

Shocks, Access To Credit and Rural Households Resilience: An Evidence From Cote D'ivoire

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ABSTRACT

Rural households in Côte d'Ivoire face a variety of shocks, the most common of them are those related to the health and death of an active member of the household. Based on data from the household living standard survey (ENV2015), we have identified the determinants of welfare of these rural households from a multiple linear regression. Our results showed that household size, farmland possession, and shock have a negative impact on household welfare while age, education, and industry activity of the head of households have a positive influence on welfare, provided that the household head operates in a sector other than agriculture and has at least primary education. Access to financial services, especially savings and credit, has a positive impact on welfare. In the second part of the work, it was revealed that access to a substantial level of credit, savings, the fact for the head of household to work in the sector of services and to have at least secondary level of education, strengthen the resilience of these households to overcome the effects of shocks.

Keywords : Rural households, Access to credit, shock, welfare, Resilience

Introduction

After independence in 1960, Côte d'Ivoire opted for economic liberalism and a policy of developing coffee and cocoa crops. The favorable prices of these two crops over the next two decades will create a period of sustained growth that some will identify as the "Ivorian economic miracle". At the end of the 1970s, the Ivorian economy was brutally shaken by a series of external shocks, the most important of which came from the coffee and cocoa markets. These shocks will lead to a worsening of the economic situation and this process will be accentuated by the burden of debt and the continuation of a major demographic expansion - 3.8% per year. The structural adjustment programs adopted as early as 1981, aimed at curbing an economic and structural crisis, without managing to correct the macroeconomic imbalances of the Ivorian economy and reverse the downward trend in its growth, will prove to be dramatic for a large segment of the population. In fact, many households have become poor as a result of a poor harvest, or a fall in commodity prices, or the loss of a job. And while the phenomenon was mainly confined to rural areas, poverty will gradually spread to urban areas.

In general, household consumption changes with the life cycle of the household (Blundell et al., 1994, Attanasio et al., 1999, Fernández-Villaverde & Krueger 2007, Browning & Ejrnæs 2009). The increase in consumption during the life cycle requires the use of external capital, in this case, the credit to cover the needs of the household. Numerous studies have shown that access to credit has a positive impact on the well-being of the household (Khandker 1998, Panjaitan, Drioadisuryo and Kathleen 1999, Remenyi and Benjamin 2000, Wright 2000, Khandker 2001a, Khandker and Faraque, 2001b, Coleman, 2002, Pitt and Khandker, 2002, Khandker, 2003, etc.).

In reality, the consumption of rural households depends on their incomes, which are generally subject to significant variations. Firstly, these incomes depend to a large extent on agricultural production, which itself is strongly affected by climate hazards (World Bank 2001, FAO, 2008), while prices of agricultural products often fluctuate widely, mainly due to the laws of the market. Secondly, the rate of agricultural production itself is uneven and production expenditure is unequally distributed during the production cycle. Rural incomes are largely realized with crops. In addition to these instability factors cited above, rural households in Côte d'Ivoire regularly face many shocks and the Household Life Standards Survey (ENV2015) reveals that out of a representative sample of 12900 households, 12.6% of them reported experiencing a shock in the last twelve months preceding the survey and the most cited shock is the illness / death of an active household member.

On the basis of this observation, we will present our work in four sections: the first section will deal with the review of the literature, the identification of research questions and objectives. The second section will focus on the methodology ie the model and the study data. The third section will present the results of our analysis while the last section will present the conclusions and recommendations and the scientific contribution.

1. Background / Research goals / Objectives

Access to the financial market globally and access to the credit market by the rural poor have been at the heart of many studies given their importance for improving the living conditions of these households. The integration of risk into the poverty reduction dynamics makes it possible to understand a variety of mechanisms developed by households to either prevent risks (risk management strategies) or adapt to the shock (adaptation strategies). This literature review will be divided into two parts : the first one will deal with the importance of access to credit in improving rural household welfare and the second one will try to identify the strategies adopted by these households to prevent or adapt their living conditions to shocks. At the end of this first analysis, we can seize the opportunity of conducting our study which aims to grasp the relationship that may exist between shocks and access to credit and better appreciate the resilience of households in the context of improving their living conditions.

Ensuring that farmers have adequate access to financial resources is a key principle of successful rural development strategies. Policymakers have long understood that rural producers who can not meet their capital needs must be content with suboptimal production strategies. When producers are unable to make the necessary initial investments or bear additional risk, they must give up the improvement of their productivity, their incomes and their well-being (Besley, 1995, Bank 2008a). In addition, without adequate access to loans or insurance, producers faced with negative shocks such as drought, disease or a significant drop in prices of production goods may lose some of the few assets they own (Diagne et al. Zeller, 2001). Conversely, producers who have access to well-designed credit, savings and insurance services may have capital to finance the inputs, labor and equipment they need to generate income; they can afford to invest in riskier but more profitable companies and asset portfolios; and may adopt more effective strategies to stabilize their food intake (Zeller et al., 1997). Overall, greater access to financial services offers opportunities to improve agricultural production, food security and the economic vitality of communities and entire nations.

Rural households and agricultural enterprises in developing countries obtain credit and insurance from a wide range of financial service providers, including commodity traders, banks, cooperatives and mutuals, contract agricultural enterprises and inputs ; they can also borrow informally from relatives, friends, owners, traders or money lenders. A defining characteristic of many of these financial transactions is that they involve "active monitoring" (Tirole, forthcoming cited by Conning and Udry, 2005). Monitoring or surveillance is used both as a surrogate and as a complement to collateral safeguards and enforcement strategies. Money lenders and financial intermediaries, in addition to investing in the control and supervision of their clients, can also intervene to significantly shape the choice of technology and other production decisions of their customers.

Financial markets (credit, savings and insurance markets) in developing countries and particularly in the sub-Saharan region are largely underdeveloped, are generally non-existent, particularly in rural areas, and for those that exist, many work imperfectly (Morduch, 1995). Also, although private banks are nominally open to financing agriculture, they generally view agricultural producers as high risk clients. Low levels of capitalization, lack of formal credit history, insufficiently secure collateral (partly due to land issues), seasonality of income, influence of unpredictable weather and other exogenous factors and avenues limited legality for the execution of contracts, are made to discourage commercial banks in their willingness to finance small farmers and other micro-household enterprises (Joyn Coop, 2014).

Lanza (1995), admitting first and foremost that rural growth has historically been disadvantaged by financial sector policies favoring urban development over rural development, is based on case studies from Costa Rica and Indonesia, to show how appropriate and inappropriate policies related to banking and financial infrastructure, mobilization of rural savings, capital formation, securities markets and credit allocation can affect rural development. Lastly, the author recommends financial sector reforms such as the privatization of financial structures, the regulation of the prudential supervision of intermediaries and the liberalization of credit and interest rate systems in order to stimulate production and encourage rural growth. As Zeller (2001) points out, financial services can be used for income generation on the one hand and for income and consumption alleviation on the other. While insurance and savings are *ex ante*, ie preventive strategies for smoothing consumption, consumer credit is generally used *ex post facto* to a calamity. Thus, the experience of a shock would then be positively correlated with the demand for credit and negatively with the demand for the other two services.

Following works that have focused on analyzing the access of poors to financial markets, we will have to focus on studies that are related to the rural poors access of to credit market.

Access to credit plays a major role in poverty reduction efforts in many developing countries. For rural poor households, credit represents a substantial portion of their annual income and provides significant financial means to generate additional income. Despite the importance of credit in poverty reduction strategies, the majority of rural poor are constrained in their willingness to access credit in the formal credit market. Recent financial reform programs in many developing countries have not had a positive impact in terms of improving access to credit for the majority of the rural population (Mohamed and Temu, 2009). This situation of limited access to credit is confirmed by a 1975 report of the World Bank on agricultural credit which noted that less than 1% of farmers in some African countries had access to subsidized loans while in a country like Taiwan almost all farmers had access (World Bank 1975). The report also noted that in Latin America and Asia, it is not uncommon for 70 to 80 percent of small farmers to have virtually no access to this credit. Also, many factors have been identified as influencing rural households' access to credit in the formal credit market in the literature (see Ibrahim et al., 2007, Nur- yartono et al., 2005, Dallimore and Mгимeti, 2003). Mohamed, 2003, Temu et al., 2001, Daniels 2001, Vaessen 2001, Mushinski 1999, Kashuliza and Kochar 1997).

