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Wealth, Living Standards and Perceptions in a Cotton Economy: Evidence from the Cotton Reform in Burkina Faso

by

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Wealth, Living Standards and Perceptions in a Cotton Economy: Evidence from the Cotton Reform in Burkina Faso*

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Abstract

The cotton economy of Burkina Faso has been characterized by a changing rural environment for farmers since late nineties, which has come with the cotton reform and the resulting cotton boost. There have been slight improvements in living standards and rural households' income while the subjective feeling of wealth has significantly increased.

In this paper, I explore the channels through which the elements of the changing rural environment can bridge the wedge between subjective and objective measures of wealth. In addition to the basic determinants of subjective welfare that can be found in the happiness economics literature, namely absolute and relative income measures, health and social status (and expectations of future incomes), I investigate the empirical validity of institutional and technological change as well as the perceptions about the reform. I propose a bivariate ordered Probit model to deal with endogenous covariant perceptions in the assessment of subjective wealth.

I find that the significantly positive evolution of subjective wealth has been driven by the relative measure of income, the feeling of progress through institutional and technological improvements and by enthusiastic perceptions about the reform's effects on poverty alleviation and welfare. This evolution has been altered by the beliefs about a larger input access and better agricultural abilities resulting from the reform (comparison effect).

JEL Codes: I32, 013, Q16, Q18

Keywords: subjective wealth, Burkina Faso's cotton, rural development, agricultural policy, perceptions.

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1. Introduction

Cotton has been one of the leading factors of poverty alleviation throughout the African continent over the last decades, as shown in many studies (see for example, Goreux, 2003). These studies point out that the cultivation of *Gossypium* has been associated to more food security and more cash income into rural zones. The latter has allowed households to access better health and education commodities while the positive effect on food security has been a consequence of agronomic complementary effects from cotton to other food crops[3]. In addition, one has not to forget that cotton cropping has brought many agricultural inputs to farmers[4], responsible for higher yields, notably in cereal production. As a consequence, the cotton cropping prevents from rural exodus, in some extent. These features have to be emphasized for Sahelian countries (Mali, Burkina Faso, or Chad for instance) where no alternative cash crop, such as the cotton one, looks relevant in participating to poverty reduction and development.

In his elegant historical survey, Bassett (2001)[5] shows that cotton has been one of the few development "success stories" as a result of a partnership process between farmers and their social organizations and ex colonial or parastatal companies. The development of cotton economies in Sub-Saharan Africa resulted in more democratization, and education (see Bingen, 1998; for the Malian case), as well as better living standards than in subsistence economies with an active participation (even leading) to the national growth dynamics (see Azam and Djimtoingar, 2004; for Chad). Today, millions of households live from cotton growing throughout the African continent, as a consequence of this historical process. Some countries have also been reducing their commercial deficit with cotton earnings[6] and providing new funds for public policies.

Yet, these cotton economies are fragile and very sensitive to world prices. The declining trend of cotton prices over the last crop campaigns, in addition to the recent increase in input prices, has threatened African cotton sectors that have accumulated large deficits. The latter were

[3] Food crops benefit from the remainder of mineral and/or organic fertilizers in soils formerly planted in cotton as well as from less sanitary problems. Cotton is known as a very good starting crop in a rotating crop system in many dried tropical agro-ecological systems.

[4] These inputs are often delivered by cotton companies, through in-kind credit schemes repaid by cotton purchases from customers. Being a cotton grower is often the only way for rural producers to access agricultural inputs so that the availability of agricultural inputs through cotton growing reveals economic complementarities between cotton and other crops.

[5] The « peasant cotton revolution » has consisted of evolving social institutions, top quality research and well performing agricultural assistance in French speaking Africa, providing farmers with a beneficial technical and social environment.

[6] These revenues account for 30 to 60 % of overall export earnings in countries such as Burkina Faso, Mali or Benin.

also the consequence of huge problems of management within firms and through ill-performing credit schemes. The sector has been undertaking a significant pace of reforms starting in the early nineties, contingently to the global liberalization of agriculture in Sub-Saharan Africa. These reforms mainly consist of the privatization of former parastatal companies or official boards, the setting of a new institutional design with the establishment of new financial and administrative tools, and the greater involvement of producers associations. At first glance, these reforms seem somewhat puzzling because of their ambiguous effects on producers (income, poverty) and on production incentives as well as on national production. Some countries have experienced short-term cotton boost thanks to the entry of new investors in the sector, but also long-term coordination failures leading to the collapse of production. There has been an adaptation of policies with the emergence of regulatory schemes to overcome these difficulties and to make credit schemes work for producers, even in liberalized industries[7].

In Burkina Faso, the reform has led to a pattern of impressive mid-term cotton growth, based on the growth of cotton areas (inflow of labor and capital, new technologies, better designed local institutions and credit access, see Kaminski and Thomas, 2008). The key reasons of this pattern lie in a proper and appropriate timing of the different measures with the setting of a transparent partnership between producers and investors within a new institutional framework, which preceded the privatization of the former parastatal company, the SOFITEX. The privatization process largely benefited producers, entering into the capital of SOFITEX when the government withdrew from the parastatal, and undertaking a greater scope of responsibilities, allowing them to reach at substantial bargaining power. One has to mention that the cotton boost has been fostered by the effect of the Ivorian Crisis in 2002 through a massive inflow of labor force when more than 500,000 Burkinan people escaped from Côte d'Ivoire to come back home[8].

However, national living standards surveys do not report a significant increase in living standards and only slight changes in income on average. Indeed, the price paid to cotton growers has not increased because of the world cotton market environment and due to more expensive inputs. The rise of agricultural income has only concerned farmers having experienced a large increase of cultivated land or those who entered cotton production during the reform and experienced a fast extension of both cotton and non-cotton cultivated land. Finally, the cotton

[7] In liberalized cotton sectors, credit schemes are subject to strategic defaulting as the presence of different ginners and input providers in the same local markets without financial clearing allows cotton growers to borrow from one and to sell their cotton to another without repaying their input credit. This is what I will call "poaching" later on.

[8] See the discussion in Kaminski (2007).

reform has yielded a more equal distribution of income in rural cotton zones with no significant living standards improvement[9].

Beyond the line of understanding the effects from the Burkinan cotton reform on wealth and living standards of rural households, a room for an empirical investigation of the determinants of perceived wealth and associated perceptions of the reform has emerged. Indeed, I led a survey in rural cotton areas in March 2006 and found out that people were exhibiting an enthusiastic perception of the reform, both on production incentives and on welfare and income. Moreover, they feel unambiguously wealthier than at the beginning of the reform measures (a decade ago). These perceptions give support to the reform process and reveal a popular adhesion. This issue is particularly interesting in a political economy framework (see Rodrik, 1996; or Binswanger and Deininger, 1997) where public policies based on poverty reduction or agricultural adjustment should take into account expected effects on subjective well-being in a political economy framework.

Hence, one arising challenge would be to identify the channels whereby the cotton reform has influenced the perceptions and the beliefs of cotton growers about their living standards and their income. An analysis of the differences between objective and subjective indicators of living standards should be done to understand the underlying mechanisms of divergence between actual living standards and income and subjective well being. Another step is to determine the factors of the perception of the reform's effects and to use them as potential explanatory variables of subjective well-being evolution over the last decade.

In this endeavor, I can rely on the flourishing literature of the economics of happiness, both on theoretical and empirical grounds to help us setting our empirical framework. This literature focuses on two issues: the effect of social status, and particularly the labor market status, on happiness and the relationship between income and happiness. In fact, the two issues are linked together as social status is correlated to relative income through social comparisons, which appears as a strong determinant of happiness in the empirical literature. An excellent overview of the relationship between income, happiness and utility is provided by Clark, Frijters and Shields (2007). In this paper, they argue that studying happiness or satisfaction brings some valuable information to predict future behavior and that analyzing subjective well-being data provides a

[9] The improvement of living standards subsequently to a rise of income can occur with some delay as it requires some mid-term investment in infrastructures (housing, building schools and hospitals, deep wells, roads). Hence, the dynamic processes of living standards and income evolutions after the cotton reform are different and it is not very surprising that agricultural income could have risen without a significant improvement of living standards.

complementary alternative to the revealed-preference more traditional framework used in economics.

In my setting, I also have to consider the perception of a policy change that yielded a changing socio-economical environment for producers. Thus, the satisfaction with the reform is an issue that has to be explored because it would have changed the choices of farmers and influenced their subjective well-being. Main determinants of this kind of perceptions are found to be welfare effects (absolute and relative) but there is a room to include beliefs and expectations as in Bonnet *et al*. (2006). Accounting for perceptions of the cotton reform of Burkina Faso at the household level seems to be relevant in our analysis since the reform process has been partly captured by cotton farmers associations and a group mechanism is likely to have driven farmers' perceptions. In this regard, perceptions of the reform policy might have influenced perceptions of own wealth by households.

In this paper, I depart from the existing literature by studying the determinants of rural subjective well-being with the inclusion of an opinion on a sector's reform that changed the social and the institutional environments of farmers. The key point in my empirical setting is to account for endogenous opinions on the reform to bridge the gap between subjective and objective welfare. I firstly unveil the determinants of perceived effects from the reform and the ones of subjective well-being of cotton growers. Then, I develop an empirical framework to jointly estimate opinions on the reform and subjective well-being with possible endogenous opinions in the assessment of rural subjective welfare. Is cotton a strategy for subjective poverty reduction and for the improvement in living standards? Is cotton growth related to an increase in rural welfare? Which are the impacts on income and subjective wealth distributions?

The remainder of this paper is as follows. Section 2 presents the estimation strategy of subjective well-being in a changing cotton economy such as the Burkina Faso one, with a summary of the related literature. In Section 3, I describe the Burkina Faso cotton economy and the available data as well as descriptive statistics derived from the collected data in March 2006. Section 4 presents the econometric results related to the empirical setting of Section 2. Section 5 concludes.

2. An empirical framework of subjective well-being in a cotton economy

A famous point in the economics of subjective well-being/ happiness stands in the "Easterlin paradox" (Easterlin, 1974; Easterlin, 1995). The Easterlin's statement involves that average life

satisfaction indicators have remained constant in developed countries (Diener *et al*. 1999) while they experienced high rates of GDP over large periods. For developing countries, in contrast, there is a clear positive trend of the income/happiness relationship. At the individual level, many empirical papers using cross-sectional data report a significant positive correlation between income and happiness from one country. This holds for developed (Blanchflower and Oswald, 2004) as well as developing (Graham and Pettinato, 2002) countries. This paradox is worked out theoretically when accounting for the role of relative income (Van de Stadt *et al*., 1985) with respect to a reference group (social comparison) or a reference income in time (habituation) in the formulation of indirect utility functions. However, the social comparison externality is not the only one at work with relative income. Indeed, Senik (2004) has shown that income of other members of a reference group can bring information on what would be own income in the future through expected wage profiles. This approach of utility functions has direct implication for poverty analysis. Indeed, as Sen (1983) firstly argued, relative concerns such as relative consumption should be taken into account when setting a poverty line or measuring poverty. This would put together income levels and income profiles into the implementation of poverty measures. Moreover, there is a need to include non-material ingredients in poverty indexes to provide a wider representation of well-being.

Recent empirical work using panel data to control for unobserved individual personality traits yields positive estimates of changes in real income in explaining changes in subjective well-being (Ravallion and Lokshin, 2001; Clark *et al*., 2005) with slope heterogeneity and country-fixed effects. These papers put forward the main role played by health, job, and marital status in the income/happiness relationship. Controlling for country-fixed effects in cross-country models enables the authors to assess the correlation between happiness and macroeconomic variables (GDP, GDP rate of growth, inflation) as in Di Tella *et al*. (2003).

Coming back to the analysis of the determinants of subjective well-being and its evolution in cotton areas of Burkina Faso, I may refer to the econometric techniques to deal with the problems invoked in the empirical literature with panel data. The so-called “anchoring effect” is one of the most significant challenges. It lies in the difficulties to estimate an indirect latent and unobservable utility function when facing a subjective variable based on personal ladders, such as subjective well-being. The correlation between the verbal expression of satisfaction and the latent utility is far from trivial with a matter of interpersonal comparability when people exhibit psychological differences. Indeed, as Ravallion and Lokshin (2001) have shown, the identification of welfare effects has to take into account that people have in mind their own ladders of satisfaction and their own way to answer surveys. Moreover, some cognitive biases and misreporting -cognitive

dissonance for instance- are often cited as sources of potential biases because subjective data can be subject to manipulation (see Bertrand and Mullainathan, 2001). Finally, the answer to questions on subjective welfare can vary according to mood effects or remind. The use of panel data allows the authors to control for individual-fixed effects to capture personality traits, assuming orthogonal mood effects in standard residual terms. Another technique presented by Clark *et al*. (2005) consists of latent class estimations to introduce intercept and slope heterogeneity between income and satisfaction with financial situation. Intercept heterogeneities treated by class of individuals are a way to address the treatment of the anchoring effect while slope heterogeneity allows for a non-linear pattern of income influence on happiness. This approach is particularly relevant for their cross-country analysis and data at the national level. However, I believe that the approach of Ravallion and Lokshin (2001) is more appropriate for household data. Nonetheless, other problems are present: aggregation (forgetting within-household inequalities), income measurement (attenuation bias), misspecification of the relevant income variable, income endogeneity[10], definition of the relevant reference group and non-linearity of the explanatory variables of the subjective welfare variable.

Another interesting issue stressed by the literature on subjective welfare is the money metrics approach, which is supported by surveys where people are asked about their financial needs to reach at a predefined level of welfare (see Pradhan and Ravallion, 2000). Unfortunately, it is shown that it does not correct for the endogeneity bias, which remains most of time, as in Ravallion and Lokshin (2001). This approach is consistent with the assessment of subjective poverty lines, which can be applied to this study. However, the definition of subjective poverty measures must be implemented with caution and addressed with specific methodology, as claimed by Kapteyn *et al.* (1988).

Concerning the determinants of the satisfaction with respect to a reform agenda, an empirical study (Bonnet, Dubois, Martimort and Straub, 2006) of the global dissatisfaction about the privatization of infrastructures in Latin America shows that individual beliefs and expectations as well as absolute and relative welfare effects are responsible for the perception of privatization (dissatisfaction in this case). Combining and disentangling welfare effects and shifts in beliefs allow the authors to explain the perception of the reform and the divergence from welfare effects (see Table 1 in the appendix).

[10] Income is also driven by social effects and correlated with unobserved latent personality traits in subjective welfare or other missing variables.

A range of arguments in the literature encompasses the role of beliefs in self-assessment of welfare and self-judgment of policies. Benabou and Tirole (2006) take into account the role of beliefs in the redistributive policies of both US and European policies, emphasizing the importance of "believing in a just world". Hopkins and Kornienko (2004) bring evidence about the role of beliefs into the relationship between happiness and income distribution. They introduce conspicuous consumption through interdependent preferences, showing that inequality matters differently for the rich or for the poor according to expectations on social mobility and social norms, political opinions… Piketty (1995) highlighted the role of individual experience and perception of social mobility in political attitude and redistribution policies while Zaller (1991) focused on how information could influence opinions, in the presence of belief systems. Martimort and Straub, 2006 worked out a political economy problem: how corruption responds in the ownership structure of major public service providers?

In the table 1 (see appendix), a resume of econometric techniques and main findings of the Clark *et al*. (2005), Bonnet *et al.* (2006) and Lokshin and Ravallion (2001) have been summed up.

