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Basic Pensions and Poverty Reduction in sub-Saharan Africa*

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Abstract: This paper explores the role of basic pensions in reducing poverty in sub-Saharan Africa. Using the most recent Senegalese household income-expenditure data survey, we set up scenarios of universal and means-tested basic pension schemes with different generosity levels. Simulations suggest that basic pension benefits have sizable impact on poverty decline among household, 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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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 suggests that poverty among older people is low in countries where there exists a generous pension or safety net coverage for the elderly, such as in Brazil, Chile or South Africa. In contrast, in countries where old-age pension systems are nonexistent 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). Also, evidence suggests that in developing countries the positive effects of pensions go beyond the direct beneficiaries (the older people) and spill over to the other members of their households. Case studies in Brazil and South Africa show that children within beneficiary households have higher school enrollment rates and better health status than those living in households that do not receive a pension (Duflo, 2003).

However, despite such a positive role, most of African populations remain uncovered by a pension scheme. Except in a few countries (South Africa, Namibia, Mauritius, and Botswana), almost no African country has put emphasis on broadening its pension system coverage or setting up 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 rather well and that formal pension schemes would crowd out private transfers and worsen old people's conditions. Because of that recommendation, the issue of pension provision is seldom considered in development programs and poverty reduction strategies in Africa.

Such a low priority put on pensions 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 a fitting framework of support and care provision. By living within extended families, older people benefit from the support and care of their coresidents, because of the resilience of the cultural and social norms of respect and reverence for elders in African societies. So there is no need for developing state-organized policy for old-age support. This view is rather naive. It is based more on 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 shows 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). Further, 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. These have prompted new forms of living arrangements like households without prime age adults. Households of "elderly with children" or of "elderly only" are now widespread across the continent (Zimmer and Dayton, 2003). Thus, many traditional multigenerational

households have now missing-generations, with the responsibility for helping the household falling on older people (Lloyd-Sherlock, 2000).

Another fallacy concerns the social payoff of a policy supporting the old. Because of resource 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 in 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 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 shows 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 found out that younger children in South Africa living with their grandparents draw 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, because of the form of living arrangements in South Africa, social expenses on the elderly and social expenses 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. Exploring 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 point out 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 suggests a negative effect on labor supply, particularly male labor supply (Bertrand, Mullainathan, and Miller, 2003). In contrast, there is a positive effect on migration-decisions 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 displays 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 impressive declines 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 decline in national poverty incidence 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 poverty incidence 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 African countries, the coverage rate of the social protection system is 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] because of improvements in medical and nutritional conditions. The number of people who are more than 60 years old is growing fast (5 percent per year). And this occurs within a context of a high fertility rate and huge progress in reducing infant mortality. The implication is a growing number of people who potentially need family support. This is likely to put added strains on families' capacities to provide such support properly. Thus, within families, a trade-off becomes pressing between supporting the older members and supporting the younger. However, in this trade-off, neither alternative comes without its cost. 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 a later age.

This paper follows the approach of (Bourguignon *et al.,* 2004; Subbarao and Kakwani, 2005) and (Subbarao and Kakwani, 2005) by exploring the impact of basic pensions on poverty reduction. It also aims at setting up reliable estimates of the fiscal cost of a basic pension scheme in a context of African country with high fertility rate and increasing old-age population. However, our study differs from these papers on certain points. It does

[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.

not look at the effects that a basic pension benefit induces on household's decisions of labor supply, and income sharing 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 about 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 estimating old age poverty because of two major reasons: 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 to 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:

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

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 proper 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 people 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 rather favored, and the elderly have the higher fraction in poverty. Their conclusion is that when the economies of scale 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. After that, we remodel 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 means that children are as needy as adults; child cost equals 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 by the poverty line, the average income or consumption, and the Lorenz curve representing 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 nonnegative parameter of inequality aversion (Foster, Greer, and Thorbecke, 1984). The FGT P_α measure is given by:

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

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 or poverty incidence *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 cut out 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 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 estimate the three poverty measures with and without the income paid by the program.

