

Determinants of non-farm employment and non-farm earnings in Ecuador

Cristian Vasco and Grace Natalie Tamayo

Abstract

This article analyses the determinants of both participation in non-farm employment and non-farm earnings in Ecuador. Using the Dubin-McFadden two-step estimation method, the results show that women are more likely than men to engage in non-farm self-employment but earn significantly less than men employed in the non-farm sector. Non-farm wage employment is a common choice among more educated individuals in landless households, while farm wage employment seems to be the only source of employment for uneducated landless people. Participation in non-farm work is more likely in areas located near medium-sized cities with dynamic economies. Finally, there are regional differences in employment patterns which appear to be associated with both the availability and the quality of land. This information is relevant in relation both to rural population growth and to the continuous process of land fragmentation in rural Ecuador.

Keywords

Rural employment, income, rural areas, mathematical analysis, econometric models, Ecuador

JEL classification

P25, R11, R58

Authors

Cristian Vasco is a full professor at the Faculty of Agricultural Sciences of the Central University of Ecuador. clvasco@uce.edu.ec

Grace Natalie Tamayo is an academic coordinator at the Faculty of Management and Economic Sciences of the Indoamérica Technological University, Ecuador. grace.tamayo@indoamerica.edu.ec

I. Introduction

Rural non-farm employment (RNFE) is important for the livelihoods of rural people in developing countries. In Latin America, it generates more than 40% of rural households' income and employs about 35% of the rural adult population (Köbrich and Dirven, 2007).

RNFE is widely associated with poverty reduction (Elbers and Lanjouw, 2001; Lanjouw and Lanjouw, 2001), risk reduction (Ellis, 2000; Haggblade, Hazell and Reardon, 2010), higher income (Haggblade, Hazell and Reardon, 2010) and reduced pressure on natural resources (Ellis, 1993). Therefore, understanding the nature and patterns of participation in RNFE is a first step towards assessing its potential as a rural development tool.

A number of empirical studies have analysed the drivers of participation in RNFE in Latin America. In Chile, Berdegue and others (2001) found that female-headed households with good education and access to credit were more likely to participate in non-farm work. Laszlo (2005) found the same for Peruvian households in districts with more population centres and a more developed tourism sector. In Nicaragua, Isgut (2004) determined that off-farm wage labour was principally undertaken by men with a low level of education. In contrast, non-farm self-employment was common among women, while non-farm wage employment was carried out mainly by the well-educated. Ferreira and Lanjouw (2001) studied the determinants of non-farm work in north-east Brazil, finding that well-educated men were more likely to engage in well-paid non-farm work, whereas women engaged in low-income non-farm jobs. Also in Brazil, Jonasson and Helfand (2010) found that the likelihood of participation in RNFE was higher near population centres.

Few studies have examined the determinants of participation in and returns to non-farm employment in Ecuador. Using data from the 1995 Living Standards Measurement Survey, Elbers and Lanjouw (2001) found that RNFE was undertaken mainly by well-educated women from non-cultivating households. Nevertheless, the picture changed for high-productivity non-farm jobs, which were mainly carried out by men. Lanjouw (1999) found that educated households which did not farm and had access to electricity and a telephone were more likely to own rural businesses. However, the extent to which RNFE has changed and evolved since the 1990s is a question that remains to be answered.

Using data from the 2010 National Survey of Employment, Unemployment and Underemployment (ENEMDU), this paper analyses the determinants of non-farm employment and non-farm income in Ecuador. In distinction to former research in Ecuador and Latin America, it relies on a Dubin-McFadden two-step estimation method which controls for both simultaneity in decisions regarding a person's principal source of income and potential selection bias in earning regressions. To anticipate some of the findings, non-farm employment is the principal source of income for an important fraction (36%) of Ecuador's rural population. Well-educated individuals from wealthier households prefer to engage in non-farm wage employment. Conversely, farm wage employment is the (only) choice for uneducated individuals from poor households. Lack of land appears to be a push factor driving the rural population into non-farm employment. Women are more likely to obtain their income from non-farm self-employment but have lower earnings than men. Non-farm employment flourishes in areas near medium-sized towns with a dynamic agricultural sector. The rest of this paper is structured as follows. Section II presents the theoretical framework. Section III introduces the data and the variables. Section IV describes the empirical strategy. Section V then presents and discusses the results, and section VI concludes.

II. Theoretical framework

The rural livelihood model (Ellis, 1999) is a good point of departure for analysing income diversification decisions. Rural households try to maximize their returns subject to a number of constraints, among them cash, time and technology. The model holds that diversification is a function of the returns to labour time spent on on-farm activities in comparison to off-farm employment. With a fixed amount of farm assets (land and infrastructure) and household labour time, a household compares the returns and chooses between allocating more labour time to farm work and investing it in non-farm activities. In practice, the rural livelihood model holds that a household makes decisions regarding livelihood diversification subject to different endowments of natural capital (land, water, trees), physical capital (irrigation canals, implements, roads), human capital (education, skills, health), financial capital or its substitutes (cash, savings, cattle) and social capital (networks, associations).

Diversification decisions are determined by pull and push factors. Households or individuals allocate labour to RNFE provided it yields higher returns than farm activities, controlling for risk (Reardon and others, 2000), these returns being the pull factor. This mainly occurs in regions where successful agricultural, mining and tourism activities make local economies dynamic. The push factors, on the other hand, are income risks resulting from a number of factors, among them climatic risks, scarcity of land and market failures. The literature distinguishes between risk management (*ex ante*) and risk coping (*ex post*) strategies (Reardon and others, 2000). In the first case, households voluntarily choose to diversify income sources in order to prevent potential income failures, while in the second case households diversify to cope with unexpected events that threaten their livelihoods. Additionally, Reardon and others (2000) list a set of capacity variables including human, financial, social and physical capital that households or individuals require to engage in non-farm activities.