In Burkina Faso, one should observe the significant increase in self-reported subjective wealth while incomes followed a slower pattern during the cotton reform. How the standard results from the economics of subjective welfare can be applied to an African cotton economy such as the one of Burkina Faso, in a social and technical changing environment for rural households? In addition to the basic determinants which are present in the literature, one should take into account technological and social change and associated perceptions from the reform on different sources of poverty reduction: input and credit access, income, agricultural knowledge... Indeed, other determinants of subjective well-being than the ones presented before should be intuitively put forward: the cotton reform has generated a new institutional and technological environment for producers, thus participating to their perception of welfare, not only through direct effects on income but also through other ones such as the feeling of progress[11] and indirect effects on opinions and expectations. Do people feel less poor because of higher income or because they feel more technologically or institutionally advanced?

Including these parameters to the empirical setting will bring more appropriate and stereotyped features of the changing cotton economy of Burkina Faso in order to estimate the determinants of subjective well-being.

[11] Here I deal with a broad notion of progress that can be driven either by technological change, democratization, or by more managerial responsibilities for instances.

To apply the main findings of the literature to our empirical setting, I have to deal with some problems coming from my data. Indeed, I do not get a longitudinal survey but only cross-sectional data with some variables of recall. Then, how to control for unobserved individual differences in personality influencing subjective and objective welfare as well as household characteristics? Some solutions can be proposed. The use of some recall variables can allow eliminating individual-fixed effects to partially capture psychological traits and latent heterogeneity, which may be correlated with time-varying variables. In addition, as in Ravallion and Lokshin (2001), I can add an identical independently distributed normal residual term to capture mood variability effects and assuming them as orthogonal to dependent variables.

Concerning the perception of a reform, one should use opinion variables as in Bonnet *et al.* (2006) in addition to other welfare variables but they have to be instrumented by their lagged values and a set of fundamental beliefs which are likely to explain consistently the propensity to be more or less critical on a economic reform. The potential endogeneity bias created by the introduction of opinion variables can also be reduced by year-fixed effects and country time-invariant effects. A pseudo-panel methodology can overcome the problem arising with measurement errors when estimating the subjective welfare across one group.

However, I only have available recall variables for one point in time and no lagged variables. The data does not contain much beliefs and opinions but I am not dealing with a panel and/or cross-country analysis. Heterogeneity in fundamental beliefs and opinions that can be interesting in our setting is only related to the environment of cotton producers: relationships and management quality of local institutions of producers, perceptions of the cotton reform and subjective factors of welfare improvement. Furthermore, I have variables at household level, not at individual one, which can create some aggregation measurement errors. However, it is not possible to use a pseudo-panel method as in Bonnet *et al.* (2006) and, even a latent class method seems inappropriate due to an insufficient number of observations. Nevertheless, some household heterogeneity in subjective well-being and perceptions of the reform can be captured through variables on land distribution, land use, evolution of agricultural systems, health and education constraints, housing and expenditures, cattle and non-farm income, social transfers and so on.

Once I estimate the subjective welfare determinants, I should address the issue of perception of the reform through a bivariate Probit methodology with simultaneous estimations on subjective perceptions from the reform and subjective wealth. It will enable me to cope with endogenous perceptions from the reform in the assessment of subjective well-being. Before, I should estimate

separately the determinants of these two variables of interest by univariate ordered Probit as I am going to state now.

Let us introduce now, the following latent indirect utility function (for household i at time t):

$$U_{it}^{*} = \alpha_1 \ln(y_{it}) + \alpha_2 \ln(\frac{y_{it}}{y_{it}*}) + \alpha_3 \ln(\frac{y_{it}}{y_{it-1}}) + \beta_t X_{it} + \eta_i + \varepsilon_{it} \quad (1)$$

where y_{it} is a measure of per capita income, $y_{it}*$ is a measure of the per capita income of the reference group, y_{it-1} is the lagged per capita income and X_{it} is a vector of household characteristics including assets, perceptions, marital status, household size, and expectations, institutional and technical variables and several dummies such as mechanization, farmland, technical assistance, land allocation… η_i is a vector of household fixed effects designed to capture personality traits and personal ladders. The residual term, ε_{it}, is independent across households and time, identically distributed following the normal law, centered in zero, with a homoskedastic variance σ^2. It corresponds to orthogonal shocks related to mood variability and measurement errors.

This specification of the latent utility function is useful when one wants to deal with social comparisons and habituation to cash income as well as time-invariant unobserved familial differences. Note that latent utility does not depend on lagged utility, which is an assumption of the model: no auto-correlation. I am not dealing with slope and intercept heterogeneities in the income/satisfaction relationship as in Clark *et al.* (2005) but I introduce measures of relative income and households time-invariant fixed effects that may control for the anchoring effect and the non-linear pattern of satisfaction with respect to income.

People transform their utility function in a reported well being at time t according to a scale of J+1 discrete numbers. Call their answer u_{it} which belongs to the set of {0, 1… j… J}. The latent continuous utility function U_{it}^{*}, as defined above in (1), can take values on J+1 intervals, separated by J+2 ordered threshold parameters $\{s_o = -\infty, s_1, \ldots, s_j, \ldots, s_J, s_{J+1} = +\infty\}$ such that

$$u_{it} = j \Leftrightarrow s_j \leq U_{it}^{*} < s_{j+1} \quad (2)$$

Then, the distribution of the observed u_{it} conditional on y_{it}, $y_{it}*$, y_{it-1}, X_{it} and η_i is the standard ordered Probit. The parameters estimates are the solution of the Full Information Maximum Likelihood (FIML) under the assumption of exogeneity of independent variables.

Concerning the evolution of subjective well-being, the change in the latent utility values incurred by individuals between two points in time is:

$$\Delta_{t=1}^{t=2} U_{it}^{*} = \alpha_1 \Delta \ln(y_{it}) + \alpha_2 \Delta \ln(\frac{y_{it}}{y_{it}*}) + \alpha_3 \Delta \ln(\frac{y_{it}}{y_{it-1}}) + \beta \Delta_{t=1}^{t=2} X_{it} + \mu_i \qquad (3)$$

when assuming a time-invariant effect for the vector of dummies and variables, X_{it}. μ_i is an independent and identically distributed shock, following a normal law centered in zero and having an homoskedastic variance ν^2. The advantage of this in-differences latent utility function is not to rely on potential unobservable individual or household fixed effects η_i. Then, I follow the same reasoning as above with an observable in-differences discrete measure of satisfaction, $\Delta u_{it,}$ which maps the number of won or loosen rungs on the satisfaction ladder to the differential latent utility, as described above in (3). The only difference is now that the threshold parameters will differ from the ones used in (2) and now, they will be 2J+1 intervals corresponding to 2J+2 cut off values. As before, the conditional distribution of Δu_{it} with respect to its independent variables would be the standard ordered Probit model under the exogeneity assumption.

Now, I introduce the following household latent opinion variable on cotton reform with respect to a specific economic or social component *j* defined as:

$$Z_{ij}^{*} = \delta_{1j} \ln(y_i) + \delta_{2j} \ln(\frac{y_i}{y_i *}) + \delta_{3j} B_i + \zeta_{ij} \qquad (4)$$

where y_i is the per capital household income as defined in (1), for a fixed point in time, y_i * is the per capita household income of the reference group, B_i is a set of household characteristics with some possibly included in X_{it} for a fix point in time. ζ_{ij} is a residual term, independent across households, identically distributed following the normal law, centered in zero, with a homoskedastic variance ω_j^2. This term corresponds to orthogonal shocks of mood variability and heterogeneity in psychological sensitivities to the observed effects from the reform on *j*.

The verbal expression of the perceived effect from the reform on a component *j* is a discrete variable z_{ij} that may reflect different intra and inter-personal ladders. To take this into account, let us assume that it exists a scale of J+1 numbers and that the latent continuous utility function Z_{ij}^{*}, as defined above in (4), can take values on J+1 intervals, separated by J+2 ordered threshold parameters $\{s_{o,j} = -\infty, s_{1,j}, \ldots, s_{j,j}, \ldots, s_{J,j}, s_{J+1,j} = +\infty\}$ such that:

$$\mathbf{z_{ij} \; C \; \{0, 1 \ldots j \ldots J\} \text{ and}}$$

$$\mathbf{z_{ij} = j \Leftrightarrow s_{j,j} \leq} Z_{ij}^{*} \mathbf{< s_{j+1,j}} \qquad (5)$$

Then, the distribution of the observed z_{ij} conditional on y_i, y_i^* and B_i is the standard ordered Probit (under exogeneity assumption of the explanatory variables of the latent one).

Once I estimate separately the subjective welfare and perception from the cotton reform, one interesting issue is to estimate them jointly in a bivariate framework. Sajaia (2007) has provided a bivariate procedure for ordered Probit models. This permits to introduce covariant residual terms and to correct for the potential endogeneity of perceptions into the estimation of subjective well-being. This has been used in Kaminski and Thomas (2008) to jointly estimate the evolution of cultivated land and the land share dedicated to cotton crop during the reform in Burkina Faso with endogenous evolution of farmland in the land allocation decisions. I apply the same procedure to this setting (see the above cited references for the detailed presentation of the model) with the following system of latent variables:

$$\begin{cases} \Delta_{t=1}^{t=2} U_{it}^* = \alpha_1 \Delta \ln(y_{it}) + \alpha_2 \Delta \ln(\frac{y_{it}}{y_{it}^*}) + \alpha_3 \Delta \ln(\frac{y_{it}}{y_{it-1}}) + \beta \Delta_{t=1}^{t=2} X_{it} + \gamma Z_{ij}^* + \mu_i \\ Z_{ij}^* = \delta_{1j} \ln(y_i) + \delta_{2j} \ln(\frac{y_i}{y_i^*}) + \delta_{3j} B_i + \zeta_{ij} \end{cases} \quad (6)$$

where (μ_i, ζ_{ij}) follows a bivariate normal law centered in zero with respective variances v^2 and ω_j^2 and with correlation coefficient $\rho = \mathrm{Cov}(\mu_i, \zeta_{ij}) / (v\omega_j)$. The possible correlated error terms of the two equations of (6) correct the potential endogeneity of Z_{ij}^* on $\Delta_{t=1}^{t=2} U_{it}^*$ whenever γ is significantly different from zero (Wald test) and the simultaneity of these processes.

The endogeneity of perceptions from the cotton reform in the assessment of subjective well-being can be tested in the univariate ordered Probit by the Rivers-Vuong approach, so that only the relevant endogenous perception would be chosen as the second latent variable to estimate jointly with the latent utility function in (6). It will lead to the estimation of a single bivariate ordered Probit system of two latent functions.

The identification of (6) requires an exclusion restriction to be satisfied. At least one variable in B_i must not be comprised in the set of variables belonging to $\Delta_{t=1}^{t=2} X_{it}$. This variable is interpreted as a valid instrument of the latent opinion on a reform's effect, which corrects the endogeneity bias when one estimates the parameters of the evolution of subjective well-being.

How to justify the role of subjective beliefs in the reform's effects? Individual perceptions of a political event participate to the cotton group's values and opinions, which can be interpreted as a complementary good to farmers' own income and other social relational and positional goods in

the indirect utility function expressed above. This club good can be seen as "advertising" the farmers' group quality and performances in the spirit of Becker and Murphy (1993) that an individual belonging to the group is willing to consume to make its own income more valuable. Therefore, the choice of a relevant instrument in the latent opinions about reform's effects should be closely related to the characteristics of cotton groups. I will introduce such an instrument in the next sections.

3. The Cotton reform in Burkina Faso and the survey of cotton growers

3.1 An overview of the cotton reform and the cotton boost with welfare effects

Since 1960 and the independence of the Burkina Faso, the cotton sector had been managed by the SOFITEX parastatal company who held a monopsony on cotton seed and a monopoly in input provision and distribution, input credit, ginning and marketing cotton. The national production of cotton fiber grew steadily under rises in crop productivity and land extension. This pattern prevailed until the end of eighties. The pattern of national production of cotton seed since 1960 is presented in Figure 1 of the appendix.

The industrial organization of the cotton sector was polarized around the SOFITEX and the government who was the main owner of the company, both provided inputs by in-kind credit and extension services such as research and technical assistance. They were also involved in the provision of local public goods as rural road maintenance or education to producers. The latter were organized in village groups (GV[12]). Those GVs were composed by cotton as well as non-cotton farmers but the input credit repayment was only levied on cotton earnings. Moreover, those interlinked contracts between GVs and SOFITEX included joint-liability clauses among farmers. This mechanism led incentives for cereal farmers to strategically default on their credit commitments and low incentives of production for cotton ones.

As a result, the production slowed down then began to drop in the beginning of the nineties, when agricultural productivities reached a ceiling and SOFITEX accumulated large arrears. This pattern changed after the currency devaluation in 1994[13]. Indeed, the enhanced price-competitive Burkinan economy allowed the SOFITEX to better pay cotton seed to producers and to have larger margins on the cotton fiber. However, the cost of imported inputs rose substantially, so that the

[12] *Groupements Villageois.*

[13] In 1994, the CFA Franc was devaluated by half of its value.

problem of input credit was not solved. Furthermore, GVs kept performing badly in their repayment performances. At the end of the nineties, the national production was about to collapse after a new fall and producers' representatives, officials and SOFITEX's executives agreed on a reform plan of the sector.

The first step was an institutional reform, from local organizations to national ones. At the local scale, GVs were replaced by GPCs[14], new designed organizations for cotton growers. The first GPCs were established in 1996. They were based on the principle of free association between farmers, with their own rights of co-opting and matching by affinities whereas GVs were imposed at the village scale with constrained formation of credit groups. In these new organizations, farmers elect their representatives, must declare their land share dedicated to cotton to plan for input credit. These structures have enabled SOFITEX to better control input needs and allowances, and farmers to peer monitor each other thanks to more affinities in smaller and more homogenous groups. Once GPCs became operational, their repayment performances grew up to 99 % today, attracting new producers, and securing banks and SOFITEX who have increased their financial commitments to extend the input credit scheme to new GPCs and new producers until today.

This reform of local organization of producers resulted in a strong empowerment of producers' associations who created their unions at departmental and provincial levels, and then the national cotton union of producers, the UNPCB[15]. The cotton unions are now about to become financially autonomous, and have undertaken a growing number of new responsibilities: cereal input provision, bargaining prices and interest rates on credit, defending producers' rights, management recommendations for GPCs, choice of input provider… As a consequence, producers benefited from the privatization process of the cotton sector, the next step of the reform.

The privatization process started in 1999 in the context of the ASP[16] of Sub-Saharan Africa economies when World Bank required the withdrawal of the government from the industry to clear the accumulated deficit of SOFITEX. The government gave half of its company's share to UNPCB, which entered into the capital of the ginning firm and the former gave up funding extension services. A new professional partnership association was created between SOFITEX and UNPCB to redefine the organization of extension services and the management of input credit schemes. This cooperative agreement gave support to the new organization of the industry with

[14] *Groupements de producteurs de cotton.*

[15] *Union nationale des producteurs de coton du Burkina Faso.*

[16] Adjustment Structural Plan.

stronger producers, a weaker public sector keeping the sole role of supervision, and more vertical coordination (due to the vertical integration) with horizontal differentiation.

The third step of the reform consisted of the entry of two new investors in the ginning market to support the cotton boost and to inject more capital into the sector (ginning factories, extension services), without changing the recently established organization. The monopsonistic system was maintained with the definition of exclusive zones of purchasing seed cotton. These two new firms were incorporated into the professional partnership association where all decisions have been collectively taken up to now, and where a new and more transparent pricing mechanism has been set up. More detailed information about the cotton reform of Burkina Faso can be found in Kaminski (2007) or Kaminski and Thomas (2008).

