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# Labor Markets in Rural and Urban Haiti

## Based on the First Household Survey for Haiti

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## Abstract

This paper addresses labor markets in Haiti, including farm and nonfarm employment and income generation. The analyses are based on the first Living Conditions Survey of 7,186 households covering the whole country and representative at the regional level. The findings suggest that four key determinants of employment and productivity in nonfarm activities are education, gender, location, and migration status. This is emphasized when nonfarm activities are divided into low-return and high-return activities. The wage and producer income analyses reveal that education is key to earning higher wages and incomes. Moreover, producer incomes increase with farm size, land title, and access to tools, electricity, roads, irrigation, and other farm inputs.

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## Based on the First Household Survey for Haiti

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## 1. Introduction

Haiti, with some 8 million people, is the poorest country in the Western Hemisphere and has been so for quite some time. It is also one of the Caribbean Community's most populous with 306 people per sq. km in 2003. Haiti has experienced a tortuous development notable for political instability and structural and institutional weakness. This, paired with the country's historical, socio-economic, and agricultural development have caused adverse long-term effects in several areas such as food security, nutrition, education, and income poverty.

In 2001, 49 percent of the Haitian households lived in absolute poverty with 20, 56, and 58 percent of the households in metropolitan, urban, and rural areas, respectively, being poor based on a US$1 a day extreme poverty line. Most of the approximately 4.3 million indigents live in rural areas (3.06 million) and others live in the metropolitan and other urban areas (1.27 million). Poverty is especially extensive in the northeastern and northwestern regions of Haiti. The analyses are based on a recent national household survey (which is still not released) and available data.

Social indicators such as literacy, life expectancy, infant mortality, and child malnutrition also show that poverty is broad in Haiti. Around 4 out of 10 people cannot read or write; around 20 percent of children suffer malnutrition, nearly half the population has no health care and more than four-fifths have no clean drinking water. Although still very high, these indicators show that poverty in non-income terms decreased in the last decades. However, most of the social indicators do show that poverty has increased since the mid-late 1990s. Moreover, the gap between rich and poor people and between regions is still large, such as between the Northeast and West regions.

This paper addresses labor markets in Haiti, including farm and nonfarm employment and income generation. The paper is organized in 4 sections. Section 2 presents the data and methodology used throughout the paper. Section 3 presents analyses of the labor market and addresses correlates of farm and non-farm employment, the likelihood of being employed in the high/low productivity sectors, the composition of rural labor income generation, and determinants of farm incomes. Finally, Section 4 concludes and gives policy recommendations. Before initiating the analyses, this section ends with a short background presentation of the current situation in Haiti.

Haiti's 200-year history has been marked by political instability and weak institutional capacity, resulting in a debilitated economy and an impoverished population. The current complex emergency is rooted in a four-year political impasse. In 2000, Aristide's party, Lavalas Family, claimed an overall victory in disputed legislative and municipal elections, then later that year, the opposition boycotted the presidential election that Aristide won unopposed with low voter turnout. As a result, in 2002 growing lawlessness, instability, and politically motivated violence began to overwhelm the country. On February 29, 2004 Aristide resigned from the presidency and on March 9, 2004 Haiti's seven-person advisory council selected Latortue, a former United Nations

official and foreign minister, as Haiti's Prime Minister. Having determined that the situation in Haiti continued to constitute a threat to international peace and security in the region the Security Council decided to establish the United Nations Stabilization Mission in Haiti (MINUSTAH) and requested that authority be transferred from the Multinational Interim Force, authorized by the Security Council in February 2004, to MINUSTAH on June 1, 2004.

## 2. Data and Methodology

This section presents data sources and the methodologies used in the paper to analyze poverty and labor markets in Haiti.

### Data

Haiti is completing the first comprehensive household survey that covers both rural and urban areas. National household data are critical for making informed decisions on alleviating urban and rural poverty in Haiti. The analyses in this paper are based on the national households survey (*l'Enqueête sur les Conditions de Vie Haïti*— the Haiti Living Conditions Survey (HLCS)) from 2001 (still unreleased). Population data are from publications produced by the statistical office (*Institut Haitien de Statistique et d'Informatique*—IHSI). The survey was undertaken in all nine regions (*department)* and is representative at the regional level in Haiti. The dataset includes 7,186 households. It is the first time in Haiti's history that a survey of this magnitude has been conducted. (See FAFO for more information.[2])

The household survey consists of 15 SPSS files (these files are dated 10.06.2004 and named Base de Données Mar). The Bank obtained them directly from the Haitian statistical agency via FAFO the Norwegian institution that has worked with the statistical office. We have discovered a number of serious flaws. The most important flaw relates to the variable describing the metropolitan-urban-rural status of a household/individual, which is different in the different files. After discussions with the IHSI the only reliable data for metropolitan, urban, and rural levels are those based on the file with household information, therefore these data are used throughout the paper.

To calculate poverty, income including self-consumption has been used. Income is for the past 12 months based on a number of individual income sources and self-consumption is estimated value of consumption (and barter) of household production of crops, meat, and fish during the last week. First respondents answer questions on consumption of own production, and the market value of it. Secondly an average unit price of each type of good was calculated for the whole sample and multiplied by the quantity consumed last week and multiplied by 52 weeks.

[2] FAFO's website: www.fafo.no.

## Methodology

The income-poverty measures are designed to count the poor and to diagnose the extent and distribution of poverty. The income-poverty measures proposed by Foster, Greer, and Thorbecke (1984) are used throughout the paper. These are the headcount rate (P0), poverty gap (P1), and squared poverty gap (P2) measures. The former measures the magnitude of poverty and the latter two poverty measures assess both poverty magnitude and intensity.

The headcount rate is defined as the proportion of household heads (not the whole population) below the poverty line. One concern applying the P0 measure is that each individual below the poverty line is weighted equally and, therefore, the principle of transfers is violated. A limitation of the measure is illustrated by the fact that it would be possible to reduce the P0 measure of poverty by transferring money from the very poor to lift some *richer* poor out of poverty, hence increasing social welfare according to the measure. P0 takes no account of the degree of poverty and it is unaltered by policies that lead to the poor becoming even poorer.

One measure of poverty that takes this latter point into account (at least in weak form) is the poverty gap measure (P1). P1 is the product of incidence and the average distance between the incomes of the poor and the poverty line. It can be interpreted as a per capita measure of the total economic shortfall relative to population. P1 distinguishes the poor from the not-so-poor and corresponds to the average distance to the poverty line of the poor. One problem with the poverty gap, as an indicator of welfare is that, poverty will increase by transfers of money from extreme poor to less poor (who become non-poor), and from poor to non-poor. Furthermore, transfers among the poor have no effect on the poverty gap measure.

The P2 measure of poverty is sensitive to the distribution among the poor as more weight is given to the poorest below the poverty line. P2 corresponds to the squared distance of income of the poor to the poverty line. Hence, moving from P0 towards P2 gives more weight to the poorest in the population.

This paper sets its poverty bar very low. To define "extreme poverty" or indigence it uses a US$1 a day poverty line, which is annually 2,681 gourdes.[3] Those that earn a per-capita income above US$1 are above the indigence line and therefore not extremely poor. The poverty lines used for rural, urban, and metropolitan areas are identical, as consumer price index data do not exist for different regions or locations in Haiti. This may overestimate poverty in rural areas slightly.

[3] The conversion is based on the 2000 PPP. The questionnaire asks for information about income in the last 12 months and self-consumption in the last week (which is multiplied by 52 to obtain the annual self-consumption).