III. Data and variables

The main source of data is the 2010 National Survey of Employment, Unemployment and Underemployment carried out by the National Institute of Statistics and Censuses (INEC). The survey is nationally representative and includes information about employment, income and housing for 82,774 urban and rural people. The present study focuses on a subsample of 16,014 individuals in rural areas aged 15 or over who were in work (even if unpaid) at the time of the survey. In the context of this study, RNFE is defined as any occupation other than farm self-employment and farm wage employment.

Definitions and descriptive statistics for the variables used in the empirical analysis are presented in table 1. The dependent variables are four dichotomous variables indicating whether an individual has farm self-employment (FSE), farm wage employment (FWE), non-farm self-employment (NFSE) or non-farm wage employment (NFWE) as his or her principal occupation. One aim of this study is to examine the determinants of income from non-farm activities. Predictors include a set of individual, household and parish or regional characteristics that are described below. Individual variables include age, gender, household headship, education and ethnicity. Returns to education are expected to be higher in the non-farm sector. To control for this effect, three dichotomous variables taking the value of 1 if an individual has completed primary, secondary or university education, respectively, are included in the specification. In rural Ecuador, gender may be linked not only to income discrimination but also to discrimination in the division of labour (Martínez, 2000). For this reason, a dummy variable taking

the value of 1 for women is included in the model. Ethnicity is controlled for by four dummy variables indicating whether an individual identifies himself or herself as either indigenous, black, Montubio¹ or white. The mestizo group, the largest in the sample, is used as the excluded group. Additionally, a dummy indicating whether an individual is the household head is included in the model.

Household characteristics include demographic variables, wealth and land ownership. Household demographic indicators include a dummy taking the value of 1 if the household head is female and the number of male children, female children, adult males and adult females (see table 1 for definitions) in the household. These variables are expected to influence individual employment decisions. In order to control for household wealth, an index constructed from household assets is included in the specification.² Wealth may not only confer the ability to overcome entry barriers to participation in high-return non-farm activities, but may also be associated with higher levels of social capital, which can be useful when searching for a non-farm job. Landholding size is another important determinant of participation in non-farm work (Elbers and Lanjouw, 2001), but the 2010 National Survey of Employment, Unemployment and Underemployment unfortunately does not include information about landholding size. As an alternative, a dummy variable taking the value of 1 if the household owns land has been added to the model.

Availability of electricity and a telephone is generally positively correlated with RNFE (Lanjouw, 1999; Elbers and Lanjouw, 2001). To account for this, the proportions of rural households with access to an electricity connection and a telephone line estimated at the parish level from the 2010 Population and Housing Census are included in the list of predictors. Distance to and the size of surrounding markets have also been found in the past to be important determinants of non-farm employment (Jonasson and Helfand, 2010). To test this hypothesis in the Ecuadorian case, the road distances³ from a parish to the closest town with a population of 50,000-100,000, 100,000-250,000, 250,000-500,000 and more than 500,000 people are included in the model. The longer these distances, the smaller the likelihood of an individual working in the non-farm sector should be expected to be. Finally, two dummies taking the value of 1 if an individual lives in the Costa or the Oriente region, respectively, control for regional differences. Individuals residing in the Sierra, the largest group in the sample, are left as the reference group.

Table 1
Variables and descriptive statistics

Variable	Description	Mean	Standard deviation
<i>Dependent variables</i>			
<i>FSE</i>	Farm self-employment as principal occupation (0/1)	0.453	0.497
<i>FWE</i>	Farm wage employment as principal occupation (0/1)	0.211	0.408
<i>NFSE</i>	Non-farm self-employment as principal occupation (0/1)	0.104	0.305
<i>NFWE</i>	Non-farm wage employment as principal occupation (0/1)	0.230	0.421
Non-farm income	Log of non-farm income (dollars)	5.297	0.854

¹ The Montubio are an ethnic group formed of campesinos living exclusively in the Ecuadorian littoral.

² This index is the first principal component of the following variables: home and car ownership, availability of piped water and an indoor shower, and the number of televisions, DVD players, radios, computers, mobile phones, refrigerators and stoves. The first principal component accounts for about 32% of variation.

³ Road distances were obtained from the Ministry of Transport and Public Works and provincial governments. In the case of two islands and three parishes with no road connections, straight-line distances to the nearest parish with a road connection were taken and added to the road distance from that parish to the nearest town with a population of 50,000-100,000, 100,000-250,000, 250,000-500,000 and more than 500,000, respectively.

Table 1 (concluded)

