Basic Pensions and Poverty Reduction in Sub-Saharan Africa*

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CREPP
Working Papers

2007/07

Abstract: This paper investigates the role of basic pensions in alleviating poverty in sub-Saharan Africa. Using the most recent Senegalese household income-expenditure data survey, we construct scenarios of universal and means-tested basic pension schemes with different generosity levels. Simulations indicate that basic pension benefits have sizeable impact on poverty reduction amongst households, with elderly members, which translates into large decreases in aggregate poverty measures. The paper also analyzes the fiscal costs of basic pensions and shows that these are fiscally affordable as long as pension levels are reasonable. This suggests that basic pension programs could be financially sustainable in sub-Saharan African.

Keywords: Poverty, Pension, Old-age, Fiscal policies, sub-Saharan Africa, Senegal

JEL Classification: D39, H39, H55, I32, I38, J14, O55

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* An earlier version of this paper has been published in the proceedings of the *XXVI^e Journées de l'Association d'Economie Sociale* "Economie Sociale et Droit" held in Nancy on 7-8 Septembre 2006. I thank the participants in this conference for their useful comments. I also thank Professor Pierre Pestieau for his helpful remarks and suggestions. I gratefully acknowledge the financial support from the Government of Luxembourg through the program "Bourse Formation-Recherche, BFR". The usual disclaimers apply.

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1. Introduction

It is now widely recognized that in developing countries pensions play an important role in securing and improving the livelihoods of older people and reducing poverty. Evidence indicates that poverty among older people is generally low in countries where there exists a generous pension or safety net coverage for the elderly like in Brazil, Chile or South Africa. In contrast, in countries where old-age pension systems are inexistent or target a few number of people, older people are over-represented among the poor (Barrientos, 2003; Barrientos, Gorman, and Heslop, 2003; Bourguignon *et al*., 2004; Deaton and Paxson, 1997). Moreover, evidence suggests that in developing countries the positive effects of pensions go beyond the direct beneficiaries (the older people) and spill over on the other members of their households. Case studies in Brazil and South Africa indicate that children within beneficiary households have higher school enrolment rates and better health status than those living in households that do not receive pension (Duflo, 2003).

However, despite such a positive role, the majority of African populations remain uncovered by a pension scheme. Except few countries (South Africa, Namibia, Mauritius, and Botswana), almost none of African countries have put emphasis on broadening its pension system coverage or implementing a safety net program supporting the elderly. This was in line with the World Bank's recommendations in its report on the old-age crisis (World Bank, 1994). The World Bank's argument was that traditional support systems for older people in African societies are working relatively well and that formal pension systems would crowd out private transfers and make things worse. As a consequence of that, the issue of pension provision is seldom considered in development programs and poverty reduction strategies in Africa. It seems therefore that the provision of pension scheme has not been a priority.

Such a low priority put on pension and on the livelihood of older people in Africa is grounded on a series of arguments which in reality are fallacious. One of these arguments is that family living arrangements in Africa give older people an appropriate framework of support and care provision. By living within extended families, older people benefit from the support and care of their coresidents, due to the resilience of the cultural and social norms of respect and reverence for elders in African societies. Then, there is no need for developing state-organized policy for old-age support. This view is rather naive. It is more based on an intuition than on a systematic investigation on how intergenerational relationship works within African families. The reasons are twofold. First, co-residence does not systematically imply old-age support. Evidence clearly indicates that relations between age-groups within African families work as intergenerational exchanges based on the economic contribution of the protagonists (Meillassoux, 1992). Older people's ability to contribute is then essential for them to access household support (Barrientos, Gorman, and Heslop, 2003). Furthermore, social norms of respect and support for elders are likely to be less binding when younger generations are in poor economic conditions (Aboderin, 2004). Second, family living arrangements in Africa are radically changing under the effects of the HIV/AIDS pandemic, migration and urbanization. This phenomenon has prompted new forms of living arrangements like households without prime age adults. Households type of "elderly with children" or of "elderly only" are now widespread across the continent (Zimmer and Dayton, 2003). Thus, many traditional multigenerational households have become missing-generations ones, with the responsibility for sustaining the household falling on older people (Lloyd-Sherlock, 2000).

Another fallacy concerns the social payoff of a policy supporting the old. Due to resources constraints, policy makers in Africa usually argue that it is socially more profitable to focus on the needs of other age groups (children, mothers, and young workers) than to support the old people. This view broadly stems from the human capital theory. It is built on the idea that the returns on investment in the productive capacity of the young are likely to be higher than return on investment on the old. Indeed, such a view makes sense. However, investing in the young would be vain if the conditions that make this investment efficient are misperceived. Research has shown that poverty is intergenerational. That is, older people bequeath poverty to their dependents. Thus, old-age poverty is one of the prime causes for lack of childhood development and education and for poor nutrition and health (Barrientos, Gorman, and Heslop, 2003; Buchmann, 2000). Acquiring education and good health is then quite difficult for children living with poor old people. In consequence, the returns on investment on the children would likely be nil if decision makers fail to put a great emphasis on the conditions of the old. In contrast, investing in the elderly in Africa is likely to be socially profitable. Evidence from South Africa indicates that cash transfers to the elderly proved to be an effective tool of fighting poverty and redistribution, reaching simultaneously the elderly and their younger coresidents. A study by (Case and Deaton, 1998) has established that younger children in South Africa living with their grandparents derive large and direct benefits from the cash transfers received by the latter. This study has also found that these cash transfers disproportionately benefited the impoverished children since children with a low household per capita income are more likely to be living with an old person. The conclusion is that, due to the form of living arrangements in South Africa, social expenditures on the elderly and social expenditures on children are not alternatives. Even, cash transfers to the elderly turn out to be a good instrument to channel money to children living with them. Investigating further the behavioral effects induced by such program, Duflo (2003) found a positive correlation between these transfers and children's nutritional status. More precisely, these estimates indicate that pensions received by women had a large impact on the anthropometric status (weight for height and height for age) of girls. These pensions have also been known to affect the behavior of prime-age adults who live with the elderly. Evidence indicates a negative effect on labor supply, particularly male labor supply (Bertrand, Mullainathan, and Miller, 2003) and a positive effect on migration decision - specifically of women - to places of employment, either to work or to look for a job (Posel, Fairburn, and Lund, 2006).

