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Summary:

We broaden the analysis of pro-poor growth in monetary terms to include non-monetary dimensions of poverty and to compare the results obtained from both indicators, namely consumer expenditures and a composite poverty indicator. In addition, we use several pro-poor growth measurements to see in what proportion their results converged or diverged in order to determine whether it was possible to extrapolate a course of action intended to assist the decision-maker in coming to a decision. Lastly, we chose to conduct this analysis in three geographical areas of Senegal (Dakar, other urban centres and the rural zone) from 1994/95 to 2001/02. We demonstrated the importance of conducting a multidimensional analysis of pro-poor growth. This is even more true when analyses are conducted on population sub-groups.

Keywords: Multidimensional poverty, pro-poor growth, measurement of poverty.
JEL Codes: I32, O18, O4

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Introduction

Since the establishment of the Millennium Development Goals (MDGs), pro-poor growth has aroused increasing interest among researchers and politicians. Two main findings have emerged from this recent rush of enthusiasm. First, the very definition of the concept of pro-poor growth is beset by differing interpretations. One consequence of this diversity of definitions is that there are different approaches towards the measurement of pro-poor growth and its effects on the poor. Secondly, current literature often focuses on the monetary aspect of poverty and hence of pro-poor growth. As Klasen (2005, 2008) stresses, case studies of countries in the *Operationalizing Pro-Poor Growth* (OPPG) program have placed particular emphasis on the income dimension of pro-poor growth; non-monetary dimensions were studied only in cases where a link to the monetary aspect was present. However, this is contrary to the thrust of MDGs which consider the non-monetary dimensions of welfare (particularly education, health and gender equality) as important as income poverty. More precisely, a consideration of the non-monetary aspects of poverty (for example, health, education, nutrition and culture) is just as important. Furthermore, its scope is essential to the process of developing policies for reducing poverty because it permits, among other things, interventions and the implementation of focused policies promoting a reduction in distortion risk in relation to a general intervention.

Up to now, certain empirical studies on poverty have used social indicators in their research (Klasen, 2000; Grimm *et al.*, 2002). More recently, Klasen *et al.* (2005) and Klasen (2008) introduced non-monetary poverty into pro-poverty analysis by applying a pro-poor growth measurement, Ravallion and Chen's (2003) growth incidence curve, to non-monetary indicators. However, very few studies have used a composite poverty indicator for a multidimensional analysis of pro-poor growth.

In this study, we opted to broaden the analysis of pro-poor growth in monetary terms to include non-monetary dimensions of poverty and to compare the results obtained from both indicators, namely consumer expenditures expressed as an adult equivalent and a composite poverty indicator capable of yielding an aggregate welfare measurement integrating a group of dimensions that could be said to characterize poverty. In addition, we used several pro-poor growth measurements to see in what proportion their results converged or diverged in order to

determine whether it was possible to extrapolate a course of action intended to assist the decision-maker in coming to a decision. Lastly, we chose to conduct this analysis in three geographical areas of Senegal (Dakar, other urban centres and the rural zone) from 1994/95 to 2001/02.

The rest of this paper is divided as follows. In the next section, we detail the concepts and methods used to construct the composite poverty indicator. We then present the results obtained from a comparative analysis of the non-monetary and monetary dimensions of pro-poor growth. This comparison was also conducted in each of Senegal's geographical areas. Finally, we propose some conclusions and recommendations.

1. Concepts and method

When only the monetary dimension is considered, it is often supposed that income growth has been accompanied by non-monetary growth. However, this inference is not always valid (Klasen, 2000). In this view, Kakwani and Pernia (2001) note that it is "superficial" to conduct studies on the operationalization of pro-poor growth by using only the income dimension of poverty whereas poverty is a multidimensional phenomenon, which means that pro-poor growth is as well. Therefore our analysis of pro-poor growth in Senegal would be incomplete if the study of it were not extended to the non-monetary dimensions of poverty. To achieve the objectives of this study, two sources of data were used, namely the *Enquête sénégalaise auprès des ménages* [Senegalese household surveys] ($ESAM_I$ and $ESAM_{II}$) conducted in 1994/95 and 2001/02 respectively.

As we observed previously, the literature highlights the fact that in an analysis of poverty the monetary and non-monetary approaches complement each other. The non-monetary approach to poverty corresponds to a non-utilitarian vision. It comprises two main approaches: Sen's (1985) "capability approach" and the basic needs approach. The first interprets welfare as the capacity for achieving functionings, such as being adequately fed and in good health, as well as taking part in the life of the community. According to this approach, an individual must possess certain basic characteristics necessary for achieving a certain standard of living. The second, the basic needs approach, considers that a person must be able to satisfy certain fundamental needs

(education, health, hygiene, sanitation, drinking water, shelter and access to basic infrastructures) in order to achieve a certain quality of life. In this study, we favoured the basic needs approach.

In order to conduct an analysis of pro-poor non-monetary growth, we constructed a composite poverty indicator[4] with the help of a multiple correspondence analysis (MCA). For $ESAM_I$, we followed the methodology employed by Ki *et al.* (2005) and proceeded in two stages: 1) the selection of a group of basic one-dimensional indicators and the construction of the CPI; 2) the establishment of a poverty line. For $ESAM_{II}$, we used the composite poverty indicator delineated in Ki *et al.* (2005).

The literature mentions two main approaches in order to aggregate the different aspects of non-monetary poverty into a composite poverty indicator (CPI): the entropy-based approach and the inertia-based approach. The principal distinction is that the entropy-based approach is based on dynamic mechanics whereas the inertia-based approach comes from static mechanics. In our study, we used the inertia-based approach[5] in order to aggregate different dimensions of non-monetary poverty to obtain a global view of the phenomenon.

1.1. Selection of basic unidimensional indicators and construction of the CPI

This study focuses on the multiple correspondence analysis as a factorial analysis technique since it is the one best adapted to the structure of the database used. Moreover, this method was used by Ki *et al.* (2005) in the construction of the 2001 CPI. The MCA applies to qualitative variables and the variables may be codified in binary form (0 or 1). In this way, the weights used endow this technique with the interesting property of better demarcating between rich and poor. To better focus on the poor population, this process attributes small weights to rare or luxury goods in the increase of welfare and large weights to more accessible goods in the decrease of welfare.

[4]Two approaches are frequently employed in the literature for measuring multidimensional poverty (See Ki *et al.* (2005) for further explanations of composite poverty indices, as well as a comparison of these two tools). In our study we favoured a composite poverty indicator.

[5]The inertia-based approach is based on different, so-called factorial, multidimensional analysis techniques: principal components analysis (PCA), generalized canonical analysis (GCA) and multiple correspondence analysis (MCA). For this study, we considered the inertia-based approach for two main reasons: the outcome is a composite poverty indicator that allows the least possible space for the arbitrary in its definition of functional form and the approach enables an optimal choice to be made of the relevant dimensions of poverty while avoiding redundancy of information. See Asselin (2002) for further details.