Financial market imperfections, such as information asymmetries and transaction costs, are likely to restrict access to credit for the poor, micro and small businesses - lacking collateral, credit history and relationships - thus preventing them from seizing investment opportunities and leading to persistent inequalities and slower growth. This is reflected in the conventional wisdom that lending to poor households is a failure in advance because the costs of doing so are too high; the risks too high, the propensities to save these households too low, and very few of these households only have assets to offer as collateral for the loans that will have to be granted to them. Note that in developing countries, formal and informal credit sectors coexist despite large interest rate differentials. This coexistence is worrying given the recent wave of financial liberalization aimed at broadening

and deepening the formal credit markets. Two main explanations are proposed in the literature. First, the informal sector may be the recipient of "excess" demand from the formal sector (Bell, Srinivasan and Udry 1997, Conning 1996, Hoff and Stiglitz 1990). From this point of view, formal lenders have limited local information and must rely on collateral to resolve moral hazard and adverse selection issues inherent in credit operations. The ability of informal lenders to substitute information-intensive control and monitoring for the guarantee allows them to offer contracts to people who are excluded from the cheaper formal sector. A second alternative explanation is that lower transaction costs allow informal lenders to offer loans with lower effective costs (Chung 1995, Kochar 1997, Mushinski 1999). From this point of view, the informal sector should not be the area of last resort, but rather the preferred sector (Boucher and Guirking, 2007). The importance of the informal sector in rural credit is confirmed by the Survey of the Standard of Living of Ivorian households (ENV2015) which revealed that 75% of loans in Ivorian rural areas come from individuals while MFIs and other organizations approximately 15% when the banking sector was able to grant about 5% of this credit.

Credit has a significant impact on the level of investment in agriculture. It is estimated that about 95% of agricultural machinery in India is purchased with loans from official credit institutions (Sarkar, 2013).

The relationship between credit and poverty and vulnerability to poverty has also been analyzed by other studies. Zaman (1999) examines the extent to which microcredit reduces poverty and vulnerability through a case study of BRAC, one of the largest providers of microcredit for the poor in Bangladesh. According to the author, increases in income or consumption (ie poverty reduction) can occur if the credit is used for an income-generating activity and this activity generates returns that exceed the repayments of the loans. Quach et al. (2005) seek evidence of the impact of credit on the economic well-being of households in Vietnam. Their results confirm that household credit contributes positively and significantly to the economic well-being of households in terms of per capita expenditure, per capita food expenditure and non-food expenditure per capita.

It is obvious that credit plays an important role in increasing agricultural productivity. Rapid and easy access to credit allows farmers (including marginal farmers) to purchase the inputs and machinery needed to conduct agricultural operations and increase production (Abedullah, 2009, Saboor et al. 2009). No one can ignore the contribution of credit in improving the living conditions of households, increasing production and adopting new technologies essential for increasing agricultural productivity. Despite its contribution to the rural environment, we can not ignore the influence that the vagaries and conditionalities of the economic, political and climatic environment could have on agriculture and rural households in general. It is the consideration of these facts that has aroused interest of the scientific community around the issues of risk management and adaptation to shocks.

Rural households depend on agriculture and their incomes are often subject to wide variations due to inconsistent climatic conditions (Dercon 1996, Adams 1984). Alderman and Paxson (1994) distinguish risk management from shock adaptation strategies. Risk management strategies attempt to reduce the risk of the ex ante revenue process (income smoothing). Risk adaptation strategies include self-insurance (through precautionary saving) and informal sharing of risks in groups. Households can insure themselves by accumulating assets in good years, which they exhaust in bad years. Alternatively, informal arrangements can be made between members of a group or village to support each other in case of difficulties. These mechanisms are observed within extended families, ethnic groups, neighborhood groups and professional networks. Risk coping strategies may also involve trying to earn extra income in case of difficulties. These mechanisms gain strength after shocks and help to isolate patterns of consumption from income variability (Morduch, 1995).

The relevance of each of these strategies can only be understood through economic analysis. Indeed, many studies have examined the effectiveness of formal and informal risk-sharing and consumption-smoothing arrangements (eg Alderman and Paxson 1994, Jalan and Ravallion 1999, Townsend 1994). Several studies have examined the ability of households to manage risk and adapt their consumption in environments characterized by incomplete formal financial markets, uninsured risks, constraints on ubiquity of loans (loans) and risk aversion of farm households (Deaton & Muellbauer 1980, Deaton 1990, Deaton 1991, Deaton 1992a, Rosenzweig & Wolpin 1993, Zimmerman & Carter 2003, Kazianga & Udry 2006). A combination of these features not only creates fluctuations in income, but may also limit the paid use of assets and the ability of households to undertake profitable activities (Rosenzweig & Wolpin 1993, Dercon 2002, Dercon 2005). However, access to goods can help rural households cope with income uncertainty and out of poverty. Also, others works have focused on the analysis of the formal and informal mechanisms of ex post adaptation adopted by households in response to various shocks (Murendo et al, 2011, Townsend 1987, 1994, Mace 1991, Cochrane 1991, Fafchamps 2003, Fafchamps and Lund 2003, Zhang and Ogaki 2004).

Asfaw and Braun (2004) examine the impact of the disease on rural household consumption and the capacity of existing risk-sharing mechanisms to ensure consumption against health shocks. Using data from Ethiopia, the authors reveal that neither the households themselves nor the existing risk-sharing mechanisms are able to insure household non-food items against head-of-household disease in the sampled areas. Using information on individual health status from the Indonesian family life survey, Lim (2017) finds evidence that Indonesian farm households cope with chronic diseases of adult men through substituting for intra household work. However, the results show that this strategy is not effective in case of serious health shocks.

Kim and Prskawetz (2009) examine the impact of idiosyncratic shocks on household consumption, education spending, and fertility in Indonesia. They assess whether investment in children's human capital and fertility are used to smooth Indonesian household consumption. Their results indicate that the coping mechanisms are rather effective for Indonesian households facing a difficult economic situation. Only in the case of unemployment do they see a significant drop in consumer spending and education spending as fertility rises.

Murendo et al. (2011) analyze the effects of drought on the food security of rural Ethiopian households and the associated risk management strategies. Extensive ex ante adaptation strategies widely practiced in the region include storing crop residues as fodder for livestock, raising livestock tolerant to drought, mixed cropping, using short-term crop varieties, and the adoption of conservation practices. Ex-post adaptation strategies used by households include the sale of assets and the use of informal networks. This article shows that training farmers in forage production and conservation, as well as soil and water conservation

practices, appears to be a key option to strengthen farmers' ability to adapt and cope to drought. Dercon (2002) reviews the literature on poor households' use of risk management and risk adaptation strategies. His work identifies constraints on their effectiveness and discusses policy options. The results show that risks and bottlenecks limit the possibilities of using assets as insurance, that entry constraints in given business sectors limit the usefulness of income diversification. Informal risk sharing offers only limited protection, leaving some poor people exposed to very serious negative shocks. On the other hand, public safety nets are likely to be beneficial, but their impact is sometimes limited and they may have negative externalities on households that are not covered. Nakagawa and Shaw (2004) examine the role of social capital in post-earthquake rehabilitation and reconstruction programs in two cases: Kobe, Japan, and Gujarat, India. The Kobe case study shows that community with social capital and a tradition of community activities can proactively participate in the rebuilding program, and so can succeed and recover as quickly as possible. In Gujarat, it has been observed that the community with social capital has the highest satisfaction rate for new urbanization and has the fastest recovery rate. Ultimately, the importance of social capital in the reconversion of households to shocks has been confirmed by many studies. However, other strategies can be developed by households to adapt to these shocks.