The observed cotton boost over the 2001-2005 agricultural campaigns (see Figure 1) has been related to the reform agenda in Kaminski and Thomas (2008). The authors insist on the role played by the reform on production incentives through the new local institutions, the GPCs, the confidence effects from more transparent relationships and decision within the industry, and indirect effects on extension of total cultivated land: mechanization, orientation of rural labor, technical assistance and technology adoption… In Kaminski (2007), a theoretical framework is drawn to understand the impacts from the change in the design of cotton growers' organizations and from their growing bargaining power on their repayment performances and their production incentives. From these conclusions, one cannot reject the basic idea that the cotton reform has been crucial in the observed cotton boost[17]. However, I should wonder how living standards, rural income and global welfare have evolved in cotton areas during the cotton reform and, how did farmers perceive these evolutions? This is leading to the evaluation of subjective and objective welfare effects from the reform as well as subjective and objective effects on poverty reduction.

I have led some interviews with producers' representatives, officials, executives of the sector as well as researchers and experts of the cotton sector of Burkina Faso in February 2006. Here are the assertions on the welfare and income effects from the cotton reform on farmers that they made during the interviews. It will be useful in order to state some hypotheses to test within the estimation strategy that I have established in the previous section.

[17] The cotton boost has also been fostered by the Ivorian Crisis in 2002; with a massive inflow of formerly Burkinan people settled in Côte d'Ivoire towards rural areas of Burkina Faso (see the introduction and the argumentation in Kaminski, 2007).

For experts, welfare and income effects at national level are quite insignificant, due to intra-household allocations and an unequal distribution of cotton benefits, and to the limited increase in agricultural earnings at the household level. Cotton growth is not correlated with global poverty reduction. According to World Bank, food and social habits have persisted and positive impacts associated to the cotton crop have concerned education, health and housing quality in cotton areas. There are no redistributive policies for non-cotton and poorer areas. However, the positive effect of cotton crop rotations on cereals has kept down starvation and cotton areas are today self-sufficient for cereal consumption. Cotton revenues are often used for investment in transports, housing, leisure, social events or livestock upsizing. National living standards surveys (INSD, or Ministry of Economy) show that cotton growers have better living standards than the remainder of the rural society, with positive intra-household distributive effects on education and, in a lesser extent, for health and food. This pattern of low improvement of living standards for rural farmers living in cotton areas is linked to the rise of input costs, so that cotton crop seems to be non-profitable for less than 7 ha (17 acres) of cultivated land and for low crop productivities. Some projects[18] are at work to develop other crop technologies to use less chemical inputs and more organic applications in order to maintain the soil fertility in the long run and to obtain higher margins on production.

Another interrogation lies in the future of extension services, in a context of low margins and less funds in the private sector, with no commitment from the government…and potential perverse effects on rural welfare.

The cotton boost has enabled more farmers to obtain cash income, to access input credit and to mechanize. However, the individual associated rise of income and welfare is low because of limited access to input credit for each farmer (credit rationing) and peer-control within GPCs. The cotton boost has been based on the entry of new farmers in cotton growing but not on a spectacular rise of cropped cotton by farmer. Nevertheless, this picture should be nuanced as some farmers have increased significantly their cotton earnings but this pattern has been mitigated by the rise of input costs. One has not to forget that the Ivorian crisis led to a substantial decrease of remittances to rural households, thus offsetting the positive effect of the cotton reform. The increase of income has not been correlated with a big change of living standards but some improvements have been observed (education, health, and housing) and are expected in the near future.

[18] There is an attempt to develop organic cotton crop even if the results are not convincing for now. The French cooperation has implemented a project of sowing under a vegetal cover. Finally, the government has agreed on the importation of GM seeds for next years. These attempts to develop new technologies underline the willingness of the actors of the Burkina Faso cotton Sector to reach at higher productivities and smaller production costs.

3.2 The survey of cotton growers and available data

The data set that I use in this paper is the result of a survey of households belonging to GPCs across 20 villages. This survey was done in March 2006 in representative zones of cotton production with 300 interviewed households, accounting for 0.2 % of national production. However, the survey is not representative of rural Burkina Faso since only cotton growers were interviewed. The goal of the survey was to identify the determinants of the cotton growth (through the growth of cotton areas), but not to quantify them. The absence of former cotton growers, who would have exited the production during the reform, accounting for a marginal number, does not change the conclusions on the role of the reform on cotton boost. In the empirical investigation of the determinants of subjective welfare, one should bear in mind that the sample of this survey does not represent the rural society of Burkina Faso. However, the available data are useful in the identification of the channels through which the cotton reform has reduced rural poverty and increased subjective welfare. The availability of variables on economic activities and on living standards as well as subjective variables allow including the perceptions of farmers and the changing environment in the rural society as potential explanatory variables in the perception of welfare. The presence of recall variables enables to identify the system of equations (6).

An original questionnaire was designed with recall variables and variables about the evolution of agricultural systems and economic decisions within each household. These variables were added to basic variables informing living standards -housing, education, health, consumption, credit, savings, crops, cattle- and perceptions of poverty and about the reform. In addition to objective variables, households were asked about the reasons and the determinants of their choices and of the evolution of their decisions during the reform, concerning agricultural management. The availability of both objective and subjective variables on the evolution of rural welfare and farming systems is useful in order to study empirically a dynamic process (evolution of subjective welfare during the reform) with cross-sectional data. Detailed information on available data that I use in this paper is presented in the Table 2 of the appendix.

More information on the survey design can be found in Kaminski and Thomas (2008).

3.3 Descriptive statistics of subjective and objective welfare variables and descriptive analysis of data

The first tables and figures in the appendix inform about the basic statistics of variables of interest and deserve some comments.

Concerning living standards, a look at table 3 confirms that changes have been slight: better used raw-material in housing, more access in telephone, water access shifting from welling to drilling, more means of locomotion, better literacy rates and health indicators. However, schooling and health constraints[19] have remained high for interviewed households. It is a very difficult task to find a link between the cotton reform and the observed changes of living standards. The availability of cash income is likely to have enabled some households to access medicines, to pay for the schooling of their children and to improve their habitat. But the development of infrastructures is not under the responsibility of cotton growers even if cotton unions have invested some funds. The withdrawal of the government from the cotton sector is likely to have had a bad impact on rural infrastructures. One most significant feature of Table 3 lies in the moderate shift of health consumption from traditional to conventional fashions[20] with a decrease in infantile mortality and in the number of diseases and injuries.

Table 4 displays complementary information about the evolution of living standards during the reform, namely, the evolution of consumption. I notice that consumption has not decreased for the majority of the sample over 10 years. However, not everybody has been able to increase all kinds of consumption and there may have been substitution effects and not only income effects. Largest increases concern health, energy or clothing while global increase is important for energy, clothing, social events, cereals, animal proteins and condiments. Smallest increases concern milky products, alcohol and tobacco, tubercles, fruits and education. Diversification of food consumption has not been achieved for many households while savings and investment have been following a positive pattern. This can be a long-term risk strategy for households[21]. Differences between increases and decreases give us an idea about substitution effects: there are big for clothing, energy, social events, health and cereals and low for milky products, tubercles, fruits and education.

Then, I display some objective indicators of wealth and wealth distribution. First, in Table 5, I present the standard poverty and Gini indexes (headcount ratio, poverty gap). The headcount ratio exhibits a very high level of poverty but I should take this figure with caution as incomes in our survey are likely to be under-estimated under self-reporting of incomes and assets by households. According to the data of INSD, this figure is more around 60 % than 80 %. However, among the poor, the distribution of income is much more equal, as can be suggested by the relative low values

[19] These variables are self-assessed (subjective) evaluations of difficulties in sending children to schools and reaching at a satisfactory health state.

[20] From the *tradi-praticien* (traditional healer) to the doctor or the nurse.

[21] Notice that savings have more increased than investment.

of P1 and P2. Distribution of income is quite unequal and much more than the one of subjective wealth (see hereafter) as figure 3 can confirm. The distribution of land is less unequal than the one of income with a large fraction of the population endowed with some respectable amount of land (figure 4). The estimated density functions by non-parametric methods –here, the Kernel estimator- of the logarithm of income and land confirm these first observations. Although there are big inequalities in the distribution of these elements, the majority of the population gets close levels of income and cultivated land per capita. Moreover, the correlation between land and income per capita is quite clear from figure 6 so that the richest households are likely to be the ones entitled with the biggest and likely, the most fertile amounts of land. However, income and land may have different effects on subjective wealth and so forth, on subjective poverty.

Table 6 displays the descriptive statistics of the perceptions of the effects from the cotton reform. I learn that cotton reform was subjectively more effective on income, on input access than on poverty reduction. Nevertheless, good scores for income are close to those for perceived welfare. In general, perceived effects from the reform seem to be very significantly positive with a big heterogeneity across households. Figure 6 displays the distribution of subjective wealth with an unambiguously rise in average value and the whole distribution has shifted upwards over the reform period, reflecting a first-order stochastic dominance. This is confirmed with Table 7 and Figure 7, which show that, with respect to subjective wealth, the reform has generated more winners than losers. Beyond this observation, it is also noteworthy to see a more equal distribution, representing a second-order stochastic dominance of the current subjective wealth distribution over the one of 10 years ago. From now, I will use the subjective wealth as my subjective well-being indicator although it is much incomplete about perception of well-being. However, the perception of wealth is likely to bring us more information that the satisfaction with financial situation, used in Clark *et al.* (2005). One interesting feature displayed in figure 8 is the lack of correlation between subjective wealth and absolute or relative income whereas they are believed to be determinant. The basic explanation lies in the issue of the "anchoring effect". As people get their own scale of what they perceived to be wealth or welfare, they match different income level to the same level of wealth. The verbal expression of subjective wealth must not be a surjection of the intrinsic satisfaction with wealth.

[Table 6, Figures 6 & 7 here]

The tables of correlations (Tables 8, 9, 10) bring the information that income and welfare perceived effects from the reform are very correlated (52 %) while welfare effect has some

significant degree of correlation with input access, poverty reduction and agricultural knowledge effects (between 20 and 25 % for each). Then, poverty reduction is also much correlated with agricultural knowledge effects (47 %). I can conjecture that the perceived increase in welfare is caused by the increase in income but also by the feelings that agricultural systems have positively been enhanced thanks to the reform and that some poverty reduction has been achieved.

While perceptions about the positive effects of the reform on welfare and income (and poverty reduction) are the most correlated with subjective wealth (Table 8), perceptions on the reform's effects on input access and agricultural techniques and abilities are the more correlated with past subjective wealth (Table 9). This has to be linked with the figures of Table 10, where I see that the latter effects are negatively correlated with the evolution of subjective wealth during the reform. One can conjecture that, as subjective wealth is incurred through social comparisons and as the reform has allowed more households, and notably poorer ones, to access inputs and to benefit from improvements in agricultural technologies, then relative subjective wealth may have decreased for the wealthiest households, and all the more remarkable when people have strong perceptions about this. In brief, as subjective wealth is also relative to the average income through social comparisons, perceptions of positive effects from the reform on input access and agricultural abilities are associated to less inequality and more equal distribution of income in the village. This can be supported by the observation of the correlations among reform's perceptions made in the last paragraph. People feel richer because of the perception of the reform on their own income and welfare evolution but less rich relative to the average of the village because they perceived that everybody accesses poverty reduction factors as input credit, agricultural technology and assistance, so that there is a perverse effect on subjective wealth for the richest people of the income distribution and a positive complementary effect for the poorest one.

Notice that the gain in subjective wealth during the reform decreases with experience in cotton growing. It has to be related with the relative effects discussed previously but also with the habituation to cash income, the third term in equations (1) and (3). New cotton growers experienced with new income feels richer than before while more experienced ones tend to feel relatively poorer (social comparisons) or marginally less rich (oneself comparisons). To finish, there is no apparent relationship between the evolution of land allocation – through the land share dedicated to cotton- and the gain in subjective welfare although a rise in land share could have traduced a rise in cash income and in subjective wealth (see figures 9 and 10 in the appendix). Once again, I can expect the "anchoring effect" to be responsible for the observed noise.

These first statements should be confirmed and checked out trough the application of our empirical setting to the data.

4. Empirical results and estimations

4.1 Which data and variables can fit to the empirical setting?

Coming back to Section 2, I have now a set of variables to use in the previously presented empirical setting. In addition to measures of income, I use per capita expenses of representative food and non-food goods, assets such as land, debt, credit, habitat's size and health status[22]. The relative measure of income is the ratio of the difference between per capita household's income and the sample village average over the sample village average. This measure seems relevant as the measured sample village average represents the average of income between cotton growers (same social environment) within the same village (same geographic environment). To control for the habituation with cash income and for potential auto-correlation of subjective wealth, I use the past subjective wealth, expressed before the reform, and the experience with cotton growing as explanatory variables. The negative income shock caused by the Ivorian crisis and materialized by a substantial decrease in remittances received by Burkinan rural households is captured by the evolution of received transfers (both formal and informal) variable.

To be consistent with this approach, I use an (incomplete) set of individual-fixed effects such as expectations[23] and beliefs but they can be time-varying. For this reason, I include other variables of institutional and technological change[24] plus an ethnical group dummy that can be treated as time-invariant. The ethnical dummy -belonging to a resident group or not- is likely to be largely responsible for latent heterogeneity of wealth perceptions, as the own experience of households about the evolution of their agricultural systems. In addition, I introduce perceptions of the effects from the reform and of poverty (e.g. subjective needs as money metrics variables) as possible endogenous beliefs.

Concerning the evolution of subjective wealth, I deal with the same kind of variables and I introduce dummies on the evolution of consumption of representative food and non-food goods

[22] They stand for idiosyncratic characteristics or control variables for income measurement errors.

[23] Here I use the past and present expectations about cereal and cotton prices as well as own crop productions.

[24] I also use these variables as they are believed to characterize the changing global environment of farmers and to participate to their perception of wealth (through the feeling of progress): evolution of total cultivated land and evolution of land share dedicated to cotton, mechanization (use of draft animals).

and past expectations. Then I add some variables associated to the evolution of agricultural systems. I introduce also an index of risk aversion (see Table 2).

In the next step, I treat perceptions of the effects from the reform as potentially endogenous and use absolute and relative income variables as before plus a set of welfare variables (e.g. housing, transfers). In the same way, I add expectations as well as institutional and technological variables plus a risk aversion index. Finally, I introduce some new subjective variables. These ones are the importance factors for households in the contribution of their subjective wealth and its pattern (see Table 2). They were not used before because of their likely collinearity with the objective variables in the explanation of perceived wealth. However, they can be useful to identify the channels whereby farmers have evaluated the reform and how the impacts have been directly perceived.

To consistently estimate (6), I need a valid instrument for potentially endogenous perceptions of the effects from the reform. This instrument is a variable that has influenced the perception of reform's effects but not the one of wealth. As GPCs have been set to let people match them by affinities with flexibility, it is likely that the relationships and management of these cotton farmers' organizations have not impacted the way farmers have perceived their financial and social situation, *ceteris paribus*. Indeed, as farmers now can access agricultural inputs more equally, the quality of GPCs does not matter much in the perception of wealth if other determinants of latent heterogeneity are controlled for. However, the perceived effects from the reform could have differed with respects to the quality of management and relationships within GPCs though farmers have been able to switch groups more easily. According to the performances of GPCs, farmers might have felt heterogeneous effects from the reform on their input access, agricultural abilities, and thus, on their income and welfare. The way GPCs affect perceived wealth might only be through the subjective beliefs about reform's effects. Based on this argument, I consider dummies about GPCs' internal relationships and management quality as instruments when estimating (6). This choice is also related to our discussion at the end of section 2. Indeed, the own assessment of the quality of GPCs can be interpreted as the propensity to consume the club good of the group's political opinion on the reform through the degree of adhesion to the group and its political involvement. The way farmers put some value on the group's opinion reflects their feeling of being involved in the reform process and its farmers' appropriation.