## Quantile Regressions

*Model*

The underlying economic model used in the analysis will simply follow Mincer's (1974) human capital earnings function extended to control for a number of other variables that relate to location. In particular, we apply a semi-logarithmic framework that has the form:

$$\ln y_i = \varphi(x_i, z_i) + u_i \qquad (1)$$

where $\ln y_i$ is the log of earnings or wages for an individual, i; $x_i$ is a measure of a number of personal characteristics including human capital variables, etc.; and $z_i$ represents location specific variables. The functional form is left unspecified in equation (1). The empirical work makes extensive use of dummy variables in order to catch nonlinearities in returns to years of schooling, tenure, and other quantitative variables. The last component, $u_i$, is a random disturbance term that captures unobserved characteristics.

*Quantile regressions*

Labor market studies usually make use of conditional mean regression estimators, such as OLS. This technique is subject to criticism because of several, usually, heroic assumptions underlying the approach. One is the assumption of homoskedasticity in the distribution of error terms. If the sample is not completely homogenous, this approach, by forcing the parameters to be the same across the entire distribution of individuals may be too restrictive and may hide important information.

The method applied in this paper is quantile regressions. The idea is that one can choose any quantile and thus obtain many different parameter estimates on the same variable. In this manner, the entire conditional distribution can be explored. By testing, whether coefficients for a given variable across different quantiles are significantly different, one implicitly also tests for conditional heteroskedasticity across the wage distribution. This is particularly interesting for developing countries such as Haiti where wage disparities are huge and returns to, for example, human capital may vary across the distribution.

The method has many other virtues apart from being robust to heteroskedasticity. When the error term is nonnormal, for instance, quantile regression estimators may be more efficient than least squares estimators. Furthermore, since the quantile regression objective function is a weighted sum of absolute deviations, one obtains a robust measure of location in the distribution, and as a consequence the estimated coefficient vector is not sensitive to outlier observations on the dependent variable.[4]

[4] That is, if $y_i - x_i'\hat{\beta}_\theta > 0$ then $y_i$ can be increasing towards + ∞, or if $y_i - x_i'\hat{\beta}_\theta < 0$, $y_i$ can be decreasing towards -∞, without altering the solution $\hat{\beta}_\theta$. In other words, it is not the *magnitude* of the

The main advantage of quantile regressions is the semi-parametric nature of the approach, which relaxes the restrictions on the parameters to be fixed across the entire distribution. Intuitively, quantile regression estimates convey information on wage differentials arising from nonobservable characteristics among individuals otherwise observationally equivalent. In other words, by using quantile regressions, we can determine if individuals that rank in different positions in the conditional distribution (i.e., individuals that have higher or lower wages than predicted by observable characteristics) receive different premiums to education, tenure, or to other relevant observable variables.

Formally, the method, first developed by Koenker and Basset (1978), can be formulated as[5]

$$y_i = x_i'\beta_\theta + u_{\theta i} = \text{Quant}_\theta(y_i \mid x_i) = x_i'\beta_\theta \qquad (2)$$

where $\text{Quant}_\theta(y_i \mid x_i)$ denotes the $\theta^{th}$ conditional quantile of y given x, and i denotes an index over all individuals, i = 1,…,n.

In general, the $\theta^{th}$ sample quantile ($0 < \theta < 1$) of y solves

$$\min_{\beta} = \frac{1}{n}\left\{ \sum_{i:y_i \geq x_i'\beta} \theta \mid y_i - x_i'\beta \mid + \sum_{i:y_i < x_i'\beta} (1-\theta) \mid y_i - x_i'\beta \mid \right\}. \qquad (3)$$

Buchinsky (1998) examines various estimators for the asymptotic covariance matrix and concludes that the design matrix bootstrap performs the best. In this paper, the standard errors are obtained by bootstrapping using 200 repetitions. This is in line with the literature.

## 3. Labor Markets and Income Generation

Labor markets are important for poverty reduction in Haiti. Employment is key to lifting poor families out of poverty. In the longer term, Haiti's rural population growth will slow down and this will affect poverty through its broader effects on the labor market.[6] The population growth experienced in previous decades has resulted in an

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dependent variable that matters, but on which *side* of the estimated hyper plane the observation is. This is most easily seen by considering the first-order-condition, which can be shown to be given as (see Buchinsky 1998) $\frac{1}{n}\sum_{i=1}^{n} (\theta - \frac{1}{2} + \frac{1}{2}\text{sgn}(y_i - x_i'\hat{\beta}_\theta))x_i = 0$.

This can be seen both as a strength and weakness of the method. To the extent that a given outlier represents a feature of "the true" distribution of the population, one would prefer the estimator to be sensitive, at least to a certain degree, to such an outlier.

[5] See Buchinsky (1998).

[6] See Verner (2007).

elastic supply of unskilled labor. As a result wage levels have remained low, except for high skilled, well-educated workers.

Labor is poor people's most abundant asset and it accounts for the majority of their total income. Nonetheless, the poor are constrained in their labor use in a number of ways: lack of jobs, low wages, and wage discrimination especially for women.

A poverty analysis for Haiti reveals that many workers are poor despite full-time work.[7] The challenge of creating employment is therefore to increase worker productivity and tighten the labor market for competitive wages to lift the employee's household out of poverty.

This section addresses determinants of employment, workers' wages, and producers' income. Employment is analyzed using a probit model. The wage determination process is analyzed using the quantile regression methodology (Section 2). This methodology characterizes the distribution of labor income in more detail than traditional OLS and two stage least squares (2SLS) regressions, as it makes it possible to break down the wage determination process across the entire wage distribution. Producer incomes are analyzed using an augmented production function model allowing for effects of farmer characteristics as well as farm production and infrastructure characteristics.

Port-au-Prince, despite the paucity of jobs, attracts many people from rural areas. Even the remote prospect of regular work draws an estimated 100,000 people each year from the countryside. This migration has led to an explosion of house building that has created work for construction laborers, but for the most part they join the estimated one million Haitians working in the informal sector that covers a multitude of occupations from self-employed traders and artisans to casual laborers. The most common activities are the reselling of minute quantities of everyday goods and basic services. Markets and streets are full of people attempting to make a living by selling items such as used clothing, fruit and vegetables, chewing gum, pens, soap, etc. Others run roadside micro-enterprises that, for example, repair broken-down machinery of all kinds and break rocks for use in house or road construction.

Formal sector jobs are few in Haiti. Ninety percent of the formal economy jobs that exist in Haiti are located in Port-au-Prince. Approximately half of the formal sector jobs are in the public sector, in particular in education, health, and justice. Other formal jobs are in state-owned enterprises such as telephone and electricity companies, the police force, and the tax and custom services. The rest of those with formal employment work in the small private sector, mainly in assembly factories, banking, commerce, and transportation. Since 1995, the one area of employment that has increased is the provision of private security, reflecting concerns about increased crime.

[7] See Verner (2007).

Haitians living in rural areas are always on the move, weeding fields, harvesting crops, fetching drinking water, or driving livestock to fresh pasture. The people cannot afford to be idle.

Unemployment is a serious problem, particularly in urban areas. The unemployment rate among household heads in Haiti reached 38.9 percent in 2001 according to the household survey. The rate is highest in urban areas; 48.8 and 36.7 percent in metropolitan and other urban areas respectively compared to 35.6 percent in rural areas.

**Agricultural and Nonagricultural Employment**

It seems fairly clear that the economy must remain a central focal point for policy makers aiming to reduce poverty. Employment is therefore essential and both the farm and nonfarm sector play a key role. The nonfarm sector is heterogeneous and includes a great variety of activities and productivity levels across nonfarm jobs. Moreover it can reduce poverty in a couple of distinct but qualitatively important ways. First, high-productivity activities seem to provide the rural population with sufficient income to escape poverty. Second, vulnerable segments of the population, such as the poorest tend to be concentrated in the low or less productive rural nonagricultural activities—mainly due to skill and educational deficiencies and location disadvantages. These low-productivity/return occupations nevertheless provide a critical contribution to their livelihoods preventing further destitution.

