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Subjective Wealth, Policy Change, and Political Opinions: Evidence from the Cotton Reform in Burkina Faso

By

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Abstract

This paper provides new evidence on the pattern of individual subjective welfare after a natural experiment in policy-led rural development, and aims to identify the causal relationships between subjective welfare and political opinions on the effects of the policy change. I adopt a structural approach by introducing a reference-based utility function that contains a signal of individual participation in the policy change, which is conveyed by political opinions. Using data collected in cotton areas of Burkina Faso, several simultaneous estimations are performed to analyze seemingly covariant political opinions on the recent cotton reform and changes in subjective wealth, while addressing measurement issues related to subjective indicators as well as heterogeneity in latent psychological factors. In addition to absolute and relative indicators of wealth, the large increase in subjective wealth is found to be driven by enthusiastic opinions about the reform's effects on welfare and poverty alleviation, as well as by technical and institutional changes. The endogenous impact of political opinions on subjective wealth underlies the partial appropriation of the reform's welfare effects by farmers.

JEL Codes: I32, 013, Q16, Q18

Keywords: Subjective Wealth; Burkina Faso, Policy Change; Rural Development; Political Opinions.

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1. Introduction

The study of subjective well-being[1] has proven insightful for utility theory as well as for welfare analysis through rigorous empirical treatment.[2] The use of subjective data indeed challenges standard economic theory while becoming increasingly accepted as reliable (Krueger and Schkade 2007) and covering many aspects of welfare which are not measurable by surveys. Several lines of empirical evidence indicate the shape of interdependent preferences and the complex impact of a reference group income on individual utility (Graham and Pettinato 2002; Senik 2004) through social comparisons and information effects.[3] In a more unified theoretical framework, Easterlin (2001) shows that as material aspirations increase with income (moving individual reference across time), income growth does not necessarily lead to an increase in experienced utility as measured by subjective welfare variables, which differs from expected utility.

Despite this flourishing literature, little empirical microeconomic evidence exists in the context of development. First, the identified reference income group and moving individual reference effects might affect the utility function differently. Second, subjective data allow for a more in-depth analysis of poverty than conventional objective measures (e.g. income or consumption), since the latter do not capture all aspects related to well-being (Ravallion and Lokshin 2005) or multidimensional poverty (Lokshin et al. 2004). Hence, such analyses might provide policymakers in developing countries with another tool for evaluating policy and for assessing political support of policy change. Last, local players can be involved in developmental stages, and therefore their endogenous participation may also modify their experienced utility.

This paper aims to provide new evidence on the pattern of individual subjective well-being in the context of development when individuals are subjected to an exogenous policy change in which they can participate, and to identify the causal relationships between subjective

[1] I will use subjective welfare and subjective well-being interchangeably throughout the paper. Subjective wealth is a particular variable pertaining to subjective welfare variables.

[2] Despite severe criticisms claiming that answers to subjective questions are pure noise (see Bertrand and Mullainathan 2001), a cautious treatment of subjective data has been proven to yield convincing results (Ravallion and Lokshin 2001).

[3] For a full survey of these issues, see Clark et al. (2007).

welfare and political opinions on the effects of the policy change. If the outcome of the policy change on individual welfare only depends on the overall participation of all individuals, then while individual participation is endogenous, the welfare effects of the policy change are exogenous at the individual level. Those welfare effects will heterogeneously affect individuals' experienced utility because they have different income reference points (both in time and across individuals of a reference group). Consequently, individuals will heterogeneously appraise the policy change in addition to their varying degree of individual (endogenous) participation. Last, noting that opinions also reflect endogenous individual participation, they may alter experienced utility by conveying a positive or negative signal about one's own political involvement. A positive signal, for instance, would mean that the positive effects of the policy change have been appropriated by the individual through his/her participation. The social environment in which the same absolute welfare effects translate into heterogeneous experienced utility and in which collective action takes place can thus provide an internal locus of control[4] for both political opinions and subjective welfare. Such causal relationships and assertions are worth identifying, by studying the joint pattern of subjective welfare and political opinions in the course of a policy-led development experience.

Taking the case of an exogenous change in the policy environment of smallholders in Africa (a commodity reform), I first study the joint pattern of individual subjective welfare and political opinions on the effects of the reform,[5] and then I identify the causal relationship between both subjective indicators, accounting for individual participation in policymaking and local development. To do so, I explore which objective channels (institutional or technical change) emerging from the changing rural environment, in addition to the standard determinants found in the empirical literature (namely absolute and relative welfare effects, social and health status), matter in the pattern of smallholders' subjective welfare and political opinions. This is to control for transitory developmental effects on subjective welfare.[6] For identification purposes, I build a structural framework in which opinions on a rural-development policy and the pattern of subjective welfare are jointly and endogenously determined, due to endogenous participation of individuals in the policy change.

[4] Locus of control is a concept developed from Rotter (1966) that relates individuals' perception about the outcomes of their actions and their causes, whether they are internal (contingent on one's actions) or external (outside personal control). These beliefs affect subjective welfare as well as political opinions.

[5] These are the policy's effects on individual welfare, poverty reduction, individual incomes, access to agricultural inputs, and agricultural knowledge and abilities,

[6] The so-called "Easterlin Paradox" (Easterlin 1974), stating a cross-sectional positive income-happiness relationship but a stationary effect over time, should also be reexamined in the course of development. Indeed, transitory effects can occur during developmental steps when sudden economic changes affect households' everyday lives. The latter may attach subjective values to new economic and social opportunities, as well as to their new institutional environment and technical skills. They may, however, return to a reference level in the long run.

The case of rural development is particularly relevant here, because it involves rural communities, and therefore enables further exploration of the role of group mechanisms in the process of development and policy change through their effects on experienced utility and political opinions. I then propose a within-individual estimation strategy to jointly estimate changes in a subjective welfare indicator and political opinions among rural households. Last, I apply the empirical strategy to data from rural Burkina Faso.

The cotton reform experience of Burkina Faso fittingly lends itself as a sound natural experiment. First, the cotton sector is the main driving force for agricultural growth and constitutes one of the major poverty-reducing strategies in the region (Goreux 2003). Second, the Burkinabè reform is commonly acknowledged among international donors as one of the few successful reforms across Sub-Saharan Africa, with its unique participation of cotton farmers in agricultural policymaking and empowerment through the establishment of more professional organizations and their influential national union. This intervention has been decisive in terms of agricultural development over the last decade (Kaminski et al. 2011). It has led to a pattern of impressive mid-term cotton growth, based on the increase in cotton areas (Kaminski and Thomas 2011).

I use subjective wealth as a measure of subjective welfare, that is, the perceived rank of each rural household on a wealth ladder, which is more directly related to a utilitarian perspective than to happiness indicators (as in Ravallion and Lokshin 2001),[7] because we may expect a closer relationship between this variable and objective ones (income and other financial indicators). Because the income and wealth of a reference group matter,[8] subjective wealth also reflects absolute and relative land and cotton land holdings and livestock. These can bring additional subjective wealth because of their positional role in a poor rural society, as cotton earnings are the main source of farm cash income for rural households of southern Burkina Faso, and are also a factor in social prestige. This enables determining the appropriate indicator of the reference group effect not only on subjective wealth (as in Van Landeghem et al. 2008) but also on political opinions.

In Burkina Faso, national surveys report no significant increase in living standards and only a slight increase in income, on average, among cotton-producing households. Indeed, the price paid to cotton growers has not increased because of the world cotton market

[7] In this paper, subjective wealth is ranked on a ladder of 0 to 10 of appreciation of household financial situation. A rank of 5 means that the household is able to satisfy basic food needs, health, and social expenses.

[8] The income reference group effect entails the "reflection problem" (Manski 1993) since welfare effects depend on the composition of this group, therefore welfare effects are endogenous. To identify welfare effects, variables that affect the composition of the reference group should be moderately related to those affecting outcomes in the population.

environment, and more expensive inputs have hampered farmers' profitability margins. A rise in agricultural income has only been observed for farmers who experienced a large increase in cultivated land or those who entered cotton production during the reform and experienced a rapid extension of both cotton and non-cotton cultivated land. The political crisis in Côte d'Ivoire since 2002 has also adversely affected Burkinabè rural households which formerly received remittances from their relatives. Finally, the cotton reform has yielded a more equal distribution of income in rural cotton zones with no significant improvement in living standards.[9]

The data that I collected in 2006 in representative cotton areas nevertheless showed that subjective wealth had much improved over the reform period. Political opinions on the cotton reform effects also reflected a positive appraisal, according to several opinion indicators. These positive dynamics contrast with those of poverty and income.

In addition to objective welfare changes, the results indicated that cotton reform-led technological and institutional changes (adoption of animal farming and newly established cotton cooperatives) had increased subjective wealth. Relative welfare effects involve farmers comparing their expenditures for social events (conspicuous consumption) and cereal consumption. Furthermore, political opinions have an endogenous signaling effect on the pattern of subjective wealth, which highlights the advertising value of farmers' participation to the cotton reform.

The remainder of this paper is organized as follows. Section 2 briefly introduces the features of the evolving cotton economy of Burkina Faso and describes the evolution of main economic variables of interest during the cotton reform. Section 3 lays out the structural model and the estimation strategy. Section 4 discusses econometric estimations and results, and section 5 concludes.

2. The evolving cotton economy of Burkina Faso

Cotton production has been one of the leading factors in poverty alleviation throughout the African continent in the last century, based on a peasant cotton revolution in West Africa (Bassett 2001). The cultivation of seed cotton (*Gossypium*) has been associated with more food security and more cash income in rural zones. This has enabled households to access better health and education commodities, while the positive effect on food security has been a

[9] An improvement in standards of living does not necessarily follow from an increase in income, since it requires some mid-term investment in infrastructures (housing, building schools and hospitals, deep wells, roads). Hence, the dynamic pattern of living standards and income were different along the cotton reform when agricultural income rose without a significant improvement in living standards.

consequence of complementary agronomic effects of cotton on other food crops.[10] In addition, one should not forget that cotton cropping has brought many agricultural inputs to farmers,[11] which have been responsible for higher yields, notably in cereal production. As a consequence, cotton cropping has prevented the rural exodus to some extent. These features have to be emphasized for Sahelian countries (Mali, Burkina Faso, and Chad for instance), where cotton cultivation remains the dominant strategy for rural-poverty reduction and development. The development of cotton economies in Sub-Saharan Africa has 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 in (and even leading to) national growth dynamics (see Azam and Djimtoingar 2007 for Chad).