4.2 Econometric results

I begin by presenting the results of the univariate ordered Probit estimations on current subjective wealth, evolution of subjective wealth and perceived effects from the reform.

Once I control for past subjective wealth in Table 11, I find that the relative measure of income is highly determinant in the assessment of current subjective wealth while the absolute measure of income is not. Assets such as land, debt, input credit and housing matter while investments in durable goods and specific kinds of consumption or expenses also appear to be determinant: cereals and dairy products positively, education costs negatively. Adding expectations and dummies on the evolution of agricultural systems brings evidence about the positive role of mechanization and the increase in total farmland as well as the rise in input demand and the technical assistance. It also enables to identify an ethnicity effect and an optimistic effect about the future cereal prices. People who belong to resident ethnic group are more likely to express less wealth or less satisfaction with their financial situation than people from migrant ethnic groups. People who have migrated towards cotton areas here express a better current situation than in the past, which led them to feel wealthier than resident ethnic group, other things being equal. The introduction of perceptions of reform's effects and of poverty does not change substantially the previous results but brings some valuable added information. Indeed, I can derive from the last column of Table 11 that people feel wealthier the more they believe that the reform has triggered a process of poverty reduction and the less they believe that the reform has increased input access and improved technical abilities in agriculture. Indeed, the increase in input access and in agricultural performances is consistent with the perception of a decreasing relative income, as discussed previously in section 3. To finish, the introduction of money metric variables show us that the lack of money to pay for social events and/or clothing and transportation negatively affects the feeling of wealth. Indeed, these are among the easiest visible components of wealth and I can conjecture that they much matter in the feeling of poverty.

[Table 11 here]

In Table 12, I focus on the determinants of the evolution of subjective wealth, using the same kind of variables as before, plus new ones about the evolution of consumption, investment and savings, past expectation of agricultural prices, past agricultural assistance (before the reform) and risk aversion. The main conclusions drawn from the last paragraph remained unchanged, that means that the determinants of current subjective wealth are also determining the evolution of this subjective variable. It is worth adding that the evolution of savings as well as investment and consumption are not significant in the evolution of subjective wealth, only current levels matter. The current level of health expenses becomes positively significant while the current level of cereal does not anymore. About expectations, the past expectation on cotton prices is significantly

negative while expectations -current or past- on cereal prices are not so. The mechanization effect is only significant for recently equipped farmers, the ones that have adopted draft animals during the reform. The rise in land share dedicated to the cotton crop is now positively significant in the evolution of self-assessed wealth, but it is not the case anymore neither for the evolution of input demand nor for the role of technical assistance. Finally, the more risk-averse households are less likely to experience a rise in subjective wealth, other things being equal. I will check these first statements when analyzing the bivariate ordered Probit estimates.

[Table 12, here]

Table 13 presents the univariate ordered Probit estimates of the perceived effects from the reform. It will be useful in order to deal with endogenous perceptions in the estimation of subjective wealth evolution and to understand the role of perception for subjective poverty reduction concerns. Now, I can identify the main factors of these perceptions and firstly observe that the determinants of perceptions are very specific to each one. While the relative measure of income is relevant for the determination of the perceived effect of the reform on income (positively) and on input access as well as on agricultural abilities (negatively), the absolute one is relevant for the perceived effect on welfare (positively). There is a positive influence from the housing size not only on the perceived effect on income but also, and more significantly, on poverty alleviation and agricultural abilities. It is noteworthy to verify the significance of both expectation and institutional quality dummies (the variable denoted "GPCs"), specifically to each perception. Hence, it seems that the choice of our instruments is particularly relevant. The mechanization has not changed significantly the perceptions, excepted for recently equipped farmers when evaluating the reform effect on input access and for formerly equipped farmers when perceiving the reform effect on welfare. This result suggests that recently mechanized farmers have not experienced greater associated input deliveries so that they perceived a lower input access and that formerly mechanized farmers have experienced or perceived less welfare gain than others on average. Moreover, the migration allowed some households to experience marginally better income, welfare and input access than households belonging to resident ethnic groups. In other words, migrant ethnic groups are more sensitive to the positive effects from the cotton reform on their own income, welfare and input access. The level of technical assistance has played a positive role on the perception of the reform's effect on agricultural abilities and a negative one on the perception of the reform's income effect. Risk aversion is associated to more sensitivity with respect to the effect of the reform on poverty alleviation.

Finally, I add a set of subjective variables (see their description in Table 2) that people expressed to explain the evolution of their subjective wealth during the reform, which can be related to their own beliefs about the determinants of wealth. These variables appear to be quite relevant in our analysis of perceptions of the reform. The more households agree with the importance of the reform in their subjective wealth evolution, the more they perceived positively all effects of the reform but the one on input access. The same observation can be made for the importance of familial labor and actions of the household and the one of local cotton organizations, except that the former does not work anymore for the perception of the effect on agricultural abilities and the latter for the perception of the effect on income while it works for the perception of the effect on input access. These results should be complementary as people perceived differently what the reform did and consisted of, for example, people may not attribute the setting of new local cotton groups to the reform agenda. Note also that there is a positive attributed role to the World Bank policy on the perception of the reform's effect on income and a negative one on the perception of the reform's effect on input access. In addition, one would add the negative significance of the importance of developed countries policies in the evolution of subjective wealth on perception of the reform's effects on welfare and on input access.

[Table 13 here]

To deal with the endogeneity of perceptions in the assessment of subjective wealth and its evolution, I firstly use the Rivers-Vuong (1988) approach to test for this issue. The results of these tests are displayed in Table 14. The main observation is the rejection of the exogeneity assumption for the perception of the reform's effects on welfare and input access. Introducing these tests changes some estimates such as the land variable (not significant anymore), the education expenses and the expectation on future crop production (now significant) when introducing the perceived effect on input access. Other related changes are the increase in land share allocated to cotton (no more significant) for the perceived effects on both input access and welfare, the past expectation on cotton prices (less significant) and the resident ethnic group dummy (no more or less significant) for all perceptions. Note that the estimates of the perceptions are quite different from table 12, which reflects an obvious endogeneity bias. The difference is particularly relevant for the estimates of own perceptions -estimate of the perceived effect on welfare when testing for the endogeneity of this effect, for instance- except for the perception of the reform's effect on input access.

Some nice interpretations can be drawn from these observations. First, the endogeneity of perceiving a higher input access has important implications such as capturing the effect from land

on subjective wealth, and making education expenses and expectation on future crop production significant. The more people believe that they access inputs better or that they live better because of the reform, the more they expect their crop production to rise. Second, perceptions about both welfare effects and input access (endogenous) capture the effects of land allocation in favor of cotton on subjective wealth. Here, the endogenous perceptions work as objective variables with no additional information. Third, I can conjecture that migrant ethnic groups perceived more the positive effects from the reform than resident ones.

[Table 14 here]

In Tables 15 and 16, I introduce exogenous or endogenous perceptions, one by one and display the estimates of both subjective wealth evolution and perceptions of the reform's effects. I apply the bivariate ordered Probit methodology presented in section 2. Which are the noticeable changes from the resulted presented in tables 12 and 13?

Concerning the evolution of subjective wealth, as mentioned above, the land variable -total farmland cultivated by the household- is no more significant with an endogenous perception of the input access effect whereas the education expenses become a relevant negative determinant. The other corrections created when introducing endogenous or exogenous perceptions, as the ones discussed in the previous paragraph, are confirmed: less or no more significant ethnicity effect, significant expectation on future crop production with endogenous perceived effect on input access, no more significant increase in land share allocated to cotton with endogenous perceived effects on input access or welfare. Having controlled for exogenous or endogenous perceptions, the estimates looks like the ones of Table 12, except for the estimates of perceived effects of input access and welfare when these perceptions are treated as endogenous: they are no more significant. Endogenous perceptions may not be an appropriate specification of the model of simultaneous equations, as stated in (6).

[Table 15 here]

The Table 16 displays the estimates of the five different perceived effects of the cotton reform when they are estimated jointly with the evolution of subjective wealth, treated as endogenous or exogenous according to the significance of their Rivers-Vuong tests in Table 14. Compared to Table 13, the estimates are not significantly different and the main conclusions still hold.

[Table 16 here]

The bivariate approach helped to deal with endogenous or covariant perceptions and to treat some independent variables as instruments in the estimation of the evolution of subjective wealth. It is worth noting that for perceptions treated as exogenous, the correlation coefficient of the two residual terms (of the two estimated equations) is significant, except for the perceived effect on income. Once I controlled for the observed components of perceived reform's effects on poverty alleviation and agricultural abilities, the latter is negatively (respectively the former is positively) correlated with the evolution of subjective wealth, traducing simultaneity biases. These two specifications with exogenous perceptions are the most relevant for the bivariate ordered procedure since they exhibit a significant correlation term between simultaneous errors of the two equations.

The five different specifications of bivariate ordered Probits displayed in tables 15 and 16 are not all justified. Introducing endogenous perceptions of the reform's effects leads to non-significant correlation between residual terms, so that the bivariate procedure yields the same results than a univariate one. Thus, a simpler ordered Probit specification would have been sufficient with a two-step estimation procedure to treat the endogenous perceptions. A treatment effect model or a sequential approach could have been called for.

The analysis of these estimates enables us to put forward the idea of a strong link between relative income -and no significant absolute measure of wealth- and the evolution of subjective wealth. Moreover, the main components of the changing rural society, those are land extension, mechanization, technology adoption, and new institutions, as well as beliefs and satisfaction about the reform agenda and its effects matter importantly in the self-reported feeling of wealth, either as determinants or as instruments. Surprisingly, the basic living standards do not appear to have played substantially in the evolution of subjective wealth, which may help to explain the gap between the slight changes in living standards and farm income, and the significant positive move of perceived wealth in cotton areas. The role of own and social comparisons has been verified but subjective wealth has been fostered by the increasing feeling of social and technical progress as well as the perceptions of the reform.

Subjective channel has been found to be the more important; the more farmers are satisfied with internal management and relationships of their local groups. It means that the more cohesive the farmers' group is, the more political opinion matters in the own assessment of welfare and the more the political change has been appreciated.

5. Conclusion

Although some slight changes of living standards must be related to cotton expansion, one may expect more significant long-run effects (cotton experience) due to accumulated cash income[25]. This paper has shown that there were greater changes in perceived wealth and welfare because of optimistic beliefs, new responsibilities in agrarian organizations, new agricultural technologies and changes in social status (health and social events) as well as perceptions about positive effects on welfare and poverty alleviation caused by the reform. Some of these determinants had been significant because of the reform process, which can explain the global satisfaction entitled with it.

Two important implications must be drawn:

- Technical and social environment such as agrarian institutions, social organizations and relationships, technical assistance, access to production inputs, etc. matter in the perception of wealth and can lead to subjective poverty reduction in a rural cotton economy.
- There are several limitations arising from social comparisons (relative income), cotton experience (habituation to cash income) but also some boosting effects caused by the role of opinions and beliefs from a successful policy change. These effects are likely to be the reflection of group's mechanism with the involvement and the appropriation of the cotton reform policy by Burkinan cotton growers and their related organizations.

In my interpretation, it is likely that subjective poverty reduction and increases in both aggregate and individual distribution of subjective wealth (first and second-order stochastic dominance) precede more important improvement in living standards or occurs without any significant improvement. However, with the decline of world cotton prices, the positive income effect from the cotton reform may vanish in the future with a subsequent greater counter-effect on subjective wealth level and distribution (habituation effect/ loss aversion). However, the positive effect from changes in the rural technical and social environment must be more sustainable and stable in the long-run.

In the assessment of poverty reduction strategies, or any related policies, this paper put forward the idea that opinions matter in subjective poverty alleviation as well as the social environment surrounding a rural community[26]. This could affect the design of such policies when

[25] Experience with cash earnings, investment strategies, better intra-household allocations…

[26] This may occur even without any improvement of individual living standards.

targeting not only on observed poverty but also on what people bear. This may also make relevant collecting subjective data when evaluating (*ex post*) or foreseeing (*ex ante*) policy effects on subjective welfare and its distribution. The way agricultural policies are conducted should account for this kind of subjective impacts so as to embed popular support and happiness concerns into the analysis of rural policies. Subjective channels have different impacts according to group mechanisms, according to the influence and the cohesion of farmers groups and their related social organizations. Appropriation of a reform policy by farmers can be responsible for a popular adhesion to the reform agenda, thus reinforcing the position of policymakers, as shown in this particular study of the Burkina Faso cotton economy. The mechanism through which the political change is supported by farmers has been shown to be the positive impact of political change opinions on the own assessment of farmers' wealth that partly capture objective welfare and technical effects.

The particular kind of relationship between farmers, policymakers and foreign cooperation is likely to have influenced these mechanisms because farmers' groups can be involved into political processes according to the performances of their social organizations, the political regime and the willingness of foreign actors and governments to work with farmers' representatives. In Burkina Faso, this has led to a strong leadership for cotton farmers, capable to work with policymakers and to be responsible for a growing number of responsibilities. This has been supported by the willingness of government and foreign actors to delegate decisional and management power to farmers to establish a consistent industrial partnership leading to better production incentives. In Mali, the democratic regime is more favorable for farmers to put pressure on government and jeopardizing cotton production to oppose to any reform policy. Democracy is associated to less coercion power of government and more lobbying power of farmers, yielding to the prevalence of the political *status quo*. Lack of leadership for cotton farmers makes any negotiation difficult between producers and policymakers and is responsible for the reluctance of farmers to enter into a partnership with the parastatal.

I believe that it should be interesting to pursue this study further with panel data or field experiments to better characterize the dynamics of such evolutions (perceptions and subjective welfare) in a changing rural environment. These developments are left for future research.

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6. Appendix

Table 1: Main findings and econometric techniques of Ravallion and Lokshin (2001), Clark *et al.* (2005) and Bonnet *et al.* (2006)

Paper	Clark *et al*. (2005)	Ravallion and Lokshin (2001)	Bonnet *et al*. (2006)
Estimated subjective variable	Satisfaction with financial situation	Changes in satisfaction with life	Opinion about privatization
Data	Panel	Panel	Panel
Models	Latent class ordered Probits	Ordered Probits with latent heterogeneity	Probit and ordered Probits
Econometric refinements and controls for potential biases	Introduce intercept (anchoring effect) and slope heterogeneity, identification of classes of individuals	Inter and Intra personal ladders, time invariant unobserved personality differences influences sociological/economic characteristics and reported well being	Opinion variables needs correcting biases (2SLS), country year-fixed effects, aggregate data to (measurement errors) and pseudo-panel methods (anchoring).
Explanatory significant variables	Log (p.c.[27] income) Labor force status Wave dummies Time invariant characteristics Threshold parameters	Change in household p.c. income, change in household p.c. expenditure, proportions of teenagers and adult women in the family, familial situation, change in employment status, change in reported health, occupation	Individual characteristics Wealth characteristics Access to basic services Country level dummies endogenous: macroeconomics, political environment, governance, distribution Individual opinions
Main results	People transform income into well being in their own way (slope and intercept (cuts) differences across classes	No Effects from family size. Big welfare cost of unemployment and of health deterioration	U shaped effect from education Wealth effect, employment categories Opinion effects (left, trust, perception of the future and the evolution of economics)
Implications	Marginal effect of income on well-being is heterogeneous across classes and should reflect different behaviors and preferences for redistribution	Unless there is sufficient income gain, the mere availability of a job will not attract the unemployed back to work and the improvement in perceived health after a disease does not restore life satisfaction.	Beyond the mix of absolute and relative welfare effects, individual beliefs and expectations matter (magnifying U-shaped distribution of satisfaction with respect to income education). Two channels: information and expectation.

