The 2009 Annual Meeting of the Middle East Economic Association (MEEA)
January 2-5, 2009, San Fransisco, CA, USA

Journal of Middle East Economic Association and Loyola University Chicago,USA, Volume 11, September 2009

Households poverty and water linkages: Evidence from Algeria

Samir B.E. MALIKI[1], Abderrezak BENHABIB[2] & Jacques CHARMES[3]
University of Tlemcen, Laboratory MECAS, Algeria
BP 226, 13000, Tlemcen, Algeria
Tel & Fax +213 (0) 43 21 21 66

Abstract

The aim of this paper is to quantify the subjective poverty of Algerian households by taking into consideration water domestic characteristics as the direct focus. The importance of this factor stems from a strong hypothesis that a structurally sound socio-economic policy to reduce poverty must take into consideration, among other variables, the improvement of housing conditions (Benhabib & all, 2007).

We attempt to apply the test-equality of two or more ROC (Receiver Operating Characteristic) curves to determine the true poor household through the water factor. The ROC method consists of defining the water indicators of poor households on the basis of a comparison of the standard indicators of the Social Ordinary Living Patterns (Townsend, 1979) made upon 26 items and 8 dimensions of water-poverty relationship.To do that, we proceed with a field survey on a sample of 786 households in the wilaya of Tlemcen (Maliki, 2008). A classification is made according to the hydraulic characteristics of the poor households.

The results show that the main indicators that characterize the true subjective poor Algerian households are the type of access to water, the means of water storage, the use of kitchen, water complementarity and the presence of hydric transmission diseases.

These results may shed some light into the best approach policy makers can take for a pertinent targeting of poor households as far as poverty alleviation is concerned.

Keywords: Poverty – Water – ROC- Household– Algeria.
JEL Codes: I32 - R20

[1] Corresponding author: Dr. Samir Baha-Eddine MALIKI, Faculty of Economics and Management, MECAS laboratory, University Abou Bekr Belkaid of Tlemcen, Algeria Email : sb_maliki@mail.univ-tlemcen.dz /samirmaliki@yahoo.fr
[2] Professor Abderrezak BENHABIB is Director of the Laboratory MECAS, University Abou Bekr Belkaid Tlemcen, Algeria, Email: abenhabib1@yahoo.fr
[3] Professor Jacques CHARMES is Director of DSS, IRD, France, Email : Jacques.charmes@ird.fr

Introduction

Since the announcement of the eight objectives of the Millennium Development Goals, MDG, where the access to safe water is considered as an important part of the first objective linked to the elimination of the extreme poverty and hunger (United Nations, 2000), water and poverty have become more integrated and put to the forefront in the public debate (see table 1).The last report of the UNDP 2006, entitled "Beyond scarcity : Power, poverty and the global water crisis" has come to confirm the necessity to take the water factor as a central element in combating poverty, particularly in Algeria. Actually, in terms of climate, Algeria is characterised by a semi-arid nature, the fact that brings a high degree of scarcity in water availability.

Insert Table 1

In fact, the average theoretical availability of water has attained a critical threshold estimated at 500m^3/capita/year, representing less than half the scarcity threshold fixed by the World Bank at 1000m^3/capita/year, and less than the fifth of the threshold of 2000 m^3/capita/year. There is a general consensus that this critical issue may be caused by bad governance of water.

Poverty measurement has always relied on one-dimensional or multidimensional methods that are computed on the basis of the poverty line, although the fuzzy set method tackles the poverty line by integrating it within a graded range on the basis of membership functions (Benhabib et all., 2007). However, as measurement problems persist, we propose the Receiver Operating Characteristics method called ROC as a better tool to quantify poverty. In this case we look at the relationship between water and poverty in order to know more about water characteristics that may better explain household poverty level.

Literature on international data gathering can sometimes obscure the way poor households have access to water. International statistics help draw a distinction between "improved" and "unimproved" access. The improved encompasses three dimensions of water security: quality, proximity and quantity. For international reporting purposes, people are classified as enjoying access to water if they have at least 20 litres a day availability of clean water from a source of less than one kilometer from their home (UNDP, 2006)[4].

This paper aims at defining targets of poor Algerian households on the basis of water characteristics using both the household's subjective poverty measures and water access conditions for better quantification of their interactions in order to help policy makers to set adequate policies for poverty alleviation in Algeria.

The study consists of classifying the households on the basis of real subjective poverty measure according to water access conditions by applying the test-equality of one or more ROC (Receiver Operation Characteristic) curves. To do that, we shall present in the first section some poverty

[4] Human development report, 2006, « Beyond scarcity : Power, poverty and the global water crisis"

measurements in Algeria which will be followed in the second by a presentation of ways to reducing poverty by water. In the third section, targeting the poor households by water will be examined and then tested through an application of the test-equality of ROC curves to the region of Tlemcen; Policy options will be proposed in the conclusion.

1. Measurement of poverty in Algeria

Literature on poverty is extremely abundant and characterized by an unusual level of ambiguity relative to economic theory. As such, it provides many different definitions of what poverty is; each conceptualisation obviously leads to a particular identification of the poor (Asselin, & Dauphin, 2001). The level of poverty can be measured, generally, on the basis of two approaches: the material and non material, the utilitarian and non utilitarian.

The first approach deals only with the material side on the basis of the economic welfare function, and defines poverty in terms of scarcity of goods and resources (Bey, 1999) that putting some limits on the satisfaction of basic needs such as nutrition, clothing and housing. This definition implies two important aspects of "material" poverty regarding small revenues and non-satisfaction of basic needs.

In short, this approach is set exclusively on the basis of revenue and does not give enough importance to non marketable goods and services that have an impact on the household level of living and, may thus, contribute to increase or decrease the poverty level biais. For this reason, this approach is completed by a conceptualisation based on satisfaction as far as fundamental needs are concerned.

Furthmore Sen (1985) avoids this first approach by relying on social justice, equity and equalities. His definition of poverty, based on the capacity approach, takes into account not only the economic factors, but also legal, political, social and individual dimensions.

The second approach, the utilitarian, sets some indicators upon goods and services consumed by a household thus delimiting the notion of "utility" only to the "economic well-being". This approach ignores the non quantifiable aspects of utility such as the "non tradable" goods and the non-material elements of human condition such as freedom.

The indicator that derives from the utilitarian approach is consumption expenditure of goods and services, normalized to take into account price differences and household's characteristics. The non–utilitarian approach and mainly that based on capacities help determine the ability to get goods as an explanatory variable of well-being, while keeping consumption as an indicator.