2.1. The reform of Burkina Faso and its implications for growth and employment

The cotton reform movement was prompted by several internal and external factors. The former centralized systems were exhibiting worsening outcomes, including low producer incentives (implicit taxation) and low managerial performance (high default rate on input credit and inefficient parastatal management), which led to macroeconomic instability, namely high rates of public debt and inflation. Aid conditionality was also tied to sectoral reforms and to the elimination of former parastatals and official boards in the region, as part of structural adjustment plans within the Washington Consensus.

While some elements of these reforms were the same across West and Central French-speaking Africa—particularly the dismantling of parastatal companies, which allowed competition to raise price incentives for producers and improved overall management and the financial situation of the sector—the approach of Burkina Faso was highly original in several respects. The distinctive features of the reform were sequencing and gradualism, and a focus on institutional reform (establishment of new cotton cooperatives and cotton union, inter-professional agreement, and new governance rules) with a specific emphasis on increasing the participation of farmers through various new institutional arrangements (Kaminski et al. 2011). This enabled producers to become professional partners, taking on a growing number of responsibilities in managing the industry and influencing government policy while the sectoral organization hardly changed, evolving from a public monopoly to a hybrid public-

[10] Food crops benefit from the mineral and/or organic fertilizers remaining in soils formerly planted with cotton (background effects) as well as from less sanitation problems. Cotton is known as a very good starting crop in a rotating crop system in many dry tropical agro-ecological systems.

[11] 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, and the availability of agricultural inputs through cotton growing therefore reveals economic complementarities between cotton and other crops.

private model based on local monopolies with concession areas. Thereafter, the focus was on strengthening the institutional framework to make it compatible with the ongoing market reforms, and improving market coordination in the delivery of crucial public goods.

It is worth considering the following stylized facts. Burkina Faso has become the current African leader (in 2006 and 2007) in cotton production and exports of lint cotton with the entry of many new producers (some being migrant returnees from Côte d'Ivoire), and production has multiplied threefold during the reform. Cotton growth has been based on an extensive process of cotton land expansion led by new incentives for production arising from better contractual relationships between/within cotton groups and cotton firms (Kaminski and Thomas 2011). The direct effects of the reform have involved earlier payments for raw cotton to farmers, easier access to inputs and guaranteed sales. This has been accentuated by the positive effect of land extension (and a lower need for own-produced food) driven by mechanization (animal farming), better technical assistance, and a larger rural labor force. The reform itself constituted the decisive factor of these outcomes (Kaminski et al. 2011).

Before the reform, cotton production accounted for 3.3% of total national agricultural production in constant value, while this value rose to over 8% in 2006 (FAO 2007). For the other agricultural products, annual average growth rates in constant value stagnated at around 2%. Cotton production has therefore played an increasing role in agricultural growth, and now accounts for more than 10% of total GDP growth. As for employment, the cotton boom has absorbed roughly 150,000 new farmers (the number of cotton farmers doubling in those 10 years), some of whom were already land croppers while others were migrants. The absorption of migrant farmers from Côte d'Ivoire was remarkable because the cotton reform allowed them to quickly access inputs and form their own farmer groups which were then integrated into the national and regional cotton unions.

2.2. Data and dynamics of objective welfare indicators

The data set used in this paper is the result of a survey of households belonging to GPCs (*Groupements de Producteurs de Coton*) across 20 villages. This survey was carried out in March 2006 in representative zones of cotton production with 300 interviewed households, accounting for 0.2% of national production. An original questionnaire was designed with recall variables and variables pertaining to the evolution of agricultural systems and economic decisions within each household. These variables were added to basic variables reporting living standards and economic activities—housing, education, health, consumption, credit, savings, crops, cattle—as well as perceptions of poverty and opinions about the reform. For the latter, household heads were first asked to report their satisfaction with respect to their

familial financial situation[12] on a *[0,10]* scale, below 3 indicating that they felt poor, 5 indicating average, and above 8 indicating rich. Then they were asked to report this measure as applied to their situation 10 years prior, when the first GPCs had been established in the village. In another section of the questionnaire dealing with the cotton reform, they were also asked to report their satisfaction with the policy on a *[-10,+10]* scale with respect to its effects on poverty alleviation, input access, farm skills, own income and welfare. A score of zero meant that the interviewee did not attribute any impact to the reform, and negative (positive) scores meant adverse (improving) effects. Detailed information on available data is presented in Table A1 in the appendix. Table 1 displays summarizing statistics on the evolution of the main items of consumption and Table A2 (appendix), the living standards. More information on the survey design can be found in Kaminski and Thomas (2011).

According to national censuses and permanent surveys (INSD 2003, 2006), the evolution of rural incomes has been positive, but admittedly counterbalanced by the negative effect of the political crisis in Côte d'Ivoire,decreased world cotton prices and increased input prices. With the poverty line set at 100,000 FCFA in 2006, 47% of the sample is below it, corresponding to the national average. Data from INSD (2006) exhibit stationary poverty indexes at both the national and regional levels.[13]

Table A2 shows a slight improvement in living standards, notably for literacy rates, health indicators and access to water. However, schooling and health constraints[14] have remained high for the interviewed households. The availability of cash income is likely to have enabled some households' access to medicine, payment for the schooling of their children and improvement of their dwelling. But withdrawal of the government from the cotton sector is likely to have had a negative impact on rural infrastructures. One most significant feature of Table 1 lies in the moderate shift of health consumption from traditional to conventional,[15] with a decrease in infant mortality and in the number of diseases and injuries. Nevertheless, persistence of poverty levels, even in the cotton areas, highlights the fact that positive changes relate mostly to households above the poverty line.

[12] The precise question was "How wealthy do you think you and your relatives in the household are?" Households were presented a drawn scale with 0 to 3 representing several degrees of poverty severity, 3 to 5 representing below average, 5 to 8 representing above average, 8 to 10 representing several degrees of richness.

[13] The poverty dynamics is subject to several discrepancies, according to the analytical approach, whether utilitarian or based on capabilities (Lachaud 2005). Contrary to the positive trend of poverty reduction found by the World Bank (2005), both cardinal and ordinal measures of poverty either worsened or remained stationary from 1994 to 2005. There was neither first-order nor second-order stochastic dominance of poverty distribution during this period. Moreover, monetary and non-monetary measures exhibit similar results.

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

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

Measures of the evolution of per-capita consumption (Table 1) exhibit slight increases on average, although a significant proportion of the rural population has suffered from decreasing consumption patterns. The largest increases apply to health, energy and clothing, while global increase is important for energy, clothing, social events, cereals, animal proteins and condiments. Smallest increases apply to dairy products, alcohol and tobacco, tubers, fruits, and education. Diversification of food consumption has not been achieved for many households, while savings and investments have followed a positive trend.

[Table 1 here]

Nevertheless, profit-sharing of cotton-related activities evolved in favor of cotton producers during the reform, seeing them reap larger margins. Importantly, cotton reforms were highly effective when compared to a counterfactual situation in which the Ivorian crisis and the fall in cotton prices accompanied stagnant production levels (Kaminski et al. 2011). The fact that rural incomes have slightly increased and living standards have improved despite these adverse shocks implies that the reform has been successful.

2.3 Subjective indicators of wealth and satisfaction with the reform

Descriptive statistics from the sample show that, despite slight increases in income and living standards, and under stationary poverty, the subjective wealth indicator has unambiguously increased (see Figure 1) over the reform period. The pattern is a first-order stochastic dominance of the current distribution of subjective wealth with respect to that before the reform. The experience of increasing wealth was perceived by 90% of the sample.[16] The relationship between current income and subjective wealth is positive and concave across households, albeit of low significance (Figure A1 in the appendix). This is also true when the objective variable is the current value of livestock. This is in line with findings from the empirical literature on happiness economics applied to individual cross-sectional data (Blanchflower and Oswald 2004; Graham and Pettinato 2002). However, it contrasts with time-series data that exhibit constant average life-satisfaction indicators (Easterlin 1974, 1995) over long periods of GDP growth.

[Figure 1 here]

[16] See the matrix of subjective wealth mobility in the appendix (Table A3).

To offer an explanation for the increase in subjective wealth, I look at the correlation between changes in familial land holdings or animal husbandry[17] on the one hand, and changes in subjective wealth on the other. Here again, the link is not significant (see Figure A2 in the appendix).

I also look at the self-expressed opinions about several effects of the cotton reform on rural households. Table 2 shows that these opinions are rather enthusiastic—but heterogeneous among households—notably for perceived effects on familial income, welfare and input access.

[Table 2 here]

The next section offers a conceptual framework to explore the joint pattern of subjective wealth and political opinions with no corresponding pattern in individual incomes or other objective wealth indicators.

3. Conceptual framework

3.1 Conceptual issues

One crucial issue to be addressed is the representation of a reference-based indirect utility function (ordinal), meaning that households might compare their own wealth to a reference level across time and households (within a reference group). To account for transitory developmental effects, one should incorporate elements of technical or institutional change as well as political opinions that may enter the utility function as external effects (externalities) because of their signaling content (as argued in the introduction of this paper). The latter may also be simultaneously determined by some common variables and unobserved beliefs (e.g. internal vs. external locus of control). Therefore, a joint-estimation strategy should be provided. This section discusses the conceptual issues and lays out a structural framework from which the estimation strategy will be derived in the next section.

The Easterlin Paradox—lack of correlation between subjective and objective welfare across time—is worked out theoretically by accounting for the role of relative income (Van de Stadt et al. 1985) with respect to a reference group and/or to a reference income in time (habituation and preference for increasing wages over time/loss aversion) in the formulation

[17] This relationship may arise because the main cotton reform effect on agricultural production relied on land extension. Furthermore, land holdings better explain the pattern of subjective wealth (as claimed by Van Landeghem et al. 2008) because they capture non-economic benefits, such as social prestige. In Burkina Faso however, land is still a semi-public local good, and livestock is more commonly seen as an indicator of wealth stock.

of indirect utility functions. A first effect is the comparison externality when wealthier neighbors negatively affect the social rank of the household. In contrast, Senik (2004) has shown that the welfare of other members of a reference group can provide information on what will be own welfare in the future through expected wage or income profiles. This information effect can dominate the first effect under high income or social mobility. Information and comparison also carry different weights for the rich versus the poor (Ravallion and Lokshin 2005), and for specific relations between an individual and his/her reference group (Kingdon and Knight 2007).[18] In rich countries, social comparisons are based on consumption of positional goods, while in poor rural areas, land holdings (Van Landeghem et al. 2008) and livestock are likely to carry more weight.

