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# Son preference and multidimensional well-being

Mehwish Ghulam Ali, Ashton De Silva, Sarah Sinclair, and Ankita Mishra\*

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**Abstract:** *Son preference*, or desire by parents for male offspring, is a common gender bias that obstructs policy efforts towards the United Nations' Sustainable Development Goals on gender equality. The gendered nature of well-being calls for a multidimensional approach. Popular measures are often unidimensional and limited in capturing the granularity of intra-household gender disparities, which as evidence suggests often begin at home. Using the Pakistan Demographic and Health Surveys, this study examines the nuanced relationship between multiple dimensions of individual well-being and son preference, as captured via a novel measure of son preference called 'gender preference at birth' (GPB). Findings indicate that son preference, as measured by GPB, affects inter- and intra-household well-being in complex ways. Results indicate women and girls fare better overall in smaller households, despite the presence of son preference. However, larger gender gaps *within* these households suggest parents may be channelling any resource benefits to sons. These findings highlight the need for disaggregated analysis of son preference when devising well-being strategies for women and girls in Pakistan.

**Key words:** gender, fertility, multidimensional poverty, development economics, health economics

**JEL classification:** J13, I31, J16, I30, I32

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# 1 Introduction

Son preference presents a challenge in reducing gender inequality in well-being. The association between son preference and discriminatory practices against women and girls is well documented (Bongaarts and Guilмото 2015; Klasen 1994; Klasen and Wink 2002; Sen 1990; Yount et al. 2014). The relationship between gender and well-being has received much attention globally and it is generally accepted that women are more deprived than men in general (Muñoz Boudet et al. 2018, 2021). Even among the poor, female individuals are more likely to be deprived than their male counterparts (Olinto et al. 2013).

However, experiences in well-being by gender are more complex than simple empirical observations that women are poorer than men and hence require a deeper understanding of the mechanisms via which these experiences arise (Millar and Glendinning 1989).

A shift is required from popular unidimensional income or expenditure-based measures of poverty to a multidimensional approach. The former may ignore the dimensions of deprivations that women and girls are more likely to face. For example, studies find that girls are less likely to be born and if born are less likely to survive, receive an education, receive required medical treatment and live above the poverty level compared with boys (e.g., Das Gupta et al. 2003, 2009; Guilмото 2009, 2012; Guilмото and Tovey 2015; Milwertz 2008). Most unidimensional measures of poverty consider the household as a unit of analysis, often ignoring intra-household analysis, limiting their ability to capture inequalities arising within the household. Hence, a multidimensional and individual level approach is required for a better understanding of the effect of son preference on poverty.

The timing of son preference has received little attention in studies investigating the effect of son preference on poverty outcomes. Son preference can exist pre-birth in the form of sex-selective technologies and stopping rules or post-birth in the form of female infanticide or neglect of young daughters. Son preference pre-birth can be either *additive* or *substitutive* in nature to post-birth preferences, resulting in overestimation or underestimation of the effect of son preference on poverty. There is some evidence that pre-birth preference can increase or reduce overall discrimination against women and girls, depending on the context (Goodkind 1996, 1999; Kashyap 2019). Hence, to obtain an accurate depiction of the effect of son preference on poverty outcomes, it is important to distinguish and include both types of son preference.

In accordance with these issues, two gaps in the existing research were identified in this study. First, an individual level measure of poverty is required to differentiate outcomes by gender *within* households when investigating the effects of son preference on poverty. Second, differentiation between pre- and post-birth son preference is required while estimating poverty outcomes.

This study makes two important contributions to existing knowledge by addressing these research gaps. First, an individual level indicator for multidimensional poverty is developed using available person level data on health and education. An individual measure of poverty allows for differentiation of poverty outcomes by gender within households. Second, a distinction is made between pre- and post-birth son preference in the present study by using the 'gender preference at birth' (GPB) measure of son preference previously developed by the authors, where it was established that son preference leads to larger families and unwanted fertility (Ali et al. 2022). This study expands on those

findings to determine whether gender gaps in well-being arise from resource dilution because of larger families or discriminatory practices in resource allocation.

## 2 Literature review

Poverty needs to be viewed as a multidimensional concept rather than a unidimensional one and at the individual level when investigating son preference.<sup>1</sup> Unidimensional measures of poverty such as the International Poverty Line do not capture the variety of deprivations women and girls may face as a result of son preference.

Multidimensional poverty measures offer the potential for being gender sensitive. They have their theoretical foundations in the *capabilities approach* proposed by Sen (1984). Nussbaum (2001) pointed out that multidimensional measures of poverty offer greater potential for gender sensitivity than unidimensional approaches. The Multidimensional Poverty Index (MPI) is a popular approach developed by Alkire and Foster (2011). The MPI is the weighted average of deprivations faced by households in health, education, and standard of living, in line with the Human Development Index.

Deaton (1997) notes that poverty is an individual condition, hence, individual rather than household experiences in poverty are more relevant when investigating the impact of son preference. Bessell (2015: 228) notes, 'while households collectively suffer from poverty, [. . .] not all members of a household suffer in the same way or to the same extent'. Owing to the significance of intra-household inequalities for gender, individual poverty analysis becomes important (Alkire 2002; Alkire and Foster 2008 [2007]; Alkire et al. 2014, 2016, 2017; Atkinson 2003; Atkinson et al. 2002).

Despite their tangible benefits over unidimensional measures, multidimensional poverty measures are household level and hence mask intra-household gender differentials<sup>2</sup> (Bessell 2015; Pogge and Wisor 2016), even though most gender inequalities emerge within the household (Asfaw et al. 2010; Klasen and Lahoti 2016, 2021). By ignoring intra-household poverty, the incidence of overall poverty may be underestimated leading to biased social policies (Deaton 1989, 1997, 2018).

Few studies have assessed gender gaps using individual measures; however, some have focused on demographic subgroups for the whole population: children (e.g., Roche 2013; Rodríguez 2016; Roelen et al. 2010), women (e.g., Alkire et al. 2013; Bastos et al. 2009; Maduekwe et al. 2020), and adults (e.g., Agbodji et al. 2015; Bessell 2015; Mitra et al. 2013; Pogge and Wisor 2016; Vijaya et al. 2014).

A single measure of individual poverty would allow for poverty comparison across different demographic subgroups such as children and adults. The challenge in developing individual level indicators, as noted by Haddad and Kanbur (2001), is the difficulty of measuring how public goods in

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<sup>1</sup> For a detailed understanding of how GPB can affect poverty, refer to Ali et al. (2022).

<sup>2</sup> By construction, households that comprise both male and female members cannot contribute to a gender gap if at the household level the poverty of all members is considered equal (Wiepking and Maas 2005).

the household are shared by individuals. For some indicators, data are only available at the household level and hence cannot be disaggregated at the individual level.<sup>3</sup>

It is possible to construct an individual level measure using existing data and measures and exploiting some degree of variation. The global MPI developed by OPHI (Alkire et al. 2020b) uses data across the dimensions of health, education, and standard of living. Indicators in health and education are created from individual data before being aggregated for the household. Hence, it is possible to differentiate between individuals for these indicators. For example, the nutrition indicator in the global MPI is calculated by using individual information on malnutrition. Yet, in most multidimensional measures, poverty is calculated at the household level and then all individuals are assigned the same poverty as the household, making these estimates unreliable for individual analysis (Alkire et al. 2014, 2017; Alkire and Foster 2011; Chakravarty and Ana 2016). Assigning the same the poverty level to each member of the household can be unreliable depending on how indicators are used to assign deprivation status.

Deprivation can be assigned either in a *restrictive* or an *expansive* manner (Klasen and Lahoti 2016). Indicators for deprivation in health such as nutrition are restrictive in nature given that all members of the household are considered deprived if any one person is malnourished. As indicators for health for men tend to have better outcomes than that for women, this indicator may overstate deprivation in health for men. Conversely, indicators in education such as years of schooling tend to be expansive in nature; that is, no household member is considered deprived if at least one person in the household has completed five years of schooling. Education indicators for women tend to be worse than for men, hence this indicator would underestimate deprivation in education for women.

Finally, given that the MPI is an aggregate measure consisting of both restrictive and expansive indicators, using survey-based data to measure multidimensional poverty for different demographic groups may misconstrue the prevalence poverty.