The data used come from household surveys ESAM-I and ESAM-II.[2] These are nation-wide surveys carried out in 1995 and 2001 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 (1995)	743.2	662.5	384.7
ESAM II (2001)	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 combinations of β and θ. As expected, we note that large economies of scales dramatically reduce the incidence of poverty. Results point out 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 insensitive to changes in economies of scales. This is related to similarities in the forms of living arrangements. Evidence from table A1 shows 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 note that changes in the economies of scales do not overturn the poverty ranking between the household types. Figures from table 4 show that, when economies of scales increase for a fixed child cost, poverty levels decrease sharply for all households types, without affecting relative poverty rates between these different types of households. When θ decreases, the incidence of poverty also decreases, in manner similar across all household such that we can assume that household poverty profiles are not sensitive to the variations of economies of scales. This is a result of average household size remaining relatively constant despite differences in demographic structures (table A2).

Tables 3 and 4 also show the effects of changes in child costs on poverty incidence across age groups and households types. We note that declines in child cost (holding the parameter θ fixed) result in large poverty declines 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), poverty decreases by 6.78 percentage points for children. And poverty among adults and elderly decreases by 5.81 and 5.50 points respectively. Meanwhile, 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 poverty incidence i.e. percentage of people who are poor Distinguishing different age groups

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

Table 4: Household poverty incidence 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**
$\beta = 1.0, \theta = 1.0$	**68.48**	76.04	62.76	**68.29**	**79.20**
$\beta = 1.0, \theta = 0.9$	**58.00**	65.11	52.64	**57.10**	**67.68**
$\beta = 1.0, \theta = 0.8$	**44.68**	49.95	40.71	**43.39**	**51.94**
$\beta = 1.0, \theta = 0.7$	**30.71**	34.19	28.10	**30.12**	**35.27**
$\beta = 1.0, \theta = 0.6$	**19.64**	20.75	18.81	**19.89**	**21.04**
$\beta = 0.75, \theta = 1.0$	**61.93**	70.53	55.47	**60.14**	**73.30**
$\beta = 0.75, \theta = 0.9$	**50.29**	57.70	44.71	**48.26**	**59.76**
$\beta = 0.75, \theta = 0.8$	**37.34**	42.50	33.46	**35.91**	**43.97**
$\beta = 0.75, \theta = 0.7$	**24.92**	28.16	22.49	**23.88**	**28.83**
$\beta = 0.75, \theta = 0.6$	**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 underlining there are not huge differences in the size of poverty declines across age groups and household types when child cost varies. This is because of the fact the average ratio of children within households is almost identical for all age groups (see tables A1 and A2). Because of that, changes in child cost are likely to have little impact on relative poverty. Poverty ranking between age groups or between household types remains similar when child cost varies, holding economies of scales constant. Further, 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

When comparing poverty profiles across households, we note that poverty is more pervasive among households comprising elderly. By any measure, these households have the highest levels of poverty. Table 4 shows that, when $(\beta, \theta) = (0.5, 1)$, the poverty incidence for households comprising elderly is 10 points higher than that of the average population (63.18 percent opposed to 53.04). Meanwhile the poverty incidence for households without an old person is only 45.41 percent. Households are poorer when they comprise both elderly and children. Almost two-thirds of households with elderly and children are poor. This is less likely to be because of the presence of fewer working-age adults than to the presence of a higher number of older people in the household (see table A2). In contrast, that may be related to the presence of a highest number of older people. A comparison between households with different types of household heads also reveals that elderly headed households are more affected by poverty. More than 60 percent of these households are poor, while for households not headed by an old person the poverty incidence is at 50 percent.

Another noteworthy result is that the poor households from those comprising old people are poorer than the poor households without elderly. The average distance separating households with elderly from the poverty line, as proportionate to that line, is higher than that of households without elderly. Thus, the average income shortfall as proportionate to the poverty line is only 0.14 for poor households not comprising elderly, while it amounts to above one-fifth for those with an old person (0.21). The poverty gap is also rather 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 total poverty measures over the period 1995-2001. Results point out that poverty measures do not vary uniformly across the different types of households. By any measure and in poverty reduction, households without elderly outperform those comprising older people. For example, the size of reduction in the poverty incidence for this type of household represents almost 11 percentage points. That is above the national average and corresponds to twofold that 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 among households stem from the presence or absence of the elderly. This suggests a strong association between the presence of an old person within a household and the probability for this household

falling into poverty. This can be compared to results from (Subbarao and Kakwani, 2005). They found that, in 10 out of 15 African countries, households with no elderly have a much lower incidence of poverty than households with elderly and children. They also found that households headed by the elderly show a higher poverty incidence in 12 out of 15 countries compared to households not headed by old people. Similar differences apply when comparing poverty gap or poverty severity ratios.