[27] Per-capita.

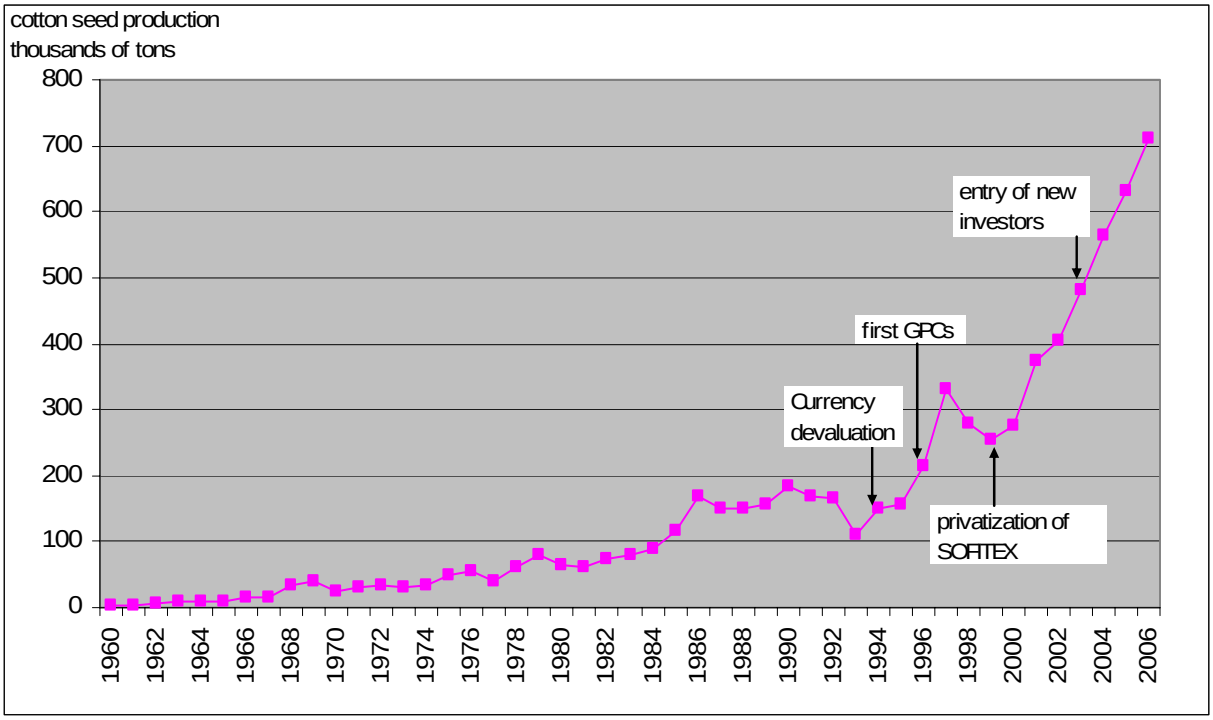

Figure 1: Production of cotton seed in Burkina Faso since 1960

Table 2: Summary statistics of main variables (except living standards and consumption evolutions)[28]

Variable	Description	Mean	SE
	Household main characteristics		
Labor force	Number of labor force unities (1 for a man, 0.8 for a woman, 0.6 for a child between 6 and 18 years, 0.3 for a child under 6)	6.393	3.499
Children	Number of children under 6 years in the household	2.633	2.188
Adults	Number of people over 18 years in the household	3.98	2.309
Schooling	Rate of school enrolment for child between 6 and 18 years	.447	.361
Education level	School degree of the household's chief: No school (53 %), alphabetization (10 %), coranic school (6 %), 5 years (20 %), 9 years (7 %)		
Religion	Main religion practiced in the household: Islam (60 %), Catholicism (15 %), Protestant (3 %), Animist (22 %)		
Ethnic group	Ethnic group of the household: Bobo (21 %), Mossi (24 %), Gourounsi (15 %), Dagara (13 %), Local ethnic groups (24 %), Senoufo (3 %)		
Village	Village of residence	-	
Time of residence	Years of residence in the village of the household's chief	19.457	15.294
Risk aversion	Willingness to receive compensation to reduce risk when being paid the harvested production (between 0 and 100 (in thousands FCFA)).	71.242	21.063
Expected cotton price	Anticipation of the trend of cotton price in the future	Increase: 29.7 %	
Expected cereal price	Anticipation of the trend of cereal prices in the future	Increase: 12 %	
Expected crop production	Anticipation of the trend of crop production of the household in the future	Increase: 21.67 %	
	Income, Consumption, Assets		
Income	Generated household income from crop production, sales of cattle, non-farm income and received transfers in thousands FCFA	877.686	962.947
P.c.i	Generated income divided by labor force unities (per capita)	137.296	112.815
Relative p.c.i	Rate of difference between individual per capita income and the average village per capita income	0	.755
Land	Total cultivated land divided by labor force unities in ha	1.089	.603
Cattle	Total value of the livestock of the household in thousands FCFA	657.629	943.749
Input credit	Value of the loan of agricultural inputs in thousands FCFA	300.231	311.119
Credit	Value of other loans (formal and informal) in thousands FCFA	26.475	347.427
Transfers	Value of received transfers (pensions, gifts,…) in thousands FCFA	1.713	11.551
Non-farm	Value of non-farm generated income in thousands FCFA	13.446	29.003
Investment	Value of investment last year in thousands FCFA	87.931	368.540
Social Events	Value of social events spent last year in thousands FCFA	33.398	45.356
Energy	Value of energy spent last year in thousands FCFA	30.663	31.387
Transport	Value of transport spent last year in thousands FCFA	31.192	44.562
Clothing	Value of clothing spent last year in thousands FCFA	40.775	37.035
Housing	Value of housing spent last year in thousands FCFA	28.670	50.233
Education	Value of education spent last year in thousands FCFA	11.659	22.616
Health	Value of health spent last year in thousands FCFA	30.724	40.693
Alcohol/Tobacco	Value of alcohol and tobacco spent last month in thousands FCFA	1.287	2.801
Beverages	Value of beverages spent last month in thousands FCFA	4.584	7.344
Condiments	Value of condiments spent last month in thousands FCFA	3.093	3.481
Fat nutrients	Value of fat nutrients spent last month in thousands FCFA	1.531	2.567
Milk products	Value of milk products spent last month in thousands FCFA	.631	1.260
Animal proteins	Value of animal proteins spent last month in thousands FCFA	3.371	3.188
Fruits	Value of fruits spent last month in thousands FCFA	1.369	2.333
Vegetables	Value of vegetables spent last month in thousands FCFA	1.868	1.825
Tubercles	Value of tubercles spent last month in thousands FCFA	1.227	1.764
Cereals	Value of cereals spent last month in thousands FCFA	5.651	11.828

[28] See below.

Agricultural systems and social/ technical environment			
Mechanization	Level of mechanization of the household: traditional farming (20 %), animal farming adopted during the reform (60 %), already mechanized before the reform (20 %)		
Technical assistance	Number of visits of cotton technical agents last year	2.953	5.691
Agricultural assistance	Number of visits of agricultural agents 10 years ago	1.947	2.843
Input demand	Evolution of the demand for inputs during the reform: Much more (29 %), More (53 %), Same (14 %), Less (4 %)		
Δ Land	Evolution of total cultivated land by the household: decrease (4 %), same (28 %), increase less than 1 ha (40 %), increase less than 2.5 ha (13 %), increase less than 5 ha (7 %), >5 ha (7 %)		
Δ Cotton share	Evolution of the land share dedicated to cotton during the reform: decrease (6 %), same (18 %), more (33 %), much more (42 %)		
Cotton experience	Experience with cotton growing: New grower (3 %), Less than 3 years (9 %), Between 3 and 5 years (14 %), Between 5 and 10 years (24 %), More than 10 years (49 %)		
GPC management	Perceived quality of management of the cotton group of producers: very good (20 %), correct (66 %), low (13 %), very bad (1 %)		
GPC quality	Perceived quality of internal relationships within the cotton group: very good (35 %), correct (55 %), low (9 %), very bad (1 %)		
Perceptions (except perceptions from the reform)			
Subjective wealth	Feeling of wealth on a scale of [0,10] for the household today	5.313	1.601
Past subjective wealth	Feeling of wealth on a scale of [0,10] 10 years ago	2.960	1.950
Δ Subjective wealth	Rate of variation of the feeling of wealth	.430	.387
World price	Subjective effect of cotton world price on subjective wealth[29]	2.487	3.728
Cotton reform	Subjective effect of the cotton reform on subjective wealth	3.083	3.060
Household effort	Subjective effect of the household's actions on subjective wealth	4.497	3.459
Cotton unions	Subjective effect of the cotton unions on subjective wealth	2.017	2.725
Ginners	Subjective effect of the ginning firm on subjective wealth	.633	1.756
Word bank	Subjective effect of the policy of World Bank on subjective wealth	.353	1.482
NGOs	Subjective effect of the actions of NGOs on subjective wealth	.487	1.643
Developed countries	Subjective effect of the policies of developed countries on subjective wealth	.423	1.614
Cereal/ Tubercles needs	Perceived nutritional deficiency in cereals and tubercles for the household	High deficiency: 0.047 Moderate : 0.403	
Animal protein needs	Perceived nutritional deficiency in animal proteins for the household	High deficiency: 0.39 Moderate: 0.457	
Milk product needs	Perceived nutritional deficiency in milk products for the household	High deficiency: 0.313 Moderate: 0.4	
Fruits/ Vegetables needs	Perceived nutritional deficiency in fruits and vegetables for the household	High deficiency: 0.19 Moderate: 0.563	
Health/ Education need	Subjective financial need for health and education expenses	154.088	171.340
Housing/ Energy need	Subjective financial need for housing and energy expenses	302.048	756.577
Cloth/ Transport need	Subjective financial need for clothing and transport expenses	190.267	288.151
Social events need	Subjective financial need for social events expenses	140.453	173.250
Farm investment credit	Perceived impact on welfare from access to farm investment credit	6.46	2.962
Non-farm investment credit	Perceived impact on welfare from access to non-farm investment credit	3.987	3.434
Food credit	Perceived impact on welfare from access to food credit	2.787	5.959
Extension services	Perceived impact on welfare from access to extension services	4.353	3.407
Transport means	Perceived impact on welfare from access to better transport means	4.493	3.422
Irrigation	Perceived impact on welfare from access to irrigation	5.133	3.677
Clean water	Perceived impact on welfare from access to clean water	5.36	3.149
Health care center	Perceived impact on welfare from the presence of a health care center in the village	5.863	3.014
School	Perceived impact on welfare from the presence of a school in the village	5.04	3.227
Ginning factory	Perceived impact on welfare from a closer ginning factory	3.58	3.627
Better GPC	Perceived impact on welfare from a better performing GPC	4.023	3.429

[29] All these subjective effects on subjective wealth are on a scale of [0,10].

Table 3: Evolution of living standards during the reform

Living standards	**Today**		**Ten years ago**	
#Rooms for the household	5.27	(3.5)	3.25	(2.19)
Quality of walls	banco 91 %	briks 6 %	banco 93 %	briks 3 %
Quality of roof	iron 27 %	clay 24 %	iron 13 %	clay 27 %
	banco 24 %	straw 21 %	banco 27 %	straw 30 %
Quality of ground	clay 78 %	cement 11 %	clay 81 %	cement 8 %
	banco 9 %		banco 11 %	
Building cost of habitat (thousands FCFA)	566.61	(1076.98)	275.29	(539.06)
Housing changes	quality improvement 23 %		quality improvement 17 %	
	size increase 20 %		size increase 10 %	
Property right	owner 76 %	loan 15 %	owner 74 %	loan 15 %
Water source	drill 68 %	well 28 %	drill 46 %	well 45 %
Water consumption	288.05	(248.23)	157.01	134.64
Light	lamp/ candles 97 %		lamp/ candles 95 %	
Heat source	wood 99 %		wood 99 %	
Distance to the main market	no change : 7.8 km			
Distance to the first road	no change: 6.0 km			
Telephone access	33 %		32 %	
Distance to the first phone center (en km)	14.89	(16.45)	27.21	(23.08)
Main mean of locomotion	bike 64 %	moto 32 %	bike 83 %	moto 12 %
At least one person can read	58 %		40 %	
At least one person can write	52 %		33 %	
At least one person can compute	53 %		38 %	
Schooling constraints	cost (5.77)	distance (1.94)	cost (5.66)	distance (2.41)
	need for labor force (1.7)		need for labor force (2.32)	
# diseases/ injuries	2.73	(2.15)	3.41	(5.03)
Consultations	nurse: 74 %	doctor: 20 %	nurse: 63 %	doctor: 18 %
	healer: 4 %		healer:16 %	
Time to the consultancy center	44.6 min	(56.01)	56.0 min	(71.36)
Vaccination rates: yellow fever	73 %		56 %	
Meningitis	93 %		76 %	
Hepatitis	44 %		14 %	
Tuberculosis	52 %		40 %	
DT Polio	86 %		77 %	
Heath state constraints	cure prices (6.64)		cure prices (6.53)	
	distance to care center (3.22)		distance to care center (3.43)	
	consultations prices (2.18)		consultations prices (2.42)	
Infantile mortality	9.2 %	(12.54)	12.8 %	(15.98)

Note: standard deviations in parenthesis if present
except for schooling and health state constraints (mean of a graduation on [0,10]).

Table 4: Evolution of food and non-food consumption during the reform

Evolution of reported consumption/UC	Large increase	Slight increase	Constance	Slight decrease	Big decrease
Savings	12 %	45 %	43 %	(No accumulation)	
Investment	20 %	29 %	29 %	16 %	6 %
Social events	20 %	47 %	13 %	12 %	8 %
Energy	21 %	46 %	18 %	11 %	4 %
Transports	17 %	40 %	19 %	15 %	9 %
Clothing	21 %	47 %	16 %	11 %	5 %
Housing	10 %	40 %	26 %	18 %	6 %
Education	9 %	28 %	40 %	16 %	7 %
Health	21 %	39 %	14 %	19 %	7 %
Alcohol/ Tobacco	7 %	16 %	55 %	12 %	10 %
Beverages	20 %	38 %	23 %	14 %	5 %
Condiments	16 %	47 %	24 %	10 %	4 %
Fat nutrients	5 %	48 %	31 %	10 %	6 %
Milk products	5 %	21 %	43 %	16 %	15 %
Animal proteins	17 %	47 %	14 %	14 %	7 %
Fruits	6 %	34 %	36 %	18 %	6 %
Vegetables	10 %	44 %	28 %	15 %	3 %
Tubercles	5 %	33 %	37 %	18 %	7 %
Cereals	19 %	53 %	17 %	7 %	4 %

Table 5: Poverty indexes and income inequality: poverty line set at 200,000 FCFA per equivalent capita per year[30]

Po (headcount ratio)	P1 (Poverty gap)	P2	Gini (on income)	Gini (on land)
82 %	0.426	0.270	0.381	0.447

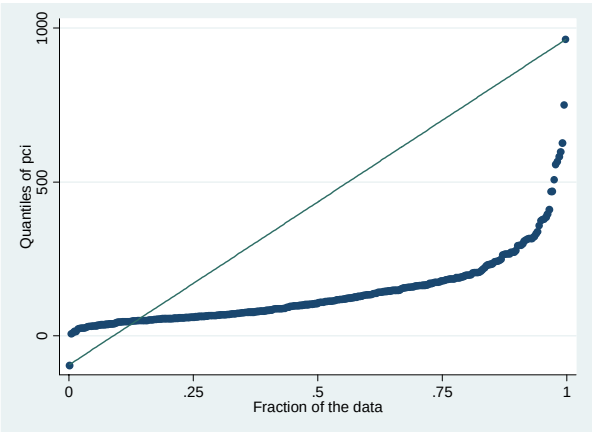

Figure 2: Per capita income distribution

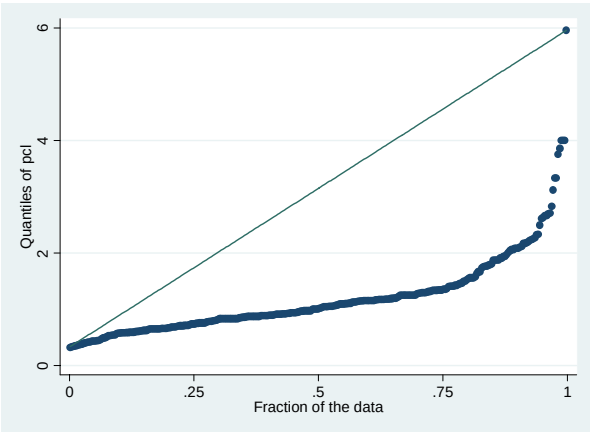

Figure 3: Per capita land distribution

[30] This threshold corresponds to the standard absolute and objective poverty line of 1$/day/capita. Note that poverty indexes are over-estimated because of the likely under-reporting of income and assets by households. Moreover, I cannot precise our measures of income by precise measures of consumption without a true panel.

