THE PHILIPPINE REVIEW OF ECONOMICS
VOL. XLI NO. 2 DECEMBER 2004

Village characteristics and employment choice in rural Philippines

*Karl Kendrick Tiu Chua**

Abstract

This paper examines Philippine rural employment choice and patterns. It uses a first-of-a-kind dataset that consolidates data from the Family Income and Expenditure Survey 2000 (FIES), the Census of Population *Barangay* Schedule 2000 (CPH5), and the Agrarian Reform Community (ARC) Level of Development Assessment 2000 (ALDA). A multinomial logit model is utilized to determine employment likelihood in different sectors given a set of individual and household attributes and village characteristics. The results reveal that the lack of facilities, services and formal establishments is primarily responsible for keeping rural dwellers in the impoverished agricultural and informal service sectors. This study also shows that individual and household attributes are generally in accord with theory and other empirical studies.

JEL classification: J23, J24, R10
Keywords: Labor demand, human capital; skills; occupational choice; labor, productivity

1. Introduction

A study of economic growth and development is incomplete without considering the rural sector. Rural Philippines comprises 53 percent of total employment (Labor Force Survey [LFS] 2002) and accounts for three-fourths of national poverty (Family Income and Expenditure Survey [FIES] 2000). Traditionally, rural dwellers were employed in the agricultural sector. However, agricultural employment has been contracting since the 1970s. Figures from the National Statistics Office (NSO) show that the share of agriculture in total employment has declined from 54.4 percent in 1974 to 36.5 percent in 2002, while the share of the service sector has increased from 35 percent in 1974 to 47.5 percent in 2002 (LFS 1974-2002). Figure 1 shows employment percentage shares by sector for the past 29 years. With fixed arable land, low productivity and a fast-growing rural labor force, farm laborers have been moving out from an overcrowded agricultural sector to other sectors in big numbers, with some even migrating to the cities. This has lowered real wages in the

*Assistant professor, Department of Economics, Ateneo de Manila University, Philippines. Author can be reached via email: kchua@ateneo.edu.

non-agricultural sectors, especially in the unskilled rural service sector, the primary alternative to agriculture work. At present, about 58 percent of the rural poor are employed in the agricultural sector while the remaining 42 percent are dependent on income earned outside the farm, understood to include farmlands, fisheries, forest areas, livestock facilities, etc. (LFS 2002).

