Human Capital, Culture, Markets Access and Productive Inefficiency in a Diversified Open Economy—Empirical Evidence from Rural Haiti ‡

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"Development Challenges in the 21st Century"

by

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Abstract

Haiti is the most open economy in the Caribbean Region. Trade liberalization policy was adopted therein between 1986 and 1996, and negatively impacted the agricultural sector (Jacob 2002, 2003, 2004, 2008) which is still very important in the economy—providing 25% of Gross Domestic Product (GDP), 50% of total employment, 46% of total food requirements of the population, and (to a lesser extent) 5.5% on total exports (compared with 50% in 1980 and 10% in 1990). Using a unique primary cross sectional data set of 815 household farms—collected in 2006—, We estimate productive efficiency under non parametric Constant Return to Scale (CRS) DEA (Data envelopment analysis) model (Jacob 2008). Inefficiency scores were then measured as deviation from the best practices frontier (Featherstone, Langemeier, and Ismet 1997), and model, using Tobit procedures (McDonald and Moffitt 1980; Maddala 1983), the determinants that are linked with. We first show the causal role of cultural beliefs and religious practices on farmers' efficiency. After controlling for a set of exogenous variables, the findings show the crucial role human capital as an asset for increasing efficiency while market access difficulties, and slow-moving cultural practices inherited from previous generations have a negative impact. In order to quantify the impact on technical efficiency of changes in the explanatory variables, the estimated coefficients (the total effects) are decomposed in: (i) the conditional variation in uncensored values of inefficiency themselves, and (ii) the variation in the probability of the dependent variable to fall in the uncensored part of the distribution (MacDonald and Moffitt 1980; Roncek 1992). Policy makers should pay attention to factors associated with inefficiency for poverty alleviation interventions.

Keywords: productive efficiency, agriculture, development, religiosity, culture, Haiti, market liberalization.
JEL Classification : D1; D2; O12; Q1; Z12

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1. Introduction

The measurement of efficiency in agriculture in developed and developing countries has received a great attention during the last two decades. But to be useful for policy management, the determinants of inefficiency among farmers must be studied as well (Puig-Junoy and Argilés 2000)—an avenue which has benefited from growing attention in recent years. But, despite the growing number of papers devoted to analyzing efficiency determinants in agricultural economics, little attention has been paid to culture and religiosity as possible sources of inefficiency. More generally, at the micro-economic level, economists are reluctant to measure the impact of culture on economic outcomes. Audibert (1997) and Audibert, Mathonnat and Henry (2003) are the only two studies that have attempted to measure social cohesion and ethnical affiliation effects on productive efficiency. Most of the empirical studies devoted to the measurement of the effect of human capital are mainly focused on three aspects: schooling, training and experience. Among others, in a descriptive paper, Logossah (2007) suggests that family and society (or community) are effective in transmitting and conditioning knowledge and practices over time, which are a type of human capital termed « family and social human capital ». Innaccone (1990) proposes the « religious human capital » as result of participation and knowledge of religious doctrines. How relevant is culture on micro-economic outcomes? To answer to this question, I expanded the conventional "human capital" concept to the family and to the society—as suggested by Logossah (2007).

This paper aims at enhancing our understanding of how different components of human capital (general and vocational, formal and non formal, agricultural and non agricultural) affect the productive efficiency in agriculture, and the channels by which some cultural traits and religious practices affect micro-economic outcomes. It also investigates the role played by access to different—formal and informal—institutions, and especially agricultural markets. The rest of this paper is organized as follows. Section 2 presents a brief overview of the Haitian agricultural sector. Section 3 reviews briefly the literature. Section 4 summarizes the data and models. The sections 5 and 6 respectively establish the empirical evidence—with a special emphasis on human capital, cultural beliefs and market connectedness—and some concluding remarks. The results show that there are high levels of inefficiency in the Haitian agricultural sector. They also show how important is standard years of schooling and (formal and informal) vocational training, non-farming experience on agricultural productive efficiency, but the counterproductive effect of religiosity, cultural traits, location and institutional weaknesses as well.

2. Agriculture as an important sector of the anaemic Haitian economy

204 years ago, Haiti won its independence following an armed slave rebellion. Unique in the world history, it was the only population to have successfully completed such a military prowess against the French army. Despite this glorious past, today one refers to Haiti as perfect example of a State which has missed all revolutions (social, political, agrarian), and hence its economic take-off. Why, despite this military and political achievement, a plan to build a nation and a development model have not materialized? Why does the development process succeed elsewhere and fail in Haiti? By what mechanisms does this country prohibits so effectively economic progress and keeps its population in an abject poverty with an average annual per capita income of 414 USD (current United States Dollar)? What is the role of cultural beliefs in the endemic underdevelopment of Haiti? Why did revolutions of many other peoples led to national development except for that of Haiti?

Several theories and views (the colonialism, the international imperialism, the economic system adopted, the debt for Independence, the cultural beliefs, etc.) have been put forward by sociologists, anthropologists, geographers and historians (see for instance, Benoît 1970; Honorat 1974; Pérodin 1978; Souffrant 1995; Barthélémy 1996; Fridolin 2000; Bernardin 2006). But, these factors do not explain everything and are not all supported by sufficient empirical evidence. The history of Haiti is marked by numerous social, political and institutional problems that reveal the deep nature and structural errors and contradictions accumulated immediately after the independence—and now one may doubt of the real capacity (or willingness) of its elites to develop their country. In 1973, Pierre-Charles, quoted in Pierre-Etienne (1997)—put forward feudalism and foreign domination as obstacles—thought that it is an illusion to look forward to any hypothetical progress as the result of natural evolution after 160 years of independence, since Haiti has exhausted all its possibilities of progress and no longer affords to offer its people even a minimum of welfare.[1] The debate is still open, and to contribute, I focus my attention on a micro-economic perspective and prioritize the agricultural sector in which most of the population derives its livelihoods.

Why does Haiti fail to prevent the fall of the agricultural sector which has been the « cash cow » of the whole economy since the colonial period? This paper does not intend to answer to this question. For a detailed presentation and the evolution of the sector, policies assessment as well, see for example Victor (1999), ANDAH and PAPDA (2000), Jacob (2000, 2006, 2008). Among Caribbean countries, however, Haiti belongs to the group for which agriculture has the highest percentage (almost 30%) in GDP and employment of the labor force (see Mena 1999 for a categorization of the countries in the Caribbean region). However, one should note the predominance of an « internal colonization » state (Hurbon 1999) which has lived of the peasantry just as a predator without ever returning to this area even a share of collected rents. This « mining » process (Mondé 1999), the « hand-placing individuals over the State in lieu of agricultural policies » (IRAM[2] 1990: 15), or the « senseless slaughter of national resources » (Honorat 1974: 258)—consisting in asking to the soil all the wealth the country could claim (Pierre-Charles, 1993)—did not create the conditions for the reproduction of the system itself. However, former constitutional (Chéry-Frédéric 1998) and recent (see Article 247 of the current Constitution of 1987) texts assign to agriculture the main source of national wealth and well-being of the population. If a development model has not existed for the economy, we can say the same about the agricultural sector—which made Haiti the "Pearl of the Antilles" during the colonial regime—and still subject to exploitation comparable to that of a mine.

In the 80s and the 90s, successive governments adopted several structural adjustment programs (SAP) that led a dogmatic dismantling of tariff and non-tariff barriers (see Jacob 2003, 2004, 2006, 2008 for an evaluation of the SAP). Table 1 illustrates the new tariffs applied in the agricultural sector since 1995 even taught a recent adhesion into the Caribbean Common Market (CARICOM) since July 2002. This new orientation which put the farmers in unfair competition and thus aggravating the process of poverty of small holders farmers—which began at least since the slaughter of the pig population (which has been main source of saving for the farmers) in the early 80s because of supposed African swine fever (see Dewind and Kinley 1888). However, despite a massive exodus of the peasants from rural areas—82% of the rural population that lives with less than 2 USD per day (IHSI[3] 2003)--, agriculture continues to play a crucial role in the economy. Currently, it employs

[1] He wrote (see p.135): « Inutile … de nourrir des illusions sur un hypothétique progrès, fruit de l'évolution naturelle. Après 160 ans d'indépendance, Haïti a épuisé toutes ses possibilités de progrès et n'a plus les moyens d'offrir à son peuple ne fût-ce qu'un minimum de bien-être ».

[2] Institut de Recherche et d'Application des Méthodologies de développement

3 Institut Haïtien de Statistique et d'Informatique.

49.6% and 93.3% of the active population respectively throughout the whole country and in rural areas (IHSI 2005a), contributes to 25% of GDP (BRH[4] 2006), and 46% of total food needs of the population (CNSA[5] 2005). Theses indicators are yet declining dramatically over the last two decades. For instance, the contribution to total exports is currently 5.5%—against 50% in 1980 and 10% in 1990 (Ministère de l'Économie et des Finances 1996). Since 1987, taxes on exports have been removed as a requirement of the first 3-years SAP. Crop yields are low and declining. Agricultural productivity (as expressed in added value per farmer), already low, has decreased from 578 USD in the early 80s to 407 USD per annum during the second half of the 1990s (World Bank 2000), a decrease of approximately 30% over fifteen years. The index of per capita food production also decreased steadily leading to a food deficit at the national level. This country—predominantly agricultural and self-sufficient in some productions, about 20 years ago—is becoming increasingly dependent on commercial imports to meet the population needs of consumption. This situation suggests the failure of agricultural and rural development policies. It also points out the nature of the relationships between Governments and peasants that I referred to earlier in this paper.

Tableau 1
Tariffs (%) on agricultural imports in Haiti and in the CARICOM countries, 1998

Products	Haiti	CARICOM (Common external Rates)
Rice	3	40
Wheat Flour	0	5
Sugar	3	25
Maize	15	40
Banana	0	30
Sorghum	0	40
Bean	5	30-35
Pork meat	5	5
Chicken meat	5	40
Milk	0	30-35
Egg	0	40

Source : IRAM and Group Croissance (1998) and ANDAH[6] and PAPDA[7] (2000).

In Haiti, farmers' access to agricultural downstream markets by commercialization is being modulated by inexistence of roads, means of transportation and conservation, etc. as well as unfair competition. In this context of defective or missing institutions, peasants adopt different livelihood strategies (permanent or temporal migration, Local producers Organization (LPO) based on social capital norms, reciprocity and collective actions; off-farms income and employment; cutting trees for making charcoal, etc.) to diversify their income and cope with economic income shocks to which they are continually facing. But, due to extreme poverty and productive endowments inequalities, these options are not the same for all farmers (see Jacob 2008). Therefore, differences in farmers' economic performances are not due to x-inefficiency. Numerous factors might help to explain what rational farmers do not operate on the efficient frontier, given the archaic technology that still prevails in the Haitian agriculture following two centuries of independence. How can one boost this sector, which continues to ensure livelihoods to the most of the population? What can be done to alleviate rural poverty? In an attempt to answer these questions, I empirically analyse farm productive efficiency, and identify the factors—both quantitative and qualitative—that are responsible for its variations between farmers.

3. Literature review

[4] Banque de la République d'Haïti.
[5] Coordination Nationale de la Sécurité Alimentaire
[6] Association Nationale Des Agro-professionnels Haïtiens.
[7] Plate-Forme Haïtienne de Plaidoyer pour un Développement Alternatif.

Since the pioneer works by Mincer, Schultz, and Becker in the 1960s that led to the development of the Human Capital Theory (HCT), education and training are probably among the most studied topics. But economists have been reluctant in studying econometrically culture and religion. In two following sections, I briefly review the related literature.

3.1 Different ways for human capital creation and accumulation

"Human capital" (general education, formal or informal training) investments are well known—at the macro-economic level—as an adequate factor of economic growth and hence, socio-economic development. So a deficiency in human capital stock can convict a poor country to remain poor (Graca, Jafarey and Philippopoulos 1995 ; Azariadis et Drazen 1990 ; Stark et Wang 2002). At the micro-economic level, such investments are profitable for improving the workforce productivity, and are recoverable through wages for its beneficiaries. Human capital variables are (almost) always questioned in frontier models devoted agricultural economics—due to the role of the agricultural sector in the developing countries and the increasingly attention the HCT benefits since the last decades. As FAO (2002) suggests, education is a prerequisite for building a food-secure world, reducing poverty and conserving and enhancing natural resources. Numerous studies—with little exception (Indonesia for example, Hasnah, Fleming and Coelli 2004)—in different parts of the world (Abdulai and Eberlin 2001 ; Bravo-Ureta and Pinheiro 1997 ; Rios et Shively 2005; Featherstone, Langemeier and Ismet 1997; Heshmati and Mulugeta 1996; Alabi 2003; Ogunyinka and Ajibefun 2004; Idiong 2007; Dhungana, Nuthall and Nartea 2004; Larson and Plessmann 2002) show the significant role of human capital in increasing efficiency in agriculture.

By focusing more on individuals dealing with work and training decisions, and hence with current cost and future benefits, the HCT neglects accumulation of knowledge by collective procedures (Gleizes 2000). Obviously, one should note that human capital is also formed in the family (In-Home-Training) since the very young age of the child even before formal education attendance—which is complementary—and parents (especially mothers) reduced, in this regard, their other activities (work, leisure, sleep and other domestic productions) to facilitate this process (Leibowitz 2003). Coleman (1988) argues that social capital in the family (relationship between parents and children) and social capital in the community play a crucial role in the creation of human capital of future generations. He suggests that even if the parents' human capital stock is low, social capital in the family (available for the education of children) can be extremely high as parent-child relationships are strong. Becker (2002) acknowledges the influence of family on the knowledge, skills, values and habits of their children—parents affect the level of education, the stability of marital status, propensity to smoke and get to work on time, and many other dimensions of their children's lives. Honorat (1974) notes the role of values and attitudes—acquired from the cradle—to the maintenance and functioning of current institutions. Human capital is also shaped by other informal mechanisms—particularly in developing countries where access to formal education remains a challenge.[8] These processes are then similar to the "on-the-job training" observed in employment situation by Mincer (see Leibowitz 2003) in that they occur outside the formal framework of schooling. To the extent that one occurs before (and during)—the in-home training--, and others after formal education (the informal training), it is clear that some

[8] For instance, in Africa, where « L'artisan ou l'entrepreneur assume une grande responsabilité vis-à-vis des parents de l'apprenti et il doit veiller à poursuivre, au-delà de la formation professionnelle, l'éducation, au sens large, du jeune qui lui est confié » Bas (1998 : 10). In rural Haiti, non agricultural and vocational non formal training are being organized in the same way, but also by NGOs within development project. Whereas non formal agricultural training are offered by public services of the Ministry of Agriculture (MA) and NGOs, while formal training is developed trough public and private authorized Centres or Institute of Agriculture.

cultural traits and values, transferable from generation to generation, are by-products transmitted through the either production process of human capital. Thus, cultural traits and ethical behaviors are also transmitted within the family and influence individuals' behaviours throughout their lives. As Logossah (2007) suggests, society acts as a sort of primitive "mould" which also transfers to children a « social and family human capital »-- which determines economic and social behavior in their adult life. These assumptions were also used as a basis to test the effect of « religious human capital » (Iannaccone 1990) and Haiti-specific ethical values (transmitted within the family and the community as informal human capital) on the economic performance of agricultural holdings. Innaccone (1990) notes the reciprocal interaction between "religious human capital" that he defines as the familiarity with the doctrines of a religion, its rituals, traditions and members—and the attendance to this religion would enhance satisfaction that in turn determines participation in this religion. This participation is indeed the main source of creating a stock of per capita "religious human capital"—which tend, as participation, to grow according to a decreasing rate over time and according to a U-shape curve with age—which is a specific form of human capital than the individual acquires (through his parents and the institutions that they support) as it would happen in any other human activity.[9] It is therefore understandable why the beliefs and customs—transmitted by parents and religious institutions, contrary to general education and vocational training (Iannaccone 1990)—are kept from one generation to another. It is therefore a form of "family and social" human capital consistent with the previous section aimed at extending conventional human capital to the family and the community. Beyond the school indeed, these entities carry out and maintain culture in a society.

Although, conventional human capital variables (including farming experience and its approximated measure by the farmer's age) are recurring in most of the recent studies, little attention has been given to the empirical study of these above-mentioned forms of human capital which derive from tradition and customs.

3.2 How relevant is culture in economic outcomes?

Until recently, economists have been reluctant to explore the role of culture on economic phenomena. Without testable hypotheses, there is a priori no role of culture on economy (Guiso, Sapienza and Zingales 2006a, b). However, the debate on the relationship between culture and economic outcomes is quite old and might be linked to the 1776 Adam Smith'work on *The Wealth of the Nations*. But the book published in 1905 of the German sociologist Weber, *The Protestant ethic and the spirit of capitalism*—invaluable despite the initial criticisms (see Ferguson 2005)—has greatly contributed to refocus attention on this relationship during the last century. For example, Banfield (1958), Hirschman (1967), or Landes (1998), all saw culture as a fundamental determinant of economic performance—see an excellent review in Guiso, Sapienza and Zingales (2006a, b). What is being changed actually is the introduction of cultural variables into econometric models—since this is facilitated by the development of mathematical tools in economics and the availability of reliable data. Recent works—using several databases and notably the European Value Survey (EVS), the World Value Survey (WVS), or the General Social Survey (GSS)—have been devoted on the determinants of trust (Alesina and La Ferrara 2002) and the various channels (trust, ethnic background, country of origin of the ancestors, religious denomination, etc.) through which culture affect macro- and micro-economic outcomes (Guiso, Sapienza and Zingales 2006a, 2006b; Tabellini 2006).

[9] This is the « *Learning by doing* » principle popularized by Arrow (1962).