### **3 An individual level measure for multidimensional poverty**

In this section, a framework for measuring multidimensional poverty at the individual level is provided using an approach similar to Alkire and Foster (2011), Espinoza-Delgado and Klasen (2018), and OPHI (2018). A list of common steps in calculating multidimensional poverty is provided (see Table 1). The list of notations specific to individual measures of multidimensional poverty proposed in this study is provided (see Table 2).

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<sup>3</sup> For example, the standard of living indicator is created by considering deprivations in electricity, water, fuel, durable goods, and housing. In the absence of data on how these resources are shared within the household, it is not possible to determine how these resources are allocated within households.

**Table 1: Steps for measurement of multidimensional poverty**

Step	Description
1	Identifying the unit of analysis
2	Identifying the dimensions for analysis
3	Choosing indicators for each dimension
4	Set deprivation cut-off
5	Apply poverty lines
6	Count the number of deprivations for each person
7	Set the second cut-off, $k$
8	Apply cut-off $k$ to obtain the set of poor persons
9	Calculate the poverty headcount, $H$
10	Calculate the average poverty gap, $A$
11	Calculate the adjusted headcount, $M_0$

Source: author's description based on OPHI (n.d.).

**Table 2: List of notations for measuring individual multidimensional poverty**

Variable	Definition
$n$	Total number of individuals
$j$	Indicator for each dimension of analysis
$d$	Total number of indicators
$x_{ij}$	Achievement of individual $i$ in indicator $j$
$z_{ij}$	Individual level deprivation cut-off for each indicator $j$
$g_{ij}$	Deprivation status for individual $i$ in indicator $j$
$w$	Weights that reveal relative importance of each indicator
$c_i$	Deprivation score for individual $i$ , which is obtained by adding the weighted deprivations
$k$	Minimum deprivation score of any individual to be classified as multidimensionally poor
$p_k$	Poverty classification, which identifies individual $i$ as poor when their deprivation score is at least $k$
$H$	Headcount ratio (i.e. number of poor individuals divided by total individuals)
$A$	Intensity of poverty (i.e. the average deprivation score across the poor)
$M_0$	Adjusted headcount, which is calculated as $H \times A$

Source: authors' description based on OPHI (n.d.).

**Step 1:** Identify the unit of analysis (i.e. the *individual* denoted by  $i$ ).

**Step 2:** Identify the dimensions for analysis (i.e. health, education, and standard of living).

**Step 3:** Choose indicators for each dimension. Let  $j$  represent the indicator for each dimension of analysis and  $d$  represent the number of indicators of poverty under analysis where  $d \geq 2$ .

**Step 4:** Set a deprivation cut-off for each indicator. This step establishes the first cut-off in the method. Every person is identified as deprived or non-deprived with respect to each indicator. Let  $x_{ij}$  represent the achievement of individual  $i$  in indicator  $j$  and  $x_{ij} \geq 0$  and  $z_{ij}$  represent the individual level deprivation cut-off for each indicator  $j$ . The  $i$ th individual is deprived in indicator  $j$  if  $x_{ij} < z_{ij}$ .

**Step 5:** Apply the poverty lines. Each individual's achievement  $x_{ij}$  is replaced with their status with respect to each cut-off. Let  $g_{ij}$  represent the deprivation status for individual  $i$  in indicator  $j$  such that

$$g_{ij} = \begin{cases} 1 & \text{if } x_{ij} < z_{ij} \\ 0 & \text{if } x_{ij} \geq z_{ij} \end{cases}$$

The process is repeated for all indicators in all dimensions.

**Step 6:** Count the number of deprivations for each individual. (Each dimension has been assigned equal weights and each indicator within each dimension has equal weights as well.) Let  $w = (w_1, \dots, w_d)$  represent the vector of weights that reveals relative importance of each indicator such that

$$w_j > 0 \text{ and } \sum_{j=1}^d w_j = 1$$

and  $c_i$  represent the deprivation score for individual  $i$ , which is obtained by adding the weighted deprivations such that

$$c_i = \sum_{j=1}^d w_j g_{ij}$$

If individual  $i$  is not deprived in any indicators,  $c_i = 0$ , conversely  $c_i = 1$  when the individual is deprived in all indicators.

**Step 7:** Set the second cut-off. Let  $k$  represent the second cut-off (i.e. minimum deprivation score of any individual to be classified as multidimensionally poor).

**Step 8:** Apply cut-off  $k$  to obtain the set of poor individuals and censor all non-poor data. Let  $p_k$  represent the poverty classification, which identifies individual  $i$  as poor when their deprivation score is at least  $k$ . Formally

$$p_k(x_i; z) = \begin{cases} 1 & \text{if } c_i \geq k \\ 0 & \text{otherwise} \end{cases}$$

**Step 9:** Calculate the headcount  $H$  by dividing the number of poor individuals ( $q$ ) by the total number of people ( $n$ ).  $H$  represents the incidence of poverty (i.e. multidimensional poverty headcount ratio):

$$H = \frac{q}{n}$$

**Step 10:** Calculate the average poverty gap,  $A$  (i.e. the average number of deprivations a poor individual suffers).  $A$  represents the intensity of poverty (i.e. the average deprivation score across the poor):

$$A = \frac{1}{q} \sum_{i=1}^q c_i(k)$$

**Step 11:** Calculate the adjusted headcount,  $M_0$ . If the data are binary or ordinal, multidimensional poverty is measured by the adjusted headcount,  $M_0$ , which is calculated as  $H \times A$ .



$M_0(x_i; z)$  represents the adjusted headcount ratio such that

$$M_0(X; z) = H \times A$$

Formally

$$M_0(X; z) = H \times A = \frac{q}{n} \frac{1}{q} \sum_{i=1}^q c_i(k)$$

To calculate multidimensional poverty at the household level a similar approach to Alkire and Foster (2011) has been followed:

Let  $h$  represent the number of households such that  $h=1, \dots, H$ ;  $z_{hj}$  represent the household level deprivation cut-off for each indicator  $j$ ;  $x_{hj}$  represent the achievement of household  $h$  in indicator  $j$  and  $x_{hj} \geq 0$ ; and  $g_{hj}$  represent the matrix of deprivations for household  $h$  in all indicators  $j = 1, \dots, d$ .

A deprivation cut-off is *restrictive* when the achievement of the least well-off household member or an overwhelming majority of household members is above the cut-off for the household to be non-deprived (i.e.  $g_{hj} = 1$  if  $\min(x_{hj}) \leq z_{hj}$  or zero otherwise), such that an entire household is considered deprived in nutrition if at least one member is malnourished.

The deprivation cut-off is said to be *expansive* when the achievement of any one individual or minority of individuals has to be above the threshold for all individuals in the household to be non-deprived (i.e.  $g_{hj} = 1$  if  $\max(x_{hj}) \leq z_{hj}$  or zero otherwise); such that an entire household is non-deprived in years of education if at least one household member has at least five years of schooling. Formally

$$g_{hj} = \begin{cases} 1 & \text{if } \min(x_{hj}) \leq z_{hj} \\ 1 & \text{if } \max(x_{hj}) \leq z_{hj} \\ 0 & \text{otherwise} \end{cases}$$

$c_h$  represents the deprivation score for household  $h$  such that

$$c_h = \sum_{i=1}^d w_j g_{hj}$$

The deprivation score  $c_i$  for individuals is considered identical within the household when multidimensional poverty is measured at the household level.

The motivation for this research stems from the hypothesis that  $c_i$  and  $c_h$  are not identical across gender (and age) subgroups because there is no perfect equality among household members. When deprivation cut-offs are defined restrictively at the household level the number of deprived individuals would be overstated such that health outcomes would be misidentified in this case. Conversely, when deprivation cut-offs are defined expansively, the number of individuals with deprivation would be understated such that education outcomes would be misidentified. The impact on  $M_0$  of the difference between  $c_i$  and  $c_h$  depends on whether the overstatement or understatement is larger.