Schultz (1975) argues that educated people adapt more easily to changing economic conditions, use assets more efficiently, obtain better credit arrangements and more quickly exploit new sources of income. Rosenzweig and Wolpin (1993) find that in India, oxen are used as stockpiles, that is, they are sold at the wrong time for smoothing consumption. Udry (1994) finds that households in northern Nigeria obtain loans when needed, which they repay on the basis of random shocks to themselves and lenders. Kochar (1999) finds that Indian men increase hours of work in the market in response to unexpected changes in crop profits. Risk adaptation measures appear to vary by region and situation. The existing literature on idiosyncratic income uncertainty and its effects on agricultural households in developing countries assumes that these households are particularly vulnerable to shocks related to agricultural production and income. It is argued that shocks to crop incomes reduce household wealth not only directly but also as a result of costly household measures to protect consumption against such shocks. These include choosing less risky but less profitable agricultural investments, and *ex ante* diversion of productive capital into more liquid assets or the *ex post* sale of such assets to smooth consumption (Mukesh Eswaran and Ashok Kotwal, 1989). , Jonathan Morduch, 1994). A second theme in this literature is that credit markets play a central role in protecting consumption against idiosyncratic shocks to crop income. Thus, inter-household differences in vulnerability to such shocks are most often related to differences in access to credit markets (Eswaran and Kotwal, 1989, Morduch, 1990). DeLoach and Smith-Lin (2017) examine the effect of access to formal banking services on households' ability to smooth consumption in response to the disease of adult workers. The results of his work reveal that the means by which households smooth consumption differ according to their access to formal services. Those with access to formal credit increase borrowing from banks, while those with access to formal savings only, but not credit, benefit from savings. Households without access to formal banking services eventually liquidate productive assets. The existing literature evaluates these different strategies to analyze their effectiveness to allow the household to maintain its standard of living in case of actual occurrence of the given shock.

In Côte d'Ivoire, the household standard of living survey (ENV2015) reveals two categories of shocks that affect households: shocks that affect all households in a given area (drought, flood, etc.) and shocks that particularly affect certain households (job loss, illness of an active household member). In this survey conducted by the National Institute of Statistics, 12.6% of households reported having suffered at least one shock in the last 12 months. The shock most cited by households (31% of households) is the illness / death of an active member of the household. Then come shocks such as lack of economic opportunities (14%), lack / irregularity of rains (11%) and diseases and crop damage (8%). The successive crises that the country has experienced and the hazards related to the consequences of global warming have weakened households in general and rural households in particular. These shocks have had a negative effect on the economic activity of the affected households and this, on their ability to cope with shocks. Half of affected households (51%) say they have experienced a decrease or loss of their income and 6% of households say they have lost assets. Also, the ability to produce or buy food has been significantly reduced for about one third of households (33%).

In response to these shocks, rural households have developed several compensation strategies. These strategies can be classified into food-type strategies (modification of eating habits or the reduction in the number of meals or quantities consumed, etc.) and non-food (sale of productive and non-productive goods, livestock, solidarity, use of loans, etc.). Data analysis shows that more than half (54%) of shocked households have developed at least one food strategy versus 20% have developed non-food strategies. However, 26% of shocked households report that they have not developed a strategy to deal with shocks. The high income dependence of Ivorian rural households on the instability of commodity prices (particularly coffee and cocoa and many other crops such as latex, cashew, etc.) on the international market, the diversity of idiosyncratic shocks that these households face, make the analysis of the situation of these households an atypical case. Also, at the end of this review, note that many studies have been conducted to either study the influence of various shocks on the consumption of rural households, or to understand the relevance of each of the strategies adopted by rural households to prevent risks or coping with shocks in an environment of uncertainty. Despite the diversity of this work, none of them, to the author's knowledge, has focused on the case of rural households in Côte d'Ivoire and it is to fill this gap that this analysis is conducted.

Rural households in Côte d'Ivoire depend mainly on agriculture unfortunately subjected to many climatic hazards having a structural effect on agricultural productivity. In addition, the laws of the market have led to a sustained downward trend in commodity prices in the international market. Shocks, whether idiosyncratic (illness or death of a family member, job loss, etc.) or covariates (falling prices of production goods, diseases and crop damage, etc.) are part of everyday life of these rural households. They will therefore have to identify mechanisms to reduce their impact in view of a consistent smoothing of consumption and an improvement of their level of well-being. The aim of this study is to determine the conditions for improving the welfare of rural households in a shock situation. Our analysis answers three research questions: What determines the welfare

of rural households in Côte d'Ivoire? At what level can credit be an instrument for reconversion of households in shock? What are the factors that determine the resilience of households in shock?

Two objectives are therefore assigned to this study: the first relates to the identification of determinants of the level of well-being of rural Ivorian households; the second seeks to determine the influence of access to credit and other factors on the adaptation of households in shock.

Following this literature review, we will focus on the presentation of the methodology chosen to conduct this study.

2. Methodology

The analysis model

The variable used as proxy for welfare is the consumption per adult of the household (Quach et al., 2005). The model for estimating the determinants of household well-being is the following multiple linear regression:

$$CPA_i = \beta_0 + \beta_1 age_i + \beta_2 AL_i + \beta_3 HS_i + \beta_4 AC_i + \beta_5 EL_i + \beta_6 HI_i + \beta_7 Choc_i + \beta_8 SA_i + \beta_9 OD_i + \beta_{10} SV_i + \beta_{11} AS_i + \epsilon_i \dots \dots \dots (1)$$

Where CPA_i is the value of consumption per adult of the household i . age_i is the age of the head of the household replaced by the variable CA_i which represents the age categories of the head of the household i in the second model. Three categories are taken into account, dividing this variable into three binary variables: the first one takes into account households whose head is less than 35 years old (CA_{35i} takes the value 1 if the age of the household head is smaller than 35 and 0 if not), the second takes into account households whose head is between the ages of 36 and 55 (CA_{55i} is 1 if the head of the household is between 36 and 55 years old and 0 if not) and the last one takes into account households whose head is between 56 and 105 years old (CA_{105i} takes the value 1 if the age of the head of household is between 56 and 105 years old). In model 2, the reference category of our analysis is CA_{35i} .

AL_i is a binary variable with a value of 1 if the household has agricultural land and 0 if not; EL_i is a four-category variable splitting this variable into four binary variables indicating the education level of head of household: the first EL_{0i} is a binary variable with a value of 1 if the head of household has no education level and 0 if no ; EL_{1i} takes the value 1 if the head of household has the primary level and 0 if not; EL_{2i} takes the value 1 if the head of household has the secondary level and 0 if not; EL_{3i} takes the value 1 if the head of household has the upper level and 0 if no. The reference modality of our analysis is EL_{0i} . AS_i is a variable with four categories representing the different sectors of activity. AS_{1i} , AS_{2i} , AS_{3i} and AS_{4i} are binary variables representing respectively the fact that the head of household operates in the sector of agriculture, industry, trade and services. $Choc_i$, SA_i , OD_i , SV_i are binary variables representing, respectively, whether the household has had a shock in the last 12 months, the fact that the head of household whether employee or not, whether or not the household get it own dwelling, whether the household has saved or not during the 12 months preceding the survey. HS_i , AC_i , HI_i are independent variables representing, respectively, the size of the household i , the amount of credit obtained by the household i (in thousand of fcfa) and the main income of the household i (in thousand of fcfa).

This model can be interpreted in several ways. Let the following linear regression model:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \epsilon \dots \dots \dots (2)$$

Let σ_k be the standard deviation of the variable x_k . By dividing each x_k by σ_k and multiplying the corresponding value of β_k by σ_k , we obtain:

$$y = \beta_0 + (\sigma_1 \beta_1) \frac{x_1}{\sigma_1} + (\sigma_2 \beta_2) \frac{x_2}{\sigma_2} + \epsilon \dots \dots \dots (3)$$

$\beta_k^{Sx} = \sigma_k \beta_k$ is an x -standardized coefficient.

To standardize the dependent variable, let σ_y be the standard deviation of y . We standardize y by dividing equation (2) by σ_y :

$$\frac{y}{\sigma_y} = \frac{\beta_0}{\sigma_y} + \frac{\beta_1}{\sigma_y} x_1 + \frac{\beta_2}{\sigma_y} x_2 + \frac{\epsilon}{\sigma_y} \dots \dots \dots (4)$$

Thus, $\beta_k^{Sy} = \beta_k / \sigma_y$ is a y -standardized coefficient.