Variable	Description	Mean	Standard deviation
<i>Individual variables</i>			
Age	Individual's age (years)	41.554	17.426
Female	Individual is female (0/1)	0.334	0.441
Household head	Individual is the household head (0/1)	0.466	0.498
Primary education	Individual completed primary school (0/1)	0.516	0.499
Secondary education	Individual completed secondary school (0/1)	0.024	0.154
University education	Individual completed university (0/1)	0.024	0.153
Indigenous	Individual is indigenous (0/1)	0.157	0.364
Black	Individual is black (0/1)	0.017	0.131
Montubio	Individual is Montubio (0/1)	0.084	0.278
White	Individual is white (0/1)	0.018	0.134
<i>Household variables</i>			
Female head	Household head is female (0/1)	0.162	0.368
Male children	Number of male individuals aged under 15	0.847	1.075
Female children	Number of female individuals aged under 15	0.796	1.065
Male adults	Number of male individuals aged 15 or older	1.806	1.125
Female adults	Number of female individuals aged 15 or older	1.654	0.979
Wealth	Wealth index	0.244	2.065
Land ownership	Household owns land (0/1)	0.481	0.499
<i>Parish and regional variables</i>			
Electricity	Proportion of households with access to electricity (2010 census)	0.885	0.136
Telephone	Proportion of households with access to telephone (2010 census)	0.179	0.151
Distance 1	Log of the distance to the closest town with 50,000-100,000 inhabitants (km)	3.065	1.714
Distance 2	Log of the distance to the closest town with 100,000-250,000 inhabitants (km)	3.649	1.688
Distance 3	Log of the distance to the closest town with 250,000-500,000 inhabitants (km)	4.273	1.718
Distance 4	Log of the distance to the closest town with more than 500,000 inhabitants (km)	4.917	1.055
Costa	Individual resides in Costa region (0/1)	0.358	0.479
Oriente	Individual resides in Oriente region (0/1)	0.052	0.223

Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010 and the Population and Housing Census of 2010.

Note: (1/0) identifies dummy variables.

IV. Empirical strategy

Both the choice of working category and earnings from the principal occupation are estimated by means of a Dubin-McFadden two-step estimation method (Dubin and McFadden, 1984). In the first step, the likelihood of an individual working in either FSE, FWE, NFSE or NFWE is estimated using a multinomial logit model. The second step estimates the determinants of individual earnings during the month of November 2010, given the category of employment chosen in the first step. In order to control for possible correlation of errors between the two stages, the second step includes a selection correction term computed from the first step.

In this context, individuals choose a category of employment c from among a number of alternatives M based on the latent conditional utility E_c^* .

$$E_c^* = z_c \gamma_c + \eta_c, \quad c = 1, \dots, M \quad (1)$$

where z_c stands for a vector of the individual, household and parish variables already described, γ_c is a vector of estimators and η_c is the disturbance term. E_c takes the value of 1 if employment category c is chosen and 0 otherwise.

For the chosen category, the log of earnings (y) is modelled as:

$$y_1 = x_1 \beta_1 + u_1 \quad (2)$$

where x is a vector of explanatory variables affecting y , and u stands for a disturbance term with the following properties: $E(u_1|x, z) = 0$ and $V(u_1|x, z) = \sigma^2$. It is assumed that the model is identified by excluding some of the variables in z from the variables in x . The dependent variable y_1 is observed only when employment category 1 is selected. This occurs when:

$$\begin{aligned} E_1^* &> \max_{c \neq 1} (E_c^*) \\ \varepsilon_1 &= \max_{c \neq 1} (E_c^* - E_1^*); \varepsilon_1 < 0 \end{aligned} \quad (3)$$

Assuming that η_c is independent and identically Gumbel-distributed, the cumulative and density functions are: $G(\eta) = \exp(-e^{-\eta})$ and $g(\eta) = \exp(-\eta - e^{-\eta})$, respectively. Following McFadden (1973), this specification allows the probability of employment category 1 being chosen to be estimated using a multinomial logit model of the following form:

$$P(z_1 \gamma_1 > \varepsilon_1) = \frac{\exp(z_1 \gamma_1)}{\sum_{c=1} \exp(z_c \gamma_c)} \quad (4)$$

The second part of the analysis examines incomes in each employment category, with emphasis on NFSE and NFWE. It is possible that individuals in one category differ in a substantial way from those in the other categories and that these differences influence earnings. This shortcoming is noted by several other studies (Elbers and Lanjouw, 2001; Lanjouw, 2001; Isgut, 2004; Jonasson and Helfand, 2010; Atamanova and Van den Berg, 2012) which use selection bias correction methods when modelling earnings from non-farm employment. In a similar fashion to the Heckman two-step method, the Dubin-McFadden approach also controls for sample selectivity. As there are several choices, however, there are several correction terms, one for each category of employment in this case. To estimate the determinants of earnings in each category, this paper relies on the variant of the Dubin-McFadden correction method proposed by Bourguignon, Fournier and Gurgand (2007):

$$y_1 = x_1 \beta_1 + \sigma \left[\rho_1 m(P_1) + \sum_{c=2 \dots M} \rho_c \frac{P_c}{P_c - 1} m(P_c) \right] + v_c \quad (5)$$

where $m(P_c)$ and $m(P_1)$ are the probabilities, $(\sigma \rho_1), \dots, (\sigma \rho_c)$ are the coefficient terms for the polychotomous correction of selectivity bias and v_c is an orthogonal error parameter which has zero mean expectation. This approach has the advantage that it performs well even if the assumption of independence of irrelevant alternatives (IIA) is violated (Bourguignon, Fournier and Gurgand, 2007).

V. Results and discussion

1. Descriptive analysis

Table 2 shows the proportions of the rural population engaged in RNFE by region and sector. While commerce is more important in the Costa (coastal region), manufacturing and construction employ a significant share of the workforce in the Sierra (the highlands). Teaching and public service employ a larger share of the population in the Oriente (the Amazon) than in the Costa or the Sierra. Something similar occurs with the mining sector, because oil camps are located in the Oriente. On average, 33.5% of the rural Ecuadorian workforce is in non-farm employment. Patterns of labour allocation by geographical region between farm self-employment (FSE), farm wage employment (FWE), non-farm self-employment (NFSE) and non-farm wage employment (NFWF) are presented in figure 1. The share of people having FWE as their primary occupation is considerably larger in the Costa than in the Sierra and the Oriente. The proportions of people in RNFE do not seem to vary much across regions. These results are consistent with the shares of earned income by employment category (figure 2). While FSE accounts for more than 40% of household income in the Sierra and the Oriente, the share drops to 32% in the Costa. In contrast, the share of household income from FWE is more than twice as high in the Costa as in the Sierra or the Oriente.