A study by (Subbarao and Kakwani, 2005) also clearly demonstrates that similar cash transfer programs in other African countries would have a significant impact on poverty among the elderly and their households. Their simulations show a very impressive reduction in old-age poverty if 0.5 % GDP were mobilized in a social pension program for single elderly, those living with children or elderly-headed households. And they note that in five out of 15 countries the reduction in national headcount poverty is greater if the program is targeted to households headed by the elderly than for those not headed by the elderly. See table 1 below.

Table 1: Change (%) in Headcount ratio due to targeting 0.5 % GDP to the elderly

	Individuals		Households			
	Elderly person		Not led by elderly		Led by elderly	
Countries	Group	Overall	Group	Overall	Group	Overall
Burundi	−69.7	−0.4	−0.5	−0.4	−1.9	−0.2
Burkina Faso	−100.0	−0.2	−2.1	−1.5	−3.6	−1.0
Cote d'Ivoire	−100.0	−0.5	−2.5	−1.9	−22.1	−5.0
Cameroon	−100.0	−0.3	−1.2	−1.0	−5.9	−1.3
Ethiopia	−93.4	−0.5	−1.7	−1.4	−5.5	−1.0
Ghana	−58.8	−0.5	−1.4	−1.1	−4.0	−0.8
Guinea	−100.0	−0.4	−2.4	−1.7	−2.8	−0.8
Gambia	−100.0	−0.1	−1.4	−1.0	−2.3	−0.7
Kenya	−66.3	−0.8	−1.4	−1.2	−7.5	−1.4
Madagascar	−100.0	−0.5	−1.3	−1.2	−8.5	−1.0
Mozambique	−76.4	−0.5	−0.3	−0.3	−3.4	−0.5
Malawi	−60.9	−0.5	−0.6	−0.5	−2.1	−0.3
Nigeria	−91.3	−0.6	−0.6	−0.5	−6.9	−1.2
Uganda	−92.8	−1.0	−1.5	−1.3	−5.5	−0.9
Zambia	−99.8	−0.5	−0.6	−0.5	−2.7	−0.4

Source : (Subbarao and Kakwani, 2005)

This paper explores the feasibility of introducing in Sub-Saharan African countries a minimum income for old age independent of the worker's history of earning, drawing evidence from the latest Senegalese household expenditure survey. In this country, like in most of African countries, the coverage rate of the social protection system is very small. It covers only 2 percent of the total population, corresponding to 9 percent of the active population. The rest of the population relies on family network support. Meanwhile, there are a growing number of people whose life expectancy is continuously rising[1] due to improvements in medical and nutritional conditions. The number of people who are more than 60 is growing fast (5 percent per year). And this occurs within a context of high fertility rate and huge progress in reducing infant mortality. The implication is a growing total number of people who potentially need family support. This is likely to put additional strains on families' capacities to provide such support appropriately. Thus, within families, a trade-off becomes imperative between supporting the older members or supporting the younger. However, in this trade-off, no options would be desirable. If family support is skewed toward the elderly to the detriment of children, it induces adverse effects on children such as schooling postponement, precocious emergence in the labor market and a deprivation of their health status. In contrast, if support goes mainly to children, the older people then would likely be forced into destitution. To address these problems, it would therefore be logical to reorient public policy strategies putting a greater emphasis on income provision at later age.

The approach used in this paper follows the one from (Bourguignon *et al.*, 2004; Subbarao and Kakwani, 2005) and (Subbarao and Kakwani, 2005) by constructing reliable estimates of the fiscal cost of a basic pension and of its impacts on poverty. However, this study differs with these papers on one point. It does not look at the effects that a basic pension benefit induces on

[1] It is noteworthy that, unlike most of African countries, Senegal is characterized by a low level of HIV seropositivity prevalence rate and a low level of AIDS-related mortality, suggesting that life expectancy is not adversely affected by the HIV/AIDS pandemic.

household's decisions of labor supply, and income allocation to food, schooling, transfers, or saving as done by (Bourguignon *et al*., 2004). Our data do not allow identification of variation in household labor supply or expenditures.

The paper is organized as follows. Section 2 provides evidence on old-age poverty in Senegal. Section 3 gives taxonomy of basic pensions. Section 4 analyzes the implications of the different forms of basic pension in terms of poverty reduction and fiscal cost. Section 5 concludes.

2. Old-age poverty in Senegal

2.1. Methodology and data

Conventional methodology for inferring individual well being from household income or expenditure may be misleading when it is applied to an African setting. In fact, using household per capita income or expenditure as a welfare indicator introduces a downward bias in the estimation of old age poverty due to two major factors: the economies of scale and the relative cost of children. The issue on economies of scale is related to the fact that a larger household can achieve the same level of well being with lower per capita income or expenditure than a smaller household. Evidence on elderly living arrangements in developing countries suggests that, with few exceptions, the old groups live in smaller sized households than the young groups (Deaton and Paxson, 1997). Therefore, failure to adjust for the presence of economies of scale will systematically overestimate the well being of the old because they live in smaller households. The issue on children's cost raises the fact that in developing countries, children are not as needy as adults. The cost of children differs significantly from the cost of adults. It is likely that the relative costs of children are lower in developing countries compared with developed countries. Thus, failure to adjust for differential costs of children and adults will also overestimate the well-being of the elderly as they live, on average, in households with fewer children (Deaton and Paxson, 1997).