Labor markets can be analyzed in many ways. One way is to consider the agricultural and nonagricultural sector or the off-farm sector. Off-farm employment has traditionally been seen as a low productivity sector, producing low quality goods. The sector, in this view, is expected to shrink as the economy develops and incomes increase. However, recent research shows that the rural nonfarm sector has a positive role in absorbing a growing rural labor force and slowing rural-urban migration. Moreover, the nonagricultural sector contributes to national income growth and in promoting a more equitable distribution of income (Lanjouw and Lanjouw 2001). Lanjouw and Lanjouw also find that the nonagricultural sector is large and growing in developing countries. In Latin America alone 47 percent of the labor force in rural settlements and rural towns are employed in off-farm activities. Moreover, 79 percent of women in the Latin American rural labor force are employed in off-farm activities. In Haiti 52.4 percent of the workers are engaged in off-farm activities—98.7, 55.4, and 37.2 percent in metropolitan, urban, and rural areas, respectively, in 2001.

| Table 1: Probability of being Employed in the Nonagricultural Sector, 2001 | | | | | | |
|---|---|---|---|---|---|---|
| | Nonagricultural Employment | | Low-productivity Nonagricultural Employment | | High-productivity Nonagricultural Employment | |
| | dF/dx | t | dF/dx | t | dF/dx | t |
| Female* | 0.50 | 12.41 | 0.13 | 5.75 | 0.11 | 3.74 |
| Family Size | 0.03 | 3.64 | 0.02 | 4.93 | 0.00 | -0.71 |
| Primary education* | 0.17 | 3.97 | -0.06 | -2.46 | 0.21 | 5.70 |
| Secondary education* | 0.33 | 7.41 | -0.07 | -2.63 | 0.37 | 8.48 |
| Tertiary education* | 0.35 | 4.99 | -0.14 | -3.84 | 0.68 | 6.55 |
| Migrated* | 0.18 | 2.43 | 0.00 | 0.16 | 0.03 | 0.75 |
| Social capital* | 0.08 | 1.79 | -0.01 | -0.43 | 0.03 | 0.77 |
| Land per capita (ha) | 0.00 | 5.12 | 0.00 | 2.84 | 0.00 | 4.93 |
| Rural* | -0.30 | -2.95 | -0.12 | -2.19 | -0.28 | -3.83 |
| Rural female* | -0.05 | -1.01 | 0.16 | 5.23 | 0.12 | 3.01 |
| Rural fam size* | -0.02 | -2.11 | 0.00 | -0.30 | -0.01 | -1.41 |
| Rural primary education* | 0.02 | 0.32 | 0.08 | 2.47 | -0.01 | -0.35 |
| Rural secondary education* | 0.04 | 0.58 | 0.10 | 2.06 | 0.08 | 1.41 |
| Rural migrant* | 0.04 | 0.44 | 0.08 | 1.92 | 0.09 | 1.69 |
| Rural social capita* | -0.03 | -0.61 | -0.01 | -0.49 | 0.06 | 1.37 |
| Rural ha per capita | 0.00 | 0.27 | 0.00 | 2.73 | 0.00 | 1.09 |
| Southeast* | -0.61 | -6.47 | -0.07 | -1.38 | -0.21 | -4.47 |
| North* | -0.30 | -3.10 | 0.19 | 4.18 | -0.21 | -5.25 |
| Northeast* | -0.54 | -5.44 | 0.23 | 3.93 | -0.27 | -6.43 |
| Artibonite* | -0.49 | -5.32 | 0.13 | 3.27 | -0.29 | -7.79 |
| Center* | -0.58 | -6.33 | 0.01 | 0.25 | -0.29 | -8.16 |
| Southeast* | -0.49 | -4.81 | 0.02 | 0.36 | -0.22 | -4.94 |
| Grand-Anse* | -0.43 | -4.26 | 0.16 | 3.31 | -0.27 | -6.84 |
| Northwest* | -0.47 | -4.69 | 0.01 | 0.29 | -0.19 | -3.92 |
| Rural Southeast* | 0.32 | 4.76 | 0.09 | 1.12 | 0.15 | 1.93 |
| Rural North* | 0.18 | 2.09 | -0.03 | -0.77 | 0.04 | 0.49 |
| Rural Northeast* | 0.29 | 4.04 | -0.05 | -0.89 | 0.20 | 1.79 |
| Rural Artibonite* | 0.23 | 2.79 | -0.10 | -2.72 | 0.19 | 2.79 |
| Rural Center* | 0.27 | 3.68 | -0.06 | -1.24 | 0.36 | 4.55 |
| Rural South* | 0.24 | 2.83 | -0.03 | -0.57 | 0.13 | 1.65 |
| Rural Grand-Anse* | 0.23 | 2.81 | -0.10 | -2.65 | 0.31 | 4.00 |
| Rural Northwest* | 0.29 | 4.13 | 0.07 | 1.14 | 0.14 | 1.73 |
| Pseudo R2 | 0.50 | | 0.16 | | 0.37 | |

Note: Excluded variables: No education and West region. Number of obs = 4,349. (*) dF/dx is for discrete change of dummy variable from 0 to 1; t is the test of the underlying coefficient being equal to 0.

*Source:* Own calculations based on HLCS 2001.

What determines what types of workers are most likely to seek employment outside the agricultural sector? Nonagricultural activities are expanding in Latin America and the Caribbean and a large share of total household income is generated in this sector in the region as well as in Haiti.[8] This section examines factors, which are associated with employment in nonagricultural activities in rural and urban Haiti.

The analyses of participation in nonfarm activities are multivariate and estimate a probit model of involvement in nonfarm activities as a primary occupation on a range of individual, household, and geographical characteristics. The specification of the model draws on findings above, which suggest that the choice of primary occupation is affected by for example education and gender. Rather than reporting the parameter estimates, which are difficult to interpret on their own, Table 1 presents the marginal effects associated with each explanatory variable. These can be interpreted as indicating the effect of a percentage change in the explanatory variable on the probability of involvement in nonfarm business activities, taking all other variables in the specification at their means.[9]

Findings from above and recent research have shown that the nonfarm sector can often be seen as a source of both high-return employment as well as a "last resort" option (see Ferreira and Lanjouw 2001). Therefore, following Ferreira and Lanjouw, this paper presents estimations of two additional models with the same specification of regressor, but differentiating between high-return nonfarm activities as opposed to low-return nonfarm activities. The nonfarm subsectors are designated as either high return or low return depending on the average annual earnings accruing to the individuals whose primary occupation is in that sector. If the average annual wage is below the extreme poverty line, the sub-sector is designated as low return, or low productivity sector. Conversely, if the average annual return from a sub-sector is above the poverty line, the sub-sector is designated as high return.

Table 1 presents three probit models linking the probability of a worker having primary employment in nonagricultural wage-labor occupation to a range of explanatory variables (age, gender, schooling variables, migration status, social capital, land, household size, location, and regional dummies) included in the analysis. In the first model, comprising all combined nonfarm activities in Haiti, the dependent variable takes the value of one if the worker is primarily employed in nonagricultural wage labor and zero if the worker is primarily employed in agricultural wage labor. The second and third model split those employed in the nonagricultural labor force into two groups; those with a low productivity (low-return) job and those with a high productivity (high-return) job.

Considering all nonfarm employment together, women are significantly more represented in the nonagricultural wage-labor force than men in both rural and urban

[8] See Verner (2007).