In the last decade , there has been a shift from a physiological model of deprivation[5], focused on the non-fulfilment of basic material or biological needs, to a social model of deprivation that focus on such elements as lack of autonomy, powerlessness, lack of self-respect / dignity, etc.

[5] Deprivation takes many different forms in every known society. People can be said to be deprived if they lack the types of diet, clothing, housing, household facilities and fuel and environmental, educational, working and social conditions, activities and facilities which are customary, or at least widely encouraged and approved, in the societies to which they belong (Townsend, 1979).

In the past, standard analysis of poverty dynamics was based largely, if not exclusively, on economic and human capital that contributes to explaining physiological deprivation (see fig. 1). However, Five additional forms of capital such as social, political, cultural, coercive and natural capital (Shaffer, 2008)[6] have come to play an increasingly important role as far as delimitation of social deprivation is concerned.

Insert Figure 1

In Algeria, the actual indicators confirm the existence of some improvements in poverty level. According to the Ministry of employment and national solidarity, poverty level decreased of about 2.3 % between 2000 and 2006.

Yet, in contrast, the UNDP considers that the number of poor approximates the 10 millions, a figure that exceedes largely the 723020 poors presented by the ministry of employment and solidarity. Moreover, along with the ministry figures, the latest CNES (2007) shows that the proportion of the population living below the nutritional poverty threshold has moved from 3.6% in 1988 to 1.6% in 2004, representing 518000 individuals.

From a general angle the global poverty threshold that concerned 3.98 million individuals in 1995 decreased to 2.2 million in 2004 with an annual average decrease of 6.37%. As a result, the measurement of the Human Poverty Index (HPI) shows a decreasing index between 1995 and 2005 (CNES, 2007).

Insert Table2

Despite these statistical improvements, poverty research in Algerian has focussed so far on the consequences of poverty, i-e bad nutrition, unemployment, exclusion etc…, ignoring the forces that lie behind the existence of this phenomenon. As such, the understanding of the existing relationships between the causes of poverty as well as the forces standing behind these relationships can help decision makers elaborate a better targeting of the poor, and consequently set up an efficient resource allocation (Maliki & all, 2006).

---

6 1. ***Economic Capital*** corresponds broadly to those factors of production (land, labour, capital) which generate primary income as well as economic assets (livestock, jewellery, etc.) and credit.
2. ***Human Capital*** refers to individual characteristics or attributes which are central for the achievement of human goals. A short list would include satisfactory levels of physical and cognitive development due to adequate health, nutrition and education.
3. ***Social Capital*** refers to those social organisations, relationships and networks which facilitate co-ordination and management of extra-market and collective tasks and which provide critical support in times of crisis. Social capital relates closely to concepts of trust and reciprocity.
4. ***Political Capital*** comprises the network of informal and formal political alliances which provide access to resources and confer decision-making authority.
5. ***Cultural Capital*** includes those norms, beliefs and values which assign roles, confer status and determine entitlements and obligations of different social groups (based on gender, caste, age, ethnicity, etc.).
6. ***Coercive Capital*** which includes sources of violence, intimidation, force, etc., is a means of enforcing social norms and maintaining (at times, repressive) social relationships.
7. ***Natural Capital*** refers to the quality and quantity of the stock of available natural resources, including common property resources, and to the knowledge/skills required for natural resource management and conservation.

This brief outline makes us put forward the following main issues: Is poverty measurement in Algeria constrained by the usual chosen methods, or influenced by the statistical data used, or lead by the sample surveyed, or, from an administrative angle, slanted by the diversity of institutions in charge of the measurements, or finally, conceptually biased due to a partial ignorance of the deepness of the phenomenon. Our approach tackles the last issue.

2. Poverty reduction by water

The provision of water is related principally to health in the way that it mobilisation causes Hydric Transmission Diseases HTD. According the World Health Organization (W.H.O), 80% of illnesses are of hydric origin. Nowadays, water is becoming a concern in poverty debate and is included as an important objective of the MDG. Studies (United Nations, 2000) show that access to water can have positive impact on the eradication of extreme poverty and hunger.

This relationship enables us to encompass the frontiers within which water can be a factor of production and reproduction of poverty through its scarcity, its quality, its price value, difficult access, etc.

The year 1996 has been an international year of poverty eradication as proclaimed by the United Nations. The organizations like UNDP and the World Bank have set the mechanisms that help make international comparisons of poverty gaps. The phenomenon has become variable in time and space, and consequently the real causes of poverty remain superficial and the interactions between variables, fuzzy.

The first index that introduced the water factor is the human poverty index HPI[7] of UNDP[8]. It allows calculating the percentage of the population that has no access to drinking water.

The WPI (water poverty Index) introduced by Sullivan (2002, 2003) is presented in the framework of an interdisciplinary approach that integrates the availability of water with economic and social variables that reflect some level of poverty (See Table 3).

Insert Table 3

The principal objective of the index lies in the existence of some links between the access to water and the incidence of poverty.

[7] The human poverty index for developing countries (HPI-1) and The human poverty index for selected OECD countries (HPI-2) include the average of the population without sustainable access to drinking water

[8] The Human Development Index HDI of UNDP measures the average achievements in a country in three basic dimensions of human development – longevity, knowledge, and a decent standard of living. It contains three variables: life expectancy, educational attainment, and real GDP per capita. The HDI would seem to serve as the best available intermediate proxy, not only for institutional capacity, but also generally for the level of social resources in a country. Life expectancy would serve as a proxy for the general level of welfare and development; the educational attainment as a proxy for institutional capacity; and the real GDP per capita as a measure of economic performance.

Generally the index is expressed as follows:

$$WPI = \frac{\sum_{i=1}^{N} wixi}{\sum_{i=1}^{N} wi} \qquad 0 < WPI < 1 \qquad (1)$$

With:

wi: represents the weight applied to each component.
X: the value of each component of the index.

The components *xi* of the index are (see table 1) Resource (R), Access (A), Use (U) capacity (C) and Environment (E).

Each of the components is first standardised so that it falls in the range 0 to 100; thus the resulting WPI value is also between 0 and 100.

Lawrence & al (2002) have used the WPI in order to make a comparison between different countries. What can we draw out from this comparison is the dominance of the resource variable.

Another index, the SWSI (Social Water Scarcity Index) developed by (Ohlsson 1998), serves to highlight the importance of a society's social adaptive capacity to face the challenges of water scarcity. The formula consists of dividing the Water Stress Index WSI (commonly evaluated by comparing the volume of renewable water resources per capita at a national level) into HDI. Table 4 exhibits results for some countries including Algeria and shows how the SWSIs differ on the basis of different social resources as measured by the HDI.