To account for the economies of scale within household and the difference in household's composition, many studies use the "adult equivalent per capita expenditure" as indicator of living standard. Assume that Y is the total household expenditure, A and K the number of adults and children in a household respectively, the adult equivalent per capita expenditure corresponds to

$$y^e = \frac{Y}{m} \tag{4.1}$$

where *m*, the adult equivalent household size, equals:

$$m = 1 + \left[\left(A - 1\right) + \beta K\right]^{\theta} \tag{4.2}$$

The parameter β corresponds to a measure of the cost of children relative to adults and θ reflects economies of scale within the household. The value of these parameters ranges between 0 and 1. However, there is no consensus on their appropriate values for developing countries. Using the Engel curve method, Lachaud estimates the value of A for the Burkina Faso to 0.53 and the relative cost of children for age group 0-4 years to 0.6 (Lachaud, 2000). Based on these

values of the parameters Lachaud analyzes the relation between the equivalence scale and the spatial poverty in Burkina Faso. Two results are worth noting in his study. First, households having many children are not necessarily the poorest in Burkina Faso, except in the large cities. Second, the incidence of poverty strongly increases in households comprising only older persons when (β, θ) varies from (1, 1) to (0.60, 0.53). Deaton and Paxson explore the sensitivity of poverty counts to variations in assumptions about child cost and economies of size using data from a set of developing countries (Deaton and Paxson, 1995). They found that for a fixed poverty line, the poverty ranking for children and for the elderly depends on the values of the two parameters. For (β, θ) combinations of (1, 1), (1, 0.75), and (0.75, 1), children have higher fractions of poor than the elderly. In contrast, for combinations (0.5, 0.5), (0.75, 0.5), and (0.5, 0.75), where there are either large economies of scale, or low child cost, or both, children are relatively favored, and the elderly have the higher fraction in poverty. Their conclusion is that when the economies of scale and/or the child cost change, the profile of poverty changes also.

In our analysis, we pay attention to the possible impacts of differences in living arrangements and child cost on poverty profiles in Senegal. Thus, we first explore the sensitivity of relative poverty profiles to alternatives combinations of β and θ. For that purpose, we proceed as follows. We start by measuring the poverty profiles of the different age groups and households assuming away any economy of scale and a child cost equivalent to one. Thereafter, we reconstruct these profiles using alternatives specifications of the values of β and θ. Then, we look at whether changes in the combinations of β and θ overturn poverty ranking across age groups or household types. Recall that when θ = 1, there are no economies of scale and lower values of A correspond to increasing economies of scale. When β = 1, that signifies that children are as needy as adults; child cost is equivalent to the one of adults. We consider a person as old if she is 60 years or more and a child as one who is 14 years old or less. For poverty comparison between households, we focus on: households comprising three generations, elderly-headed households, and households with elderly, households with children and households without elderly.

We consider various poverty measures which can be characterized in terms of the poverty line, the average income or consumption, and the Lorenz curve representing the structure of the relative income distribution. Thus, the poverty measure P is written as:

$$P = P(z, \mu, L) \tag{4.3}$$

where z is the poverty line, μ is the mean income or consumption and L is the Lorenz curve. The most famous explicit functional forms for $P(z, \mu, L)$ are the FGT class of additively decomposable poverty measures P_α, with α as a non-negative parameter of inequality aversion (Foster, Greer, and Thorbecke, 1984). The FGT P_α measure is given by:

$$P_\alpha = \frac{1}{n} \sum_{y_i < z} \left[\frac{z - y_i}{z} \right]^\alpha \tag{4.4}$$

where y_i is the income or consumption of the *ith* household or individual and *n* is the population size. When $\alpha = 0$, P_0 corresponds to the headcount index *H* which measures the proportion of the poor population in total population. *H* is given by:

$$H = \frac{q}{n} \tag{4.5}$$

with *q* as the number of the poor and n the total population. For $\alpha = 1$, P_1 refers to the poverty gap index in per person terms. P_1 corresponds to the product of *H* and *I*, with *I* as the proportionate shortfall of the average income of the poor from the poverty line *z*. This measure represents the fraction of the poverty line *z*, which would have to be given per person of the whole population to eliminate poverty. When $\alpha = 2$, P_2 corresponds to the severity of poverty. It is given by the mean of the squared proportionate income shortfall of individuals below the poverty line *z*. P_2 is a poverty measure which reflects how poor the poor are. It is therefore very sensitive to the income distribution among the poor; the worse this distribution is, the more severe poverty is.

The FGT measures have the propriety that they are additively separable. Thus, if we divide the total population into *K* mutually exclusive groups, the aggregate measure is the population weighted average of the measures for all subgroups of the population.

$$P = \sum_k f_k P_k \;; \qquad k = 1,.....K \tag{4.6}$$

where, f_k and P_k are the population share and poverty measure of the *kth* group.

To assess the impact on poverty of alternative forms of basic pensions, we compute the three poverty measures with and without the income paid by the program.

The data used come from the household surveys ESAM-I and ESAM-II.[2] These are nation-wide surveys implemented in 1995 and 2000 respectively. They targeted households selected from three strata: Dakar (the capital), other cities and rural areas. Data were collected on 3278 households in ESAM I while ESAM II comprised 6608 households. The questionnaires cover information on individuals' characteristics (age, education, sex, occupation, marital status, etc.) and indications on households' structure (size, composition, etc.) and budget[3] (expenditures, income, assets, housing, etc.). The poverty line we use is that calculated by the *Direction de la Prévision et de la Statistique* - DPS of the Ministry of Finance of Senegal (table 2).

[2] ESAM: Enquête Sénégalaise Auprès des Ménages

[3] Unlike ESAM I, ESAM II does not contain information on the sources of household incomes.

