is obtained whereby, she will participate in the labour market if any of these variables impact on the market demand and her LS functions according to rule (4). These conditions, show that the relevant determinants of LFP include non-labour income as well as observed and unobserved personal characteristics.

Model Specification

As mentioned above, the presence of a stunted child increases the financial and time constraints of their caregivers and, as such, their LS may increase or decrease. To estimate the effect of child stunting on MLS, we estimated the following equations:

Univariate Probit

Let LFP denoted as Y be a binary variable that takes the value one if the woman participates and zero otherwise. Assuming Y is a linear function of the presence of a stunted child (CS) and other covariates, the equation is as:

$$Y_i = \beta_0 + \beta_1 CS_i + \beta_2 E_i + \beta_3 H_i + \beta_4 F_i + \beta_5 A_i + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where i indexes individuals; β_0 is the intercept; β_1 to B_5 is the estimation parameter (measure of the impact of the variables on Y_i; E measures the woman's level of education; H measures health status; F measures family variables that affect the woman's decision to participate; and A reflects additional control variables that affect LFP like age, race, presence of an employed male, marital status and location; while μ_i is the unobserved variation also known as the error term. A univariate probit model can be used to estimate (7):

$$Y_i^* = \beta_6 CS_i + \beta_7 X_i + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Where X_i is a vector of observed characteristics (E, H, F, A) that affect Y_i^*. Y_i^* is a latent variable which cannot be observed directly. The observed outcome Y_i, for individual i is defined by the sign of the latent variable as follows:

$$Y_i = \begin{cases} 1 \text{ if } Y_i^* > 0 \\ 0 \text{ if } Y_i^* \geq 0 \end{cases} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

μ_i is normally distributed with mean $E[\mu_i] = 0$ and variance var $[\mu_i] = 1$. CS is a binary variable that takes the value one if the child is stunted and zero otherwise. Given that CS is a binary independent variable the marginal effect (ME) of having a stunted child in a household on the probability of LFP measures the sample average of the discrete change in CS, that is, how the predicted probability of participating change as CS changes from 0 to 1 while holding other variables (X) at their observed values:

$$ME = \frac{1}{n}\sum_{i=1}^{n}[\emptyset(\beta_6 CS_i + \beta_7 X_i \,|CS=1) - \emptyset(\beta_6 CS_i + \beta_7 X_i \,|CS=0)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

Where Ø is the standard normal distribution function, $Ø(\beta_6 CS_i + \beta_7 X_i)$ is the marginal predicted probability of participating in the labour force which is computed for all observations using the estimated coefficients, and n is the number of individuals in the sample.

Results and Discussion

Table 2: Descriptive statistics of variables used

Variables		N
LFP (%)	62.1	9406
Non-participation (%)	37.9	9406
Grant (mean)	1712.6	6628
Stunted child (%)	10.0	9631
No stunted child (%)	90.0	9631
18-24years (%)	23.6	9631
25-29years (%)	19.2	9631
30-34years (%)	18.1	9631
35-44years (%)	24.8	9631
45-52years (%)	14.2	9631
Matric+ (≥12 years of schooling) %	50.0	9577
Health status (Good) %	92	9414
Married (%)	31.6	9576
Rural (%)	37.5	9631
Urban (%)	62.5	9631
African	90.4	9629
Coloured	9.6	9629
Employed male	36.9	9631
No employed male	62.1	9631
Household size (mean)	6	9631

Source: Authors' calculation using NIDS wave 5

Based on a priori knowledge, it is expected that the presence of a stunted child in a household should negatively impact on FLFP since in most homes females are seen as primary caregivers (Kleven et al., 2009). Education is expected to have a positive impact on FLFP. The completion of higher education is more likely to lead to a higher probability of labour market participation (Borjas, 2009; Leibbrandt et al., 2012). The marital status of a woman can have two effects;

increase or decrease her LFP. For married women, LFP critically depends on the primary earnings and total income of the family and her bargaining strengths (Bourguignon & Chiappori, 1992; Agarwal, 1997; Gough & Killewald, 2011).

The presence of an employed male in a household may have a positive or negative effect on FLFP. In some cases, matching may occur between similarly employed husband and wife, while on the other hand, men with the assured jobs may discourage their wives or relatives from working because they feel their income will be sufficient enough to run the house (Majumder, 2012). Generally, job opportunities are more in urban areas than in rural areas. It is observed that those living in the rural areas are less likely to participate in the labour market compared to those in urban areas (Wittenberg, 2002; Mbatha & Roodt, 2014; Chatterjee, Murgai & Rama, 2015).