The multiple correspondence analysis provided us with the basic elements for selecting variables for constructing the CPI. The main criterion for selecting variables for the CPI was ordinal consistency on the first axis which, for a given indicator, ensured that its ordinal welfare structure was consistent with the ordinal structure (scores) of its categories on the first axis. The final list of variables and categories for the CPI obtained from the final MCA with their respective scores for $ESAM_I$ (1994/1995) and $ESAM_{II}$ (2000/2001) is provided in the Annex. Categories with a positive score increase welfare, whereas those with a negative score decrease it.

The functional form of the CPI is equal to the mean weights of categories corresponding to the mean normalized scores[6]. In considering *i* the index of a given household and C_i its value for the composite indicator, we can define functional form of the CPI (C_i) as follows[7]:

$$C_i = \frac{\sum_{k=1}^{K}\sum_{j_k=1}^{J_k} W_{j_k}^{k} I_{j_k}^{k}}{K} \qquad (1)$$

Where K is the number of category indicators, j_k the number of indicator k categories, w_{jk}^{k} the weighting coefficient (the normalized score on the first axis: $\frac{score}{\lambda_1}$) of category J_k in which λ_1 is the first eigenvalue associated with the first factorial axis, I_{jk}^{k} is the binary variable (0,1), taking value 1 when the household or individual possesses category j_k and 0 if not.

1.2. Non-monetary poverty levels

To delineate a poor or non-poor household, we established non-monetary poverty levels according to the reference household method, which consists in setting a poverty level on the basis of partial poverty levels determined for each base indicator entering the construction of the CPI. Reference households considered for $ESAM_I$ (1994/95) and $ESAM_{II}$ (2001/02) possess the definitive features given in Table 1.

The CPI value obtained for each reference household corresponds to the non-monetary poverty levels used in this study, namely a level of 0.051 for 1994/95 and 0.0088 for 2001/02.

[6]The score is computed from the factorial coordinate of each of the category indicators on the first factorial axis. This score reflects the importance of the indicator on the first factorial axis. The weight sought in the indicator's functional form corresponds to this normalized score (relationship between the score and the eigenvalue).
[7]Asselin (2002).

Table 1: Features of reference household

Goods and services that it can access	Goods and services that it cannot access
ESAM I (1994-95)	
Education level of household head: Primary	Television
	Video
Literacy: Household head literate	Owner of dwelling
	Telephone
Nature of roof: solid material (weatherproof[8])	Refrigerator/freezer
	Range
Nature of walls: concrete brick	Electric iron
	Sewing machine
Possession of a radio/radio cassette recorder	Car
	Bicycle
Type of toilets: sanitized	Air-conditioning unit
	Car
Gas stove	Washing machine
	Computer
	Ventilator
	Hi-fi sound system
	CPI value for the reference household (level) = 0.051
ESAM II (2001-2002)	
All the children attend school	Television
Access to primary school in under 30 minutes	Watch/Clock
Access to health services in under 30 minutes	Fuel for a non-modern kitchen
Potable drinking water used	Agri-food market more than 30 minutes away
Water source less than 15 minutes away	Refrigerator/freezer
	No access to electricity produced by SENELEC but uses a modern source
No food problems	Public transport more than 15 minutes away
	Secondary school more than 30 minutes away
Some members are illiterate	
Uses modern energy (electricity, gas)	
Owns a radio	
Roof of weatherproof materials	
Owns mattress/bed	
Sanitized toilets	
	CPI value for the reference household (level) = 0.088

Source: ESAM $_{I}$ and $_{II}$ and Ki *et al.* (2005).

1.3. Measurements of pro-poor growth

A measurement of pro-poor growth is defined as an index allowing all of the information available to be synthesized to evaluate whether the growth was for the benefit of the poor. For

[8]Weatherproof roof of concrete, zinc, tile or slate

this study, we focused on a comparison between pro-poor growth measurements based on the choice of the pro-poor growth definition used in the literature, namely the absolute and the relative approaches. For the purposes of comparison, we used the same pro-poor growth measurements with both the monetary and non-monetary dimension. On the monetary side, the variable of interest measuring the standard of living is the consumer expenditure per adult equivalent. On the non-monetary side, the variable is our composite poverty indicator.

Boccanfuso and Ménard (2008) designed a toolkit of measurements developed since the early Nineties. This toolkit will be used in this study. Thus, among the measurements analyzing the distribution of growth independently of the definition of pro-poor growth used (aggregate measurement), we apply the decomposition method of Datt and Ravallion (1992). This method of decomposing poverty shifts allows an evaluation and differentiation of the relative contribution of the effect of growth and the effect of distribution. The final component, the residual, monitors the interaction between the effects of growth and redistribution. In certain cases, this residual may be very large, making interpretation difficult. Therefore Kakwani (1997) proposes a variant of the decomposition of poverty which effectively eliminates Datt and Ravallion's (1992) residual term. He considers the sum of the average effects of growth and inequality to be equal to the shift in poverty. The method is similar to that of Datt and Ravallion (1992) except for the fact that decomposition is achieved without residual or is complete.

Ravallion and Chen (2003) propose a pro-poor growth measurement, the *growth incidence curve* (GIC), derived from first-order stochastic dominance conditions. The GIC analyzes the impact of economic growth aggregated on different percentiles of the income distribution among the population using the income growth rate at the p^{th} *percentile* of income distribution between two dates. This measurement may be used for any welfare indicator, whether monetary or non-monetary. Most pro-poor growth empirical studies use it for the monetary dimension, but certain studies published recently extend the analysis to the non-monetary dimension, using the GIC as a measurement (Gunther *et al.,* 2006; Klasen *et al.,* 2005; Klasen, 2008). We have observed two main drawbacks to this measurement. On the one hand, in their study Duclos and Wodon (2004) classify this curve in the "demanding" category of first-order pro-poor judgments. In other words, growth will be considered pro-poor only if total percentiles characterizing the poor have incomes growing at a faster rate than the mean income growth rate

(or another target growth rate, such as median income)[9]. On the other hand, we must be cautious with regard to the robustness of the evolution of growth rates to the extremes of income distribution produced by this measurement, as emphasized by Ravallion and Chen (2003) themselves. These authors also define an absolute measurement[10]. The *pro-poor growth rate* (PPG) is obtained from the mean growth rates for each percentile below the poverty level.

The literature on pro-poor growth also proposes measurements linked to a relative definition of pro-poor growth, in other words when economic growth benefits the poor proportionally more than the non-poor. McCulloch and Baulch (1999) established a simple measurement of pro-poor growth called the *poverty bias of growth*. Thus, the index captures the poverty variation inherent in the pro-poor growth process, namely the extent to which the growth process diverges from a neutral distribution[11]. This index also has limitations since, in certain cases, a high index does not imply a greater reduction in poverty[12] precisely because of the fact that poverty also depends on the growth effect.