We can standardize all the coefficients of both x and y :

$$\frac{y}{\sigma_y} = \frac{\beta_0}{\sigma_y} + \left(\frac{\sigma_1 \beta_1}{\sigma_y} \right) \frac{x_1}{\sigma_1} + \left(\frac{\sigma_2 \beta_2}{\sigma_y} \right) \frac{x_2}{\sigma_2} + \frac{\epsilon}{\sigma_y} \dots \dots \dots (5)$$

The data

The data used in this research are those from the 2015 Household Living Standards Survey produced by the National Institute of Statistics (Côte d'Ivoire). The research unit is the household and the people who live there. The universe of the survey is made up of all African households residing in Côte d'Ivoire. It is a multi-topic national survey, with modules covering many aspects of the standard of living. The General Census of Population and Housing (RGPH2014) served as a sampling frame. The sampling follows a two-stage draw with first-stage proportional allocation of Census Districts or Enumeration Area in the strata of the study; In the second degree: systematic drawing of 12 households by enumeration area. The sample is stratified into three sets and provides significant results for the region and the place of residence, the city of Abidjan and all of Côte d'Ivoire, urban and rural. The size of the sample per stratum varied between 276 and 1188 households, to take account of the demographic weight of certain regions, ie a total sample of 12 900 households for the 33 strata (31 regions plus the city of Abidjan and the District Autonomous of Yamoussoukro). The household survey has 16 sections (household composition, household governance, health and education, employment, income-generating activity, livestock characteristics, agriculture, , ...). As part of our analysis, only rural households (55% of observations) were selected. Following the presentation of our database, it is convenient for us to proceed to the presentation of the results and the resulting discussions.

3. Résultats and discussions

Descriptive statistics

The database of our work contains 53,475 observations. A total of 12 variables were retained in the model including a dependent variable and 11 independent variables. Among the 11 independent variables, there are 4 numerical variables and 7 indicator variables, 2 of which each have three modalities with a reference modality. The dependent variables of our model is the consumption per adult named CPA. It is evaluated in thousands of CFA francs and has a minimum value of 17 and a maximum value of 5140. The average of this variable in the analysis sample is 590 with a standard deviation of 497. The four numerical variables of our sample are: age, HS, AC and HI. Each represents the age of the head of the household, the size of the household, the amount of credit obtained by the household in thousands of CFA francs and the main annual income of the household also in thousands of CFA francs. The minimum age of the head of the household in the sample is 15 years and the maximum age is 89. The average age is 37 years old. The HS variable for household size takes values between 1 and 16 with an average of 2.3 and a standard deviation of 1.76. The amount of credit obtained by the households in our sample varies between 0 and 7000 with a value of 0 corresponding to the households that did not have credit during the last twelve months preceding the survey. The last numeric variable is the HI variable, which represents the household's main income, evaluated in thousands of CFA francs. The minimum value of this variable is 0.018 and the maximum value is 23 000 000. The average income is 21,434. In total, 7 dummy variables are included in our model: AL, EL, Shock, SA, OD, SV and AS. The variable AL takes two values (1 if the household has agricultural land and 0 if no) and the reference modality is the 0 modality. The average is set at 0.66 and therefore 66% of the households in our sample have land farm. The EL variable takes four values representing the different levels of education of the household head. Modalities 0, 1, 2 and 3 correspond respectively to the fact that the head of household has no level of education; he has primary, secondary and higher levels. The averages of modalities 1, 2 and 3 are respectively set at 0.2; 0.19 and 0.02; the average of the modality 0 is therefore set at 0.59. This means that in our sample of 53,478 observations, 20% of households have primary level, 19% have secondary level and only 2% have the highest level. Households in which the head has no level of education are the most numerous with 59% of the total workforce. The reference modality of the variable EL is the modality 0. The variable Shock takes two values 0 and 1 with the modality 1 for the households having suffered a shock during the last twelve months preceding the survey and 0 if not. The industry, trade and services sectors use respectively 13%, 19% and 18% of the observations in our sample. The agriculture sector alone employs 50% of households (see Table 1). Tables 2, 3 and 4 present the situation of rural credit in relation to the fact that the household has suffered or not a shock. In Table 2, we see that in the sample of the entire rural population from which information was collected during this survey, 12.24% were hit by a shock during the last 12 months (39,163 individuals out of a total of 320,000 individuals). By reducing the size of this sample to 20,229 individuals, 19% of households were shocked, 89% of the total population applied for and received credit in the last 12 months. Shocked households receiving a credit at the same time represent a workforce of 3,547. This represents 91% of the number of households that suffered a shock, so 91% of the households that suffered a shock in the sample had solicited and obtained a credit. This shows the importance of credit in household coping strategies. Table 4 presents the sources of rural credit according to whether or not the household experienced a shock during the 12 months preceding the survey. Individuals occupy a prominent place in the provision of rural credit. Out of a total of 18,013 loans granted, 13,515 loan contracts were provided by individuals (friends, relatives, pawnbroker, etc.).

Table 1 : Descriptive statistics of the linear regression model (without weights)

Estimation sample regress			Number of obs = 53478	
Variable	Mean	Std. Dev.	Min	Max
CPA	589.6898	497.2693	17.2267	5140.22
age	36.7927	12.9673	15	89
1.AL	.6603463	.4735961	0	1
HS	2.297954	1.760659	1	16
AC	22.2003	243.2345	0	7000
EL				
1	.1967164	.3975198	0	1
2	.1916676	.3936166	0	1
3	.0225513	.1484695	0	1
HI	21434.94	680744	.018	2.3e+07
1.Choc	.0955907	.2940319	0	1
1.SA	.4133101	.4924321	0	1
1.OD	.4080183	.4914711	0	1
1.SV	.4253525	.494401	0	1
AS				
2	.1274543	.3334843	0	1
3	.1929018	.3945803	0	1
4	.1771196	.3817734	0	1

Source : Our computation from ENV2015 database

Table 2 : Descriptive statistics of rural households subjected to shocks

Le ménage a t-il subit un choc	Freq	Percent	Cum.
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durant les 12 derniers mois ?				
	0	280,697	87.76	87.76
	1	39,163	12.24	100.00
Total		319,860	100.00	

Source : Our computation with data from ENV12015 database

Tableau 3 : Crossing rural households subjected to shocks with access to credit

Ménage a sollicité et obtenu un crédit?			
Le ménage a t-il subit un choc durant dernier 12mois ?	0	1	Total
	0	1,858	14,466
	1	358	3,547
Total		2,216	18,013

Source : Our computation with data from ENV2015 database

Tableau 4 : Sources of rural credit selon que le ménage ait subit ou pas un choc

Le ménage a t-il subit un choc durant 12 dernier mois ?			
Auprès de quelle organisme a-t-il obtenu un crédit ?	0	1	Total
Bank	611	135	746
Institutions of crédit	356	45	401
Social funds	2	42	44
COOPEC	48	1	49
Others imf	140	0	140
ROCA	282	86	368
Related persons	10,980	2,535	13,515
Cooperative/gvc	912	217	1,129
Others	1,135	486	1,621
Total	14,466	3,547	18,013

Sources : Our calculs from ENV2015 database

This group represents 75% of the total number of credits granted to rural people during the last 12 months. At the level of shocked households, this figure represents a workforce of 2,535 or 71% of loans granted to this group. From Table 4, we can classify the actors involved in providing credit to the rural poor. Thus, following individuals, the second group of organizations playing a major role in the provision of rural credit in Côte d'Ivoire is the other sources with 9% and then the group of cooperatives and GVC with 6.26% of rural credit, then comes the banking sector with 4%. All credit institutions provide 2% of rural credit. The last four positions are held respectively by tontines, other microfinance institutions (excluding COOPEC which stand for Coopérative d'Epargne et de Crédit), COOPEC and the social funds in the last position. At the end of this first presentation, it could be noted that rural households in Côte d'Ivoire rely heavily on credit to cope with the effects of the shocks they face and the main source of rural credit in Côte d'Ivoire is related individuals. Is it tempting to know what types of shocks these households face?