Further, when breaking up[4] the contributions of different household types to declines in total poverty measures, we also find that households not comprising old people have the largest influence on total poverty decline over the period 1995-2001. Almost 70% of the reductions in national poverty incidence 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 reduction in aggregate poverty incidence is related to changes in poverty within households comprising elderly. For reductions in total 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 from the high growth rates enjoyed by the Senegalese economy. The implication is that the effectiveness with which growth translates into poverty reduction in Senegal depends importantly on the presence or not of an old person within a household. Households comprising old people are thus likely to be handicapped in being able to take advantage of 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**
Poverty incidence	**-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

[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:

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

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

Households types	Poverty incidence	Percentage change Poverty gap	Poverty severity
All households	100.00	100.00	100.00
Total intragroup 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 appealing for developing countries with limited administrative capacities and incomplete record-keeping system. First, the scheme is simple and easy to run. There is no need to control the income, wealth or employment status of the beneficiaries. It involves thus low transaction costs. Second, it does not discourage the elderly from working or penalize those who save for their old age. Also, 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 decline 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 complex or benefits are subject to stigma. However, it is worth stressing that, because it is universal, such a basic pension scheme is 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 recovering part of the cost by subjecting benefits to incomes taxes with higher tax rates above a given threshold. But this could be difficult to set up 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 generous or if per capita output falls sharply (Willmore, 2007). Using algebraic calculations, he proves that what is crucial is the per capita output. He estimates thus that a universal basic pension does not imply burdensome taxes if per capita output is growing or constant.

Unlike a universal basic pension scheme, a targeted one allows the control of 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 total costs associated with pension provision can be limited. Also, 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, distinctions need to be made between the following:

1. Income-testing: a pension is paid to elderly people with a cash-income below a certain threshold value;
2. Mean-testing: a pension goes to elderly people with a cash-income and assets below a certain threshold value;
3. Proxy-means testing: a pension is paid to elderly people who fit certain criteria which are easier to follow than income or assets and which correlate with poverty (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. Because 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 to be entitled to basic pension benefits. A tested pension program reduces the incentive to save for retirement. It also reduces incentives for people to work when old and near the threshold of claim. Also, because of the complexity of the rules of claim and delivery and due to social prejudice usually associated to tested benefits, targeted pension schemes often face a nontake-up problem. The implication is that the proportion of eligible people claiming benefits could be lower than potentially expected. Because of that, the objectives of poverty alleviation would not be met.

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

$$\tau * y = e * b * y \tag{4.7}$$

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. Therefore, basic pension plans could be made fittingly affordable by raising the age of qualification and the income threshold or setting pension benefits at moderate levels.

4. Simulation results

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

1. a universal pension benefit given to all elderly people;
2. a poverty-tested pension benefit given to all poor elderly;
3. a poverty-tested pension benefit given to the poorest among poor elderly;[5]
4. a poverty-tested pension benefit given to the richest among 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 needed to be nonnegative. Let p_i be the pension benefit paid to a household *i*, we consider two options:

1. The pension benefit corresponds to the poverty line taking account of the living area: $p_i = z$
2. The 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 $y_i < z$.

Note that we use these levels of pension benefits just for illustration. We are not recommending that this should be the ideal pension's level. We are merely 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 shown that old people in Senegal often live in large and multigenerational households.

The results show that both a universal pension scheme covering all elderly people whatever their resources, and a basic pension plan covering only the poor among the elderly yield the same poverty reduction. However, in terms of poverty-efficient allocation, the strategy of universal coverage is inferior to the alternative of covering only the poor among the elderly. Under a universal basic pension program, resources are wasted on people with income above the poverty line.

[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.