Table 2: Poverty Lines (Per equivalent adult and per day in Franc CFA; 1 Euro1 = 655.957 Francs CFA)

	Dakar	Other Cities	Rural
ESAM I	743.2	662.5	384.7
ESAM II	879.0	712.8	497.9

Source: Ministry of Finance, (DPS, 2004)

2.2. Empirical evidence

Sensitivity analysis

Table 3 gives poverty measures for the different age groups across a range of combinations of β and θ. As expected, we observe that large economies of scales dramatically reduce the incidence of poverty. Results indicate that, when we hold child cost fixed and allow even modest economies of scales, poverty incidence drops for all age groups substantially. Recall that the economies of scale are larger at the lower values of the parameter A. It is also noteworthy that when θ decreases (holding β fixed); poverty reduces almost in the same amplitude for all age groups. For example, when θ decreases from 1 to 0.9 the poverty rate falls by 11.79 points of percentage for children and by 12.41 and 11.08 points for adults and elderly respectively. This suggests that poverty ranking across age groups in Senegal is likely to be neutral to changes in economies of scales. This is related to similarities in the forms of living arrangements. Evidence from table A1 indicate that people live in households with almost the same number of household members on average. Thus, the average size of household for a child is 13.18, and that is 12.57 and 11.94 for an adult and an elderly person respectively.

We also observe that changes in the economies of scales do not overturn the poverty ranking between the household types. Figures from table 4 indicate that, when economies of scales increase for a fixed child cost, poverty levels decrease sharply for all households types but that does not affect relative poverty rates between these different types of households. When θ decreases, the incidence of poverty also decreases but quite identically for all household types in a way that we can conclude that poverty comparisons between these households is not sensitive to the variations of the economies of scales. The reason is that the average number of household members is quite similar for all these households even if their demographic structures are not identical (table A2).

Tables 3 and 4 also show the effects of changes in child costs on poverty incidences across age groups and households types. We observe that reductions in child cost (holding the parameter θ fixed) result in large poverty reductions for all age groups and households types. Figures in table 3 indicate that, when child cost decreases from 1 to 0.75 (holding economies of scales fixed), the level of poverty decreases by 6.78 percentage points for children while poverty among adults and elderly decreases by 5.81 and 5.50 points respectively. And when child cost decreases further, from 0.75 to 0.5, poverty level drops by 10.38, 8 and 6.94 points for children, adults and elderly respectively.

Table 3: Individual headcount ratio i.e. percentage of people who are poor distinguishing different age groups

Combinations of (β and θ)	Children	Adults	Elderly
β = 1.0, θ = 1.0	81.35	74.58	76.73
β = 1.0, θ = 0.9	69.56	62.17	65.65
β = 1.0, θ = 0.8	54.01	46.71	50.31
β = 1.0, θ = 0.7	35.10	29.72	34.83
β = 1.0, θ = 0.6	20.67	17.70	20.74
β = 0.75, θ = 1.0	74.57	68.77	71.24
β = 0.75, θ = 0.9	60.91	55.12	58.50
β = 0.75, θ = 0.8	44.43	39.40	43.29
β = 0.75, θ = 0.7	27.88	24.52	28.80
β = 0.75, θ = 0.6	16.32	14.61	17.26
β = 0.50, θ = 1.0	64.20	60.77	64.30
β = 0.50, θ = 0.9	49.39	46.72	50.49
β = 0.50, θ = 0.8	33.25	31.12	35.50
β = 0.50, θ = 0.7	20.75	19.44	22.96
β = 0.50, θ = 0.6	12.39	11.74	13.60
Population shares	43.87	50.58	5.55

Table 4: Household headcount ratio i.e. percentage of households who are poor distinguishing different types of households

	Types of household				
Combinations of (β and θ)	All	With elderly	Without elderly	With Child & no elderly	With child & elderly
β = 1.0, θ = 1.0	68.48	76.04	62.76	68.29	79.20
β = 1.0, θ = 0.9	58.00	65.11	52.64	57.10	67.68
β = 1.0, θ = 0.8	44.68	49.95	40.71	43.39	51.94
β = 1.0, θ = 0.7	30.71	34.19	28.10	30.12	35.27
β = 1.0, θ = 0.6	19.64	20.75	18.81	19.89	21.04
β = 0.75, θ = 1.0	61.93	70.53	55.47	60.14	73.30
β = 0.75, θ = 0.9	50.29	57.70	44.71	48.26	59.76
β = 0.75, θ = 0.8	37.34	42.50	33.46	35.91	43.97
β = 0.75, θ = 0.7	24.92	28.16	22.49	23.88	28.83
β = 0.75, θ = 0.6	16.22	17.52	15.24	15.92	17.59

$\beta = 0.50, \theta = 1.0$	53.04	63.18	45.41	48.95	65.44
$\beta = 0.50, \theta = 0.9$	41.21	49.51	34.96	37.42	51.00
$\beta = 0.50, \theta = 0.8$	28.98	34.52	24.89	26.37	35.33
$\beta = 0.50, \theta = 0.7$	19.46	22.30	17.32	18.13	22.54
$\beta = 0.50, \theta = 0.6$	13.08	13.73	12.59	12.70	13.53
Population shares	1.0	0.43	0.57	0.60	0.40

It is worth emphasizing that there are no huge differences in the size of poverty reductions across age groups and household types when child cost varies. This is due to the fact that the average ratio of children within households is almost identical for all age groups (see tables A1 and A2). As a consequence of that, changes in child cost are likely to have little impact on relative poverty. Then, poverty ranking between age groups or between household types remains quite identical when child cost varies, holding economies of scales constant. Furthermore, it is noteworthy that in poverty studies carried out in Senegal, child cost is usually valued to 0.5 of an adult and $\theta = 1$ (no economies of scales). Thus in what follows, we use these values of the parameters β and θ to analyze poverty among the elderly in Senegal.