An interesting candidate as a reference group in cotton-producing areas of Burkina Faso is the GPC within which farmers obtain inputs, coordinate to market their crops, manage internal debts and payments, and interact on a regular basis. Farmers thus share information about members' input use, land use, and cotton earnings, so that income might be a source of comparison as well.[19] We then consider various channels of social comparisons: land holdings, livestock, rural incomes, and traditional conspicuous consumption (social events).

3.2 A reference-based utility structural framework

Consider a two-period setting in which an exogenous policy change takes place in t and affects, in $t+1$, the welfare of a rural household i, while the latter may initially decide on its involvement in policymaking through its local group. The decision to get involved entails a fixed cost in the initial period and has repercussions in the subsequent period.

According to the literature, assume the indirect utility U_{it} to be affected by per-capita income y_{it} and by the average per-capita income within a reference group y_t*. In addition, part of household income c_{it} (in monetary terms, labor, land, or cattle) is used to contribute to the activities of the cotton group, which in turn contributes to the political involvement of farmers through their national union. The overall contribution c_t of local cotton groups increases

[18] This approach of utility functions also has direct implications for the poverty analysis, as in this case. Indeed, as Sen (1983) first argued, relative concerns such as relative consumption should be taken into account when setting a poverty line or measuring poverty. This would combine income levels and income profiles into the implementation of poverty measures. In the context of poverty, a lower rank on the wealth ladder means that in the case of a crisis, the household will suffer from a lack of access to basic commodities (absolute effect). However, a richer neighbor might provide this household with employment or aid (information effect).

[19] Cotton groups as a reference group makes sense here, due to information sharing within the group and to the fact that cotton production is observable. At the same time, variables affecting the composition of cotton groups and welfare outcomes are moderately related since group formation is flexible in the mid run and dissatisfied farmers may change or establish their own group. Group mechanisms only affect welfare outcomes when the group is poorly managed and experiences internal financial difficulties (a marginal share of the sample). Thus the reflection problem (Manski 1993) is not a crucial concern in this case.

available household income in a subsequent period $t+1$ through political bargaining and economic cooperation with other stakeholders. The return to c_t on households' income is assumed to have a common component, $f(c)$, and a specific one, θ_i. $f(c)$ is a positively increasing and concave function of the overall contribution of local cotton groups and equals 0 when there is no contribution.

I then assume that farmers' political involvement provides them with an additional source of welfare, which is related to their feeling of political and economic empowerment. I model this as an external signal, σ_{it+1}^{G}, which is a household-specific function of the overall contribution c and of the characteristics of group G_i to which individual i belongs. Indeed, differential information channels on the impact of farmers' involvement can be conveyed by different groups, according to their governance quality, their influence, their composition, and their size. This signal acts like an advertising effect, which can be seen as either a positive or negative externality as in the spirit of Becker and Murphy (1993). Whereas political involvement increases household incomes, farmers may still be dissatisfied with the attitude of their leaders, in the case of elite capture for instance. So, σ_{it+1}^{G} may be either an increasing or decreasing function of c. In $t+1$, household welfare may be written as an additive indirect utility function containing the standard terms and a signal:

$$V_{it+1}=U_i(y_{it+1}(1+\theta_i f(c)),y_{t+1}^{*}(1+\theta^{*}f(c_t)))+\sigma_{it+1}^{G}(c_t) \quad (1)$$

where asterisks refer to the average characteristics of the reference group (the GPC in our case). In t, household welfare is not affected by the policy change but households incur the cost of political involvement so that their individual welfare is the following indirect utility function:

$$V_{it}=U_i(y_{it}-c_{it},y_t^{*}-c_t^{*}) \quad (2)$$

Assuming an interior solution ($0 < c_{it} < y_{it}$), the household optimal contribution c_{it} is the solution of:

$$\max_{c_{it}} V_{it}+\frac{1}{1+\rho}V_{it+1}=U_i(y_{it}-c_{it},y_t^{*}-c_t^{*})+\frac{1}{1+\rho}U_i(y_{it+1}(1+\theta_i f(c_t)),y_{t+1}^{*}(1+\theta^{*}f(c_t)))+\frac{1}{1+\rho}\sigma_{it+1}^{G}(c_t)$$

$$\text{such that } \sum_i c_{it}=c_t \quad (3)$$

where ρ is the usual discount rate and $U_i(.)$ is a concave and increasing function of household income but may take any specific form with respect to the reference group income. Let us

rename the two arguments of U_i as Y_i and Y^*, which are observable income levels. Solving the two-period optimization problem (3) entails the following first-order condition:

$$f'(c_t)[\theta_i \frac{\partial U_i}{\partial Y_{it+1}} y_{it+1} + \theta^* \frac{\partial U_i}{\partial Y_{t+1}^*} y_{t+1}^*] + \sigma_{it+1}{}^G{}'(c_t) = [1+\rho][\frac{\partial U_i}{\partial Y_{it}} + \frac{\partial U_i}{\partial Y_t^*}] \quad (4)$$

The optimal contribution equalizes the discounted present value of marginal returns on welfare and costs to the marginal advertising effect. Hence, the advertising effect rests on the same determinants as those of indirect utility, that is, household income and average income of a reference group, in addition to group characteristics defining the signaling function and to the parameters of the utility function. It becomes:

$$c_{it}^* = c_{it}(Y_{it}, Y_{it+1}, Y_t^*, Y_{t+1}^*, X_i, X^*, G_i) \quad (5)$$

where X_i and X^* are, respectively, vectors of time-invariant household and reference group characteristics (fixed effects), and G_i is a vector of the characteristics of the cotton group (GPC) to which the cotton farmers belong.

The variable of interest is the welfare change that occurred after the policy change:

$$\Delta V_i = U(Y_{it+1}, Y_{t+1}^*, X_i, X^*) - U(Y_{it}, Y_t^*, X_i, X^*) + \sigma(Y_{it}, Y_{it+1}, Y_t^*, Y_{t+1}^*, X_i, X^*, G_i) \quad (6)$$

where $\Delta(.)$ is a within-individual across-time operator. Assuming functional separability of the utility function and taking its logarithmic transformation, (6) reduces to:

$$\Delta V_i = \Delta \ln u_1(Y_i) + \Delta \ln u_2(Y^*) + \sigma(Y_{it}, Y_{it+1}, Y_t^*, Y_{t+1}^*, X_i, X^*, G_i) \quad (7)$$

where u_1 and u_2 stand for the increasing and concave sub-utility functions of their respective arguments.

While household and reference incomes are measurable, it is rather difficult to measure the advertising value of the farmers' actions, or their contribution to political involvement and subsequent empowerment. But households' own opinions on the policy change in which they have been involved, such as the experience of the cotton reform, may provide information on the value of this signal according to their particular experience in welfare changes and to their individual participation within their own group. Indeed, the political opinions—albeit plagued by subjective noise—do convey a signal about the welfare change attributed by rural households to the policy change, aside from the experienced objective changes, that is, the intrinsic value of the participation externality (advertising effect).

The empirical strategy should therefore test for the significance of the political opinion in the assessment of subjective wealth when controlling for the other determinants, in order to validate my hypothesis of an advertising effect. The estimated parameter would then represent the indirect value of the latent signaling effect in the latent utility function, since opinions do not directly reveal the signaling effect. But directly introducing political opinions in this utility function also makes sense with respect to the Becker and Murphy (1993) advertising theory since opinions reflect the advertising value of the reform, which farmers may also "consume" alongside other goods. The reason why opinions have advertising value refers to our argument regarding farmers' participation. Therefore, specifying a utility function which depends directly on political opinions may instead be viewed as a reduced-form approach.

4. Empirical framework

4.1 Econometric issues: slope and intercept heterogeneity

The main econometric problem when estimating the utility function introduced above lies in the fact that this utility is a latent function that is never observed. Instead, the verbal expression of satisfaction, which is the observed one, has no trivial correlation with the latent utility. This is a matter of interpersonal comparability in which each household exhibits psychological differences and therefore expresses subjective wealth according to its own wealth scale.

Indeed, as Ravallion and Lokshin (2001) have shown, the identification of welfare effects has to consider that people have their own ladders of satisfaction in mind and their own way of answering surveys. Moreover, some cognitive biases and misreporting—cognitive dissonance for instance—are often cited as sources of potential bias. Finally, the answers to questions on subjective wealth can vary according to mood or recall effects. The use of panel data is helpful in controlling for individual fixed effects capturing personality traits, assuming orthogonal mood effects in standard residual terms. This allows introducing a scale effect to correct for intercept heterogeneity, the so-called "anchoring effect". This effect will vanish when one looks at the changes in subjective wealth of an individual across time. Therefore, as our data are only cross-sectional but include information on past and current subjective wealth, I favor a within-individual approach across time where individual changes in subjective wealth are jointly estimated with individual political opinions over the reform period.

Latent heterogeneity may, however, induce different relationships between explanatory variables and the subjective variable, that is, slope heterogeneity. This kind of heterogeneity can be treated when using latent class estimations, as in Clark et al. (2005), in which classes of observations are selected by the data. Dealing with latent heterogeneity is a key issue here and enables working with a non-linear relationship between income and social variables, and subjective wealth. I will then perform separate estimations for different social and income groups of the sample.

4.2 Endogeneity and simultaneity issues

One should also test for the endogeneity of political opinions in the change in subjective wealth since I model optimal household contribution to the policy change endogenously to welfare, which is conveyed as a signal in the utility function by political opinions. In this case, one should either derive a reduced form of (6) or consider a relevant identification strategy. An endogenous political opinion relates to the fact that the contribution of cotton farmers is indeed chosen at the household level, meaning first, voluntary participation, and second, appropriation of the policy change if the signal turns out to be of positive value.

The opinions about a policy change not only reflect satisfaction with its related experienced welfare effects (both absolute and relative); they also reflect unobserved beliefs pertaining to the social environment (social norms) of households and their ability to dissociate the effects of the policy change from their experienced welfare change. Unobserved beliefs include belief in institutions and policymakers (e.g. beliefs of corruption in privatized service sectors in Latin America, Martimort and Straub 2009), expectations of social mobility (Piketty 1995) and social justice, or inequality concerns (Hopkins and Kornienko 2004), which, in turn, affect subjective welfare (see Benabou and Tirole 2006, for the case of social justice and redistributive politics). In addition to objective changes in welfare (and some common determinants), political opinions and changes in subjective wealth may thus be simultaneously estimated by common unobserved beliefs while being subject to the same kind of already-introduced slope and heterogeneity issues. I now introduce a simultaneous-estimation framework in which opinions may be endogenous in the changes of subjective wealth, and I present the identification strategy.