Age is also deemed as a potential confounder. At different ages women have different experiences, family responsibilities and working capabilities (Lee & Lee, 2013). The likelihood of participating in the labour market decrease with age (Sefiddashti et al., 2016) and this decrease may also result from age discrimination by employers (Riach & Rich, 2010; Ahmed, Andersson & Hammarstedt, 2012). Household size can either increase or reduce income and housework burdens. Thus, can have either a negative or positive effect on FLFP (Posadas & Vidal-Fernández, 2013; Compton & Pollak, 2014; Shen, Yan & Zeng, 2016; Garcia-Morán & Kuehn, 2017). Cash transfers like social grants also determine FLFP (Coetzee, 2013; Tanga & Gutura, 2013). Good health positively impacts on FLFP (Anderson & Grossman, 2009; Cai, 2010; Martin et al., 2011). The historical background of South Africa gives Coloureds higher advantage in the labour market (Van der Berg, 2010). Hence, it is expected to have higher LFP for Coloureds compared to Africans.

Table 3: Distribution of LFP across key background characteristics

Characteristics	Non Participant (%)[95% confidence interval]	Participant (%)[95% confidence interval]	Total (N)
18-24years	62.4[59.1-65.5]	37.6[34.5-40.9]	2638
25-29years	31.7[28.4-35.2]	68.3[64.8-71.6]	1686
30-34years	30.2[26.6-34.0]	69.8[66.0-73.4]	1517
35-44years	26.2[23.3-29.3]	73.8[70.7-76.7]	2099
45-52years	36.0[32.3-39.8]	64.0[60.2-67.7]	1463
African	38.4[36.6-40.1]	61.7[59.8-63.4]	8089
Coloured	33.6[28.6-39.1]	66.4[60.9-71.5]	1317
Rural	46.7[44.4-48.9]	53.3[51.1-55.6]	4662
Urban	32.5[30.3-34.7]	67.4[65.3-69.7]	4744

Source: Authors' calculation using NIDS wave 5

Table 3 reveals even without a regression analysis that as age increases LFP thus increase and then drops at an older age. As expected, the age groups 18-24years old and 45-52years have the lowest LFP compared to the other three age groups (the more active age groups). Also, the rate of participation of Coloureds compared to Africans and the urban area compared to rural area conforms with our a priori expectations.

Table 4: FLFP by child's nutritional category

LFP status	Nutritional status (%) [95% confidence interval]		Total (N)
	Child is stunted	Child not stunted	
Strict non-LFP	12.7[11.0-14.6]	87.3[85.4-89.0]	4047
Strict LFP	8.7[7.3-10.3]	91.3[89.7-92.7]	5359
Broad non-LFP	12.5[10.8-14.4]	87.5[85.6-89.2]	3829
Broad LFP	8.9[7.5-10.5]	91.1[89.5-92.5]	5577

Source: Authors' calculation using NIDS wave 5

The result in table 4 shows that for both the broad and narrow definitions of LFP there is a difference of approximately 4% between women in households with stunted children who did not participate in the labour market and those who did. This suggests that there is a positive relationship between better child nutritional status and FLFP.

Regression Results

When other controlled variables are not included in the model the result in table 5 reveals that there is a 95% chance that the presence of a stunted child in a household will negatively affect FLFP. Based on the ME the presence of a stunted children in a household will likely lead to approximately 11% change (decrease) in FLFP.

Table 5: The Effect of child stunting control on FLFP

Variables	Coefficient (Standard error)	ME (Standard error)
Stunted Child	-0.267**(0.039)	-0.106**(0.015)
Prob > chi2		0.000
Pseudo-R^2		0.004
Predicted probability		0.570
Number of Observation		9407

Source: Authors' calculation using NIDS wave 5, **p<0.05

Including other female and household characteristics into the model, it was observed that females in households with stunted children at less likely to participate in the labour force as seen in table 6. Holding all other variables constant the ME was statistically significant at 5% with about 4% chance of not participating in the LF. All other controls were significant at 5% except for the presence of an employed male in the household and household size that were insignificant at the conventional levels of statistical significance. In addition, the a priori expectations were met. For instance, age which was statistically significant and positive, LFP increased up to mid-forties and decreased subsequently at the age group 45-52years. This finding is similar to that observed by Ntuli and Wittenberg (2013) in their study on the determinants of black women's LFP in Post-Apartheid South Africa. Ntuli and Wittenberg (2013) found that those between the age group 15-19 years have a significantly higher LFP compared to those 55-59years old. Having at least a matric (≥12 years of schooling) was associated with approximately 14% increase in LFP. Income from government was associated with a reduction in LFP though the change was very small.