Kakwani and Pernia (2000) propose the *pro-poor growth index* representing the ratio of the actual reduction in poverty over the reduction that would have been observed in the absence of change in income distribution[13]. Growth will be pro-poor (respectively pro-rich) if an inequality variation is accompanied by a reduction (respectively increase) in total poverty. Finally, if the ratio is included in the interval between 0 and 1, the growth is not strictly pro-poor even if poverty decreases. In order to overcome non-compliance with the monotonicity axiom and to take into account the real growth rate of the economy, Kakwani and Son (2003) propose another pro-poor growth rate measurement, the *poverty equivalent growth rate* (PEGR). This rate takes into consideration both the scale of growth and the manner in which the benefits of growth are redistributed between poor and non-poor. The PEGR is the growth rate (γ^*) that

[9]Duclos and Wodon (2004) determine how pro-poor judgments may be made more robust by the choice of pro-poor growth measurements and poverty lines used.

[10]A pro-poor growth measurement is said to be absolute when the poor benefit as much or more from growth than non-poor households.

[11]We are defining it simply as the opposite of the contribution of inequality to the reduction of poverty in Kakwani's (1997) method of dynamic decomposition.

[12]In the literature, it would be said that this index does not follow the monotonicity axiom.

[13]This ratio is expressed in terms of *elasticity*, namely the percentage variation of the reduction in poverty following a 1% rise in mean income, the distribution remaining unchanged. As with McCulloch and Baulch's (1999) index, Kakwani and Pernia's (2001) index does not comply with the monotonicity axiom.

would generate the same reduction in poverty as the growth rate observed (γ) in the presence of a growth process unaccompanied by any shift in inequality (all individuals then obtain the same proportional benefit from growth). This simply means that growth will be pro-poor (pro-rich) if γ^* is greater (less) than γ. Even if this index has interesting properties, it remains sensitive to the choice of a poverty level.

In 2004, Son proposed the *poverty growth curve* (PGC) with reference to Atkinson's (1987) theorem. This theorem states that a full upward (downward) shift of the generalized Lorenz curve unambiguously indicates a decrease (increase) in poverty[14]. Thus, a transfer of wealth from the richest to the poorest is considered to be a shift in pro-poor income distribution[15]. Furthermore, the PGC complies with the monotonicity axiom. In our view, growth is pro-poor when this PGC is above the mean income growth rate for the whole population for all percentiles. In this case, the poor benefit proportionally more than the non-poor from the gains of growth and inequality decreases.

Other authors measure pro-poor growth by referring to the concept of *poverty growth elasticity (total or partial). Total* poverty growth elasticity is defined as the relative shift in the poverty rate between two periods when mean income increases by 1% for a given poverty level (De Janvry and Sadoulet, 1995; Ravallion and Chen, 1997; Dollar and Kraay, 2000). Conversely, *partial* poverty growth elasticity represents the relative shift in the poverty rate when mean income decreases by 1% and income distribution remains constant. These are the decomposition methods developed by Ravallion and Huppi (1991), Datt and Ravallion (1992) and also Kakwani (1993)[16]. Bourguignon (2003) and Lopez and Serven (2004) propose intermediate approaches.

2. Results of the analysis of pro-poor growth

In this section, we present the results obtained from different measurements of pro-poor growth on the basis of monetary and multidimensional indicators. Our analysis will also take into consideration the geographical zones of Senegal, namely the capital (Dakar), other urban

[14] The *poverty growth curve* differs from the *growth incidence curve* of Ravallion and Chen (2003) because it derives from second-order dominance conditions and considers the income growth rate *up to the* p^{th} quantile and *not at the* p^{th} quantile.

[15] It is then a question of complying with the income distribution sensitivity axiom or the transfer axiom.

[16] A detailed presentation of these decomposition methods may be found in Boccanfuso and Kaboré (2004).

centres and the rural zone. In 1994/95, the majority of households lived in the rural environment (40.07%), almost one-third in Dakar (33.50%) and the rest in other urban centres (26.43%). In 2001/02, the proportion of households living in the rural environment rose to 48.60%, and fell in Dakar and the other urban centres to 30.10% and 21.30% respectively. Therefore, between 1994 and 2001/2002, there was a population shift from the urban to the rural environment.

When considering economic growth, the economic context of the period under study, 1994/95 to 2001/02, should also be recalled. After several years of weak and unstable growth, the devaluation of the CFA franc in 1994 marked the beginning of a period of strong and sustained growth in Senegal. Following macro-economic policies and structural reforms implemented by the country, economic expansion seemed more vigorous than in the past, with a GNP growth rate of 5% per annum from 1994 to 2001/02 resulting in a GNP per capita increase in Senegal of 2.5% per annum (OCDE, 2002). According to Azam *et al.* (2004), this period of strong economic growth resulting from the positive impact of the post-devaluation boom should be interpreted with caution since the period from 1993 to 1994 could be over-estimated because of particular economic circumstances and the absence of reliable data.

Table2: Poverty and poverty variation in Senegal

			ESAM I (1994/95)	ESAM II (2001/2002)
Senegal	Poverty rate (%)	Monetary	60.46	51.01
		Non-Monetary	67.57	53.82
	Poverty variation (% points)	Monetary	-9.45	
		Non-Monetary	-13.75	
Dakar	Poverty rate (%)	Monetary	47.81	33.05
		Non-Monetary	37.16	6.13
	Poverty variation (% points)	Monetary	-14.76	
		Non-Monetary	-31.03	
Other urban centres	Poverty rate (%)	Monetary	65.36	45.24
		Non-Monetary	63.63	35.17
	Poverty variation (% points)	Monetary	-20.12	
		Non-Monetary	-28.46	
Rural areas	Poverty rate (%)	Monetary	65.45	56.31
		Non-Monetary	95.74	91.06
	Poverty variation (% points)	Monetary	-9.14	
		Non-Monetary	-4.68	

Source: Estimates made by the authors, using $ESAM_{I}$ and $_{II}$ data, with Stata

Table 2 shows poverty rates obtained through two indicators (monetary and composite) for the two periods studied. Irrespective of which indicator was used, a reduction in poverty in Senegal

and its regions was observed between 1994/95 and 2001/02 with, however, a sharper decline when the multidimensional indicator was used, with the exception of the rural zone. It is also interesting to note that this zone is significantly more affected by poverty when viewed in multidimensional form. Furthermore, over the same period, it can be observed that the rural environment showed the lowest decrease in the ratios of monetary (-9.14%) and non-monetary (-4.68%) poverty.

Table 3 presents the results of decomposition according to the methods of Datt and Ravallion (1992) and Kakwani (1997) in the monetary (M) and non-monetary (N-M) dimensions of poverty. It also provides a global view of the different results of relative measurements[17].