The individual's capacity to evaluate the sole effects of a policy change is related to his/her social background, political affiliation and activities, and education. In the case of the cotton reform in Burkina Faso, this depends on the cotton groups' characteristics, G_i, and their experience in cotton growing. Note that the vector G_i is an exclusive component of the advertising effect in the change of latent utility occurring after the policy change, as in (6).

While G_i also determines optimal contribution according to (5) and therefore impacts individual and reference incomes, it is reasonable to consider that the actual contribution will not sensibly impact these income levels if it is small. G_i could then represent a valid instrument for endogenous political opinions to identify the signaling effect of the cotton reform on changes in subjective welfare (here, on subjective wealth). This will have an explicit effect in the opinion variables and will stand as a relevant instrument for opinion endogeneity in changes in subjective wealth.

One must also consider X_i and X^*, which would be valid instruments under functional separability in (7), as exclusive determinants of the signal function. But they may be correlated with measurement errors in subjective wealth or with omitted variables. Experience in cotton growing, however, acts as a control for farmers' perception of the reform's effects: it does not influence the pattern of subjective wealth *per se* and it can be used as a relevant instrument.

4.3 The empirical model

Let us first consider a specification of the latent utility function stated in (1), assuming functional separability:

$$V_{it+1} = \alpha_1 \ln(Y_{it+1}) + \alpha_2 \ln(\frac{Y_{it+1}}{Y_{t+1}*}) + \alpha_3 \ln(A_{it+1}) + \alpha_4 \ln(\frac{A_{it+1}}{A_{t+1}*}) + \beta_1 X_i + \beta_2 X^* + \gamma z_{it+1} \quad (8)$$

where A_{it} is a vector of non-income wealth components such as land holdings, livestock, health status, or consumption of positional goods,[20] and X_i and X^* are, respectively, a vector of household (resp. reference group) characteristics which are assumed to be time-invariant. Asterisks still stand for the reference group (all cotton farmers from the same GPC) and z_{it+1} stands for the latent value of the cotton farmers' signaling effect with regard to their participation in cotton policymaking. Hence, γz_{it+1} is the total value of advertising and γ is the signal value. A change in the latent utility function is therefore:

$$\Delta V_i = \alpha_1 \Delta \ln Y_i + \alpha_2 \Delta \ln \frac{Y_i}{Y*} + \alpha_3 \Delta \ln A_i + \alpha_4 \Delta \ln \frac{A_i}{A*} + \gamma z_{it+1} \quad (9)$$

[20] I do not introduce land rights since their impact on land investment and farm profitability is not significant in rural Burkina Faso (Brasselle et al. 2002).

where $\Delta(.)$ is still the within-individual across-time operator before and after the policy change (cotton reform here). According to (5) and the former discussion (see previous sub-section), I also specify a form for z_{it+1}:

$$z_{it+1} = \delta_1 \Delta \ln Y_i + \delta_2 \Delta \ln \frac{Y_i}{Y*} + \delta_3 \Delta \ln A_i + \delta_4 \Delta \ln \frac{A_i}{A*} + \delta_5 X_i + \delta_6 X^* + \varphi G_{it+1} + \chi T_i \qquad (10)$$

where G_{it+1} is a vector of group characteristics for household *i* after the policy change and T_i is experience with cotton growing. Note that this latent variable only depends on the objective welfare change, but this is not the case for political opinions which, as already mentioned, may be affected by subjective changes and heterogeneity issues, as in the case of subjective wealth.

Since the dependent variables are either subjective statements or a transformation of the latent functions I have introduced so far, one needs to treat them within an appropriate estimation strategy to identify welfare and advertising effects (simultaneity and endogeneity issues). Of particular importance, the latent utility function is not directly measurable by subjective wealth, and latent heterogeneity can substantially modify the relationship between the two, as stressed in the previous sub-section.

I now present an econometric model to consistently and simultaneously estimate both (9) and a transformation of (10) when one has only the stated ordered variables (verbal expression) that reflect them, addressing latent heterogeneity issues. I then test for the endogeneity of political opinions in the changes in subjective wealth over the reform period. To this end, I use the Rivers-Vuong (1988) approach applied to single-equation ordered probit estimations to account for the ordinal nature of the latent utility function and the discrete nature of the dependent variables. Then I estimate a bivariate ordered probit model of simultaneous change in subjective wealth and political opinions, while allowing for endogenous political opinions.

Let us denote W_{it} as the subjective wealth expressed by household *i* at time *t*. η_i is a vector of household time-invariant variables (fixed effects) designed to capture stable personality traits and personal ladders, which is already included in X_i. *v* is a village fixed effect. These two latter effects vanish when one looks at ΔW_{it}, as in Ravallion and Lokshin (2001). Z_i is a vector of *k* opinion indicators on the effects of the cotton reform collected at time *t+1*, which are different transformations of the latent variable z_{it+1}. One can consider several opinion

indicators one by one (the indicator for the welfare effect being the most relevant) in the formulation of change in subjective wealth.[21] Therefore, the core structural model is:

$$\begin{cases} \Delta W_i = \alpha_1 \Delta \ln Y_i + \alpha_2 \Delta \ln \frac{Y_i}{Y*} + \alpha_3 \Delta \ln A_i + \alpha_4 \Delta \ln \frac{A_i}{A*} + \gamma Z_{ik} + \varepsilon_i \\ Z_{ik} = \delta_{1k} \Delta \ln Y_i + \delta_{2k} \Delta \ln \frac{Y_i}{Y*} + \delta_{3k} \Delta \ln A_i + \delta_{4k} \Delta \ln \frac{A_i}{A*} + \varphi_k G_i + \chi_k T_i + \delta_5 X_i + \delta_6 X^* + v + \mu_{ik} \end{cases} \quad (11)$$

Residual terms (ε_i ,μ_{ik}) are independent across households and identically distributed following the bivariate normal law, centered in zero with respective variances v^2 and ω^2 and with correlation coefficient $\rho=Cov(\varepsilon_i ,\mu_{ik})/(v\omega)$. They correspond to orthogonal shocks related to mood variability and measurement errors, thereby capturing correlated unobserved beliefs across both equations of (11). The system is estimated for k opinion indicators one by one.

4.4 Estimation strategy

The available data constitute a discrete variable, according to a defined scale. Moreover, the dependent variables are ordinal.[22] Scores are related to a specific ladder whose rungs are not proportional (8 out of 10 does not mean twice 4)—only rank matters. One should then consider ordered-discrete choice estimation.

Households transform their latent utility function (resp. latent signaling effect) in a reported subjective wealth (resp. a political opinion k) according to a scale of $J+1$ (resp. $2I+1$) discrete numbers at time t or $t+1$ (resp. at time $t+1$). Call their answers v_{it} and v_{it+1} (resp. z_{ik}). The reported change in subjective wealth, denoted $\Delta v_i = v_{it+1}-v_{it}$, which maps the number of won or lost rungs on the satisfaction ladder to the differential latent utility, belongs to the set of $\{-J, \ldots,-j,\ldots,-1,0,1,\ldots j,\ldots J\}$. z_{ik} belongs to the set of $\{-I,\ldots,-i,\ldots,-1,0,1,\ldots i,\ldots I\}$. Therefore, ΔV_i (resp. z_{it+1}), such as introduced in (9) (resp. in (10)), will take values on $2J+1$ (resp. $2I+1$) intervals, separated by $2J+2$ (resp. $2I+2$) ordered threshold parameters $\{r_{-J} = -\infty, r_{1-J}, \ldots, r_{-j}, \ldots, r_{0,\ldots,} r_{j,\ldots,} r_J, r_{J+1} = +\infty\}$ (resp. $\{s_{-I} = -\infty, s_{1-I}, \ldots, s_{-i}, \ldots, s_{0,\ldots,} s_{i,\ldots,} s_I, s_{I+1} = +\infty\}$) such that:

$$\begin{cases} \Delta v_i = j \Leftrightarrow r_j \le \Delta V_i < r_{j+1} \\ z_{ik} = i \Leftrightarrow s_i \le z_{it+1} < s_{i+1} \end{cases} \quad (12)$$

[21] I only consider bivariate processes of changes in subjective wealth and one opinion indicator, and not multivariate ones. Because I seek to indirectly account for the signaling effect of farmers' participation in cotton policymaking in subjective wealth changes, then estimating subjective wealth with a covariant opinion one by one is sufficient. However, I perform several estimations with different opinion indicators since they reflect different transformations of the latent signaling effect, for robustness and comparative purposes.

[22] The use of ordinal variables is related to the assumption of ordinal utility made by economists. Working with cardinal well-being variables, as assumed in psychology, has been shown to have a limited impact on the results (Ferrer-i-Carbonell and Frijters 2004).

The conditional distribution of ΔV_i (resp. z_{it+1}) with respect to its independent variables is then the standard ordered probit estimate of the first (resp. second) equation of system (11). The parameter estimates are the solution of the full information maximum likelihood (FIML) under the assumption of exogeneity of independent variables.

The joint conditional distribution of both dependent variables can be estimated by a consistent FIML bivariate ordered probit estimator of system (11), such as provided by Sajaia (2007). All parameters can be consistently estimated up to a constant term, including *2J+2I* cutoff values. This approach was followed in Kaminski and Thomas (2011).[23] If residual covariance of (11) is not significant, but one has endogenous variables, then a reduced form of the system may exist and one can account for endogeneity biases. It is preferable, however, to estimate the two structural equations of (11) to derive insightful interpretations. If residual covariance is significant, then one can control for exogenous simultaneity of both processes.

The possible correlated error terms of the two equations in (11) correct the potential endogeneity of Z_{ik} on ΔW_i, whenever γ is significantly different from zero (Wald test), as well as residual covariance. Testing $\gamma = 0$, would complement the Rivers-Vuong (1988) test performed in the single-equation estimations.

The identification of (11) requires satisfaction of an exclusion restriction under endogenous processes, if any. I have already stated that experience in cotton growing and group characteristics will be treated as exclusive determinants (instruments) of political opinions.

