

Measurement and Socio-Demographic Determinants of Child Multidimensional Poverty in Senegal

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Abstract

Understanding the different components of child poverty and the factors that influence them is crucial and even necessary for achieving the goal of reducing poverty in all its forms and for all age and gender groups and meeting the recently adopted Sustainable Development Goals (SDGs). In light of these, the contributions of this paper are twofold: i) It constructs and analyzes a Child-focused Multidimensional Poverty Index (C-MPI) for Senegal using the Alkire-Foster Methodology and ii) it investigates and estimates the determinants of child multidimensional poverty with a focus on the role of the number of children (family size), and mother's characteristics (education and employment). We adopt an instrumental variable approach that uses the presence of twins as an instrument for family size. Our analysis uses a sample of 21,437 children aged 0 to 17 years from the Senegal's Demographic and Health Survey (DHS) 2014. Preliminary results show that 47% of children in Senegal are multidimensionally poor. These poor children are deprived on average in 45% of the weighted indicators of poverty analyzed. This leads to a C-MPI value of 0.22. We also observe a heterogeneous distribution of child multidimensional poverty for urban and rural areas and across the four geographical regions of the country. In terms of poverty composition, education is the dimension that contributes the most to the C-MPI. Findings of the second part of the paper suggest a positive causal impact of the number of children on child multidimensional poverty. Mother's characteristics (education and employment) are also strongly associated to child multidimensional poverty. This confirms (using a multidimensional poverty measure) the benefits to reinforce actions towards the demographic transition in Africa; more educated women with better participation in the labor market would mean low fertility, better investments on children and consequently low child multidimensional poverty and a better future for all.

JEL Classification: I31, I32, J13.

Keywords: Women's empowerment, Fertility, Child Poverty, AF Method, Senegal.

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1 Introduction

The United Nations adopted in 2015 the Sustainable Development Goals (SDGs) with the objective of improving people’s lives all over the world over the next 15 years. “Ending poverty in all its forms everywhere” is the first goal of this commitment. The target 1.2 of this goal is to *reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions* (UN 2015¹). If poverty affects social (age or gender) groups differently; its most devastating effects are on children, to whom it poses a great threat by affecting their education, health, nutrition and security (UNICEF 2015²). Understanding the components of child poverty and the factors that influence them is crucial and even necessary for achieving the goal of poverty eradication. In light of these, the overall objective of this paper is to investigate the nature of multidimensional poverty for children in Senegal and how it is affected by socio-demographic variables such as fertility, and mother’s education and employment. This will not only show the features of simultaneous deprivations the poor children experience in Senegal but it will also document and test the hypothesis of intergenerational transmission of poverty from the mother to the child using a multidimensional approach.

Since the seminal studies by Becker and Lewis (1973) on the child quantity-quality tradeoff, the relationship between household size and welfare or poverty has been a subject of several empirical studies. A considerable research has been carried out on this topic in both developed countries (Peichl et al., 2012 ; Buhmann et al., 1988 ; Coulter et al., 1992) and developing countries (White and Masset, 2003; Chaudhry, 2009 ; Meenakshi and ray, 2002 ; Woolard and Klasen, 2005). The hypothesis that parents make tradeoffs between their number of children and the “quality” of those children does have important implications for growth and poverty reduction policies (Dang and Rogers 2013). Low population growth induced by smaller family sizes leads to increased human capital and higher earnings (Angrist, Lavy and Schlosser, 2010), as well as to economic development (de la Croix and Doepke, 2003; Moav, 2005). The poverty-related literature on this quantity-quality tradeoff has focused on households or adults and is limited to using unidimensional or consumption-based measures. Several studies of this quantity-quality tradeoff have focused on child education using variables such as school enrolment and school attainment (Li, Zhang, and Zhu, 2007; Angrist, Lavy and Schlosser, 2010; Black-Devereux-Salvanes, 2010; Qian, 2009; Dang and Rogers, 2013). However, the “quality” of the child should be considered from an early age perspective and using a multidimensional approach. Indeed, as argued by Heckman (2012), the highest rate of return in early childhood development comes from investing in early childhood, from birth through age five, in *disadvantaged families*. Therefore, it is essential to consider the “quality” of the child from a broader