First of all, testing the relationship between culture and economic outcomes requires a consensus on a suitable definition of "culture" and a direction for the causation. Or the concept of "culture" encompasses a reality so vast and varied that it becomes difficult to measure its causal effects on economic phenomena.[10] Further, studies on culture have commonly to deal with the reverse causality problem: from culture to economy and from economy to culture (see for example Barro and McCleary 2003, 2004). Guiso, Sapienza and Zingales (2006b: 23) suggest a narrow definition of culture that aims at helping to remove these constraints and facilitate a better understanding of the effect cultural inheritance—considered as exogenous—over economy : "*Those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation*". This definition is adopted here and on this basis religion—as well as religious practices—are considered as exogenous, avoiding thus endogeneity bias in the regressions. As Becker (1996), cited in Guiso, Sapienza and Zingales (2006b: 24) argues, individuals have less control over their culture—which is given to them for their lives and whose depreciation rate is low—than other forms of social capital and cannot alter their ethnic, racial or their family history, although they can (with difficulties) change their country or religion.[11]

Religion is one of the dimensions of culture that is the oldest studied since Weber's work. The merit of this work is to show how economic development is dependent on current culture in a society. The religious phenomena constitute an important component of culture. It is also a complex element that seems almost defy every definition (Isambert 1976). As Weber (1930), cited in Barro and McCleary (2003), argued, religious practices and beliefs have important consequences for economic development. Economists have also avoided its study while other social sciences have failed to appreciate its economic and rational characteristics because of its singular aspects (Stark, Finke and Iannaccone 1996). Weber showed that the reformed Protestant version of Christianism has played a key role in the rise of capitalism in the northern part of Europe (region economically less advanced than the South before the Protestantism reform), while a modern version of the Confucianism encourages economic growth through education and individual achievement.[12] Weber's argument is that development of a rational capitalist behaviour requires to be accompanied by a set of "transformative ideas", which Calvinism and Puritanism have provided (Hammond 1995: 1120). In theoretical approaches on the relationship between economic and social life, and religion, this later is sometimes considered (i) as an endogenous variable that depends on socio-economic development (theory of *secularization* or *modernization*; a high level of development, and per capita education and income is associated with low religiosity)[13], (ii) sometimes as an exogenous variable, which in turn influences economic, political or social activity (*religious market* theory).[14] There is also a reverse causality between the two phenomena, but the second perspective has formed the premise for the Weber's thesis, ie the relationship from religion to economy.

Recently, macro-economic empirical works have used the economic framework for modeling the effects of religious affiliation and beliefs (Barro and McCleary 2003, 2004), motivational or post materialist factors (Granato, Inglehart and Leblang 1996; Levine and Renelt 1992) on economic growth. Granato, Inglehart and Leblang (1996) use a model of endogenous growth on a 25 countries sample and show how culture affects economic growth through the

[10] See for example, Unesco (1989), Friboulet (1998) or Houtart and Rémy (1997) for different definitions.
[11] Even children tend to keep the religious denomination of their parents (but not the professional occupations of them) and even if they have to change their religion during their adult life, they naturally choose the one that comes closest to the religion in which they grew up and the same force drives them to choose their spouse in the same religion—see Innaccone (1990) for a discussion.
[12] Granato, Inglehart and Leblang (1996: 608) argue that the medieval Christianism—as traditional Confucianism—had yet condemned the quest for profit, entrepreneurship and individual accumulation.
[13] The USA remains, in this respect, the great exception (see Ferguson 2005).
[14] For a detailed discussion, see Barro et McCleary (2003, 2004, 2006), Heineck (2001) or Mangeloja (2008).

motivational factors (which, in turn, act on entrepreneurship and effort). Their results show that Asian societies—for instance, South Korea, Japan, China—that emphasize economic success, autonomy and self determination have better economic performances unlike the African nations (Nigeria, South Africa) which emphasizes conformity to social norms and traditional and cultural values (obedience, religious faith, etc.) which tend to discourage economic accumulation by inhibiting efforts for innovation and entrepreneurship. Barro and McCleary (2003, 2004) show that economic growth across countries responds positively to the extent of religious beliefs (notably those in hell and heaven), but negatively to church attendance. Guiso, Sapienza and Zingales (2006a, b) show the role of cultural variables as important as economic variables to explain differences in domestic savings rates or political preferences for redistribution. Tabellini (2006) shows that culture—measured by individual values and beliefs (such as trust and respect of others, as a measure of social capital, confidence and the belief in individual self-determination)—has a causal and positive effect on the current regional economic development in Europe. His findings do not suggest the precedence of formal institutions on culture with which the formers interact to determine, in particular behaviours of economic and political agents. We then assume—following Guiso, Sapienza and Zingales (2006a, b)—that religious affiliation is an exogenous variable that will not change easily during a human life. Therefore, it is feasible to study the causation from religious practices to economic performance. Tomes (1985) stresses that religion is an important dimension in the family environment that includes values, skills, goals and a culture inherited (or acquired during childhood) that influence income, return to human capital and the intergenerational transmission of economic status.

Far from being an accessory component of development, culture can act as an engine or an obstacle with regard to the development process. What individuals want and do is affected by their culture. One is both subject and actor of the development process. Therefore, individuals (and the institutions they put in place), by their behaviours can enhance or block the development process. If economic and political institutions enable countries to make difference in their process of economic development, cultural factors—hardly measurable however—are no less important and their distinctive effects can be measured and compared to those of standard factors of growth (Granato, Inglehart and Leblang 1996). Culture plays therefore an important role in economic choices by affecting risk behavior—which in turn affects, for example, the probability of becoming an entrepreneur (Guiso, Sapienza and Zingales 2006a, b). Nevertheless, several authors point out the role of culture in the growth tragedy in Africa. Onana (1997), for the Sub-Saharian Africa region, note widespread corruption, incivism, mismanagement, nepotism, tribal and ethnic affiliation, assisted mentality, etc. that contrast with modern economic development requirements. In this vein, Logossah (2007) describes risk aversion, faith in help from others, negligence for the earthly life and preference for the present moment that perpetuate underdevelopment trough under-productivity trap, self-defeatism and little concern for innovation efforts.[15] Therefore, culture can act as a handicap for the development process. A fortiori, the lack of economic progress in Haiti for over 200 years after its independence seems to denounce—as mentioned by different authors (Benoît 1970; Honorat 1974; Pérodin 1978; Bazile 1979; Souffrant 1995; Barthélémy 1996; Fridolin 2000)—a causal link (potentially negative) of culture on economic outcomes "Telle culture, tel niveau de développement" argued Honorat (1974 :260). Observers often describe Haiti as a "tragedy of the commons" where individualistic interests prevent from any public goods perspective (see e.g. White and Runge 1994).

[15] For a view on the dynamism of « Negro-African » cultures in Haiti and how they are kept unchanged better than any other regions of the world, see Benoit (1986) and Aristide (1979). See also Souffrant (1995) for a sociological argument on the absence of own conscience of farmers who reproduce what they ancestors have always done and the reasons for these religious practices.

In the agricultural sector, Audibert, Mathonnat and Henry (2003) and Audibert (1997) are the only two refered studies devoted to the social and cultural determinants of efficiency. Audibert (1997) show the positive effect of family and ethnical cohesion among the rice producers in Mali. Whereas, Audibert, Mathonnat and Henry (2003) control for Muslim religious affiliation (without significant findings) but show that belonging to the Tagbana ethnic group—the more traditional one—make the farmers less efficient in Ivory Coast.[16] Empirically, at the micro level, either in developed and developing countries, little attention has been paid to the relation between religiosity— fundamental component of culture which denotes religious practices—and economic performance. Therefore, the relationship Culture-Productivity-Efficiency should be further investigated. To help to fill this gap, this paper uses a set of cultural and religious indicators from the rural Haitian context and empirically tests their effects on productive efficiency. Of course, cultural beliefs are specific to every country. In some cases, they may stimulate development process or micro-performances trough individual economic behaviour more in line with the prerequisites of development achievements. While in other cases, they may handicap economic progress. We do nevertheless agree that no culture is superior to another. However, with respect to the prerequisites of modern economic development, we hypothesize that observed cultural traits and religious behaviours—notably beliefs in ancestral spirits, in a life after death, or in God to improve everything in the farms, etc. can act as a disincentive to risk taking, innovation and investment effort in agricultural productivity—might (negatively) affect productive efficiency in rural Haiti. However, culture appears as a "black box" (Tabellini 2006: 32) and more micro-economic studies are needed to clarify remaining grey areas.

4. Data and Methodology

4.1 The data

The data used in this paper come from a unique primary cross sectional data set of agricultural households—collected in 2006 in 3 geographical departments (Sud, Artibonite and Ouest), 13 communes and 53 communal sections. The respondents have been randomly selected after a multistage procedure for the choice of heterogeneous agro-ecological location. The survey has been conducted by 10 trained agents according the face-to-face method of data collection who reported the answers into the questionnaire. This pre-coded and tested questionnaire allow to collect data on the social background of the farmers, their access to institutions (irrigation, credit, training, technical support, remittances, etc.), cultural and religious traits, financial agricultural outcomes (including crops and livestock), non agricultural self-employments and wage for the agricultural year 2005-2006 and other relevant information.[17] It contains both closed and open-ended questions that take 4-5 hours long to be administered. Usually the interviews were conducted in the farmer's home in the evening. After removing questionnaires with inconsistent, unreliable or incomplete information, the sample size was set at 815 observations to which are related the following

[16] On another vein, White and Runge (1994) first attempted to empirically study the correlation from individuals' religious affiliation to participation in public collective action in Haiti. They distinguish between those who expressed Catholic, Protestant and Voodoo affiliation. Or as Barthélémy (1996) and others argue, one should not distinguish between Catholic and Voodoo as they are two facets of the same medal. However, White and Runge (1994) do not report any significant effect of religion affiliation on public collective action in Maissade (Haiti). Nevertheless, one should be aware that several anti-voodoo crusades by different Governments and the Catholic Church (see Rigaud 1953; Houtart and Rémy 2001; Francois 2005) do not permit an open expression of the voodoo religious affiliation. That is, a potential bias remains. In my own survey, few respondents express explicitly voodoo affiliation (8%) or both catholic and voodoo affiliation (1.7%). The Catholics, Protestants and Atheistic are respectively 52.8%, 25% and 11.8%. Therefore, it is more suitable to isolate Protestants from the others. In this vein, Métraux (1977) suggested that Protestants refuge in this religion as to discontinue with voodoo practices.

[17] A full description of the questionnaire and the questionnaire itself—9 sections and 226 questions—can be found in Jacob (2008).

empirical results.[18] Tables 1 and 2 present summary of statistics of the survey (see Table A in Appendix A for definition of the variables in the inefficiency effects model). One should note for instance a low level of formal education (less than 4 years) and small farm size (1.20 ha on average) with dominant sharecropped and rented tenure. Off-farm incomes account for 24% of total income, while almost 50% of the respondents are facing difficulties for down-stream market connectiveness.

Table 2
Descriptive statistics for variables in the inefficiency models

Code	Number of observations	Mean	Standard Deviation (SD)
Inefficiency score	815	0.785520	0.221149
Age	815	46.85399	13.67046
Masc	815	0.928834	0.257259
Expna	815	6.542331	11.07747
Alp	815	0.131288	0.337923
Naec	815	3.949693	4.086133
Primi	815	0.321472	0.467328
Primc	815	0.060123	0.237860
Postprim	815	0.241718	0.428387
Fpaf	815	0.093252	0.290963
Fpai	815	0.310429	0.462954
Fpfha	815	0.078528	0.269165
Fpiha	815	0.282209	0.450351
Partrel	815	0.733742	0.442272
Prieredieu	815	0.981595	0.134493
Apmort	815	0.533742	0.499166
Obamel	814	0.820639	0.383890
Espnc	815	0.085890	0.280373
Sacrif	815	0.114110	0.318141
Masdevl	815	0.181595	0.385747
Masstr	815	0.230675	0.421523
Uec	815	0.611043	0.487813
Usa	815	0.458896	0.498614
Fvi	815	0.532515	0.499248
Ptail	815	0.640000	0.480000
Pms	815	0.110491	0.116112
Atp	815	0.598773	0.490448
Transf	815	0.346012	0.475989
Rrnartc	814	0.240479	0.321768
Credf	815	0.047853	0.213586
Credi	815	0.179141	0.383706
Endet	815	0.079755	0.271079
Npm	815	5.596319	3.091200
Ima	815	0.622859	0.219340
Artibonite	815	0.332515	0.471404
Ouest	815	0.477301	0.499791
Dmmp	815	0.494479	0.500277
Montagne	815	0.127607	0.333857
Etae	815	0.025767	0.158536
Etaos	815	0.056442	0.230914
Irr	815	0.652761	0.476385
Elect	815	0.309202	0.462449
Anac.	814	0.4361179	0.4962072

Notes.—The average value for dummies variables indicate the proportion of the farmers who answered « Yes » to a question.

4.2 The empirical models

4.2.1 Measuring technical efficiency

The frontier production methodology has become increasingly pervasive in the empirical literature over the last two decades (for a survey, see for example, Bravo-Ureta et al. 2007; Thiam, Bravo-Ureta and Rivas 2001; Coelli 1995). The two most used groups of frontier

[18] But, due to missing value after transformation in certain variables, the number of observations is less in certain regressions.

models for the efficiency measurement are: parametric (deterministic and stochastic) and non-parametric or mathematical programming techniques (Data Envelopment Analysis, DEA). They differ in assumptions imposed to the data. The deterministic models assume that any departure from the frontier is due to inefficiency while in the stochastic frontier, departure is due to statistical noise resulting from factors outside the firm's control (Bauer 1990; Rahman 2007; Bravo-Ureta et al. 2007). Whereas the DEA-approach uses input and output data to construct a piece-wise frontier surface over the data (a detailed description can be found in Coelli 1996). It assimilates every departure from the frontier to inefficiency—confusing therefore random error, missing variables, etc. with inefficiency (see, among others, Puig-Junoy and Argilés 2000). But DEA allows dealing with multi-output/multi-input production processes. Furthermore, it doesn't impose any functional form to the data. In developing countries, farms operate as multi-outputs firms but this fact has received little attention in the frontier literature. India is the most studied country, whereas rice is the most studied crop (Bravo-Ureta and Pinheiro 1993). Although, an aggregated monetary measure of multi-output (see Appendix C) is used in this paper, we however prefer—like others (e.g. Audibert, Mathonnat and Henry 2003; Featherstone, Langmeier and Ismet 1997; Rios and Shively 2005)—a two-stage methodology in order to avoid unfairly impose a (potentially biased) production technology (Wilson 2005) to the entire sample that is observed as very heterogeneous in the rural Haiti.

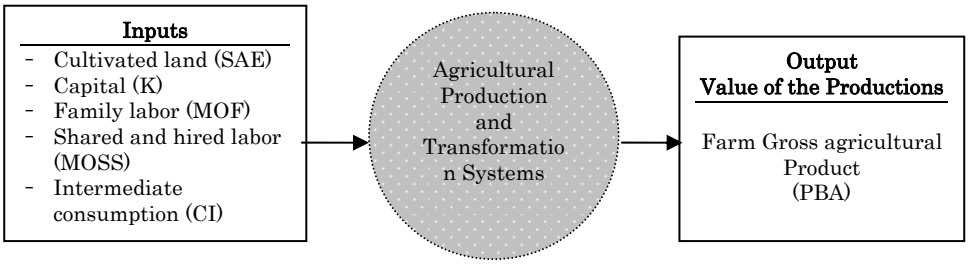
Figure 1
Map of Haiti

Firstly, a DEA model (1) allows to measure under CRS efficiency score for every farm. The CRS-hypothesis is preferred here due to the very simple technology observed in the Haitian agriculture during the survey and well known as stagnant during all the 200 years of history of the country. We also prefer an *input-orientation* due to the fact farmers do have a better control on their inputs rather than on their outputs subject to natural factors—weather, topography, soil quality, etc.—and adverse institutional, technical and economic environment.[19] Technical efficiency under CRS is a better measure of agricultural productivity (Helfand and Levine 2004) while monetary measure of output has implications for the interpretation of

[19] The choice of an orientation in a DEA model depends on the situation under analysis (de Lancer 1999), but also on the degree of control farmers have on the variable involved in the production process (Brázdik 2006).

inefficiency scores which therefore reflect a mixture of technical and allocative inefficiency in production (Puig-Junoy and Argilés 2000).

Figure 2
Outline of the DEA production model



Source : The author.

In the DEA-model, we relate—as outlined in figure 2—five inputs to the annual Gross agricultural product (PBA), measured in 2005-2006 Haitian Gourdes (HTG), as a measure of output. The inputs are : the cultivated land (SAE, in Ha)—as a fixed asset--, the capital expenditures (K, in HTG), the family labour (MOF, in average annual hours, AAH)[20], the shared and/or hired labour (MOSS, in average annual hours)[21], and intermediate consumptions (CI, in HTG) such as fertilisers, pesticides, seeds, food for the cattle, etc. The dual DEA model can be written as follows:

$$\min_{\Theta,\lambda} \Theta - \varepsilon\left(\sum_{i\in I_D} s_i^- + \sum s_r^+\right)$$

$$\text{subject to :}\begin{cases} \Theta x_{i1} - \sum_{j=1}^{n} x_{ij}\lambda_j - s_i^- = 0;\ i \in I_D \\ x_{i1} - \sum_{j=1}^{n} x_{ij}\lambda_j - s_i^- = 0;\ i \in I_N \\ -PBA_{r1} + \sum_{j=1}^{n} PBA_{rj}\lambda_j + s_r^+ = 0 \\ \lambda_j \geq 0, \varepsilon > 0 \\ j = 1,2,...,n = 815;\ r = 1 \\ I = (1,2,...,m = 5) = I_D \cup I_N \text{ avec } I_D \cap I_N = \varnothing \end{cases} \quad (1)$$

Θ_1 is the efficiency score for the targeted *j=1* farm and varies between 0 and 1, λ_j a weight vector.[22] PBA_j is the monetary value of the total output for the farm *j*, i=SAE,MOSS,MOF,F,CI refers to the five inputs used by farm j. I consider SAE as a non

[20] Along the line of Sidhu and Bananante (1981), quoted in Abdulai and Eberlin (2001), we treat hours worked by females, child under 15 years and other non- adult persons in the household contributing to agricultural work as half of that of active men.

[21] The Haitian peasants have a very long tradition of exchanging their labor force to help each others in a reciprocal (rotating) and democratic way. They then set up and participate in labor exchange groups—to which we refer hereafter as Masstr—see Noriac (1999), Noriac and Smucker (1998) for description, and Jacob (2008) for impact measurement on economic outcomes.

[22] Solving the model for j=1 gives place to a sequence that affects all j by the weighting system.

discretionary input (see Cooper, Seiford, and Zhu, 2004 for analytical details) in the short run. s_r^+, s_i^- are slack variables while I_D and I_N refer respectively to the discretionary and non discretionary subsets of inputs. $\varnothing$ is empty, and ε is a scalar.[23] I use the DEA-Excel-Solver package (Zhu 2003)[24] to solve the envelopment model (1).