Insert Table 4

3. Targeting the poor households by the water factor: the ROC curves

Actually, the Algerian households benefit from a price water subsidy. A new water tariff policy has been applied in Algeria since 2005. Prices are then computed, on one side, for domestic users on different thresholds according to the level of consumption, and on the other side, for industrial consumers on a uniform basis. Prices include two taxes, a uniform management tax applied on a national level and a specific tariff for each area. For domestic uses the tariffs of 1 m^3 are 10 dinars, 32.5 dinars, 55 and 65 dinars according to increasingly different thresholds.

In short, after this price readjustment of water, the average tariff of water increased with the rate of 53%, passing from 26, 2 DA/m^3 (0, 37$) to 40 DA/$m^3$ (0, 57$). For domestic use the increase is about 40% (22, 2 to 31 DA/m [3)] (see table 5).

It should be noted, however, that water subsidies that turned around 60 to 67% before 2005 decreased to 44 and 54%.

The Algerian survey of households consumption for 2000 (ONS in Benachenhou, 2005) shows that categories with lowest income spend 5,29% of their income to water consumption, whilst for the rich categories, the percentage is 0,8% only. Because of subsidies, this percentage is better than most of

developed countries, i-e 4% in the United Kingdom and 3% in France. Without subsidies, the real price of water would be threefold bigger, around 4%.

Insert Table 5

On the ground of equity, we can presume that the poorest households should not be constrained in a disproportionate way by water expenditure. On this basis the measurement of poverty becomes more complicated if we want to dissociate poor households from the rest of the population.

So even if one devotes a great amount of money to implement social programs, the soundness can only be pertinent if we manage to achieve real targeting of vulnerable individuals (households).

If follows, hitherto, that measurement of poverty can be greatly improved if we take into account water access conditions that can help better elaborate social programs. The advantage of this method based on the ROC analysis rests mainly on a computation of a household's classification without referring to a poverty line.

3.1. The ROC analysis

The use of the ROC helps determine more effectively on one side, true poor households, and on the other side, allows selecting the variables that can be considered as pertinent targeting indicators.

The ROC approach is a graphical non-parametric technique which has been originally developed in the fields of signal detection, psychology theory and medicine, among other fields. The first application of ROC curves to economics, and more specifically in poverty monitoring and targeting, was initiated by Wodon (1997) using household expenditure survey data from Bangladesh. Since then, the ROC methodology has generally been used in economics to assess the accuracy of a diagnostic test performed to differentiate between two states or conditions, for instance the poor and the nonpoor.

3.1. a. The ROC curve

A ROC curve is a graph that resembles an inverted Lorenz curve. We plot, on the vertical axis some arbitrary cut-off points, known as sensitivity (SE), i-e the probability that a poor household will be classified as poor, against the probability that a non-poor household will be classified as poor (one minus specificity (SP) on the horizontal axis[9]. It is conventional to link the ROC analysis to the incidence of Type I and Type II statistical errors (Wodon, 1997 and Baulch, 2002) (see table 6).

The probability of Type I error is 1 minus SE (i.e. the probability of identifying a poor household as non-poor) whereas the probability of Type II error is 1 minus SP (i.e. the probability of identifying a non-poor household as poor).

[9] SE is the true-positive rate, which is the proportion of positive cases that are correctly classified by the use of the diagnostic test and SP is the true-negative rate, which is the proportion of negative cases that are correctly classified. Therefore, the ROC curve discloses the relationship between the true-positive and the false-positive rate across different cutoff points

Insert Table 6

The ROC curve illustrates how the two types of errors (exclusion of some poor households and inclusion of some non-poor households) vary with the choice of a particular level of the indicators (Minot and Baulch, 2002). Hence, the ROC curve summarizes SE and SP errors obtained along a range of cut-off points delimited by zero and unity. Figure 2 shows the area under the ROC curve that can be used to provide a statistical summary measure of the overall performance and predictive value of the underlying poverty targeting model (Tuan *et al*., 2004).

Insert Figure 2

The area below the ROC curve can take on values between zero and one. The greater (smaller) that area, the better (worse) is the power of the model used in prediction. A 45-degree line, corresponding to an area of 0.5, has no explanatory power since the probability that a poor household be classified as poor is no higher than the probability that a non-poor household be classified as poor. A vertical line from the origin followed by a horizontal line extending to the upper-right corner (equivalent to an area of one) has perfect predictive power (Baulch, 2002).

The comparison of the Areas Under the ROC Curves (AUC) is important in the explanation of the Overall Diagnostic Performance. The overall diagnostic performance of the different tests can be assessed by comparing their AUCs. The bigger it's AUC, the better the overall performance of the diagnostic test.

3.1.b. Comparing ROC curves by the binormal ROC curve

The most common way of smoothing an ROC curve is using the binormal model. It assumes a normal distribution with mean μ_1 and variance σ_1^2 for the poor households and a mean μ_0 with variance σ_0^2 for the non poor.

Then using $G(t) = \phi((\mu_0 - t)/\sigma_0)$, It follows that the threshold t can be written as a function of x as follows: $t = \mu_0 - \sigma_0\phi^{-1}(x)$. Since a threshold t corresponds to the sensitivity, we can write the functional form of the ROC curve as:

$$F(t) = \phi\left(\frac{\mu_1 - t}{\sigma_1}\right) = \phi\left(\frac{\mu_1 - \mu_0 + \sigma_0\phi^{-1}(x)}{\sigma_1}\right) = \phi\left(a + b\phi^{-1}(x)\right) \qquad (2)$$

Where

$$a = \frac{\mu_1 - \mu_0}{\sigma_1}$$
$$b = \frac{\sigma_0}{\sigma_1} \qquad (3)$$

The area under the curve for the binormal model can take the expression of a closed-form:

$$AUC = \phi\left(\frac{a}{\sqrt{1+b^2}}\right) \qquad (4)$$

3.1.C. Equality Test of two or more ROC curves

The aim of the application of this test is to define the items that allow for targeting the poor households using water characteristics. We define the standard items as representing the deprivation characteristics.