## 4 Resource dilution as a result of pre-birth son preference

In this section, a numerical example is presented of how pre-birth son preference can result in resource dilution, particularly for women. The following assumptions are made: (1) the household will continue childbearing until a son is born; (2) after a son is born, the household will stop childbearing;<sup>4</sup> (3) the gender of a child at birth is random; (4) households will try a maximum of five times for a son, then stop.<sup>5</sup> In attempting to meet son targets, households may continue to have children until a son is born. The resulting implication is that larger households will have a higher proportion of daughters than sons. In Table 3, the implication of pre-birth son preference on gender composition in the household is formally presented in a numerical example.

**Table 3: Numerical illustration of son preference and gender composition of children in the household**

Percentage of households	In each household				
	Total children	Total sons	Total daughters	Proportion of sons	Proportion of daughters
50	1	1	0	100	0
25	2	1	1	50	50
12.5	3	1	2	33.3	66.7
6.25	4	1	3	25	75
3.125	5	1	4	20	80
3.125	5	0	5	0	100

Source: authors' calculations.

The implication of son preference on child well-being, as measured by resource allocation, is illustrated in Table 4. Assume that each household has US\$100 for health expenditure of children. In the absence of post-birth son preference, households allocate this amount equally among all children. As family size increases, expenditure per child declines. As households continue childbearing to meet son targets, the proportion of daughters in each household increases; because larger households spend less on each child and have a higher proportion of daughters, in aggregate terms, less is spent on girls, even without assuming post-birth son preference.

The numerical example has three theoretical implications. First, in the presence of pre-birth son preference, smaller families may have a significantly higher proportion of sons than larger families (see Table 3). Second, children in larger families may be worse off than their counterparts in smaller families (see Table 4). Third, even in the absence of gender bias in expenditure by households, expenditure on girls may be lower than on boys where there is GPB (see Table 4).

<sup>4</sup> If the total number of children in a household is  $n$ , then the proportion of daughters is  $n-(1/n)$  and proportion of sons is  $1/n$  (e.g., in a family of four children, the proportion of daughters is 0.75).

<sup>5</sup> This can be replaced by the total fertility rate for women in a particular area.

**Table 4: Illustrative example of son preference and household expenditure**

Percentage of households <sup>a</sup>	Total children in each household	Health expenditure per child (US\$)	Total sons in each household	Total daughters in each household	Total health expenditure in US\$ on sons <sup>b</sup> ('000)	Total health expenditure in US\$ on daughters <sup>c</sup> ('000)
1	2	3	4	5	6	7
50	1	100	1	0	5,000.00	0.00
25	2	50	1	1	1,250.00	1,250.00
12.5	3	33	1	2	412.50	825.00
6.25	4	25	1	3	156.25	468.75
3.125	5	20	1	4	62.50	250.00
3.125	5	20	0	5	62.50	312.50
Total expenditure in area					6,943.75	3,106.25

Note: <sup>a</sup>Assume total number of households ( $N$ )=100,000. <sup>b</sup>Total health expenditure on sons = expenditure per child  $\times$  total sons in each household  $\times N$ . <sup>c</sup>Total health expenditure on daughters = expenditure per child  $\times$  total daughter in each household  $\times N$ .

Source: authors' calculation.

## 5 Data and Method

To estimate the effect of pre- and post-birth son preference on multidimensional poverty, the Pakistan Demographic and Health Surveys (PDHS) 2017–18 data were used (National Institute of Population Studies 2018). The unit of identification for poverty is the individual. Multidimensional poverty for individuals has been calculated similar to the approach by the Alkire–Foster method (Alkire et al. 2013, 2014, 2017; Alkire and Foster 2011). However, as the Alkire–Foster method calculates poverty for the household, a similar approach to Espinoza-Delgado and Klasen (2018) has been applied to adapt the analysis for the individual.

In Table 5, a breakdown of individuals is provided for whom information on various indicators of poverty was available by age, gender, sample and population shares.<sup>6</sup> To identify differences across gender and age (as poverty is also dependent on the stage of life of an individual), the population was divided into four age groups: children (under 6 years), adolescents (between 6 and 17 years), adults (between 18 and 59 years), and elderly (60 years or older).<sup>7</sup>

<sup>6</sup> Population shares were calculated using the World Development Indicators for Pakistan, which include an age and gender breakdown of individuals. It is worth noting that the proportion of children and adolescents is approximately 40% of Pakistan's total population, so poverty levels among children and adolescents will have a significant effect on overall poverty.

<sup>7</sup> This is consistent with the approach used by Espinoza-Delgado and Klasen (2018).

**Table 5: Sample size by age group and gender, population and population share**

		Sample <sup>a</sup>	Sample share (%)	Population share (%) <sup>b</sup>
Children				
>5 years	Male	2,029	6.84	5.94
	Female	2,003	6.75	5.50
5–9 years	Male	2,059	6.94	5.36
	Female	1,941	6.54	4.99
Adolescents				
10–14 years	Male	1,869	6.30	4.98
	Female	1,751	5.90	4.60
15–17 years	Male	995	3.35	4.71
	Female	974	3.28	4.35
Adults				
18–59 years	Male	6,819	22.97	27.54
	Female	7,393	24.90	26.20
Elderly				
60+ years	Male	1,035	3.49	2.96
	Female	817	2.75	2.86
Total		29,685		

Note: <sup>a</sup>authors' estimates based on PDHS 2017–18 (National Institute of Population Studies 2018). <sup>b</sup>authors' estimates based on World Development Indicators (World Bank 2017).

Source: authors' estimates.

## 5.1 Dimensions and Indicators

The individual measure of multidimensional poverty constructed in this research, henceforth referred to as 'individual MPI', consists of three equally weighted dimensions: health, education, and standard of living.<sup>8</sup>

In Table 6, a detailed description of indicators, weights, and cut-offs of each dimension is provided. The dual cut-off approach to identifying the poor has been used in the individual MPI, as suggested by Alkire and Foster (2011). Each person is assigned a status of deprived or not deprived in each indicator. A deprivation score for each individual is calculated using a nested weight structure for indicators; that is, equal weights across each component, and an equal weight for each indicator within each component. The deprivation score ranges from a value of 0 to 1, with higher scores indicating higher deprivation.

A person is considered poor only if the sum of the weighted deprivations for the person exceeds 'the poverty cut-off',  $k$ , and similar to the OPHI global MPI the value of  $k=0.33$ . Any individual whose weighted deprivation score was greater than 0.33 was classified as multidimensionally poor.

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<sup>8</sup> These dimensions are significant aspects of well-being and essential capabilities (Sen 1993; Stiglitz et al. 2009). They are also the same dimensions used to calculate the Human Development Index and global MPI developed by the OPHI (see Alkire et al. 2020b) and relevant capabilities from a gender perspective (Robeyns 2003).

Two comparable household measures were also constructed to illustrate the difference between individual and household level poverty measures in gender analysis.

The first comparable measure is the global MPI, similar to that developed by the OPHI (Alkire et al. 2014, 2017; Alkire and Foster 2011). Given that some of the indicators in the global and individual MPIs differ, a comparable household level MPI was created using the same indicators from the individual MPI to make household level assessment (henceforth referred to as comparable MPI).

The comparable MPI is similar to the global MPI in that every individual has the same deprivation score as the household and similar to the individual MPI in that it has the same indicators as the individual MPI. As the global and comparable MPIs are household measures, each individual within the household is assigned the deprivation status of the household. However, in the individual MPI, each individual has a unique deprivation score.

