Wages and employment in non-farm agricultural activities: a livelihood strategy in Nicaragua.

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Abstract

This article analyzes the indices for nonfarm agricultural activities, which combine agricultural activities with both employment and wages. They were made with panel data of the Living Measurement Standard Survey (1993, 1998, 2001 and 2005) and they were processed with econometric model as a parametric technique (Binary dependent variable model).

The trend indices explain the varied combination of nonfarm and farming agricultural activities. In summary, when the economic public policy makers promote preventative measures in the labour market, we see that indices for nonfarm agricultural activities grow. In fact, small farmers use first, second and third nonfarm employment as livelihood strategies for clashing the public policy restrictive. (Unemployment)

Keywords: RMEA; RMNFA; RSEA; RSENFA; RTEA; RTNFA; RMWAI; RMWNFAI; RSWAI; RSWNFAI; RTWAI; RTWNFAI.
1 Introduction

Nicaragua is a predominantly agricultural country. 28.1 % of the GDP, 15.9 % of the total exports, and the 42.6 % of national employment is given by agricultural sector. The mean features of small farmers are: a) They represent 80 % of total farmers, while they are owners of 24 % of total land; b) They have a 80 % men and 20 % are women, c) Only 0.02 % have a basic education; d) 46 % have a title deed, 16 % are without title deed, 13 % in process of legalization, and the rest other form of possession (NIID, III CENAGRO: 2001).

The paper is structured as follows. The next section reviews the empirical studies conducted by the community of agricultural economists. Methodology is presented in Section 3 and results of the research are showed in section 4.

2 Empirical studies: RNFE and RNFW

In the reviews of empirical studies we find that some studies were based on the concepts of rural, non-farm agricultural, non-farm income, and non-farm employment. Other authors explain the relation between rural employment and non-farm income, the process of suppuration rural poverty, of transformation farming and the livestock sector, and transformation into a modern rural sector. Even they discuss the trend both employment and non-farm income. They also discuss different kind of employment and non-farm income.

The concept “non-farm agricultural” is used to describe rural farmers in secondary and tertiary sectors where RNFE and RNFW are employment and income indices (Berdegué et al., 2000), others define it as derived from rural area which define the rural non-agricultural economy (RNFAE): activities and incomes. The RNAE is often defined as including all economic activities in rural areas except agriculture, livestock, hunting and fishing (Lanjouw and Lanjouw, 1997). More over “Non-Farm” is defined as being all those diverse activities associated with waged work or self-employment in work that is not agriculture but located in rural areas (David and Pearce, 2000). During the 1950, the 54 % was employed in agricultural activities of the population of the rural sector of Latin America, however in 1990 only 25 per cent was employed in it (Milicevic, 2000). This is explained by both rural-urban migrations and structural change in rural labour market.

Past investigations in some countries show that RNFA is a high and increasing proportion of the income of rural poor households in the last decade (Berdegué et al., 2000). It is a livelihood1 strategy. (The both RNFE and RNFW are part of it).

On the other hand, analysis of rural regions of the EU can point to issues of importance for the transitions economies. Outside Central Europe this studies in this field are now being undertaken, since it is recognized that in the longer term the development of the rural non-farm sector is a critical factor in providing rural employment and income (Bleahu and Janowski, 2001; Breischopf and Schreider, 1999; Deichmann and Henderson, 2000; Chaplin, 2000; Sarris et al., 1999).

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1 The concept of livelihood used in this paper is that given by Ellis (1999, p.6): “A livelihood comprises incomes in cash and in kind; the social relations and institutions that facilitate or constrain individual or family standards of living; and access to social and public services that contribute to the well-being of the individual or family.”
In countries such as Romania, where agriculture is acting as a buffer against unemployment and hidden unemployment is widespread and increasing (Davis and Pearce, 2000), RNAE is important for poverty reduction.