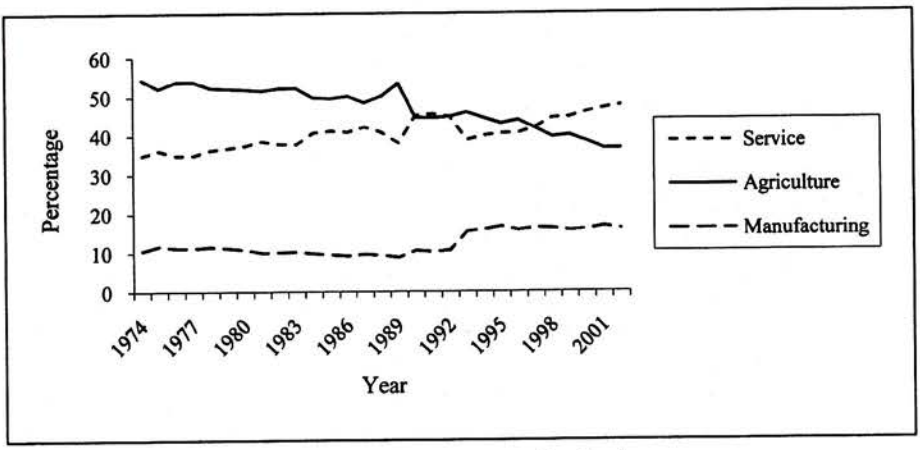

Figure 1. Employment by Sector

Source: LFS 1974-2002

The rural poor have mostly remained in a vicious cycle of poverty. Access to social services, education and credit facilities have been inadequate. Furthermore, the lack of information and a corrupt and inefficient government introduce distortions in economic policies, misallocate funds, and provide substandard public services (Balisacan [2003]). The consequence is a class of less-skilled workers incapable of improving their lot. Those engaged in agriculture are characterized by high levels of underemployment and even unemployment due to the seasonality of production and vulnerability to the environment, coupled with still-traditional farming methods and lack of land tenure. Seasonality of production results in routine cash flow problems. The lack of assets makes it difficult to obtain credit at affordable rates. Both have prevented many from shifting to modern farming methods and from being insulated against negative shocks. Outside the farm, the rural poor face less volatility in earnings but encounter the same set of inadequate facilities and services. Those who are willing to venture into small-scale enterprises also find it hard to obtain credit at reasonable rates.

Traditionally, the rural non-farm sector was considered to be a low-productivity sector producing low-quality goods and services and was expected to diminish as the country develops. It was also commonly held that this sector contributed to the growth of the informal sector, which was looked down upon as a source of growth.

Myrdal [1971] asserted in the 1970s that it was in the agricultural sector that the battle for long-term economic development would be won or lost. However, recent studies have shown otherwise.

The rural informal service sector, on the contrary, has been expanding and has actually contributed to rural employment, poverty reduction and a more spatially balanced population distribution (Lanjouw [2001]). Hayami [1999] observed that the increase in non-farm employment opportunities in recent years as a fallback to congestion in the farms has prevented both per capita income and inequality from worsening. Finally, Balisacan [1991] prescribed that uplifting poverty and maintaining a sustainable growth in rural areas were not only dependent on rapid agricultural growth but also on making economic structures and the economic environment in the non-agricultural sectors conducive to growth, as well as providing employment opportunities for the fast-growing labor force. Given the importance of both farm and non-farm activities, this study examines employment choice and patterns in rural Philippines by considering a set of individual and household attributes, as well giving emphasis on the set of village characteristics. While the first two are already very well-studied, the third is fairly novel and invites more research.

The econometric model used in this study is Theil's [1969] multinomial extension of the logit model. It was originally used in occupational choice studies given a set of individual attributes (see Boskin [1974], and Schmidt and Strauss [1975]). In recent times, the choice of dependent variable has changed from occupational type to employment by categories, such as source of income or access to agricultural land. Similarly, the regressors have also been expanded to include household attributes, such as household asset and farm size, and village characteristics, such as distance from *poblacion* (municipality proper), distance from market and distance from primary and secondary schools. These modifications are evident in recent studies on rural employment in selected Philippine villages (see Evenson [1996], Lanzona [1998], and Fuwa [2003]) and in other studies (see Hare [1992], Arif [2000], Cruz-Dona and Martina [2000], Cook [1998], and Lim-Applegate, Rodriguez and Olfert [2002]). Cook, in particular, studied employment opportunities in rural China and used four sets of regressors in determining employment outcome: individual attributes, household demographic structure and endowment, village characteristics, and political connections or other non-market rationing mechanism. The task of using three sets of regressors in this study requires consolidating datasets to bring together all the required variables into one dataset. Other studies have also combined datasets, such as household surveys and national censuses (see Hentschel, et al. [2000]).

What is new in this study? Foremost, this study employs the new consolidated dataset, which is nationally representative and free of sampling bias. This overcomes the traditional method of studying a few communities and then generalizing for the whole country. Second, the new dataset allows the use of all three sets of variables

simultaneously—individual, household and village—in analyzing determinants of employment choice. Third, this study adds to the increasing stock of knowledge on rural employment choice by exploring the contribution of a complete set of village characteristics. Finally, the new dataset allows the inclusion of the agrarian reform community (ARC) age variable, a variable never before used in employment choice studies.

The rest of the study is organized as follows: Section two describes the rural labor market. Section three discusses the dataset and methodology. Section four introduces the econometric models. Section five presents the results of the models and their implications. Finally, section six concludes.