**Table 6: Multidimensional poverty dimensions, indicators, deprivation cut-offs, and weights**

Dimension	Indicator	Deprived if	Weight
<b>Global MPI</b>			
Health	Nutrition	Any person below 70 years of age for whom there is nutritional information is undernourished accordingly <sup>a</sup>	1/6
	Child mortality	A child below 18 years of age has died in the family	1/6
Education	Years of schooling	No household member aged 10 years or older has completed six years of schooling	1/6
	School attendance	Any school-aged child <sup>b</sup> is not attending school up to the age at which they would complete Year 8	1/6
Living standards	Cooking fuel	Household cooks with dung, agricultural crop, shrubs, wood, charcoal, or coal	1/18
	Sanitation	Household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households <sup>c</sup>	1/18
	Drinking water	Household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk (roundtrip) from home <sup>d</sup>	1/18
	Electricity	Household has no electricity	1/18
	Housing	Household has inadequate housing: the floor is of natural materials, or the roof or walls are of natural or rudimentary materials <sup>e</sup>	1/18
	Assets	Household does not own more than one of these assets: radio, television, telephone, computer, animal cart, bicycle, and refrigerator, and does not own a car or truck	1/18
<b>Individual MPI</b>			
Health	Nutrition	Children below 5 years are considered malnourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below -2 standard deviations from the median of the reference population; individuals aged 6 years and above are considered deprived if they respond to having at least one impairment	1/6
	Child mortality	Same as global MPI	1/6
Education		Household members aged 10 years or older are considered deprived if they have not completed six years of schooling; children above 5 years of age but below 10 years are considered deprived if they have not completed age-appropriate schooling; children below the age of 5 years are considered deprived if the head of household is deprived in education	1/3
Living standards		Same as global MPI	1/3

Comparable MPI			
Health	Nutrition	All individuals in the household are deprived in nutrition if at least one individual is deprived in nutrition as per individual MPI	1/6
	Child mortality	Same as global MPI	1/6
Education		No individual in the household is deprived in education if at least one individual is not deprived in education as per the individual MPI	1/3
Living standards		Same as global MPI	1/3

Note: <sup>a</sup>Adults aged 20–70 years are considered malnourished if their body mass index (BMI) is below 18.5 m/kg<sup>2</sup>. Those 5–19 years are identified as malnourished if their age-specific BMI cut-off is below –2 standard deviations. Children below 5 years are considered malnourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below –2 standard deviations from the median of the reference population. <sup>b</sup>Data source for the age children start compulsory primary school: DHS or MICS survey reports (UNESCO n.d.). <sup>c</sup>A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet. <sup>d</sup>A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring, or rainwater. <sup>e</sup>A household is considered deprived if the floor is made of mud/clay/earth, sand, or dung; or if a dwelling has no roof or walls or if either the roof or walls are constructed using natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks or rudimentary materials such as carton, plastic/polythene sheeting, bamboo with mud, stone with mud, loosely packed stones, adobe not covered, raw/reused wood, plywood, cardboard, unburnt brick, or canvas/tent.

Source: authors' estimates based on OPHI (n.d.).

### 5.1.1 Health

Nutrition and child mortality are the two indicators used in the health dimension when calculating the global MPI and the individual MPI.<sup>9</sup> All individuals in the household are considered deprived in the child mortality indicator if one or more child deaths are reported in the household.

For the individual MPI, to gauge deprivation in nutrition for children aged 5 years and below, a child is deemed malnourished if their weight-for-height is two or more standard deviations below the median of the reference population. Owing to data limitations, it is challenging to obtain an individual level measure for health for all household members as there is no individual information on anthropometric data for male members aged 6 years and above in the PDHS 2017–18 (National Institute of Population Studies 2018). Instead, health functioning for individuals over the age of 5 years is proxied using data on impairment in sight, sound, speech, mobility, or memory.<sup>10</sup>

For the global MPI, an adult (18 years or above) is considered underweight if their BMI is less than 18.5. Children aged 6–17 years are considered underweight if their BMI-for-age is two or more

<sup>9</sup> Health is one of the key dimensions of well-being (Stiglitz 2009) and can be deemed a central capability (Nussbaum 2001; Robeyns 2003; Sen 2000).

<sup>10</sup> As noted by Drèze and Sen (2002), health is important intrinsically and also in what it allows individuals to do or prevents them from doing.

standard deviations below the median of reference population.<sup>11</sup> Children below 5 years of age are deemed malnourished if their weight-for-height is two or more standard deviations below the median of the reference population. For the comparable MPI, a value of deprived is assigned to the household if at least one member is impaired in any of the stated impairments.

### 5.1.2 Education

The indicators used to measure education in the global MPI are literacy and enrolment in school. A household is not considered deprived in literacy if at least one member has completed five years of schooling and is deprived in enrolment if any child has not completed the age-appropriate schooling or is not enrolled in school.<sup>12</sup>

For the individual MPI, education or potential for education is measured separately for each individual. Individuals 10 years and above are considered deprived if they have not completed six years of education. Individuals 5–10 years of age are considered deprived if they have not completed age-appropriate years of schooling or if they are not enrolled in school. Finally, for children aged 5 years and below who may not have started schooling, the schooling level of the head of household was used as a proxy for potential education status.<sup>13</sup>

### 5.1.3 Standard of living

Standard of living includes indicators for cooking fuel, sanitation, drinking water, electricity, housing, and assets. This indicator is the same for individual and household level measures.<sup>14</sup>

## 6 Estimation

Let  $y_i$  represent the individual MPI; that is, the poverty status of individual  $i$  is equal to 1 if the individual deprivation score is greater than the poverty cut-off and 0 otherwise;  $\alpha_i$  and  $\varepsilon_i$  are the constant and error terms, respectively.  $X_i$  contains the independent variable (i.e. GPB) as well as controls for individual, household, and regional characteristics. A list of variables is provided in Table 7. The following equation was estimated:

$$y_i = \alpha_i + \beta X_i + \varepsilon_i \quad (1)$$

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<sup>11</sup> The lack of anthropometric data for boys aged 6 years and above in the PDHS 2017–18 limits the identification of deprived households by the status of deprivation of children aged below 5 years or female.

<sup>12</sup> Not achieving an education level constitutes a capability deprivation (Sen 2000). Education has an intrinsic value (Drèze and Sen 2002: 39) and it can play an instrumental role in achieving personal and collective freedoms resulting in gender equality (Drèze and Sen 2002: 39).

<sup>13</sup> Children 5 years or below are considered deprived in education if the head of household is deprived in education.

<sup>14</sup> There is empirical evidence that living standard indicators contribute the most to multidimensional poverty, especially in poorer countries and rural areas (Alkire et al. 2017; Alkire and Santos 2014; Dotter and Klasen 2017; Espinoza-Delgado and Klasen 2018).

**Table 7: List of variables for estimation of multidimensional poverty**

Variable	Description
<b>Dependent variable</b>	
Individual MPI	The poverty status of individual $i$ is equal to 1 if the individual deprivation score is greater than the poverty cut-off and 0 otherwise
<b>Independent variable</b>	
Gender preference at birth (GPB)	GPB is a categorical variable divided into two categories of 'stopping behaviours' and 'exceeding behaviours'; it is equal to 1 when stopping behaviours are implemented (i.e. a household wants no more children if actual sons are more than or equal to ideal number of sons and either daughters are fewer than desired or total children are fewer than desired); it is equal to 2 if exceeding behaviours are implemented if a household has more daughters than desired; it is 0 otherwise
<b>Control variables</b>	
<b>Individual characteristics</b>	
Female	Equals 1 if the individual is female, 0 otherwise
Age group	The age group the individual belongs to (i.e. 0–4, 5–9, 10–14, 15–17, 18–59, and 60+ years)
<b>Household characteristics</b>	
Household size	The households are classified as small ( $\leq 3$ members), medium (4–6 members) and large (7+ members); it is recommended to include household type in analysis for multidimensional poverty whereby larger households are more likely to have son preference and more likely to be poor (Alkire et al. 2020a)
Head of household female	Equals 1 if the head of household is female
Last birth male	Equals 1 if the most recent birth in the household was a male
Ratio of daughters	Total number of daughters/Total number of children
<b>Regional characteristics</b>	
Province	Separate provincial dummies are created for each of the main provinces—Punjab, Sindh, Baluchistan, Khyber Pakhtunkhwa and Gilgit Baltistan; Islamabad capital territory is combined with Punjab, whereas data are not provided for Azad Jammu and Kashmir; as Punjab is largest province by population, it is taken as the point of comparison
Urban	Is a dummy variable that equals 1 if the household is in a rural area and 0 otherwise; 63% of individuals reside in rural areas, 36% in urban areas

Source: authors' compilation.

## 6.1 Independent variable

Originally, GPB was a dummy variable equal to 1 if the actual number of was more than or equal to ideal number of sons, but actual daughters were fewer than desired; or actual sons were more than or equal to ideal number of sons, but total children were fewer than desired; or household has more daughters than desired.

How households practise son preference affects their poverty. When they stop having children when son targets are met, they may have fewer children and therefore lower poverty. But if they continue to have children in the hopes of meeting son targets, their poverty levels may be higher. To capture these effects, the GPB measure was expanded into two categories:

1. Stopping behaviours: GPB is a categorical variable equal to 1 if actual sons are more than or equal to ideal number of sons and either daughters are fewer than desired or total children are fewer than desired.