[9] For dummy variables, the marginal effect is calculated as the change in the dependent variable associated with a move from a value of zero for the dummy, to one, holding all other variables constant at mean values.

areas, controlling for all other variables (Table 1). This finding is similar to the poor Northeast Brazil where women are also more likely to be represented in the agricultural sector (see Ferreira and Lanjouw 2001), different from findings from rural Mexico and Argentina, where men are more likely to work off-farm than women (Verner 2004 and 2005). After dividing the types of occupation into two groups depending on whether earnings are lower or higher than the poverty line, women are still significantly more likely than men to be employed in low-return nonagricultural activities. This is also the case for high-return nonagricultural activities, but the effect is lower, i.e. the difference between male and female participation rates is leveling out in the high-productivity nonfarm sector. In rural areas the latter findings are even stronger—women tend to be much more engaged off-farm than men.

The effect of education is strong. This has also been found in other studies. For example, Taylor and Yuwez-Naude (2000) find evidence of high returns from schooling in both crop and noncrop activities in Mexico (see Ferreira and Lanjouw 2001 for a review). Findings in Table 1 show that the probability of involvement in the nonfarm sector is positively and significantly related to education levels in Haiti. Relative to the uneducated, those with at least one level of completed education are generally more likely to find employment in the nonagricultural sector, controlling for other variables.

Findings in Table 1 also reveal that as education attainment rises, so does the probability of being employed in the nonagricultural sector in rural and urban Haiti. In the high productivity jobs, the completed primary, secondary, and tertiary education variables are all statistically significant and positive. At average values of other variables, having completed primary education raises the probability of employment in high-return jobs to around 21 percent.

Raising the level of attained education to the secondary level increases it even more. The effect of a high school education is nearly double as likely to be employed in the high-return nonagricultural employment as are primary educated workers. Moreover, university graduates have a much larger probability of working in high-return nonfarm jobs than do secondary school graduates. It is important to acknowledge that the exogeneity of education in these models can be questioned so more research would be needed to understand employment possibilities in high-productive sectors.

Spatial heterogeneity is large within Haiti. Geography influences probabilities of nonfarm sector participation even after controlling for other characteristics. Relative to those living in the West region, workers living in the other 8 regions are less likely to be employed in high-productive nonagricultural sectors and nonagricultural sectors generally, controlling for individual characteristics. The rural people outside the West and Center regions are significantly less likely than those in the rural West region to be employed in nonagricultural activities. This indicates that workers in rural localities are not stuck with cultivation only as wage employment opportunities do exist. Improving transport infrastructure that provides access to urban centers may translate into better access to off-farm jobs.

Whether a person *stayed in* or migrated to the region of current residence affects employment. Workers who migrated have a higher likelihood of being employed in the nonfarm sector. When dividing the sample in high and low-productivity, migrants to rural areas have a slightly higher likelihood than *stayers* in the specific rural area to work in the high-productivity nonfarm sector.

The probability of nonfarm employment does not statistically significantly rise with increased skill levels (proxied by age), controlling for other characteristics, in Haiti. This is the case in both urban and rural areas. Hence, there is no evidence that participation begins to decline at a certain skill level or age. This finding contrasts with findings from Brazil where older workers have a smaller probability of being employed off-farm (Ferreira and Lanjouw 2001).

When examining correlates of nonfarm employment in Haiti, findings suggest that the four key determinants of access to employment and productivity in nonfarm activities are education, gender, location, and migration status. This is emphasized when nonfarm activities are divided into low-return and high-return activities. There is evidence that the nonfarm sectors are more vibrant in more populated areas which are connected to markets and enjoy certain minimum standards of infrastructure. Hence, it is key that governments assist in augmenting the access to infrastructure services and human capital of the rural population so they can take advantage of increased opportunities.

***Determinants of Wage Worker Incomes***

Wages and incomes are keys to escaping poverty in metropolitan, urban, and rural areas in Haiti.[10] This sub-section addresses the determinants of labor incomes of employees and the self-employed (henceforth called workers), including farm-workers. It also investigates differences between low and high paid workers in urban and rural areas (the next section addresses agricultural producer incomes). Comparisons of household heads age 12 and older—located at different places in the labor income distribution shed light on these questions. Incomes of workers are compared by gender, education, skills, labor status, sector, social capital, family characteristics, and location.

The labor incomes are modeled by using log income per capita as the dependent variable. The general model contains explanatory variables in levels and allows for nonlinearities in the data. For example, the log income equation is found to be nonlinear in education. In addition, the model contains dummy variables that take the value of one if, for example, a worker holds a job in the agricultural sector, and zero otherwise. Such a dummy variable may reveal whether there is an income premium/tax related to agricultural sector employment. The $25^{th}$, $50^{th}$, $75^{th}$, and $90^{th}$ quantiles are used in the analysis. Findings indicate that incomes are by no means determined in the same way for high and low paid workers. Findings for Haiti are presented in Table 2.

[10] See Verner (2007).

Each explanatory variable will now be discussed in turn starting by location and followed by: (1) education, (2) experience, (3) labor market association and status, (4) sector, (5) gender, and (6) social capital.

Rural living is in many ways very different from urban and metropolitan living in Haiti (Table 2). The largest statistical differences in poverty reduction between rural and other areas are found in the effect of education, gender, and social capital.[11] However, as this section shows, not all variables are significant at all five quantiles.

Living in rural areas in Haiti does by itself affect wages for the workers in the first quantile. For workers in quantile 2-5 individual and other characteristics are more important than geographical location. However, rural workers in quantile 1 earn statistically significantly more than their peers in urban areas, controlling for education, skills and other variables. This finding may indicate that migration from rural to urban areas has caused an inflow of workers, maybe creating an excess supply, and therefore forced wages of the poorest workers below wages in rural areas. This is not the case for any other income level.

Human capital has proven to be important in enhancing long term economic growth.[12] A more educated workforce is likely to be more productive, flexible, and innovative, and to facilitate the adoption and use of new technologies. The increasing speed of technological change faced by firms and farms today and international economic integration means that workers need to have more skills at higher levels in order for firms or farms to be competitive. One reason for this is that employees that are more skilled can adjust more easily to changes in their firm's or farm's economic and technological environment than less skilled workers.[13]

Knowledge about educational income differentials or income gaps serves at least three different purposes. First, income differentials reveal the magnitude of incentives or returns obtained by workers acquiring education, and hence, individual educational demand. Second, knowing the extent of economic returns to human capital makes it possible to assess whether it is worth making this kind of investment instead of others. Third, income differentials disclose how the labor market translates educational inequalities into income inequalities, which is important information in the process of reducing the latter. Furthermore, educational returns link to some extent education to labor productivity and indicate the magnitude of the contribution of education to

[11] See Verner (2007).

[12] See, for example, Barro (1991) and Mankiw, Romer, and Weil (1992).

[13] One issue that needs to be mentioned relates to the endogeneity of education in the regressions. There is vast evidence of a positive correlation between earnings and education. However, social scientists are cautious to draw strong inference about the causal effect of education. In the absence of experimental evidence, it is tedious to recognize whether higher earnings observed for better educated employees are caused by their higher level of completed education, or whether employees with greater earnings capacity have chosen to acquire more education. Card (1998) surveys the literature on the causal relationship between education and earnings and finds that the average marginal returns to education is not much below the estimate that emerges from standard human capital earnings function studies.

economic growth. Therefore, it is of interest to estimate the impact of different levels of education and experience on labor incomes.

The figures in Table 2 confirm the findings of hundreds of other studies: education plays an important role in the income determination process. More educated individuals earn higher incomes than their less-educated peers.

Are returns to education constant over education levels in Haiti? According to the findings presented in Table 2, the answer is no.[14] In this analysis, findings allow comparison for workers with no completed level of education (the reference group) with their co-workers who have completed primary school, secondary school, and tertiary education.[15] In 2001, returns to primary, secondary, and tertiary education were statistically significantly different from zero and positive for all at the analyzed quantiles, controlling for other individual characteristics in Haiti.