4.2.2 Econometric analysis of the determinants of inefficiency

Secondly, we use (essentially) doubly censored and truncated Tobit models to study inefficiency—as a difference between 1 (100%) and the estimated efficiency score, ie the distance between a given farm and the best practice frontier—variability among the farmers. The dependant variable ($Ineff_i$ =1 — efficiency score) is censored between 0.00 and 0.99343. Thus the OLS are inconsistent and would lead to biased estimates. The two-limit Tobit model suggested by Rosett and Nelson (1975)—see also Maddala (1983) and Greene (2003)—is more appropriate for calculating unbiased estimates for the equation.[25] Another reason which justifies the Tobit model is that the dependent variable has a number of its values grouped around a limit-value (McDonald and Moffitt 1980: 318)—here the lower bound. I specify the following models where $Ineff_i$ is latent variable.

$$Ineff_i = \begin{cases} L_1, \text{ if } Ineff_i^* \le L_1 \\ Ineff_i^*, \text{ if } L_1 \le Ineff_i^* \le L_2 \\ L_2, \text{ if } Ineff_i^* \ge L_2 \end{cases} \qquad (2.0)$$

$$Ineff_i^* = CHC\alpha + FSHC\beta + MIA\gamma + X\delta + u_i \qquad (2.1)$$

That is, we claim that various variables—that we group in different categories--, some of which are farm-specific, and others specific to the managerial capabilities of the household head or relative to the technical, institutional and economic environment, but also to the cultural beliefs. This last dimension, as mentioned earlier, is so far neglected in most studies devoted to the determinants of technical efficiency, perhaps due to lack of databases. The inefficiency model we are attempting to run is (2.1) for which Table A (Appendix A) presents definitions of the selected explanatory variables. CHC is a vector of conventional human capital variables (age, gender, experience, schooling[26], formal (and non formal), agricultural (and non agricultural) vocational training), FSHC a vector of family, religious and social human capital (cultural beliefs; religious preference, attendance and practices, LPO and labor exchange group membership). MA refers to institutions and markets access (access to irrigation, electricity, credit and technical assistance, access to downstream market by commercialisation, location, and other environmental characteristics variables) and X a vector of farm-specific factors (such as technologies use, tenure, off-farm income, remittances, time regime, and family size). u_i is an error term i.i.d. $N(0, \sigma^2)$. L_1 and L_2 are respectively the lower and upper bound of the dependent variable in Tobit models. α, β, γ and δ are the

[23] The role of ε –which cannot be approximated by a finite value—is to ensure that no weight in the primal takes a zero value. In standard linear programming software, it takes the value 10^{-6} (de Lancer, 1999).

[24] See Barr (2004) for an overview of comparative technical performances and a state-of-the-art of software used in the DEA model resolution. See also Herrero and Pascoe (2002) and Wilson (2005).

[25] For purposes of comparison and in order to test the robustness of the first six Tobit models, I regress several measures of inefficiency upon a set of explanatory variables. In the Appendix B, I report a battery of alternative (Instrumental variables (IV)—based regressions dealing with modification in the dependent variables and the matrix of explanatory variables.

[26] I decomposed the Haitian educational system in order to control for every level—see Appendix A for variables definitions.

unknown vectors of parameters to be estimated. i=1, 2, …, n is the number of farms in the sample.

5. Empirical evidence and discussions

5.1 Non parametric measure of technical efficiency

Descriptive statistics for the variables of the DEA model are reported in the first part of Table 3. Before resolving this model, it is important to us to question not only partial correlations between the output and every input, but also between the inputs themselves to make sure that they are more correlated to the output than between themselves. These correlations are shown in Table 4. First, there is no evidence that two inputs are correlated enough to represent the same variable. Second, in general, the inputs are more correlated with PBA than between themselves. Thus, it is not necessary to eliminate among them in order to increase the discriminating power of the DEA model—because the variables can help to differentiate among the farms—and the correlation coefficients do not seem to capture something else than their own contribution to PBA. Therefore, the resolution of model (1) leads to the results shown in the second part of Table 3.[27]

Table3
Statistics summary and mean efficiency scores from the DEA model

Variables	Unity	Mean	Standard deviation	Minimum	Maximum
PBA	HTG[a]	54881.2749	7843.2710	905.0000	708550.0
SAE	Ha	1.186245	1.160814	0.010000	10.11000
MOSS	AAH	336.7853	451.8519	0.000000	3840.000
MOF	AAH	2738.7706	1564.2600	70.00000	15336.00
CI	HTG	4784.2157	7843.2710	0.000000	107160.0
K	HTG	1610.2502	3926.8588	0.000000	62000.00
Results of the DEA model (Technical efficiency scores)					
Whole sample		.2145	.22115	.01	1.00
Artibonite		.1843	.15822	.01	1.00
Ouest		.2580	.26371	.02	1.00
Sud		.1581	.17267	.01	1.00

Source : Survey (2006) and calculations by the author.
Notes.—[a]Exchange rate: 1 USD = 40 HTG in average during the agricultural year surveyed 2005-2006.

Table 4
Partial correlation between inputs and output variables for the DEA model

	PBA	K	CI	MOF	MOS	SAE
PBA	1					
K	.511**	1				
CI	.437**	.233**	1			
MOF	.085*	.069*	.153**	1		
MOS	.243**	.196**	.452**	.189**	1	
SAE	.393**	.296**	.349**	.137**	.391**	1

Source : The author's calculations.
Notes.--** (*) significant at 1% (5%). Number of observations = 815.

Results from model (1) show that only 27 farmers (3.3% of the sample) are technically fully efficient, i.e operate on the efficient frontier (technical efficiency=100%) by minimizing their use of input for a given level of output. This is a proof that access to modern technology is very difficult in this subsistence agriculture. If we add to this group all the farms with a level of efficiency of at least 80%--assuming that very little difference exists between them and the fully efficient subgroup--, we observe therefore a group of 40 farmers (fully or partially) efficient (5% of the whole sample). It should be noted that 25% of farmers operate at an efficiency level less than 8%, 50% at less than 14% and 75% of farmers less than 26%. The interquartile gap (Q3-Q1) is 18 percentage points. It shows that by removing the influence of extreme values of the lower and upper quartile—50% of all the data—the level of efficiency remains very low. The Ouest department presents—all things being equal—the best score of

[27] Individual DEA score can be obtained from the author upon request.

technical efficiency (mean = 25.80%). We do not observe any significant influence of the size on the efficiency level (Table 6). Small farms are predominant (64% of the sample). Most of them (65.4%) operate at an efficiency level of less than 20%. Unlike results reported by Hesmati and Mulugeta (1996) or Puig-Junoy and Argilés (2000), there is no significant difference between the farm size and their technical efficiency. But between farm size classes, on average medium and large size farms tend to be virtually more totally (or partially) efficient by 2-5 percentage points (Table 6).

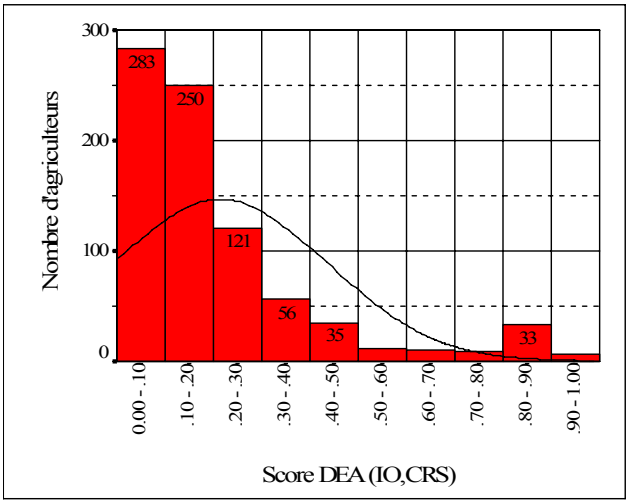
Figure 3 outlines the asymmetrical distribution of the farmers according to their level of efficiency and therefore suggests the existence of a high level of inefficiency in the agricultural sector in Haiti. The productive efficiency varies between 0.66% to 100% over the three departments under study. Its average value (21.45%) suggests a large reserve of efficiency in the current state of technology used. This implies at the same time that to be fully efficient, farmers should reduce their average productive inefficiency by about 79%, i.e. reduce (in average terms) especially their consumption of land, capital, family labour, hired and exchanged labour, and other variable costs without reducing their level of output—or increase their output with regard to their current level of consumption of different inputs.

Table 6
Farm size and productive efficiency

Productive efficiency		Farm size (Hectare, Ha) Small (<1.18 Ha)	Medium (1.18 - 3 Ha)	Large (>3 Ha)	Total
< 20%	n	351	146	36	533
	%	67.2%	63.5%	57.1%	65.4%
20-40%	n	108	52	17	177
	%	20.7%	22.6%	27.0%	21.7%
40-60%	n	30	13	3	46
	%	5.7%	5.7%	4.8%	5.6%
60-80%	n	12	4	3	19
	%	2.3%	1.7%	4.8%	2.3%
80-100%	n	21	15	4	40
	%	4.0%	6.5%	6.3%	4.9%
Total	n	522	230	63	815
	%	100.0%	100.0%	100.0%	100.0%
Chi2=6.56 ; p-value = .58					
% of total observations		64.0%	28.2%	7.7%	100.0%
Productive efficiency by group					
Mean		.2055	.2235	.2559	.2145
Standard Deviation		.20899	.23905	.24756	.22115

Source : Author's calculations.

Figure 3
Number of farmers by level of efficiency



Source : The author

With such performances, Haitian agriculture is among the most inefficient ones in the developing world during the current decade, all methods of evaluation considered (see Table 7).[28] However, without assuming, following Boussard (1987) or Duflo (2003), that farmers are always infallible optimizers—several reasons invite us to believe that factors characteristics of the environment in which farmers operate are primarily responsible. Therefore, the challenge is to know why rational producers differ both in their productive performances and very few are operating on the efficient frontier. This means that some hidden constraints limit their feasible productions and then provides an appropriate framework for an econometric multivariate analysis of the determinants of technical inefficiency, a task to which is devoted the next section.

Table 7
Technical efficiency in the agricultural sector in selected countries

Country (or territories)	Mean of technical efficiency (%)	Number of observations	Frontier type	Return to scale*	Year	Author(s)
Haiti	21,45	815	DEA	Constant	2008	Jacob
Dominican Republic	70	60	SPF	--	1997	Bravo-Ureta and Pinheiro
Spain	64	150	SPF	--	2000	Puig-Junoy and Argilés[29]
Nigeria (Ondo State)	67	67	SPF	--	1999	Ajibefun and Abdulkadri
Nigeria (Cross River State)	77	56	SPF	--	2007	Idiong
USA (Kansas)	78	195	DEA		1997	Featherstone et al.
Côte d'Ivoire	71.9	242	DEA	Constant	2003	Audibert et al.
Ouganda	65	288	SPF	--	1996	Heshmati et Mulugeta
Nepal	24	76	DEA	--	2004	Dhungana et al.
Bangladesh	86(91)	150	DEA	Constant(Variable)	2003	Wadud
Indonesia (West Sumatra)	66	70	SPF		2004	Hasnah et al.

Source : Compilation by the author.
Notes.--* adopted before the resolution of DEA model. SPF = Stochastic production frontier.

5.2 The determinants of productive inefficiency

Partial correlations were computed between the regressors in the inefficiency effect model, and the inputs in the DEA model to avoid biased second stage estimators (Audibert, Mathonnat and Henry 2003), but also between the regressors themselves in the Tobit models—in order to remove one of the variables highly correlated with each other and to avoid (multi)colinearity bias.[30] The first four models—in which are introduced at each stage a group of additional variables—do not include interaction terms (Table 8). The gradual introduction of variables allows, in each sequence, to control for the influence of a group of factors on technical efficiency. Model 4 shows the general pattern and includes the 42 explanatory variables of interest. Model 5 presents the results of the general pattern in the presence of interaction terms between selected variables. Model 6 is an alternative regression where a double truncation permits to remove from the sample the efficient holdings and the most inefficient one in order to test the robustness of the results from

[28] See, for example, Bravo-Ureta and Pinheiro (1993) and Bravo-Ureta et al. (2007) for a broader view and a compilation of empirical estimates of technical efficiency in the agricultural sector of developed and developing countries. Thiam, Bravo-Ureta and Rivas (2001) show that the number of variables in the model, the type of crops, the type of frontier (stochastic, deterministic or nonparametric), or the sample size do not affect significantly the estimates of mean technical efficiency across a sample of estimates.

[29] These authors present a compilation of recent empirical studies measuring individual farm technical efficiency using SPF on panel data and analyzing the determinants of inefficiency.

[30] For example, a dummy variable (Anac) indicating the participation in off-farm and non-farm work (or self-employment) has been removed from the second stage models due to its high correlation with the Non agricultural income/Total income ratio—r=0.852469 ; p=0.00—and with the non farming managerial experience (Expna) (r=0,649348 ; p=0,00). It's quite similar for the farming experience (Expa) which is highly correlated with the holder' age (r=0.7955 ; p=0.00).

previous five models. It should be noted that a positive (negative) sign on a parameter in the inefficiency model suggests that the variable associated has a negative (positive) influence on productive efficiency, since the dependent variable is an inefficiency measure.

Table 8
Determinants of productive inefficiency—Preliminary estimates

	Model 1			Model 2			Model 3			Model 4		
Explanatory variables	**Coeff.**		**Err. Stand.**	**Coeff.**		**Err. Stand.**	**Coeff.**		**Err. Stand.**	**Coeff.**		**Err. Stand.**
Constant	0.771626		1.142541	1.303242		1.133210	1.433910		1.125480	1.109636		1.100779
(1) Variables of Human Capital												
Log(Age)	0.069439		0.607798	-0.298227		0.602808	-0.484448		0.600782	-0.225620		0.587264
Log(Age)^2	-0.012415		0.080546	0.037552		0.079901	0.065383		0.079452	0.030077		0.077683
Masc	-0.047387		0.031262	-0.050541		0.031205	-0.051727	*	0.029269	-0.033681		0.028864
Expna	0.000117		0.001891	0.000216		0.001868	-0.006237	***	0.002290	-0.005214	**	0.002221
Expna^2	1.39E-05		4.69E-05	8.75E-06		4.63E-05	0.000127	***	4.93E-05	0.000106	**	4.78E-05
Alp	0.022238		0.024023	0.013970		0.023734	-0.017884		0.022260	-0.019637		0.021538
Primi	-0.006663		0.019326	-0.010491		0.019221	-0.014496		0.018067	-0.013698		0.017606
Primc	-0.082299	**	0.035071	-0.089915	***	0.034715	-0.064996	**	0.032369	-0.064811	**	0.031361
Postprim	-0.069620	***	0.024367	-0.077565	***	0.024519	-0.068285	***	0.023761	-0.051724	**	0.023464
Fpaf	0.015148		0.028105	0.011949		0.028250	-0.001325		0.026969	-0.009527		0.027104
Fpai	-0.021060		0.017205	-0.019969		0.017928	-0.016779		0.016960	-0.016275		0.016527
Fpfha	-0.078571	**	0.031787	-0.070254	**	0.031660	-0.080283	***	0.029683	-0.090394	***	0.028766
Fpiha	0.006983		0.019122	0.008751		0.019036	-0.017070		0.018048	-0.008462		0.017521
(2) Variables of family and social human capital												
Partrel				0.017901		0.018435	0.014905		0.017209	0.002447		0.017048
Prieredieu				0.080683		0.058179	0.122722	**	0.054196	0.106694	**	0.052485
Apmort				0.009684		0.016585	0.008390		0.015512	0.001960		0.015137
Obamel				0.053223	**	0.021394	0.055484	***	0.020023	0.042556	**	0.019404
Espnc				0.012827		0.030970	0.010962		0.028859	0.010798		0.028026
Sacrif				-0.039550		0.027633	-0.031730		0.025739	-0.015143		0.025232
Masdevl				0.015300		0.022429	0.013598		0.020936	0.011548		0.020965
Masstr				0.027842		0.020726	0.025146		0.019317	0.018602		0.018863
(3) Variables of farm-specific technology used												
Uec							0.065052	***	0.016028	0.065139	***	0.016110
Usa							0.029759	*	0.016215	0.016688		0.016076
Fvi							-0.019805		0.014986	-0.016647		0.014618
Atp							0.052069	***	0.015539	0.050975	***	0.015209
Transf							-0.037514	**	0.015781	-0.023187		0.015587
Rrnartc							-0.116633		0.114627	-0.151967		0.111602
Rrnartc^2							0.430373	***	0.127482	0.428794	***	0.124061
Log(Npm)							0.079449	**	0.037294	0.075980	**	0.036206
Log(Npm)^2							-0.021108		0.013648	-0.019836		0.013236
(4) Variables location and access to institutions												
Ima										-0.104605	***	0.034168
Dmmp										0.034131	**	0.014768
Artibonite										-0.020633		0.022996
Ouest										-0.081538	***	0.020854
Montagne										0.032732		0.024702
Etaos										-0.034133		0.033716
Etae										0.065965		0.046036
Irr										-0.060923	***	0.018224
Elect										0.017000		0.016383
Endet										0.036167		0.025981
σ	0.223359	***	0.005708	0.219492	***	0.005607	0.203219	***	0.005189	0.195578	***	0.004994
Log likelihood.	14.30332			29.51450			91.96552			122.7081		
N	815			814			813			813		
Left censored observations	27			26			26			26		
Right censored obser.	1			1			0			0		
Non censored observ.	787			787			787			787		

Source : Author' estimates.
Notes.—Dependent variable= (1—productive efficiency). All models are doubly-censored Tobit.
***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) and 10% (p<=0.1) respectively.

5.2.1 Human capital and productive efficiency

With regard to the attention economists devoted, since the last 40 years in the measurement of impact of human capital, it was appropriate to investigate in the first regression the influence of different variables of general education and training (both formal and non formal, but also agricultural and non agricultural) on productive inefficiency. From the first to the sixth model, certain components of human capital have significant and positive effect. But not all segments of Haitian education system have a significant contribution in reducing the productive inefficiency. With little exception, the first 6 models show that among all variables under analysis, three lead to efficiency gains: (i) a level of formal schooling equivalent to complete primary education (Primc)—or 6 standard years of education--, (ii)

post-primary education, secondary or university (Postprim), and (iii) the access to a formal and non agricultural vocational training (Fpfha). This latter variable is the only one which positively and significantly impact efficiency across all the first 6 models. Undoubtedly, the vocational training allows the farmers to develop their entrepreneurial and innovation skills, which lead them to take more risk both in the agricultural and the non-agricultural sectors. It may be assumed that the formal non-agricultural training gives access to incomes less influenced by random and economic shocks than in the agricultural field. This may more easily help to finance agricultural activities, and then lead to less inefficient decisions.