Table 3 : Breakdown of monetary poverty variation in Senegal from 1994/95 to 2001/02

		Senegal		Dakar		Other urban centres		Rural areas	
		M	N-M	M	N-M	M	N-M	M	N-M
Datt and Ravallion (1992)	Growth effect	-21.54	-33.80	-28.18	-26.87	-30.92	-37.41	-32.03	-60.5
	Inequality effect	15.17	32.37	14.29	62.84	13.83	36.37	32.64	4.26
	Residual data	-3.08	12.38	-0.86	-67.01	-3.03	-27.42	-9.75	51.57
Kakwani (1997)	Growth effect	-23.08	-40.00	-28.62	-60.37	-32.44	-51.12	-36.9	-34.72
	Inequality effect	13.63	26.18	13.85	29.34	12.32	22.66	27.76	30.05
Growth poverty bias		-13.63	-26.18	-13.85	-29.34	-12.32	-22.66	-27.76	-30.05
Annual poverty variation[18]		-2.40	-3.21	-5.14	-22.7	-5.12	-8.12	-2.13	-0.71
Total poverty elasticity		-0.18	-0.10	-0.25	-0.28	-0.34	-0.16	-0.12	-0.02
Explained by	Growth elasticity	*-0.44*	*-0.30*	*-0.48*	*-0.55*	*-0.55*	*-0.29*	*-0.5*	*-0.15*
	Elasticity redistribution	*0.26*	*0.20*	*0.23*	*0.27*	*0.21*	*0.13*	*0.38*	*0.13*
Pro-poor growth index		0.41	0.33	0.52	0.51	0.62	0.55	0.25	0.10
Growth rate period		52.69	132.20	59.86	109.34	58.64	176.27	73.2	234.4
Poverty equivalent growth rate		21.60	43.63	31.13	55.76	36.36	96.95	18.3	23.44
Average growth rate		6.23	12.79	6.93	11.13	6.81	15.62	8.16	18.82
Median growth rate		7.13	21.31	8.57	17.56	7.75	24.61	8.71	20.22
Pro-poor growth rate		7.14	18.23	7.97	18.22	7.1	22.64	8.76	20.13

Source: Estimates made by the authors, using $ESAM_{I}$ and $_{II}$ data, with Stata

Irrespective of whether the approach of Datt and Ravallion (DR) (1992) or the decomposition of Kakwani (K) (1997) is used with regard to Senegal and all its geographical zones, we note in Tableau 2 that the reduction in poverty observed during the period 1994 to 2001/02 benefited

[17]Given the large number of results, we will limit our analysis of the results to the poverty index P_0 namely the incidence of poverty.

[18] The annual growth rate are computed by respect to seven years with the conversion formula ((growth rate +1) $^{1/7}$) -1.

from the growth in household incomes with regard to both monetary and non-monetary dimensions. However, it was limited because of a *rise* in inequalities contributing to an increased incidence of poverty. In fact, if the inequality in expenditure per adult equivalent had remained constant at the national level between the two periods, the poverty rate would have plummeted by 21.54% (DR) and 23.08% (K) with regard to the monetary aspect, and by 33.80% (DR) and 40% (K) with regard to the non-monetary aspect. This situation may be understood by a poverty bias of negative growth, suggesting pro-rich growth for the whole country during the period studied. This measurement compares the current distribution against a neutral distribution (without inequality). A bias of -13.63 in the incidence of monetary poverty signifies that household income growth of 13.63% would be needed to stabilize the incidence of poverty to offset the increase of inequalities in the country.

For the capital, *Dakar*, shifts related to inequality also contributed to a slowdown in the reduction of poverty in these two dimensions but particularly when poverty is viewed from a non-monetary aspect. Moreover, the poverty bias of negative growth also suggests global pro-rich growth in Dakar during the period. The results obtained for *other urban centres* point in the same direction since shifts in distribution contributed to the increase in poverty. The poverty bias of negative growth expressed is further evidence of pro-rich growth in other urban centres. The *rural* environment is the more affected by poverty and has the highest incidence of poverty in both monetary and non-monetary dimensions. If the mean expenditure per adult equivalent had remained constant between the two surveys, the poverty ratio would have increased by 27.76% (monetary) and 30.05% (non-monetary) according to Kakwani's (1997) approach. Furthermore, the non-positive growth bias confirms once again a rise in inequalities and concludes that there is pro-rich growth in both dimensions.

Table 3 also presents different results for pro-poor growth measurements with reference to the relative definition for Senegal and its three geographical zones. The total elasticity of monetary poverty in Senegal (-0.18) tells us that growth of 1% in expenditure per adult equivalent would have lowered the poverty rate by 0.18%. For non-monetary poverty, poverty would have decreased in a smaller proportion, namely by 10%. The effect of monetary growth (growth elasticity) at constant inequality shows that a 1% increase in expenditure per adult equivalent would have lowered the poverty rate by 0.44% with the monetary indicator, and by 0.30% for

the composite indicator. This means that the increase in inequalities contributed to limit the reduction in poverty during the period for both dimensions (0.26% and 0.20% respectively). In this context, the pro-poor growth index (0.41) reflects growth that is not strictly pro-poor, as the redistribution was unfavourable to the poor. Since expenditure per adult equivalent rose by 52.69% in the course of the period, this resulted in a poverty equivalent growth rate of 21.60, which is the rate associated with the same level of reduction in current poverty but in the presence of a process unaccompanied by a shift in inequalities.

Conversely, the composite poverty index rose by 132.20% during the period, resulting in a poverty equivalent growth rate of 43.63%. Since real growth rates are higher than the poverty equivalent growth rate in both dimensions of poverty, the measurement allows us to infer a process of pro-rich growth for the period. Moreover, a monetary poverty equivalent growth rate of 21.60% denotes that 31.09% of growth was lost because of a rise in inequalities during the period. Likewise, the monetary poverty equivalent growth rate of 43.63% denotes a growth loss of 88.57% from 1994 to 2001/02. An examination of pro-poor growth in terms of monetary elasticity also shows a process of pro-rich growth for the Senegalese capital in the course of the period, as did the analysis conducted on the basis of the poverty equivalent growth rate. In fact, the monetary poverty equivalent growth rate indicates that 28.73% of growth was lost because of the rise in inequalities if expenditure per adult equivalent is used as a welfare indicator. This figure corresponds to 53.58% for the non-monetary dimension. Similar results are obtained when other urban centres are analyzed. For example, 79.32% of non-monetary growth was lost because of the increase in inequalities. From the monetary aspect, the expenditure growth rate per adult equivalent was lower (58.64%). resulting in a lower poverty equivalent growth rate (36.36%). The measurement for the poverty equivalent growth rate thus confirms a process of pro-rich growth in both dimensions of poverty.

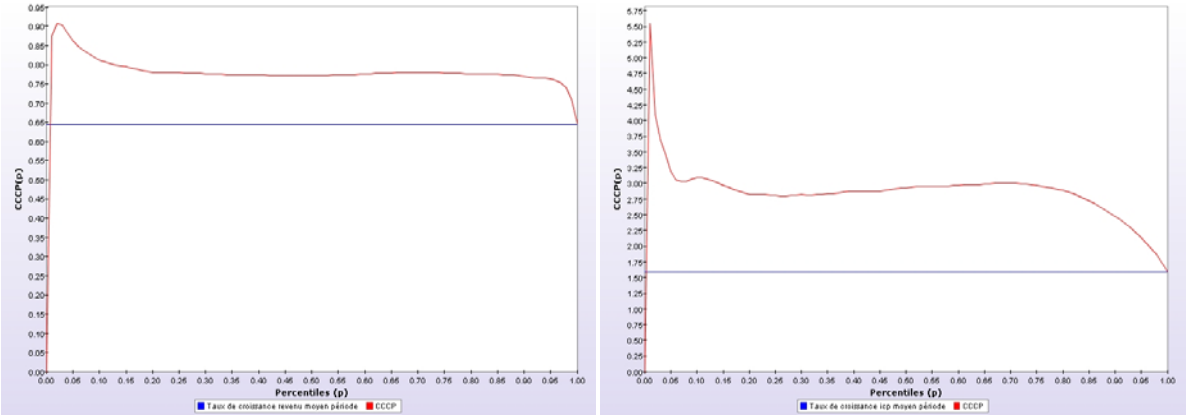
For the rural zone, an examination of growth in terms of elasticity also validates the process of relative pro-rich growth during the period. In fact, the total elasticity of poverty indicates that a drop of 0.12% (monetary) and 0.02% (non-monetary) in the poverty rate is associated with growth of 1%. In this context, the pro-poor growth index is 0.25 (monetary) and 0.10 (non-monetary), which suggests an expenditure distribution less favourable to the poor during the period. With the strongest growth rates in the country, 73.20% (monetary) and 234.40% (non-