2. Exceeding behaviour: GPB is equal to 2 if a household has more daughters than desired.

## 6.2 Descriptive statistics

In this section, the difference between individual and household multidimensional poverty is highlighted and descriptive analysis of poverty outcomes by GPB measure is undertaken.

### Aggregate Deprivation by Indicator

In Table 8, two key issues are evident from the illustration of the proportion of individuals deprived in each of the ten indicators, by gender and age group.

**Table 8: Proportion of individuals deprived in each indicator by gender and age**

Indicator	Total	Children				Adolescents				Adults		Elderly	
		0–4		5–9		10–14		15–17		18–59		60+	
		M	F	M	F	M	F	M	F	M	F	M	F
Health													
Household nutrition	0.41	0.65	0.65	0.46	0.50	0.36	0.36	0.29	0.32	0.35	0.37	0.32	0.34
Individual nutrition	0.19	0.26	0.25	0.06	0.05	0.07	0.06	0.08	0.05	0.17	0.23	0.64	0.70
Child mortality	0.25	0.26	0.26	0.28	0.29	0.29	0.29	0.25	0.27	0.22	0.23	0.17	0.20
Education													
Household years of schooling	0.26	0.31	0.32	0.34	0.34	0.25	0.27	0.17	0.24	0.22	0.23	0.26	0.25
Individual years of schooling	0.55	0.60	0.60	0.28	0.36	0.78	0.81	0.36	0.50	0.40	0.63	0.67	0.90
School attendance	0.33	0.35	0.35	0.47	0.50	0.42	0.45	0.35	0.34	0.26	0.27	0.22	0.23
Living standards													
Cooking fuel	0.50	0.52	0.53	0.55	0.55	0.52	0.56	0.52	0.54	0.45	0.47	0.48	0.46
Sanitation	0.29	0.32	0.33	0.35	0.34	0.32	0.32	0.29	0.29	0.26	0.26	0.28	0.29
Drinking water	0.17	0.17	0.19	0.18	0.19	0.18	0.19	0.15	0.17	0.16	0.16	0.14	0.14
Electricity	0.08	0.09	0.11	0.10	0.10	0.08	0.10	0.09	0.08	0.07	0.07	0.07	0.07
Housing	0.47	0.50	0.53	0.55	0.54	0.53	0.53	0.50	0.50	0.42	0.44	0.44	0.43
Assets	0.15	0.16	0.17	0.19	0.18	0.17	0.17	0.13	0.16	0.12	0.13	0.14	0.16

Note: M, male; F, female; age is in years.

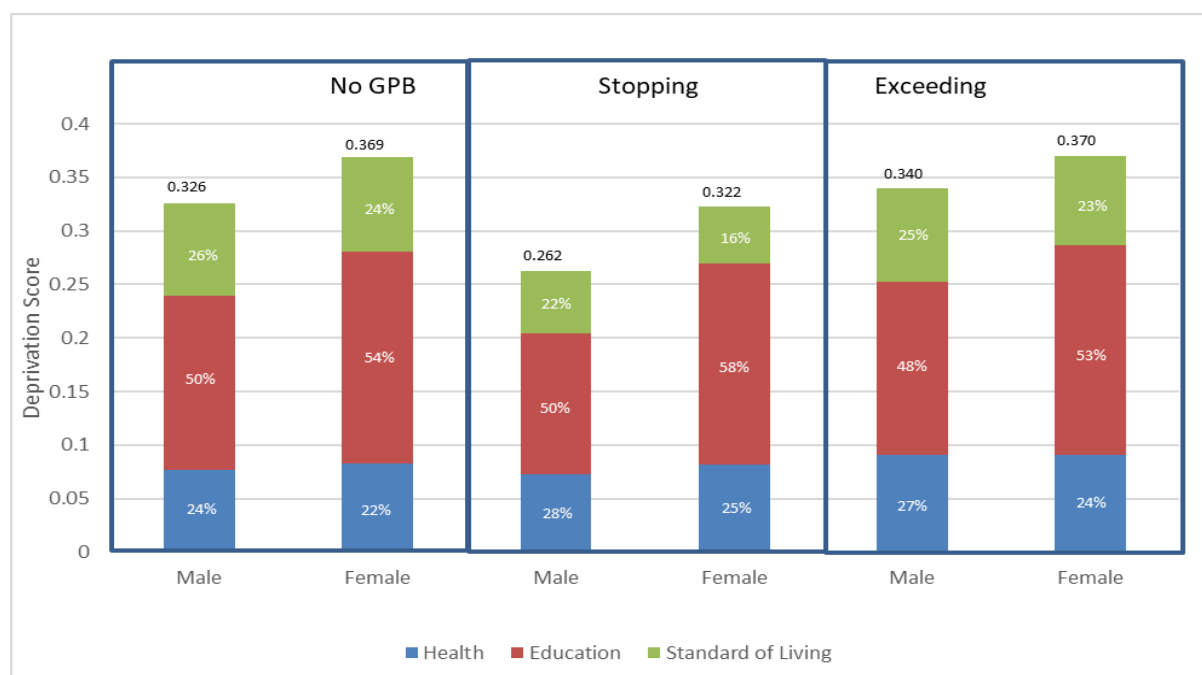
Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

First, household and individual measures identify vastly different percentages of deprived individuals in nutrition and education. For example, almost twice as many individuals are identified as deprived in nutrition by household measures than by individual measures (41% versus 19%), whereas for education, household measures identified about half the individuals as deprived compared with individual measures (26% versus 55%).

Second, according to the individual measure, gender gaps varied across age groups. The higher percentage of adult (23%) and elderly women (70%) who were deprived in nutrition indicates that elderly women may be at a higher risk of deprivation than younger cohorts. Similarly, gender differences in deprivation in education are most pronounced between the adults (63% women versus 40% men) and elderly women (90% women versus 67% men). It is important to note that in the age group 10–14 years the percentage of deprived individuals in years of schooling was very high for both boys (78%) and girls (81%).

In Figure 1, the deprivation score and contribution of health, education, and standard of living are provided by gender across GPB categories. Overall, women and girls are more deprived than men and boys across all categories. Notably, the largest gender gap is in the stopping category, even though the deprivation score for women and girls was lowest (0.322) but the score for men and boys was even lower (0.262). Education contributes most to deprivation for both genders, with highest contribution for women and girls in households with stopping (58%). This suggests that while women and girls fare better in smaller families, gender bias in households can persist. For example, parents who can afford to send children to school may choose to send sons to higher quality schools. Interestingly, contribution of standard of living to overall deprivation was lower for women than for men, which is often referred to as the ‘female paradox’.

**Figure 1: Deprivation scores by GPB and gender across various dimensions**



Note: GPB, gender preference at birth. In Appendix Figure A1, average deprivation scores for individuals are provided for each category of GPB.

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

## 6.3 Incidence and intensity of multidimensional poverty

Using a poverty cut-off ( $k$ ) of 33.33%, estimates of the multidimensional headcount ratio ( $H$ ), the average deprivation across the multidimensionally poor ( $A$ ), and the estimates of the adjusted headcount ratio ( $M_0$ ) are provided first by each measure of MPI in Table 9 and then across three categories of GPB for individual level measures of MPI in Table 10.

Two findings emerge. First, global and comparable MPI measures gave more conservative estimates of  $M_0$  than individual MPI. Similarly, the relative difference between female and male  $M_0$  was highest for individual MPI compared with global or comparable MPI.

Second, by looking at the components of  $M_0$  (i.e.  $H$  and  $A$ ), the source of variation in  $M_0$  is due to large differences in  $H$ , suggesting that it is the variation in deprivation scores of individuals and not

average deprivations of the poor that may explain the variation in the different MPI outcomes. Using household measures only would subsequently underestimate poverty for women.