The last two models (5 and 6) show that a level of incomplete primary education (Primi) affect positively the technical efficiency of holdings. Vocational trainings in the agricultural field, whether formal or informal, have not (in some cases) the expected sign and are not statistically significant. It seems that these trainings are unable to act independently in the desired direction. However, adult literacy programs (Alp) do not allow to reduce significantly the productive inefficiency in agriculture. Farmers who have attended to at least one of these programs are not different from their counterparts who never followed such programs. This suggests a lack of effectiveness of these programs—yet carried out drum beating for over fifty years—which are offered without any targeting of beneficiaries whose business sectors are quite different. There is no doubt that illiterate or uneducated farmers need a literacy program but this must be different from that devoted to urban artisans or women active in the informal (urban or rural) sector.

The age of the operator does not have any significant contribution in the first 5 models. While, in all the models, the productive efficiency is directly related to gender (Masc) of the holder, but this has no statistically significant power. However, agricultural activities benefit from years of accumulated experience in a non-agricultural activities (Expna) (models 3, 4, 5 and 6), and in any case, the expected negative sign is obtained. That is, farmers better endowed in human capital have parallel non-agricultural activities; accumulate experience and skills that allow them to be more efficient in farming. This variable has also a significant quadratic component which informs about the non-linearity of the relationship. The technical efficiency therefore increases with years of experience in non-agricultural economic activities but at a decreasing rate. The results about a positive impact of formal schooling on technical efficiency are consistent with the recent economic literature on frontier models and confirm my hypotheses. But this paper also confirms—and this is one of the major contributions of this paper—the positive effect on the agricultural productive efficiency of entrepreneurial skills developed (through experience or training) outside the agricultural sector. This interference between, beneficial to agricultural activity, between general, agricultural and non-agricultural human capital—even for non-formal training—confirms the hypotheses on this subject (see Table A). The data therefore confirm that productive efficiency in the holdings is positively and significantly influenced by any vocational training (or by a combined effect of agricultural and non-agricultural human capital) that the farmers has access to.

The square of age and non farming experience allows to capture life cycle effects. They increase technical efficiency but at a decreasing rate. Age acts as a significant factor—with convex profile—positively affects productive efficiency until a threshold of 42 years beyond which, holder's age becomes a handicap to efficiency. Therefore, age appears as a good « proxy » of risk aversion of the farmers. One should be aware that older operators and then, more experienced in farming, are less educated and more averse to competition and risk. The age group 41-50 years marked a threshold changeover in the behaviour of farmers related to emulation and aversion to competition. (see Jacob 2008). In other words, the old technology conservatism of the most experienced does not contribute to inefficiencies reduction. The final model (Model 6; Table 11) confirms that farmers aged under 42 years seem to take more

risky initiatives that have boosted productive efficiency.[31] A convex relationship is also observed with regard to non-agricultural experience and the non-farm income to total income ratio. The former reflect that non-agricultural experience over than 23 years is no longer profitable to agricultural activity—which poses the problem of human capital obsolescence.[32] While, beyond a certain threshold the off-farm activity seems to absorb too long time and becomes a factor that increases inefficiency. Indirectly indeed, the precariousness of agricultural equipment—by requiring much time of working—appears as a handicap to improving incomes in rural areas.

Tableau 9 (Model 5)
Tobit estimates of the determinants of inefficiency—Understanding terms of interaction effects

Explanatory Variables	Coefficient	Std. Error
Intercept	1.485995	1.110369
Log(Age)	-0.413511	0.591015
Log(Age)^2	0.053791	0.078042
Masc	-0.038178	0.028860
Expna	-0.005091**	0.002210
Expna^2	0.000104**	4.73E-05
Alp	-0.022899	0.021510
Primi	-0.010870**	0.018432
Primc	-0.027102	0.034321
Postprim	-0.045687	0.029814
Fpaf	0.030978	0.039980
Fpai	0.010573	0.019130
Fpfha	-0.077655**	0.032538
Fpiha	0.016563	0.020456
Partrel	0.002184	0.016844
Prieredieu	0.097921*	0.051788
Apmort	0.005546	0.015029
Obamel	0.045525**	0.019236
Espnc	0.005193	0.036954
Sacrif	-0.020103	0.028896
Masdevl	0.023485	0.020924
Masstr	0.015695	0.018917
Uec	0.083122***	0.019582
Usa	0.052511**	0.025979
Fvi	-0.030182*	0.018109
Atp	0.050101***	0.015102
Transf	-0.023047	0.015517
Rrnartc	-0.144713	0.111230
Rrnartc^2	0.413327***	0.123615
Endet	-0.000940	0.058155
Log(Npm)	0.075123**	0.035792
Log(Npm)^2	-0.019155	0.013088
Ima	-0.106154***	0.033904
Artibonite	-0.018982	0.022866
Ouest	-0.079378***	0.020804
Dmmp	0.032714**	0.014633
Montagne	0.038344	0.025091
Etae	0.081697	0.057457
Etaos	-0.123617	0.105535
Irr	-0.071262***	0.018581
Elect	0.019266	0.016225
Fpaf*Fpfha	-0.053694	0.066454
Fpai*Fpiha	-0.075800**	0.033014
Fpaf*Primc	-0.250477***	0.098736
Fpaf*Postprim	0.068102	0.056246
Jeune*Fpaf	-0.115542**	0.056879
Irr*Endet	0.045117	0.065231
Prfvd*Naec	-0.003901	0.003500
Etae*Etaos	0.041520	0.101713
Irr*Endet*Etaos	-0.111946	0.117324
Irr*Etaos	0.110714	0.113318
Uec*Usa	-0.052999*	0.031776
Montagne*Etae	-0.148774	0.160489
Montagne*Etaos	0.030502	0.124676
Masdevl*Masstr*Etaos	-0.004697	0.077396
Sacrif*Espnc	0.017878	0.055801

[31] The age indicates indeed a stage in the life cycle of the individuals (Stafford, 1983, quoted in Kimhi, 1994: 832), and the shorter the duration of the planning horizon of the older acts as a disincentive for effort in technical efficiency. Our results support those of Abdulai and Eberlin (2001) on non-linearity effects of the life cycle on technical efficiency. Norris and Battie (1987) show a similar result in farmers' decisions to adopt techniques of soil conservation in Virginia counties (USA).

[32]By contrast, Abdulai and Eberlin (2001) reported a negative and significant effect of the number of hours in non agricultural work on technical efficiency.

σ	0.192473***	0.004914
Log likelihood	135.4043	

Source : Author's estimates.

Notes.—Dependent variable =(1–Technical Efficiency). Doubly censored Tobit model (n=813). Left censored value=0.00 ; Right censored value=0.99343. Left censored observ.= 26. Right censored observ. =0. Non censored observations = 787. ***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) and 10% (p<=0.1) respectively.

One may be somehow concerned about endogeneity bias as the random shock that affect inefficiency may also affect certain regressors. The statistical package STATA10 is equipped with appropriate commands to deal with such issues in Tobit models. This procedure provides the results for two Wald tests. The first assesses the joint significance of the explanatory variables, while the second tests the null that the targeted variable is exogenous. I undertook these tests for several regressors suspected of endogeneity. The results are reported in table 10 (see also Appendix B for purposes of comparison). My field investigation led me to observe that agriculture is not prioritized by the rare formal credit programs currently operating in rural areas—which are mainly devoted to women's groups and their activities. It is therefore plausible however to think that access to these programs (if any) is also used (at least indirectly through the fungibility mechanism of the family budget) in the agricultural activities that the husband controls. Further, informal credit is more prevalent (18% of respondents against 5% in the case of formal credit) and is repaid with agricultural products, in cash or at very high interest rates (see Jacob 2008). But both of these credit markets (formal and informal) are failing and do not relax liquidity constraints for small farmers for whom the costs to invest are very high with regard to their productive endowments and the simple technology they use. Stigliz and Weiss (1981) provide the theoretical framework for the credit markets failures with imperfect information with a particular emphasis on the problems of lack of collateral and moral hazard. Ellis (1993), cited in Matchaya (2006), presents a variety of reasons—income level, default risk, but also lack of collateral—for which small farmers have little access to formal credit at competitive interest rates. As Eswaran and Kotwal (1986) and Duflo (2003) argue, the land might serve as collateral. But the absence of a land market makes this impossible (Nyangena 2007). It should be noted from this survey that more than 53% of the respondents own less than 50% of their currently cultivated land (Fvi)[33]—making difficult financial transactions using the land as collateral. Nevertheless, we tested the exogeneity of several binary variables measuring the access to formal credit (Credf), to informal credit (Credi) or to one and/or the other form of credit (CreditFI; 22% of the respondents). we used instruments at the household level (the per capita cultivated land, and religious affiliation). Wald tests accept the null hypothesis of exogeneity of these three forms of access to credit, given the dependent variable (Table 10). These excluded instruments do not seem therefore to serve as collateral for access to credit regardless to the form it may take (credit free of interest, credit for repayment with products, financial informal or formal credit). Under these conditions, we will deal with these binary variables as exogenous.[34] Exogeneity has also been confirmed for the membership to LPO, religious attendance and the willingness to improve the results of his (her) farm. We are therefore confident about the exogeneity of the regressors used with respect to the explained variable.

Interaction terms play an important role as they capture the effects of the interference between explanatory variables on the dependant variable. The preferred model (model 6) show that farmers with informal vocational training both in agricultural and non

[33] Land tenure is very complicated in Haiti. But rented, sharecropped, undivided land, etc. are predominant.

[34] It is nevertheless plausible that the amount of formal or informal credit (rather than the binary variables) could potentially be based on owned land as collateral or religious preference. But we do not have such data systematically. However, one should note the insignificant nature of the land market—the plot is passed from hand to hand among generations of one family in Haiti. This led to its excessive crumble (see Jacob 2008)—and the great variation in quality but also the market value of land (modulated by soil erosion in mountain areas, inadequate fallow period, the weaknesses/absence of irrigation infrastructure, etc..) which are not likely to support financial value of the plots.

agricultural fields tend to be less efficient than those with formal components. Additional evidence in Appendix B is mixed. This may be due to the overly theoretical character of formal trainings criticized by 30% of farmers. Should one claim that entry barriers—such as direct costs, basic education prerequisites, etc.—making informal training less unequal and externally more effective than formal training?[35] Further, access to formal agricultural training is significantly related to inefficiency reduction conditional to a completed level of primary education. While farmers with less than 40 years of age conditional to access to formal agricultural training (Jeune*Fpaf) are more efficient.

Table 10
Exogeneity Wald tests on some explanatory variables

Explanatory variables	Chi2(1)	p-value	Exogeneity (Ho)
Member of LPO (Masdevl)	0.62	0.4308	accepted
Access to formal credit (Credf)	0.01	0.9319	accepted
Access to informal credit (Credi)	0.28	0.5957	accepted
Access to formal or informal credit (CreditFI)	0.51	0.4734	accepted
Monthly religious attendance—at least one time (Partrel)	0.02	0.8822	accepted
Willingness to improve the results of his (her) holding (Obamel)	0.08	0.7801	accepted

Source : Author's calculations.
Notes.—The Null (rho = 0 : The explanatory variable is exogenous).

5.2.2 How do culture, religiosity and social capital affect productive efficiency in agriculture?

This is especially by measuring the correlation between the cultural variables and the productive inefficiency that this paper attempts to contribute to fill a gap in the economic literature of the efficiency of production. To do this, it is constructed two categories of variables. The first refers to ethical variables while the second includes variables of religiosity which express religious practices and therefore, lead to particular observed behaviours. The latter category includes general religiosity variables—which do not relate to a particular religious affiliation: the response of the farmers about their willingness to "improve the production techniques and economic performance of the holding" (Obamel, 82% of affirmative answers), and "belief in a life after death" (Apmort, 53% of affirmative answers). These variables are indicators of pursuing objectives beyond the subsistence or neglecting of the earthly life. In a second category, I take into account (1) "the attendance in religious services on a monthly basis (Partrel, 73% of respondents), (2) the fact to address a prayer to God—the full-power deity—in order to improve the results of the holdings (Prieredieu; 98% of respondents)[36], and (3) variables devoted to control for Voodoo religious practices—recognized by various recent publications as the popular religion of the farmers (and the urban proletariat). In this last sub-category, we refer to: (i) the fact of having left uncultivated areas in his/her plots as allegiance to a deity or an ancestral spirit (Espnc, 8% of respondents), and (ii) the fact that of having offered ritual sacrifices to the ancestral spirits and deities (Sacrif, 11% of respondents). Addressing the problem in these terms is to focus on the African side of the religious farmer's behaviour—well known as "services des esprits"—as opposed to the Catholic side (service of God).[37] These practices constitute a fortiori a form of "family and social human capital" since they are transmitted in the family and the community from generation to generation. As Iannaccone (1990) argues, these are also a

[35] These issues go beyond the scope of this paper and need further researches.
[36] Although constructed differently, the variables Partrel and Apmort are inspired from Barro and McCleary (2003). For my part, through the variable Apmort, I aim to measure whether, in shaping the ethical behaviour of farmers, it leads to a neglect of the earthly life (and hence, the effort and innovation), which in turn, will generate inefficiency.
[37] On the complementarity between Catholicism and Voodoo, see Barthélémy (1996). Saint-Louis (2000: 91-92) observes a permanent struggle between the two religions which despite their crossing retain their own prerogatives: « Respectabilité, dignité pour l'un, adhésion, croyance pour l'autre. Lutte sans fin entre le modèle africain intériorisé, vécu et le modèle européen extériorisé, utilisé pour les avantages sociaux qu'il procure. ». This is in line with Souffrant (1995: 110) who notes a conflict between a dominant religion (that of the urban world, the Catholicism) and a dominated religion (that of the rural world, the Voodoo).

"religious human capital". Bellegarde-Smith (2006) notes that even with the migration of some members in most families, a same person continues Voodoo rituals for all other members, even in the upper classes of the Haitian society.

A priori, in the Haitian context, religiosity and cultural beliefs may impose their influence on economic performances in agriculture by at least five channels.

- Firstly, by days of work avoided in order to respect the wishes of *loas* (the ancestral spirits) or religion : this behavior makes less available the work of the holder which is crucial on the farm. It might also suggest that this leisure time (family or social non-market activities) would allow the workforce to be regenerated or more motivated. Therefore, one might expect a mixed (negative or positive) effect on productive efficiency. The survey showed that 73% of farmers observe at least one day free of work in order to respect their religious beliefs. For over 68% of them, this day is Sunday (this is the case especially for Protestants who attend more frequently in official services of their religion)[38], but it can also be any day of the week or several days in a same week depending on the preferences of a given loa for Voodoo participants.
- Secondly, a majority of 53% of the respondents believe in a life after death. This may be the basis of a transcendent fatalism that would lead to neglect the earthly life in the hope of an eternal life after the death symbolized, for "vaudouisants" (Voodoo practitioners), by ancestors, who became deities of cemeteries—see Ledan Fils (2006) for an overview on the "Gédés" tradition inherited from Dahomey and Egypt during the slavery period. This also means that farmers—beyond a particular religious affiliation—may be satisfied with a minimal subsistence objective, which will minimize, in turn, potential efforts for innovation and investment that are long term decisions.
- Thirdly, behaviours consisting in offering some part of their productions to loas through ritual sacrifices and ceremonies, farmers abandon the opportunity costs of these agricultural products value in terms of consumption or revenue in the household even though they have faced real production costs. They are 11% who express making sacrifices (by donating food and animals to loas) for ritual Voodoo ceremonies in order to promote better results in their holdings by the ancestors and deities. These behaviours may be in conflict with the farm technical efficiency in a context of extreme poverty and scarcity.[39]
- The willingness to improve production techniques and the agro-economic performance (Obamel ; 82% of the respondents) might in turn stimulate the farmers to take initiatives in favour of technical efficiency.
- Finally, by the spaces left without cultivation in their fields as a sign of allegiance to a deity or an ancestor in a country where land is a very scarce—0.08 ha of per capita arable land (World Bank 2000), 1.18 ha of cultivated land as indicated in our data set—farmers abandon production and related revenue.[40]

[38] There are significant differences (p-value=0.00 for Chi2=10 test) among the respondents in terms of their attendance (at least one time a month) to the official services of their religion: Catholics, 53.3%; Protestants, 87.7%; Voodoo participants, 24.6%.

[39] Several texts describe these sacrificial ceremonies (for instance Rigaud 1953; Barthélémy 1996; Renois 2006). Renois explains the *Gédés* ceremonies celebrated on November 1 and 2, where goats and chickens are killed, and also grains, and fruits are offered in honour of the Loas and ancestors. Barthélemy (1996) notes that « L'aspect public du rituel vodou marqué par de nombreuses cérémonies pour honorer les Loas familiaux, pour accomplir des vœux ou provoquer la guérison. Ces cérémonies aboutissent toutes à un sacrifice dont l'importance varie avec celle des enjeux … ». He explains (p.202) that the ritual sacrifices and others ceremonies held regularly in honour of one lwa (loa) or another to which individuals are faithful and accountable, and even to prevent disease in the family. Every farmer has his specific needs: "I go the a Hougan—the Voodoo priest—only when a member of my family has a problem or gets sick, but not for gardens" said a farmer who participated in my survey.

[40] An operator of the plain of Arcahaie (Ouest) argues that if he only "intends to fill the source that flows in his plot, it may invade all the surrounding lands".

As we can see, the services for Loas lead to consumption of time and sacrifices in terms of agricultural products, and animal, and to which one must add an opportunity cost to take into account production that is being abandoned in areas which are not put under crops because supposedly inhabited by a spirit or a Loa. In times far better than today for the poor peasants, Métraux (1977) had not he made the same observation that Voodoo ceremonies are expensive and weigh heavily on peasants income? Far to please or displease, offend or take position adverse or favorable to such practices, or particular religion—and because economics is basically atheist (Tomes 1985)--, on the basis of these premises, there are good reasons to assume that most of these behaviours may negatively affect the rural economy and notably farms' productive efficiency by minimizing factors that are so scarce—such as land, labour, or meagre wealth created in a very poor economy. In other words, our claim is that these religious practices (except Obamel) impact positively productive inefficiency.