monetary) in the course of the period, we obtain the lowest poverty equivalent growth rates (18.30% and 23.44% respectively), much lower than the effective growth rate. That said. since growth rates considerably increased during the period, poverty equivalent growth rates indicate that 54.90% and 210.96% were lost because of an evolution of distribution less favourable to the poor.

The measurement of the poverty growth curve also tells us about the performance of economic growth. Monetary and non-monetary poverty growth curves (Figure 1) indicate that the expenditure growth rate for the poor is greater than zero for all percentiles, confirming the decrease in poverty in these two dimensions in Senegal. Furthermore, since growth rates for the poor are higher than those for the population as a whole, we can state that there has been a full upward shift of the Lorenz curves and that second-order dominance conditions for the distribution of 2001/02 over that of 1994/95 have been respected. The measurement allows us to infer pro-poor monetary and non-monetary growth with a decrease in inequalities for all percentiles, diverging from the findings yielded by other relative inequalities measurements during the period.

Figure 1: Poverty growth curves of monetary (a) and non-monetary poverty (b) in Senegal

(a) (b)

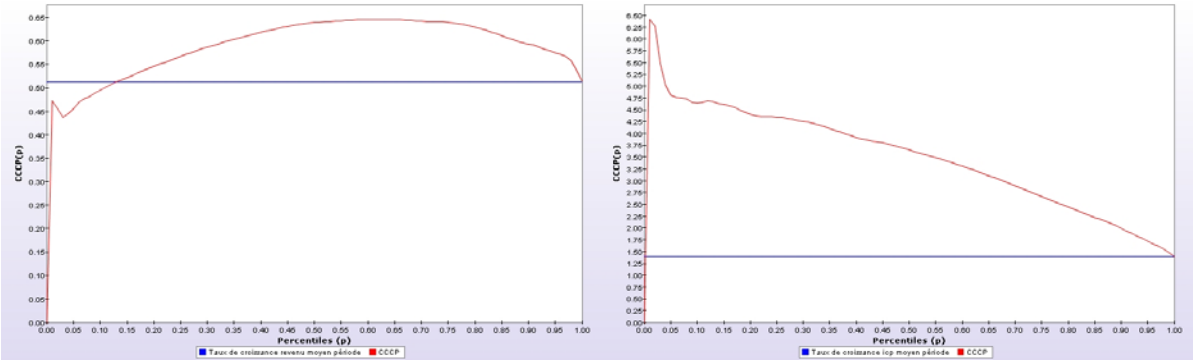


Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with DAD

Likewise, these curves contradict the preceding result relating to pro-rich growth during the period for the Senegalese capital. These poverty growth curves allow us to infer pro-poor growth with a decrease in inequalities for the period under consideration since they comply with second-order dominance conditions for both dimensions of poverty.

Figure 2: Poverty growth curves of monetary (a) and non-monetary poverty (b) in other urban centres

(a) (b)

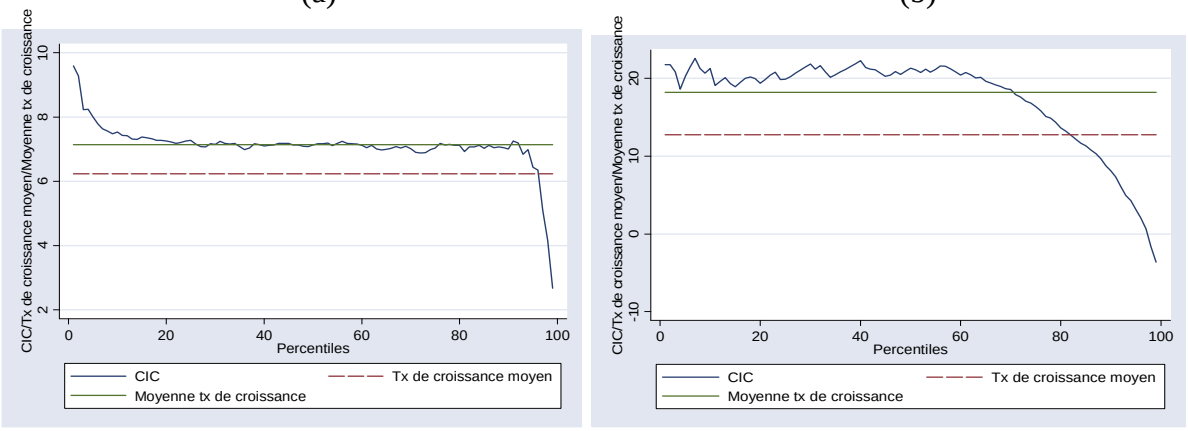


Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with DAD

The monetary poverty growth curve (Figure 2(a)) for other urban centres confirms the reduction in poverty during the period. Furthermore, it validates the findings yielded by the other measurements showing a process of pro-rich growth with an increase in inequalities for the period under consideration because second-order dominance conditions are not respected. The non-monetary poverty growth curve (Figure 2(b)) invalidates the pro-rich growth previously found and allows us to infer pro-poor growth with a reduction in poverty and a decrease in inequalities during the period. Finally, for the rural environment, the measurement allows us to infer a process of growth favourable to the poor with a decrease in inequalities from 1994 to 2001/02 for both dimensions of poverty, which is similar to the results obtained at the national level and in the Senegalese capital.