Results (see appendix 1) shows that the first type of access to water ACS1 (connexion to the drinking water network), the sanitation through sewer net EUSE1, the presence of the kitchen in the housing CUISINE1, the purchase from a water tank vehicule COMPLEM2, the absence of HTD in the household MTH2 and finally housing in an building apartment LOG2 corresponds to the Ordinary Living Patterns (Townsend, 1979) or Socially Perceived Necessities (Mack & Lansley, 1985)

3.2. Poverty -water linkage in Algeria

The poverty alleviation package implemented since 1994 in relation to the gradual elimination of basic good subsidies would trap people in poverty in a way that revenue transfers to the poor move slower than the poverty line. A few examples from real day life would prove this point. Starting by wage earners, the legal monthly minimum wage of 8000 AD[10] applied since January 2001 represents approximately 4 times the poverty line. Actually, this salary will keep a family of four, just on the poverty line. Given the fact that in Algeria, average family is composed of seven people, it is clear that a single minimum wage earner could not keep his family out of poverty, if not extreme poverty. In fact even for an average earner, the outlook is not much different. In 1996 average wage was 5 times the poverty line that was marginally higher than a minimum wage earner. The situation is even worse for people in public working programs, where the wage is only half the legal minimum (Laabas, 2001).

In the case of access to water and sanitation a great effort has been made by the Algerian government to increase both the rate of connexion to the drinking water network and the rate of connexion to the water drain network. The rate of connexion to the public networks for drinking water and sanitation has improved significantly from 1966 to 2005. In 2005, 79% of the population was connected to the drinking water network, and 75% for the sanitation's (Benachenhou, 2005) (see table 7). Although, population connected to drinking water and drain network increased significantly in absolute figures, it

[10] Actually the legal monthly minimum wage is 12000 AD. A recent study in 2006, made by the General Union of Algerian Workers, shows that the minimum monthly food invoice for a family of six people has risen to 11210 AD: 6 loafs of bread/day for 8 AD / the unit: 1080 AD, 2 liters of milk / day for 28 AD/liter: 1680 AD, 1 kg of potato / day for 70 AD / kg: 2100 ADA 10 kg of tomatos for 70 AD/kg:700 DA, 50 kg of semolina of average quality: 2300 AD, water:350 AD, electricity: 3000 AD.

remains however that the population not connected in both networks has not changed significantly in absolute terms between 1966 and 2005.

Insert Table 7

We applied the method ROC to household's data in order to find out whether water indicators can determine true subjective poor households. For this concern, we used the rule of decision as applied to the eight parameters as shown in Table 8.

Insert Table 8

We choose, in this study, a classification of each parameter compared to a reference variable that can be given through a frequency control and a social consensus. Townsend (1979) explains that the items selected must belong to the Ordinary Living Patterns. He considers that one item belongs to an ordinary way of life if he is carried out by at least 50% of the members of the society.
For our study we have 8 variables and 26 items presented in Table 9.

Insert Table 9

3.3. Sample and data collection

A method of survey based on two levels is adopted. The first level relates only to the communes that face a real problem of access to the water resource. On the basis of indicators of the last Algerian official census (1998), we choose only the communes of the wilaya of Tlemcen that are confronted to serious handicaps as far as the availability and the access to water is concerned. In the second step, we introduce criteria to measure the size and the rank of the communes. This first level enables us to sort out 15 communes out of the 53 of the wilaya of Tlemcen.
The corresponding sample is 28% of the communes of the wilaya. The 15 communes add up to 78 622 households in 1998. As we decide to question 1% of the households living in the 15 communes we finally get a sample of 786 households[11].

4. Results and discussion

Results show that 26, 97% of the head of households consider their households as poor and very poor. We prefer to use a subjective measurement, knowing that the price differentials of goods between areas are not objectively observed (Maliki, 2008)
True subjective poor households are the households that have access to drinking water through wells. The water complement indicator shows that even though households are connected to the drinking

[11] The wilaya (State) of Tlemcen comprises 53 communes (departments). The sample concerns only 15 departments, 10 rural and 5 urban. For more details, see Maliki (2008).

water network, they use water complements due to shortfalls in water flow and pressure (see appendix 1).

The means of storage reveal that true poor households use only jerry cans and plastic tank. These households do not possess tank with or without pump.

Results show that the households fitted with a mobile tank are almost in the area of the poor (ROC Area = 0.4714). The poor households seek water in the wells or are constrained to buy a mobile tank (on average the price oscillates between 600 AD and 1000 AD).

The water complementary utilisations figures show the dominance of the Purchase from a water tank vehicle. Paradoxically, we find that a good proportion of poor households use the two types of water sanitation, which implies that the connection of the households with the official sanitation network is not a potential indicator to target the poor.

Finally the indicator linked to the presence of a kitchen in a house indicates that its absence is a sign of higher subjective poverty compared to water conditions (0, 5939).

Traditionally, the provision of water supply and sanitation services in developing countries has always been a public service managed by national and local entities. Substantial private sector involvement is considered inappropriate on the basis of at least five important characteristics of water and sanitation sector (Rees, 2001):

• The natural monopoly that characterises the water sector and the lack of substitute products;
• The public and merit goods supplied by the sector;
• The crucial relationship between water infrastructure and urban/economic development;
• The highly capital-intensive nature of the sector and the over-whelming presence of sunker-costs, which increase private-sector risks;
• The multi-purpose and hydric interconnected nature of the water resource itself.

Achieving distributive efficiency is a difficult task and should involve more than some purely economic consideration. If the bigger consummers are allowed to purchase all the water in a purely free market, some groups, typically farmers and farm workers are going to lose water and their economic support base. This requires that the economy and the political system be able to provide alternative livelihoods, compensate third parties affected by market transactions and judge between diverse claims for allocation (Lundquist, Gleick, 1997).

Conclusion

The purpose of our paper is to quantify the relationship between subjective poverty and water deprivation as far as Algerian households are concerned. The Receiver Operating Characteristic used in this study has brought to light the importance of water factor measurement in poverty evaluation process much more than other multidimensional axiomatic methods such as fuzzy set with graded membership functions, (Maliki, 2007) and non axiomatic methods (indices). Results show that the frequency of water, the storage and the access type can be considered as better indicators of poverty and thus be used for a pertinent targeting of poor household.

Moreover, as far as policy implications are concerned, we consider that the Algerian state should look more into the organization of hydraulic sector that is lacking in management and governance. The water managing, Water Algerian organization (l'Algérienne des Eaux) must take part of the process of conception and implementation of poverty alleviation policies by:

- improving the water supply for the households
- Best controlling wells and water sources
- applying a water solidarity pricing for the low households incomes
- re-examining pricing on the basis of differential district living standards

References

Asselin, Louis-Marie & Anyck Dauphin (2001), Poverty Measurement: A Conceptual Framework, IDRC, Canada.

Benachenhou A. (2005), Le prix de l'avenir, *Thotm editions*, Paris.

Baulch, Bob (2002), Poverty Monitoring and Targeting Using ROC Curves: Examples from Vietnam, IDS Working Paper 161, Institute of Development Studies, University of Sussex, England.