3 Methodology

In the binary dependent variable model, the dependent variable, y may take on only two values 0-1 y might be a dummy variable representing the occurrence of an event (in our case this is employment), or a choice between two alternatives: employment in agricultural activities or employment in nonfarm agricultural activities. Suppose that we model the probability of observing a value of one as:

$$\Pr (y_i = 1 /x_i, \beta) = 1 - F(- x'_i \beta)$$  \hspace{1cm} (1)$$

where F is a continuous, strictly increasing function that takes a real value and returns a value ranging from zero to one. The choice of the function F determines the type of binary model. It follows that:

$$\Pr (y_i = 0 /x_i, \beta) = F(- x'_i \beta)$$  \hspace{1cm} (2)$$

Given such a specification, we can estimate the parameters of this model using the method of maximum likelihood. The likelihood function is given by:

$$l(\beta) = \sum_{i=0}^{n} y_i \log (1 - F(- x'_i \beta)) + (1 - y_i) \log (F(- x'_i \beta))$$  \hspace{1cm} (3)$$

The first order conditions for this likelihood are nonlinear so that obtaining parameter estimates requires an iterative solution. I use Eviews 5.1 that by default uses a second derivative method for iteration and computation of the covariance matrix of the parameter estimates. There are two alternative interpretations of this specification that are of interest. First, the binary model is often motivated as a latent variables specification. Suppose that there is an unobserved latent variable

$$y^*_i = x'_i \beta + \mu_i$$  \hspace{1cm} (4)$$

where $\mu_i$ is a random disturbance. Then the observed dependent variable is determined by whether $y^*_i$ exceeds a threshold value:

$$y_i = \begin{cases} 1 & \text{if } y^*_i > 0 \\ 0 & \text{if } y^*_i \leq 0 \end{cases}$$  \hspace{1cm} (5)$$

In this case, the threshold is set to zero, but the choice of a threshold value is irrelevant, so long as a constant term is included in $x_i$. Then:

$$\Pr (y_i = 1 /x_i, \beta) = \Pr (y^*_i > 0) = \Pr (x'_i \beta + \mu_i > 0) = 1 - F_{\mu}(- x'_i \beta)$$  \hspace{1cm} (6)$$

where $F_{\mu}$ is the cumulative distribution function of $\mu$. Common models include probit (standard normal), logit, (logistic), and gompit (extreme value) specification for the F function. In principle,

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2 See table No 1 that shows exchange ratios, annual inflation, farm sample and description variable.
the coding of the two numerical values of $y$ is not critical since each of the binary responses only represents an event. Nevertheless, Eviews require that I code $y$ as zero-one variable. This restriction yields a number of advantages. For one, coding the variable in this fashion implies that $y = 1$.

$$E\left(\frac{y_i}{x_i}, \beta\right) = 1 \cdot \Pr(y_i = 1/x_i, \beta) + 0 \cdot \Pr\left(y_i = \frac{0}{x_i}, \beta\right) = \Pr\left(y_i = \frac{1}{x_i}, \beta\right) \tag{7}$$

This convention provides us with a second interpretation of the binary specification as a conditional mean specification. It follows that we can write the binary model as a regression model:

$$y_i = (1 - F(-x_i, \beta)) + \epsilon_i \tag{8}$$

where $\epsilon_i$ is a residual representing the deviation of the binary $y_i$ from its conditional mean. Then:

$$E(\epsilon_i/x_i, \beta) = 0 \quad V\text{ar}(\epsilon_i/x_i, \beta) = 0 \quad F(-x_i, \beta) \left(1 - F(-x_i, \beta)\right). \tag{9}$$

As Eviews requires a code dependent variable, it is coding as a zero-one. One if the farm employs working economic population in agricultural activities, zero if the farm no employs it. On the other hand, there are two groups for coding independent variables. The first group is for wage and the second is for employment. The first is coding for the salary index $x_i$. The calculation for $x_i$ is as follows:

$$x_i = \sum_{k=1}^{n} \alpha_k * I_k \tag{10}$$

Where, $x_i$ is the monthly real wage index of each farm; $\alpha_k$ is the more important farm or nonfarm agricultural activity “K” and finally $I_k$ is the simple index for the farm activity “K”.

The weighting of each farm activity is arrived at by divide it between the total farm wages in a year. It is as follow:

$$\alpha_k = \frac{WAGE(k)}{TOTALWAGE} \tag{11}$$

Where, $\alpha_k$ is the participation of each farm activity in the total earnings; $WAGE(k)$ is the income of each farm activity “K”; and $TOTALWAGE$ is the total wage.

The simple index of each farm activity “K” is used to divide the average salary between farm activities in a month during the current period and the annual average in the base year (Central Bank of Nicaragua, 1994).
The data source is the household survey named Living Standards Measurement Survey (LSMS\(^3\)) of the National Institute of Information and Development (NIID). Hence, I make six wage and six employment indicators (See table 1 and 2).