However, all these costs may be—for those who are facing to them—completely justified and part of a rational behaviour. In his anthropological analysis, Barthélemy (1996 :200) suggests that « il n'est pas étonnant que les rites religieux viennent apporter des solutions adaptées, sur le plan des croyances et du vécu, aux problèmes de la vie quotidiennes. » Métraux (1977) did not say anything different by writing that : « C'est surtout par l'intermédiaire de rites magiques que le paysan cherche à accroître ou à` maintenir la fertilité de ses champs. » As Heineck (2001) argues, religious practices activities may generate an immediate utility rather than a profit after death. In such a case, these investments would return in terms of more personal satisfaction or of accomplishing wishes, healing, preventing dangers or violence, or even improving plots production. All these returns, however, are difficultly observable and measurable economically.[41] This argument finds also theoretical support in the "New Home Economics"—popularized by Becker (1964, 1965), Becker and Michael (1973), see Iannaccone (1990)—which expands the borders of economics to non-market behaviour, and the economics of religion (Iannaccone, 1992), which studies religious producers and consumers (the latter deal between cost and benefits and seek the highest returns on their spiritual investments). Besides the usual economic goods and services, religious products fall into a third category that economists term "household commodities" that families and individuals produce for their own consumption (Becker 1976, quoted in Iannaccone 1992:124). Economic tools—the rational choice theory, for instance—are now powerful enough to scientifically study religion. "Religion is advertised and marketed, produced and consumed, demanded and supplied" argues (Iannaccone 1992:123).

The religious variables are introduced from model 2 (Table 8). If it is excepted the variable Sacrif—which is not significant in any model—one of the more interesting findings of this paper is that most of the cultural variables have the expected positive sign (ie generate inefficiency in production) but not all variables are statistically significant at the conventional levels. However, in models 2, 3, 4, 5, and 6, the variables Obamel and Prieredieu are statistically different from zero. These findings indicate that—regardless any religious denomination—the belief that simply by addressing a prayer to God will improve farm performance seems to act as an obstacle to initiatives and risk taking, which minimizes effort and motivation, and hence productive efficiency.[42] That is, if farmers express their

[41] Even thought, religious practices can also be seen as a production process, but if the inputs (such as clothing, transportation, sacrificial offerings, financial contributions for financing the operation of the temple and its charity works, but also time and the work that members of a family invested in various religious activities) are quite measurable, religious products themselves are complex and largely unobservable (Iannaccone 1990). The beliefs are the main output of the religious sector, while attendance to cults allows to measure the inputs in the sector; therefore greater participation means greater use of resources (Barro and McCleary 2003).

[42] This finding is consistent with of Obenga (1990)'s observations, cited in Logossah (2007 :65), exploring the African philosophy in the Pharaonic period, describes that individuals prefer looking in superstitious ways rather than in current life solutions to the problems they face. Souffrant (1995: 123), Haitian sociologist, describes the prayer as a

willingness to improve their production techniques and holding performance—probably to avoid of being perceived otherwise—their fatalistic mind state and lack of motivation prevail. It should also be noted that among the 82% of farmers who are willing improvements in their outcomes, 65% invest in the factor they have the more, the own labour force. But we will see that this factor alone and with respect to a threshold, is counterproductive for efficiency. Instrumental-based regression reported in Table B3 (Appendix B) suggests that the dummy variable Apmort (Responses to the question : Do you believe in a life after death?; Yes=1) is positively correlated with inefficiency. This may explain that farmers neglect current life, long term decisions and innovation, which in turn negatively impact efficiency.

As Fafchamps and Minten (2002: 175) suggest, "ignoring social capital is no longer valid when markets are imperfects". Another set of cultural variables refers to social capital (Masdevl, Masstr and Credi). Membership of LPO, recently created notably within the democratization process initiated in 1986 after the Duvalier's dictatoship—cooperatives; organization for irrigation, credit, youth, watershed management,[43] etc. (17% of the respondents)—or agricultural-oriented and traditional rotating labor exchange group (23% of the respondents), access to informal credit that enable to cope together with common constraints (such as liquidity, needs of work, etc.) do not have significant effect on efficiency (even after instrumenting Masdevl, see also Appendix B). However, 70% of farmers who are members of these associations would remain to cooperate for the common benefit even if they receive any modern agricultural equipment that would increase labour productivity. Are LPO themselves so inefficient to allow their members to be in turn more efficient in production? How the overall institutional collapse affect theses grassroots organizations? Specific investigations are needed to answer to these questions. However, these are plausible hypotheses with regard to previous surveys conducted by the Ministry of Agriculture (MARNDR[44] and PAIFC[45] 1998, 1999; Bouyer 1999).

5.2.3 Farm characteristics, technologies usage and productive efficiency

From model 3 (Table 10), others farm-specific variables are introduced in the model. Inefficiency responds positively and significantly to the use of fertilizer (Uec) and improved seeds (Usa) in all the models. These modern entrants seem then act independently on production but not on efficiency, while their interaction term reduces inefficiency (Table 11). Favorable effect from fertilizer is then conditional to modern seeds usage (Uec*Usa). The results also show that full time farmers (Atp)—at least 35 hours per week in his holding—are less efficient. Probably because they do not have another job, they are more severely affected by liquidity constraints, and therefore make inefficient decisions. There are also those who are unable to overcome entry barriers to non-agricultural labour market.[46] This finding is being confirmed by controlling for the dependence of income generated by off-farm activities—measured by the ratio off-farm income/total income (Rrnartc)—which significantly reduces inefficiency (but at a decreasing rate suggesting a suitable mediation between agricultural and non agricultural in order to derive maximum return). Indeed, there are at least two channels by which non agricultural activities can strengthen farm's economic performance: (i) they relax liquidity constraints by generating additional income and (ii) they allow non farming managerial experience which is useful in farm management. Income

social problem in underdeveloped countries and mentions that « Une certaine conception de la prière détourne les masses de la lutte sociale, et, ainsi, entrave leur libération … le chrétien des masses est enclin à faire de la prière exclusivement une demande et une demande de biens matériels ».

[43] See White and Runge (1992) for a field experiment of peasant group formation in Maissade (Haiti) for watershed management.

[44] Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural.

[45] Projet d'Appui Institutionnel et de Formation des Cadres.

[46] This argument is particularly relevant in cases of non agricultural self- employment—see Mduma and Wobst (2005) for a discussion, and Mendola (2007) for a review.

diversification appears then as a leverage to reduce poverty in rural Haiti. Remittances (Transf)—which are motivated both by altruism and self interest (Jacob, Forthcoming)—also increase productive efficiency by relaxing liquidity constraints as well and easing investments in income generating activities. In this agriculture with low access to irrigation, natural shocks may be frequent. For instance, missed the first rain for default of liquidity to pay for labour or purchase seeds, is often synonymous with compromised returns and incomes. This will put at risk—at least in the short run—financial equilibrium of the holding. By contrast, inefficiency increases with household size (Npm, measured in natural log) as reported in Alabi (2003). This means that even thought they can contribute to family labour, individuals in the household increase expenses for food, education, cloths, health, etc. trough the dependency ratio. But a threshold effect exists as well. Finally, more than 50% of the respondents do not own all the plots they are cultivating. But, the model 5 suggests that, despite the weight of land rents paid by tenants for access to land, the latter do not seem to be less efficient than owner-cultivators.

5.2.4 Access to rural institutions and productive efficiency : How do location affect farm efficiency?

Models 4 and 5 show that productive efficiency responds positively to access to irrigation (Irr). This explains that, since farmers no longer depend on rain to cultivate their plots, they are more efficient. While access to electricity (Elect) increases inefficiency. This result is not surprising insofar as this commercial energy is not used in the farms for processing or storage products. And, without doubt, the households (31% of the sample) who have access (on a formal basis or not) are facing a financial bill. Therefore, public capital expenditures are directly effective for this subsistence agriculture when they are made in the form of irrigation. This supports a view of Binswanger et al. (1993: 338) that such investments can increase agricultural production by shifting the production frontier.

However, the more farmers are connected to agricultural downstream markets (Ima), selling increasingly greater proportions their crops and their stock of cattle, the more they are efficient. Latruffe et al. (2002), among others, reported a similar result for Poland. Access to formal and/or informal credit does not significantly affect farm efficiency (results not reported here)—may be because of the interest rates are too high, the amount of credit too low, or the delay for repayment too short, etc. to do so--, and do not really relax liquidity constraints for agricultural investments. Although the data reject suspected endogeneity bias on these variables, it is selected a new dummy variable (Endet) for farmers who were being currently indebted during the survey (in an institutionalized framework or not, or that the credit has been contracted by the head or by his wife). It is assumed therefore that this proxy (Endet) is directly linked to access to credit and may also affect the technical efficiency of small holders. Results reported in Table B2 (Appendix B) seems to confirm that indebtedness leads to inefficient decisions. The survey indicate indeed that 53% of farmers who have had access to credit were unable to repay the full amount due during the year under survey. An other concern is about the result that access to technical assistance from public services (Etae) tend to increase inefficiency while that from Non Governmental Organization (NGO) tend to decrease it. This is confirmed by the alternative regressions reported in Appendix B. Aside from training and irrigation, public assistance are inefficient except when they are conditional location in mountain areas. However, only 21 farmers (3% of the sample) express they have access to technical assistance of the Ministry of Agriculture (MA). For 30% of them, this support has consisted in information and technical advice which has enabled to 37% of them to find appropriate solutions to problems of their holding. One can therefore assume that the topographical conditions of the plots in mountain regions led the MA services to recommend soil conservation techniques (termed as «cordons pierreux», « rampes vivantes», « haies vives », etc.) during the surveyed year (or earlier) to limit the effects of

erosion that has already reached exaggerated proportions.[47] Indeed, the MA has made environmental protection one of its main field of intervention since the 1990s because of an agro-sylvo-pastoral imbalance accelerated by deforestation for the manufacture of charcoal (in a two-thirds of mountain territory). [48] It is however surprising that such a few number of farmers benefit from these interventions.

Location is also crucial in increasing efficiency. Farmers located in Ouest and Artibonite are more efficient relative to those located in South (the omitted group). In the same way, farmers in mountain areas are less efficient than those in others agro-ecological areas. All things being equal, soil erosion phenomenon due to deforestation, limitation of the potential of crops diversification in mountain area,; better access to institutions and infrastructures (road and transportation means, etc.) which facilitate access to up- and down-stream markets (thus to better opportunities), dominance of cash crops due to irrigation and modern entrants, etc. in Artibonite and Ouest permit to discriminate among the farmers. The dummy variable Dmmp confirms that farmers who are facing lack of endowment and infrastructures services (such as the downstream markets) are less efficient. This variable seems also to capture—for the 49% of the farmers who responded "Yes"—the market distortions introduced by the ASP which led to unfair competition between local producers and those from the Dominican Republic and United States of America as well whose products are imported legally or illegally (see Jacob 2000, 2006, 2008).

5.2.5 Evidence from an alternate doubly-truncated Tobit model

In model 6, we introduce a double truncation on the limit-values of the dependent variable. As Amemya (1984) and Greene (2003, Chapter 22) argue, this leads to focus our attention on the really inefficient farmers after removing values at the mass point 0.00 and the value 0.99343. It follows that 28 farmers—the 27 fully efficient and the most inefficient ones—are excluded. Model 2 may the be rewritten as follows :

$$\text{Ineff}_i \begin{cases} = 0.00, \text{ if } \text{Ineff}_i^* \le 0.00 \\ = \text{Ineff}_i^*, \text{ if } 0.00 < \text{Ineff}_i^* < 0.99343 \\ = 0.99343, \text{ if } \text{Ineff}_i^* \ge 0.99343 \end{cases} \qquad (3.0)^{49}$$

By re-running the model—whose convergence is achieved after 10 iterations—, the results are reported in Table 11. This preferred model (Model 6)—as well as those reported in Appendix B--, aimed at testing the robustness of the previous ones, confirm that the findings remain globally the same—even after alterations in the vector of explanatory variables, changes in the estimation procedures and instrumentation of a set of variables. We should note that the data fail to reject the disruptive effect of certain cultural variables on productive efficiency. If there is a willingness to improve the outcomes their holding, the paths and solutions preferred (a prayer to the all-powerful God, ceremonies devoted the

[47] Latortue (1998) estimated that 42 million of tonnes of arable land are lost by erosion. This is equivalent to some 8 000 to 10 000 ha of arable land.

[48] See Victor (2005).

[49] The likelihood function can be written as follows :

$$L=\prod_{S1} Q\left(\frac{\text{Ineff*}}{\sigma}\right).\prod_{S2} P\left(\frac{\text{Ineff*-0.9934}}{\sigma}\right).\prod_{S3} \frac{1}{\sigma} Z\left(\frac{\text{Ineff*-Ineff}}{\sigma}\right) \qquad (3.1)$$

where P denotes the normal cumulative distribution of probability, Q=1-P and Z is the density function. The sample has then been divided in three subgroups (S1, S2 and S3) to take into account observations respectively at the lower- and upper-limits and the non-limit values as well.

deads and the ancestral spirits, ritual sacrifices, etc.) do not seem likely to change the situation on the farms according to the evidence my econometric models. These findings are consistent with the new field of research, the *behavioral economics*, which suggests that rural communities do not always seek the best options because they are constrained by social and/or psychological norms (see Mendola 2007: 61).[50]

However, in the rural Haiti, institutional shortcomings and failures, and the level of socio-economic development of the country (that maintain and perpetuate in turn mentalities of self-defeatism) need to be pointed out. It would be inappropriate to blame the farmers for behaviours that are in conflict with modern rural and agricultural development values. Their defeatism or refuge in religion (and a fortiori in Voodoo) may be linked with their loss of confidence in institutions that have failed to fulfill their roles, and which had to withdraw from their duties as imposed by the ASP. As Hurbon (1999) explains, the peasantry has no longer relationship with the Haitian Nation-State. Faced with a predator State which used the peasantry for its own subsistence until the 1950s, the latter has withdrawn on "itself" since an entire century. This predation can no longer be continued, since there is nothing left to exploit, the farmers themselves—no longer accept their material conditions of existence: the lack of roads, infrastructures, health centers, schools, etc.—leave the countryside and become informal merchants in the cities or elsewhere abroad. Indeed, during my investigation, several peasants—demotivated by previous investigations without results—have done everything to ensure that this research was not a public initiative of the State prior to cooperate, while others have simply refused to answer questions or have been hostile.

How could it be different in a society where the greatest number is systematically marginalized? Where to find a refuge if not in beliefs or in religion when institutions are missing so much in their role? One must not make the victims guilty. It is therefore understandable, as Saint Louis (2000 :88) argues that « la structure sociale globale gardant, tout compte fait, la même rigidité, rien n'empêche que le vodou demeure dans le temps le même lieu de refuge, conserve sa même résonance de protestation contre une société de caste ». When we asked farmers if they make any decisions, for instance, to deal with a lack of rain or too much rainfall, a majority (56%) responded negatively—of whom 38% prefer to rely on the divine generosity since "God won't abandon them" and 59% have no resources to do anything. It is therefore obvious that, while it is true that poverty itself is a handicap, endogenous traits of the Haitian culture (social and family human capital, social philosophy, beliefs, customs and practices) act as blocking factors the development process and in turn lead to poverty. We can therefore assume that future generations of farmers will keep such behaviours and practices intact as they have been permanently preserved over previous generations. That is, it still will be not profitable for economic efficiency. The results presented in this paper seem relevant for the whole society, since as Tardieu (2005) observes, with respect to the issue of economic development and the Globalization, the fatalism of all the elites : « … l'Haïtien se laisse aller avec une délectation morbide. Pour lui, la messe est dite, advienne que pourra ! » (p16). Then, culture seems to a causal factor of low agricultural productivity, and beyond, of the level of economic performance and development.[51] As people are a product of they environment and culture (Benoît 1986), there is no reason to think that

[50]In his analysis of the totalitarian vision (of the world) of African cultures, Ndoye (2006: 22) notes that « L'individu ne peut pas par sa seule propre force réussir une entreprise car il lui faut le soutien occulte d'autres forces. Dès lors, la crise ou l'échec ne relève pas non plus de causes naturelles ou objectives. Il y a toujours des forces derrière, bienfaitrices ou nuisibles ». These beliefs contrast with the determinism, the rational explanations of success, but over-all the resources management. Planning is then neglected because the future is elusive according to these behaviours.

[51] Galbraith (1979) in *The Nature of Mass Poverty* pointed out that the poor are being perfectly adapted to their labour intense status and an accommodation to poverty makes it culturally ingrain and the poor and their offspring tend to stay in that vicious circle (see Victor 2008).

cultural behaviours will change without economic development and sufficient schooling. And as culture evolves with regard to the general economic and social context, and long enough and formal education (Houtart and Remy 1996: 18), it is therefore plausible to think that with the development, certain cultural behaviours and attitudes will shift into other forms.

Table 11
Understanding marginal effects using a doubly-truncated Tobit model

	1		2	3	4
Modèle 6				**Marginal Effects**	
Explanatory variables	**Non standardized coeff.**		**Std. Error**	$\delta E(Ineff^*)/\delta x_i$	$\delta F(z)/\delta x_i$
Constant	6.812330	**	3.121194	--	--
Log(Age)	-3.222274	**	1.659426	-2.7869	-0.8218
Log(Age)^2	0.430901	**	0.219777	0.3727	0.1099
Masc	-0.099921		0.089272	-0.0864	-0.0255
Expna	-0.013084	**	0.006535	-0.0113	-0.0033
Expna^2	0.000289	*	0.000155	0.0002	0.0001
Alp	0.017348		0.064692	0.0150	0.0044
Primi	-0.127065	**	0.050773	-0.1099	-0.0324
Primc	-0.038769		0.089520	-0.0335	-0.0099
Postprim	-0.117375		0.076752	-0.1015	-0.0299
Fpaf	0.122280		0.111972	0.1058	0.0312
Fpai	0.028277		0.049792	0.0245	0.0072
Fpfha	-0.130391	*	0.078048	-0.1128	-0.0333
Fpiha	-0.005695		0.053237	-0.0049	-0.0015
Partrel	0.003133		0.042188	0.0027	0.0008
Prieredieu	0.285504	***	0.109946	0.2469	0.0728
Apmort	0.035660		0.038925	0.0308	0.0091
Obamel	0.121094	**	0.049508	0.1047	0.0309
Espnc	0.054814		0.093957	0.0474	0.0140
Sacrif	-0.046448		0.066916	-0.0402	-0.0118
Masdevl	0.039852		0.056778	0.0345	0.0102
Masstr	0.028174		0.052379	0.0244	0.0072
Uec	0.158990	***	0.052058	0.1375	0.0405
Usa	0.232291	***	0.076559	0.2009	0.0592
Fvi	-0.011217		0.050545	-0.0097	-0.0029
Atp	0.115450	***	0.040686	0.0999	0.0294
Transf	-0.078574	**	0.039896	-0.0680	-0.0200
Rrnartc	-0.802714	***	0.322769	-0.6943	-0.2047
Rrnartc^2	1.782240	***	0.425754	1.5414	0.4545
Endet	-0.028687		0.202604	-0.0248	-0.0073
Log(Npm)	0.210685	**	0.093232	0.1822	0.0537
Log(Npm)^2	-0.045618		0.033845	-0.0395	-0.0116
Ima	-0.291507	***	0.098357	-0.2521	-0.0743
Artibonite	-0.047730		0.064546	-0.0413	-0.0122
Ouest	-0.144965	**	0.062344	-0.1254	-0.0370
Dmmp	0.088941	**	0.039514	0.0769	0.0227
Montagne	0.241560	***	0.097183	0.2089	0.0616
Etae	0.278022		0.172479	0.2405	0.0709
Etaos	-0.408694	*	0.241075	-0.3535	-0.1042
Irr	-0.186078	***	0.053846	-0.1609	-0.0475
Elect	0.077252	*	0.044124	0.0668	0.0197
Fpaf*Fpfha	-0.262573	*	0.152818	-0.2271	-0.0670
Fpai*Fpiha	-0.142341	*	0.085946	-0.1231	-0.0363
Fpaf*Primc	-0.579682	**	0.269177	-0.5014	-0.1478
Fpaf*Postprim	0.149010		0.148473	0.1289	0.0380
Jeune*Fpaf	-0.259111	*	0.149696	-0.2241	-0.0661
Prfvd*Naec	-0.006334		0.008766	-0.0055	-0.0016
Etae*Etaos	0.068506		0.265718	0.0593	0.0175
Irr*Endet*Etaos	-0.400761		0.320540	-0.3466	-0.1022
Irr*Endet	0.135487		0.216935	0.1172	0.0346
Irr*Etaos	0.357327		0.268068	0.3090	0.0911
Uec*Usa	-0.250647	***	0.091683	-0.2168	-0.0639
Montagne*Etae	-0.955029	***	0.357798	-0.8260	-0.2436
Montagne*Etaos	0.401561		0.382637	0.3473	0.1024
Masdevl*Masstr*Etaos	0.246891		0.269241	0.2135	0.0630
Sacrif*Espnc	0.052166		0.140004	0.0451	0.0133
σ	0.262315	***	0.021199		
Log-likelihood	692.9930				

Source : Author's calculations.