Table 19 in the appendix presents the different types of shocks that rural households in Côte d'Ivoire face. These are the first shocks on a list of 3 identified for the last 12 months preceding the survey. These first shocks were retained in our analysis. It should be noted at this point that many shocks have been identified as having a negative impact on the standard of living of rural people. Individually, the serious illness of one or more members of the household comes in first place with 19.06% or a workforce of 7466 individuals affected by this shock. The second shock is the death of a household member or relative with 14.6%; the death of one or more members of the household, the lack of rain or irregular rains, the lack of economic opportunities and the death of a household asset represent respectively 9.63%; 6.66%; 5.52% and 4.81% of this population. By compiling the death and illness of a household member or relative, it is found to be the major shock to rural households in Côte d'Ivoire. The cumulative frequency of this shock is estimated at 48.1%, ie almost half of the shocks identified.

Following the presentation of the database and the variables of our analysis, let us remember that the rural households in Côte d'Ivoire are mainly governed by a leader exerting in the sector of the agriculture and having no level of education. These households are more likely to experience shocks related to the illness or death of a member. They make more use of credit to curb the effects of the various shocks they face and the main source of this credit is the informal market (related and particulars). In order to continue our analysis, we must now turn to the results of our estimates after making a brief statement of the statistical tests conducted before making these different estimates.

Results and discussions

A multiple linear regression model was used in our analysis. The dependent variable of our model is the welfare of the household. The welfare proxy used here is the equivalent adult consumption. Statistical tests were conducted and the results of these tests are available as an appendix to this study in Tables 11; 12; 13 and 14.

Table 5 : Resultats of standardized coefficients

	b	t	P>t	bStdX	bStdY	bStdXY	SDofX
age	4.2218	600.037	0.000	56.593	0.008	0.112	13.405
1.AL	-10.2925	-51.060	0.000	-4.867	-0.020	-0.010	0.473
HS	-114.7154	-2.1e+03	0.000	-194.523	-0.226	-0.384	1.696
AC	0.1308	321.668	0.000	27.541	0.000	0.054	210.590
EL							
1	80.3183	372.102	0.000	33.240	0.158	0.066	0.414
2	181.1170	787.548	0.000	72.256	0.357	0.143	0.399
3	576.4668	863.162	0.000	76.046	1.137	0.150	0.132
HI	0.0000	39.477	0.000	3.359	0.000	0.007	6.4e+05
1.Choc	-90.5052	-304.785	0.000	-26.062	-0.179	-0.051	0.288
1.SA	53.3415	273.668	0.000	26.172	0.105	0.052	0.491
1.OD	16.2184	89.964	0.000	7.934	0.032	0.016	0.489
1.SV	121.8256	699.253	0.000	60.206	0.240	0.119	0.494
AS							
2	25.5297	96.340	0.000	8.734	0.050	0.017	0.342
3	0.9223	3.873	0.000	0.366	0.002	0.001	0.397
4	97.7055	380.028	0.000	36.020	0.193	0.071	0.369
constant	548.4402	1447.406	0.000

b = raw coefficient / t = t-score for test of b=0 / P>|t| = p-value for t-test / bStdX = x-standardized coefficient / bStdY = y-standardized coefficient/ bStdXY = fully standardized coefficient/ SDofX = standard deviation of X

Source : Our computation with data from ENV2015

The adjusted R2 and R2 of this model is evaluated at 0.235 so 23.5% of the variations of our dependent variable are explained by the independent variables of our model. Following these tests, the regression was performed to estimate the coefficients of the model. The result of this regression is shown in Table 5. The first variable of the model that was studied is the age of the head of household measured by the 'age' variable. The coefficient of this variable is significant at the 1 per 1000 level. The coefficient of this variable is positive, showing that the age of the household head increases with the consumption per adult and therefore with the well-being of the household.

This is probably due to the fact that household assets increase with the age of the head of the household. According to Roberts (2001), many heads of households receive pensions and other benefits as they become aged. This positive coefficient could also be explained by the fact that the dependency ratio decreases with the increase in the age of the head of the household. Indeed, when the head of the household gets older, some children would be old enough to get a good job and no longer be in charge of the household. However, this result is contrary to that of Baiyegunhi (2008) who finds a positive relationship between the age of the head of the household and the household's poverty status.

Possession of agricultural land identified by variable AL has a negative relationship with household welfare. Households with farmland have much worse welfare situations than those who do not. The possession of land does not necessarily mean the development of these lands for the realization of productive activities that can improve the welfare of these households. The situation of agricultural land is very confused in rural Côte d'Ivoire and many landowners do not have the relevant land documentation. Also, many landowners prefer to make land available to farmers for a derisory annual rental fee. This variable is statistically significant at the 1 per 1000 level. This result is consistent with that of Baiyegunhi (2008) who finds a positive relationship between land ownership and household poverty status in South Africa. According to this author, such a coefficient is explained by the fact that in terms of production of subsistence goods, landowners do not realize any economy on these lands (Aliber, 2003). The HS variable for household size has a negative relationship with consumption per adult. The increase in the size of the household leads to a decrease in consumption per adult, thus a reduction in the welfare of the household, all other things being equal. Increasing the household size of an additional individual reduces the consumption per adult by 114 units all things being equal. This is explained by the fact that the other variables being kept constant, the increase in the size of the household forces the household to share its consumption among a larger number of individuals, which reduces the share that each will have to receive from the household with same initial endowment. The variable HS is statistically significant at the 1 per 1000 level.

There is a positive relationship between the amount of credit obtained and the welfare of the household, all other things being equal. The increase of the credit amount of 1000 units results in an increase in the welfare of the household of 13% of 1000f or 130 units all things being equal. The coefficient of this variable is statistically significant at the 1 per 1000 level. It has been demonstrated in many studies that access to credit improves the welfare of the household through the provision of investment credit that can boost the income of the household (Adugna and Heidhues, 2000) while allowing smoothing of consumption (Zeller et al. 1994).

Access to credit could significantly influence household income by helping its members exploit economic opportunities and, as a result, lift them out of poverty (Binswinger and Khandker, 1995, Adugna and Heidhues, 2000).

Our work also related the level of education of the head of household and the consumption per adult of the household. The reference modality of the analysis is modality 0 which corresponds to the fact that the head of household has no level of education. All other things being equal, households headed by primary school boys see their well-being increase by 80 units

compared to households whose head has no education. Similarly, those whose head is at the secondary level see their consumption per adult increase by a greater value, that is to say 181 units. Compared to the welfare of the household whose head has no level of education, the increase in well-being is much greater when the head of the household is at the higher level. Here, all things being equal, there is an increase in consumption per adult of 576 units when moving from a household whose head has no level of education to a household headed by the head with higher level. This result is in line with that of Baiyegunhi (2008) who finds that a higher level of education leads to a higher level of well-being, also for the household. A study conducted by Mukherjee and Benson (2003) showed that raising the maximum level of education to a level of 4 to 8, from Standard 8 to JCE, or from JCE at MSCE, there is an increase in per capita household consumption of 22, 19, 11.5 and 17 percent, respectively, in rural south, rural center, rural north and urban centers.

There is a positive relationship between the main income of household and the consumption per adult of the household. The variable representing the household income has a very low coefficient because of the size of its standard deviation, but it is statistically significant at the 1 per 1000 level. The increase in income allows the household to acquire consumer goods and increase its consumption per adult and its welfare accordingly.

The shocks have a negative coefficient and therefore have a negative impact on the consumption per adult of the household, the other variables being constant. Shocks reduce the well-being of the household. The variable representing shocks is statistically significant at the 1 per 1000 level. The explanation that might justify the sign of this coefficient is related to the fact that shocks tend to destroy opportunities for household income generation. Whether they are of sanitary origin or linked to the death of an active member of the household or in relation to climate change, the shocks often have a direct impact of reducing the income of rural households and thus the consumption per adult of the household.

All things being equal, households whose head is salaried see their welfare measured by consumption per adult improve by 53 units or 53,000 per person. The SA variable, which refers to the fact that the household head is an employee, is statistically significant at the 1 per 1,000 threshold. A household whose head is an employee has income stability which may in turn lead to relative stability of consumption per capita.