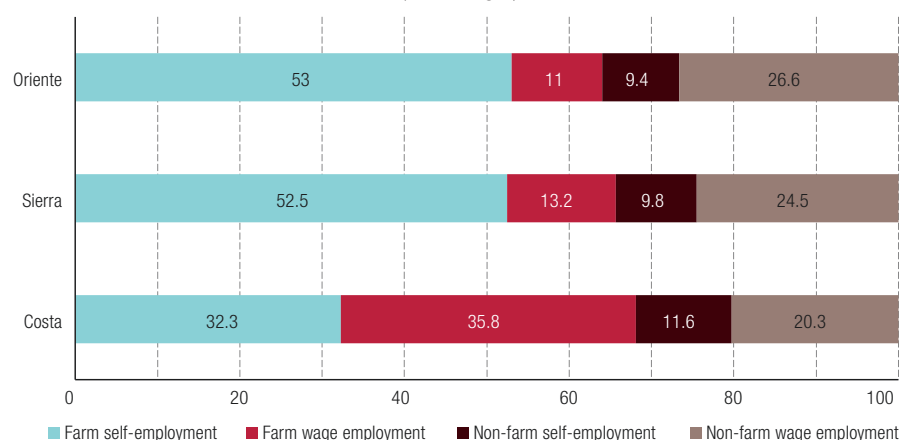
Table 2
Rural non-farm employment share by region and sector
(Percentages)

	Costa	Sierra	Oriente
Commerce	13.7	8.5	9.0
Transport and communication	2.1	2.8	1.5
Finance	0.1	0.1	0.0
Property	0.9	0.7	0.7
Public service	1.0	1.4	4.1
Teaching	1.9	2.0	5.9
Health services	0.8	0.7	2.0
Mining	1.6	0.3	3.1
Manufacturing	3.5	8.7	2.6
Construction	3.6	5.7	4.3
Domestic service	1.4	2.1	1.1
Other	1.2	1.3	1.7

Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010.

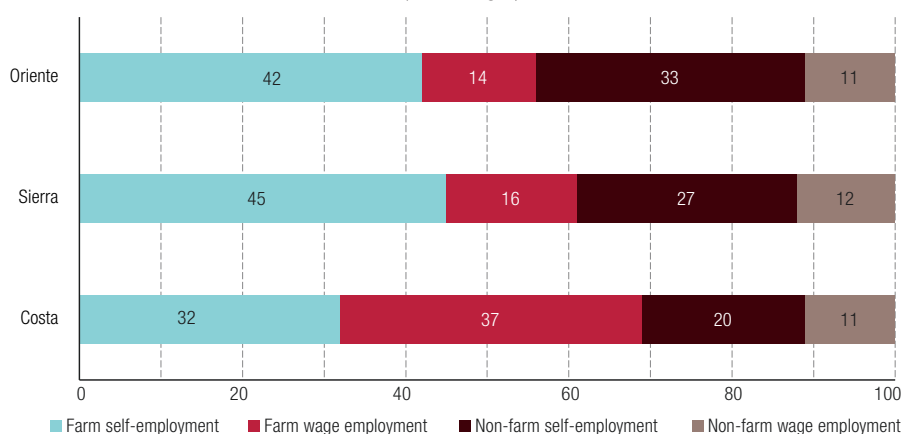
Table 3 presents average incomes by region and subsector. Wages vary far more across sectors than regions. For agriculture, however, incomes from both FSE and FWE are highest in the Costa, probably because most exportable agricultural commodities are produced there. At the other extreme, earnings from farming are lowest in the Oriente, especially in self-employment. Non-farm incomes are higher than farm incomes everywhere except the Costa, with public service, teaching and mining paying the most, particularly the last. Wages for commerce and teaching are highest in the Oriente. This may reflect a scarcity of skilled workers in those sectors pushing up wages there. Mining workers earn considerably more in the Oriente than in the Sierra and the Costa, which is not surprising given that, as mentioned before, oil exploitation takes place in the Oriente.

Figure 1
Principal occupation by employment category and region
(Percentages)



Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010.

Figure 2
Household earning shares by employment category and region
(Percentages)



Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010.

Table 3
Mean monthly individual rural incomes from primary occupation, by region and sector
(Dollars)

	Costa		Sierra		Oriente	
	Self-employment	Wage employment	Self-employment	Wage employment	Self-employment	Wage employment
Agriculture	283	185	160	151	139	172
Trade	192	226	279	245	254	259
Manufacturing	152	261	198	246	184	213
Construction	263	257	282	267	-	268
Public service	-	516	-	675	-	621
Teaching	-	372	-	457	-	475
Mining	290	339	264	342	196	630

Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010.

2. Econometric analysis

To begin with, the independence of irrelevant alternatives (IIA) assumption is examined by means of the suest-based Hausman tests of IIA assumption. The test fails to reject the null hypothesis of independence of alternatives, which is evidence that the IIA assumption is not violated.