Figure 3: Growth incidence curves of monetary (a) and non-monetary poverty (b) in Senegal

(a) (b)



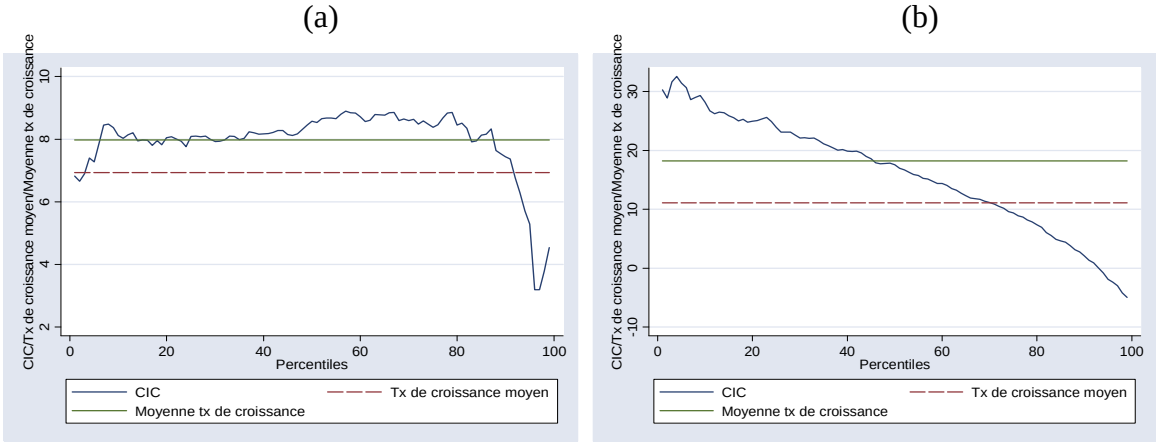
Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with Stata

Finally, we applied the growth incidence curve (GIC) developed by Ravallion and Chen (2003). This aggregated measurement also provides the means to analyze growth for the period studied for Senegal and its three geographical zones. For the monetary dimension of poverty, the curve represents the expenditure growth rate per adult equivalent for each percentile of the population. For the non-monetary dimension, it represents instead the growth rate of the composite poverty index for each percentile of the population.

With the assistance of the monetary growth incidence curve, it was observed (Figure 3(a)) that growth was mostly distributed equally for all percentiles with the exception of the lowest, which benefited more from growth, and the highest, which benefited less. In fact, the curve shows that, during this seven-year period, income distribution did not vary significantly because income growth was generated at an almost identical rate over the entire distribution. Therefore, according to this measurement, growth was pro-poor in absolute terms. On the non-monetary side, the growth incidence curve indicates that the poor benefited more from growth with CPI growth rates above the mean for the first seventy percentiles (Figure 3(b)).

Lastly, the monetary and non-monetary growth incidence curves (Figure 4) confirmed the sharp reduction in poverty in both dimensions of poverty in the Senegalese capital. From the monetary point of view (Figure 4(a)), the measurement allows us to infer pro-poor monetary growth in absolute terms. However, percentiles representing the poorest households (the first five) show lower income growth paralleled by that of the richest households which had lower growth rates than those recorded over the whole distribution.

Figure 4: Growth incidence curves of monetary (a) and non-monetary poverty (b) in Dakar

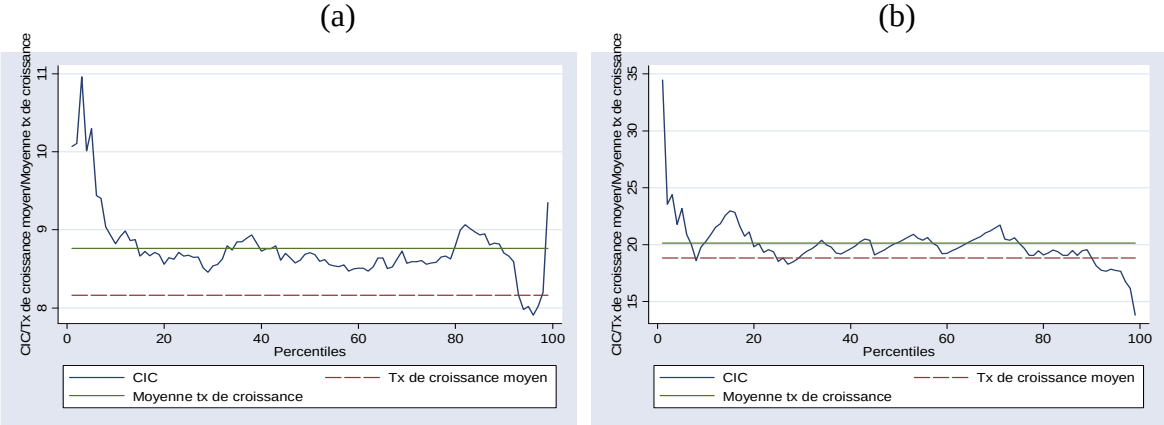


Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with Stata

However, it appears that, from a relative point of view, the poorest did not benefit the most from this growth. This result also holds for households in other urban centres (Figure 8(a)). In fact, the monetary GIC shows growth rates for the first quintiles that are lower than those recorded for the population as a whole. On the non-monetary side, the growth incidence curve obtained for the Senegalese capital (Figure 4(b)) is situated above the pro-poor growth rate equal to 18.22%, which is in itself higher than the general growth rate (11.13%) for the first fiftieth distribution percentiles. allowing us to declare pro-poor growth for the period. The results obtained for other urban centres also point in the same direction (Figure 8(b)).

For the rural zone, the results obtained suggest different characteristics. Monetary (Figure 5(a)) and non-monetary growth incidence curves (Figure 5(b)) confirm the reduction in poverty because the expenditure growth rate per adult equivalent is positive for all percentiles. Therefore the measurement allows us to infer pro-poor growth in absolute terms in rural areas in both dimensions. However, the measurement does not allow us to confirm a decrease in inequalities in both dimensions of poverty since the *growth incidence curve* does not decline for all percentiles on both curves. However, we may conclude that growth is pro-poor for the first decile for the two indicators used.

Figure 5: Growth incidence curves of monetary (a) and non-monetary poverty (b) in rural areas



Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with Stata

3. Conclusion

In conclusion, we are in a position to confirm that our analysis of pro-poor growth from the monetary and non-monetary aspects demonstrates the importance of conducting a multidimensional analysis of pro-poor growth. Although pro-poor growth analyzed from both

the monetary and non-monetary aspects of poverty is positively correlated, the analysis yields similar results essentially with regard to variations and other non-consolidated items in terms of amplitude. First, both monetary and non-monetary poverty rates fell between 1994 and 2001/2002, irrespective of the geographical zone. This decrease in the number of poor people is substantiated by all of the measurements considered, with the exception of the growth incidence curve which led us to infer divergent outcomes.

In the monetary and non-monetary dimensions of poverty, growth benefited poor households residing in the urban environment more than those in the rural environment. Nevertheless, it was noted that in the urban environment a 1% rise in growth resulted in a greater decrease in poverty in its non-monetary dimension than in its monetary dimension. The opposite was observed in the rural environment (poverty decreased more in its monetary than non-monetary dimension). With regard to inequalities, growth was redistributed more unequally in the rural environment than in the urban environment for both dimensions of poverty. For all households, a more unequal redistribution of growth was observed in the non-monetary dimension than in the monetary. If inequalities had remained constant during the period, our results show that the incidence of monetary poverty would have decreased by 23.08% in its monetary dimension and by 40% in its non-monetary dimension, contrary to the recorded decrease of 9.45% and 13.81% respectively. In other words, poverty reduction timelines would have been shortened in the absence of distortion in the process of growth redistribution. All the measurements studied allowed us to conclude that there was a most unequal redistribution of income between rich and poor from 1994 to 2001/02, with the exception of the poverty growth curve measurement.

Therefore this article brings to the fore the importance of analyzing pro-poverty in its monetary and non-monetary dimensions. This is even more true when analyses are conducted on population sub-groups. We can see, for example, that discrepancies in both dimensions are greater for the poorest group (rural) in our analysis, underscoring the fact that caution is called for when implementing policies.