Poverty among elderly

Table 5 gives the poverty measures in 1995 and 2000 for the different age groups and for the whole population using the combination $(\beta, \theta) = (0.5, 1)$. What is striking from this table is that, by all measures, poverty profiles are quite identical across age groups. Disparities in poverty measures are only noticed between areas, with a higher concentration of poverty in rural areas compared to urban areas. This leads to a conclusion that being poor is apparently not related to the age of the individuals; thus, growing old in Senegal does not imply more poverty. This is however a misconception of the reality. The main reason is that, due to the form of living arrangements prevailing in Senegal, poor people are likely to live together. It is therefore obvious that individual poverty profiles would tend to be similar.

In contrast, when comparing poverty profiles across households, we observe that poverty is more pervasive amongst households comprising elderly. By all measures, these households have the highest levels of poverty. For example, it can be seen from table 4, with $(\beta, \theta) = (0.5, 1)$, that the poverty incidence for households comprising elderly is 10 points higher than that of the average population (63.18 percent opposed to 53.04), while the poverty incidence for households without old person is solely 45.41 percent. And households are poorer when they comprise elderly and children. Almost two-third of households of this type are poor. This is likely not due to the fact that households with children and elderly have less working age adults or a higher proportion of children (see table A2). In contrast, that may be related to the presence of a highest number of older people. Comparison from household headship perspective also reveals that elderly-headed households are more affected by poverty. More than 60 percent of these households are poor, while poverty incidence accounts for only 50 percent for households not headed by an old person.

Another noteworthy result is that poor households amongst those comprising old people are poorer than the poor among households without elderly. The average distance separating households with elderly from the poverty line, as a proportion of that line, is higher than that of households without elderly. Thus, the average income shortfall as a proportion of the poverty line is only 0.14 for poor household not comprising elderly, while it amounts to above one-fifth for those with old person (0.21). The poverty gap is also relatively more important for poor households comprising elderly and children (0.22) and those headed by an old person (0.20). Table 5 reports changes in aggregate poverty measures over the period 1995-2001. Results indicate that the poverty measures do not vary uniformly across the different types of households. By all measures and in terms of poverty reduction, households without elderly outperform those comprising older people. For example, the size of reduction in the headcount index for this type of households represents almost 11 percentage points. That is largely above the national average and corresponds to twofold the one of households comprising elderly. What could explain these disparities? Going back to living arrangements within households, we see that the proportion of adults and the proportion of children are almost similar in both types of households. It seems then that the differences in the incidence and the depth of poverty amongst households stem from the presence or not of elderly. This suggests a strong association between the presence of an old person within a household and the probability for this household to fall in poverty. This can be compared with results from (Subbarao and Kakwani, 2005). They find that households with no elderly have a much lower incidence of poverty than households with elderly and children in 10 out of 15 African countries. Moreover, households headed by the elderly, compared to those not headed by the elderly, show higher level of headcount index in 12 out of 15 countries, with substantial differences (more than 10 percentage points) in 7 countries (Burundi, Burkina Faso, Cote d'Ivoire, Gambia, Kenya, Malawi and Zambia). They also find that the similar differences by household types are applied when comparing poverty gap or poverty severity ratios.

Furthermore, when decomposing[4] the contributions of different household types to reductions in aggregate poverty measures, we also find that households not comprising old people have the largest influence on aggregate poverty reduction over the period 1995-2001. Almost 70% of the reductions in the national headcount and poverty gap indexes are due to poverty reduction among households without elderly, while it accounts for 66% of the reduction in the poverty severity index. In contrast, only 26% of the reductions in aggregate headcount index are related to changes in poverty within households comprising elderly. For reductions in aggregate poverty gap and poverty severity, it accounts for 27 and 30% respectively. All this suggests that households with elderly have benefited much less than the other household types with the high

[4] Using the additive property of FGT poverty measures, we replicate the decomposition formula proposed in (Huppi and Ravallion, 1991) to explain change in poverty over time in terms of within-group poverty change (controlling for their base period population shares), population shift effects and interaction effects. Let P_{kt} denotes the FGT poverty measure or population-group *k* with population share f_k at time *t*. Then, change in poverty measure *P* can be written as follows:

$$\begin{aligned} P_{t+1} - P_t &= \sum (P_{kt+1} - P_{kt}) f_{kt} && (\text{Within groups effects}) \\ &+ \sum (f_{kt+1} - f_{kt}) P_{kt} && (\text{Population shifts effects}) \\ &+ \sum (P_{kt+1} - P_{kt})(f_{kt+1} - f_{kt}) && (\text{Interaction effects}) \end{aligned}$$

growth rates enjoyed by the Senegalese economy during this period. The implication is that the effectiveness with which growth translates into poverty reduction in Senegal depends crucially on the presence or not of an old person within households. Households comprising old people are thus likely to be handicapped in seizing growth-driven opportunities to escape poverty.

Table 5: Poverty variation over 1995-2000 (points of percentage)

	Types of household				
	All	With elderly	Without elderly	With Child & no elderly	With child & elderly
Headcount	-8.37	-4.84	-10.60	-9.16	-4.27
Poverty gap	-3.77	-2.27	-4.73	-4.43	-2.22
Poverty severity	-1.87	-1.26	-2.26	-2.18	-1.24
Population shares	1.0	0.43	0.57	0.60	0.40

Source: Our own calculations using ESAM I and ESAM II

Table 6: Contribution to poverty variation by households types (1995-2000)

	Percentage change		
Households types	Headcount	Poverty gap	Poverty severity
All households	100.00	100.00	100.00
Total intra-group effects	95.75	96.23	96.48
Households without elderly	69.73	69.15	66.33
Households with elderly	26.01	27.07	30.15
Population-shifts effects	2.87	2.46	2.45
Interaction effects	1.38	1.31	1.07

Note: Population shares in period 1 correspond to 55.06% for households not comprising old people and 44.94% for those with elderly.