Benhabib and all.(2007), The Analysis of Poverty Dynamics in Algeria : A Multidimensional Approach, Topic in Middle Eastern and North African Economies, electronic journal, Volume 9, Middle East Economic Association and Loyola University Chicago,USA, September.

Bey M. (1999), Recherches sur la pauvreté : état des lieux. Contribution à la définition d'une problématique, *Tiers Monde*, n °180, Paris.

CNES (2007), Rapport national sur le développement humain en Algérie 2006, en coopération avec le PNUD, Algiers.

Laabas, B. (2001), Poverty Dynamics in Algeria, Paper presented at ERF/World Bank Conference on Poverty and Its Determinants in MENA Countries, Sanaa, Yemen

Lawrence, P. J. Meigh and C. Sullivan (2002), The Water Poverty Index: An International Comparison, Keele Economics Research Papers, KERP 2002/19.

Lundqvist, J., Gleick, P. (1997), Sustaining our Water into the 21st Century, Background Document of The Comprehensive Assessment of the Freshwater Resources, World Stockholm Environmental Institute (SEI), Stockholm.

Mack J. and Lansley S. (1985), Poor Britain, George Allen and Unwin, London.

Maliki S.B.E. (2006), Politique de l'eau en Algérie : les modèles marchands face à la pauvreté, in Revue *Les Cahiers du MECAS*, n°2, Avril, Université de Tlemcen, Algérie, pp.105-114.

Maliki S.B.E. (2007), Conditions eau et pauvreté subjective en Algérie : analyse non paramétrique par les courbes ROC , in Revue *Les Cahiers du MECAS*, n°3, Avril, Université de Tlemcen, Algérie, pp.127-139.

Maliki S.B.E. (2008), Quantification de la relation Pauvreté-Eau des ménages algériens : Application d'un modèle indiciaire, PHD thesis , University of Tlemcen, Algeria.

Maliki S.B.E, Charmes J. & Benhabib A. (2006), Pauvreté et eau: réalité et interactions en Algérie, communication in *10èmes Rencontres Euro-Méditerranéennes,* "Inégalités, pauvreté et développement économique dans les pays méditerranéens", Université du Caire, 4-5 novembre.

Minot N., & Baulch B. (2002), The Spatial Distribution of Poverty in Vietnam and the Potential for Targeting, Policy Research Working Paper 2829, Washington D.C, the World Bank and IFPRI.

Ohlsson, L. (1998), Water and Social Resources Scarcity, an Issue Paper commissioned by FAOAGLW.

Rees, J. A. (2001), Regulation and Private Participation in the Water and Sanitation Sector, Global Water Partnership

Sen, A. (1985), Commodities and Capabilities, Amsterdam, North-Holland

Shaffer P. (2008), New thinking on poverty: Implications for globalisation and poverty reduction Strategies, Real-World Economics Review, issue n°47, University of Toronto, Canada.

Sullivan, Caroline (2002), Calculating a Water Poverty Index, *World Development* Vol.30, 7:1195 – 1210,Elsevier.

Sullivan, Caroline and al. (2003), The Water Poverty Index: Development and Application at the Community Scale, *Natural Resources* 27:189 – 199.

Townsend P. (1979), Poverty in the United Kingdom: A Survey of Household Resources and Standards of Living, Penguin Books, Harmondsworth,London.

Tuan, T., T., Harphan & N.T. Huong (2004), Validity and Reliability of the Self Reporting Questionnaire 20 Items in Vietnam, Hong Kong, *Journal of Psychiatry,* Vol. 14, N° 3

UNDP (2006), Beyond Scarcity: Power, Poverty and the Global Water Crisis, Human Development Report, USA.

United Nations (2000), United Nations Millennium Declaration (55/2), available at http://www.un.org/millennium/declaration/ares552e.pdf.

Wodon Q.T. (1997), Targeting the Poor Using ROC Curves, *World Development* Vol. 25, 12: 2083-2092.