¹<https://sustainabledevelopment.un.org/?menu=1300> (visited on May 19, 2016)

²<http://www.unicef.org/mdg/poverty.html> (visited on May 19, 2016)

angle. In addition to being restrictive in terms of poverty dimensions analyzed, the negative correlation between family size and monetary poverty in developing countries has been criticized. Indeed, this relationship does not hold once the potential economies of scale in consumption induced by larger family sizes are taken into account (Lanjouw and Ravallion, 1995; White and Masset, 2003; Ravallion, 2015). What can we learn about this relationship if a broader concept of poverty, taking into account for simultaneous deprivations experienced by children, is adopted? What is the role of women's empowerment (mother's education and employment) in this relationship? Is there an evidence of any intergenerational transmission of multidimensional poverty from the mother to the child? These are the main interconnected questions addressed by the paper. A child-focused multidimensional approach makes it possible, on the one hand, to better investigate and understand the quantity-quality tradeoff in a more broader framework, and on the other hand, to identify areas and policy actions to eradicate child poverty.

The contributions of the paper to the literature are twofold: i) it constructs and analyzes a child-focused Multidimensional Poverty Index (C-MPI) for Senegal using the Alkire-Foster Methodology (Alkire and Foster 2011) and ii) it investigates and estimates the determinants of child multidimensional poverty with a focus on the role of the number of children (family size), and mother's characteristics (education and employment). Alkire and Foster (2011) propose a multidimensional poverty measurement methodology based on the counting approach, exhibiting interesting features of subgroup decomposability and dimensional breakdown. Thus, we propose a child-specific multidimensional poverty measure suitable for the identification and targeting of the most disadvantaged and vulnerable children in policy making. To link the child poverty measure to family size and mother's characteristics, our empirical specification takes into account the endogeneity of the family size. We adopt an instrumental variable approach that uses the presence of twins as an instrument for family size. The second contribution provides estimates of the causal link between the quantity and quality of children from a multidimensional poverty perspective. Our analysis uses a sample of 21437 children aged 0 to 17 years from the Senegal's Demographic and Health Survey (DHS) 2014.

Preliminary results show that 47% of children in Senegal are multidimensionally poor. These poor children are deprived on average in 45% of the weighted indicators of poverty analyzed. This leads to a C-MPI value of 0.22. We also observe a heterogeneous distribution of child multidimensional poverty for urban and rural areas and across the four geographical regions of the country. In terms of poverty composition, education is the dimension that contributes the most to the C-MPI. Findings of the second part of the paper suggest a positive causal impact of the number of children on child multidimensional poverty. Mother's characteristics are also strongly associated to child multidimensional poverty. Indeed, we find a negative relation between mother's education and child

poverty; and, a positive relation between unskilled activities of mother and child poverty. Finally, we don't find evidence that parents take into account their children wellbeing in their fertility decision. Our child poverty measurement results show the different facets of simultaneous deprivations the poor children face in Senegal. This comprehensive and detailed assessment of child poverty provides useful insights for public policies to fight child poverty, in particular for the targeting of the most disadvantaged and vulnerable children, and the monitoring and evaluation of child-oriented socioeconomic programmes. Results from the analysis of the determinants of child poverty do confirm (using a multidimensional poverty measure) the benefits to reinforce actions towards the demographic transition in Africa; more educated women with better participation in the labor market would mean low fertility, better investments on children and consequently low child multidimensional poverty and a better future for all.