Finally, I address the issue of slope heterogeneity by splitting the sample according to significant household characteristics, namely ethnic background and income status. Indeed, the right-hand-side variables are likely to have a heterogeneous relationship with the left-hand-side ones in (11), due to heterogeneous preferences other than the ladder "anchoring" effect. I then estimate the system for the different subsamples as robustness checks. This enables checking for heterogeneity in the reference group and advertising effects. This is a departure from Clark et al. (2005), who let the data select subgroups with the use of the EM algorithm, but I justify this by the fact that ethnic status is a key variable for wealth perception, and that the reference effect has different channels, according to income groups.

To sum up, my estimation strategy is as follows. I first estimate the two equations of (11) separately, with the Rivers-Vuong statistics. I then perform the bivariate ordered estimates for three different political opinions. According to previous exogeneity tests, I treat opinion

[23] See this paper for more details about the model and the computation of joint probability pairs.

variables as either exogenous or endogenous in the estimation of changes in subjective wealth. Finally, I run robustness checks.

5. Econometric results

I use several objective income and non-income wealth indicators. To be consistent with system (9)-(10), I consider differences in levels of familial land holdings, cotton shares (acreage shares), cereal consumption per adult equivalent, savings, and livestock value, in both absolute and relative terms, while controlling for changes in household size (in adult equivalents). Regarding non-income variables, I also consider changes in conspicuous consumption in social events (expenditures) as well as current debt and changes in the number of diseases and injuries. Last, I use mechanization dummies to account for technical change and distinguish its effect from the signaling effect.

In both equations, the set of control variables is composed of the current household size (adult equivalent), ethnic status, and length of village residence, age and education of the household's head. I also use those fixed effects in equation (9) to account for the heterogeneity in answering retrospective questions (capturing life-cycle components),[24] although fixed effects vanish in the estimation equation. While household size controls for decreasing marginal costs of living and increasing labor force, ethnicity may control for differential access to land and productive assets. Village and GPC fixed effects are also introduced in the control vectors of the second equation of system (11).

I consider three opinion indicators that reflect different aspects of the reform, namely opinion on the experienced welfare effects of the reform, opinion on input access, and opinion on poverty reduction (distributional concerns). Finally, I use cotton experience dummies and cotton group characteristics as instruments for endogenous political opinions. To ensure proper identification of these latter opinions, cotton group variables comprise a set of stated variables which are specific to each rural household involved in cotton production. They are, namely, experienced quality of relationships and management within the GPC. Since cotton experience controls for the farmers' ability to self-select into groups, group characteristics do not have any impact on experienced welfare *per se*, except if they endogenously induce farmers to contribute to the political activity of their group. They may only impact the changes in subjective wealth through the signaling channel. If they have no effect, cotton

[24] As shown by Dercon and Hoddinott (2004), increase in subjective welfare or reduction in subjective poverty as measured by retrospective data in rural communities in Ethiopia differs from actual data due to comparison effects with the reference group. Those effects are already accounted for in our empirical model.

experience controls for households' exposure to the effects of the reform that are captured in the change of objective welfare and wealth measures. Finally, note that cotton experience dummies allow controlling for potential selection biases in the signaling effect from participation in the cotton reform. Indeed, experience in cotton growing affects farmers' perception of the reform with varying exposure to cotton institutions and varying hindsight in appraising institutional changes, everything else held constant.

Rivers-Vuong tests (Tables A4 and A5 in the appendix) are applied to the separate equations of (11). Exogeneity of all opinion channels is rejected (significant Rivers-Vuong test statistics), except for the opinion on the reform's effects on input access (but this is not significant), as shown by the estimates of Ordered Probits 3-5 in Table A4. When controlling for endogenous political opinions, note that the negative effect of opinion about the reform's effect on input access vanishes, as seen by comparing Ordered Probit 2 to Ordered Probit 5.

Therefore, one needs to consider endogenous political opinions in changes in subjective wealth, which is in line with our hypothesis of a signaling effect of farmers' participation in cotton policymaking. An exogenous opinion on the input-access effect of the reform means that farmers' participation has seemingly not been felt as having impacted their input access *per se*. Other endogenous political opinions mean that opinions on the welfare and poverty-reduction impacts of the reform do convey the signal of farmers' participation, which will be accounted for in the simultaneous-equation estimations and the results of which are presented in Tables 3 and 4. I focus on these results since simultaneous estimations are better specified by allowing simultaneous opinions and changes in subjective wealth.

Table 3 displays the estimates of changes in subjective wealth while Table 4 displays the estimates of political opinions. Residual covariance is significant, except for the first specification with endogenous political opinions about the reform's effect on own welfare. For this reason, I also present another specification with endogenous political opinion on the welfare effect in the ordered probit estimation of the changes in subjective wealth, in a two-stage estimation framework (IV-Ordered Probit). The political opinion on the welfare effect of the reform is not significant in either specification. However, the political opinion on the poverty-reduction effect is significantly positive, and I therefore consider this political opinion the one that conveys the value of the signaling effect of farmers' participation. This can be interpreted by the fact that individual farmers' participation is motivated by an endogenous poverty-reduction objective (which can be more community-oriented), while they do not attribute some of the individual experienced welfare changes to their own involvement

in the policy. The signaling effect of farmers' participation is then better carried by the political opinion about the reform's effect on poverty reduction.

Simultaneity justifies the joint-estimation approach and the endogenous nature of political opinions in subjective wealth change, meaning that formation of the two sets of subjective indicators cannot be disentangled and it is not a sequential process. The negative residual covariance indicates that once observable determinants of opinions and subjective wealth changes are controlled for, unobservable effects such as unobserved beliefs in social or income mobility are negatively correlated across equations. Since the policy change provides an external locus of control for farmers' experienced welfare changes, thereby affecting their subjective wealth change, unobserved beliefs (e.g. internal locus of control through farmers' participation in the change) are substitute effects on political opinions, and vice versa.

To interpret objective welfare effects, one needs to dissociate the own-welfare effect from that of the reference group. Since all objective variables are in logarithmic form, this is easily done. The own effect is the sum of the two estimated parameters associated to the own-welfare variable and the relative variable. Indeed, the numerator of the relative variable contains a logarithm of the absolute term. The reference group effect is therefore the opposite of the parameter associated to the relative term. For the latter, a positive (resp. negative) estimate thus means a comparison (resp. information) effect. In other words, higher average welfare within the reference group weakens (resp. strengthens) the households' pattern of subjective wealth.

[Table 3 here]

With regard to objective welfare determinants of the changes in subjective wealth, income-change components were comprised of relative changes in per-capita cereal consumption (comparison effect) and reduction in household debt (due to the better functioning of cotton groups that improved repayment mechanisms and streamlined internal debts). For non-income components, subjective wealth was positively affected by increases in the average value of livestock pertaining to cotton farmers from the same GPC (information effect), and negatively by average conspicuous consumption (comparison effect). Importantly, another channel influencing this subjective indicator was technical change (adoption of animal farming and ox plows). Note that absolute effects are not significant since absolute and relative terms offset each other. So the only pure absolute objective welfare changes that drove the actual pattern of subjective wealth stem from average increases in the value of cotton farmers' livestock and adoption of animal farming. As might be expected, fixed effects

are not significant, except for the role of ethnicity, involving a negative scale effect for households belonging to resident ethnic groups relative to households from migrant ones. All else being equal, households from migrant groups placed more value on the self-improvement of their financial situation and significantly, reported lower experienced changes in wealth (i.e. subjective wealth). This may be due to the fact that in the course of the cotton reform, farmers from ethnic minorities had better and fairer access to agricultural inputs and were able to establish their own GPC, thereby improving their economic prospects and material aspirations. This may also reflect a retrospective bias in subjective wealth for migrant households (or newcomers). Note that all of these effects are robust to the five specifications presented in Table 3.

Overall, technical and institutional changes were key (and the main factors) in explaining the unambiguous upward shift in subjective wealth distribution over the reform period. This is in line with the hypotheses introduced at the beginning of the paper regarding the transitory effects of rural development on subjective welfare. More importantly, income effects were not significant, apart from the information effect of livestock, which is a relevant long-term indicator of wealth in Sub-Saharan Africa due to its role as a buffer stock and savings account. The non-significance of changes in land holdings is in line with local social norms concerning land and the absence of related markets for land transactions in Burkina Faso (see Stamm 1994). I was also able to find the relevant comparison effect in the population of cotton farmers channeled through expenditures in social events and cereal consumption. The importance of conspicuous consumption is not common in rural areas of low-income countries. The expansion of cotton cultivation, however, drove an increase in the cash inflow to cotton villages, thereby exacerbating the importance of social events for comparison purposes.

[Table 4 here]

With regard to political opinions, the absolute and relative welfare effects are both significant but differ according to which opinion is considered. For instance, positive political opinions about the reform's effect on poverty reduction were held by households who experienced an increase in their land holdings relative to the GPC members' average (comparison effect). However, for the opinion on the welfare effect, the information effect of average livestock value was the main welfare effect. Conspicuous consumption in social events was not significant while evolution of savings conveyed an information effect for all political opinions. Note that technical change had a negative impact (attenuation effect) on the

formation of political opinions: non-mechanized farmers were more enthusiastic about the various reform effects than already-equipped ones. Note also that individual and village fixed effects were significant, underlying "anchoring" effects in opinion formation. The positive coefficient of household size may reflect spillovers for larger households endowed with more labor stock and economies of scale. The ethnicity bias, as identified in the estimates of Table 3, is also significant for all opinions except that on the poverty-reduction effect. This also makes sense since farmers' opinion on poverty-reduction impacts of the reform are probably not formed according to each individual situation but rather according to farmers' broader communities. This is in line with my previous conjecture that ethnic minorities benefited from institutional change by increasing their opportunity to access inputs through their cooperatives. It is likely that input access did not change that much for resident ethnic groups.

As for the choice of instruments with respect to endogenous opinions, they all seem significant. Farmers were noticeably more enthusiastic about the reform impacts when they had no experience in cotton growing or between 3 and 5 years of experience, compared to others. These were the farmers who were likely to harness the full benefits of the reform. The individual experience of each farmer within his/her GPC was also of particular importance, in accordance with the specification of the signal function introduced in the conceptual section of this paper. Reform enthusiasm was then correlated with good relationships experienced among GPC members, while the reform's impact on input access was more positively appraised in well-managed groups.