2. Rural labor market

Rural employment analyses are not easily undertaken when using neoclassical labor market theories. The standard neoclassical model is a powerful tool when analyzing the allocation and pricing of labor in a first-best world, but is ill-equipped when there are missing or imperfect markets and severe information asymmetries leading to high transaction costs, all very noticeable in the rural sector. These forms of market failures are the primary consequences of rural village isolation, both economically and spatially, from the mainstreams of formal economic activity.

The isolation of villages, economically and spatially, is a critical starting point in the analysis of rural employment choice and patterns. Employment of rural dwellers is primarily influenced by factors within their respective villages with most dwellers primarily working within the village boundaries. In this sense, localized rural employment choice is largely influenced by its own village characteristics.

Neoclassical theory argues that employment outcome is based on the utility-maximizing choice of an individual subject to constraints such as wage rates, employment availability, job characteristics, individual qualifications, and the general economic environment. One can model the neoclassical employment choice problem as follows:

$$\begin{aligned} &\text{Max} \quad U(E) = f\left(w(N,L), X\right) \\ &\text{s.t.} \quad \left\{w(N,L) \otimes X\right\} \in \Omega, \end{aligned} \tag{1}$$

where $U(E)$ is expected utility of employment choice, w is a vector of wage level as a function of the demand for labor N and the supply of labor L, X is a vector of other factors including job characteristic, individual qualifications, and general macroeconomic environment, and Ω is the feasible set. X may shift the employment possibility set inwards or outwards. However, the above maximization problem may not be suitable in the rural sector. In rural areas, many markets, particularly the labor market, do not clear. Moreover, village location and characteristics determine

availability and access to employment when labor mobility is limited and when opportunities to migrate are few. The isolation of villages also limits the effects of the macroeconomic environment on rural employment. Moreover, job characteristics and preferences may not even matter since many rural dwellers take whatever jobs are available, or generate their own employment, in response to poverty.

Given that a different treatment is necessary for the rural labor market, the model of employment choice in this study is based on three primary sets of variables: individual, household and village, giving special emphasis on village characteristics as the limiting condition for employment choice given rural village isolation. The vector $\boldsymbol{X}$ of other factors is included with the hypothesis that its effect would be minimal. Thus, the maximization problem is the following:

$$\begin{aligned} \text{Max} \quad & U(E) = f\left(w\left(N(\boldsymbol{I},\boldsymbol{H},\boldsymbol{V}), L(\boldsymbol{I},\boldsymbol{H},\boldsymbol{V})\right), \boldsymbol{H},\boldsymbol{V},\boldsymbol{X}\right) \\ \text{s.t.} \quad & \left\{w\left(N(\boldsymbol{I},\boldsymbol{H},\boldsymbol{V}), L(\boldsymbol{I},\boldsymbol{H},\boldsymbol{V})\right) \otimes \boldsymbol{H} \otimes \boldsymbol{V} \otimes \boldsymbol{X}\right\} \in \Omega, \end{aligned} \tag{2}$$

where $\boldsymbol{I}$ is the vector of individual attributes, $\boldsymbol{H}$ the vector of household attributes, $\boldsymbol{V}$ the vector of village characteristics, and the other notations have the same meaning as above. $\boldsymbol{H}$ and $\boldsymbol{V}$ may enter the problem directly or indirectly through wage determination. Individual characteristics have the same interpretation as the neoclassical model. Household attributes enter the problem more visibly in developing country rural sector owing to the interdependence of household members in maintaining smooth consumption given credit and labor market imperfection. Village characteristics, in terms of facilities and services and formal establishments, are hypothesized to enter significantly in the employment choice problem.

As expected, village isolation and the lack of integration with the formal economy result in low access to credit, education and a wide range of facilities and services. Government efforts to develop and integrate primarily agricultural *barangays* (smallest political unit of the Philippines; village) with the formal economy have led to the creation of ARCs. ARCs are clusters of *barangays* that serve as convergent areas of development efforts of all government agencies and non-government organizations (NGOs). For consistency, NARC is used to label *barangays* that are not part of an ARC. ARCs benefit from direct assistance that includes infrastructures, roads and irrigations, credit and health facilities, training, and marketing. Schools are generally not included in the package. As of March 2000, 1,060 ARCs covering 4,925 *barangays* have been established in the country (Reyes [2001]).