Notes.—Dependent variable =(1—Productive efficiency). Number of observations = 815 ; Included observations =787 ; Excluded observations =28. Left limit value =0,00 ; Right limit value =0,99343. ***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) and 10% (p<=0.1) respectively.

5.2.6 Decomposing the coefficients of a truncated Tobit model

The inefficiency models point out the key factors that are important public policy in the rural sector. In these models, however, estimated non standardized coefficients are those of the

latent variable and therefore do not reflect marginal effects of the explanatory variables in every point (MacDonald and Moffitt 1980). Therefore, additional information can be obtained in transforming these non standardized coefficients. In order to quantify the impact on the technical efficiency of changes in explanatory variables, the calculated coefficients (the effects total) are decomposed in: (i) the conditional variation of uncensored values of inefficiency, and (ii) the change in the probability of becoming part of the uncensored distribution (MacDonald and Moffitt 1980; Roncek 1992).[52] In our case, changes in explanatory variables will affect (i) non limit value of inefficiency (S3) and (ii) the probability that (totally or partially) efficient farmers become inefficient. More directly, the question which is here addressing is, for instance : what is the marginal effect on inefficiency of access to irrigation or vocational training, or an increase in the sold proportion of PBA? In columns 3 and 4 in Table 11 are reported marginal effect of each explanatory variable for the preferred model.[53] They give an interesting perspective on rural development in Haiti. Column 3 show for instance that—relative to illiterate farmers—a level incomplete primary education (Primi; 1-5 standard years) should decrease inefficiency (all others things being equal) by -0.1099 for inefficient farmers (and no –0.127065 as predicted by the non standardized coefficient). In the same time, the probability for efficient farmers to become inefficient is reduced by 3.24% (column 4). Meanwhile, if farmers are able to sell 1% more of their agricultural products, the inefficiency would be reduced by -0.2521 and the likelihood of becoming inefficient would be reduced by 7.43%.

While the reliance on a prayer addressed to God to improve holding performance increases the inefficiency by 0.2469 and the likelihood of becoming inefficient (for a farmer who is currently not) would increase by 7.28%. Among the cultural variables, this transcendent self-defeatism—driven by religious beliefs—which is the bigger handicap to the productive efficiency in the agricultural sector. In the field of conventional human capital, vocational training conditional to complete primary education, has the greatest impact in reducing both inefficiency (-0.5014) and the likelihood of becoming inefficient (-14.78%). On the other hand, the control of the economic environment by non-agricultural generating income activities (Rrnartc) is also essential: a 1% increase in the non-farm income on total income ratio would reduce inefficiency by almost 1% (-0.6943). Also a paradox persists: beyond a threshold of this ratio—which leads to devote more time to off-farm activities making then the farmers less available for work in their holding—, inefficiency will increase by +1.5414 if Rrnartc keeps increasing. Finally, it is noted that 86% of the total changes in the explanatory variables will affect (positively or negatively) inefficiency (S3) and the remaining 14%, the probability of being inefficient (for farmers in the group S1).

6. Concluding remarks

We take advantage of a rich and unique data set to measure productive efficiency and model the determinants of inefficiency in the agricultural sector in Haiti. We first expanded human capital concept to non-formal and non-agricultural components, measured their interaction, and also assessed the impact of cultural traits on farm performance, a field of research neglected by economists. In other words, in addition to traditional variables of human capital—the number of years of schooling, experience, training, contact with extension

[52] See also LeClere (1994), Greene (2003) and notably Roncek (1992) and Kang (2007).

[53] Following Tobin (1958), McDonald and Moffit (1980) and Roncek (1992) give analytical derivatives for such calculations. Empirical derivatives for model 6 can be found in Jacob (2008). Even taught, the normal cumulative distribution function F(z) is not linear (McDonald and Moffitt 1980 : 319 ; Roncek 1992 :505), the proportion of farms in non-limit value may be approximated by $F(z)=787/815=0.97$. As $F(z) > 0.5$ (central point of the normal curve), the region under the curve to find (Roncek 1992: 505) is $F(z)-0.50=0.97-0.50=0.47$. The value in the table of the normal curve is 0.4706, which corresponds to a « z-score » of 1.89 and an ordinate—the normal density function-- $f(z)=0.0669$.

agents—, we focused as well on the special role played by the informal education received by individuals within their families and in the Haitian society through cultural beliefs and customs, and on the non-formal and non-agricultural vocational training on agricultural productive efficiency. The empirical results show that productive efficiency in average is 21.45% and only 3% of farmers are fully efficient. This suggests the existence of high level of inefficiencies in agriculture Haitian but also that enormous potential gains for productivity are available. However, after controlling for the location, farms-specific' characteristics, social capital, access to formal and informal institutions, and for other assets controlled individually or collectively, this paper shows the crucial role of human capital (education and vocational training) in farmers' economic performance. Whereas cultural beliefs reduce productive efficiency regardless any particular religious denomination. This study presents an innovative attempt to measure the effects of an expanded human capital to culture and religiosity, and market access on individual outcomes. The findings show how a fatalistic state of mind in the Haitian peasantry—which has always been a victim of inefficient agricultural and economic policies—no longer trusts public institutions which have never properly fulfilled their role. Under missing and incomplete markets, the peasants prefer then to look trough they cultural beliefs and "religious human capital" the solutions to current problems of their farm that they consider unable to solve by themselves. But inefficiency responds positively to these behaviours. That is, self-defeatism seems to lead to neglect efforts of innovation and risk taking. The collapse of agricultural and rural development institutions seems to provide the permissiveness for these observed behaviours. Farmers' productive behaviours then suffer from the influence of ethical rules in which they believe and that govern themselves. Therefore, the Haitian culture (by determining attitudes to work, and strategies to improve farms performance) has a negative impact on productivity, and agricultural and rural development process. This paper shed a new light on the issue of underdevelopment in Haiti. Further, it is one of the few—following Puig-Junoy and Argilés (2000), and Helfand and Levine (2004)—that assess the technical efficiency of a « non-specialized » sample farm. It opens new avenues to better address the challenges of agricultural and rural policies in Haiti, and as well for empirical research on the obstacles to the development process in this country.

Local Producers Organizations (LPO)—although, they are useful as an alternative to formal (but weak) institutions--, fail to impact significantly farm efficiency. However, instrumental regression (see Table B3 in Appendix B) seems to support my hypothesis that they contribute to make farmers more efficient, but the statistical power is low.[54] Public institutions seem to be somehow effective in mountain areas and in providing access to irrigation in the plain areas. While a better connectiveness to the local (agricultural and non-agricultural) economy trough off-farm activities, as well as remittances received from migrants, have a decisive impact on increasing efficiency. The results are robust to the inclusion of a wide range of control variables, to the use of alternative econometric methods and changes in the dependent variable. Policy makers should pay great attention to the determinants of efficiency. Agricultural and non-agricultural training are among the most profitable investments in rural areas. In an environment with notably institutional shortcomings, LPO may help to reduce transaction costs (collective purchase of inputs or seeds, informal credit, information sharing, grants seeking to finance their micro projects, better access to non-formal training in agriculture and others sectors, etc.), but more importantly to help people to take a more active role in defining their future. They must therefore benefit more attention and assistance from public policy makers and NGOs.

References

[1] Abdulai, Awudu and Richard Eberlin (2001). « Technical efficiency during economic reform in Nicaragua: Evidence from

[54] We paid attention to the problem of validity and relevance of the instruments used (Stock, Wright and Yogo 2002) and the modern econometric techniques (Angrist 2000; Greene 2003).

farm household survey data». *Economic Systems* 25 (2001):113-125. Available online at: www.elsevier.nl/locate/ecosys.

[2] Ajibebefun, Igbekele A. and Abdullahi Abdulkadri (1999). « An investigation of technical inefficiency of production of farmers under the National Directorate of Employment in Ondo State, Nigeria». *Applied Economics Letters* 6: 111-114.

[3] Alabi, R.A. (2003). «Human capital as determinants of technical inefficiency of cocoa based agro-forestry system ». *Food, Agriculture & Environment* 1(3&4) : 277-281.

[4] Alesina, Alberto and Eliana La Ferrara (2002). « Who trusts others? ». *Journal of Public Economics* 85: 207-234.

[5] ANDAH and PAPDA (2000). *Impacts des mesures de libéralisation sur la sécurité alimentaire, l'environnement et la vie des petits producteurs ruraux.* Port-au-Prince : OXFAM/UK.

[6] Angrist, Joshua D. (2000). *Estimation of limited-dependent variable models with dummy endogenous regressors: Simple strategies for empirical.* Technical Working Paper 248. Cambridge : National Bureau of Economic Research (NBER).

[7] Aristide, Achille (1979). *Culture, civilisation et développement.* Port-au-Prince : Imprimerie Henri Deschamps.

[8] Arrow, Kenneth J. (1962). « The Economic Implications of Learning by Doing » *The Review of Economic Studies* 29(3):155-173.

[9] Audibert, Martine; Jacky Mathonnat, and Marie-Claire Henry (2003). « Social and health determinants of the efficiency of cotton farmers in Northern Côte d'Ivoire ». *Social Science & Medecine* 56: 1705-1717.

[10] Audibert, Martine (1997). «Technical Inefficiency Effect among Paddy Farmers in the Villages of the Office du Niger, Mali, West Africa ». *Journal of Productivity Analysis* 8:379-394.

[11] Azariadis, Costas and Allan Drazen (1990). « Threshold externalities in economic development ». *Quarterly Journal of Economics* 105: 501–526.

[12] Barr, Richard S. (2004). « DEA software tools and technology: A state-of-the-art survey ». In *Handbook on Data Envelopment Analysis.* Cooper W. William, Lawrence M. Seiford and Joe Zhu (Eds). Series: *International Series in Operations Research & Management Science*. Vol. 71.

[13] Barro, Robert J. and Rachel McCleary M. (2004). "Religious Faith and Economic Growth : What Matters Most-Belief for Belonging?" *The Heritage Lectures.* Vol. 841. (17 juin). Washington : The Heritage Foundation. Publié également après une tradition française de Julie Lochard : Robert BARRO. 2005. « Foi religieuse et croissance économique : Quels sont les facteurs déterminants ? » *Problèmes Économiques.* No. 2.882 (mercredi 14 septembre).

[14] _____ and ____. (2003). *Religion and Economic growth.* Mimeographed. Harvard University.

[15] _____ and ____. (2006). « Religion and Economy ». *Journal of Economic Perspectives* 20(2): 49-72.

[16] Bas, Daniel (1988). « La formation dans les pays en développement : Quels sacrifices pour quels résultats ? ». *Problèmes économiques* 2.086 (10 août) : 6-12. Article également publié sous le même titre dans la *Revue Internationale du Travail* (BIT) 127(3).

[17] Barthélemy, Gérard (1996). *Dans la splendeur d'un après-*midi d'histoire. Port-au-Prince : Imprimerie Henri Deschamps.

[18] Bauer, Paul W. (1990). « Recent developments in the econometric estimation of frontiers ». *Journal of Econometrics* 46(1990):39-56.

[19] Bazile, Charles-Max (1979). *L'haïtien ne serait-il pas le propre handicap à son développement ?* Port-au-Prince : Atliers Fardin.

[20] Becker, Gary S. (2002). « Human Capital ». *The Concise Encyclopedia of Economics*. Indianapolis: Liberty Fund, Inc., ed. David R. Henderson. Available online from http://www.econlib.org/library/Enc/HumanCapital.html. Accessed 4 January 2008.

[21] Benoit, Max (1986). « Le dynamisme des cultures noires en Haïti ». In *Spécificité et dynamique des cultures négro-africaines*. Paris : UNESCO.

[22] Benoît, Pierre (1970). « Le défi de financer le développement d'Haïti ». In *Culture et développement en Haiti.* LEMAAC. (mai 1970). Coll. Caraibes. Montréal : Ed. LEMAAC.

[23] Bernardin, Ernst A. (2006). « Les racines historiques de la pauvreté en Haïti ». In : *Les Cahiers du CREGED*. 2 : 1-25. Port-au-Prince : CREGED – Université Quisqueya.

[24] McDonald, John F. and Robert A. Moffittt (1980). «The uses of Tobit Analysis». *The Review of Economics and Statistics.* Vol. 62. No. 2. May. pp. 318-321.

[25] Boussard, Jean Marc (1987). *Économie de l'agriculture.* Coll. Économie agricole et agro-alimentaire. Paris : Economica.

[26] Bravo-Ureta, Boris E. and António E. Pinheiro (1997). « Technical, economic and allocative efficiency in peasant farming: Evidence from the Dominican Republic. *The Developing Economies*. March. XXXV-1: 48-67.

[27] Bravo-Ureta et al. (2007). «`Technical efficiency in farming : a meta-regression analysis ». *Journal of Productivity Analysis* 27:57-72.

[28] Bravo-Ureta, Boris E. and António E. Pinheiro (1993). « Efficiency analysis of developing country agriculture : A review of the frontier function litterature ». *Agricultural and Resoure Economics Review* 22(1):88-101.

[29] Brázdik, Frantisek (2006). *Non-parametric analysis of technical efficiency: Factors affecting efficiency of West Java rice farms.* Working Paper 286. Prague : Center for Economic Research and Graduate Education—Economic Institute.

[30] BRH (2006). *Rapport annuel.* Port-au-Prince: Banque de la République d'Haïti.

[31] Chéry-Frédéric, Guirlène (1998). *Politiques agricoles et développement de l'Agriculture en Haïti : Une étude de cas, la Plaine du Cul de Sac.* Mémoire présenté à la Faculté des études supérieures de l'Université Laval pour l'obtention du grade de Maître ès Arts en Géographie. Québec : Département de Géographie, Faculté des Lettres, Université Laval.

[32] CNSA (2005). *Haiti : Bilan de la sécurité alimentaire 2003-2005.* Port-au-Prince : CNSA. Rapport disponible sur le site Internet de l'Institution à : www.cnsaonline.htm.

[33] Coelli, Tim J. (1996). *A guide to DEAP Version 2.1 : A Data Envelopment Analysis Computer Program.* Center for Efficiency and productivity Analysis. Department of Econometrics, University of New England.

[34] Coleman, James (1988). « Social capital in the creation of human capital ». American Journal of Sociology 94: Supplement S95-S120.

[35] Cooper, William W., Lawrence M. Seiford and Joe Zhu (2004). *Handbook on Data Envelopment Analysis*. Boston, MA: Kluwer Academic Publishers.

[36] de Lancer, Patria D. (1999) « Data Envelopment Analysis : An Introduction ». Mimeo. Springfield: University of Illinois at Springfield.

[37] Devienne, Sophie et Michel Brochet (1997). *Étude diagnostic de la situation agricole de la section rurale de Mathador (Commune de Dondon - Haïti).* Rapport de mission à la FAMV et au MARNDR pour le compte de la Mission de Coopération et d'Action Culturelle (Ambassade de France en Haïti). Paris : Institut National Agronomique Paris-Grignon.

[38] Dewing, Josh snd David Kinley III (1988). *Aide à la migration (L`impact de l`assistance internationale à Haïti).* Québec : Editions CIDICHA.

[39] Duflo, Esther (2003). *Poor but rational?* Mimeographed. Boston : Department of Economics (MIT) and National Bureau of Economic Research (USA).

[40] Dhungana, Basanta R.; Peter L. Nuthall and Gilbert V. Nartea (2004). « Measuring the economic inefficiency of Napalese rice farms using data envelopment analysis ». *Australian Journal of Agricultural & Resource Economics* 48(2): 347-369.

[41] Ellis, Frank (1998). « Household strategies and Rural Livelihood Diversification ». *The Journal of Development Studies* 35(1) :1-38.

[42] Eswaran, Mukesh and Ashock Kotwal (1986). « Access to capital and agrarian production organisation ». *The Economic Journal* 96(June) :482—498.

[43] Fafchamps, Marcel and Bart Minten (2002). « Returns to social networks capital among traders ». *Oxford economic papers* 54: 173-206.

[44] FAO (2002). *Targeting the rural poor : the role of education and training.* Paper presented by Lavinia Gasperini and Charles Maguire at the International Working Group on Education held in Lisbon, Portugal, 19-21 November 2001.

[45] Featherstone, Allen M ; Michael R. Langemeier, and Mohammad Ismet (1997). "A Nonparametric Analysis of Efficiency for a Sample of Kansas Beef Cow Farms." *Journal of Agricultural & Applied Economics* 29(1): 175-184. (July).

[46] Ferguson, Naill (2005). « Religion et déclin économique de l'Europe : Y aurait-il un lien? » *Problèmes économiques* 2.882(14 septembre) : 10-14.