[Table 5 here]

Last, I check for heterogeneous welfare effects, to deal with the slope heterogeneity issue. An important point is that group-specific estimates (presented in Table 5) are very different across income (poor vs. non-poor) and ethnic groups. This means that each group has specific relationships between own and reference welfare levels and their own subjective wealth. This confirms the heterogeneity of the latent utility function, as well as slope heterogeneity in the relationship between objective and subjective welfare changes. For instance, the information effect of livestock becomes a comparison effect for resident ethnic groups, while expenditures on social events and cereals now take the form of information effects. For resident groups and the non-poor fraction of the sample, changes in land holdings also matter for comparison purposes. Among the poor, there is no identified comparison effect, so their subjective wealth increase is due only to information effects. The non-poor compare themselves through conspicuous expenditures on social events and land holdings. The information effect

conveyed by the change in livestock value is only valid for poor households. Finally, political opinions on the reform's welfare effect only affected the subjective wealth of poor households and those of migrant ethnic groups, that is, the disadvantaged groups. Note also that the ethnicity bias in subjective wealth appraisal is only present for non-poor households. Taken together, these results suggest that disadvantaged groups place more value on experienced welfare changes, as well as on the signaling effect of their participation in the reform, than other groups. As already discussed, this may be due to the egalitarian effects of the reform.

Regarding political opinions, comparison and information channels are also specific to each group. While changes in land holdings (comparison) only matter for non-poor and migrant groups, changes in cotton cultivation patterns now convey an information effect which is relevant only for migrant groups and the poor. For resident groups, this information effect is conveyed by a change in savings.

6. Conclusion

This paper considered the issue of subjective welfare (through the use of the subjective wealth variable) in the context of rural development. Accounting for political involvement and participation of farmers enabled coping with the subjective channel of the reform's appropriation through the representation of a signaling (advertising) effect in a reference-based utility function. I found that political opinions on the reform's effects were endogenous and positive in the experienced changes in subjective wealth, thereby underlying farmers' appropriation of reform-driven welfare changes.

The empirical puzzle stated in the introduction—an unambiguous rise in subjective wealth with no significant corresponding rise in income or reduction in poverty—was solved by introducing variables reflecting technical and institutional changes, in addition to the positive signaling effect conveyed by the positive and endogenous effect of political opinions. Overall, mechanization, adoption of more operational cotton cooperatives (GPCs) leading to more input access and debt reduction, and increases in the average value of cotton farmers' livestock (information effect) were the core explanations. I also highlighted the comparison role of conspicuous consumption in social events. Of equal importance, all of these welfare effects impacted groups heterogeneously with respect to changes in subjective wealth and political opinions, suggesting specific information and comparison channels and heterogeneous welfare effects in the change of subjective wealth. The egalitarian effects of the cotton reform on groups that had been formerly discriminated against allowed them to benefit from easier access to agricultural inputs, which led them to increase their material

aspirations and report higher levels of experienced changes in subjective wealth than other groups, for given experienced changes in objective welfare. This is notably highlighted by the ethnicity bias in the reporting of subjective wealth.

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Figures and Tables

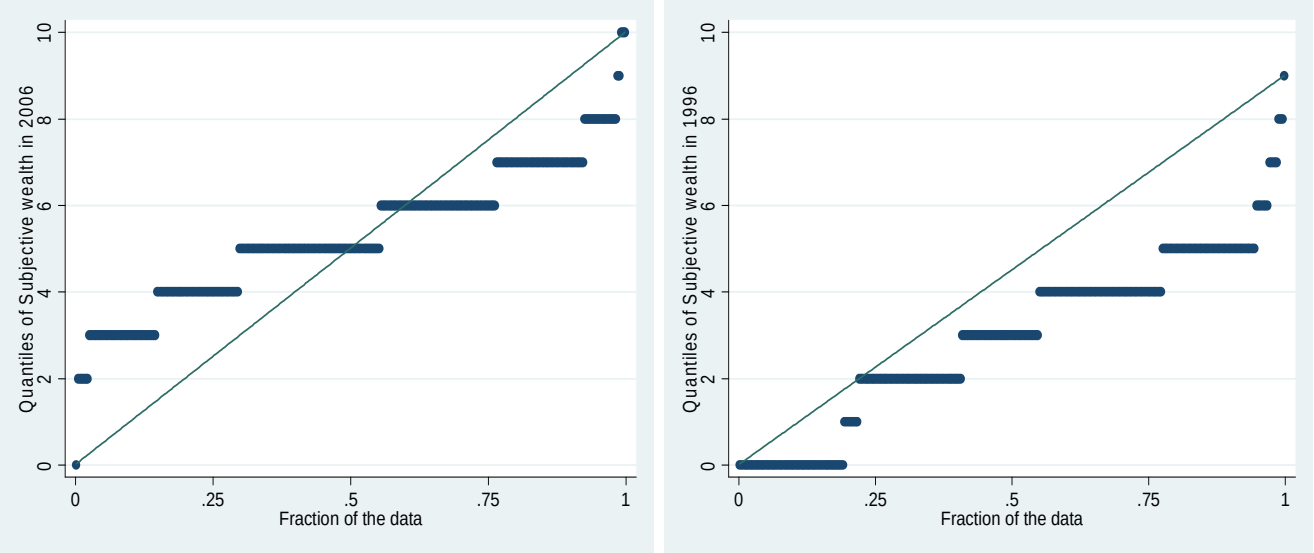


Figure 1. Distribution of subjective wealth of the sample in 1996 and in 2006 (299 obs.)

Table 1. Evolution of household consumption and investment during the reform

Changes in consumption by households	Large increase	Slight increase	Constant	Slight decrease	Large decrease
Investment	20%	29%	29%	16%	6%
Social events	20%	47%	13%	12%	8%
Energy	21%	46%	18%	11%	4%
Transport	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%
Dairy 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%
Tubers	5%	33%	37%	18%	7%
Cereals	19%	53%	17%	7%	4%

Note: 299 observations.

Table 2. Perceptions of reform's effects (on a scale of [0,10])

Perceived effects of the reform on:	Mean	SE	Min	Max	Median	Interquartile
Income	5.74	2.88	0	10	6.5	3
Welfare	5.13	2.82	0	10	6	3
Input access	5.83	2.94	0	10	6	3
Agricultural knowledge and abilities	2.97	3.05	0	10	3	6
Poverty reduction	3.07	3.03	0	9	3	6

Note: 299 observations.

Table 3. Bivariate ordered estimates of changes in subjective wealth

Change in Subjective Wealth Explanatory variables	Bivariate Ordered Probit 1: endogenous opinion on welfare effect	IV-Ordered Probit with endogenous opinion on welfare effect	Bivariate Ordered Probit 2: endogenous opinion on poverty effect	Bivariate Ordered Probit 3: exogenous opinion on input effect
Δland	.032 (.203)	.013 (.214)	.182 (.199)	-.048 (.166)
Δrelative land	.132 (.216)	.153 (.232)	-.103 (.224)	.219 (.164)
Δcotton share	-.197 (.436)	-.170 (.450)	-.050 (.407)	-.073 (.404)
Δrelative cotton share	.281 (.447)	.255 (.461)	.088 (.422)	.157 (.417)
Δln(livestock)	.062 (.054)	.065 (.053)	.086 (.052)*	.071 (.050)
Δln(relative livestock)	-.076 (.044)*	-.077 (.044)*	-.097 (.045)**	-.077 (.045)*
Δln(cereals)	-.350 (.217)*	-.356 (.215)*	-.514 (.212)***	-.365 (.210)*
Δln(relative cereals)	.363 (.248)*	.360 (.247)	.508 (.243)**	.348 (.242)
Δln(social events)	-.631 (.234)***	-.644 (.240)***	-.733 (.216)***	-.680 (.210)***
Δln(relative social events)	.552 (.247)**	.569 (.255)**	.619 (.221)***	.615 (.215)***
Δln(savings)	.218 (.577)	.281 (.631)	-.131 (.428)	.472 (.346)
Δln(relative savings)	-.011 (.527)	-.064 (.527)	.285 (.395)	-.226 (.347)
ln(debt)	-.174 (.090)**	-.168 (.093)*	-.194 (.054)***	-.144 (.069)**
Δln(diseases/injuries)	-.036 (.061)	-.039 (.063)	-.010 (.059)	-.048 (.057)
Mechanization	.381 (.205)*	.398 (.214)*	.466 (.174)***	.442 (.180)***
Traditional farming	reference	reference	reference	reference
Remaining mechanized	.205 (.242)	.188 (.249)	.086 (.216)	.131 (.216)
Household size	-.011 (.029)	-.009 (.030)	-.016 (.024)	-.003 (.025)
Δhousehold size	.001 (.022)	.002 (.022)	.012 (.022)	.005 (.022)
Age	-.002 (.010)	-.001 (.010)	.010 (.010)	-.000 (.010)
Resident ethnic group	-.305 (.197)*	-.321 (.203)*	-.357 (.166)**	-.365 (.172)**
Length of village residence	.007 (.005)	.007 (.005)	.003 (.005)	.006 (.005)
Education dummies	yes	yes	yes	yes
Opinion on welfare	.086 (.135)	.065 (.156)	-	-
Opinion on poverty	-	-	.206 (.079)***	-
Opinion on input access	-	-	-	-
Constants: 11 cutoffs	8 significant cutoff values	7 significant cutoff values	9 significant cutoff values	7 significant cutoff values
Pseudo R^2	.101	.131	.139	.092
Residual covariance	-.147 (.353)	-	-.439 (.274)*	-.189 (.073)***
Observations	296	296	296	296

Note: robust standard errors in parentheses, * is significant at 10%, ** is significant at 5%, *** is significant at 1%. Each dependent variable is a political opinion on a particular effect of the cotton reform. The first set of explanatory variables contains objective measures of changes in wealth. The number of significant cutoff values indicates the validity of an ordered specification when compared to a binary one.