The variable OD measures the fact for the household to live in their own dwelling. It is statistically significant at the 1 per 1000 level. Its coefficient is positive and its value is 16. This means that everything else being equal, the transition from a household not living in their own home to a household living in his own home increases the welfare of the household. This could be explained by the fact that asset disposition such as one's own dwelling for example is considered both an economic resource and a source of prestige within the community of rural inhabitants. Assets such as housing could be the source of an inkling of future generations in poverty or simply allow them to escape from poverty. This result is similar to that of Baiyegunhi (2008) who finds that the more the household has assets in terms of poultry, cattle and livestock, the less the household remains poor.

The variable SV determines that the household was able to accumulate savings during the last 12 months preceding the survey. The coefficient of this variable is positive and statistically significant at the 1 per 1000 level. All other things being equal, the shift from a household that did not constitute savings during the last 12 months to a household that constituted leads to an increase in consumption per adult of 121 units, ie 121000fCFA. Households with saving can use this amount of money saved to increase their consumption per capita when needed. This is probably what explains the increase in the welfare of these households.

The last variable of our model is the sector of activity of the head of household measured by the variable SA. The four sectors selected are agriculture, industry, trade and services. Each of these sectors corresponds respectively to the four categories of the variable namely 1, 2, 3 and 4. The reference modality for the estimate is modality 1, which corresponds to the agricultural sector. Other things being equal, a household headed by person working in industry sector has a higher consumption per adult than a household headed by person working in the farm sector. The transition from a household whose head is engaged in agriculture to a household whose head operates in commerce does not have a significant impact on the welfare of the household. On the other hand, per capita consumption of the household increases by 97 units when moving from a household head in the agriculture sector to a household head in the service sector. It can be seen that households whose head is engaged in a sector other than the agricultural sector have a better level of welfare than those whose head is in agriculture. This is probably due to the fact that agriculture in rural Côte d'Ivoire is very rudimentary and its income is irregularly distributed during the year. Also, climatic hazards related to global warming cause instability of agricultural production, rural incomes and indirectly the per capita consumption of these households. Each of the modalities of this variable is statistically significant at the 1 per 1000 level. These results are consistent with those of Aliber (2003) and Baiyegunhi (2008) who find that in rural South Africa, it is unlikely that agriculture can provide a significant level of well-being to rural people.



As a result of the discussion of the regression results, the impact of some variables in our model on the welfare of households subjected to shocks was measured. Figure 1 presents the graph of the evolution of the predictions of per capita consumption according to the amount of the credit obtained by the household subjected or not to a shock. The curve in blue shows the evolution of welfare as a function of the amount of credit obtained by the household that has not been shocked and that in red presents the same curve for households that have suffered a shock. The difference in welfare between these two curves is relatively important.

At the initial level, there is a difference of about 90 units, or 90000 of difference in annual per capita consumption between households that have not suffered shock and those that have suffered a shock. The slopes of these two curves are evolutionary and the value of the slope is 13%, all the other variables being evaluated at their average. Thus, in a shock situation, households are able to improve their well-being when they have access to increasingly large amounts of credit. The graph shows that households in shock reach the initial level of well-being of non-shocked households when they obtain a credit ranging between 600,000 and 700,000 CFA francs, all other variables being kept at their mean in the model. As a result, this chart shows that credit can be an effective tool for controlling the effects of shocks on household welfare as measured by per capita consumption. These results are consistent with the work of Zeller (2001), which shows that the experience of a shock is positively correlated with the demand for credit.

In Tables 6, 7, 8 and 9, the influence of the variables OD (dwelling in one's own home), SA (head of the wage-earning household), SV (household with or without savings), AS (sector of activity of the head of household) and EL (level of education of the head of household) on the well-being of the households in shock situation was evaluated.

. Table 6 : Predictions of CPA at(Choc=(0 1) OD=(0 1)) atmeans estname(Pr_CPA) statistics(all)

Expression: Linear prediction

	Choc	OD	Pr_CPA	se	z	p	ll	ul
1	0	0	599.190	0.115	5224.429	0.000	598.965	599.415
2	0	1	615.408	0.140	4394.990	0.000	615.134	615.683
3	1	0	508.685	0.290	1754.534	0.000	508.117	509.253
4	1	1	524.903	0.306	1716.681	0.000	524.304	525.502

Specified values of covariates

	age	1. AL	HS	AC	1. EL	2. EL	3. EL	HI	1. SA	1. SV	2. AS	3. AS	4. AS
Current	36.5	.662	2.23	18	.219	.199	.0177	19200	.404	.424	.135	.196	.162

Source : Our computations with data from ENV2015

. Table 7 : Predictions of CPA at(Choc=(0 1) SA=(0 1)) atmeans estname(Pr_CPA) statistics(all)

Expression: Linear prediction, predict

	Choc	SA	Pr_CPA	se	z	p	ll	ul
1	0	0	584.087	0.119	4890.859	0.000	583.852	584.321
2	0	1	637.428	0.146	4373.245	0.000	637.142	637.714
3	1	0	493.581	0.291	1694.238	0.000	493.010	494.152
4	1	1	546.923	0.309	1769.709	0.000	546.317	547.529

Specified values of covariates

	age	1. AL	HS	AC	1. EL	2. EL	3. EL	HI	1. OD	1. SV	2. AS	3. AS	4. AS
Current	36.5	.662	2.23	18	.219	.199	.0177	19200	.397	.424	.135	.196	.162

Source : Our computations with data from ENV2015

In Table 6, it can be seen that in the absence of shock, households living in their own apartments have a higher welfare than households living in apartments other than their own. The result is similar for shocked households who live in their own dwelling. Their welfare is higher than those who live in apartments other than their own. However, the per capita consumption of shocked households living in their own house is lower than in non-shock households who live in dwellings other than their own. However, the fact for the household to dwell in their own home can not compensate for the effects of a shock and allow households in shock to reach the same level of welfare as households without shock, the other variables being evaluated at their mean.

The effect of the SA variable on the welfare of households in shock is almost the same as the effect of the OD variable on the welfare of households in shock. The other variables being maintained at their average, when a non-salaried household is shocked, this leads to a drop in per capita consumption of 90 points or 90000f.

This drop in well-being is also the same for a salaried household that has suffered a shock. In the same vein, when a household is in shock, the fact that he is an employee increases his well-being by 50 points, or 50000 CFA per person. The increase in well-being is the same for a household that has not suffered a shock and whose head changes status from non-salaried to salaried. Thus, the fact of being an employee does not sufficiently compensate for the welfare losses related to the shock.

. Table 8 : Predictions of CPA at(Choc=(0 1) SV=(0 1)) atmeans estname(Pr_CPA) statistics(all)

Expression: Linear prediction, predict

	Choc	SV	Pr_CPA	se	z	p	ll	ul
1	0	0	553.962	0.115	4798.478	0.000	553.736	554.188
2	0	1	675.788	0.135	5023.891	0.000	675.524	676.051
3	1	0	463.457	0.293	1579.128	0.000	462.882	464.032
4	1	1	585.282	0.299	1959.678	0.000	584.697	585.868

Specified values of covariates

	1.	1.	2.	3.	1.	1.	2.	3.	4.				
	age	AL	HS	AC	EL	EL	EL	HI	SA	OD	AS	AS	AS
Current	36.5	.662	2.23	18	.219	.199	.0177	19200	.404	.397	.135	.196	.162

Source : Our calculs with data from ENV2015

. Table 9 : Predictions of CPA at(Choc=(0 1) AS=(1 2 3 4)) atmeans estname(Pr_CPA) statistics(all)

Expression: Linear prediction, predict

	Choc	OD	Pr_CPA	se	z	p	ll	ul
1	0	1	586.134	0.125	4687.604	0.000	585.889	586.380
2	0	2	611.664	0.235	2604.547	0.000	611.204	612.124
3	0	3	587.057	0.202	2905.456	0.000	586.661	587.453
4	0	4	683.840	0.225	3045.800	0.000	683.400	684.280
5	1	1	495.629	0.296	1671.669	0.000	495.048	496.210
6	1	2	521.159	0.355	1469.360	0.000	520.464	521.854
7	1	3	496.552	0.343	1448.055	0.000	495.880	497.224
8	1	4	593.335	0.343	1731.134	0.000	592.663	594.007