3. Data and methodology

This study uses a first-of-a-kind dataset that consolidates data from the following: Family Income and Expenditure Survey 2000 (FIES), Census of

Population and Housing *Barangay* Schedule 2000 (CPH5), and ARC Level of Development Assessment 2000 (ALDA). The first two datasets were acquired from the National Statistics Office (NSO) and the third from the Department of Agrarian Reform (DAR).

The three datasets were consolidated into one dataset with rural household as the unit of observation. *Barangay* was used as the joining field. FIES has 39,615 households of which 16,091 (40.62 percent) are rural-based. CPH5 has 41,991 *barangays* (about half of them classified as rural[1]) of which 1,352 (3.22 percent) are found in FIES. CPH5 also has 4,925 (11.73 percent) ARC *barangays*, of which 239 (17.68 percent) are found in FIES (see Tables 1 and 2). The project of consolidating the three datasets revealed 14 (0.01 percent) missing rural *barangays* in CPH5, which means that 167 (1 percent) rural households living in those *barangays* would have to be discarded. The available *barangays* resulted in matching 15,924 (99 percent) rural households with their respective *barangay* and ARC information. Because the 14 rural *barangays* and 167 rural households do not systematically come from the same province, one does not worry about sample bias. The consolidated dataset is further narrowed down to include only those who are employed. This results in 14,263 (89.57 percent) households.

Table 1. Barangay classification - sample

Classification	*Count*	*%*
ARC	239	17.68
NARC	1,113	82.32
Total	1,352	100.00

Source: CPH5 and ALDA

Table 2. Barangay classification - population

Classification	*Count*	*%*
ARC	4,925	11.73
NARC	37,066	88.27
Total	41,991	100.00

Source: CPH5 and ALDA

[1] Urban-rural classification in the Philippines is based primarily on population density and infrastructure rather than on economic and income indicators. Thus, there are many urban areas that still retain the physical and economic features of rural areas. This is one limitation of the study.

The relevant variables of this study include both individual and household attributes as well as village characteristics. Individual attributes taken from FIES include age, sex (a dummy variable henceforth called 'dummy'), marital status (dummy), and years of education of the household head. Household attributes include the number of babies and young children in the household, number of household members already employed, land asset (dummy), and financial asset. Tenure class and bank deposits from FIES are used to determine if a household owns its lot and to proxy for financial asset, respectively.

From a list of 22 *barangay* facilities and services from CPH5 (see Table 3), the more relevant variables for this study are: market, housing project, elementary school, street pattern, access to national highway, health center, water works and electricity. Both street patterns and highway access proxy for infrastructure support. This study also constructs a village characteristic weighted composite index (see Hentschel, et al. [2000] for a related study that uses a composite index on village characteristics) derived from a weighted sum of all the facilities and services of the *barangay* (see Table 3). Each of these facilities and services is assigned points depending on its relative importance in providing and supporting employment opportunities. Judgment of the author based on preliminary empirical analyses is used in assigning the points. The lower the index, the less endowed a village is in terms of facilities and services. The paper hypothesizes that the index gives a likelihood ratio greater than one (i.e. positive coefficient) when non-agricultural sectors are compared with the agricultural sector. The paper also hypothesizes that each household regardless of source of income has equal opportunity to access the facilities and services of the village, hence the index is the same for all households within a village. This is consistent with theory since most of these facilities and services are public goods and therefore one household's use cannot exclude another's use.

As an alternative means of analysis to the facilities and services dummy variables, the index serves to capture the interaction of various village variables given that many facilities and services are complementary. Put differently, the characteristics of a village that enter into employment choice are quite complex and interrelated. Improvement in only one aspect does not necessarily translate into general improvement in welfare when other aspects are not improved as well. For instance, Balisacan and Pernia [2001] empirically test the interaction between education and infrastructure. When regressed individually, both variables are insignificant. However, when regressed as an interaction term, the result is very significant. Moreover, Reyes [2001] argued that land redistribution does not necessarily improve farmer welfare unless it is complemented by a development package, which may include irrigation, credit, electricity, clean water, health and education.