[47] Friboulet, Jean-Jacques (1998). « Capital culturel et droits de l'homme : Le rôle des villes ». In *Conférence européenne pour les Droits de l'Homme*. 15-17 octobre. Barcelone.

[48] Gleizes, Jérome (2000). « Le capital humain » *Multitudes* 2(2000/2) : 111-112.

[49] Graca, Job; Saqib Jafarey and Apostolis Philippopoulos (1995). «Interaction of Human and Physical Capital in a Model of Endogenous Growth ». *Economics of Planning* 28: 93-118.

[50] Granato, Jim, Ronald Ingelhart and David Leblang (1996). « The Effect of Cultural Values on Economic Development: Theory, Hypotheses, and Some Empirical Tests ». *American Journal of Political Science* 40(3): 607-631.

[51] Greene, William (2003). *Econometric Analysis.* 5th edition. New Jersey : Prentice Hall.

[52] Guiso, Luigi, Paola Sapienza, and Luigi Zingales (2006a). « Does Culture affect economic outcomes? ». Paper prepared for *The Journal of Economic Perspectives* 20(2), march 2006. Available online at: http://www.kellogg.northwestern.edu/faculty/sapienza/htm/Guiso_Sapienza_Zingales_JEP.pdf. and at : Centre for Economic Policy Research. ISBN/Report CEPR Discussion Paper No. 5505.

[53] _____; _____ (2006b). « Does Culture affect economic outcomes? ». *The Journal of Economic Perspectives* 20(2): 23-48.

[54] Hammond, Phillip E. (1995). Book Review [Weber's Protestant Ethic: Origins, Evidence, and Contexts. Edited by Hartmut Lehmann and Guenther Roth. 1993. Cambridge University Press] *Social Forces* 73(3): 1119-1120.

[55] Heineck, Guido (2001). *The determinants of Church attendance and religious human capital in Germany: Evidence from panel data.* Discussion paper No. 263. Berlin : Department of Economics, University of Bamberg.

[56] Helfand, Steven M. and Edward S. Levine (2004). «Farm size and the determinants of productive efficiency in Brazilian Center-West ». *Agricultural Economics* 31(2004): 241-249. Available online at : www.sciencedirect.com, or at : www.elsevier.com/locate/agecon.

[57] Herrero, Inés and Sean Pascoe (2002). «Estimation of technical efficiency: a review of some of the stochastic frontier and DEA software ». In: *Computers in Higher Education Economics Review.* Volume 15. Issue 1. (Available online at : http://www.economicsnetwork.ac.uk/cheer/ch15_1/dea.htm).

[58] Heshmati, Almas and Yilma Mulugeta (1996). «Technical Efficiency of the Uganda Matoke Farms ». *Applied Economics Letters.* 3: 491-494.

[59] IHSI (2005). *IVième Recensement Général de la Population et de l'Habitat.* Résultats Définitifs – Ensemble du Pays. Port-au-Prince : IHSI-Bureau du Recensement.

[60] ____ (2003). *IVième recensement général de la population et de l'habitat.* Résultats préliminaires. Port-au-Prince : Editions des Antilles, SA.

[61] Hasnah; Fleming, Euan, and Coelli, Tim (2004). « Assessing the performance of a nucleus estate and smallholder scheme for oil palm production in West Sumatra : a stochastic frontier analysis ». *Agricultural systems* 79: 17-30.

[62] Honorat, Jean-Jacques (1974). *Enquête sur le développement.* Port-au-Prince : Imprimerie Centrale.

[63] Houtart, François et Anselme Rémy (2001). *Les référents culturels à Port-au-Prince – Études des mentalités face aux réalités économiques, sociales et politiques.* 2e édition. Port-au-Prince : Centre de Recherche et de Formation en Économique et Sociale pour le Développement (CRESFED).

[64] Hurbon, Laennec (1999). « Le développement rural, l'État et la mondialisation ». In *Les Actes de la Semane du Développement Rural : Les Organisations Professionnelles Agricoles : Enjeux et Stratégies.* Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural et Service de Coopération et d'Action Culturelle de l'Ambassade de France (éds). Port-au-Prince : Imprimerie Henri Deschamps. pp. 224-227.

[65] Iannaccone, Laurence R. (1990) "Religious Practice: A Human Capital Approach."*Journal for the Scientific Study of Religion* 29 (3):297-314.

[66] _____. (1992). « Religious markets and the Economics of religion ». *Social Compass* 39(1):123-131.

[67] Idiong, I.C. (2007). « Estimation of Farm Level Technical Efficiency in Smallscale Swamp Rice Production in Cross River State of Nigeria: A Stochastic Frontier Approach » *World Journal of Agricultural Sciences* 3(5): 653-658.

[68] IRAM (1990). *Quelles politiques agricoles pour Haïti ?* Paris : Iram.

[69] _____ and Group Croissance (1998). *La tarification des principaux produits agricoles en République d'Haïti.* Rapport. Port-

au-Prince : MARNDR.

[70] Isambert, F. A. (1979). « Religion et politiques rurales » In *Sociologie Rurale.* Placide RAMBAUD, éd. Paris : Editeur Mouton. Ecole des Hautes Etudes en sciences Sociales de Mouton. pp.291-294.

[71] Jacob, Sergot (Forthcoming). Private transfers to small farmers in Haiti—Social security mechanism or selfish interests?

[72] _____ (2008). *Capital Humain, Productivité Agricole et Rationalité des Agriculteurs—Une Étude Empirique avec Application de l'Approche « Data Envelopment Analysis » sur Données d'Haïti.* PhD Dissertation in Economics of development (Université d'Auvergne CERDI-CNRS & Université Antilles Guyane CEREGMIA, France).

[73] _____ (2004a). « Libéralisation, déclin de l'agriculture et pauvreté paysanne en Haïti : Les effets pervers du Laissez-faire-kapitalismus ». *Nouvelles images d'Haïti.* No. 27. Juin. Paris : Collectif Haïti de France. Disponible à http://www.collectifhaïti-nouvellesImages dhaïti.htm et à www.collectif-haiti.fr/data/File/solidaires_eleveurs_haitiens_presentation_2007.pdf. Revue mensuelle à comité de lecture.

[74] _____ (2004b). *Réformes néo-libérales en Haïti : cohérence, impacts sur l'économie paysanne, et perspectives de développement.* Communication présentée au Colloque international sur les « Impacts économiques et politiques de la mondialisation » tenu à Port-au-Prince, Haïti du 1er – 3 Septembre 2004 et organisé par la Faculté des Sciences Économiques et Administratives (Université Quisqueya) et l'Association Haïtienne des Économistes (AHE). In *Actes du Colloque.* FSEA et AHE. 2006 (octobre). Port-au-Prince : Quality Plus. pp. 385-421. Publié également en avril 2006 dans *Les Cahiers du CREGED.* No. 2. pp.61-95. Port-au-Prince : Université Quisqueya. Disponible en ligne sur le site de l'AHE à : www.ahe-ht.org/documents-pdf/Actes_Colloque_Mondialisation.pdf et à : http://www.caraibe.auf.org/IMG/pdf/Actes_colloque_de_483_pages.pdf.

[75] _____ (2003). « Impact des ajustements structurels sur le secteur agricole en Haïti ». In *Question agraire et Mondialisation.* Alternatives Sud IX-2002(4) : 99-117. Paris, Hongrie, Italia et Louvain-la-Neuve : L'Harmattan et Centre Tricontinental. (Résumé disponible en anglais à : www.cetri.be). Revue à comité de lecture international.

[76] _____ (2002). « Libéralisation des marchés agricoles, expérience haïtienne ». Papier présenté au *Premier Forum Européen sur la Coopération au Développement Rural* organisé par le Centre Technique de Coopération Agricole et Rurale (CTA-ACP-UE) et l'Inter-Réseaux à Montpellier (France), 4 - 6 septembre. Article disponible à: http://forum1.inter-reseaux.net/spip_redirect.php3?id_article=152([55]). Forum à comité de lecture.

[77] _____ (2001). « Les conséquences agricoles de la libéralisation : Le cas d'Haïti ». In *Lire-Haïti* 1(2) : 42-48. Septembre. Port-au-Prince : Université Caraïbe. Revue à comité de lecture.

[78] Kang, Jeong-han (2007). «The Usefulness and Uselessness of the Decomposition of Tobit Coefficients». *Sociological Methods & Research* 35(4):572-582.

[79] Kimhi, Ayal (1994). « Quasi Maximum Likelihood Estimation of Multivariate Probit Models : Farm Couples' Labor Participation ». *American Journal of Agricultural Economics.* 76(November) : 828-835.

[80] Larson, Donald F. and Frank Plessmann (2002). *Do farmers choose to be inefficient ?– Evidence from Bicol, Philippines.* Policy Research Working Paper 2787. Whashington DC : The World Bank.

[81] Latortue, François. 1998. *L`Économie rurale (et les problèmes de développement en Haïti).* Port-au-Prince : L`Imprimeur II.

[82] Latruffe, Laure et al. (2002). *Determinants of technical efficiency of crop and livestock farms in Poland.* Working paper 02-05. August. Rennes : Institut National de la Recherche Agronomique (Unité d'Économie et de Sociologie Rurales).

[83] LeClere, Marc J. (1994). « The decomposition of coefficients in censored regression models : Understanding the effect of independent variables on taxpayer behavior ». *National Tax Journal* 47(4): 837-45. (December).

[84] Ledan, Jean Fils (2006). « Les Gédés » In *A propos de l'histoire d'Haïti, saviez-vous que …* Volume II. Port-au-Prince : Henri Deschamps. 1997. Extrait publié dans *Le Nouvelliste* 37497. (Vendredi 3 au dimanche 5 novembre).

[85] Leibowitz, Arleen A. (2003). « In-home training and the production of Children's Human capital ». *Review of Economics of the Household* 1: 305-317.

[86] Logossah, Kinvi (2007). « Éthique sociale et trappe à sous-développement : Le Cas de l'Afrique sub-saharienne » *Les Cahiers du CREGED* 3:56-73. Port-au-Prince : Université Quisqueya.

[87] Maddala, G.S. (1983). *Limited-Dependant and Qualitative Variables in Econometrics.* Econometric Society Monograph. Cambridge : Cambridge University Press.

[88] McDonald, John F. and Robert A. Moffittt (1980). «The uses of Tobit Analysis». *The Review of Economics and Statistics.* Vol. 62. No. 2. May. pp. 318-321.

[89] Mangeloja, Esa (2008). *Implications of the Economics of Religion to the Empirical Economic Research.* Working paper. University of Jyväskylä, School of Business and Economics (Finland).

[90] MARNDR & PAIFC. 1998, 1999. Enquêtes auprès des organisations paysannes (du Nord, de l'Ouest, du Haut et du Bas Plateau Central). Damien : MARNDR et PAIFC.

[91] _____ and Service de Coopération et d'Action Culturelle—Ambassade de France. 1999. *Les Organisations Professionnelles Agricoles : Enjeux et Stratégies.* Actes de la Semane du Développement Rural. Port-au-Prince : Imprimerie Henri Deschamps.

[92] Mduma, John K. and Peter Wobst (2005). « Determinants of rural Labor Market Participation in Tanzania ». *African Studies Quarterly* 8(2). Available online at :http://web.africa.ufl.edu/asq/v8/v8i2a2.htm.

[93] Matchaya, Greenwell Collins (2005). *The Impact of Rural Producers Organizations on People's Livelihoods. The Case of National Small Holder Farmers' Association of Malawi in Kasungu District: An Instrumental Variable Approach.* Mimeographed. Leeds : Leeds University Business School (UK).

[94] Mena, Alfredo (1999). « Situation de l'Agriculture dans la Caraïbe ». In *Les Actes de la semaine du Développement Rural, Les Organisations agricoles : Enjeux et Stratégies.* Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural et Service de Coopération et d'Action Culturelle de l'Ambassade de France (éds). Port-au-Prince : Imprimerie Henri Deschamps. pp. 28-30.

[95] Mendola, Mariapia (2007). « Farm household production theories: A review of Institutional and Behavioral responses ».

[55] Also available on the web page of IRED (Innovations et réseaux pour le développement) at : http://www.ired.org/modules/iredforum/show.php?id=7&idjour=1.

Asian Development Review 24(1):49-68.

[96] Métraux, Alfred (1977). *Le Vaudou Haïtien.* Paris : Éditions Gallimard.

[97] Ministère de l'Économie et des Finances (Haïti). 1996. *Cadre de politique économique pour les exercices fiscaux de 1995-96 à 1998-99.* Juillet. Port-au-Prince : Ministère de l'Économie et des Finances.

[98] Mondé, Carl (1999). « Place de l'agriculture dans le développement rural ». In *Les Actes de la semaine du Développement Rural, Les Organisations agricoles : Enjeux et Stratégies.* Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural et Service de Coopération et d'Action Culturelle de l'Ambassade de France. Port-au-Prince : Imprimerie Henri Deschamps. pp. 55-56.

[99] Noriac, Dathis and Glenn Smucker (1998). *Organisations paysannes en Haïti, Tendances et implications.* Port-au-Prince : Éditions La Ruche.

[100] _____ (1999). « Histoire de organisations paysannes en Haiti ». In *Les Actes de la semaine du Développement Rural, Les Organisations agricoles : Enjeux et Stratégies.* Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural et Service de Coopération et d'Action Culturelle de l'Ambassade de France. Port-au-Prince : Imprimerie Henri Deschamps. pp. 63-68.

[101] Ndoye, Mamadou (2006). « Cultures africaines : défis et opportunités pour le développement ». In *Culture et développement en Afrique.* Berthelemy, J-C et Coulibaly, A. (dir). Paris : L'Harmattan.

[102] Norris, Patricia E. and Sandra S. Batie (1987). « Virginia farmers'soil conservations decisions: An application of Tobit Analysis ». *Southern Journal of Agricultural Economics.* (July): 79-90.

[103] Nyangena, Wilfred (2007). « Social determinants of oil and water conservation in rural Kenya ». *Environment, Development and Sustainability.* Springer Netherlands Availible online at : www.springerlink.com/index/4566742885774645.pdf. Accessed on January 19, 2008.

[104] Ogunyinka, Ebenezer O. and Igbekele A. Ajibefun (2004). « Determinants of Technical Inefficiency on Farm Production : Tobit Analysis to the NDE Farmers in Ondo State, Nigeria ». *International Journal of Agricultural & Biology:* 1560-8530/2004/06-2-355-358.

[105] Onana, Jean-baptiste (1997). « De la relation entre culture et développement : leçons asiatiques pour l'Afrique » *Politique Africaine* 68 :96-111.

[106] Pérodin, Serge (1978). « Dimensions psycho-sociologiques du développement ». In *Cours international d'été en Haiti* . Centre Haitien d'Investigation en Sciences Sociales. Document final.

[107] Pierre-Étienne, Sauveur (1997). *Haïti : L'invasion des ONG.* Les éditions du CIDIHCA. Port-au-Prince : Imprimerie Le Natal SA.

[108] Puig-Junoy, Jaume and M. Josep Argilés (2000). *Measuring and explaining farm inefficiency in a panel data set of mixed farms.* Mimeographed. Barcelona: Department of Economics and Business – Pompeu Fabra University.

[109] Rahman, Sanzidur (2003). « Profit efficiency among Bangladeshi rice farmers ». *Food Policy* 28:487-503.

[110] Renois, Clarens (2006). « Des graines et des fruits servis aux morts ». *Le Nouvelliste.* No. 37497 (vendredi 3 au dimanche 5 novembre 2006). Port-au-Prince : Le Nouvelliste. pp. 1, 4 et 48.

[111] Rios, R. Ana and Gerald E. Shively (2005). *Farm size and nonparametric efficiency measurements for coffee farms in Vietnam.* Selected paper prepared for presentation at the American Agricultural Economics Association. Annual Meeting. Providence (Rhode Island). July 24-25. West Lafayette : Perdue University (Department of Agricultural Economics). Perdue University ARP manuscript # 2005-17671.

[112] Rigaud, Milo (1953). *La tradition Voudoo et le Voudoo haïtien (Son temple, Ses Mystères, Sa Magie).* Paris : Éditions Niclaus. (Réimprimé en 2003 par les Ateliers Fardin, Port-au-Prince : Collection du Bicentenaire - Haïti 1804-2004).

[113] Roncek, Denis W. (1992). «Learning more from Tobit coefficients: Extending a comparative analysis of political protest ». *American Sociological Review.* Vol. 57 (August). pp. 503-507.

[114] Rosett, Richard N. and Forrest D. Nelson (1975). «Estimation of the Two-Limit Probit Regression Model ». *Econometrica.* 43(1): 141–146.

[115] Stiglitz, Joseph E. and Andrew Weiss (1981). « Credit Rationing in Markets with Imperfect Information » *The American Economic Review* 71(3): 393-410. (June).

[116] Saint Louis, Fridolin (2000). *Le Vodou haïtien – Reflet d'une société bloquée.* Paris : L'Harmattan.

[117] Souffrant, Claude (1995). *Sociologie prospective d'Haïti.* Québec : CIDIHCA.

[118] Stark, Oded and Yong Wang (2002). « Inducing human capital formation: Migration as a substitute for subsidies ». *Journal of Public Economics* 86(2002):29-46.

[119] Stock, James H.; Jonathan H. Wright and Mothiro Yogo (2002). « A survey of weak instruments and weak identification in Generalized Method of Moments ». *Journal of Business & Economic Affairs* 20(4):518-529.

[120] Wilson, Paul W. (2005). « FEAR 1.0 : A software Package for Frontier Efficiency Analysis with R ». Mimeographed. Department of Economics. Austin : University of Texas. Available online at : http://www.eco.utexas.edu/faculty/Wilson.

[121] Tabellini, Guido (2006). *Culture and institutions: Economic development in the regions of Europe.* Mimeographed. (May). Available online at: http://www.princeton.edu/~pegrad/papers/tabellini.pdf.

[122] Thiam, Abdourahmane, Boris E. Bravo-Ureta and Teodoro E. Rivas. (2001). « Technical efficiency in developing country agriculture: a meta-analysis ». *Agicultural Economics* 25 (2-3):235-243.

[123] Victor, André (2008). « La pauvreté durable ». *Le Nouvelliste* (11 Janvier). Disponible en ligne à : http://www.lenouvelliste.com/article.php?PubID=1&ArticleID=52568&PubDate=2008-01-19.

[124] _____ (2005). « Section Environnment—La logique des catastrophe naturelles de l'année 2004 » In *Situation économique et sociale d'Haiti en 2004.* PNUD (éd.). Port-au-Prince.