This finding indicates that having completed at least a few years of education contributes more to incomes than not having completed any education at all. Moreover, overall the premium is rapidly increasing with attained education. In Haiti, the median worker experiences a return of 83, 203, and 1,272 percent for completed primary, secondary, and tertiary education, respectively.[16] More educated individuals earn dramatically higher incomes than do their less-educated counterparts. However, for the median worker, the returns are slightly lower in rural areas, 61, 170, and 1,200 percent for completed primary, secondary, and tertiary education, respectively.

Returns across the income distribution are not constant for workers with any of the three levels of completed education (Table 1). Findings indicate that workers with completed primary education in the low end of the income distribution receive higher returns to education than their peers in the middle and high end of the distribution. This result has also been found in the case of South Africa (Mwabu and Shultz 1996). Workers in rural areas obtain a lower return than their urban peers at most quantiles, except for quantile 1 and 5. This could indicate that there is a problem with heterogeneity of primary education quality in rural areas. Workers with completed secondary education face the same problem as workers with completed primary education. Although returns are significantly higher for completing one more level of education, the returns vary across the distribution and follow a downward trend. Workers in the low end ($10^{th}$ quantile) receive a 332 percent return, median workers a 203 percent return and the top end ($90^{th}$ quantile) workers receive a 177 percent return. One explanation could be that social networks or capital that is not captured by our social capital variable may be working

[14] Unmeasured ability and measurement error problems have been dealt with in the literature applying data on twins, see for example Card (1998) and Arias, Hollack, and Sosa (1999).

[15] The so-called "sheepskin effect" states the existence of wage premiums for completing the final year of elementary school, high school, or university. Therefore, it has been argued that credentials, such as a school diploma or university degree are more important than years of schooling per se. That is one reason for not having a continuous education variable in the regressions.

[16] The percentage return is calculated as (exp (coefficient estimate) – 1) * 100.

better or be higher among the poorer segments than richer segments of the working population in Haiti.

Findings for tertiary education follow the pattern for completed primary and secondary education and workers with complete tertiary education do face decreasing returns across the income distribution; i.e. workers in the low end of the income distribution are paid more than their peers in the high end (the absolute premium is still much larger for those in the higher quantiles). Hence, workers with the same level of education are not compensated equally.

Table 2: Determinants of Labor Income in Haiti, 2001

Quantile Regressions

Dependent variable: Log total income (per capita)

| | 10th quantile | | 25th quantile | | Median | | 75th quantile | | 90th quantile | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Return % | P>\|t | Return % | P>\|t | Return % | P>\|t | Return % | P>\|t | Return % | P>\|t |
| Age | 1.06 | 2.87 | 0.03 | 0.13 | 0.44 | 2.97 | 0.32 | 1.79 | 0.36 | 1.50 |
| Female | 5.49 | 0.43 | 12.86 | 1.51 | 10.26 | 1.90 | 0.31 | 0.05 | 4.03 | 0.53 |
| Family size | -28.45 | -4.46 | -28.02 | -6.87 | -28.37 | -11.30 | -30.18 | -10.27 | -25.98 | -6.63 |
| Squared family size | 1.78 | 2.71 | 1.73 | 4.16 | 1.93 | 7.68 | 2.17 | 7.49 | 1.54 | 4.13 |
| Primary Education | 95.20 | 4.91 | 75.39 | 6.41 | 82.69 | 10.58 | 80.55 | 8.70 | 69.21 | 6.11 |
| Secondary education | 331.80 | 9.42 | 199.94 | 11.12 | 202.99 | 17.32 | 220.13 | 15.25 | 177.48 | 10.50 |
| Tertiary Education | 1850.47 | 9.01 | 1319.14 | 11.66 | 1271.89 | 18.32 | 1158.91 | 14.83 | 910.23 | 11.05 |
| Work tenure >5 y. | 69.89 | 1.83 | 46.58 | 2.02 | 5.59 | 0.45 | 17.22 | 1.12 | 17.87 | 0.92 |
| No info (work ten.) | 96.34 | 2.46 | 49.30 | 2.23 | 6.19 | 0.53 | 17.24 | 1.19 | 13.16 | 0.74 |
| Industry | 47.89 | 1.13 | 14.78 | 0.64 | -16.12 | -1.27 | -10.87 | -0.70 | -20.77 | -1.13 |
| Agriculture | -14.58 | -0.52 | -19.89 | -1.14 | -34.70 | -3.42 | -44.32 | -4.03 | -55.52 | -4.46 |
| Service | -7.11 | -0.27 | -3.88 | -0.22 | -14.81 | -1.40 | -6.77 | -0.52 | -0.99 | -0.06 |
| Inactive | -52.58 | -2.63 | -40.22 | -2.79 | -30.39 | -3.10 | -21.96 | -1.81 | -17.58 | -1.14 |
| Social capital | 19.06 | 1.41 | 14.70 | 1.74 | 0.65 | 0.13 | -6.22 | -1.07 | -7.06 | -0.96 |
| Rural | 290.90 | 2.29 | 41.67 | 0.88 | 19.72 | 0.69 | -18.32 | -0.63 | -30.05 | -0.85 |
| Rural*age | -0.71 | -1.55 | 0.23 | 0.78 | -0.09 | -0.48 | 0.21 | 0.93 | 0.33 | 1.13 |
| R*female | -6.90 | -0.46 | -21.49 | -2.41 | -21.53 | -3.77 | -5.74 | -0.78 | -5.21 | -0.56 |
| R*family size | 1.97 | 0.21 | 0.15 | 0.03 | 3.50 | 0.92 | 4.51 | 1.01 | -6.95 | -1.28 |
| R*sq. fam. size | -0.47 | -0.58 | -0.16 | -0.30 | -0.44 | -1.40 | -0.58 | -1.61 | 0.61 | 1.33 |
| R*prim. edu. | -20.13 | -1.31 | -19.36 | -1.95 | -22.17 | -3.52 | -21.27 | -2.81 | -13.27 | -1.31 |
| R* second. edu. | -39.46 | -2.20 | -17.13 | -1.30 | -32.81 | -4.28 | -33.26 | -3.63 | -14.56 | -1.09 |
| R* tertiary edu. | -59.57 | -1.35 | -59.23 | -1.77 | -72.36 | -4.03 | -70.61 | -3.13 | -14.04 | -0.34 |
| R*tenure >5 years | -24.06 | -0.69 | -18.49 | -0.77 | 6.08 | 0.35 | -2.94 | -0.15 | 3.53 | 0.14 |
| R*no info (tenure) | -33.89 | -1.07 | -11.48 | -0.48 | 8.87 | 0.52 | -0.44 | -0.02 | 7.08 | 0.29 |
| R*industry | -60.33 | -1.83 | -36.96 | -1.43 | -21.77 | -1.18 | -15.19 | -0.67 | 0.25 | 0.01 |
| R*agriculture | -34.92 | -0.98 | -14.72 | -0.57 | -11.87 | -0.70 | 16.96 | 0.74 | 46.08 | 1.40 |
| R*service | -43.82 | -1.38 | -23.68 | -0.99 | -25.32 | -1.67 | -20.70 | -1.11 | -16.51 | -0.67 |
| R*inactive | -35.91 | -1.05 | -32.70 | -1.44 | -39.85 | -2.90 | -38.93 | -2.37 | -35.68 | -1.67 |
| R*social | 12.80 | 0.76 | 11.73 | 1.10 | 20.46 | 2.89 | 24.19 | 2.82 | 14.05 | 1.35 |
| Constant | 34800 | 13.92 | 198324 | 27.20 | 573767 | 46.74 | 1269479 | 40.81 | 2308427 | 31.33 |
| Pseudo R2 | 0.1027 | | 0.1035 | | 0.1276 | | 0.1763 | | 0.2108 | |

*Note:* Excluded categories: No completed education, 1-4 years work tenure, and public.
The percentage return is calculated as (exp (coefficient estimate) – 1) * 100. Number of observations: 7099.