To estimate a binary dependent variable model, I choose a third method: Probit, Logit and Gompit. For Probit:

\[
Pr(y_i = 1|x_i, \beta) = 1 - \Phi(-x_i\beta) = \Phi(x_i\beta)
\]

(12)

where \(\Phi\) is the cumulative distribution function of the standard normal distribution.

For Logit:

\[
Pr (y_1 = 1|x_i, \beta) = 1 - \left( 1 + e^{-x_i\beta} \right)^{-1}
\]

(13)

\[
= e^{-x_i\beta} / (1 + e^{-x_i\beta})
\]

which is based upon the cumulative distribution function for the logistic distribution.

For Gompit

\[
Pr(y_i = 1|x_i, \beta) = 1 - \left( 1 - \exp(-e^{x_i\beta}) \right)
\]

(14)

\[
= \exp\left(-e^{x_i\beta}\right)
\]

which is based upon the CDF for the Type-1 extreme value distribution is skewed.

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<tr>
<th>LSMS Years</th>
<th>Exchange rate CSx US</th>
<th>Annual Inflation (%)</th>
<th>Farm sample</th>
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<td>6.35</td>
<td>19.5</td>
<td>11,121</td>
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<tr>
<td>1998</td>
<td>11.1938</td>
<td>18.5</td>
<td>11,610</td>
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<tr>
<td>2001</td>
<td>13.8408</td>
<td>4.7</td>
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<tr>
<td>2005</td>
<td>17.1455</td>
<td>9.58</td>
<td>19,325</td>
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Table 2: Coding variables of binary dependent variable model

<table>
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<th>Code</th>
<th>Variable</th>
<th>Description</th>
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<tr>
<td>WEP</td>
<td>(y_i)</td>
<td>Working economic population (more than 10 year and less than 60 year)</td>
</tr>
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<td>RMEA</td>
<td>(x_1)</td>
<td>Rural mean employment in farm agricultural activity</td>
</tr>
<tr>
<td>RMENFA</td>
<td>(x_2)</td>
<td>Rural mean employment in nonfarm agricultural activity</td>
</tr>
<tr>
<td>RMWAI</td>
<td>(x_3)</td>
<td>Rural mean wage index in farm agricultural activity</td>
</tr>
<tr>
<td>RMWNFAI</td>
<td>x_4</td>
<td>Rural mean wage index in nonfarm agricultural activity</td>
</tr>
<tr>
<td>RSEA</td>
<td>(x_5)</td>
<td>Rural second employment in farm agricultural activity</td>
</tr>
<tr>
<td>RSENFA</td>
<td>(x_6)</td>
<td>Rural second employment in nonfarm agricultural activity</td>
</tr>
<tr>
<td>RSWAI</td>
<td>(x_7)</td>
<td>Rural second wage index in farm agricultural activity</td>
</tr>
<tr>
<td>RSWNAI</td>
<td>(x_8)</td>
<td>Rural second wage index in nonfarm agricultural activity</td>
</tr>
<tr>
<td>RTEA</td>
<td>(x_9)</td>
<td>Rural third employment in farm agricultural activity</td>
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<tr>
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<td>(x_{10})</td>
<td>Rural third employment in nonfarm agricultural activity</td>
</tr>
<tr>
<td>RTWAI</td>
<td>(x_{11})</td>
<td>Rural third wage index in farm agricultural activity</td>
</tr>
<tr>
<td>RTNFAI</td>
<td>(x_{12})</td>
<td>Rural third wage index in nonfarm agricultural activity</td>
</tr>
</tbody>
</table>

\(^3\) Living Standards Measurement Survey (LSMS), is widely recognized as a leader in introducing and improving integrated household surveys in developing countries. The LSMS has been an important effort of the World Bank Development Research Group (DECRG) for more than 20 years (World Bank, 2006)
4 Results

4.1 Employment

In the period 1990-1994, the stability of the work force registered important structural changes. This was the result of reduction of the size of the army, conciliation plan of the country, public sector reduction through the application of a plan of occupational conversion, labour mobilization plan, and privatization enterprise process of the area of people ownership. (Central Bank of Nicaragua: 1994-93)