Figure 1 : Poverty Reduction Strategies

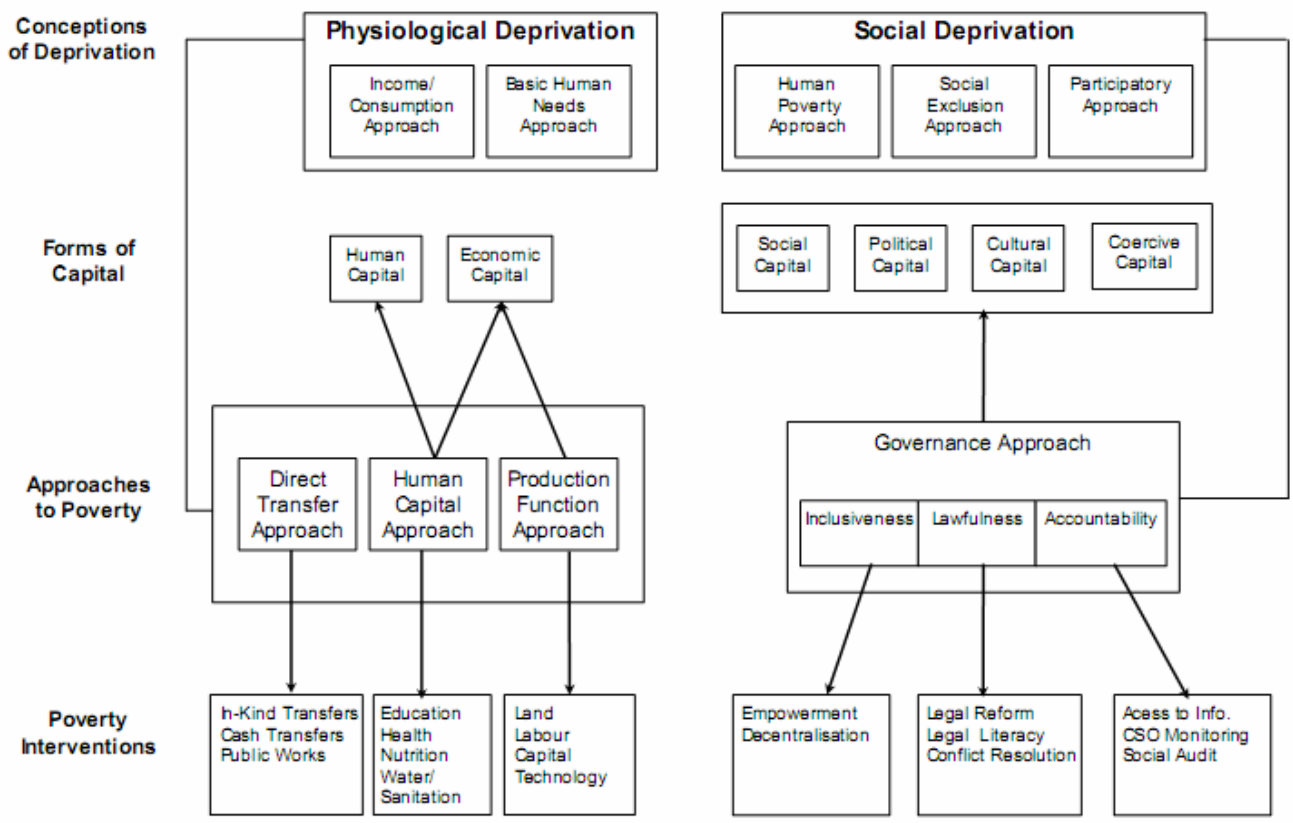


Figure 2 : The ROC curve

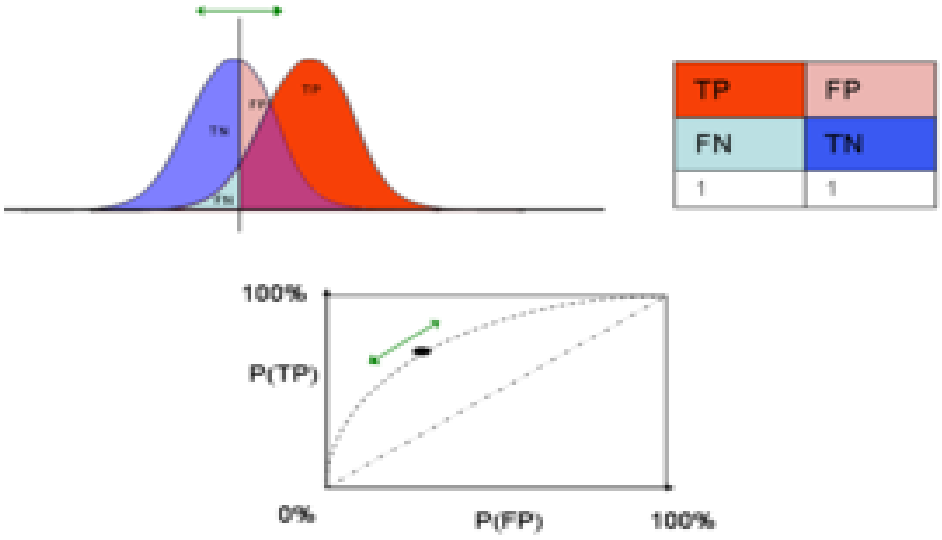


Table1: Links to water sources

MDG	Examples of links to water resources
1.Eradicate extreme poverty and hunger	- Livelihood strategies and food security of the poor depend directly on water quantity and quality (for agriculture, fisheries, drinking, etc.) and sanitation services. - The poor often have insecure rights to water resources and inadequate access to information, markets and decision- making- limiting their capability to protect or access water resources and improve their livelihoods and well-being.

Source: U.S Government, « The global water crisis: evaluating U.S. strategies to enhance access to safe water and sanitation », Serial No. 109–127, WASHINGTON, 2006, P.15, Available via http://www.house.gov/international—relations.

Table2: The HPI in Algeria (1995-2005)

Year	1995	1999	2000	2004	2005
HPI (%)	25.23	23.35	22.98	18.15	16.60

Source: CNES, 2007

Table 3: WPI components

Resources	The physical availability of surface and ground water, taking account of the variability and quality of the resource as well as the total amount of water.
Access	The extent of access to water for human use, accounting not only for the distance to a safe source, but for the time needed for domestic water collection, and other significant factors. Access means not simply safe water for drinking and cooking, but water for irrigating crops or for industrial use.
Capacity	The effectiveness of people's ability to manage water. Capacity means the allowed income to purchase improved water, education and health
Use	The ways in which water is used for different purposes; it includes domestic, agricultural and industrial use.
Environment	An evaluation of an integrated environment related to water within an ecosystem.

Source: Sullivan, 2003.

Table 4: Social Water Stress Index

Countries	Water Stress Index* (WSI)	Standard hydraulic categorization of water stress or water scarcity	Human Development Index (HDI)	Social Water Stress Index** (SWSI)	Social resource scarcity categorization of water stress or water scarcity
Algeria	19	Water scarcity	0.737	26	Water-scarcity
Egypt	11	Water-scarce	0.614	17	Water stressed
Jordan	31	Absolute water scarcity	0.730	43	Absolute water scarcity
Morocco	9	Water stress	0.566	16	Water stress
Syria	3	Relative sufficiency	0.755	4	Relative sufficiency
Tunisia	23	Absolute water scarcity	0.748	31	Absolute water scarcity
Palestinian Territ	16	Water-scarce	0.733	22	Water-scarce
Turkey	3	Relative sufficiency	0.772	4	Relative sufficiency
Israel	26	Absolute water scarcity	0.913	28	Water scarce

* The Water Stress/Scarcity Index (WSI) used here equals hundreds of persons per flow unit (one flow unit is one million cubic meter of renewable water):
• Relative sufficiency: 0-5
• Water stress: 6-10
• Water scarcity: 11-20
• Absolute water scarcity: >20

** The Social Water Stress/Scarcity Index suggested here is computed by dividing WSI into HDI:
• Relative sufficiency: 0-9
• Water stress: 10-19
• Water scarcity: 20-29
• Absolute water scarcity: ≥30

Source: Ohlsson, L. 1998.

Table 5: Water tariffs and subsidies in Algeria 2005

Tariff/uses		Price in Algerian Dinars	Percentage Of subsidies
Domestic	Average	31	57
	Threshold 1	28,3	60
	Threshold 2	24,9	65
	Threshold 3	31,6	56
	Threshold 4	46,7	35
Administrative		51,8	28
Commerce & services		57,2	20
Industry & tourism		65,5	8
Average		**40**	**44**

Source : Benachenhou (2005), p.56.