Table 3. Barangay facilities and services

Facility & Service	*Weight*	*Facility & Service*	*Weight*
Barangay hall**	1.00	Elementary school**	3.00
Church**	1.00	High school**	2.00
Plaza*	1.00	College**	2.00
Cemetery*	1.00	Public library**	2.00
Telegraph*	1.00	Street Pattern*	2.00
Postal*	1.00	Highway*	3.00
Newspaper*	1.00	Hospital**	2.00
Phone*	2.00	Health center**	3.00
Poblacion*	2.00	Water works*	3.00
Market*	3.00	Electricity*	3.00
Housing project*	2.00		

Source: CPH5 and author's estimates

* Refers to physical infrastructure, ** refers to social infrastructure

The following establishment variables are included as well: number of service sector, manufacturing sector and financial sector establishments. The financial sector is taken out from the service sector to isolate the effects of formal credit institutions on employment choice. To proxy for the agriculture sector, an indicator—whether over 50 percent of the *barangay* residents are into agriculture (dummy)—is used. ARC age is obtained from ALDA.

Finally, agricultural indicator, major source of income, and minor source of income from FIES are used to come up with employment choices. Tables 4 to 10 summarize pertinent information on the variables.

Table 4. Summary of variables

Binary Variables	*Yes*	*%*	*No*	*%*	*Total*
Employed?	14,263	89.57	1,661	10.43	15,924
Male?	12,793	89.69	1,470	10.31	14,263
Married?	12,308	13.71	1,955	86.29	14,263
Spouse employed?[1]	5,098	39.83	7,703	60.17	12,801
Deposits? (Financial asset)	1,098	7.70	13,165	92.30	14,263
Own dwelling lot? (Land asset)	10,245	71.83	4,018	28.17	14,263
Agriculture is >50% of people in bgy[1]	11,243	80.50	2,724	19.50	13,967
Unemployed in agriculture?	295	17.76	1,366	82.24	1,661
Live in an ARC?	2,525	17.70	11,738	82.30	14,263

[1] missing data present

Source: FIES, CPH5 and ALDA

Table 5. Highest grade completed

Level	*Count*	*%*
None	1,023	7.17
Grade school undergraduate	4,085	28.64
Grade school graduate	3,462	24.27
High school undergraduate	1,711	12.00
High school graduate	2,261	15.85
College undergraduate	992	6.96
College graduate	703	4.94
Missing data	26	0.17
Total	14,263	100.00

Source: FIES

Table 6. Household members employed

Number	*Count*	*%*
0	10	0.07
1	6,802	47.69
2	5,020	35.20
>2	2,431	17.04
Total	14,263	100.00

Source: FIES

Table 7. Household head sex and employment choice

Employment	*Female*	*%*	*Male*	*%*	*Total*
Agriculture	455	0.31	6,519	0.51	6,974
Wage	327	0.22	3,440	0.27	3,767
Self-employed	227	0.15	1,610	0.13	1,837
Others	461	0.31	1,224	0.10	1,685
Total	1,470	1.00	12,793	1.00	14,263

Source: FIES

Table 8. Household head marital status and employment choice

Employment	*Single*	*%*	*Married*	*%*	*Total*
Agriculture	774	0.40	6,200	0.50	6,974
Wage	444	0.23	3,323	0.27	3,767
Self-employed	263	0.13	1,574	0.13	1,837
Others	474	0.24	1,211	0.10	1,685
Total	1,955	1.00	12,308	1.00	14,263

Source: FIES

Table 9. Barangay residence and employment choice

Employment	*NARC*	*%*	*ARC*	*%*	*Total*
Agriculture	5,638	0.48	1,336	0.53	6,974
Wage	3,193	0.27	574	0.23	3,767
Self-employed	1,531	0.13	306	0.12	1,837
Others	1,376	0.12	309	0.12	1,685
Total	11,738	1.00	2,525	1.00	14,263