Interestingly, during 1993 to 2005, livelihood strategies were used in Nicaragua as second and third employment in nonfarm agricultural activities. These were RSENFAI, RTENFAI. In contrast RMENFAI was higher than RMEA in 1993; therefore it was lower than RMEA during 1998 to 2005. The working population was employed on rural mean agricultural activity, however RSENFA (-0.78 probit, -1.62 logit and -1.59 gompit) was negative for 1993. Only in 2005 it reach 1.14 probit, 1.99 logit and 2.02 gompit. So, the third nonfarm agricultural activity (RTENFA) appears as a livelihood strategy. It is an increasing trend. For 1993 to 2005 the ratios of them are: probit 1.08, logit 0.66, gompit 0.58. (See Table No 3 and 4). A possible explication to these ratios may be the economic policy of the government. For example: during 1998, Nicaragua experienced the consequences of hurricane Mitch, in the next year, as a result, public investment increased the infrastructure to manage reconstruction of bridges, highways, schools, health centers, and house destroy by it. Agriculture, construction and trade were the sectors that contributed to employment generation (82 per cent in 1999) (Central Bank of Nicaragua: 1999).

Employment showed unfavorable behaviour in 2001. It was caused by: a) slowing down of economic activity, which was reflected by fall of the GDP growth of 2.5 points less than the previous year, b) supply increase of the labour force, and c) employment informal increased that absorbed part of unemployment hand work due to decrease activity formal sector. (Central Bank of Nicaragua: 2001)

In 2005, the generation of employment shows more dynamism than economic activity. 107,800 new jobs were created, and the increase was 5.5 per cent, in comparison November 2004. (Central Bank of Nicaragua: 2005)

4.2 Salary

The indices for wages show a varied behaviour. The wages in nonfarm agricultural activities had a great weight in 1993. Therefore RMWNFAI, RSWNFAI, RTWNFAI had highest index. In fact, in 1990 the wage(s) policy was focused in deregulation of labour market, consequently, workers became more efficient and productive. Afterwards, this was a wage freeze policy and public sector reduction until 1994 (Central Bank of Nicaragua: 1994). In contrast, the wage in agricultural activities is highlighted as RMWAI, RSWAI in 1998, although the RTWNFAI was an exception.

For 2001, RSWNFAI was the only index in nonfarm agricultural activities. During 2001, paradoxically the real wage experienced a recovery of 7.8 per cent. In contrast these were a slowing down of economic activity and low average productivity of input work factor. The increase is due to low inflation of this year. The minimum legal wage was established in February of this year, as result modest increase of 12 per cent in each and every economic sector, but the livestock and crop sector

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4 See table No 3 and No 4, Fig 1-4
was the exception, where wages increase 22.2 per cent. This sector shows a basket of necessities cover of 47.7 per cent, if we use as a reference the urban basket; however it increases 112 per cent, if we use the cost of the basket rural. (Central Bank of Nicaragua: 2001)

For 2005, only RSWAI is an index representative of agricultural activities. However, RMWNFAI and RTWNFAI are significant of nonfarm agricultural activities. In 2005 the average national wage shows an increase of 15.5 per cent (8.8 per cent in November 2004). The minimum legal wage was agreed in May 2005, as result increase of 16.5 per cent in construction and financial activity, and 15 per cent in other activities. When the tripartite commission considers the coffee sector, so they agree minimum legal wage increase of 26.6 per cent (7.9 per cent in 2004) (Central Bank of Nicaragua: 2005).
References


Central Bank of Nicaragua, Annual Report, 1993, pp53-63


National Institute of Information and Development, Third Census National Agricultural. 2001


Annex

Table 3: Coefficients estimates of employ and wage in farm and nonfarm agricultural activities, 1993-2005.

<table>
<thead>
<tr>
<th>Variables/Years</th>
<th>Probit</th>
<th>Logit</th>
<th>Gompit</th>
<th>Probit</th>
<th>Logit</th>
<th>Gompit</th>
<th>Probit</th>
<th>Logit</th>
<th>Gompit</th>
<th>Probit</th>
<th>Logit</th>
<th>Gompit</th>
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<tr>
<td>RMEA</td>
<td>1.470089</td>
<td>2.572856</td>
<td>2.601692</td>
<td>2.417625</td>
<td>2.345989</td>
<td>0.893810</td>
<td>1.472855</td>
<td>1.559175</td>
<td>1.338052</td>
<td>2.329083</td>
<td>2.371879</td>
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<td>1.270763</td>
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<td>1.128349</td>
<td>1.252336</td>
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<td>0.131660</td>
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Table 4: Technical coefficients

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pág. 10
Fig. 1 Employ indexes 1993-2005

Fig. 2 Real wage indexes 1993-2005
Fig 3 Employ indexes 1993 - 2005

Fig 4 Wages indexes 1993-2005