Table 4 presents the marginal effects of a multinomial logit model with four possible outcomes. Women are more likely to be in self-employment (agricultural or non-agricultural) and less likely to be in FWE than men. Farm work takes place close to home and it is easier for women to combine child-rearing with FSE. Additionally, in the context of rural Ecuador, it is culturally accepted that women carry out farm work (Martínez, 2000). Earlier research (Lanjouw, 1999; Elbers and Lanjouw, 2001) concluded that women were more likely to participate in RNFE. However, when RNFE is divided into NFSE and NFWE, the gender dummy has a significant effect only for NFSE. These results agree with a number of qualitative studies (Martínez, 2000, 2002 and 2004) suggesting that men engage in off-farm work, whether agricultural or otherwise, while women devote themselves to the family plot and non-farm activities (retailing and handicraft manufacturing).

Table 4
Determinants of principal occupation type in rural areas (marginal effects)

Variable	Farm self-employment	Farm wage employment	Non-farm self-employment	Non-farm wage employment
<i>Individual variables</i>				
Age	-0.007***	-0.000	0.006***	0.001
Age squared	0.000***	0.000	-0.000***	-0.000***
Female	0.094***	-0.165***	0.086***	0.015
Household head	0.017	-0.025***	0.012*	-0.004
Primary education	-0.017*	-0.018***	0.011**	0.010
Secondary education	-0.031	-0.127***	0.011	0.147***
University education	-0.329***	-0.164***	-0.026**	0.520***
Indigenous	0.089***	-0.119***	-0.015	0.046
Black	-0.005	-0.012	-0.021	0.040
Montubio	0.069***	0.028***	-0.032***	-0.064***
White	-0.030	-0.024	0.029	0.025
<i>Household variables</i>				
Female head	-0.070***	0.008	0.019**	0.042***
Male children	0.002	0.001	0.016	-0.005
Female children	0.002	0.003	0.016	-0.007
Male adults	-0.002	0.017***	-0.010***	-0.009**
Female adults	-0.013***	0.000	-0.007***	0.020***
Wealth	-0.033***	-0.029***	0.023***	0.038***
Land ownership	0.374***	-0.162***	-0.024***	-0.142***
<i>Parish and regional variables</i>				
Electricity	-0.488***	-0.374	0.033	0.492***
Telephone	-0.416***	-0.065***	0.100***	0.382***
Distance 1	0.010***	-0.015***	0.003	0.001
Distance 2	0.010***	-0.010***	0.000	0.000
Distance 3	0.011***	0.004	-0.005***	-0.010***
Distance 4	-0.004	0.000	-0.000	0.004
Costa	-0.291	0.059***	0.065***	0.166***
Oriente	-0.119	-0.023	0.033**	0.110***
Number of observations	16 014			
Wald test χ^2	9 076			
Log likelihood	-15 670			

Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010 and the Population and Housing Census of 2010.

Note: *** significant at 1%; ** significant at 5%; * significant at 10%.

As expected, education is negatively correlated with the likelihood of having FWE as the principal occupation. Individuals who have completed primary, secondary or higher education are less likely to be agricultural wage earners. The effects of education on NFSE are as expected. While the likelihood of participating in NFSE is greater for individuals who have completed primary school than for those with no education, it drops dramatically for those who hold a university degree, as expected. This reflects the relatively low education endowments required by the NFSE sector. The likelihood of partaking in NFWE increases for those who have completed either secondary or higher education, reflecting the fact that, in rural Ecuador, returns to education are found only in NFWE.

The results also show that household heads are less likely to become agricultural wage earners. On the other hand, being indigenous increases the likelihood of having FSE as the main source of income and reduces the odds of being a wage labourer. This agrees with previous research (Vasco, 2013a and 2014) concluding that indigenous peoples mainly rely on reciprocal labour to meet their workforce requirements. Belonging to the Montubio ethnic group increases the odds of participating in FSE and FWE, on the one hand, while reducing the likelihood of partaking in either form of non-farm employment, on the other. These findings are not surprising given that this group has traditionally engaged in agriculture.

Individuals from households with more adult men are more likely to be agricultural wage earners. This may be because members of households with labour flexibility diversify their income by engaging in FWE. Conversely, individuals from households with more adult men are less likely to take part in NFSE and NFWE. The number of adult women in a household is negatively correlated with the likelihood of participation in FSE and NFSE and positively correlated with the odds of being a non-agricultural wage earner. Having more women to enter either FSE or NFSE allows other household members to engage in NFWE.

Individuals from wealthier households are less likely to take part in agricultural work but more likely to engage in non-agricultural activities. Wealthier households are in a better position than their poorer peers to overcome the entry barriers (licence fees, equipment acquisition, etc.) that participation in RNFE often entails (Reardon and others, 2000). Land availability is positively correlated with the likelihood of engaging in off-farm work (agricultural and non-agricultural). Overall, these results indicate that lack of land is a push factor driving the rural population into off-farm activities, whether agricultural or otherwise. More educated people can access better paid non-farm jobs, while FWE is the choice for the landless uneducated population.

Availability of electricity or a telephone is negatively correlated with the likelihood of partaking in FSE and FWE, which is not surprising given that these services are mostly available in urban areas. In contrast, individuals residing in parishes where electricity and telephony are available are more likely to engage in NFSE and NFWE. This is consistent with earlier research concluding that infrastructure plays a crucial role in facilitating non-farm job opportunities in rural areas (Elbers and Lanjouw, 2001; Vasco, 2013b).

As expected, FSE is more common in remote population centres, with the exception of towns of more than 500,000 inhabitants. In the case of FWE, only Distance 1 (distance to the nearest town with 50,000-100,000 people) and Distance 2 (distance to the nearest town with 100,000-250,000 people) were significant and had the expected negative sign. These results indicate that the bulk of farms able to hire labour, and thus the most dynamic agricultural labour markets, are concentrated near small cities rather than big cities. For non-farm employment (both NFSE and NFWE), Distance 3 (distance to towns of 250,000-500,000 people) is significant and has the expected negative sign. A possible explanation for this finding is that the group of Distance 3 towns includes three medium-sized cities, among them Santo Domingo de los Tsachilas (368,000 people) and Ambato (330,000 people). Albeit with different patterns, these cities have three common characteristics: they have relatively large populations, advantageous geographical locations and close links with the agricultural sector.