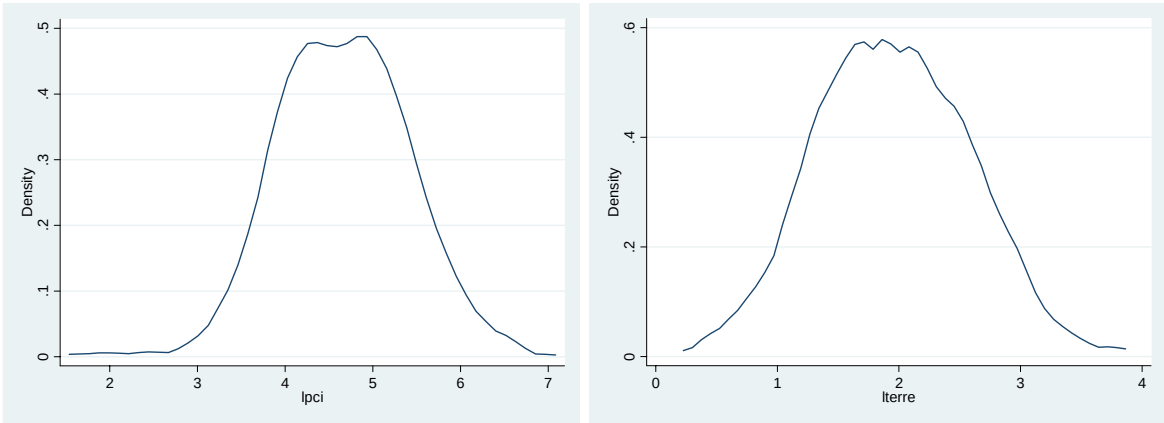

Figure 4: Kernel estimations of the log (per capita income) and log (cultivated per capita land) densities

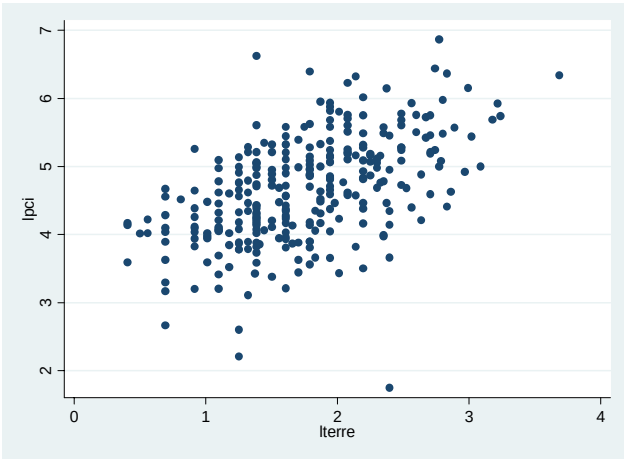

Figure 5: Joint distribution of log (P.C. land) and log (P.C. income): an obvious link.

Table 6: Perceptions of reform's effects (on a scale of [0,10])

Perceived effects of the reform	Mean	Standd error	Min	Max	Median	Interquart.
On income	5.74	2.88	0	10	6.5	3
On welfare	5.13	2.82	0	10	6	3
On input access	5.83	2.94	0	10	6	3
On agricultural knowledge and abilities	2.97	3.05	0	10	3	6
On prices/ World price of cotton	0.82	2.23	-5	10	0	0
On poverty reduction	3.07	3.03	0	9	3	6

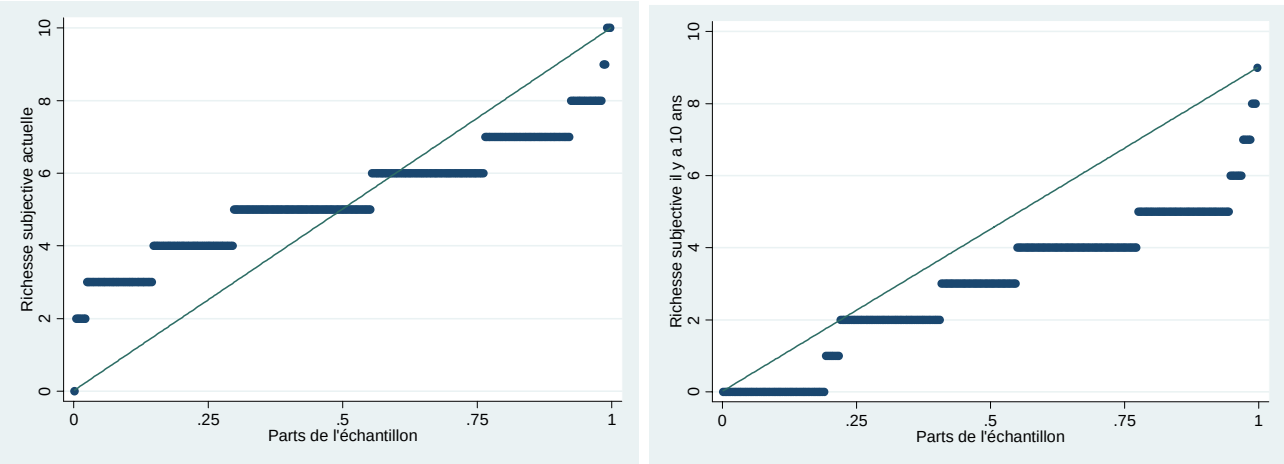

Figure 6: Distribution of subjective wealth before the reform and today

Subjective Wealth	Subjective Wealth 10 years ago									
	0	1	2	3	4	5	6	7	8	9
0	1									
1										
2	1	2		1	2					
3	7	5	17	1	6	1				
4	10	1	17	10	1	3	1	2		
5	18		17	19	14		3	2	1	1
6	10		3	9	24	14			2	
7	10		1	2	13	20	1	1		
8					7	9	2			
9			1			1				
10						3				

Table 7: Matrix of subjective wealth mobility: a significant positive move

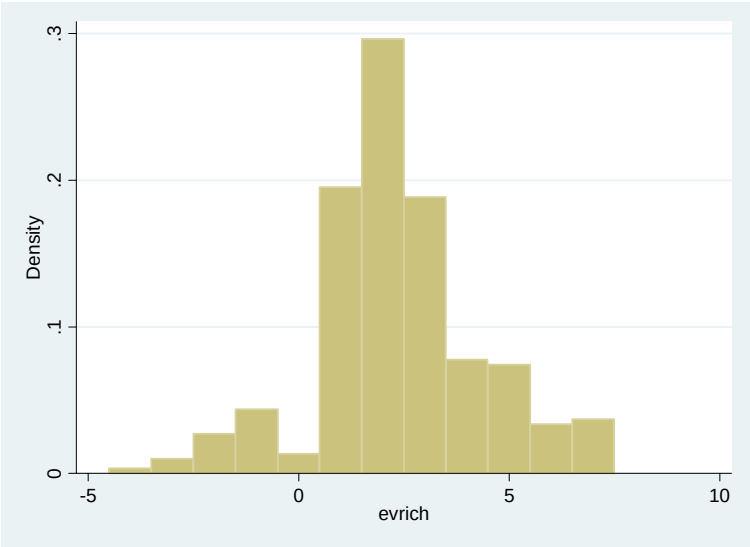

Figure 7: Distribution of the evolution of subjective wealth

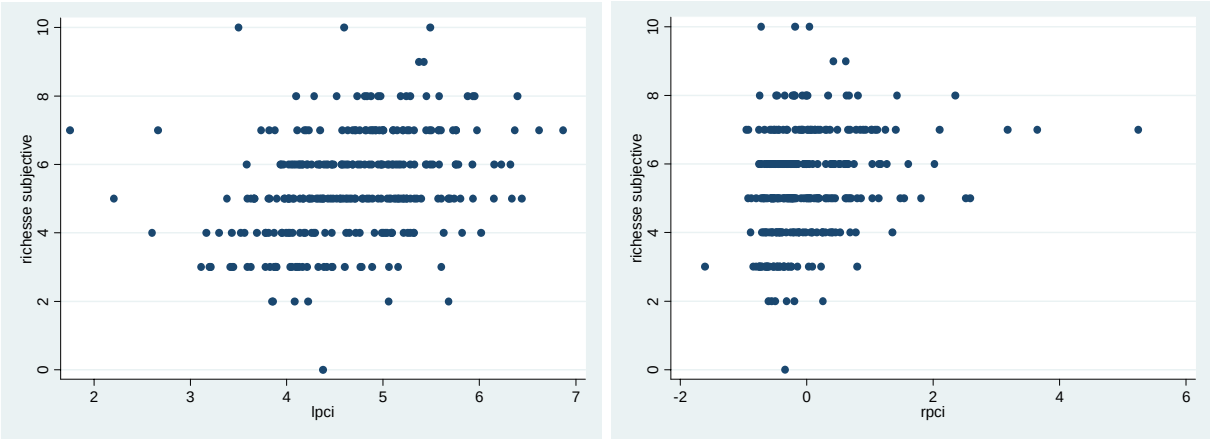

Figure 8: Subjective wealth versus absolute and relative income; no clear link, suspected anchoring effect (people have in mind their own scale of wealth)

Role of perceptions: Correlation between perceptions of the reform and …

Table 8: … Present subjective wealth :

	Subj wealth	income	welfare	input	abilities	w price	poverty	other
subj wealth	1.0000							
income eff	0.2244	1.0000						
welfare eff	0.1550	0.5228	1.0000					
input access	0.0424	0.0975	0.2610	1.0000				
agr abilities	0.0079	0.0224	0.2130	0.2308	1.0000			
world price	0.1305	0.0155	0.0645	-0.0088	0.2592	1.0000		
poverty eff	0.1752	0.1693	0.2246	0.2312	0.4694	0.0944	1.0000	
other eff	0.2063	-0.0269	-0.0274	-0.1265	0.0576	0.2231	0.0568	1.0000

Table 9: …Past subjective wealth (before the reform)

	rrich	effrev	effwel	effintr	effcomp	effmarm	effpauv	effautr
rrich	1.0000							
effrev	0.0125	1.0000						
effwel	-0.0176	0.5149	1.0000					
effintr	0.2582	0.0977	0.2655	1.0000				
effcomp	0.1566	0.0236	0.2197	0.2233	1.0000			
effmarm	0.0644	0.0083	0.0559	-0.0113	0.2569	1.0000		
effpauv	0.1835	0.1721	0.2284	0.2298	0.4666	0.0849	1.0000	
effautr	0.0469	-0.0265	-0.0273	-0.1252	0.0604	0.2254	0.0581	1.0000

Table 10: …Evolution of subjective wealth (in percentage)

	erich	effrev	effwel	effintr	effcomp	effmarm	effpauv	effautr
erich	1.0000							
effrev	0.0986	1.0000						
effwel	0.1266	0.5191	1.0000					
effintr	-0.2231	0.1004	0.2652	1.0000				
effcomp	-0.1356	0.0294	0.2191	0.2223	1.0000			
effmarm	0.0031	0.0063	0.0563	-0.0108	0.2586	1.0000		
effpauv	-0.0734	0.1676	0.2299	0.2317	0.4717	0.0838	1.0000	
effautr	0.0561	-0.0278	-0.0271	-0.1250	0.0612	0.2252	0.0575	1.0000

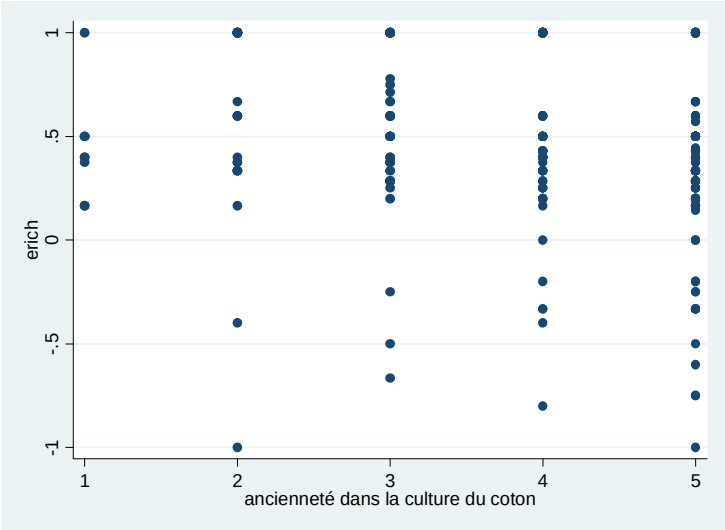

Figure 9: Gain in subjective wealth versus cotton experience

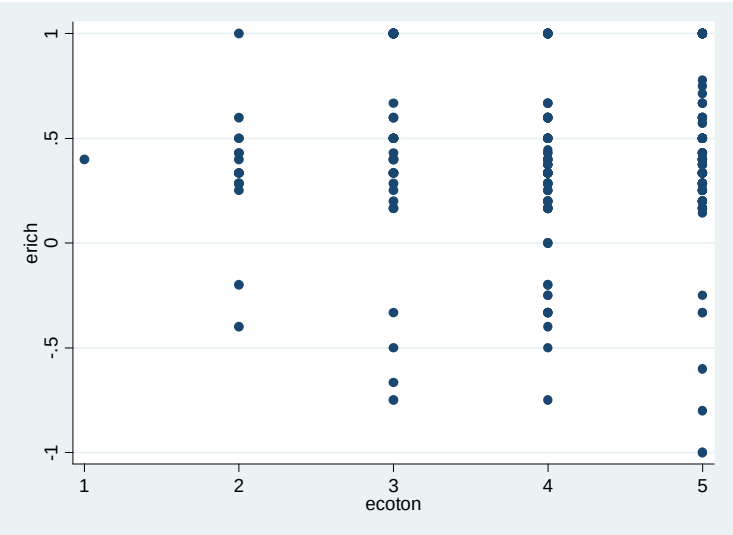

Figure 10: Gain in subjective wealth versus evolution of land share allocated to cotton