Table 6 Sensitivity, specificity and Type I and Type II errors

	Nonpoor	**Poor**
Predicted Nonpoor	$SP = NP^{-} / NP$	$1 - SE = P^{-} / P$
Predicted Poor	$1 - SP = NP^{+} / NP$	$SE = P^{+} / P$

SP *specificity;* **SE** *sensitivity;*
P *number of the poor;* **NP** *number of the nonpoor;*
P+ *number of the poor classified as poor;* $\mathbf{P}^{-}$ *number of the poor classified as nonpoor;*
$\mathbf{NP}^{+}$ *number of the nonpoor classified as nonpoor; and* $\mathbf{NP}^{-}$ *number of the nonpoor classified as poor.*

Source : Wodon, (1997

Table 7: Connexion to the drinking water network and the water drain network between 1966 and 2005 in Algeria

	1966	**1977**	**1987**	**1998**	**2005**
Population (10^3)	12012	16948	22714	29272	33000
Connexion to the drinking water network					
Percentage (%)	37,1	45,8	57,8	70,8	79
Population with connexion (10^3)	4458	7762	13129	20725	26070
Population without connexion (10^3)	7554	9186	9585	8547	6930
Connexion to the water drain network					
Percentage (%)	23,1	39,9	51,7	66,3	75
Population with connexion (10^3)	2775	6643	11743	19407	24750
Population without connexion (10^3)	9237	10305	10971	9865	8250

Source: Benachenhou, 2005

Table 8: Decision matrix for subjective poverty and water deprivation

	No water deprivation	**Water deprivation**	
No poor household	**No consistent poverty SP TN**	**Water deprivation FP**	TN +FP=1
Poor household	**Subjective poverty FN**	**Consistent poverty SE TP**	FN+ TP=1

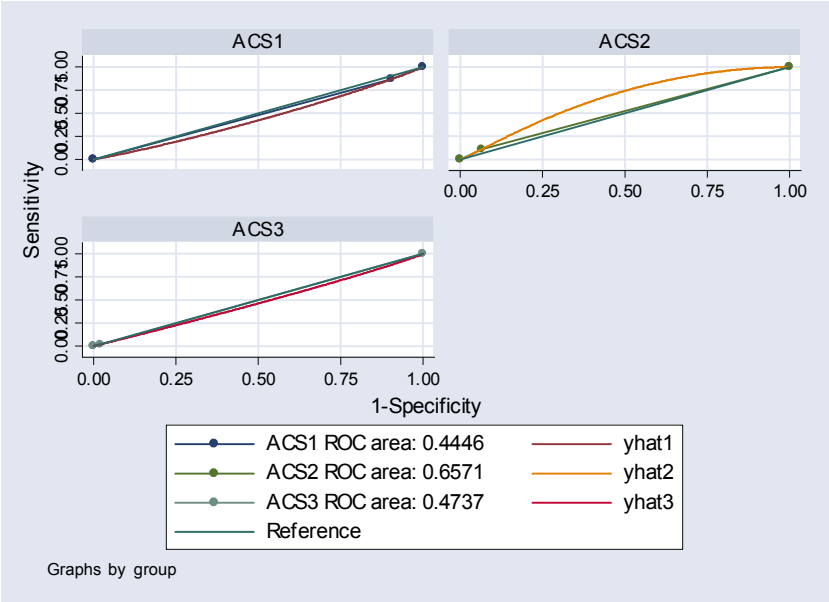
Source: Maliki, 2008

Table 9: Variables of households water conditions

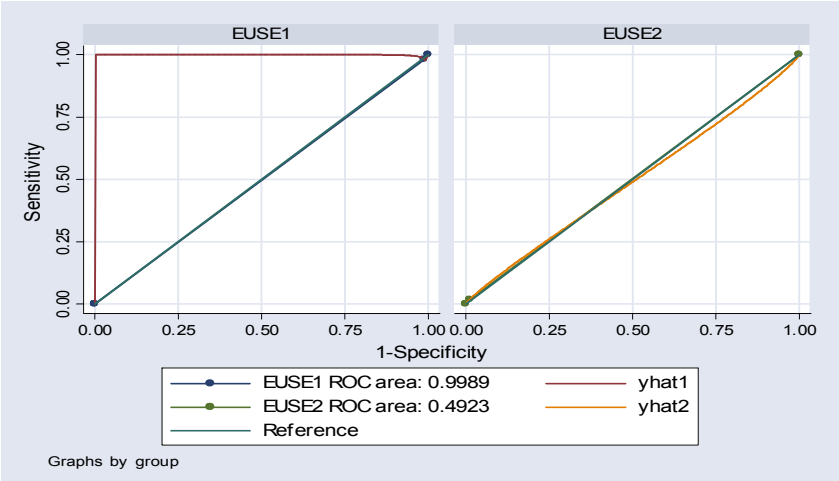
Water conditions	
Variables	**Description**
	Water access
ACS1	Connexion to the drinking water network
ACS2	drinking water through access to wells
ACS3	drinking water through access to water tank vehicles
	Water frequency supply
FREQ1	Supply of few hours /day
FREQ2	Supply of one day / week
FREQ3	Supply of 2 days / week
FREQ4	Supply of 3 days / week
FREQ5	Supply of more than 3 days / week
	Storage means
STOK1	Built-in water tank with pump
STOK2	Built-in water tank
STOK3	Mobile Tank
STOK4	Various household storage means (Jerry cans – plastic tank….)
	Water complementary utilisations
COMPLEM1	From Wells
COMPLEM2	Purchase from a water tank vehicle
COMPLEM3	Provisioning from water natural sources
COMPLEM4	Purchase of mineral water
	Water drain & sanitation
EUSE1	Drain through sewer net
EUSE2	Drain through a septic tank
	Kitchen – housing characteristics
CUISINE1	Normal Housing with kitchen
CUISINE2	A one room-kitchen Housing
	Type of housing
LOG1	Traditional house
LOG2	Housing in an building apartment
LOG3	Villa
LOG4	Precarious housing
	HydricTransmission Diseases
MTH 1	Presence of HydricTransmission Diseases
MTH 2	Non presence of Hydric Transmission Diseases

Source: Maliki, 2008

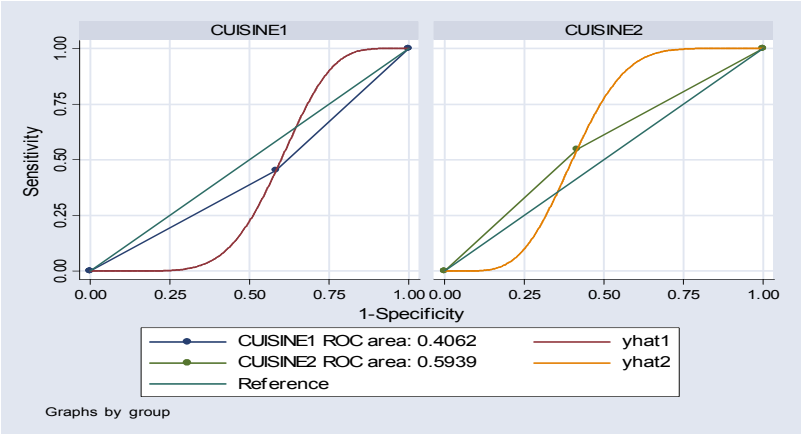
Appendix 1: Test equality of the 8 variables to a standard item