Table 4. Bivariate ordered estimates of political opinions

Political opinions Explanatory variables	Bivariate Ordered Probit 1: opinion on welfare effect	IV-Ordered Probit: First-stage (opinion on welfare effect)	Bivariate Ordered Probit 2: opinion on poverty-reduction effect	Bivariate Ordered Probit 3: opinion on input-access effect
Δland	-.236 (.185)	-.240 (.186)	-.513 (.204)***	.078 (.171)
Δrelative land	.319 (.188)*	.337 (.191)*	.738 (.217)***	.075 (.177)
Δcotton share	.659 (.380)*	.691 (.383)*	.056 (.374)	.460 (.362)
Δrelative cotton share	-.663 (.393)*	-.695 (.398)*	.100 (.386)	-.399 (.362)
Δln(livestock)	.017 (.064)	.007 (.064)	-.098 (.067)	-.009 (.059)
Δln(relative livestock)	.023 (.060)	.026 (.061)	.117 (.063)*	.011 (.058)
Δln(cereals)	-.103 (.269)	-.081 (.266)	.243 (.304)	-.138 (.230)
Δln(relative cereals)	-.120 (.268)	-.133 (.264)	-.350 (.318)	.279 (.249)
Δln(social events)	.-162 (.227)	.-176 (.225)	.467 (.284)*	.281 (.212)
Δln(relative social events)	.280 (.245)	.283 (.239)	-.308 (.297)	-.338 (.227)
Δln(savings)	1.176 (.351)***	1.172 (.348)***	1.216 (.353)***	.338 (.347)
Δln(relative savings)	-.964 (.365)***	-.959 (.361)***	-1.115 (.372)***	-.322 (.361)
ln(debt)	.116 (.074)*	.118 (.073)*	.108 (.093)	-.126 (.073)***
Δln(diseases/injuries)	-.059 (.054)	-.058 (.053)	-.070 (.057)	-.004 (.058)**
Mechanization	.259 (.186)	.263 (.184)	-.031 (.197)	-.314 (.184)*
Traditional farming	reference	reference	reference	reference
Remaining mechanized	-.499 (.228)**	-.481 (.228)**	-.013 (.224)	-.006 (.240)
Experience in cotton growing	3 to 5 years**	3 to 5 years*	Newcomers and 3 to 5 years**	3 to 5 years*
GPC characteristics	Bad relationships***	Bad relationships**	Very good relationships**	Well managed***
Household size	.058 (.024)***	.056 (.024)***	.046 (.025)*	.068 (.023)***
Δhousehold size	.012 (.025)	.011 (.025)	-.025 (.026)	-.024 (.026)
Age	.007 (.010)	.004 (.010)	-.017 (.011)	.002 (.010)
Resident ethnic group	-.405 (.156)***	-.412 (.156)***	-.036 (.178)	-.448 (.164)***
Length of village residence	-.000 (.005)	-.000 (.005)	.007 (.005)	-.001 (.004)
Education dummies	Yes	Yes	Yes	Yes
GPC dummies	Yes	Yes	Yes	Yes
Village effects	Yes	Yes	Yes	Yes
Constants:	All 10 cutoff values significant	7 cutoff values significant	All 9 cutoff values significant	5 last cutoff values significant
Pseudo R^2	.101	.079	.139	.092
Residual covariance	-.147 (.353)	-	-.439 (.274)*	-.189 (.073)***
Observations	296	299	296	296

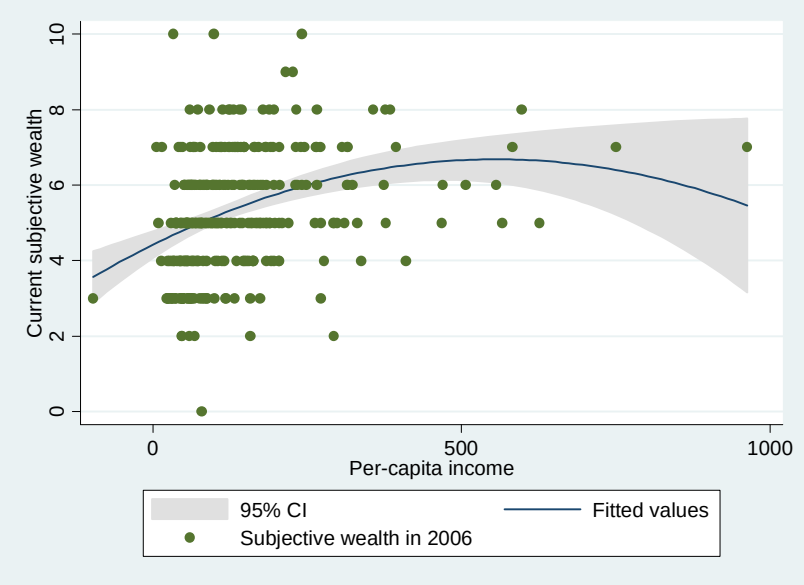
Note: robust standard errors in parentheses, * is significant at 10%, ** is significant at 5%, *** is significant at 1%. Each dependent variable is a political opinion on a particular effect of the cotton reform. The first set of explanatory variables contains objective measures of changes in wealth. The number of significant cutoff values indicates the validity of an ordered specification when compared to a binary one.

Table 5. Robustness checks: heterogeneity of effects by ethnic status and income groups (only significant effects are displayed)

Change in Subjective Wealth Explanatory variables	IV-Ordered Probit 1 for migrant ethnic groups	IV-Ordered Probit 1 for resident ethnic groups	BioProbit 1 for poor households	BioProbit 1 for non-poor households
Δland	.648 (.483)	-.404 (.305)	.420 (.349)	-.248 (.261)
Δrelative land	-.488 (.518)	**.569 (.316)***	-.253 (.290)	**.494 (.281)***
Δln(livestock)	-.093 (.078)	**-.188 (.111)***	.016 (.074)	.064 (.079)
Δln(relative livestock)	.035 (.075)	**.183 (.110)***	-.140 (.081)*	-.051 (.073)
Δln(cereals)	-.196 (.377)	.652 (.400)*	-.333 (.443)	.594 (.389)
Δln(relative cereals)	.346 (.429)	**-.600 (.408)***	.502 (.538)	**-.773 (.441)***
Δln(social events)	-1.050 (.330)***	.857 (.478)*	-.220 (.427)	-1.377 (.338)***
Δln(relative social events)	.906 (.342)***	**-.918 (.476)****	.007 (.457)	1.278 (.342)***
ln(debt)	-.306 (.188)*	-.104 (.119)	-.580 (.305)**	-.129 (.068)*
Mechanization	.316 (.356)	.383 (.268)	.151 (.258)	.293 (.373)
Traditional farming	reference	reference	reference	reference
Remained mechanized	.325 (.527)	.332 (.264)	.714 (.352)	-.440 (.419)
Resident ethnic group	-	-	.015 (.367)	**-.509 (.237)****
Length of village residence	.021 (.009)**	.005 (.006)	.005 (.007)	.005 (.012)
Opinion on welfare effect	.179 (.112)*	.102 (.161)	.344 (.071)***	-.174 (.121)
Constants:	4/9 cutoff values significant	6/11 cutoff values significant	6/10 cutoff values significant	7/10 cutoff values significant
Residual covariance	-	-	-.833 (.341)***	.426 (.347)
Pseudo R^2	.219	.073	.153	.122
Observations	119	180	139	157
Opinion	Welfare effect (first stage)	Welfare effect (first stage)	Welfare effect	Welfare effect
Δland	-1.495 (.487)***	-.141 (.276)	-.608 (.334)*	-.521 (.249)**
Δrelative land	1.611 (.519)***	.157 (.265)	.400 (.308)	.694 (.249)***
Δcotton share	1.937 (1.130)*	.849 (.549)	2.045 (.661)***	.120 (.547)
Δrelative cotton share	-2.225 (1.177)**	-.746 (.562)	-2.027 (.688)***	-.165 (.547)
Δln(livestock)	-.103 (.105)	-.137 (.138)	.113 (.106)	.034 (.085)
Δln(relative livestock)	.158 (.099)*	.163 (.132)	-.027 (.092)	-.024 (.090)
Δln(savings)	-.964 (.854)	1.776 (.482)***	1.344 (.520)***	.251 (.562)
Δln(relative savings)	1.175 (.892)	-1.373 (.510)**	-1.468 (.557)***	.162 (.556)
ln(debt)	.029 (.135)	.132 (.100)	.050 (.257)	.176 (.100)*
Experience in cotton growing	3 to 5 years***	Not significant	3 to 10 years***	1 to 3 years**
GPC characteristics	Very well managed and good relationships**	Not significant	Badly managed***	Not significant
Household size	.087 (.047)**	.038 (.033)	.113 (.043)***	.030 (.036)
Age	.006 (.014)	.006 (.016)	.014 (.015)	-.001 (.013)
Resident ethnic group	-	-	-.973 (.386)***	-.253 (.224)
Constants: cutoff values	5/8 cutoff values significant	5/10 last cutoff values significant	All cutoff values significant	2/9 cutoff values significant

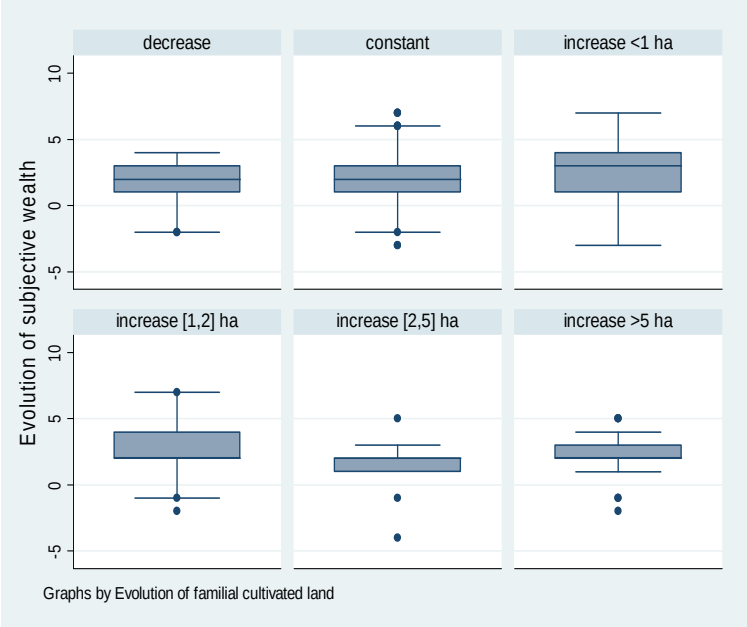
Note: robust standard errors in parentheses, * is significant at 10%, ** is significant at 5%, *** is significant at 1%. Poor households are those lying below the income poverty line of 100,000 FCFA per adult equivalent in 2006. The number of significant cutoff values indicates the validity of an ordered specification when compared to a binary one.

Appendix



Source: Author construction

Figure A1. The empirical relationship between per-capita income and subjective wealth



Source: Author construction
Note: On the y-axis, positive numbers relate to the number of additional rungs of subjective wealth gained during the reform, while negative numbers relate to lost rungs.