Specified values of covariates

	1.	1.	2.	3.	1.	1.	2.				
	age	AL	HS	AC	EL	EL	EL	HI	SA	OD	SV
Current	36.5	.662	2.23	18	.219	.199	.0177	19200	.404	.397	.424

Source : Our calculs with data from ENV015

. Table 10 : Predictions of CPA mtable, at(Choc=(0 1) EL=(0 1 2 3)) atmeans estname (Pr_CPA) statistics(all)

Expression: Linear prediction, predict

	Choc	EL	Pr_CPA	se	z	p	ll	ul
1	0	0	541.814	0.117	4611.375	0.000	541.584	542.045
2	0	1	622.133	0.184	3383.297	0.000	621.772	622.493
3	0	2	722.931	0.198	3644.582	0.000	722.542	723.320
4	0	3	1118.281	0.656	1705.493	0.000	1116.996	1119.566
5	1	0	451.309	0.294	1534.534	0.000	450.733	451.885
6	1	1	531.627	0.329	1613.722	0.000	530.982	532.273
7	1	2	632.426	0.328	1927.658	0.000	631.783	633.069
8	1	3	1027.776	0.702	1464.226	0.000	1026.400	1029.152

Specified values of covariates

	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
	age	AL	HS	AC	HI	SA	OD	SV	AS	AS	AS
Current	36.5	.662	2.23	18	19200	.404	.397	.424	.135	.196	.162

The SV variable has a greater impact on the welfare

Source : Our calculs with data from ENV2015

of rural households in shock, as shown in Table 8. The other variables being maintained at their mean, for a non-shock household, the fact that he has saved during the last twelve months allows him to increase his welfare or consumption per person by 121 points compared to a non-savings household. This consumption goes from 553 to 675. When a household in situation 1 in the table goes to situation 3, that is to say, undergoes a shock, its well-being falls from 553 to 463. But when the latter was able to build up savings, its well-being goes back to 585, which is above its initial value in 1. So saving allows for a full resilience of households in a shock situation.

Table 9 shows the influence of the SA variable related to the sector of activity of the head of household on the welfare of households in shock. The four modalities of this variable namely 1, 2, 3 and 4 correspond respectively to agriculture, industry, trade and services. For a household that initially did not suffer a shock, the fall of well-being is the same within the same sector of activity following a shock. Taking the agricultural sector as a reference, let us assume the situation described in 1 (absence of shock and head of household in agriculture). When a household suffers a shock, its welfare falls from 586 to 495. However, when the head of household migrates to the industry sector, his well-being goes back to 521 (situation 6). While migrating to trade, there is no significant change (situation 7), but migration to the service sector raises welfare from 495 to 593, which is above its initial value in 1. In this way, only households operating in services manage to overcome the effects of shocks.

The last variable in our analysis is the education level of the household head. Table 10 shows the influence of the EL variable on the welfare of households in a shock situation. The four categories of this variable namely 0, 1, 2 and 3 correspond respectively to 'no level', 'primary level', 'secondary level' and 'higher level'. For a household that initially did not suffer a shock, the fall in well-being is the same within the same level of education following a shock. By taking the modality 0 as a reference, suppose the situation described in 1 (no shock and head of household has no level of education). When a household suffers a shock, its welfare falls from 541 to 451. However, when the head of the household moves from the situation of lack of education level to the fact that he has reached the primary level, the household welfare increased from 451 to 531 (situation 6). When the level passes rather from absence of level to the secondary level, the well-being passes from 451 to 632 (situation 7). If the education level pass is rather of absence of level at the higher level, the welfare passes from 451 to 1027. Thus, it is in situations 7 and 8 that the well-being passes beyond its initial value being described in 1 (541). It is the households whose head reaches the secondary and higher levels that manage to overcome the effects of shocks. These results are consistent with the work of Schultz (1975) who argues that educated people adapt more easily to changing economic conditions.

As a result of this second analysis, it can be seen that the households that manage to overcome the effects of shocks have one of the following characteristics: they have received a credit of more than 700,000; have a leader with at least secondary education level; have a leader operating in the service sector; could have been savings during the twelve months preceding the survey. These are the elements allowing households to avoid the negative effects of shocks on their level of per capita consumption and thus on their welfare.

4. Conclusion and recommendations

At the end of our analysis, the first observation that emerges is that each of the variables of our model proved to be significant at the threshold of 1 per 1000. Some variables of our model have a negative impact on the well-being of the households. This is the case of the size of the household which, when it increases, leads to a reduction in the per capita consumption of the household. Ownership of agricultural land and the fact that the household suffered a shock during the 12 months preceding the survey have a negative effect on the welfare of rural households in Côte d'Ivoire. Other variables, on the other hand, have a positive effect on the well-being of rural households. The education level of the household head has a significant impact on household welfare. The higher the level of education, the greater the gap in well-being compared to a household whose head has no level of education. This is alarming given that almost 50% of rural households in Côte d'Ivoire do not have any level of education. As for the household head sector, households whose head is operating in a sector other than agriculture have a relatively higher level of well-being than those whose head is in agriculture (about 75% of rural households are in agriculture). However, the difference is more pronounced when the head of the household is engaged in services than in a household headed by the farmer. On the other hand, there is no major difference in well-being between a household whose head is in commerce and another whose head is in agriculture. Similarly, the age of the head of household has a positive impact on well-being, probably because of the accumulation of assets with the age of the head. The fact that the household has a chef who is employed and the household to live in his own home both have a positive effect on the welfare of the household. The results of our work reveal the importance of access to financial services by rural people. In fact, households that have been able to build savings are seeing their well-being increase substantially compared to those that could not constitute savings. Access to credit also has a positive effect on the well-being of households.

In the second part of the work, the analysis of the effect of certain variables on the welfare of households in a shock situation made it possible to determine the different profiles and interventions that could improve the resilience capacity of rural households. Thus, the following character traits improve the resilience of rural households to shocks: having a leader with secondary education, having a leader with a higher level of education, having a leader in the service sector. Subsequently, households that have saved in the last 12 months and those that received credit worth at least 700,000 are able to overcome the effects of shocks and maintain their level of well-being beyond his initial level before the shock.

It is therefore appropriate to make the following recommendations at two levels: first, at the level of the variables that could improve the well-being of rural households, and secondly at the variables that could strengthen the resilience of these households in shock. First, the improvement of well-being must take into account two aspects relating on the one hand to the households themselves, on the other hand to the rulers. Each head of household will have to make arrangements to improve his level of education regardless of his age. There is no age to learn and the Anglo-Saxon model is evocative on this question. On the other hand, a migration to the service sector would be beneficial but requires training or substantial learning. Households should also make all necessary arrangements to improve their level of access to financial services including credit and savings. On the side of the rulers, we should set up educational infrastructure that can accommodate the elderly and allow them to resume the class path. It will be necessary to promote such establishments for their dissemination throughout the territory. In this, the evening classes are the ideal parade to lead such initiatives. Policymakers must also encourage the financial sector to design more products for rural people. Micro-finance is a preferred route that can be explored at best. Togba (2009) shows that the lack of confidence in microfinance institutions and the sensitivity of households to the interest rate contribute to reducing the probability of these households participating in microfinance programs. It suggests the creation of networks of social capital within these institutions and then between them and the borrowers. However, microfinance does not remain the preferred means of access to credit in Côte d'Ivoire (only 1% of rural households have access to credit through the microfinance channel) and credit is not the only financial service concerned by our study. For household resilience, access to formal financial services allowing rural households to receive greater amount of credit is recommended. On the other hand, rural households should be able to accumulate savings. Lastly, sustainable mechanisms will have to be engaged by household heads to ensure their migration to more viable sectors such as services.

Here we see the importance of access to financial services in improving welfare and building the resilience of rural households to shocks. Also, a good understanding of this resilience capacity requires that we understand the determinants of the demand and sources of rural credit, and those of rural households saving. This is a global analysis of the determinants of access to financial services in rural Côte d'Ivoire.