3. Taxonomy of basic pensions

There are two options for structuring a basic pension program. These are: *i)* a universal flat pension scheme; and *ii)* a flat pension scheme targeting the elderly poor. A universal flat pension scheme, often referred as a "demogrant", covers the entire aged population. It provides the same pension benefit to all elderly people irrespective of their earnings history, assets or income. It has three important advantages which makes it very appealing, particularly for developing countries with limited administrative capacities and incomplete record-keeping system. First, the scheme is very simple and easy to administer. There is no need to determine the income, wealth or employment status of the beneficiaries. It involves consequently very low transaction costs. Second, it does not discourage the elderly from working or penalize those who save for their old age. Moreover, paying benefits regardless of needs will not be seen as charity and does not therefore create social stigma. The third advantage, which stems from the two previous ones, is that a universal pension scheme has less take-up problem. To meet objectives of poverty reduction in old age, it is fundamental that the entitled people are not discouraged to claim their benefits. And this will not be the case if benefits' delivery rules are very complex or benefits are subject to stigma. However, it is worth stressing that, because it is universal, such a basic pension scheme tends to be very costly, with consequent tax rates. The implication is that a universal basic pension program is usually regarded as a luxury that will be difficult to afford. To address this cost issue, some analysts suggest retrieving part of the cost by subjecting benefits

to incomes taxes with higher tax rates above a given threshold. But this could be difficult to implement in developing countries with limited administrative capacities to collect taxes. Willmore challenges this concern about the cost and argues that a universal basic pension is unsustainable only if pensions are extremely generous or if per capita output falls sharply (Willmore, 2007). Using algebraic calculations, he demonstrates that what is crucial is the per capita output. He estimates thus that a universal basic pension does not imply onerous taxes if per capita output is growing or constant.

Unlike universal basic pension scheme, a targeted one allows to control costs by reducing eligibility to benefits. In effect, under a targeted pension scheme, benefits are paid only to old people whose income or assets lie below a specific level. Thus, the aggregate costs associated with pension provision can be limited. Moreover, by focusing only on a specific target, such a scheme also allows to offer more generous pension benefits. Note that when structuring a targeted pension scheme, there are three distinctions to be made between the following:

1. Income-testing: pension is paid to elderly people with a cash-income below a certain threshold value;
2. Mean-testing: pension goes to elderly people with a level of cash-income and assets below a certain threshold value;
3. Proxy-means testing: pension is paid to elderly people who fit certain indication values correlated with poverty which are easier to observe than income or assets (such as household size, geographical location, number of children, etc.).

Despite the advantages highlighted above, a targeted pension program does, however, carry some important limits. First, administrating such a program is not simple. As a consequence of that, administrative costs would likely increase, as would opportunities for corrupt behavior of public officials. Second, a tested pension program carries a moral hazard problem characterized as "prodigality effect". Rational prodigality occurs when people don't save for their retirement relying on public support hat they expect to receive later when they are old. In the presence of tested pension program, people who behave as "rational prodigals" are then likely to reach retirement without saving or not saving enough in order to be entitled to basic pension benefits. A tested pension program reduces thus incentive to save for retirement. It also reduces incentives for people to work when old and near the threshold of entitlement. Moreover, due to the complexity of the rules of entitlement and delivery and also due to social prejudice usually associated to tested benefits, targeted pension schemes often face a non-take-up problem. The implication is that the proportion of eligible people claiming benefits could be lower than what is potential expected. And, as a result of that, the objectives of poverty alleviation could not be met.

Basic pension benefits (universal or tested) are usually financed through general income or consumption taxes. The amount of taxes needed to finance benefits depends on the number of beneficiaries, determined by the eligibility conditions and on the level of generosity of the pension. The budget constraint requires that tax revenue equals pension expenditures or, equivalently, that tax revenue per capita equals expenditure per capita:

$$\tau * y = e * b * y \qquad (4.7)$$

where τ is the tax rate; *y* is *per capita* GDP; *e* is the proportion of the population eligible for a basic pension; and b is the ratio of the pension benefit to *per capita* GDP.

Solving for τ gives:

$$\tau = e * b \tag{4.8}$$

The tax rate (as proportion of GDP) corresponds then to the proportion of the population eligible for pension benefits times the ratio of the pension to *per capita* GDP.

Thus, the more generous the pension and the larger the proportion of eligible people, the higher the fiscal cost of pension benefits will be. A large the proportion of eligible people is dependent on a low eligibility age and a high income threshold high. Therefore, basic pension plans could be made appropriately affordable by rising the age of qualification and the income threshold and/or setting pension benefits at very moderate levels.

4. Simulation results

Our simulation strategy consists as follows. We first consider three alternative forms of basic pension schemes:

1. a universal pension benefit is given to all elderly people;
2. a poverty-tested pension benefit is given to all poor elderly;
3. a poverty-tested pension benefit is given to the poorest amongst poor elderly;[5]
4. a poverty-tested pension benefit is given to the richest amongst poor elderly.

In a second step, we measure under each form of basic pension scheme the impact of pension transfers following different levels of generosity. Note that all pension transfers are required to be non-negative. Let p_i be the pension benefit paid to a household *i*, we consider two options:

1. the level of pension benefit corresponds to the poverty line taking account of the living area: $p_i = z$
2. the level of pension benefit corresponds to the average income shortfall of poor households: $p_i = z - \bar{y}_q$;

   with $\bar{y}_q = \frac{1}{q}\sum_{i=1}^{q} y_i$ and $y_i < z$.