Self-reported health shows an estimate of 16% increase in LFP. The result also reveals a negative relationship between marriage and LFP. This supports Becker (1981) ideology on marriage and LFP which established that those who are single are more likely to participate in the labour market compared to married individuals. Ntuli and Wittenberg (2013) also found a

negative relationship between marital status and LFP. Compared to rural areas, LFP in urban areas is more likely to increase by roughly 7%. Furthermore, compared to Africans the probability of LFP increases by about 10% for Coloureds.

The linktest was used to test the fitness of the model. The _hatsq was insignificant at the conventional significant levels indicating that our model fits perfectly. The broad LFP was used to robust the model in table 6. The presence of a stunted child in the household was no longer statistically significant as well as the presence of an employed male and household size which also remained insignificant. This is shown in table A.2 in the appendix

Table 6: The effect of childhood stunting and other controls on FLFP

Variables	Probit	
	Coefficient (Standard error)	ME (Standard error)
Stunted child	-0.093**	-0.037**
	(0.045)	(0.018)
Grant	-0.000**	-0.000**
	(0.000)	(0.000)
25-29	0.693**	0.257**
	(0.048)	(0.016)
30-34	0.803**	0.291**
	(0.051)	(0.016)
35-44	0.955**	0.343**
	(0.049)	(0.014)
45-52	0.716**	0.262**
	(0.055)	(0.018)
Matric+	0.369**	0.144**
	(0.035)	(0.013)
Coloured	0.270**	0.105**
	(0.051)	(0.019)
Married	-0.154**	-0.061**
	(0.041)	(0.016)
Health status	0.408**	0.162**
	(0.058)	(0.023)
Urban Area	0.185**	0.073**
	(0.034)	(0.014)
Household size	-0.005	-0.002
	(0.006)	(0.003)
Employed male	0.048	0.019
	(0.037)	(0.015)
Number of Observations	6576	6576
Prob > chi2	0.000	0.000
Pseudo-R^2	0.087	0.087
Predicted probability		0.545

Source: Authors' calculation using NIDS wave 5, **p<0.05

Limitation

Although the might be endogeneity of childhood stunting, this could not be proven in this analysis due to the lack of an appropriate instrumental variable.

Conclusions

This paper has determined the impact of the presence of a stunted child in a household on FLFP. The results indicated that there is a negative association between the presence of a stunted child in a household and FLFP. The aforementioned discussion ascertains that females in households without a stunted child are more likely to participate in the labour force than those with. Hence, policies geared towards reducing childhood stunting will be an effective tool to increase FLFP significantly in South Africa.

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Appendix

Appendix A.1 Variables description

Variables	Description
18-24 years	1=Yes and 0 = Otherwise
25-29 years	1=Yes and 0 = Otherwise
30-34 years	1=Yes and 0 = Otherwise
35-44 years	1=Yes and 0 = Otherwise
45-52 years	1=Yes and 0 = Otherwise
Matric+	1=Yes and 0 = Otherwise
Health Status (good)	1=Yes and 0 = Otherwise
Married	1=Yes and 0 = Otherwise
Urban area	1=Yes and 0 = Otherwise
Coloured	1=Yes and 0 = Otherwise
Employed male	1=Yes and 0 = Otherwise

Table A.2: The effect of childhood stunting and other controls on broad FLFP

Variables	Probit	
	Coefficient	ME
	(Robut Standard error)	(RobustStandard error)
Stunted child	-0.060	-0.024
	(0.046)	(0.018)
Grant	-0.000**	-0.000**
	(0.000)	(0.000)
25-29	0.687**	0.249**
	(0.048)	(0.016)
30-34	0.786**	0.248**
	(0.051)	(0.016)
35-44	0.933**	0.328**
	(0.049)	(0.014)
45-52	0.694**	0.249**
	(0.055)	(0.017)
Matric+	0.316**	0.122**
	(0.035)	(0.013)
Coloured	0.291**	0.111**
	(0.051)	(0.019)
Married	-0.168**	-0.066**
	(0.041)	(0.016)
Health status	0.380**	0.151**
	(0.059)	(0.023)
Urban Area	0.137**	0.054**
	(0.034)	(0.013)
Household size	-0.001	-0.000
	(0.006)	(0.002)
Employed male	0.049	0.019
	(0.038)	(0.015)
Number of Observations	6576	6576
Prob > chi2	0.000	0.000
Pseudo-R^2	0.087	0.078
Predicted probability		0.571

Source: Authors' calculation using NIDS wave 5, **p<0.05