**Table 9: Comparison of various multidimensional poverty indicators constructed using a dual cut-off approach ( $k=0.33\%$ )**

	Total	Male	Female	Difference between female and male household members	
				Absolute	Relative
Global MPI					
MPI ( $M_0$ )	0.242	0.237	0.246	0.009	3.66%
Headcount ( $H$ )	0.45	0.444	0.456	0.012	2.63%
Intensity ( $A$ )	0.537	0.534	0.539	0.005	0.93%
Individual MPI					
MPI ( $M_0$ )	0.311	0.276	0.347	0.071	20.46%
Headcount ( $H$ )	0.583	0.521	0.645	0.124	19.22%
Intensity ( $A$ )	0.534	0.53	0.537	0.007	1.30%
Comparable MPI					
MPI ( $M_0$ )	0.28	0.275	0.284	0.009	3.17%
Headcount ( $H$ )	0.531	0.525	0.538	0.013	2.42%
Intensity ( $A$ )	0.526	0.525	0.528	0.003	0.57%

Note:  $M_0=H \times A$ , where  $H$  is the headcount ratio, measured as the proportion of population that is deemed multidimensionally poor, and  $A$  is the intensity of poverty, measured as the average deprivation score of the poor. Comparison of various multidimensional poverty indicators constructed using dual cut-off approach along with comments is available in Appendix Table A1.

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

**Table 10: Comparison of poor across different dimensions of GPB**

	No GPB		Stopping		Exceeding	
	Male	Female	Male	Female	Male	Female
MPI ( $M_0$ )	0.287	0.346	0.224	0.302	0.294	0.340
Headcount ( $H$ )	0.542	0.641	0.443	0.599	0.545	0.630
Intensity ( $A$ )	0.530	0.541	0.504	0.504	0.539	0.540
Observations	3,754	3,625	1,024	586	2,332	2,758

Note: GPB, gender preference at birth.  $M_0=H \times A$ , where  $H$  is the headcount ratio, measured as the proportion of population that is deemed multidimensionally poor, and  $A$  is the intensity of poverty, measured as the average deprivation score of the poor.

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

Distribution of poor individuals by gender for each category of GPB is provided in Table 10. Across all three categories of GPB, women were poorer than men in  $M_0$ . The intensity of poverty  $A$  of women was similar to that of men across all categories; however, a higher proportion of women were deprived than men, as can be seen in the headcount ratio  $H$ . This may suggest that there were more female members than male members in poorer households, or that in poor households where son preference was present a higher number of daughters may have been born. It also indicates that intra-household distribution of resources may be skewed in favour of men.

## 7 Results

Average marginal effects of poverty estimates are provided using individual deprivation scores in Table 11. In Column 1, the estimates of GPB as a dichotomous dummy variable are presented,<sup>15</sup> whereas in Column 2, GPB is separated into stopping and exceeding rules. Columns 3–5 repeat the estimation for different values of cut-off for poverty, namely,  $k=0.2$ ,  $0.4$ , and  $0.5$ .

**Table 11: Son preference and poverty (average marginal effects from logit)**

	$k>0.33$	$k>0.33$	$k>0.2$	$k>0.4$	$k>0.5$
	1	2	3	4	5
Gender preference at birth	–0.009 <i>0.008</i>				
Stopping		–0.037** <i>0.014</i>	–0.046*** <i>0.013</i>	–0.082*** <i>0.013</i>	–0.045*** <i>0.013</i>
Exceeding		0.001 <i>0.009</i>	0.023** <i>0.008</i>	0.000 <i>0.009</i>	0.026*** <i>0.008</i>
Female	0.096*** <i>0.008</i>	0.096*** <i>0.008</i>	0.063*** <i>0.008</i>	0.083*** <i>0.008</i>	0.071*** <i>0.008</i>
Observations	14,203	14,203	14,203	14,203	14,203

Note: The dependent variable is MPI (Multidimensional Poverty Index). An individual is classified as poor (MPI=1) if their individual deprivation score  $k$  exceeds the cut-off score. Standard errors in italics. \* $p<0.10$ , \*\* $p<0.05$ , \*\*\* $p<0.01$ .

Source authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

Owing to the complex and contradictory effects of different forms of GPB on poverty, it is not surprising that without differentiating between its different forms, GPB has neither the expected sign nor significance. The signs for both stopping and exceeding rules were as expected; stopping rules reduced the likelihood of an individual being poor while exceeding rules increased the likelihood. However, only stopping rules had a significant effect. This indicates a different effect of practising son preference on different groups of individuals, and those in severe poverty may face the greatest effect. In all estimations, women were more likely to be poor than men, and women 15–59 years old were less likely to be poor and those in dependent age groups (children or elderly) were more likely to be poor. Results remained robust across cut-off variations<sup>16</sup>. The variation in likelihood of poverty within age groups for female individuals indicates that the incidence of poverty, while significant, is not uniform across age groups.

These results have important implications for a country such as Pakistan where the dependency ratio<sup>17</sup> is quite high. Compared with medium-sized families, individuals in small or large families had a higher likelihood of being poor. This indicates some benefit of having a moderate-sized family. Individuals in urban areas were less likely to be poor than individuals in rural areas. Compared with

<sup>15</sup> The use of GPB as a dichotomous variable is to allow for comparison.

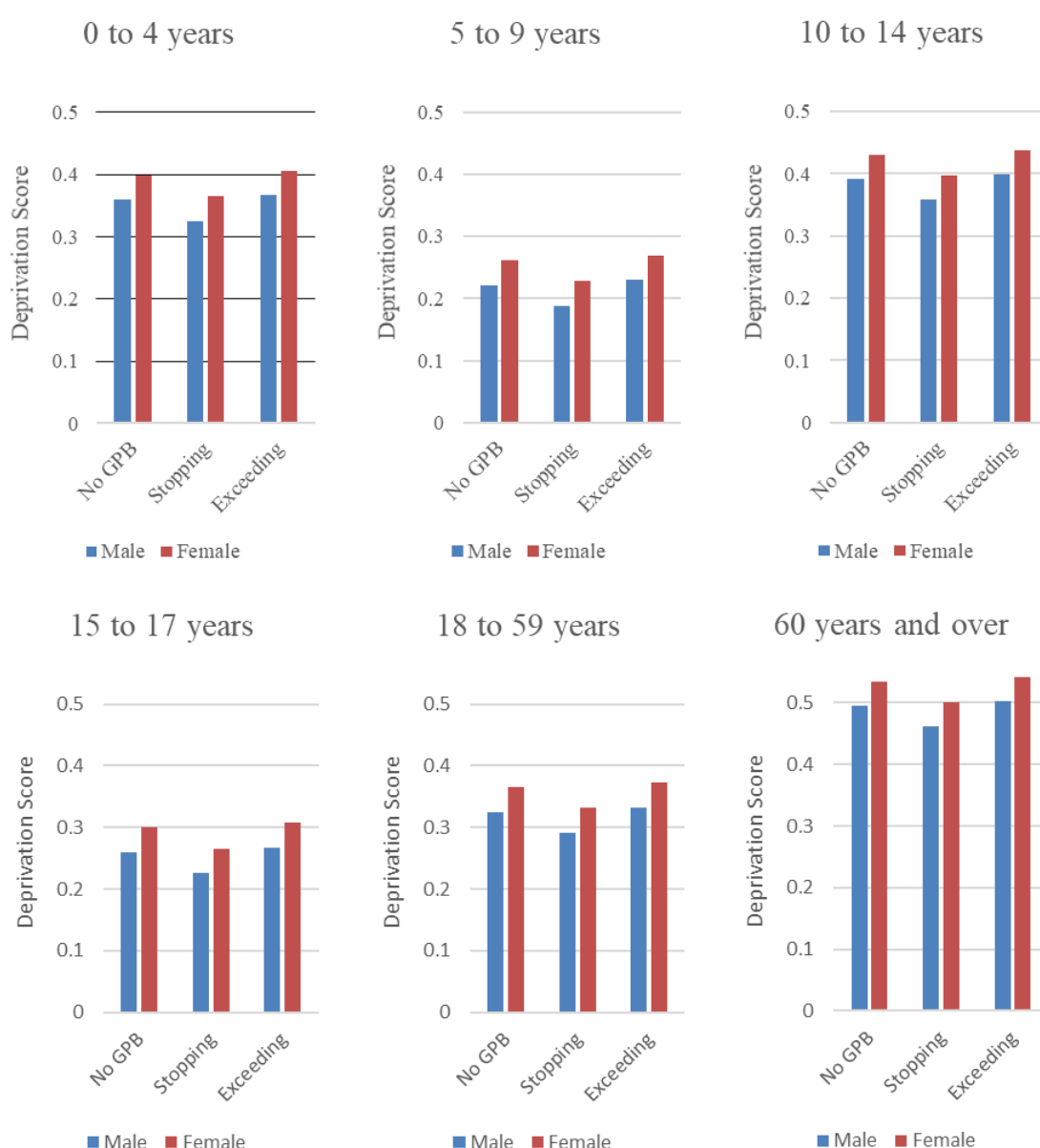
<sup>16</sup> Variation of cut-off scores are implemented in line with the advice provided in Alkire et al. (2020a) to include those who are vulnerable to poverty (i.e. individuals whose deprivation score is  $>0.2$  but  $<0.33$ ) as well as those who are severely poor (i.e. individuals whose deprivation score  $>0.5$ ).