[5] Let $(y_1, y_2, ..., y_q)$ be the income distribution among the poor. Without loss of generality, we index them: $y_1 < y_2 < ..... < y_q$. Assume y_Q the average income shortfall of the poor. We can partition the group of the poor distinguishing the poorest of the poor as those whose income is lower than y_Q while the richest ones are those whose income is higher than y_Q.

Note that we use these levels of pension benefits just for an illustrative perspective. We are not advocating that this should be the optimal level of pension. We are simply trying to provide cost estimations of what we believe to be likely upper-bound benefits.

4.1. Impact on poverty

To examine the impact on poverty of basic pension benefits, a series of results are reported in tables 7 through 9. These results concern the impact on poverty among households. In effect, our estimates assume that pension benefits are shared between beneficiaries and their co-residents. Such an assumption is realistic since evidence has showed that old people in Senegal often live in large and multigenerational households.

At first glance, one fact is worth stressing. There is no difference in terms of poverty-reduction strategy between a universal pension scheme covering all elderly people whatever their resources and a basic pension plan covering only the poor amongst the elderly. Both plans yield the same level of poverty reduction. This means then that, in terms of poverty-efficient allocation, the strategy of universal coverage is inferior to the option of covering only the poor amongst the elderly. Under a universal basic pension program, resources are wasted on persons with income above the poverty line.

Going back to tables 7-9, we also note that the poverty reduction impacts of pension benefits depend crucially on the level of generosity. Results of the simulations show impressive poverty reductions with a pension benefit's level which is equal to the poverty line. For households comprising elderly, a pension benefit of such level induces a diminution of the headcount index of 23 percent and a reduction of the poverty gap and the poverty severity indexes of 39 and 49 percent respectively. At a national level, this is translated into significant reductions in all poverty measures. Thus, the national headcount index is reduced by 12 percent and the aggregate poverty gap and poverty severity indexes by 21 and 27 percent respectively. The results are however less important when the pension benefit's level corresponds to the average income shortfall. Looking at the headcount index, we note a modest poverty reduction impact. The headcount is reduced by only 7 percent for households comprising older people and 4 percent at national level. This modest impact is likely due to the fact that a pension benefit's level of this size is not large enough to lift out of poverty the ones who are lower in the poverty scale. Simulation results in table 7 indicate that, for the poorest among the poor (those in the lower tail of the income distribution among the poor – see footnote page 14), the impact on the headcount index is zero. In contrast, for the richest amongst the poor elderly, the impact is 7 percent. This means that the headcount poverty index is more sensitive to a monetary unit given to the least poor than to someone lower in the poverty scale. Then, if resources are not sufficient enough and one aims to have as few elderly as possible remaining in poverty (lowering the headcount index), the best resource allocation strategy is to target only the poor elderly who are close to the poverty line.

The results are considerably different if one were to consider the impacts on the poverty gap and the poverty severity ratios. Evidence from tables 8 and 9 indicates that paying pension benefits exclusively to the poorest amongst the poor elderly result in greater reductions in the poverty gap and the poverty severity than if benefits were paid only to the richest of the poor. What this implies is that if the objective is to reduce the inequality amongst the poor and attenuate the

severity of poverty, the best strategy is to focus on the poor elderly lower in the poverty scale (Bourguignon and Fields, 1990).

Table 7: Percentage of reduction in headcount index

	Types of household				
Coverage	All	With Elderly	Without elderly	With Child & no elderly	With child & elderly
	Benefit's level: $p_i = z$ (240 464 FCFA or 366.6 Euros)				
Universal/All poor	12	23	0	22	55
Poorest poor	2	4	0	4	22
Richest poor	10	19	0	18	32
	Benefit's level: $p_i = z - \bar{y}_q$ (68925 FCFA or 105 Euros)				
Universal/All poor	4	7	0	7	18
Poorest poor	0	0	0	0	0
Richest poor	4	7	0	7	18

Source: Our own calculations

Table 8: Percentage of reduction in poverty gap

	Types of household				
Coverage	All	With Elderly	Without elderly	With Child & no elderly	With child & elderly
	Benefit's level: $p_i = z$ (240 464 FCFA or 366.6 Euros)				
Universal/All poor	21	39	0	38	74
Poorest poor	25	28	0	27	47
Richest poor	6	11	0	11	27
	Benefit's level: $p_i = z - \bar{y}_q$ (68925 FCFA or 105 Euros)				
Universal/All poor	8	15	0	15	37
Poorest poor	6	11	0	10	23
Richest poor	2	5	0	4	14

Source: Our own calculations

Table 9: Percentage of reduction in poverty severity

	Types of household				
Coverage	All	With Elderly	Without elderly	With Child & no elderly	With child & elderly
	Benefit's level: $p_i = z$ (240 464 FCFA or 366.6 Euros)				
Universal/All poor	27	49	0	48	83
Poorest poor	22	41	0	41	62
Richest poor	4	8	0	7	22
	Benefit's level: $p_i = z - \bar{y}_q$ (68925 FCFA or 105 Euros)				
Universal/All poor	11	21	0	20	49
Poorest poor	10	18	0	17	37
Richest poor	2	3	0	3	11

Source: Our own calculations

In summary, simulations indicate that basic pension benefits have significant poverty reduction impacts. These poverty drops are all the more so since benefits are very generous and the system is universal or covers all the poor elderly. If, however, pension benefits are not too high and do not cover all poor elderly, the poverty reduction impact will vary depending on the group targeted and on poverty measures. Furthermore, note that in these simulations, we did not look at the consequences of basic pension benefits for the elderly per se. We should however have in mind that these benefits will presumably affect their position within the household. In effect, providing basic pension benefits also leads to improvement on the capacities and the capabilities of the beneficiaries. And, it is evidenced that within extended households, the ability to contribute determines and shapes in many ways the possibilities for everyone to weigh on the decision process.