Figure A2. Evolution of subjective wealth by regimes of familial land extension

Table A1. Summary statistics of main variables

Variable	Description	Mean	SE
	Household main characteristics		
Household size	Number of consumption 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) in adult equivalents per household	6.393	3.499
Age	Age of household head, in years	33.980	8.082
Education level	School degree of the household head: No school (53%), Basic literacy (10%), Koranic school (6%), Elementary school (20%), Secondary school 9 years (7%), High school and more (4%)		
Ethnic group	Ethnic group of the household: Bobo (21%), Mossi (24%), Gourounsi (15%), Dagara (13%), local ethnic groups (24%), Senoufo (3%). Mossis and Gourounsis are non-resident ethnic groups and denoted as migrant groups		
	Subjective wealth		
Subjective wealth	Perception of wealth on a scale of [0,10] for the household today	5.313	1.601
Past subjective wealth	Perception of wealth on a scale of [0,10] for the household 10 years ago	2.960	1.950
Δsubjective wealth	Changes in the perception of wealth, in number of ranks	2.354	1.991
	Objective wealth indicators		
Income	Generated household income from crop production, sales of cattle, non-farm income and received transfers in thousands FCFA per adult equivalent	137.296	112.815
Relative income	Rate of difference between per-capita income and the average village (only cotton producers) per-capita income	0	.755
Land	Total land cultivated by the household in hectares	6.963	4.790
Livestock	Total value of the household's livestock in thousands FCFA	657.629	943.749
Debt	Value of household non-repaid credits in thousands FCFA	16.075	232.276
Social events	Expenses last year in social events in thousands FCFA	33.398	45.356
Δsavings	Savings generated by the households in thousands FCFA over the reform period	178.560	87.613
	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 and remaining since then (20%)		
Δland	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%)		
Δcotton share	Evolution of the land share dedicated to cotton during the reform: decrease (6%), same (18%), more (33%), much more (42%) (25% of additional cultivated land toward cotton)		
Cotton experience	Experience with cotton growing: newcomer (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%), adequate (66%), low (13%), very bad (1%)		
GPC quality	Perceived quality of internal relationships within the cotton group: very good (35%), adequate (55%), low (9%), very bad (1%)		

Table A2. Evolution of living standards during the reform

Living standards	**2006**		**1996**	
# rooms for the household	5.27	(3.5)	3.25	(2.19)
Quality of walls	*banco* 91%	brick 6%	*banco* 93%	brick 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 residence (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 rights	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 main market	no change: 7.8 km			
Distance to nearest road	no change: 6.0 km			
Telephone access	33%		32%	
Distance to first phone center (km)	14.89	(16.45)	27.21	(23.08)
Main means 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 consultation 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-status constraints	cure costs: 6.64		cure costs: 6.53	
	distance to care center: 3.22		distance to care center: 3.43	
	consultation costs: 2.18		consultation costs: 2.42	
Infant mortality	9.2%	(12.54)	12.8%	(15.98)

Note: standard deviations in parentheses. Schooling and health-status constraints are stated measurements on a [0,10] scale, 10 meaning insurmountable constraint to benefit from adequate education and health services. Moto stands for motorcycle and *banco* is a mud brick (fire free) which is traditionally employed in West African housing. 299 observations. Numbers in parentheses are standard errors.

Table A3. Matrix of subjective wealth mobility (299 observations)

Current subjective wealth	Subjective wealth in 1996									
	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 A4. Ordered estimates of the change in subjective wealth (number of ranks) over the reform period with Rivers-Vuong exogeneity tests

Change in Subjective Wealth Explanatory variables	Ordered Probit 1	Ordered Probit 2	Ordered Probit 3	Ordered Probit 4	Ordered Probit 5
Δland	-.047 (.166)	.059 (.173)	.268 (.208)	.212 (.205)	-.032 (.165)
Δrelative land	.218 (.165)	.114 (.173)	-.126 (.219)	-.136 (.244)	.203 (.177)
Δcotton share	.075 (.404)	-.033 (.408)	-.583 (.447)	-.080 (.402)	-.109 (.402)
Δrelative cotton share	.158 (.417)	.114 (.418)	.670 (.460)	.129 (.416)	.195 (.407)
Δln(livestock)	.071 (.051)	.083 (.051)*	.038 (.053)	.098 (.052)*	.073 (.052)
Δln(relative livestock)	-.077 (.045)*	-.091 (.045)**	-.070 (.044) *	-.107 (.047)**	-.081 (.046)*
Δln(cereals)	-.366 (.210)*	-.441 (.217)**	-.318 (.211)	-.564 (.241)**	-.376 (.216)*
Δln(relative cereals)	.348 (.243)	.477 (.253)*	.430 (.249)*	.542 (.264)**	.358 (.252)
Δln(social events)	-.680 (.210)***	-.670 (.215)***	-.500 (.223)**	-.760 (.219)***	-.683 (.215)***
Δln(relative social events)	.616 (.215)***	.576 (.219)***	.372 (.238)*	.652 (.226)***	.618 (.223)***
Δln(savings)	.477 (.346)	.226 (.369)	-.588 (.544)	-.155 (.439)	.478 (.362)
Δln(relative savings)	-.231 (.348)	-.027 (.374)	.678 (.499)	.321 (.412)	-.228 (.367)
ln(debt)	-.144 (.069)**	-.191 (.064)***	-.274 (.089)***	-.209 (.074)***	-.144 (.066)**
Δln(diseases/injuries)	-.048 (.057)	-.043 (.056)	.004 (.061)	-.012 (.059)	-.050 (.058)
Mechanization	.445 (.180)***	.375 (.173)**	.201 (.195)	.483 (.176)***	.454 (.193)**
Traditional farming	reference	reference	reference	reference	reference
Remaining mechanized	.133 (.216)	.141 (.216)	.436 (.244)*	.078 (.216)	.135 (.215)
Household size	-.003 (.025)	-.001 (.026)	-.039 (.028)	-.016 (.026)	-.004 (.029)
Δhousehold size	.004 (.022)	-.000 (.022)	-.011 (.022)	.016 (.024)	.005 (.023)
Age	-.000 (.010)	.003 (.010)	-.004 (.010)	.010 (.011)	-.001 (.010)
Resident ethnic group	-.365 (.172)**	-.412 (.172)**	-.132 (.193)	-.382 (.170)**	-.362 (.180)**
Length of village residence	.006 (.005)	.005 (.005)	.010 (.005)**	.003 (.005)	.007 (.005)
Education dummies	yes	yes	yes	yes	yes
Opinion on welfare	-	.048 (.027)*	.356 (.139)***	-	-
Opinion on poverty	-	.077 (.026)***	-	.226 (.111)**	-
Opinion on input access	-	-.078 (.025)***	-	-	.008 (.094)
Rivers-Vuong statistics			-.334 (.139)**	-.163 (.105)*	-.071 (.098)
Constants: 11 cutoffs	9 significant cutoff values	9 significant cutoff values	9 significant cutoff values	9 significant cutoff values	8 significant cutoff values
Pseudo R^2	.129	.146	.135	.138	.136
Observations	296	296	296	296	296

Note: robust standard errors in parentheses, * is significant at 10%, ** is significant at 5%, *** is significant at 1%. Three ordered probits are processed with three different Rivers-Vuong tests of exogeneity, according to the perceived effects from the reform: Ordered Probit 3 tests the exogeneity of the welfare effect, Ordered Probit 4 tests the exogeneity of the poverty-reduction effect, and Ordered Probit 5 tests the exogeneity of the input-access effect. The Rivers-Vuong statistic tests for the correlation of the residuals of political opinion equations in the equation of change in subjective wealth. If the statistic is significant, exogeneity is rejected by the test. The first set of explanatory variables contains objective measures of changes in wealth and welfare. The number of significant cutoff values indicates the validity of an ordered specification when compared to a binary one.

Table A5. Ordered estimates of the opinion indicators about the reform effects

Political opinions	Ordered Probit 1: welfare effect	Ordered Probit 2: poverty-reduction effect	Ordered Probit 3: input-access effect
Explanatory variables			
Δland	-.247 (.181)	-.555 (.201)***	-.021 (.172)
Δrelative land	.346 (.185)*	.812 (.213)***	.179 (.177)
Δcotton share	.684 (.390)*	.103 (.375)	.570 (.357)*
Δrelative cotton share	-.687 (.413)*	.005 (.391)	-.516 (.359)
Δln(livestock)	.008 (.064)	-.096 (.068)	-.017 (.060)
Δln(relative livestock)	.025 (.061)	.109 (.062)*	.026 (.058)
Δln(cereals)	-.078 (.264)	.304 (.284)	-.098 (.230)
Δln(relative cereals)	-.134 (.263)	-.336 (.288)	.227 (.251)
Δln(social events)	.-180 (.225)	.323 (.254)	.174 (.214)
Δln(relative social events)	.284 (.240)	-.226 (.266)	-.228 (.230)
Δln(savings)	1.168 (.344)***	1.237 (.350)***	.325 (.343)
Δln(relative savings)	-.952 (.356)***	-1.126 (.378)***	-.305 (.358)
ln(debt)	.117 (.073)*	.093 (.099)	-.288 (.085)***
Δln(diseases/injuries)	-.056 (.053)	-.059 (.055)	-.141 (.071)**
Mechanization	.260 (.185)	.019 (.198)	-.329 (.182)*
Traditional farming	reference	reference	
Remaining mechanized	-.473 (.226)**	.046 (.229)	-.010 (.238)
Experience in cotton growing	3 to 5 years**	Newcomers and 3 to 5 years**	Not significant
GPC characteristics	Bad relationships***	Very good relationships*	Well managed***
Household size	.055 (.023)**	.042 (.025)**	.064 (.022)***
Δhousehold size	.011 (.025)	-.040 (.026)	-.021 (.026)
Age	.004 (.010)	-.014 (.010)	.003 (.010)
Resident ethnic group	-.410 (.154)***	-.088 (.174)	-.426 (.162)***
Length of village residence	-.000 (.004)	-.007 (.005)	-.003 (.004)
Education dummies	Yes	Yes	Yes
GPC dummies	Yes	Yes	Yes
Village effects	Yes	Yes	Yes
Constants:	All 10 cutoff values significant	All 9 cutoff values significant	5 last cutoff values significant
Pseudo R^2	.079	.134	.053
Observations	299	299	299

Note: robust standard errors in parentheses, * is significant at 10%, ** is significant at 5%, *** is significant at 1%. Each dependent variable is a political opinion on a particular effect of the cotton reform. The first set of explanatory variables contains objective measures of changes in wealth. The number of significant cutoff values indicates the validity of an ordered specification when compared to a binary one.

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