The rest of the paper is organized as follows. Section 2 presents the methodology. We first present the Alkire-Foster Method and then specify and discuss the dimensions, indicators and deprivation cutoffs of the resulting C-MPI. We then present the econometric model of the determinants of child multidimensional poverty using our C-MPI measures and the identification and empirical strategy adopted. Section 3 presents the dataset used (Senegal DHS 2014) and descriptive statistics on the overall situation of children and women in Senegal. Section 4 presents the empirical (measurement and estimation) findings of the paper and section 5 discusses policy implications of our results and concludes the paper.

2 Methodology

2.1 A Child Multidimensional Poverty Index (C-MPI) for Senegal

Child poverty measurement in this paper is based on the Alkire-Foster methodology. This section presents this methodology, a description of the C-MPI and its properties, along with the measurement design. It concludes with a section on the data used for the analysis. Alkire and Foster (2011) propose a new method for measuring multidimensional poverty. It identifies who is poor by considering the intensity of deprivations they suffer, and includes an aggregation method. Mathematically, an AF measure of multidimensional poverty combines two aspects of poverty:

$$MPI = H \times A \tag{1}$$

where H is the *Incidence of poverty* or the percentage of people who are multidimensionally poor, and A is the *Intensity of poverty* or the average percentage of dimensions in which poor people are deprived. The implementation of the AF method can be summarized into three steps:

- Two identification steps: first identify who is deprived for each of the indicators of the MPI by comparing the achievements of each individual to the defined deprivation cutoffs, and then identify who is multidimensionally poor by comparing individual deprivation scores to the given poverty threshold.
- The aggregation step: finally defining the overall level of poverty for the society as a whole by summarizing the deprivations and poverty profiles of its different poor members³.

The society's members considered here are children aged 0 - 17 years. For each of these children we depict a deprivation and poverty profile in a deprivation matrix and then aggregate the matrix to obtain the C-MPI. Four dimensions of the child wellbeing are considered: education, health, living standards and other childhood conditions. These dimensions encompass 14 indicators. Table 1 below shows the dimensions, the indicators and the deprivation cutoffs for each indicator. A child is deemed deprived in an indicator if his/her characteristics match the provided definition of the cutoff. Once the indicators are selected and the cutoffs defined, for the identification of the poor children, we assigned a deprivation score C_i to each child i .

$$C_i = W_1 I_{i1} + W_2 I_{i2} + \dots + W_d I_{id} \quad (2)$$

$I_{ij} = 1$ if the child i is deprived in indicator j and $I_{ij} = 0$ otherwise

W_j is the weight attached to indicator j .

Finally, the child is identified to be multidimensionally poor if he/she is deprived in one quarter or more of the weighted indicators ($C_i \geq 1/4$)⁴. In the second part of the research, this binary indicator of poverty will be used as dependent variable to investigate the role of family size, mother's education and employment on the likelihood that the child be multidimensionally poor. The two aggregate components of the C-MPI are defined as follows:

i) the incidence of multidimensional poverty (Headcount Ratio):

$$H = \frac{q}{n} \quad (3)$$

where q is the number of multidimensionally poor children and n the total number of children in the population.

ii) the intensity of poverty:

$$A = \frac{\sum_{i=1}^n C_i(k)}{q} \quad (4)$$

³The focus axiom implies that only those identified as poor are considered. The non-poor population is censored for the aggregation.

⁴A sensitivity analysis with respect to different weights schemes will be performed to check the robustness of the results

$C_i(k)$ is the censored deprivation score or the average deprivation score across the poor children.

Finally the C-MPI is obtained a product of the incidence of poverty (H) and the intensity of poverty (A):

$$C - MPI = H \times A \quad (5)$$

This aggregate index will then be decomposed by subgroups (gender, age, regions, etc) and broken down by indicators and by dimensions (more details in Alkire and Foster 2011).