*Source:* Own calculations based on HLCS 2001.

There are several reasons for including experience characteristics in the analysis. One such reason is that a trained and educated workforce provides flexibility in adapting to changes in technology or other economic changes. Experience and years of schooling are widely used in analyses of income determination (see Mincer 1974, and Levy and Murnane 1992). The measure of experience included in this analysis is general experience measured by the age of the worker.[17]

Are returns to experience homogeneous across the population? According to the findings presented in Table 2, the answer is no. The experience variable is statistically significant for the $10^{th}$, $50^{th}$, and $75^{th}$ quantiles, controlling for other individual characteristics. Returns to experience are very low (1.1 percent and less) and falling across the income distribution in Haiti. Work tenure may capture skills learned on the job. This variable is statistically significant and positive, indicating that tenure is important in the income determination process; at least in the $10^{th}$ and $25^{th}$ quantiles.

Discrimination at an individual level is said to arise if an otherwise identical person is treated differently by virtue of that person's gender. Gender by itself has no direct effect on productivity. Under perfect competition in the capital and labor markets, equivalent employees in equivalent jobs are compensated equally, that is, there is no discrimination.

The estimation of discrimination is difficult. Worker productivity is seldom observed directly, so data must be used to proxy for the relevant productivity characteristics. The main debate occurs over whether relevant omitted characteristics differ between gender, and whether certain included characteristics capture productivity differences or instead are a proxy for gender. The following section reports findings on gender differences.

Are returns to gender homogeneous across Haitians? According to the findings presented in Table 2, the answer is no. The regressions' findings show signs of large measurable inequalities between men and women. Female incomes are statistically significant and higher than male incomes at the median, controlling for other characteristics. Findings suggest that returns to female workers are 10 percent higher than returns the male workers at the median in urban areas. The picture looks rather different in rural Haiti where the gender gap reveals that females are paid less than their male peers and statistically significantly so for the $25^{th}$ and $50^{th}$ quantiles.

The gender-earnings gap may, to some degree, be explained by choice of jobs by women in urban and rural areas. Women in rural Haiti may be more likely than men to select jobs, which are more flexible in nature. For example, women may choose part time jobs or jobs with lower working hours than men. A second factor may be gender differences in unmeasured skills, but they may very well be undercapitalized too in terms of experience. Additionally, many women choose professions where they are less forced to capitalize, for example, they work more often in teaching than male peers do.

[17] Earlier analyses (not reported in this paper) showed that there are no significant nonlinearities in the data related to age, therefore age is not included squared or in other nonlinear forms.

Economic sector matters too for wages. Wages in agriculture are lower than in industry, services, and the public sector. In particular at the higher end of the income distribution (in the $50^{th}$-$90^{th}$ quantiles) workers earn returns 35-56 percent lower than in other sectors.

Social capital is important in the wage determination process in rural Haiti while less so in urban areas. Social capital indicates whether a randomly selected individual (over age 14) from the household is a member of any popular, peasant, women, youth, social, sports, cultural, religious or political organization or club. At the $50^{th}$ and $75^{th}$ quantiles, workers in rural areas obtain returns to social capital of 20 and 24 percent, controlling for other variables. There are no returns to measurable social capital in urban areas and the lower quantiles in rural areas, except for some social capital that our social capital variable did not capture.

**Farm Technology and Inputs**

Agricultural output has suffered from a growing population farming a finite area of land. On tiny plots, the soil has become progressively less productive. The problem has been compounded by the deforestation of the country, which in turn has led to severe erosion of the fertile topsoil. As yields have declined, Haitian peasants are locked into a self-destructive cycle in which the cutting of trees and the farming of land higher up the mountainside can avoid short term financial disaster, but only create even bigger problems for the agricultural sector as a whole in the long term.

Small farmers lack modern production technology, basic infrastructure to store harvests to take advantage of cyclical price fluctuations, technical assistance to improve productivity, and organized marketing facilities. Family income is therefore highly variable and there is little opportunity for saving. They have very few assets, including education, and are therefore vulnerable to economic and climatic shocks. However, it is not only the poor farmers that lack technologically-enhanced inputs in the production process. Nonpoor farmers in Haiti also lack these inputs in order to increase farm productivity.

The vast majority of land owners have 2 hectares or less. HLCS data reveals that 78 percent of the farmers own 2 hectares or less, 19 percent own 2-7 hectares, and 4 percent own 7 or more hectares (Table 3). Hence, there are also large differences across regions, for example in the Artibonite, North, Northeast, and South regions less than 18 percent of all farms are larger than 2 hectares. Land ownership is spread very thin across farms. It is very difficult to obtain economies of scale with such small land holdings. In Haiti small farm intensification is called for, both in order to increase productivity and reduce poverty.[18]

Farmers diversify by producing crops and raising animals. Of the 62 percent of households with access to land, 88 percent cultivate the land and 3.9 percent lease it out.

[18] Income poverty among the household head of farmers with 0.5 hectares or less reached 64.8 percent and 46.8 percent of household heads with 6-10 hectares of land (See Verner; 2007).

Findings in Table 5 show that in the deciles 2-5 around 90 percent of landholders engage in cultivation activities and around 85 percent raise one or more animal. These numbers are 10 and 3 percentage points lower for the 20 percent poorest farmers.

Table 3: Land Distribution by Farm Size in Haiti, 2001 (percent)

| | Arti-bonite | Center | Grand-Anse | North | North-east | North-west | West | South | South-east | Total Haiti |
|---|---|---|---|---|---|---|---|---|---|---|
| < 0.5 ha | 22.5 | 12.7 | 14.0 | 42.0 | 23.4 | 16.3 | 18.5 | 27.6 | 19.6 | 21.5 |
| 0.5-1 ha | 32.7 | 25.8 | 27.5 | 28.4 | 33.0 | 26.5 | 31.1 | 28.2 | 25.4 | 28.6 |
| 1-2 ha | 26.6 | 32.8 | 28.4 | 18.0 | 25.9 | 31.6 | 24.7 | 27.8 | 30.3 | 27.6 |
| 2-4 ha | 11.2 | 19.7 | 13.1 | 7.6 | 11.7 | 15.9 | 15.7 | 9.8 | 17.3 | 13.7 |
| 4-7 ha | 2.7 | 5.2 | 10.2 | 2.0 | 3.6 | 5.9 | 4.9 | 4.4 | 4.7 | 4.9 |
| 7-10 ha | 1.7 | 2.0 | 3.2 | 1.0 | 2.5 | 2.1 | 2.4 | 1.9 | 1.3 | 2.0 |
| 10-20 ha | 1.5 | 1.7 | 2.7 | 0.8 | 0.0 | 1.5 | 1.8 | 0.2 | 0.4 | 1.3 |
| > 20 ha | 1.0 | 0.2 | 0.9 | 0.3 | 0.0 | 0.2 | 0.9 | 0.2 | 0.9 | 0.6 |

*Source:* Own calculations based on HLCS 2001.

Table 4: Cultivation of Land, 2001

| | Number | Percent |
|---|---|---|
| Cultivated | 3932 | 87.91 |
| Not cultivated | 353 | 7.89 |
| Leased out | 174 | 3.89 |
| Unknown | 14 | 0.31 |

Note: This table indicates results for any plot used (of those accessible)—if just one of several accessible plots are used it counts in this table as cultivated. Only households with access to land included.

*Source:* Own calculations based on HLCS 2001.