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Appendix

Table 11 : Likelihood ratio test of model1 and model2

Variable	regress1	regress2
Age imputé	4.222***	
AL	-10.292***	-17.822***
Household size	-114.715***	-113.544***
AC	0.131***	0.133***
EL		
	1 80.318***	74.437***
	2 181.117***	177.728***
	3 576.467***	560.677***
Household Inc	0.000***	0.000***
Choc	-90.505***	-91.411***
SA	53.341***	54.579***
OD	16.218***	17.126***
SV	121.826***	118.304***
AS		
	2 25.530***	27.897***
	3 0.922***	2.610***
	4 97.705***	100.650***
CA		
	55	92.965***
	105	113.437***
Constant	548.440***	664.840***

legend: * p<0.05; **p<0.01 ; *** p<0.001

Likelihood-ratio test / LR chi2(1)= -87498.64 / (Assumption: regress1 nested in regress2) Prob > chi2=1.0000

Source : Our calculs with ENV2015 data base

Table 12 : Results of test of fit

	Current	Saved	Difference
Log-likelihood Model	-2.050e+08	-2.050e+08	-43749.321
Intercept-only	-2.087e+08	-2.087e+08	0.000
Chi-square D (df=27285815/272858~1)	4.101e+08	4.100e+08	87498.642
R2			
R2	0.233	0.235	-0.002
Adjusted R2	0.233	0.235	-0.002
McFadden	0.017	0.018	-0.000
McFadden (adjusted)	0.017	0.018	-0.000
Cox-Snell/ML	0.233	0.235	-0.002
Cragg-Uhler/Nagelkerke	0.233	0.235	-0.002
IC			
AIC	4.101e+08	4.100e+08	87500.642
AIC divided by N	15.029	15.026	0.003
BIC (df=17/16/1)	4.101e+08	4.100e+08	87515.764

Difference of 8.8e+04 in BIC provides very strong support for saved model.

Source : Our calculs with ENV2015 data base

Table 13 : Result of VIF test

Variable	VIF	1/VIF
age	1.24	0.809555
1.AL	1.26	0.792592
HS	1.20	0.834088
MCD	1.02	0.982339
EL		
1	1.11	0.902430
2	1.17	0.855511
3	1.08	0.927784
HI	1.01	0.994914
1.Choc	1.02	0.984920
1.SA	1.27	0.787429
1.OD	1.08	0.925983
1.SV	1.03	0.971430
AS		
2	1.14	0.876228
3	1.24	0.805996
4	1.25	0.801620
Mean VIF	1.14	

Source : Our calculs from ENV2015 database

Table 14 : Test of nul hypothesis

-1	age = 0
-2	1.AL = 0
-3	HS = 0
-4	AC = 0
-5	1.EL = 0
-6	2.EL = 0
-7	3.EL = 0
-8	HI = 0
-9	1.Choc = 0
-10	1.SA = 0
-11	1.OD = 0
-12	1.SV = 0
-13	2.AS = 0
-14	3.AS = 0

$$F(14, 27285816) = 6.0e+05$$

$$\text{Prob} > F = 0.0000$$

Source : Our calculs with ENV2015 data base

Table 15 : Descriptive statistics of the weighted model

Estimation sample regress Number of obs = 27285832

Variable	Mean	Std. Dev.	Min	Max
CPA	597.3628	506.9457	17.2267	5140.22
age	36.52892	13.40507	15	89
1.AL	.6624403	.4728775	0	1
HS	2.228081	1.695704	1	16
AC	18.0336	210.5904	0	7000
EL				
1	.2194255	.4138574	0	1
2	.1986015	.3989473	0	1
3	.0177163	.1319182	0	1
HI	19200.09	643061.8	.018	2.3e+07
1.Choc	.0912461	.2879587	0	1
1.SA	.4037114	.4906409	0	1
1.OD	.3965332	.4891775	0	1
1.SV	.4240418	.4941967	0	1
AS				
2	.1353584	.342106	0	1
3	.1958905	.3968847	0	1
4	.1622251	.3686572	0	1
_weight	510.2254	320.763	20	2345

Sources : Our computation from the data of ENV2015

Tableau 18 : Repartition of categories of shocks

First shock	Freq.	Percent	Cum.
Lack of rain / irregular rainfall	2,609	6.66	6.66
Late rains	1,483	3.79	10.45
Late sowing	90	0.23	10.68
Drought	1,303	3.33	14.01
floods / heavy rains / violent winds	1,305	3.33	17.34
crop damage by farmers	450	1.15	18.49
crop diseases	1,131	2.89	21.37
livestock disease (epizootics)	89	0.23	21.60
destruction of crops by animals	1,079	2.76	24.36
looting of crops / cattle theft	585	1.49	25.85
forced displacement of populations	179	0.46	26.31
destruction / looting of material goods	534	1.36	27.67
occupied plantations	405	1.03	28.71
lack of economic opportunities	2,163	5.52	34.23
separation of household members	1,034	2.64	36.87
job loss by a household member	315	0.80	37.67
non-functional markets	90	0.23	37.90
death of one or more members of the household	3,773	9.63	47.54
considerable decline in crop prices	181	0.46	48.00
low availability of food on the	135	0.34	48.34
serious illness of one or more members	7,466	19.06	67.41
death of a household asset	1,883	4.81	72.22
death of a member of the household / parents	5,719	14.60	86.82
lack of seeds and / or inputs	585	1.49	88.31
bushfires	1,347	3.44	91.75
other (explain)	3,23	8.25	100.00

Total	39,163	100.00
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Sources : Ours calculs with data from ENV2015

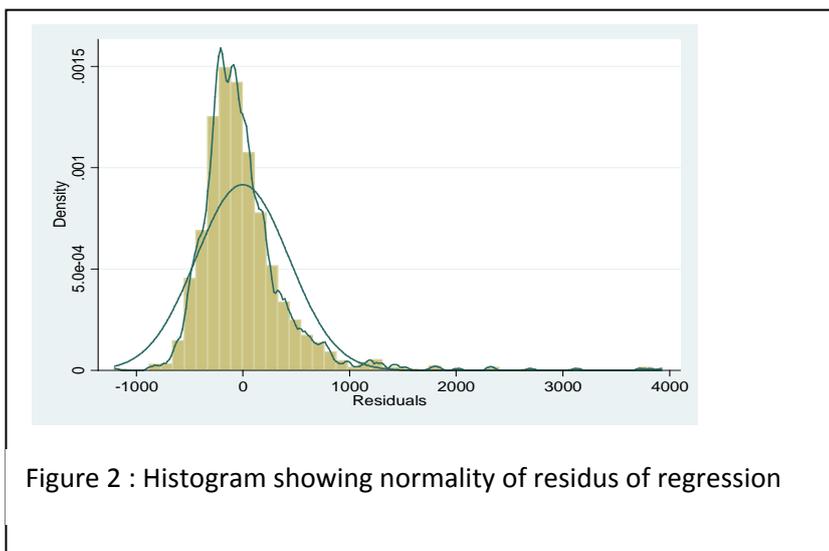


Figure 2 : Histogram showing normality of residus of regression

Table 6 : Average marginal effects from OLS model

Delta-method							
	dy/dx	Std. Err.	t	P>t	[95% Conf. Interval]		
age	4.221781	.0070359	600.04	0.000	4.207991	4.235571	
1.AL	-10.29247	.201575	-51.06	0.000	-10.68755	-9.89739	
HS	-114.7154	.0547967	-2093.47	0.000	-114.8228	-114.608	
AC	.1307823	.0004066	321.67	0.000	.1299854	.1315792	
EL							
1	80.31834	.2158503	372.10	0.000	79.89528	80.7414	
2	181.117	.2299757	787.55	0.000	180.6662	181.5677	
3	576.4668	.6678551	863.16	0.000	575.1579	577.7758	
HI	5.22e-06	1.32e-07	39.48	0.000	4.96e-06	5.48e-06	
1.Choc	-90.50516	.2969474	-304.79	0.000	-91.08717	-89.92316	
1.SA	53.34147	.194913	273.67	0.000	52.95945	53.72349	
1.OD	16.21844	.1802778	89.96	0.000	15.8651	16.57178	
1.SV	121.8256	.1742226	699.25	0.000	121.4841	122.1671	
AS							
2	25.52971	.264997	96.34	0.000	25.01033	26.0491	
3	.9223154	.2381658	3.87	0.000	.455519	1.389112	
4	97.7055	.2571007	380.03	0.000	97.20159	98.20941	

Source : Our computation with data from ENV2015