Table 1 – Dimensions, indicators and deprivation cutoffs for the C-MPI

Dimensions	Indicators	Deprivation cutoffs
Education	Years of schooling	No household member aged 10 years or older has completed five years of schooling.
	School gap	The child has more than 2 years of delay in schooling
	School attendance	The child is not attending preschool for 3-5y of age, Primary school for the 6 -11y of age and Secondary school for the 12 - 17 y of aged
Health	Child mortality	Ownership of playthings and books for the 0 -2 y of age (or birth certificate)
	Diseases and Sickness	Any child has died in the family in the five-year period preceding the survey
	DPT immunization	The child has suffered of IRA/Fever/Diarrhea/Anemia
	Nutrition1	The child did not received routine immunization recommended by WHO (BCG, DTP, measles and yellow fever)
	Nutrition2	Breastfeeding: The child was not exclusively breastfed until 6 months of age The child for whom there is nutritional information (0-5y age) is undernourished in terms of Weight-for-height (wasting) or weight-for-age (stunting)
Living Standards	Cooking fuel	The household cooks with dung, wood or charcoal.
	Electricity	The household has no electricity
	Improved sanitation	The household's sanitation facility is not improved or it is shared with other households
	Safe drinking water	The household does not have access to safe drinking water or safe water is more than a 30-minute walk (round trip)
	Assets ownership	The household does not own the appropriate set of assets (to be specified)
Other childhood conditions	Housing	Roof, wall & Floor materials and Overcrowding
	Child labour	Child Labour: the child 5 -11 years old has at least one hour of economic work or 28 hours of domestic work per week OR a children f12 -14 years old did at least 14 hours of economic work or 28 hours of domestic work per week
	Girls' development	Early Marriage/Pregnancy/Domestic violence: the girl under 18 years is married OR is pregnant, has a baby OR experiences domestic violence OR believes domestic violence is justified.

2.2 Estimating the determinants of Child multidimensional poverty

To investigate the link between child multidimensional poverty and family size and mother's characteristics, we use a control function approach with the presence of twins in the family as instrument for the family size. This control function approach makes it possible to test the endogeneity of the family size and also to take into account the heterogeneity of several subgroups. Therefore, we will be able to affirm or deny that some groups of women or households take into account the well-being of their children in their fertility decision.

The generic model can be summarize as follow:

$$N_i = x'_{in}\beta_n + \sigma_n e_{in} \quad (6)$$

$$MP_i = 1\{N_i\gamma_m + x'_{im}\beta_m + e_{im} \geq 0\}, \quad (7)$$

with the following distributional assumption

$$(e_m, e_n|w) \sim N(0, \sum(e_m e_n)),$$

with $w = (x_m, x_n)$ and

$$\sum(e_m e_n) = \begin{pmatrix} 1 & \sigma_{mn} \\ \sigma_{mn} & 1 \end{pmatrix}.$$

The first component of the model (1) is a function governing the endogenous variable N (number of children in the family). N_i represents the number of children in the family of child i . We assume that this function is linear. We consider N potentially endogenous because the number of children decisions would be based on the quantity-quality trade off. The vector x_{in} represents the set of all observable determinants of N , including the instrument; e_n is the unobserved characteristics which affect decisions about the number of children.

The second component of the model (2) represents the children multidimensional poverty status, which is an indicator function for each child i , takes the value 1 if the child is multidimensionally poor (the same model will be used for child poverty broken-down by indicators dimensions). The vector x_{im} represents the set of observable including two of our interest variable (mother's education and mother employment). e_{im} is an unobservable variable.

Our parameters of interest are γ_m for investigate the tradeoff between child poverty and family size, β_m for the effect of mother's education and employment, and σ_{mn} to verify the endogeneity of the family size. The significance of this last parameter will inform us about households behaviour toward the number of their children and their poverty.

The identification and estimation are performed in three steps.

First Step: From (1) obtain the Ordinary Least Squares (OLS) estimates $(\hat{\beta}_n, \hat{\sigma}_n)$ of the first-stage equation and the standard residuals $\hat{e}_n = (N - x'_n \hat{\beta}_n) / \hat{\sigma}_n$, where $\hat{\sigma}_n$ is a household's clustered standard errors.