Table 5: Land Holder Diversification of Activities in Haiti, 2001 (percent)

| | | Quintile | | | | |
|---|---|---|---|---|---|---|
| | | 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| Cultivation | Yes | 80.22 | 90.08 | 89.24 | 89.94 | 90.04 |
| | No | 19.78 | 9.92 | 10.76 | 10.06 | 9.96 |
| Animals | Yes | 81.97 | 84.04 | 83.61 | 86.37 | 85.86 |
| | No | 18.03 | 15.96 | 16.39 | 13.63 | 14.14 |

Note: Only households with land are included. No. observations: 4473.

*Source:* Own calculations based on HLCS 2001.

Soil erosion is a serious problem for farmers. The once-abundant forests are now thought to be 97 percent depleted. Each year around 15,000 hectares of cultivatable land is lost to soil erosion**,** and in many areas the once-regular rainy season is something of the past. For the poorest rural people, the threat of drought and famine looms every year. A never-ending demand for charcoal has stripped the country almost bare. Today only 2-3 percent of the land is covered with forest.

Moreover, the intensive use of land has caused a large soil erosion problem for farmers. Sixty-six percent of extreme poor farmers and 46 percent of the 20 percent richest farmers reported that soil erosion is a severe problem on their land in 2001. Poor farmers have little access to productivity enhancing plant nutrients and therefore see soil erosion as a more severe problem than rich farmers. Moreover, lack of titles or land ownership is another problem faced by poor farmers. Of the 20 percent poorest farmers 81 percent have a title or own their land compared to 92 percent of the 20 percent richest farmers (Table 7). Data reveal little difference in travel time to plots between rich and poor farmers (Table 8).

Table 6: Reporting on Soil Erosion in Haiti, 2001 (percent)

| | Quintile | | | | |
|---|---|---|---|---|---|
| | 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| Yes, important | 65.5 | 65.82 | 63.92 | 62.9 | 45.63 |
| Yes, minor | 7.82 | 7.47 | 8.73 | 6.47 | 7.32 |
| No problem | 26.67 | 26.71 | 27.34 | 31.63 | 47.05 |

*Source:* Own calculations based on HLCS 2001.

Table 7: Legal Title or Deed to Home and Land , 2001 (percent)

| | | Quintile | | | | |
|---|---|---|---|---|---|---|
| | | 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| Plot | Yes | 80.45 | 86.29 | 87.67 | 88.27 | 91.83 |
| | No | 19.55 | 13.71 | 12.33 | 11.73 | 8.17 |
| Home | Yes | 56.71 | 58.95 | 58.06 | 56.03 | 54.63 |
| | No | 43.29 | 41.05 | 41.94 | 43.97 | 45.37 |

*Note:* Plot: No. observations: 4473 with access to land. Yes, includes all owned, but missing legal titles, and owned with titles for at least one plot. No, includes all plots sharecropped or rented. Deed status is for largest accessible plot.
Home deed: No. observations 7177. Yes, includes those owned by deed, sales receipt, customary rights or other. No, includes those rented, long term rent, other, no reply, no legal title or rights.

*Source:* Own calculations based on HLCS 2001.

Table 8: Average Travel Time to Plot in Haiti, 2001 (minutes)

| Quintile | | | | |
|---|---|---|---|---|
| 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| 38.76 | 39.17 | 39.02 | 36.15 | 38.08 |
| (63.26) | (54.57) | (75.14) | (85.41) | (64.74) |

*Note:* Standard deviations in parentheses. Only households with access to land included. Time to largest plot if several owned (rest excluded). No. observations: 4473.

*Source:* Own calculations based on HLCS 2001.

Poor farmers have less access to productivity enhancing technology than nonpoor farmers. Of the 20 percent poorest farmers 43 percent apply less than 3 tools compared to 26 percent of the 20 percent richest farmers (Table 9). Only 19 percent of the poorest apply more than 5 tools compared to 30 percent of the richest farmers. Moreover, of the poorest 20 percent of farmers only 4 percent have access to irrigation (mechanical, hand-pump, or ditches), 2 percent use pesticides or insecticides, 7 percent use fertilizers (chemical, natural by people and animal, compost and other), and 11 percent have

obtained credit the last 12 months (Table 10). Of the richest 20 percent of Haitian farmers 23 percent use irrigation, 13 percent use pesticides or insecticides, 35 percent use fertilizers, and 11 percent have access to (or use) credit. Hence in order to increase productivity of both the poor and rich farmers, access to production enhancing technologies needs to be expanded for example via increased access to credit to finance these technologies.

Table 9: Tools Applied in Farming in Haiti, 2001 (percent)

| | Quintile | | | | |
|---|---|---|---|---|---|
| | 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| Few (0-2 different tools applied) | 42.90 | 33.37 | 33.17 | 29.49 | 26.49 |
| Some (3-4 different tools applied) | 38.30 | 42.49 | 44.23 | 43.37 | 43.19 |
| Many (5-13 different tools applied) | 18.80 | 24.14 | 22.61 | 27.14 | 30.32 |

*Note:* Only households with access to land. No. observations: 3950.

*Source:* Own calculations based on HLCS 2001.

Table 10: Technology Applied in Farming of Main Plot in Haiti , 2001 (percent)

| | | Quintile | | | | |
|---|---|---|---|---|---|---|
| | | 1 (poorest) | 2 | 3 | 4 | 5 (richest) |
| Irrigation | Yes | 4.41 | 8.39 | 15.59 | 18.04 | 23.45 |
| | Rain only | 95.59 | 92.61 | 86.41 | 84.96 | 80.55 |
| Pesticides or Insecticides | Yes | 2.03 | 4.06 | 7.53 | 10.81 | 12.72 |
| | No | 97.97 | 95.94 | 92.47 | 89.19 | 87.28 |
| Fertilizer | Yes | 7.47 | 14.52 | 22.05 | 28.25 | 35.18 |
| | No | 92.53 | 85.48 | 77.95 | 71.75 | 64.82 |
| Credit | Yes | 10.50 | 11.48 | 12.44 | 12.29 | 11.41 |
| | No | 89.50 | 88.52 | 87.56 | 87.71 | 88.59 |

*Note:* All with access to land included. Irrigation: No. observations: 3629; Pesticides: No. observations: 3932, pesticides used within last 12 months. Fertilizer: No. observations: 3611, fertilizer used within last 12 months, chemical, natural by people and animal, compost and other. Credit: No observations: 4473, credit obtained within last 12 months.

*Source:* Own calculations based on HLCS 2001.

## Determinants of Producer Incomes

After analyzing workers' labor incomes, this sub-section addresses the determinants of producer households' income from farm activities in Haiti. Determinants of producer incomes are addressed by analyzing the impact of various individual, assets, production, infrastructural, and geographical characteristics.

Producer incomes generated in agriculture are analyzed by applying an augmented earnings function method. Producer incomes from farm activities are modeled by using log annual incomes, drawn from farming activities, as the dependent variable. Only households with access to land and farming the land are included in the analysis.[19]

[19] No changes in inventory are taken into account of e.g. livestock nor are production costs taken into account?

The general model contains explanatory variables in levels, and allows for nonlinearities in data. Findings are presented in Table 11.

All included explanatory variables have the expected signs and they all are statistically significantly different from zero. Each set of explanatory variables will now be discussed in turn: (1) human capital; (2) farm size; (3) access to infrastructure; and (4) access to production enhancing techniques and inputs.