Source: Merged Dataset

Table 10. Education and employment choice

Education	*Agriculture*	*Wage*	*Self-employed*	*Others*	*Total*
None	798	80	53	92	1,023
Grade school undergraduate	2,518	672	428	467	4,085
Grade school graduate	1,748	847	437	430	3,462
High school undergraduate	759	505	263	184	1,711
High school graduate	820	760	391	290	2,261
College undergraduate	231	470	159	132	992
College graduate	98	414	103	88	703
Missing data	2	19	3	2	26
Total	6,974	3,767	1,837	1,685	14,263

Source: FIES

4. Econometric model

The study uses a multinomial logit model (see appendix) to determine a household head's (henceforth called 'head') likelihood of being in a particular employment sector over another. In this study, the multinomial logit model predicts the probability that individual *i* in village *k* will be in a particular employment sector *j* given a set of individual and household attributes, and village characteristics.

The choice of employment is defined over four employment sectors based on the main source of income of the household head. The employment choices are the following: agricultural, non-agricultural wage, non-agricultural self-employed, and non-agricultural 'others' (see Table 11), where 'others' primarily refer to financial assistance from outside the household (i.e. remittances, pension, retirement benefits, and sustenance activities, all these comprise 80 percent of 'others') and profit from rent-seeking activities (see Table 12). The regressors are the individual and household attributes, and village characteristics mentioned in the preceding section.

The base models are of two types: one uses the village characteristics index together with the individual and household attributes, while the other uses facilities and services dummy variables together with the individual and household attributes. Employment choice is also regressed over the set of village characteristics only, one using the index and another using dummy variables, to isolate the effects of village characteristics on employment choice. For completeness, the regression results on individual and household attributes are also presented. The conceptual framework yields the following reduced-form employment participation probability function:

$$\mathrm{P}(Y = \text{employment choice}) = f\begin{pmatrix}\text{individual and household attributes,}\\ \text{and village characteristics}\end{pmatrix}$$

or

$$P_{ijk}\left(Y = j \setminus X_i, Z_k\right) = \frac{e^{\alpha' x_{ij} + \beta' z_{ijk}}}{\sum_{j=1}^{J} e^{\alpha' x_{ij} + \beta' z_{ijk}}}, \qquad (3)$$

or the probability of individual *i* in village *k* being employed in *j* is a non-linear function of $\boldsymbol{X}$, a vector of individual and household attributes and $\boldsymbol{Z}$, a vector of village characteristics. This study presents its results in log-likelihood form (equation 4) to compare employment probabilities, where w'_{ik} is a vector of all variables, both attributes and characteristics, and γ_{ijk} is a vector of all parameters.

$$\ln\left[\frac{P_{ijk}}{P_{ilk}}\right] = w'_{ik}\left(\gamma_{ijk} - \gamma_{ilk}\right) \qquad \text{or} \qquad \ln\left[\frac{P_{ijk}}{P_{i0k}}\right] = w_{ik}\gamma_{ijk} \qquad (4)$$

Table 11. Four-category employment choice

Source of Income	*Count*	*%*
Agriculture	6,974	48.90
Wage	3,767	26.41
Self-employed	1,837	12.88
Others	1,685	11.81
Total	14,263	100.00

Source: FIES

Table 12. Sources of income under others

Others	*Count*	*%*
Net share of crops and others	133	7.89
Assistance from abroad	576	34.18
Assistance from domestic	503	29.85
Rental of land/properties	15	0.89
Interest from banks	4	0.24
Pension and retirement benefits	130	7.72
Rental value of owner-occupied dwelling unit	9	0.53
Income from family sustenance	137	8.13
Gifts	34	2.02
Other unclassifiable	144	8.55
Total	1,685	100.00

Source: FIES

5. Results and discussion

Tables 13 and 14 present the likelihood ratios and z values of the base models. Tables 15 and 16 present the results of the regression only on the village characteristics, one using the index and the other using dummy variables. Table 17 has the regression results on only the individual and household attributes. All models are significant with zero p-values and acceptable *pseudo-*R^2. Moreover, the likelihood ratios and significance are generally similar across models, making the variables robust. The base model and the model regressed on village dummy variables also satisfy the independence of irrelevant alternative (IIA) assumption by failing to reject the null hypothesis of the Hausman and McFadden [1984] specification test that IIA holds at greater than 99 percent. The following discusses the results of the base models and highlights the major findings variable by variable:

5.1. Individual and household attributes

The results are generally in accord with theory and other empirical studies.