Ambato is the capital of the province of Tungurahua and is considered a model of successful RNFE in the otherwise deprived central Sierra (North and Cameron, 2000). Tungurahua's advantageous location in the centre of the country has been favourable for trade in agricultural goods with both Quito and Guayaquil, the country's largest cities (Ospina, 2010). Moreover, Ambato's hinterland contains a concentration of small-scale and family-based leather, textile and woodworking factories that employ a significant share of Tungurahua's rural population. Santo Domingo de los Tsachilas is a subtropical city which connects Quito, the country's capital, with the biggest cities in the Costa, among them Guayaquil. Cattle ranching and the production of palm oil, bananas and cacao, among other tropical crops, have impelled the local and regional economies. These findings are consistent with the claim in Reardon and others (2000) that non-farm employment grows in tandem with a dynamic agricultural sector, and also with Jonasson and Helfand's (2010) argument that the size of markets, as well as distance to them, matters for participation in non-farm activities.

Residents of the Costa are more likely to work as farm wage labourers. This finding is consistent with that for the Montubios. As mentioned earlier, the large-scale production of tropical cash crops (bananas, oil palm, sugar cane and cocoa) absorbs a big share of the rural population in the region. Individuals living in the Costa and the Oriente are more likely to obtain their income from non-farm sources than those settled in the Sierra. In the case of the Costa, the difference may be associated with land ownership patterns. Whereas 53% of households in the Sierra own land, this share drops to 31% for the Costa. Land concentration seems to play a determining role in driving rural people in the Costa into FWE and RNFE in general.

The case of the Oriente is somewhat different, with landless households making up 45% of the sample for this region. Why are people more likely to engage in RNFE in a region which was relatively recently colonized⁴ and where land concentration appears not to be as acute as it is in the Costa? The answer to this question may be related to land quality. The Ecuadorian Amazon, locally known as the Oriente, is one of the world's biodiversity hotspots (Myers and others, 2000). Nevertheless, soils are very fragile and become depleted soon after vegetation is removed (Hicks and others, 1990). Under such conditions, returns to agriculture are low, as shown in table 3, and alternative income sources are needed. In any event, this finding is consistent with earlier research reporting significant growth in the share of people engaged in off-farm work in the Oriente provinces (Bilsborrow, Barbieri and Pan, 2004; Vasco Pérez, Bilsborrow and Torres, 2015). According to these authors, this is linked both to the shrinking size of farms because of continuous subdivision and to the growth of employment opportunities in urban areas.

Table 5 shows the results of the second stage of the Dubin-McFadden correction method. Following several other studies (Isgut, 2004; Jonasson and Helfand, 2010; Atamanova and Van den Berg, 2012), the identifying variables used to construct the selection correction terms are the sex of the household head and the household composition variables. Studies of this type assume that these variables do not influence earnings from each category of employment.

Being a woman reduces earnings from FSE, FWE, NFSE and NFWE by 34%, 20%, 48% and 26%, respectively. In the case of non-farm work, this finding is consistent with prior research (Elbers and Lanjouw, 2001) reporting that women are concentrated in low-income non-farm jobs. Returns to education are found only for FWE (primary and secondary education) and NFWE (secondary and university education). Having completed either secondary or higher education increases earnings from NFWE by 17% and 60%, respectively. Conversely, no education dummy had any significant effect on earnings from NFSE.⁵ This finding supports the contention that, other things being equal, NFSE does

⁴ Sustained colonization flows from the Costa and especially from the Sierra to the Oriente started during the 1970s following the discovery of oil in 1967.

⁵ The effects of education remain non-significant even when the education dummies are replaced by the number of years of formal education and its squared term.

not call for high education endowments. Overall, household heads earn more than other household members in all categories of employment. Where ethnicity variables are concerned, black people who have FSE as their principal occupation earn 23% less than their mestizo counterparts, and Montubio people earn 11% less than their mestizo peers from FWE even though they are more likely to engage in it. There are no significant differences between ethnic groups when it comes to non-farm earnings.

Wealth is positively correlated with higher earnings for all employment categories. Wealthier households are in a better position to access agricultural technology (e.g., chemical fertilizers, irrigation and mechanization), which increases yields and thence earnings. Similarly, individuals from wealthier households have the means to overcome the entry barriers that NFSE involves, such as the need for start-up capital and the cost of licence fees and machinery. In the case of wage employment, this finding may reflect the fact that members of wealthier households have more social capital and thus are able to access better-paid non-farm jobs (Jonasson and Helfand, 2010). A similar effect may exist with land ownership, which is associated with higher earnings for non-farm workers. As stated by Lanjouw and Stern (1998), access to attractive non-farm jobs may be determined by wealth, which in turn may be associated with landholding.