Going back to tables 7-9, we also note that the poverty reduction impact of pension benefits depends importantly on the 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 at this level induces a decrease of poverty incidence 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 poverty incidence 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 poverty incidence, we note a modest poverty reduction impact. The poverty incidence is reduced by only 7 percent for households comprising older people and 4 percent at national level. This modest impact is likely because of the fact that a pension benefit's 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 show 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 poverty incidence is zero. In contrast, for the richest among the poor elderly, the impact is 7 percent. This suggests that the poverty incidence is more sensitive to a monetary unit given to the least poor than to someone lower in the poverty scale. Then, in case of resource-constraints, the best allocation strategy would be to target only the poor elderly who are close to the poverty line.

The results are different if one were to consider the impact on the poverty gap and the poverty severity ratios. Evidence from tables 8 and 9 shows that targeting only to the poorest among the poor elderly result in greater declines in the poverty gap and the poverty severity. The implication is that to reduce the inequality among the poor and attenuate the severity of poverty, the best strategy is to focus on the bottom of the poverty scale (Bourguignon and Fields, 1990).

Table 7: Percentage of reduction in poverty incidence

	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

Coverage	Types of household				
	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

Coverage	Types of household				
	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 greater when benefits are generous and the system is universal or covers all the poor elderly. If, however, pension benefits are not high and do not cover all poor elderly, the poverty reduction impact will vary depending on the group targeted and on poverty measures (poverty incidence, poverty gap or poverty severity). Further, note that in these simulations, we did not look at the effects of basic pension benefits for the elderly in itself. 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 in the capacities and the capabilities of the beneficiaries. And, it is shown that within extended households, the ability to contribute fixes and shapes in many ways the possibilities for everyone to play an active role in the household decisions making.

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 cost, this equals to 77 percent of the GDP per capita.

The total matching cost represents almost 4 percent of the GDP. However, this cost is likely too high regarding the poverty reduction impact that is 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 total cost amounts to about 2.5 percent of the GDP.

When pension benefits are less generous, the resources needed (as percentage of GDP) to cover all poor elderly are much lower. Results from simulations point out 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 needs only 0.8 percent of GDP. The decrease in the aggregate poverty incidence associated with this scenario corresponds to 4 percent. Meanwhile the national poverty gap and the poverty are reduced by 8 and 11 percent respectively (see column "All" in tables 7, 8 and 9). This is significant and 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)	
	$p_i = z$	$p_i = z - \overline{y}_q$
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 large and less than that currently incurred in some countries. In Namibia, the old age cash transfer program needs 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 consider the administrative cost of setting up and managing the program and the costs of possible corruption and leakage to the non-poor. Each of these can change the estimated cost of pension benefits.

5. Conclusion

The paper has provided an analysis of basic pension's effects on poverty measures. Simulations show dramatic poverty declines among households with elderly in the different scenarios considered. And these impressive poverty declines also translate into large decreases in total poverty measures. This is because of 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 pensions are fiscally affordable when benefit levels are realistic. This suggests thus that a basic pension program could be financially sustainable in Senegal.

What is important then is the matter of implementation. There are specific administrative challenges involved here. These include fixing the right choice of basic pension mechanisms regarding the two main strategies: universal or targeted scheme. In this paper, it is suggested that the best alternative in terms of fiscal cost and poverty reduction impact is to target the poor. However the effectiveness with which this alternative translates into fiscal sustainability and poverty reduction depends crucially on the ability 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 correctly entitled people and deliver benefits effectively and in due time. In this paper, we only study the poverty reduction impact of basic pensions. It is also noteworthy that basic pensions can play an important role in 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 in female labor force participation (Duflo, 2003; Posel, Fairburn, and Lund, 2006).

Further, basic pension programs may also be beneficial through releasing deadlocks in the labor market. In most of African countries, unlike in the developed ones, unions wish to push up the age of retirement while employers are against that. Union claims mainly rely on the belief that retirement signals a fall into destitution, since retirees' incomes are low. In contrast, employers argue that even if life expectancy is growing this is not paired with productivity maintenance. Postponing retirement and keeping old workers would risk future competitiveness. Such a problem is intrinsically linked to the structures of the labor market and of pension systems in these countries. Mostly, 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 the labor market at late age (short contribution length), while non-qualified workers are low paid (they cannot contribute enough). Introducing a poverty-tested basic pension would then provide a framework to resolve 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 comprises 4.77 children, 5.45 adults and 1.26 old people.

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