Table 11: Ordered Probit estimates of the current subjective wealth

Subjective wealth Explanatory variables	Ordered Probit 1	Ordered Probit 2	Ordered Probit 3	Ordered Probit 4
Past subjective wealth	.198 (.041)***	.260 (.045)***	.229 (.044)***	.281 (.047)***
Log p.c.i	.267 (.188)	.214 (.165)	.318 (.184)*	.266 (.189)
Relative p.c.i	.349 (.121)***	.385 (.111)***	.307 (.129)**	.322 (.117)***
Log land	.835 (.206)***	.708 (.208)***	.787 (.217)****	.615 (.223)***
Log p.c. land	-.860 (.164)***	-.914 (.170)***	-.861 (.169)***	-.814 (.184)***
Debt	-.25e-2 (.08e-2)***	-.26e-2 (.07e-2)***	-.24e-2 (.08e-2)**	-.29e-2 (.08e-2)***
Input credit	-.24e-3 (.36e-3)	-.51e-3 (.43e-3)	-.07e-3 (.38e-3)	-.20e-3 (.44e-3)
#rooms/ capita	.383 (.134)***	.261 (.142)*	.408 (.138)***	.274 (.145)**
#diseases+ injuries	-.037 (.026)	-.022 (.030)	.009 (.034)	.026 (.037)
P.c. cereals	.065 (.019)***	.046 (.018)**	.066 (.021)***	.050 (.020)***
P.c. milk products	.677 (.281)**	.785 (.314)**	.591 (.309)*	.608 (.334)*
P.c. Health	.015 (.008)*	.011 (.008)	.012 (.009)	.010 (.008)
Education	-.76e-2 (.34e-2)**	-.84e-2 (.38e-2)**	-.79e-2 (.37e-2)**	-.87e-2 (.40e-2)**
Energy	.30e-2 (.23e-2)	.15e-2 (.24e-2)	.46e-2 (.24e-2)**.	-.28e-2 (.25e-2)
Social events	-.27e-2 (.16e-2)*	-.30e-2 (.16e-2)*	-.13e-2 (.17e-2)	-.20e-2 (.17e-2)
Investment	. 15e-2 (.06e-2)***	. 17e-2 (.05e-2)***	.13e-2 (.05e-2)**	.16e-2 (.06e-2)***
Expected cotton price	-	.095 (.147)	-	.125 (.155)
Expected cereal price	-	.575 (.205)***	-	.545 (.216)**
Expected production	-	.038 (.163)	-	-.014 (.176)
Mechanization < 10 yrs	-	.645 (.179)***	-	.579 (.182)***
Traditional farming	-	-	-	-
Mechanization >10 yrs	-	.746 (.212)***	-	.757 (.218)***
Resident ethnic group	-	-.309 (.149)**	-	-.466 (.156)***
Significant increase in total farmland	-	.371 (.181)**	-	.496 (192)***
Big increase in land share dedicated to cotton	-	.250 (.139)*	-	.195 (.139)
Evolution of input demand	-	.202 (.073)***	-	.159 (.077)**
Technical assistance level	-	.25e-2 (16e-2)	-	.68e-2 (.17e-2)***
Cotton experience	-	-.093 (.059)	-	-.069 (.059)
Perceived effect on income	-	-	.019 (.030)	.011 (.031)
Perceived effect on welfare	-	-	.036 (.029)	.045 (.030)
Perceived effect on poverty	-	-	.060 (.022)***	.079 (.025)***
Perceived effect on agricultural abilities	-	-	-.057 (.022)**	-.054 (.023)**
Perceived effect on input access	-	-	-.050 (.024)**	-.048 (.024)**
Health/ education need	-	-	-.27e-3 (.46e-3)	-.17e-3 (.48e-3)
Housing/ Energy need	-	-	-.03e-3 (.11e-3)	-.12e-3 (.11e-3)
Cloth/ Transport need	-	-	-.40e-3 (.34e-3)	-.75e-3 (.36e-3)**
Social events need	-	-	-.79e-3 (.45e-3)*	-.31e-3 (.48e-3)
Cut 1	.578 (.949)	1.342 (.919)	.721 (.935)	1.236 (1.037)
Cut 2	1.379 (.900)	2.158 (.883)***	1.578 (.863)*	2.127 (.982)***
Cut 3	2.512 (.917)***	3.403 (.925)***	2.785 (.895)***	3.456 (1.031)***
Cut 4	3.165 (.925)***	4.151 (.937)***	3.495 (.908)***	4.266 (1.048)***
Cut 5	4.011 (.932)***	5.111 (.955)***	4.403 (.916)***	5.292 (1.064)***
Cut 6	4.760 (.933)***	5.929 (.964)***	5.177 (.916)***	6.134 (1.070)***
Cut 7	5.689 (.920)***	6.921 (.954)***	6.118 (.905)***	7.128 (1.064)***
Cut 8	6.559 (.965)***	7.839 (.987)***	7.022 (.954)***	8.067 (1.100)***
Cut 9	6.778 (.988)***	8.075 (1.010)***	7.248 (.982)***	8.305 (1.121)***
Wald Chi^2	173.3	289.12	201.95	317.28
Pseudo R^2	.122	.172	.148	.196
Observations	297	297	297	297

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

Table 12: Ordered Probit and OLS estimates of the evolution of subjective wealth during the reform

Evolution of Subjective wealth during the reform Explanatory variables	OLS: Rate of Variation (in ranks)	Ordered Probit (number of ranks)
Log p.c.i	-.664 (.365)*	-.310 (.198)
Relative p.c.i	.557 (.342)*	.425 (.179)**
Log land	.500 (.312)	.492 (.212)**
Log p.c. land	-.701 (.314)**	-.649 (.197)***
Debt	.26e-3 (.74e-3)	-1.44 e-3 (.72e-3)**
Input credit	-1.08e-3 (.50e-3)**	-1.16e-3 (.42e-3)***
#rooms/ capita	.285 (.210)	.187 (.147)
Δ diseases+ injuries	.007 (.014)	-.011 (.010)
P.c. cereals	.054 (.051)	.033 (.025)
P.c. milk products	1.752 (.768)**	1.260 (.460)***
P.c. Health	.016 (.014)	.020 (.007)***
Education	.03e-2 (.41e-2)	-.49e-2 (.34e-2)
Energy	-.53e-2 (.28e-2)*	-.11e-2 (.27e-2)
Social events	.02e-2 (.24e-2)	-.02e-2 (.16e-2)
Investment	.01e-3 (.55e-3)	1.00e-3 (.51e-3)**
Savings	.054 (.164)	-.032 (.122)
Evolution of cereal consumption	.287 (.126)**	.126 (.093)
Evolution of milk consumption	.236 (.100)**	.094 (.074)
Evolution of health consumption	.048 (.091)	.071 (.065)
Evolution of education expenses	-.068 (.116)	-.014 (.081)
Evolution of energy consumption	.007 (.121)	.049 (.088)
Evolution of social events expenses	.162 (.117)	.082 (.082)
Evolution of investment	.242 (.108)**	.060 (.071)
Expected cotton price	.046 (.213)	.167 (.173)
Expected cotton price >10 years	-.965 (.303)***	-.512 (.199)***
Expected cereal price	-.163 (.282)	.178 (.246)
Expected cereal price > 10 years	.301 (230)	.115 (.177)
Expected production	.275 (.244)	.270 (.187)
Expected production > 10 years	.019 (.209)	-.070 (.153)
Mechanization < 10 yrs	.461 (.273)*	.562 (.207)***
Traditional farming	-	-
Mechanization >10 yrs	-.227 (.300)	.273 (.233)
Resident ethnic group	-.807 (.231)***	-.341 (.175)**
Significant increase in total farmland	.549 (.273)**	.442 (.192)**
Big increase in land share dedicated to cotton	.123 (.205)	.246 (.148)*
Evolution of input demand	-.005 (.127)	.121 (.102)
Technical assistance level	.023 (.018)	-.018 (.018)
Agricultural assistance level	-.061 (.037)*	.018 (032)
Risk premium	-.022 (.006)***	-.010 (.004)**
Perceived effect on income	.076 (.044)*	.030 (.030)
Perceived effect on welfare	.005 (.047)	.032 (.031)
Perceived effect on poverty	.006 (.037)	.071 (.028)***
Perceived effect on agricultural abilities	-.040 (.032)	-.047 (.024)*
Perceived effect on input access	-.056 (.041)	-.056 (.026)**
Constant(s)	3.889 (2.103)*	Only the three last cuts are significant
R^2 or Pseudo R^2	.645	.173
Observations	292	292

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

Table 13: Ordered Probit estimates of the perceived effects from the reform

Perceived effects from the reform Explanatory variables	On Income	On Welfare	On Poverty alleviation	On Agricultural abilities	On Input access
Log p.c. income	.065 (.231)	.924 (.345)***	.058 (.245)	.534 (.348)	.923 (.285)***
Relative p.c. income	.248 (.142)*	-.118 (.173)	-.051 (.140)	-.343 (.182)*	-.320 (.166)*
Familial Labor force	.096 (.022)***	.084 (.023)***	.036 (.025)	-.002 (.024)	.058 (.020)***
#rooms/ capita	.255 (154)*	.102 (.163)	.370 (.180)**	.447 (.162)***	.033 (.169)
Δ Housing Building Cost	.07e-3 (.14e-3)	-.01e-3 (.11e-3)	-.28e-3 (18e-3)	-.13e-3 (.12e-3)	-.13e-3 (.14e-3)
Received transfers	-.028 (.019)	-.020 (.017)	-.023 (.027)	-.022 (.028)	.017 (.020)
Expected cotton price	-.116 (.165)	-.351 (.164)**	.179 (.185)	-.180 (.186)	-.069 (.176)
Expected cotton price >10 years	.273 (.192)*	.219 (.179)	.174 (.202)	.183 (.222)	.272 (.213)
Expected cereal price	.236 (.202)	.190 (.210)	.208 (.224)	-.526 (.237)**	.320 (.213)
Expected cereal price > 10 years	-.402 (.175)**	-.132 (.177)	.159 (.188)	-.047 (.188)	-.357 (.182)
Expected production	.432 (.198)**	.378 (.173)	.169 (.195)	.081 (.200)	-.100 (.172)
Expected production > 10 years	.029 (.180)	.198 (.178)	-.111 (.186)	-.162 (.175)	.187 (.176)
GPCs	No significance	Very well managed***	Very poor relationships***	Very poor relationships***	Very poorly managed***
Mechanization < 10 yrs	.147 (.179)	-.015 (.191)	-.292 (.189)	-.147 (.192)	-.574 (.181)***
Traditional farming	-	-	-	-	-
Mechanization >10 yrs	-.279 (.231)	-.523 (.255)**	-.091 (.257)	-.357 (.262)	-.146 (.216)
Resident ethnic group	-.355 (.155)**	-.415 (.161)***	.194 (.177)	.027 (.171)	-.427 (.151)***
Significant increase in total farmland	-.322 (.180)*	-.363 (.174)**	.142 (.213)	.294 (.202)	-.055 (.171)
Big increase in land share dedicated to cotton	.137 (.151)	.054 (.145)	.008 (.169)	-.253 (.153)*	.032 (.147)
Evolution of input demand	-.015 (.093)	-.012 (.089)	-.005 (.093)	-.131 (.102)	.142 (.097)
Technical assistance level	-.040 (.013)***	-.015 (.011)	.015 (.019)	.052 (.012)***	.018 (.011)
Agricultural assistance level	.046 (.030)	-.019 (.029)	.040 (.030)	-.030 (.028)	-.032 (.026)
Risk premium	.22e-2 (.37e-2)	-.14e-2 (.37e-2)	1.25e-2 (.40)***	.83e-2 (.48e-2)*	.08e-2 (.36e-2)
Reform impact on wealth	.075 (.025)***	.060 (.025)**	.100 (.027)***	.069 (.028)**	.026 (.026)
Familial labor impact on wealth	.062 (.023)***	.114 (.024)***	.075 (.028)***	-.026 (.027)	.022 (.025)
Cotton groups impact on wealth	-.026 (.034)	.089 (.031)***	.095 (.033)***	.101 (.031)***	.072 (.029)***
World bank impact on wealth	.098 (.046)**	.050 (.046)	.026 (.057)	.012 (.059)	-.093 (.057)*
Developed countries policies	-.070 (.059)	-.149 (.047)***	.043 (.047)	.070 (.048)	-.124 (.052)**
	Other subjective impacts on welfare, Educational level, quality of relationship and management within GPCs are controlled				
Wald Chi²	155.45	188.88	197.54	156.54	145.23
Pseudo R²	.094	.143	.134	.122	.079
Observations	288	288	288	288	288

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

Table 14: Ordered Probit estimates of the evolution of subjective wealth with Rivers-Vuong tests of endogeneity

Evolution of Subjective wealth during the reform Explanatory variables	Ordered Probit 1 Endogenous perceived income effect?	Ordered Probit 2: Endogenous perceived welfare effect?	Ordered Probit 3: Endogenous perceived poverty reduction effect?	Ordered Probit 4: Endogenous perceived agricultural knowledge effect?	Ordered Probit 5: Endogenous perceived input access effect?
Log p.c.i	-.242 (.193)	-.389 (.193)**	-.239 (.191)	-.299 (.204)	-.432 (.200)**
Relative p.c.i	.444 (.196)**	.394 (.185)**	.390 (.184)**	.427 (.190)**	.437 (.178)**
Log land	.573 (.253)**	.352 (.236)	.440 (.221)**	.470 (.218)**	.378 (.231)*
Log p.c. land	-.711 (.240)***	-.505 (.223)**	-.597 (.205)***	-.604 (.204)***	-.521 (.212)**
Debt	-1.50e-3 (.70e-3)**	-1.71e-3 (.70e-3)**	-1.59e-3 (.72e-3)**	-1.53e-3 (.71e-3)**	-1.57 e-3 (.72e-3)**
Input credit	-1.12e-3 (.44 e-3)***	-1.10e-3 (.44 e-3)***	-1.13e-3 (.44 e-3)***	-1.18e-3 (.43 e-3)***	-1.13e-3 (.43e-3)***
#rooms/ capita	.200 (.158)	.160 (.156)	.143 (.155)	.117 (.160)	.191 (.156)
Δ diseases+ injuries	-.011 (.010)	-.012 (.010)	-.010 (.010)	-.011 (.010)	-.011 (.010)
P.c. cereals	.048 (.026)*	.043 (.026)	.049 (.027)*	.051 (.027)*	.043 (.027)
P.c. milk products	1.273 (.463)***	1.320 (.489)***	1.269 (.480)***	1.214 (.484)***	1.307 (.463)***
P.c. Health	.020 (.008)***	.019 (.007)***	.018 (.008)**	.019 (.008)***	.020 (.007)***
Education	-.52e-2 (.34e-2)	-.53e-2 (.33e-2)	-.48e-2 (.34e-2)	-.47e-2 (.34e-2)	-.54e-2 (.34e-2)
Energy	-.10e-2 (.27e-2)	-.12e-2 (.27e-2)	-.09e-2 (.27e-2)	-.07e-2 (.27e-2)	-.09e-2 (.27e-2)
Social events	-.02e-2 (.16e-2)	-.00e-2 (.17e-2)	-.01e-2 (.16e-2)	-.02e-2 (.17e-2)	-.00e-2 (.16e-2)
Investment	1.04e-3 (.50e-3)**	1.18e-3 (.49e-3)**	1.09e-3 (.51e-3)**	1.06e-3 (.51e-3)**	1.06e-3 (.51e-3)**
Savings	-.043 (.123)	-.027 (.123)	-.040 (.124)	-.038 (.124)	-.035 (.124)
Evolution of cereal consumption	.121 (.093)	.121 (.093)	.119 (.093)	.122 (.093)	.126 (.093)
Evolution of milk consumption	.091 (.076)	.087 (.075)	.088 (.076)	.094 (.076)	.087 (.076)
Evolution of health consumption	.080 (.065)	.082 (.065)	.088 (.065)	.082 (.065)	.087 (.065)
Evolution of education expenses	-.021 (.081)	-.009 (.081)	-.008 (.081)	-.008 (.081)	-.028 (.081)
Evolution of energy consumption	.047 (.089)	.074 (.088)	.069 (.092)	.062 (.090)	.076 (.090)
Evolution of social events expenses	.077 (.082)	.089 (.083)	.076 (.083)	.076 (.082)	.092 (.082)
Evolution of investment	.052 (.071)	.067 (.072)	.052 (.071)	.057 (.071)	.058 (.071)
Expected cotton price	.134 (.172)	.157 (.172)	.078 (.179)	.121 (.173)	.110 (.171)
Expected cotton price >10 years	-.399 (.206)**	-.474 (.200)**	-.451 (.202)**	-.457 (.201)**	-.529 (.210)**
Expected cereal price	.172 (.248)	.214 (.245)	.175 (.244)	.225 (.254)	.193 (.246)
Expected cereal price > 10 years	.004 (.187)	.077 (.182)	.040 (.182)	.074 (.187)	.110 (.185)
Expected production	.318 (.207)	.206 (.191)	.242 (.188)	.252 (.188)	.332 (.189)
Expected production > 10 years	-.046 (.160)	-.110 (.163)	-.027 (.162)	-.025 (.163)	-.107 (.160)
Mechanization < 10 yrs	.616 (.223)***	.534 (.208)***	.598 (.216)***	.585 (.212)***	.749 (.239)***
Traditional farming	-	-	-	-	-
Mechanization >10 yrs	.287 (.236)	.418 (.245)*	.317 (.235)	.341 (.242)	.430 (.242)*
Resident ethnic group	-.353 (.182)**	-.231 (.181)	-.334 (.183)*	-.292 (.179)*	-.235 (.180)
Significant increase in total farmland	.355 (.201)*	.496 (.197)**	.401 (.196)**	.381 (.198)*	.381 (.195)*