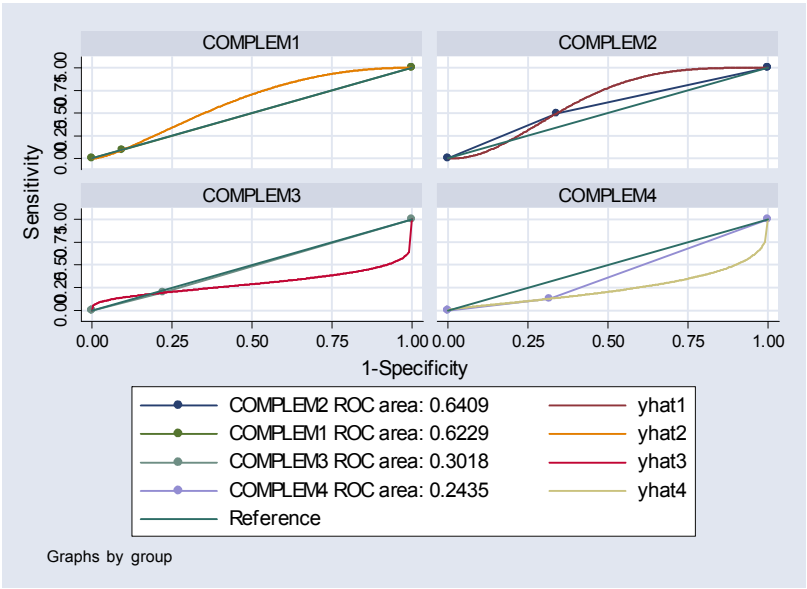
		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
ACS1	(standard)	0.4446	0.0028				
ACS2		0.6571	643.7214	57.5168	1	0.0000	0.0000
ACS3		0.4737	0.0015	3.2485	1	0.0715	0.1379



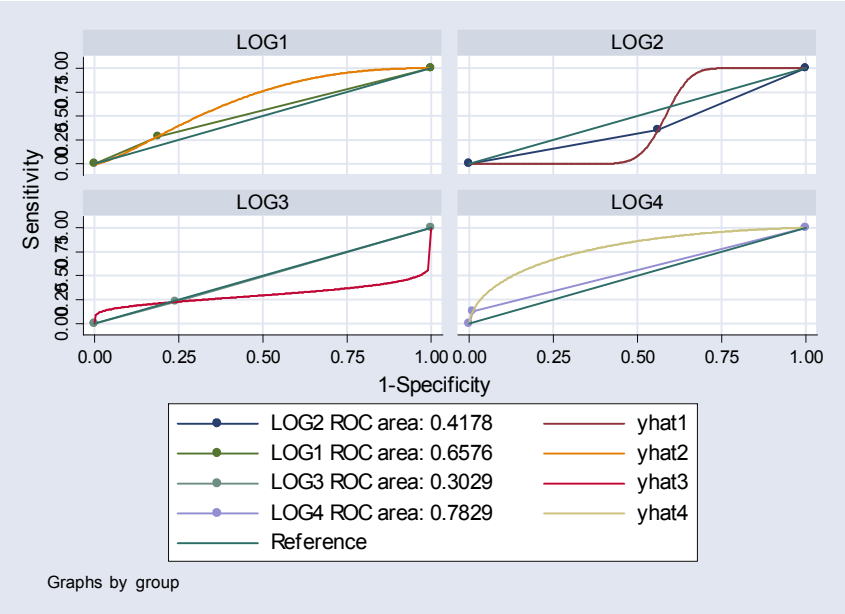
		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
EUSE1	(standard)	0.9989	0.3346				
EUSE2		0.4923	0.0004	141.2362	1	0.0000	0.0000



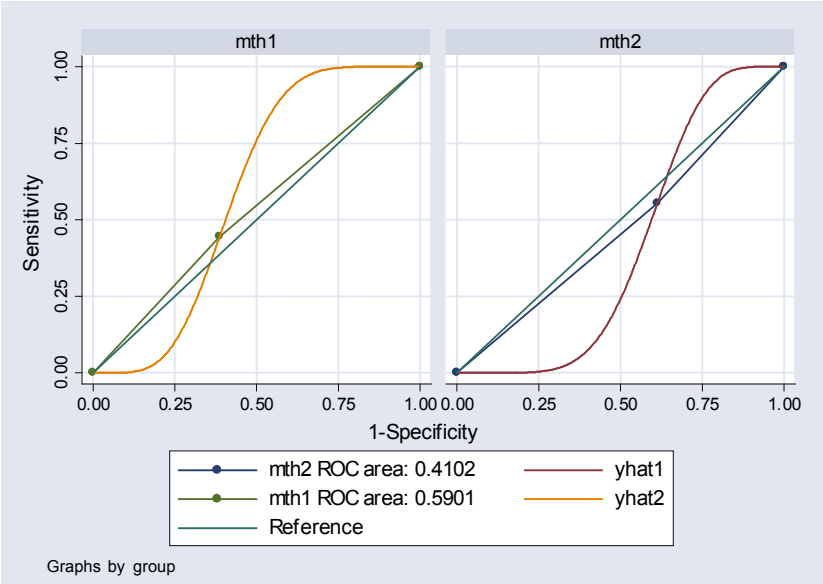
		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
CUISINE1	(standard)	0.4062	0.0221				
CUISINE2		0.5939	0.0221	21.7466	1	0.0000	0.0000



		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
COMPLEM2	(standard)	0.6409	123.3171				
COMPLEM1		0.6229	0.0080	0.3254	1	0.5684	0.9196
COMPLEM3		0.3018	0.0392	59.7024	1	0.0000	0.0000
COMPLEM4		0.2435	0.0362	92.5037	1	0.0000	0.0000



		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
LOG2	(standard)	0.4178	0.0209				
LOG1		0.6576	246.8126	53.7442	1	0.0000	0.0000
LOG3		0.3029	0.0325	10.4521	1	0.0012	0.0037
LOG4		0.7829	0.0091	149.1557	1	0.0000	0.0000



		ROC Area	Std. Err.	chi2	df	Pr>chi2	Sidak Pr>chi2
Mth2	(standard)	0.4102	36.3124				
Mth1		0.5901	0.0327	9.0643	1	0.0026	0.0026

Source : Maliki, 2008