[125] Wadud, Md. Abdul (2003). « Technical, allocative and economic efficiency of farms in Bangladesh: A stochastic and frontier and DEA approach ». *The journal of Developing Areas* 37(1): 109-126.

[126] White, Anderson T. and C. Ford Runge (1994). « Common property and collective action : Lessons from Cooperative Watershed Management in Haiti ». *Economic Development and Cultural Change* 43(1) : 1-41.

[127] Zhu, Joe (2003). Quantitative Models for Performance Evaluation and Benchmarking : Data Envelopment Analysis with Spreadsheets and DEA Excel Solver. New York : Springer Science + Business Media Inc.

Appendix A

Table A
Definitions and anticipated effect of the regressors on efficiency

Label	Description (Unity)	Anticipated Effect
Variables of conventional Human capital		
Age	Household head' age (Years)	--
Age^2	Household head' age squared (Years)	+
Masc	Gender of the Household head (Male=1)	--
Alp	Attendance to adult literacy program (dummy : Yes = 1)	+
Primi	Incomplete primary education (dummy : Yes = 1)	--
Primc	Complete primary education (dummy : Yes = 1)	--
Postprim	Post primary education (dummy : Yes = 1)	--
Fpaf	Formal agricultural vocational training (Yes = 1)	--
Fpai	Non formal agricultural vocational training (dummy : Yes = 1)	--
Fpfha	Formal non agricultural vocational training (dummy : Oui = 1)	--
Fpiha	Non formal non agricultural vocational training (dummy : Yes = 1)	--
Naec	Number of completed years of schooling (year)	--
Expna	Non agricultural of experience (Years)	--
Variables of social and family human capital		
Obamel	Willingness to improve agricultural production techniques (dummy : Yes = 1)	--
Partrel	Attendance to religious cults at least one time a month during 2005-2006 (dummy : Yes = 1)	+/--**
Prieredieu	Adress prayer to God in order to improve farm outcomes (dummy : Yes = 1)	+
Sacrif	Offer rituals sacrifices—food, cattle, etc.—in order to seek the favours of deities and *loas* (deities of Voodoo) on agricultural productions (dummy : Yes = 1)	+
Espnc	Leave spaces uncultivated in his (her) plots as allegiance to a deity and to attract its favour on crops (dummy: Yes = 1)	+
Apmort	Beliefs in a life after death (dummy : Yes = 1)	+
Masstr	Membership to agricultural rotating working group (dummy : Yes = 1)	--
Masdevl	Membership of Local producers organization (LPO) (dummy : Yes = 1)	--
Variables of farm-specific characteristics and technology used		
Ptail	Cultivated land less than the sample mean (1.18 ha) (dummy : Yes = 1)	+
Fvi	Own no more than 50% of the total cultivated land (dummy : Yes = 1)	+
Uec	Use modern fertilizers (dummy : Yes = 1)	--
Usa	Use modern seeds (dummy : Yes = 1)	--
Atp	Work at least 35 hours a week on his holding (dummy : Yes = 1)	--
Transf	Has received remittances during the agricultural years 2005-2006 (dummy : Yes = 1)	--
Pms	Share of hired labour (% of total labor used)	--
Npm	Number of persons in the household	--
Rrnartc	Corrected off-farm income (% of total income)	--
Variables of location		
Artibonite	Farm located in Artibonite (dummy : Yes = 1)	--
Ouest	Farm located in Ouest (dummy : Yes = 1)	--
Dmmp	Access to agricultural market products (dummy : Yes = 1)	+
Montagne	Farm located in mountain areas(dummy : Yes = 1)	+
Variables of access to institutions and public goods		
Ima	Share of agricultural products sold (% PBA)	--
Etae	Access to technical assistance from public institutions during the agricultural year (dummy : Yes = 1)	--
Etaos	Access to technical assistance from NGOs during the agricultural year (dummy : Yes = 1)	--
Irr	Access to irrigation (dummy : Yes = 1)	--
Credf	Access to formal credit (dummy : Yes = 1)	--
Credi	Access to informal credit (dummy : Yes = 1)	--
Endet	Indebted farmer (dummy : Yes = 1)	+/--*
Elect	Access to electricity (dummy : Yes = 1)	--

Notes.--*The effect of indebted farmer is a priori ambiguous since two effects are plausible on inefficiency. A negative one (if the credit leads to relax liquidity constraints and to invest in agricultural production) and a positive one (if the stressful financial situation farmers—high interests rates, short repayment delay, economic shocks, etc.—lead them to inefficient decisions). ** We can anticipate a competition for labor between agricultural activities and religious activities. But, the latter may also motivate farmers or allow some recovery of the labour force. Then an ambiguous relationship is possible as well.

Appendix B
Additional Evidence

Table B1
Tobit estimates of the determinants of inefficiency
Dependent variable =(1 — technical efficiency); n=813.

Explanatory variables	Coef.	Robust Std. Err.
lnAge2	-.0037266	.0158134
Sexe	-.0363835	.0292167
Expna	-.0051279***	.0017594
Expna2	.0001053***	.0000326
Alp	-.0237142	.0227142
Primi	-.0124028	.0182723
Primc	-.0279927	.0408846
PostPrim	-.0466285	.0349841
Fpaf	.0304165	.0246105
Fpai	.0115166	.0197961
Fpfha	-.0775918**	.0359374
Fpiha	.0186238	.0170526
PartRel	.0022238	.0174002
PriereDieu	.0983172*	.059506
Apmort	.0047285	.0152883
Obamel	.0453192**	.0208937
Espnc	.0037182	.0358964
Sacrif	-.0207522	.0319506
Masdevl	.022772	.0189029
Masstr	.0150016	.0176973
Uec	.0826885***	.0205519
Usa	.0555491*	.0296957
Fvi	-.0301228*	.0167477
Atp	.0495211***	.0157564
Transf	-.0227902	.0153754
Rrenartc	-.1578906*	.0898442
Rrenartc2	.4321557***	.0948777
Endet	.0214478	.0355777
lnNpm	.0721355*	.0425914
lnNpm2	-.0189817	.014705
Ima	-.106733***	.0336534
Artibonite	-.0196401	.01865
Ouest	-.0807521***	.0196731
Dmmp	.0333268**	.0144092
Montagne	.0374236**	.0190618
Etae	.0824691**	.0363651
Etaos	-.128408*	.0684814
Irr	-.072455***	.0187206
Elect	.0196129	.0155325
Fpfha X Fpaf	-.0539738	.0723812
Fpai X Fpiha	-.0778209***	.0311269
Etaos X Etae	.0416775	.0682535
Irr X Etaos	.1159257	.0834542
Fpaf X Primc	-.2511952*	.1359731
Fpaf X PostPrim	.0675907	.0457848
Fpaf X Jeune	-.1099177**	.0457712
Irr X Endet	.0212154	.0469521
Pfvd X Naec	-.0037216	.0040451
Irr X Endet X Etaos	-.1090453	.0963672
Masdevl X Masstr X Etaos	-.0035049	.0906936
UecXUsa	-.055288*	.0344811
MontagneXEtae	-.1455962	.1166575
MontagneXEtaos	.0367918	.0931299
SacrifXEspnc	.0209558	.0550457
Intercept	.729096***	.1424818
Sigma	.1925303	.0092217
F(54;759)	4.77	
Prob>F	0.00	
Log pseudolikelihood	134.7194	

Notes.—Left censored observations at Inefficiency <=0=26; Right censored observation at Inefficiency>=.99241=1; uncensored observation=786. ***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) et 10% (p<=0.1) respectively.

Table B2
Tobit estimates of the determinants of inefficiency
Dependent variable=ln(1/technical efficiency); n=813

Explanatory variables	Coef.	Robust Std. Err.
Age	.0000816	.0155363
Age2	.0000567	.0001556
Sexe	-.0987582	.1219854
Expna	-.0119251***	.0029225
Alp	-.0561907	.0882627
Primi	-.1640448**	.072078
Primc	-.2695514**	.1331727
PostPrim	-.2362191**	.0967203
Fpaf	-.0401637	.1087046
Fpai	-.0702531	.0806854
Fpfha	-.3033782**	.1279592
Fpiha	.0126699	.0756418
PartRel	.0345178	.0671547
PriereDieu	.3721974*	.2249137
Apmort	-.0113541	.0626062
Obamel	.0510262	.085607
Espnc	.0112311	.1020958
Sacrif	-.0530499	.0909691
Masdevl	.0438028	.079053
Masstr	.1067994	.0746648
Uec	.2163778***	.0674165
Usa	.0816876	.0641231
Fvi	.0127302	.0578006
Atp	.2571922***	.0619768
Transf	-.1946935***	.0601178
Rrenartc	.8440147***	.1084239
Endet	.2474046**	.110289
lnNpm	.1252695	.1549601
lnNpm2	-.0270762	.0559488
Ima	-.4786461***	.1505629
Artibonite	-.2270411***	.0883079
Ouest	-.4042325***	.0910087
Dmmp	.1664045***	.0577731
Montagne	.3346919***	.0977827
Etae	.1950501	.2256014
Etaos	-.6800147**	.3139294
Irr	-.3095842***	.0763377
Elect	.0575678	.0631152
Fpfha X Fpaf	-.1123458	.2411664
Fpai X Fpiha	-.2360457*	.1271393
Etaos X Etae	-.0885108	.3303254
Irr X Etaos	.6943108**	.3404251
Intercept	1.750958***	.4847104
Sigma	.789528	.0218909
F(42;771)	8.00	
Prob>F	0.00	
Pseudo R2	0.1284	
Log pseudolikelihood	-964,426	

Notes.—Left censored observations at dependent variable (<=0)=26; right-censored observation at dependent variable (>=4.8809237)=1; uncensored observations=786. ***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) and 10% (p<=0.1) respectively.

Table B3
Instrumental variables (2SLS) regression (n=787)

Dependant variable : ln(1 — technical efficiency)

Explanatory variables	Coef.	Std. Err.
Masdevl—Instrumented+	-.2496462	.3273238
Sexe	-.0233093	.049988
Jeune	.0496256	.0312465
Expna	-.0078634**	.0040681
Expna2	.000174**	.0000843
Alp	.0109757	.0384443
Primi	-.0848345***	.0309051
Primc	.0008576	.0651184
Postprim	-.1037088**	.0484652
Fpaf	.092655	.078657
Fpai	.0609315*	.0356872
Fpfha	-.0521548	.0581928
Fpiha	-.0128861	.0386923
Partrel	-.0082243	.0301104
Apmort	.0448571*	.0273335
Prieredieu	.172071*	.0971913
Obamel	.0807523**	.0342234
Espnc	.0313321	.066442
Sacrif	-.0470783	.0518587
Uec	.1530245***	.0351233
Usa	.1179219***	.0481324
Fvi	.0233091	.0252407
Atp	.0378942	.0265634
Transf	-.0173369	.0276529
Rrnartc	-.0237144	.2178296
Rrnartc2	.3438687	.2327521
Etae	.1428848	.1191355
Etaos	.0578781	.0822394
Credf	.0463772	.0655506
Credi	.0107113	.0358921
Endet	-.0164421	.105009
lnNpm^2	.0256902***	.0104147
Ima	-.1779053***	.0635403
Artibonite	.0255535	.0401902
Ouest	-.0366326	.0365554
Dmmp	.041097	.026053
Montagne	.0204548	.0431608
Irr	-.1418831***	.0366837
Elect	.0590271**	.0286388
Fpaf X Fpfha	-.2906361**	.1387722
Fpai X Fpiha	-.0814128	.0625032
Fpaf X Primc	-.6858335***	.1831727
FpafXPostprim	.1387891	.0984219
Fpaf X Jeune	-.2093436*	.1161882
Etaos X Etae	.0590824	.1747301
Irr X Endet	.028477	.1145872
Usa X Uec	-.1470038***	.0566304
Etae X Montagne	-.0974102	.2745778
Sacrif X Espnc	.0784263	.0996347
Intercept	-.5048847***	.1205128
Wald chi2(50)	194.27	
Prob > chi2	0.0000	
R-squared	0.1654	

Weak instruments diagnosis on the reduced form:

R2=.60; Adj.R2=.57; PartialR2=.022; F(4;733)=4.133; Prob.>F=.0026

Minimum eigenvalue statistic = **4.13307**

Critical Values	# of endogenous regressors:	1
Ho: Instruments are weak	# of excluded instruments:	4

	5%	10%	20%	30%
2SLS relative bias	**16.85**	**10.27**	**6.71**	**5.34**

	10%	15%	20%	25%
2SLS Size of nominal 5% Wald test	**24.58**	**13.96**	**10.26**	**8.31**
LIML Size of nominal 5% Wald test	**5.44**	**3.87**	**3.30**	**2.98**

Tests of over-identifying restrictions (OID) :

Sargan (score): chi2(3) =3.01506; p-value=0.3893

Basmann: chi2(3) =2.81898 ; p-value=0.4204

Notes.— *p<=.10; **p<=.05; ***p<=.01. lnNpm dropped because of colinearity. + We have used the better set of available excluded instruments from the database: membership of the traditional producers organization (Masstr; yes=1), the marital status (Statmat; married=1 and 0 otherwise), the religious affiliation (Protestant; Protestant=1 and 0 otherwise), and the age (Age) of the household head. As shown in the lower part of the Table B3, some of the R2 seem high enough. But we cannot assume that there is not a Weak-

Instrument problem. Since, F statistic is below the often-used threshold 10. Therefore, the critical values for 2SLS estimator are greater than the Minimum Eigenvalue Statistic if we accept a rejection of 10% of a nominal Wald test at the conventional 5% level. Thus, we cannot reject the null that our instruments are weak and another set of instruments should better fit the data. If we change our tolerance relative to bias, a Limited information maximum likelihood (LIML) estimator seems to be an alternative. The Sargan's and Basman's tests of over-identifying restrictions do not however fail at the 5% level. Here we accept the Null hypothesis that our excluded instruments are valid, hence they influence inefficiency only trough LPO membership. These tests assume that the errors are identically and independently distributed. The OID tests are robust to heteroskedasticity

Table B4
Tobit estimates with instrumentation of religious attendance (Partrel)
Dependent variable: Ineff (n=812)

Independent variables	Coef.	Robust Std. Err.
PartRel—Intrumented+	.0136753	.0750351
Expna	-.0050809***	.0017662
Expna2	.0001022***	.0000329
Alp	-.0218864	.022658
Primi	-.0135558	.0179489
Primc	-.0276873	.0405688
PostPrim	-.0472001	.0334507
Fpaf	.029146	.0260263
Fpai	.0085514	.0197609
Fpfha	-.0757513**	.0361471
Fpiha	.0152643	.0169809
PriereDieu	.0954982[a]	.06057
Apmort	.0043124	.021701
Obamel	.0430829**	.0206087
Espnc	.0037731	.0372967
Sacrif	-.0202161	.0338213
Masdevl	.0225736	.0188621
Masstr	.0148583	.0171238
Uec	.0820493***	.0208434
Usa	.0541228*	.0317613
Fvi	-.0313133*	.0172314
Atp	.048428***	.016333
Transf	-.0218153	.015368
Rrenartc	-.1435927a	.0921416
Rrenartc2	.4176252***	.0981009
Endet	.0192661	.0366054
lnNpm	.0709128*	.0426608
lnNpm2	-.0190559	.014681
Ima	-.1053352***	.0376213
Artibonite	-.0125882	.0226918
Ouest	-.0772029***	.019025
Dmmp	.0351977**	.0148268
Montagne	.0401141**	.0192304
Etae	.0820219**	.0366784
Etaos	-.1293822*	.0686328
Irr	-.0730501***	.0192734
Elect	.0196918	.0156507
lnrt[b]	.0037735	.0067375
Fpfha X Fpaf	-.0575416	.074115
Fpai X Fpiha	-.0755377**	.0311838
Etaos X Etae	.0387188	.0680909
Irr X Etaos	.1202579	.0844045
Fpaf X Primc	-.2511408*	.1373868
Fpaf X PostPrim	.064393	.0462451
Fpaf X Jeune	-.1036095**	.0435882
Irr X Endet	.0233926	.0471731
Pfvd X Naec	-.0041843	.0040737
Irr X Endet X Etaos	-.1150693	.0954725
Masdevl X Masstr X Etaos	-.0157409	.093522
Uec X Usa	-.0545486[a]	.0347535
Montagne X Etae	-.1526522	.117195
Montagne X Etaos	.0557776	.0942405
Sacrif X Espnc	.0179085	.0556535
Intercept	.623611***	.1213653
Alpha	-.0113202	.0764101
lns	-1.645894***	.0479034
lnv	-.9423167***	.0192709
s	.1928401	.0092377
v	.3897239	.0075103

Notes.—+The excluded instruments are gender (Sexe; Male=1); the marital status (Statmat; Married=1), the native in the area (Natif; Native=1), and the religious affiliation (Protestant; Protestant=1). With regard to dependent

variable, the religious attendance is exogenous as this is confirmed with a Wald test accepting the Null of exogeneity (Wald test of exogeneity: (Alpha=0): Chi2(1)=0.02; prob>chi2=0.8822). Left censored observations at Ineff<=0=26; Right censored observations at Ineff>=0.99241. Uncensored observations=785. ***, **, * significantly different from zero at 1% (p<=0.01), 5% (p<=0.5) et 10% (p<=0.1) respectively. [a]=significant at 11% level. [b]=total income.

Appendix C
Method of calculation of individual output (the PBA)

This Appendix clarifies the method of calculating for the major economic indicators of performance of the farmers—the PBA (the gross agricultural product). It adopts an approach similar to that suggested by the Institut National Agronomique Paris-Grignon (Devienne and Brochet 1997), which is more suitable to subsistence farming in developing countries.

The gross agricultural production (PBA) of a farm is the aggregated value (estimated at current market prices in 2005-2006 HTG) of crop and cattle production during the agricultural year 2005-2006. As farms are diversified, their productions were estimated in monetary terms and then aggregated. One may distinguish three main components: (i) the crop products (PV), (ii) the animal products (PA) and (iii) the others products (PD).

The procedures for calculating these various components are as follows:

(i) PV = Sales + Family consumption + Pay and donations with agricultural products + Stocks variation (= current stock or end of season stock – Stock at the beginning of the campaign)x(average annual price of the Product);

(ii) PA = Family consumption + Net Sales (Sales – Purchase of Animals) + Change in cattle stocks (= current stock or end of season stock -- stock at the beginning of Campaign)x(Value per animal) + Sales of animal products;

(iii) PD = Production Capital (for instance, material location to others) + Sales of crops by-products or wood for construction + Rent from land and animals + Various Financial Products (including rebates from cooperatives).

Thus, PBA = PV + PA + PD.