4.2. Fiscal cost

Table 10 summarizes the GDP cost of the different scenarios of basic pensions presented above. The highest GDP cost corresponds to the universal basic pension with benefits paid amounting to the value of the poverty line corresponding to 240464 FCFA or 366.6 Euros. In terms of generosity, this is equivalent to 77 percent of the GDP per capita.

The aggregate corresponding cost represents almost 4 percent of the GDP. However, this cost is likely too high regarding the poverty reduction impacts that are achieved. It is however possible to realize the same results with a much lower GDP cost by limiting coverage to only the poor elderly. In this case, the aggregate cost amounts to about 2.5 percent of the GDP.

When pension benefits are less generous, the resources required (as percentage of GDP) to cover all poor elderly are much lower. Results from simulations indicate that providing a pension benefit of the amount of the poverty gap (22 percent of GDP per capita thus 68925 FCFA or 105 Euros) to all poor elderly requires only 0.8 percent of GDP. The reduction in the aggregate headcount index associated with this scenario corresponds to 4 percent while the poverty gap and the poverty at the national level are reduced by 8 and 11 percent respectively (see column "All" in tables 7, 8 and 9). This is very significant and quite conforms with results from Subbarao and Kakwani (2005) who simulated the poverty reduction impacts of targeting 0.5 percent of GDP to all poor elderly in 15 African countries.

Table 10: GDP cost of each basic pension scheme (percentage)

	Level of pension benefit (in FCFA)	
	$p_i = z$	$p_i = z - \bar{y}_q$
Coverage strategy	240464.00 (366.6 Euros)	68925.19 (105.1 Euros)
Universal	3.94	1.30
Target all poor	2.45	0.83
Target the poorest of the poor	1.33	0.50
Target the richest of the poor	1.25	0.33

Clearly, it is noteworthy that this fiscal cost is not very large and even is smaller than what is observed in some countries. In Namibia, the old age cash transfer program requires almost 2 percent of GDP. In South Africa, the cost of the social pension program is estimated at between 2 and 3 percent of GDP. In Brazil, the cost of the rural pension program is around 1 percent of

GDP (Lloyd-Sherlock, 2000). And in Mauritius, the cost of the old age transfer program represents 2 percent of GDP (Willmore, 2007). However, it is noteworthy that these estimated costs do not take account the administrative cost for implementing and managing the program and the costs of possible corruption and leakage to the non-poor. Each of these can considerably change the estimated costs of the pension benefits.

5. Conclusion

The paper has provided an analysis of basic pension's effects on poverty measures. Simulations indicate dramatic poverty reductions amongst households with elderly in the different scenarios considered. And these impressive poverty reductions also translate into large decreases in aggregate poverty measures. This is due to the strong correlation between poverty and households with old people. In the Senegalese context, a basic pension program for old-age thus has a strong poverty relief effect. The paper also focuses on the issue of the fiscal costs of basic pensions. It seems that these are fiscally affordable as far as pension levels are reasonable. This suggests thus that a basic pension program could be financially sustainable in Senegal.

What is crucial then is the matter of implementation. There are specific administrative challenges involved here. These include determining the appropriate choice of basic pension mechanisms regarding the two main strategies: universal or targeted scheme. In this paper, it seems that the best option in terms of fiscal cost and poverty reduction impact is that targeting the poor. But, the effectiveness with which this option translates into fiscal sustainability and poverty reductions depends crucially on the possibility to identify cost-effectively the poor households with elderly.

This raises the issue of policy-design and administrative capacity. The key challenge is to identify appropriately entitled people and deliver benefits effectively and in due time. In this paper, we only investigate the poverty reduction impacts of basic pensions. But, it is also noteworthy that these pensions can play an important role encouraging economic activities and human capital accumulation. The available evidence from South Africa for example shows that pensions have improved children's outcomes and have also favored a rise of female labor force participation (Duflo, 2003; Posel, Fairburn, and Lund, 2006).

Furthermore, basic pension programs are also beneficial in these countries since they could contribute to ease some deadlocks in the labor market. In effect, in most of the African countries, unlike in the developed ones, unions wish to push up the age of retirement while the employers are against that. Unions' claims mainly rely on the idea that retirement signifies fall into destitution since retirees' incomes are very low. In contrast, employers' opposition is grounded on some imperative of competitiveness. They argue that even if life expectancy is growing this is not paired with productivity maintenance. Then, postponing retirement and keeping old workers would jeopardize the competitiveness. Such a problem is intrinsically linked to the structures of the labor market and of pension systems in these countries. In most cases, at retirement age, workers have not contributed enough to be entitled to a pension that would prevent them from falling into poverty. The main reason is that the qualified worker usually enters in the labor market at very late age (short contribution length), while the non-qualified workers is very low paid (they cannot contribute enough). The introduction of a poverty-tested basic pension would then provide a framework to reconcile these two imperatives.

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Appendix

Table A1: Individuals' Living arrangements

	Children	Adults	Elderly
Average			
Number of children	6.56	5.21	4.87
Number of adults	6.01	6.75	5.58
Number of elderly	0.62	0.61	1.49
Household size	13.18	12.57	11.94
Proportion of children	0.50	0.39	0.38

Note: On average a child co-resides with 5.56 other children, 6.01 adults and 0.62 old people. He lives in a household comprising 13.18 members on average and in which the average ratio of children is 0.50.

Table A2: Living arrangements by household types

	Types of household				
	All	With elderly	Without elderly	With Child & no elderly	With child & elderly
Average					
Number of children	4.28	4.77	3.91	4.68	5.10
Number of adults	4.94	5.45	4.55	5.15	5.63
Number of elderly	0.54	1.26	0.00	0.55	1.26
Household size	9.76	11.48	8.47	10.39	11.99
Proportion of children	0.41	0.38	0.42	0.44	0.41

Note: On average a household with elderly is comprised of 4.77 children, 5.45 adults and 1.26 old people.