Big increase in land share dedicated to cotton	.252 (.154)*	.191 (.155)	.239 (.151)	.258 (.155)*	.203 (.151)*
Evolution of input demand	.146 (.103)	.142 (.104)	.124 (.104)	.142 (.105)	.108 (.107)
Technical assistance level	-.023 (.018)	-.017 (.018)	-.022 (.018)	-.026 (.020)	-.021 (.018)
Agricultural assistance level	.025 (.033)	.023 (.032)	.016 (.032)	.020 (.032)	.023 (032)
Risk premium	-.010 (.004)**	-.011 (.004)**	-.012 (.004)***	-.012 (.005)**	-.012 (.004)***
Perceived effect on income	-.036 (.089)	.028 (.030)	.028 (.030)	.028 (.030)	.034 (.031)
Perceived effect on welfare	.038 (.031)	.132 (.060)**	.025 (.033)	.028 (.031)	.021 (.033)
Perceived effect on poverty	.073 (.028)***	.064 (.028)**	.122 (.052)**	.069 (.028)**	.065 (.028)**
Perceived effect on agricultural knowledge and abilities	-.050 (.024)**	-.052 (.025)**	-.054 (.024)**	-.004 (.064)	-.042 (.024)*
Perceived effect on input access	-.060 (.027)**	-.065 (.027)**	-.060 (.026)**	-.057 (.027)**	-.056 (.068)**
Rivers-Vuong test of endogeneity[31]	.071 (.090)	-.126 (.064)**	-.063 (.054)	-.057 (.070)	-.134 (.072)*
Constant(s)	Only the three last cuts are significant	First and the two last cuts are significant	Only the three last cuts are significant	Only the two last cuts are significant	First and the two last cuts are significant
R^2 or Pseudo R^2	0.172	.175	.173	.172	.175
Observations	285	285	285	285	285

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

[31] The five ordered Probit are processed with five different Rivers-Vuong tests of endogeneity, related to the five perceived effects from the reform: the first one is the effect on income, the second is the effect on welfare, the third is the effect on poverty, the fourth is the effect on agricultural knowledge and the last one is the effect on input access.

Table 15: Bivariate ordered Probit estimates of the evolution of subjective wealth during the reform

Evolution of Subjective wealth during the reform Explanatory variables	BioProbit 1: Exogenous perceived income effect	BioProbit 2: Endogenous perceived welfare effect	BioProbit 3: Exogenous perceived poverty reduction effect	BioProbit 4: Exogenous perceived agricultural knowledge effect	BioProbit 5: Endogenous perceived input access effect
Log p.c.i	-.250 (.248)	-.296 (.252)	-.285 (.247)	-.300 (.247)	-.376 (.255)
Relative p.c.i	.429 (.159)***	.400 (.159)**	.437 (.158)***	.418 (.158)***	.416 (.158)***
Log land	.520 (.213)**	.424 (.233)*	.523 (.214)**	.448 (.213)**	.352 (.233)
Log p.c. land	-.664 (.220)***	-.580 (.226)**	-.652 (.217)***	-.586 (.217)***	-.524 (.227)**
Debt	-1.51e-3 (.78e-3)*	-1.58e-3 (.79e-3)**	-1.35e-3 (.78e-3)*	-1.63e-3 (.78e-3)**	-1.57 e-3 (.76e-3)**
Input credit	-1.19e-3 (.40 e-3)***	-1.16e-3 (.41 e-3)***	-1.30e-3 (.40 e-3)***	-1.13e-3 (.40 e-3)***	-1.03e-3 (.41e-3)**
#rooms/ capita	.182 (.170)	.160 (.170)	.181 (.170)	.117 (.169)	.190 (.170)
Δ diseases + injuries	-.010 (.014)	-.012 (.014)	-.011 (.014)	-.010 (.013)	-.009 (.013)
P.c. cereals	.047 (.034)	.045 (.034)	.044 (.034)	.054 (.034)*	.040 (.033)
P.c. milk products	1.267 (.447)***	1.277 (.445)***	1.234 (.443)***	1.167 (.434)***	1.261 (.436)***
P.c. Health	.019 (.011)*	.019 (.011)**	.019 (.010)*	.019 (.010)*	.018 (.010)*
Education	-.52e-2 (.33e-2)	-.51e-2 (.33e-2)	-.52e-2 (.33e-2)	-.46e-2 (.33e-2)	-.55e-2 (.32e-2)*
Energy	-.11e-2 (.28e-2)	-.11e-2 (.28e-2)	-.11e-2 (.28e-2)	-.08e-2 (.28e-2)	-.11e-2 (.27e-2)
Social events	-.03e-2 (.19e-2)	-.00e-2 (.19e-2)	-.02e-2 (.19e-2)	-.00e-2 (.19e-2)	-.03e-2 (.19e-2)
Investment	1.03e-3 (.53e-3)*	1.08e-3 (.54e-3)**	.92e-3 (.53e-3)*	1.12e-3 (.53e-3)**	1.03e-3 (.52e-3)**
Savings	-.043 (.117)	-.040 (.117)	-.057 (.117)	-.039 (.115)	-.023 (.114)
Evolution of cereal consumption	.118 (.086)	.123 (.086)	.126 (.086)	.120 (.085)	.124 (.083)
Evolution of milk consumption	.089 (.077)	.085 (.077)	.078 (.076)	.101 (.076)	.093 (.074)
Evolution of health consumption	.081 (.068)	.082 (.068)	.077 (.068)	.081 (.066)	.074 (.066)
Evolution of education expenses	-.019 (.078)	-.015 (.078)	-.025 (.077)	-.009 (.076)	-.032 (.075)
Evolution of energy consumption	.053 (.081)	.062 (.082)	.037 (.081)	.058 (.080)	.066 (.079)
Evolution of social events expenses	.074 (.082)	.081 (.081)	.079 (.081)	.074 (.080)	.093 (.079)
Evolution of investment	.057 (.071)	.060 (.071)	.048 (.070)	.059 (.069)	.054 (.068)
Expected cotton price	.129 (.163)	.138 (.164)	.176 (.163)	.115 (.163)	.117 (.163)
Expected cotton price >10 years	-.420 (.185)**	-.444 (.185)**	-.414 (.184)**	-.454 (.184)**	-.502 (.186)***
Expected cereal price	.175 (.227)	.190 (.227)	.178 (.226)	.235 (.226)	.177 (.225)
Expected cereal price > 10 years	.030 (.169)	.052 (.170)	.057 (.169)	.065 (.169)	.087 (.171)
Expected production	.284 (.182)	.235 (.185)	.260 (.183)	.255 (.182)	.322 (.186)*
Expected production > 10 years	-.047 (.160)	-.065 (.162)	-.061 (.160)	-.027 (.159)	-.105 (.163)
Mechanization < 10 yrs	.583 (.205)***	.553 (.206)***	.516 (.204)**	.592 (.205)***	.708 (.218)***
Traditional farming	-	-	-	-	-
Mechanization >10 yrs	.292 (.255)	.336 (.260)	.280 (.254)	.345 (.254)	.388 (.258)
Resident ethnic group	-.326 (.171)*	-.278 (.175)	-.253 (.170)	-.293 (.171)*	-.243 (.176)
Significant increase in total farmland	.376 (.190)**	.435 (.196)**	.404 (.190)**	.372 (.189)**	.356 (.192)*
Big increase in land share dedicated	.241 (.145)*	.222 (.147)	.245 (.145)*	.252 (.144)*	.197 (.148)

to cotton					
Evolution of input demand	.142 (.090)	.135 (.090)	.153 (.090)*	.138 (.090)	.111 (.092)
Technical assistance level	-.020 (.017)	-.018 (.017)	-.015 (.017)	-.027 (.017)	-.022 (.017)
Agricultural assistance level	.023 (.030)	.021 (.030)	.027 (.029)	.020 (.029)	.023 (029)
Risk premium	-.010 (.004)***	-.011 (.004)***	-.009 (.004)**	-.012 (.004)***	-.011 (.004)***
Perceived effect on income	-	.029 (.028)	.033 (.028)	.025 (.027)	.033 (.027)
Perceived effect on welfare	.035 (.028)	.065 (.055)	.039 (.030)	.026 (.029)	.016 (.031)
Perceived effect on poverty	.070 (.027)***	.070 (.027)***	-	.076 (.026)***	.066 (.027)**
Perceived effect on agricultural knowledge and abilities	-.049 (.026)*	-.052 (.026)**	-.037 (.025)**	-	-.044 (.026)*
Perceived effect on input access	-.060 (.024)**	-.061 (.024)**	-.057 (.024)**	-.053 (.024)**	-038 (.070)
Constant(s)	Only the two last cuts are significant	Only the two last cuts are significant	Only the two last cuts are significant	Only the two last cuts are significant	The two last cuts are significant
Pseudo R^2	.168	.195	.205	.224	.205
ρ	.097 (.074)	-.105 (.150)	.135 (.080)*	-.242 (.082)***	-.301 (.197)
Observations	285	285	285	285	285

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

Table 16: Bivariate ordered Probit estimates of the perceived effects of the reform

Perceived effects from the reform Explanatory variables	On Income	On Welfare	On Poverty alleviation	On Agricultural abilities	On Input access
Log p.c. income	.043 (.234)	.957 (.373)***	.051 (.313)	.514 (.386)	.907 (.302)***
Relative p.c. income	.270 (.147)*	-.111 (.182)	-.049 (.175)	-.304 (.198)	-.290 (.162)*
Familial Labor force	.102 (.023)***	.088 (.024)***	.038 (.026)	-.005 (.026)	.057 (.023)**
#rooms/ capita	.280 (169)*	.128 (.170)	.358 (.183)*	.422 (.183)**	-.005 (.168)
Δ Housing Building Cost	.08e-3 (.11e-3)	-.01e-3 (.12e-3)	-.27e-3 (16e-3)*	-.12e-3 (.15e-3)	-.13e-3 (.11e-3)
Received transfers	-.029 (.027)	-.023 (.027)	-.020 (.037)	-.020 (.035)	.015 (.026)
Expected cotton price	-.093 (.166)	-.349 (.169)**	.191 (.187)	-.218 (.187)	-.113 (.165)
Expected cotton price >10 years	.265 (.182)	.202 (.185)	.210 (.207)	.196 (.206)	.305 (.181)*
Expected cereal price	.210 (.224)	.158 (.230)	.203 (.250)	-.538 (.252)**	.317 (.221)
Expected cereal price > 10 years	-.371 (.175)**	-.101 (.177)	.153 (.191)	-.003 (.194)	-.324 (.175)*
Expected production	.434 (.180)**	.384 (.185)	.168 (.202)	.063 (.207)	-.108 (.178)
Expected production > 10 years	.028 (.170)	.152 (.178)	-.050 (.187)	-.176 (.192)	.162 (.174)
GPCs	No significance	No significance	No significance	Very poor relationships**	Very poorly managed***
Mechanization < 10 yrs	.131 (.191)	-.027 (.193)	-.305 (.205)	-.134 (.208)	-.566 (.190)***
Traditional farming	-	-	-	-	-
Mechanization >10 yrs	-.304 (.250)	-.536 (.259)**	-.130 (.267)	-.317 (.282)	-.132 (.247)
Resident ethnic group	-.338 (.168)**	-.408 (.169)**	.204 (.181)	.041 (.179)	-.410 (.166)**
Significant increase in total farmland	-.357 (.187)*	-.388 (.193)**	.131 (.206)	.291 (.209)	-.006 (.188)
Big increase in land share dedicated to cotton	.120 (.144)	.025 (.146)	.042 (.156)	-.275 (.162)*	.034 (.142)
Evolution of input demand	.035 (.092)	-.005 (.092)	.017 (.016)	-.126 (.101)	.124 (.093)
Technical assistance level	-.040 (.016)**	-.017 (.016)	.040 (.030)	.051 (.017)***	.020 (.016)
Agricultural assistance level	.047 (.028)*	-.017 (.028)	.040 (.030)	-.022 (.031)	-.027 (.028)
Risk premium	.09e-2 (.38e-2)	-.30e-2 (.39e-2)	1.20e-2 (.45)***	1.00e-2 (.44e-2)**	.13e-2 (.38e-2)
Reform impact on wealth	.086 (.025)***	.062 (.026)**	.101 (.028)***	.055 (.027)**	.006 (.026)
Familial labor impact on wealth	.065 (.023)***	.121 (.024)***	.072 (.026)***	-.023 (.026)	.025 (.023)
Cotton groups impact on wealth	-.039 (.030)	.083 (.030)***	.089 (.033)***	.107 (.032)***	.079 (.029)***
World bank impact on wealth	.085 (.048)*	.036 (.048)	.019 (.057)	.030 (.053)	-.086 (.050)*
Developed countries policies	-.052 (.042)	-.126 (.044)***	.030 (.046)	.061 (.044)	-.138 (.046)***
	Other subjective impacts on welfare, Educational level, quality of relationship and management within GPCs are controlled				
Pseudo R^2	.168	.195	.205	.224	.205
P	.097 (.074)	-.105 (.150)	.135 (.080)*	-.242 (.082)***	-.301 (.197)
Observations	285	285	285	285	285

Note: robust standard errors in parentheses, * is significant at 10 %, ** is significant at 5 %, *** is significant at 1 %.

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