Then, rewrite (2) as (for simplicity, we omit the subscript i):

$$MP = 1\{x'_m \beta_m^* + N \gamma_m^* + \hat{e}_n \zeta_m^* + \tilde{e}_m \geq 0\}, \quad (8)$$

where

$$(\tilde{e}_m | e_n, w) \sim N(0, 1) \quad \text{with} \quad \tilde{e}_m = \frac{e_m - \sigma_{mn} e_n}{\sqrt{1 - \sigma_{mn}^2}}.$$

Second step: Perform a simple probit model to consistently estimate $(\alpha_m^*, \beta_m^*, \gamma_m^*, \text{ and } \zeta_m^*)$ and to obtain all the standard deviations from all parameters. After the second step, a third step is necessary to recover the structural parameters from equation (3).

Third step: Applying step 2 provides the following relation: $\sigma_{mn} = \frac{\zeta_m^*}{\sqrt{1 + \zeta_m^{*2}}}$, $\beta_m = \frac{\beta_m^*}{\sqrt{1 + \zeta_m^{*2}}}$ and $\gamma_m = \frac{\gamma_m^*}{\sqrt{1 + \zeta_m^{*2}}}$. We calculate the confidence interval of our structural parameters by bootstrapping the structural model to obtain the distribution of the parameters and then, compute the corresponding percentiles.

In addition, and to take into account the intensity of the poverty, we will perform a Tobit model with instrumental variable. In this case, the dependent variable will be deprivation score C for the poor (truncated deprivation score).

3 Data and descriptive statistics

Data for this analysis come from the Senegal's continuous DHS, 2014. Data were collected from January to October 2014. This DHS provides information on fertility, mortality, family planning, maternal and child health, nutrition, malaria and HIV. We use mother birth history data to identify children and focus on those from 0 to 17 years old. Children characteristics are linked to mother's and mother's partner characteristics. The sample size is about 21,437 children less than 18 years old.

4 Empirical results

4.1 Child multidimensional poverty in Senegal

Our main findings are as following. In term of child multidimensional poverty measure, the results show that 47% of children in Senegal are multidimensionally poor. These poor children are deprived on average on 45% of the indicators (poverty intensity). This lead to a child poverty index of 0.22. Children from the rural areas are more multidimensionally poor compared to children living in urban areas. Indeed, the incidence of poverty in the

rural areas is about 64% compared to 25% in the urban areas. Poor children in the rural areas are also more deprived compared to poor children in the urban areas. We observe a heterogeneous distribution of child multidimensional poverty in terms of region. Poverty incidence is ranged from 65% in the Centre region to 25% in the West region. Applying the decomposition property of the C-MPI illustrates the contribution of each indicator to the overall child poverty index. We notice that education is the indicator with the biggest contribution to the C-MPI with about 42%, while the contribution of the other indicators are ranged from 9% to 3%.

4.2 Econometric results: the determinants of child multidimensional poverty

According to the second part of the research, we find a positive causal impact of the number of children on child multidimensional poverty. Indeed, we find evidence of a child quantity and quality trade-off (Higher the number of children, lower the level of child well being). Mother's characteristics are also strongly linked to child multidimensional poverty. Indeed, we find a negative correlation between mother's education and child poverty; and, a positive correlation between unskilled activities of mother and child poverty. Finally, if we assume that the endogeneity of the number of children is essentially due to the reverse causality, don't found evidence that in both rural and urban areas parents take into account the child poverty in the decision of their number of children.

The results show that efforts to reduce child poverty should be done by taking into account the fact that poverty is multidimensional. Special emphasis should be put on education. Raising awareness about the benefits a high level of child well being is necessary to convince parent to take into account children well being in their fertility decision.

5 Conclusion

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