Are returns to human capital for producers constant over different education levels in Haiti?[20] According to the findings presented in Table 11, the answer is no. Findings allow for comparison of producers with no completed level of education (the reference group) with peers who have completed primary, secondary, and tertiary education. In 2001, returns to primary, secondary, and tertiary education were statistically significantly different from zero and positive, controlling for other characteristics. Moreover, the premium is rapidly increasing with attained education. In rural Haiti, an average producer experiences an impact on income of 20, 48, and 427 percent for completed primary, secondary, and tertiary education respectively. Hence, more educated producers earn dramatically higher incomes than do their less educated peers. Hence education is not only key in reducing fertility of women, but also to increase productivity of workers and farmers.[21]

The size of the producer household's land holdings is very important for the income generated on the farm. The farm size variables are all statistically significant and positive. The regression analysis presented in Table 11 reveals that at average values of other variables, income increases monotonically with farm size, although in a nonlinear fashion. In Haiti, an average producer experiences an increase in income of 14, 24, 46, 51, 70, and 141 percent for holding 0.5-1, 1-2, 2-4, 4-7, 7-10, and more than 10 hectares respectively, compared to farmers with less than 0.5 hectares of land. Hence larger farms earn higher incomes than do their counterparts with smaller farms. The low returns to small farms indicate clearly that small farm sector identification is called for in order to increase producer incomes in Haiti.

Farmers with titles to their land are *more* productive than farmers with no title to their land. The findings presented in Table 11 show the dummy variable included for farmers with title to their land is positive and significantly different from zero. Farmers with title to their land earn 19 percent more than their peers with no title, controlling for other productive factors in the analysis. This finding indicates that titles are key to improving farmers' income. The lack of land tenure can deter new investment and modernization of the agricultural sector, as shown by the experience of other countries. Moreover, with a title farmers can use their land as collateral for credit. For 2001, data reveals that very few farmers (11-12 percent) have obtained credit in Haiti (Table 10).

[20] These rates of return are calculated by the earnings function method due to Mincer (1974).

[21] See Verner (2007).

| Table 11: OLS regression of log income per capita on farming variables, 2001 | | | |
|---|---|---|---|
| Variable | Return | t | P>\|t\| |
| Primary education | 19.69 | 4.34 | 0.00 |
| Secondary education | 48.47 | 5.16 | 0.00 |
| Tertiary education | 426.58 | 5.30 | 0.00 |
| Rural | 10.79 | 2.21 | 0.03 |
| Electricity | 52.37 | 5.27 | 0.00 |
| Water | 24.63 | 4.06 | 0.00 |
| Road | 12.47 | 1.79 | 0.07 |
| Some tools | 14.95 | 1.96 | 0.05 |
| Many tools | 34.39 | 4.05 | 0.00 |
| Fertilizer | 51.66 | 8.94 | 0.00 |
| Pesticides | 16.33 | 2.17 | 0.03 |
| Irrigation | 40.80 | 6.01 | 0.00 |
| 0.5-1 ha | 13.58 | 2.43 | 0.02 |
| 1-2 ha | 23.93 | 4.09 | 0.00 |
| 2-4 ha | 46.21 | 5.90 | 0.00 |
| 4-7 ha | 51.20 | 4.64 | 0.00 |
| 7-10 ha | 70.14 | 4.54 | 0.00 |
| >10 ha | 140.58 | 7.87 | 0.00 |
| Land title | 19.25 | 4.84 | 0.00 |
| Constant | 87579.5 | 76.97 | 0.00 |
| Note: No. of observations: 3932; all farmers. Excluded categories: No completed education and <0.5 ha land. The percentage return is calculated as (exp (coefficient estimate) – 1) * 100 | | | |

*Source:* Own calculations based on HLCS 2001.

Access to infrastructural services such as water, electricity, and roads are important for producer income generation. Farmers with access to roads (paved and gravel), water and electricity earn statistically significantly higher incomes than do farmers without access to these services. Findings in Table 11 show that access to roads, water and electricity increase producer incomes by 12, 25, and 52 percent respectively. Surprisingly, telephones and obtained credit did not significantly improve producer incomes in Haiti; therefore this finding is not reported in this paper (only 18 households have a phone.

The use of productivity enhancing production techniques and inputs such as tools, fertilizers, pesticides, and irrigation, are also important for increasing producer incomes in Haiti. The use of tools, fertilizers, pesticides, and irrigation are all significantly positive determinants of farm incomes. Farms that apply these productivity enhancing technologies experience 15, 34, 52, 16, and 41 percent higher incomes than farms that do not use or have access to some tools, many tools, fertilizers, pesticides, and irrigation respectively. These findings, coupled with the findings on farm size and titles, indicate that farm intensification and increased access to production enhancing inputs are essential to increase farmer incomes. With title to their land, farmers should have increased access to credits to finance more tools, fertilizer, etc. to enhance productivity of their land.

This section showed that workers' and producers' incomes are strongly impacted by the level of completed education of the worker or farmer. In both cases the more

formal education the individual has attained the higher is his or her wage or farm income. Education is the variable that has the strongest effect on incomes and wages, therefore bringing the Haitians up the education ladder is key for poverty reduction. Moreover, workers in rural areas in the low end of the income distribution earn more than their urban peers. This indicates scarcity of this type of workers which may be caused by out migration. Many women in rural areas receive lower wages than men controlling for human capital and other characteristics. There exists a return to social capital in rural areas but not in urban areas.

Finally, for farmers, access to more land in order to increase farm sizes is key to increase income. Therefore it would be important to facilitate small farm intensification in Haiti. Increased access to titles and infrastructural services are also important to increase productivity. As more farmers gain titles to their land more farmers would have an asset that could be used as collateral to obtain micro credit for further productive investments in the farm, including tools, fertilizer, and pesticides among other things.

A direct way of improving farm productivity and revenues is via the community-based approach to land reform. Under this approach, beneficiary groups negotiate directly with potential sellers of suitable properties, and then obtain financing for the purchase of the land and complementary sub-projects and receive technical assistance. Two successful pilot projects in Brazil—the Ceará Rural Poverty Alleviation Project and the Cédula da Terra—redistributed about 640,000 hectares to benefit about 23,700 households using this approach.

## 4. Conclusion and Recommendations

This paper examined farm and nonfarm employment and income generation in Haiti. Findings suggest that the four key determinants of employment and productivity in nonfarm activities are education, gender, location, and migration status. This is emphasized when nonfarm activities are divided into low-return and high-return activities. There is evidence that the nonfarm sectors are more vibrant in more populated areas, which are connected to markets and enjoy certain minimum standards of infrastructure. Hence, it is key that governments assist in augmenting the access to infrastructure services and human capital of the rural population so they can take advantage of increased opportunities.

There seems to be evidence that education is the key determinant of income of wage workers and farmers. The wage and producer income analyses reveal that education is key to earning higher wages and incomes; the more educated workers earn higher wages than their less educated peers. Producer income increases with farm size and access to tools, electricity, road, irrigation, and other farm inputs. Moreover, farmers with title to their land have an income 20 percent higher than farmers without a title.

The analyses presented in this paper provide guidance on a social agenda and poverty alleviation strategy for Haiti. It seems fairly clear that the economy must remain

a central focus for policy makers aiming to reduce poverty. Employment is therefore essential and both the farm and nonfarm sectors play a key role. The strategic principles for reducing poverty involve seeking to strengthen the key assets of the poor, taking into account geographic differences in the poverty situation and priorities. Programs should focus on the extreme poor and prioritize among groups. Priority should be assigned to programs that target poor workers and producers. Improvements in social policies and access to public services are needed to reduce extreme poverty for these groups.[22]

The differing characteristics of poor rural households call for multiple paths out of poverty aimed at: (i) small farm sector intensification, (ii) improved employment opportunities in dynamic commercial agriculture, (iii) growth of the rural non-farm sector, (iv) migration of the young, and (v) provision of safety nets for those "trapped" in poverty. The recommended measures include improving human capital endowments, reforming the land, labor and financial markets, enhancing research and extension, improving the supply of public goods and services, pricing and trade policies, and transfer programs.

[22] Additionally, given the distribution of poverty, priority should also be given to: households with young children and people with or at risk for low educational attainment (see Verner 2006, Making Poor Haitians Count.)

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