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Annex

Table 4: List of variables and modalities with scores contributions and square cosines of the final MCA with $ESAM_I$

	Scores		Contribution		Cosines squared		Distance to the centre
Variables and modalities	**Axis 1**	**Axis 2**	**Axis 1**	**Axis 2**	**Axis 1**	**Axis 2**	**a**
Education level of head of household							
No education	-0.31	-0.11	1.51	0.50	0.33	0.05	0.27968
Primary	0.60	-0.14	0.79	0.10	0.04	0.00	8.45838
Secondary	1.45	-0.19	3.36	0.14	0.18	0.00	11.97860
Higher	2.95	-0.43	3.47	0.18	0.17	0.00	51.01120
Literary level of head of household							
Literate	0.60	-0.17	2.70	0.55	0.20	0.02	1.79325
Non literate	-0.36	-0.10	1.64	0.34	0.21	0.02	0.60061
Nature of the roof							
Roof solid (concrete. zinc. tile or slate)	0.14	0.00	0.26	0.00	0.03	0.00	0.65174
Other	-0.22	0.01	0.40	0.00	0.03	0.00	1.53435
Ownership of the home							
Owner	0.04	0.02	0.03	0.02	0.01	0.00	0.20033
Non owner	-0.22	-0.10	0.16	0.09	0.01	0.00	4.99166
Nature of the walls							
Cement bricks	0.21	0.07	0.64	0.20	0.11	0.01	0.39782
Banco (mud) bricks or other	-0.52	-0.19	1.61	0.50	0.11	0.01	2.51372
Presence of a telephone							
Telephone	2.61	0.17	7.06	0.07	0.36	0.00	18.96590
No telephone	-0.14	-0.01	0.37	0.00	0.36	0.00	0.05273
Type of toilet							
Toilets hygienic	-0.05	0.00	0.06	0.00	0.05	0.00	0.05580
Toilets unhygienic	0.95	0.00	0.99	0.00	0.05	0.00	17.92200
Hi-fi sound system							
Hi-fi sound system	2.09	-0.33	5.07	0.31	0.26	0.01	16.84770
No hi-fi sound system	-0.12	0.02	0.30	0.02	0.26	0.01	0.05936
Television							
Television	1.32	0.05	8.31	0.03	0.52	0.00	3.32637
No television	-0.40	-0.02	2.50	0.01	0.52	0.00	0.30063
Video							
Video	2.88	-0.09	9.57	0.02	0.49	0.00	16.86320
No video	-0.17	0.01	0.57	0.00	0.49	0.00	0.05930
Radio/ radio cassette player							
Radio/ radio cassette player	0.13	0.02	0.26	0.02	0.05	0.00	0.30955
No radio/ radio cassette player	-0.41	-0.07	0.83	0.06	0.05	0.00	3.23054
Refrigerator/freezer							
Refrigerator/freezer	4.14	-0.73	4.60	0.35	0.23	0.01	75.92300

	Scores		Contribution		Cosines squared		Distance to the centre
Variables and modalities	**Axis 1**	**Axis 2**	**Axis 1**	**Axis 2**	**Axis 1**	**Axis 2**	**a**
No refrigerator/freezer	-0.05	0.01	0.06	0.00	0.23	0.01	0.01317
Modern cooking stove							
Modern cooking stove	3.18	-0.01	5.95	0.00	0.30	0.00	34.17610
No modern cooking stove	-0.09	0.00	0.17	0.00	0.30	0.00	0.02926
Electric iron							
Electric iron	3.28	-0.54	5.64	0.37	0.28	0.01	38.35820
No electric iron	-0.09	0.01	0.15	0.01	0.28	0.01	0.02607
Sewing machine							
Sewing machine	1.39	-0.19	3.46	0.15	0.18	0.00	10.60940
No sewing machine	-0.13	0.02	0.33	0.01	0.18	0.00	0.09426
Car							
Car	2.69	0.19	6.34	0.08	0.32	0.00	22.62210
No car	-0.12	-0.01	0.28	0.00	0.32	0.00	0.04421
Bicycle							
Bicycle	-0.14	-0.26	0.02	0.21	0.00	0.00	15.25580
No bicycle	0.01	0.02	0.00	0.01	0.00	0.00	0.06555
Gas stove							
Gas stove	0.76	0.05	3.63	0.04	0.25	0.00	2.28750
No gas stove	-0.33	-0.02	1.59	0.02	0.25	0.00	0.43716
Air conditioner							
Air conditioner	4.32	-0.75	3.67	0.27	0.18	0.01	104.18200
No air conditioner	-0.04	0.01	0.04	0.00	0.18	0.01	0.00960
Micro-computer							
Micro-computer	1.47	-0.44	0.10	0.02	0.00	0.00	443.86700
No micro-computer	0.00	0.00	0.00	0.00	0.00	0.00	0.00225
Washing machine							
Washing machine	6.25	-1.66	0.51	0.09	0.02	0.00	999.99000
No washing machine	0.00	0.00	0.00	0.00	0.02	0.00	0.00064
Ventilator							
Ventilator	1.96	0.06	9.52	0.02	0.52	0.00	7.30070
No ventilator	-0.27	-0.01	1.30	0.00	0.52	0.00	0.13698
Moped							
Moped	0.30	-0.25	0.06	0.10	0.00	0.00	28.31270
No moped	-0.01	0.01	0.00	0.00	0.00	0.00	0.03532

Source: MCA from $ESAM_I$ data

Table 5: List of variables and modalities with scores. contributions and square cosines of the final MCA with $ESAM_{II}$