<sup>17</sup> The number of non-working-age persons in a community dependent on working-age persons.

Punjab, individuals in all other provinces were more likely to be poor and households headed by women were more likely to be poor.

In Figure 2, estimates of individual deprivation scores are provided across gender and age for each category of GPB. Men in households with no GPB were the least deprived, whereas women in households that practised exceeding rules were most deprived. The trend was the same for each age group.

**Figure 2: Individual deprivation scores across gender and age groups (margins from ordinary least squares)**



Note: GPB, gender preference at birth.

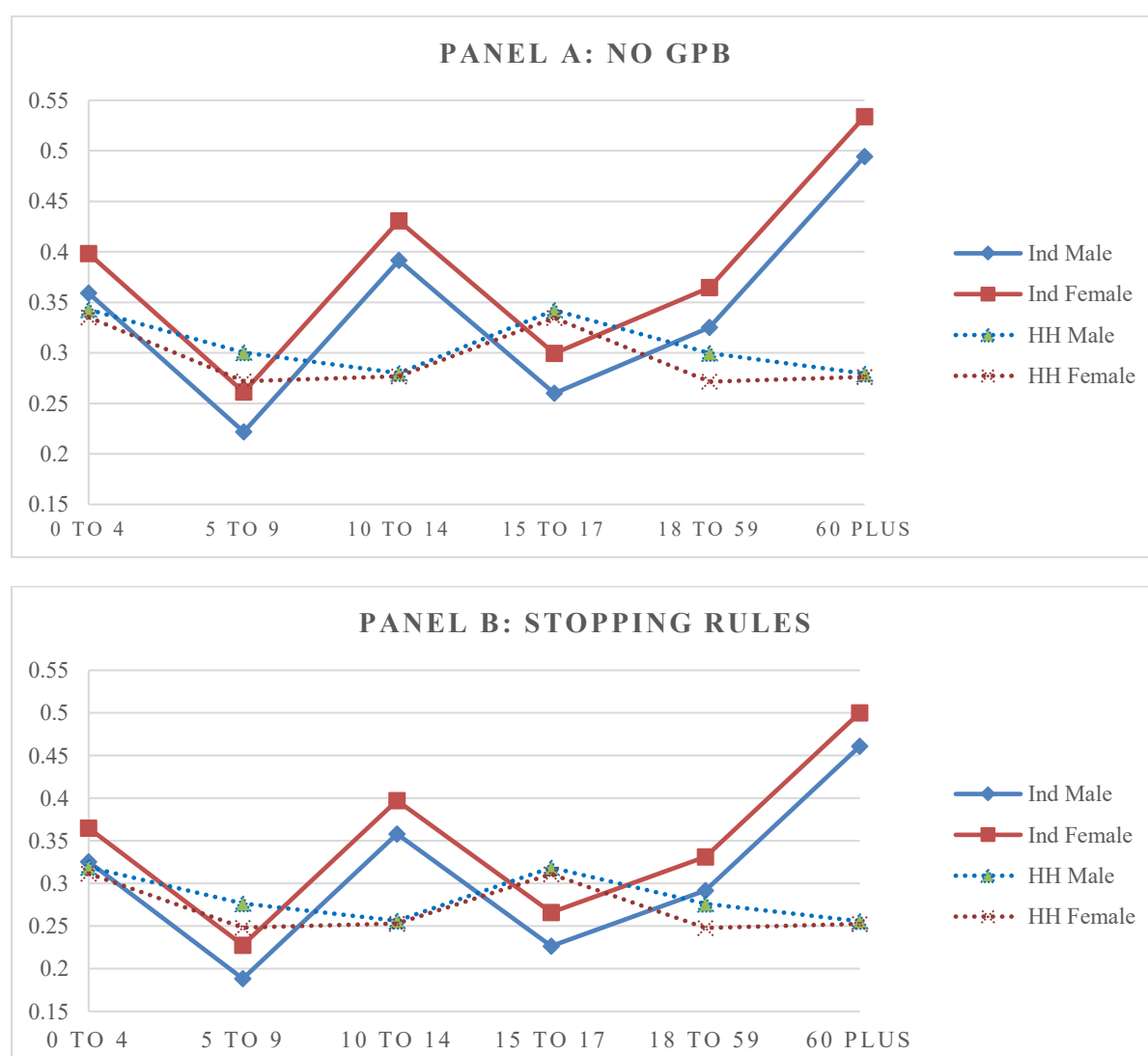
Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

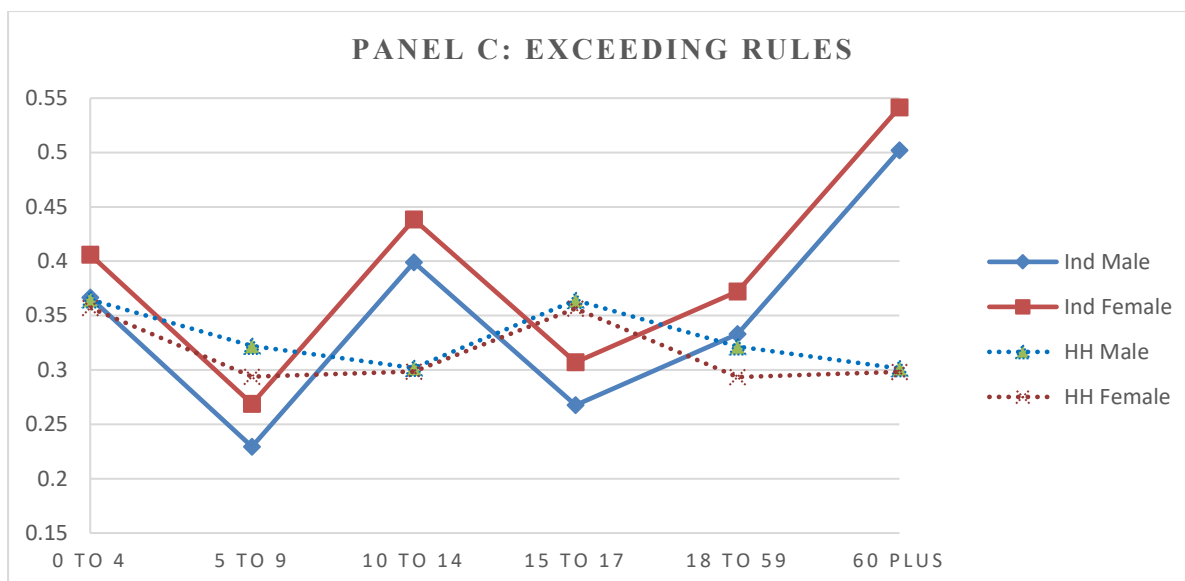
In Figure 3, estimates for individual and household deprivation across gender and age for GPB dimensions are provided to illustrate whether there was a difference between inter- and intra-

household deprivation. Deprivation scores provide a range of deprivations rather than binary (poor versus non-poor) outcomes. Hence, they provide an additional layer of analysis.

Gaps in deprivation scores were very small according to the household measures, with male household members having slightly higher deprivation scores than female members in the 5–9 years and 18–59 years age categories. Gaps in individual deprivation scores were more pronounced, with women and girls being more deprived than men and boys across each age category. Differences between household and individual deprivation of male and female individuals were most pronounced in the 10–14 years and elderly age categories. This indicates that neglecting intra-household deprivation in studies on poverty may result in variations in the data, particularly for these two age groups.