Table 5
Earnings by employment category in rural areas (log)

Variable	Farm self-employment	Farm wage employment	Non-farm self-employment	Non-farm wage employment
<i>Individual variables</i>				
Age	0.018***	0.014***	0.038***	0.028***
Age squared	-0.000***	-0.000***	-0.000***	-0.000***
Female	-0.340***	-0.225***	-0.659***	-0.303***
Household head	0.233***	0.170***	0.165**	0.203***
Primary education	0.112***	-0.150	-0.030	-0.031
Secondary education	0.450***	0.049	0.226	0.161***
University education	0.335	-0.380	0.310	0.470***
Indigenous	0.000	-0.105	-0.191	-0.044
Black	-0.231***	0.017	-0.161	-0.117
Montubio	0.007	-0.107***	-0.023	0.039
White	0.083	0.065	-0.074	-0.056
<i>Household variables</i>				
Wealth	0.104***	0.065***	0.133***	0.059***
Land ownership	0.240*	-0.010	0.128	0.156***
<i>Parish and regional variables</i>				
Electricity	-0.860***	0.417***	0.576*	0.034
Telephone	-0.365*	-0.051	-0.398	-0.021
Distance 1	-0.035***	-0.009	-0.002	0.002
Distance 2	0.005	-0.018***	0.009	0.012**
Distance 3	0.008	-0.022***	-0.017	0.014**
Distance 4	-0.111***	-0.014	0.021	-0.011
Costa	0.162	0.310***	0.136	0.022
Oriente	-0.079	0.201***	0.251*	0.217***
m ₁	0.119	-0.109	-0.045	0.185
m ₂	-0.535	-0.053	-0.086	-0.126
m ₃	-0.918	-0.090	-0.214**	0.097
m ₄	0.321	0.099	-0.289	-0.216
F-statistics	57.50***	25.13***	26.07***	56.11***
R ²	0.252	0.158	0.292	0.292

Source: Prepared by the authors, on the basis of data from the National Survey of Employment, Unemployment and Underemployment of December 2010 and the Population and Housing Census of 2010.

Note: m₁, m₂, m₃ and m₄ are the selection correction terms estimated from the selection model.

*** significant at 1%; ** significant at 5%; * significant at 10%.

Higher proportions of access to electricity are associated with lower earnings from FSE, which may reflect the fact that larger family farms and farmers entirely depending on FSE are normally found in places where service availability is low. In contrast, higher earnings from FWE are associated with higher proportions of access to electricity. This may be related to the fact that labour-intensive commodity production (e.g., flower production) is also intensive in electricity. Income from NFSE is greater in parishes with higher proportions of electricity access, with a 10% increase in this value raising self-employment earnings by 6%. Non-significance in the case of NFWE may indicate that access to electricity is an essential condition for the functioning of businesses big enough to hire labour, and so it does not play any role in determining wages.

FSE is higher near Distance 1 and Distance 4 towns. In the case of Distance 1, this may be because small towns are the main market for small-scale farmers selling their produce to traders. In the case of Distance 4, profit is higher for those farmers who are able to market their produce in the large cities included in this category. FWE is better paid in areas near Distance 2 and Distance 3 towns. A possible explanation for these findings is that more developed agricultural companies, which offer better wages than small-scale farms, are located in such areas. The further away Distance 2 and Distance 3 towns are, the higher the earnings from NFWE. A possible explanation for this finding is that competition for jobs in larger urban areas may be greater, keeping wages lower than in areas further from large cities.

Wages for agricultural labourers are higher in the Costa and the Oriente. These findings agree with the figures presented in table 3. All else being equal, earnings from non-farm employment are higher in the Oriente than in the Sierra. As mentioned earlier, oil companies, which pay the highest non-farm wages, are located in the Oriente.

VI. Conclusions

Non-farm employment is an important source of income for rural people in Ecuador, accounting for 36% of households' income and employing roughly 33% of the country's rural labour force. This study has examined the determinants of both participation in non-farm employment and non-farm income. The empirical analysis shows that women are more likely than men to participate in NFSE. However, they earn significantly less than men in both NFSE and NFWE. Participation in NFWE is more common among educated people, who usually also have the physical capital to overcome the entry barriers that RNFE involves. There is a marked tendency for landless people to engage in RNFE. The results also show, as expected, that participation in NFSE does not require high education endowments, which is evidence that the NFSE sector is still incipient.

Special emphasis has been placed on locational and geographical variables. The results suggest that RNFE blooms in areas near medium-sized towns with a dynamic agricultural sector. The likelihood of participating in non-farm work is higher in both the Costa and the Oriente than in the Sierra. There are different reasons for this, with land concentration appearing to be a major factor in the Costa and land quality in the Oriente.

There are regional variations in the wage differential between farm and non-farm income. While farm earnings are considerably lower than those from non-farm employment in the Sierra and the Oriente, those who have farm self-employment as their principal occupation in the Costa earn more than most non-farm self-employed workers. Essentially, though, non-farm wage employment offers better earnings than any form of agricultural labour, which indicates its potential for rural poverty alleviation. Nevertheless, participation in RNFE in general and well-paid RNFE in particular demands high human and physical capital endowments which are rarely available to the poor. Policy interventions

to address this should focus on providing rural people with education, training and credit to overcome the entry barriers that prevent the poor from engaging in non-farm employment.

Since participation in non-farm employment is shaped not only by distance to markets but also by market size and the local economic environment, policies should also be oriented towards supporting the development of medium-sized towns which, as shown earlier, have the potential to absorb the rural labour surplus. Investments in rural infrastructure, the promotion of agriculture and tourism and tax incentives for enterprises willing to relocate in deprived rural areas could be helpful in achieving that goal.