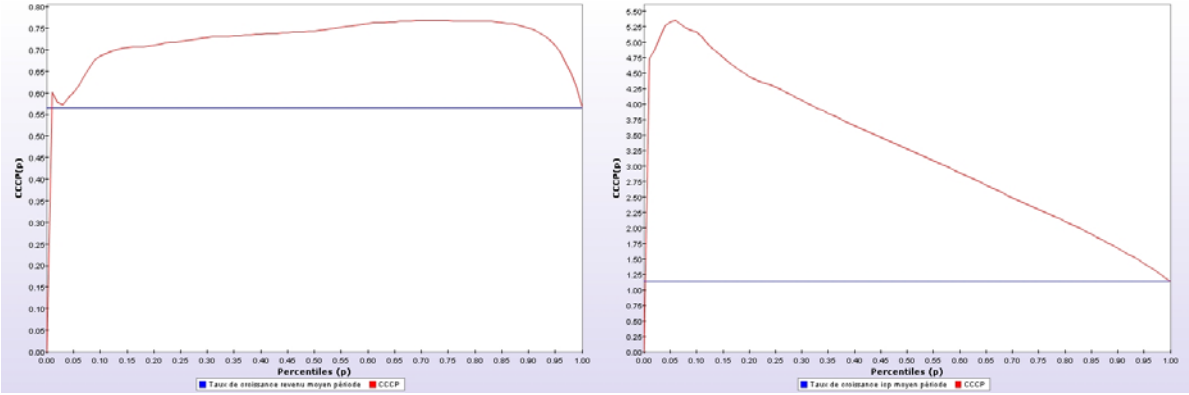
Variables and modalities	Scores on the first axis	Contribution	Cosines squared	Distance to the center
Refrigerator/freezer				
Refrigerator/freezer	1.46	4.8	0.41	5.21
No refrigerator/freezer	-0.28	0.9	0.41	0.19
Television				
Television	1.25	5.6	0.53	2.92
No television	-0.42	1.9	0.52	0.34
Mattress/bed				
Mattress/bed	0.05	0	0.04	0.06
No mattress/bed	-0.88	0.6	0.05	17
Radio/radio cassette player				
Radio/ radio cassette player	0.15	0.2	0.07	0.33
No radio/ radio cassette player	-0.44	0.7	0.06	3.06
Watch/alarm clock				
Watch/alarm clock	0.26	0.6	0.09	0.72
No watch/alarm clock	-0.36	0.8	0.09	1.4
Electricity in the household				
Electricity	1.18	6.8	0.74	1.87
No electricity	-0.62	3.6	0.72	0.53
Food problems				
Never had food problems	0.44	0.9	0.09	2.23
Experience food problems	-0.2	0.4	0.09	0.45
Nature of roof				
Roof solid (concrete)	0.46	2	0.45	0.47
Roof non-solid (thatched. wood or banco)	-0.96	4.2	0.44	2.11
Nature of walls				
Cement bricks	0.74	4	0.59	0.92
Banco (mud) bricks or wood	-0.79	4.2	0.58	1.08
Drinking water				
Drinking water	0.45	1.8	0.33	0.61
Undrinkable water	-0.73	2.8	0.33	1.63
Type of toilets				
Toilets hygienic	0.77	4	0.57	1.05
Toilets unhygienic	-0.72	3.7	0.54	0.95
Fuel for cooking				
Fuel modern	1.08	5.5	0.6	1.95
Fuel non-modern	-0.55	2.8	0.59	0.51
Type of lighting				
Source of lighting modern	1.16	6.7	0.74	1.81
Source of lighting non-modern	-0.63	3.6	0.72	0.55
Access to water				
Less than 15 minutes	0.1	0.1	0.07	0.14

Variables and modalities	Scores on the first axis	Contribution	Cosines squared	Distance to the center
More than 15 minutes	-0.72	0.9	0.07	7
Access to food market				
Less than 30 minutes	0.46	1.7	0.29	0.72
More than 30 minutes	-0.64	2.4	0.29	1.39
Access to public transport				
Less than 15 minutes	0.43	1.5	0.24	0.78
More than 15 minutes	-0.55	1.9	0.24	1.29
Access to primary school				
Less than 30 minutes	0.19	0.4	0.15	0.24
More than 30 minutes	-0.79	1.7	0.15	4.24
Access to secondary school				
Less than 30 minutes	0.9	3.8	0.42	1.95
More than 30 minutes	-0.45	1.9	0.39	0.51
Access to health services				
Less than 30 minutes	0.49	1.9	0.33	0.73
More than 30 minutes	-0.66	2.6	0.32	1.38
Primary net rate of schooling				
No child attending school	-0.49	1	0.16	1.52
Some children attending school	-0.13	0	0	3.46
All children attending school	0.42	0.7	0.11	1.64
Literacy rate				
All illiterate	-0.66	1.9	0.2	2.22
Some literate	0.12	0.1	0.02	0.76
All literate	1.17	2.3	0.19	7.38

Source : Ki et *al.* (2005)

Figure 6: Poverty growth curve of monetary (a) and non-monetary (b) in Dakar

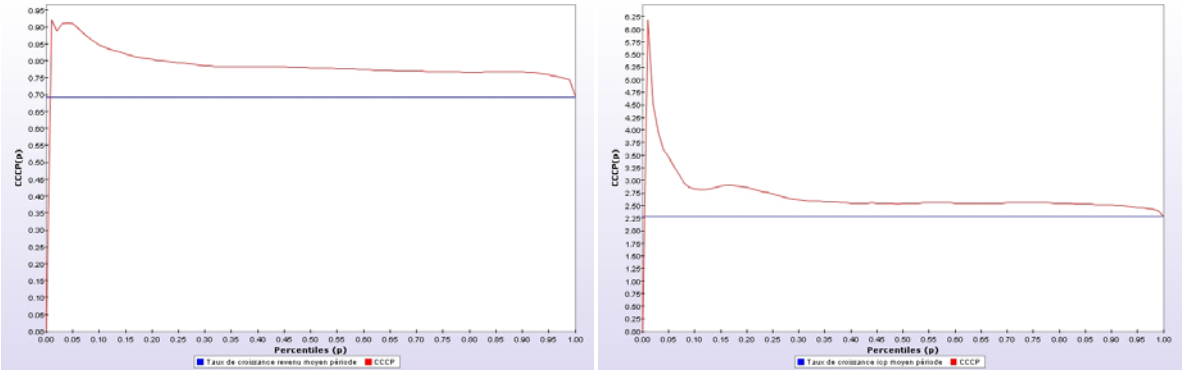
(a) (b)



Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ Data, with DAD

Figure 7: Poverty growth curve of monetary (a) and non-monetary poverty (b) in rural areas

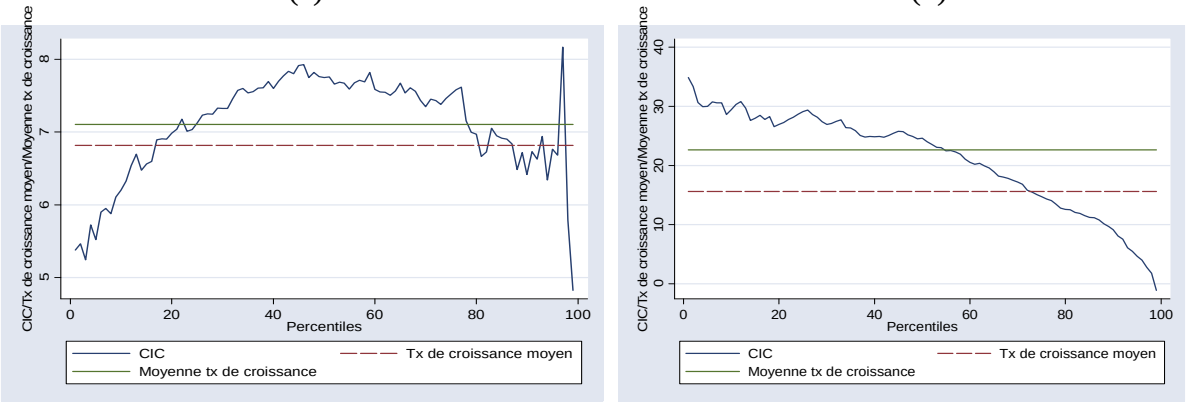
(a) (b)



Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with DAD

Figure 8: Growth incidence curves of monetary (a) and non-monetary poverty (b) in other urban centres

(a) (b)



Source: Calculations performed by the authors using ESAM$_{I}$ and $_{II}$ data, with Stata