**Figure 3: Comparison of individual and household deprivation scores (margins from ordinary least squares)**





Note; GPB, gender preference at birth; Ind, individual; HH, household head.

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

## 8 Discussion

In this study, the association between gender preference and individual multidimensional poverty was investigated. Poverty outcomes across gender were estimated using an individual level measure of multidimensional poverty.

The key findings indicate that GPB affects inter- and intra-household poverty in a complex manner. Women in households where stopping rules were observed were less deprived than their female counterparts in households where 'no GPB' and 'exceeding behaviours' were observed. However, the gender gaps in deprivation were also largest in households where stopping rules were observed. This may explain why previous studies had limited success in highlighting the role of son preferences in driving female poverty.<sup>18</sup>

This contextualizes the poverty experiences for women in Pakistan as highly dependent on age, with older women being at a higher risk of poverty. Although studies have previously discussed increases in vulnerability according to age (e.g., Ashiq and Asad 2017; Gulzar et al. 2008), the findings in this study provide a deeper understanding of the sources of those vulnerabilities for older women. When deprivation cut-offs were defined restrictively, such as in health, the total number of individuals who were identified as being deprived was much higher for household measures than for individual measures. However, with the individual measure, girls below the age of 18 years were only slightly

<sup>18</sup> In this paper, the need for an individual measure of poverty when investigating son preference was argued. However, son preference may be a function of both parents' preferences as well as that of other household members. Thus, there may be a cumulative effect of GPB on household poverty as well. Future studies can explore the effect of GPB on household poverty level because all members may get affected by varying degrees because of the decision of a few household members.

more deprived than boys the same age, whereas a higher proportion of adult and elderly women were deprived compared with their male counterparts, indicating a need for policy action for this age group.

Secondary education has been associated with lowering the likelihood of child marriages in Pakistan, as it is important for girls to remain in secondary school (Raj et al. 2014). Findings in the present study indicate that when deprivation cut-offs were defined expansively such as in education, the number of individuals identified as being deprived was much lower for household measures than for individual measures. Based on individual measures, the gender differences were stark, particularly for ages 15 years and above.

According to UNICEF (2020), 18% of women between the ages of 20 and 24 years were first married by the age of 18 years and 7% first gave birth before the age of 18 years. This indicates a need for policy that ensures that marriage does not come at the cost of loss of education for women. Education was also the largest contributor to deprivations individuals faced, indicating that perhaps the government needs more focused policies on reducing attrition and absenteeism in schools.

The Government of Pakistan and international development agencies should continue to promote gender equality to reduce poverty, and son preference should be an important consideration for policymakers. The motivation behind son preference is rooted in socioeconomic, cultural, religious, and traditional beliefs, and efforts to promote a more balanced attitude toward the gender of offspring should focus on the following strategies:

- expanding access to and ensuring the continuation of education for women and girls;
- strengthening women's participation in paid and formal market, enabling the accumulation of retirement savings and reducing the perception of dependence on sons as old-age insurance;
- reducing wealth transfers in the marriage market from the bride's family to the groom's family either in the form of wedding expenses or dowry; and
- narrowing gender disparities in inheritance rights.

The complex relationship between son preference and well-being requires a multifaceted approach that promotes gender equality through education, economic empowerment, and legal reform, ultimately paving the way for more inclusive and sustainable development.

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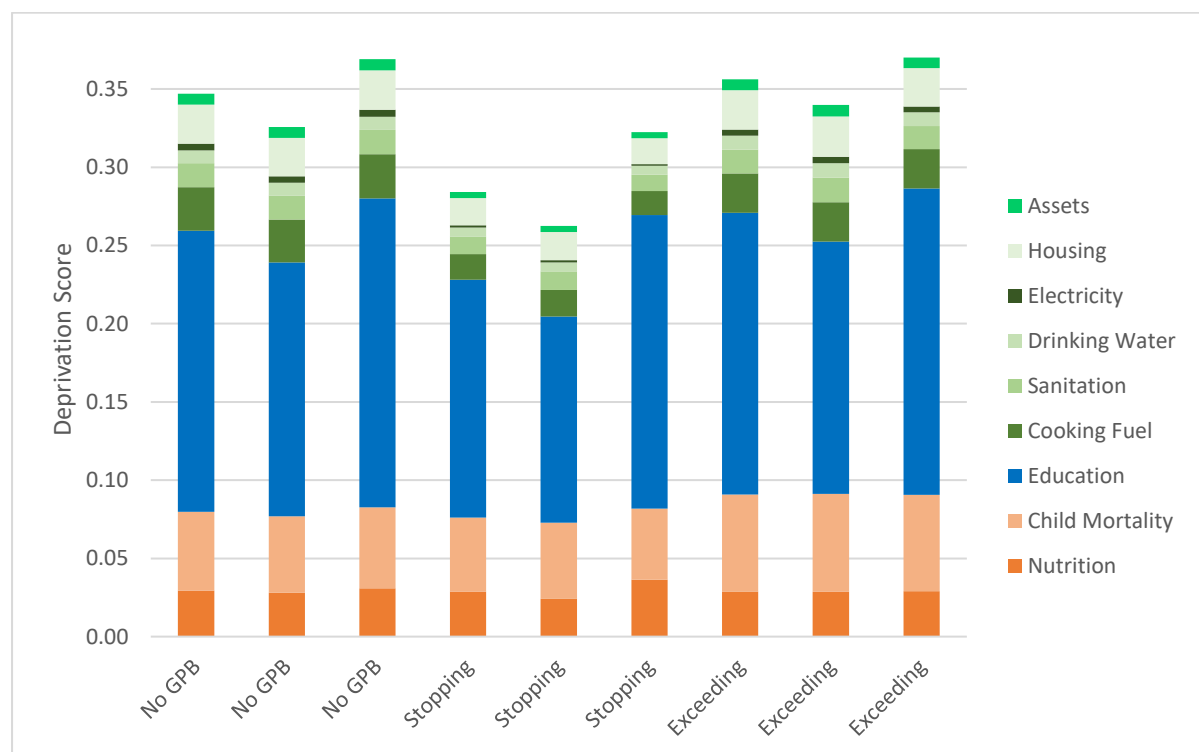
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## Appendix: Supplementary information

In Appendix Figure A1, average deprivation scores for individuals are provided for each category of GPB. Individuals from households where stopping rules were practised had the lowest deprivation scores, whereas those in households where exceeding rules were practised had higher deprivation scores.

Across all three categories, education had the largest contribution to overall deprivation, and contribution to deprivation was similar across all three categories. Health and standard of living had similar contributions to deprivation; however, within health, child mortality had a higher contribution in households where exceeding rules were practised.

**Figure A1: Deprivation scores by GPB across various dimensions**



Note: GPB, gender preference at birth.

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

**Table A1: Comparison of various multidimensional poverty indicators constructed using dual cut-off approach ( $k=0.33\%$ )**

	National MPI <sup>a</sup>	Global MPI <sup>b</sup>	Individual MPI <sup>b</sup>	Comparable MPI <sup>b</sup>
MPI ( $M_0$ )	0.198	0.242	0.311	0.280
Headcount ( $H$ )	0.383	0.450	0.583	0.531
Intensity ( $A$ )	0.517	0.537	0.534	0.526

Note: MPI, Multidimensional Poverty Index.  $M_0=H \times A$ , where  $H$  is the headcount ratio, measured as the proportion of population that is deemed multidimensionally poor, and  $A$  is the intensity of poverty, measured as the average deprivation score of the poor. <sup>a</sup>The Oxford Poverty and Human Development Initiative (OPHI 2019). <sup>b</sup>Authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

Source: authors' estimates using PDHS 2017–18 (National Institute of Population Studies 2018).

Comparing the MPIs across the three measures (Appendix Table A1), the global MPI had the most conservative measure of poverty (0.242) and the individual MPI had the highest (0.311). The comparable MPI was between the two (0.280). The global MPI headcount ratio was lowest (45% of the population was considered poor) and the individual MPI measured the highest (65.8%). Intensity of poverty across the three measures appeared similar (0.537 versus 0.534 versus 0.526), which indicates that it may be the variation in deprivation scores across individuals and not average deprivations across the poor that explains the variation in the MPI outcomes.