Bibliography

- Atamanova, A. and M. Van den Berg (2012), "Participation and returns in rural nonfarm activities: evidence from the Kyrgyz Republic", *Agricultural Economics*, vol. 43, No. 4, International Association of Agricultural Economists.
- Berdegúe, J. and others (2001), "Rural nonfarm employment and incomes in Chile", *World Development*, vol. 29, No. 3, Amsterdam, Elsevier.
- Bilsborrow, R., A. Barbieri and W. Pan (2004), "Changes in population and land use over time in the Ecuadorian Amazon", *Acta Amazonica*, vol. 34, No. 4.
- Bourguignon, F., M. Fournier and M. Gurgand (2007), "Selection bias corrections based on the multinomial logit model: Monte Carlo comparisons", *Journal of Economic Surveys*, vol. 21, No. 1, Wiley.
- Dubin, J.A. and D.L. McFadden (1984), "An econometric analysis of residential electric appliance holdings and consumption", *Econometrica*, vol. 52, No. 2, New York, The Econometric Society.
- Elbers, C. and P. Lanjouw (2001), "Intersectoral transfer, growth and inequality in rural Ecuador", *World Development*, vol. 29, No. 3, Amsterdam, Elsevier.
- Ellis, F. (2000), "The determinants of rural livelihood diversification in developing countries", *Journal of Agricultural Economics*, vol. 51, No. 2, Agricultural Economics Society.
- (1999), "Rural livelihood diversity in developing countries: evidence and policy implications", *Natural Resource Perspectives*, No. 40, Overseas Development Institute.
- (1993), *Peasant Economics: Farm Households and Agrarian Development*, Cambridge, Cambridge University Press.
- Ferreira, F. and P. Lanjouw (2001), "Rural nonfarm activities and poverty in the Brazilian Northeast", *World Development*, vol. 29, No. 3, Amsterdam, Elsevier.
- Haggblade, S., P. Hazell and T. Reardon (2010), "The rural non-farm economy: prospects for growth and poverty reduction", *World Development*, vol. 38, No. 10, Amsterdam, Elsevier.
- Hicks, J.F. and others (1990), *Ecuador's Amazon Region Development Issues and Options*, Washington, D.C., World Bank.
- Isgut, A. (2004), "Non-farm income and employment in rural Honduras: assessing the role of locational factors", *Journal of Development Studies*, vol. 40, No. 3, Taylor & Francis.
- Jonasson, E. and S.M. Helfand (2010), "How important are locational characteristics for rural non-agricultural employment? Lessons from Brazil", *World Development*, vol. 38, No. 5, Amsterdam, Elsevier.
- Köbrich, C. and M. Dirven (2007), "Características del empleo rural no agrícola en América Latina con énfasis en los servicios", *Desarrollo Productivo series*, No. 174 (LC/L.2659-P), Santiago, Economic Commission for Latin America and the Caribbean (ECLAC).
- Lanjouw, P. (2001), "Nonfarm employment and poverty in rural El Salvador", *World Development*, vol. 29, No. 3, Amsterdam, Elsevier.
- (1999), "Rural nonagricultural employment and poverty in Ecuador", *Economic Development and Cultural Change*, vol. 48, No. 1, Chicago, The University of Chicago Press.
- Lanjouw, J.O. and P. Lanjouw (2001), "The rural non-farm sector: issues and evidence from developing countries", *Agricultural Economics*, vol. 26, No. 1, International Association of Agricultural Economists.
- Lanjouw, P. and N. Stern (1998), *A Kind of Growth: Palampur 1957-1993*, Oxford, Oxford University Press.
- Laszlo, S. (2005), "Self-employment earnings and returns to education in rural Peru", *Journal of Development Studies*, vol. 41, No. 7, Taylor & Francis.

- Martínez, L. (2004), "El campesino andino y la globalización a fines de siglo (una mirada sobre el caso ecuatoriano)", *European Review of Latin American and Caribbean Studies*, No. 77.
- (2002), *Economía política de las comunidades indígenas*, Quito, Latin American Institute for Social Science Research (ILDIS).
- (2000), "La especificidad del empleo rural", *Antología de estudios rurales*, A. Torres (eds.), Quito, FLACSO Ecuador/Latin American Institute for Social Science Research (ILDIS).
- McFadden, D. (1973), "Conditional logit analysis of qualitative choice behavior", *Frontiers in Econometrics*, P. Zarembka (eds.), New York, Academic Press.
- Myers, N. and others (2000), "Biodiversity hotspots for conservation priorities", *Nature*, No. 403.
- North, L.L. and J.D. Cameron (2000), "Grassroots-based rural development strategies: Ecuador in comparative perspective", *World Development*, vol. 28, No. 10, Amsterdam, Elsevier.
- Ospina, P. (2010), "Tungurahua rural: el territorio de senderos que se bifurcan", *Ecuador Debate*, vol. 81, No. 3, Quito, Andean Centre for Population Action.
- Reardon, T. and others (2000), "Household income diversification into rural nonfarm activities", *Transforming the Rural Nonfarm Economy*, S. Haggblade, P. Hazell and T. Reardon (eds.), Baltimore, Johns Hopkins University Press.
- Vasco, C. (2014), "Reciprocal and wage labour in rural Ecuador. A quantitative analysis", *Journal of Agriculture and Rural Development in the Tropics and Subtropics*, vol. 115, No. 1.
- (2013a), "Factores determinantes del trabajo recíproco y del uso de mano de obra salariada en el Ecuador rural", *Eutopía*, No. 4, Quito, FLACSO-Ecuador.
- (2013b), "Migration, remittances and entrepreneurship: the case of rural Ecuador", *Migraciones Internacionales*, vol. 7, No. 1, Mexico City, El Colegio de la Frontera Norte.
- Vasco Pérez, C., R. Bilsborrow and B. Torres (2015), "Income diversification of migrant colonists vs. indigenous populations: contrasting strategies in the Amazon", *Journal of Rural Studies*, vol. 42, Amsterdam, Elsevier.