5.2. Sex

The base models reveal that male-headed households are more likely to be in the agricultural sector than female-headed households. Among non-agricultural sectors, males are more likely to be wage earners or self-employed when compared to 'others'. Since 'others' primarily refers to remittances, females are more likely to acquire income from 'others' when 'others' is compared with the other three employment choices. This is consistent with the observation that many overseas workers are males and send remittances to their spouses. This finding is significant across all the models presented.

5.3. Age

The age variable is generally significant but has likelihood ratios not different from 1.0000 regardless of which employment choices are being compared. This suggests that the age of household head does not really affect employment choice. A keen eye will see a secondary pattern in which younger heads are more likely to earn wages while older heads are more likely to be self-employed or in 'others'. In a related study on Australian rural employment choice, Lim-Applegate, et al. [2002] found that non-farm employment increased with declining age of farmer. This finding is consistent and generally significant across all the models presented.

5.4. Marital status

Marital status is not always significant across models. Looking at the base models, where it is most significant, one observes that married heads are more likely to be self-employed, earning from 'others', or engaged in agricultural activities rather than be a wage earner. This can arise from the lack of establishments in rural areas that can afford to pay adequate wages (Census of Establishments [1998]). Heads who are not married (single, separated and widowed) tend to rely on wages.

5.5. Education years

Among the non-agricultural sectors, higher educational attainment most likely leads to wage employment rather than self-employed or 'others'. Heads with lesser years of education are more likely to be self-employed. Between 'others' and self-employed, higher educational attainment most likely leads to 'others' since 'others' also include those who were previously wage earners and are now in pension or using their retirement benefits (7.72 percent), and those who are earning rent (1.66 percent). Higher educational attainment may lead to migration to better opportunity areas. In fact, Evenson [1996] found that more schooling led to lower probability

of staying in the same *barangay* and is highly correlated with getting a professional job or working in government, both of which are in the wage sector.

5.6. Number of household members employed

Household heads are more likely to be in the wage sector than in the three other sectors when more household members are already employed. The opposite is true when 'others' is compared to the three other sectors. Households with more members already employed are more likely to be in agriculture, wage or self-employed than in 'others'.

5.7. Age of babies and young children

The inclusion of these variables makes it possible to verify observations that some mothers, and to some extent some fathers, with very young children tend to cut down work hours to raise babies and children. In theory, this would mean that mothers or fathers cut down work that consumes the most number of hours away from home, in this case the wage sector. The base models reveal that these two variables are not always significant and intuitive. For instance, it is surprising to see that households with babies are more likely to be in wages than agriculture and 'others' despite this being time consuming. One possible explanation for this is the close-knit nature of rural villages, where it is possible to be in the wage sector while another member of the household takes care of babies.

5.8. Financial and land assets

The study distinguishes between land and financial assets. Whenever it is significant, land asset contributes to the likelihood of having an agricultural job rather than a non-agricultural job. With the onset of land redistribution, farmers who have been given farm titles usually reside in the same farm. In contrast, in the non-agricultural areas, land ownership is less formal and may be based on tribal or ancestral reasons. Among the non-agricultural sectors, owning a lot increases the probability of being in the self-employed or 'others' sectors rather than in the wage sector. This agrees with the observation that self-employed individuals usually operate their own enterprises on the same lot as their houses (i.e. *sari-sari* [petty retail] stores). The results are consistent across the different models presented.

The financial asset variable is generally significant but has likelihood ratios not different from 1.0000 regardless of which two employment choices are being compared. This suggests that financial asset does not really affect employment choice. A secondary pattern is that financial asset leans towards non-agricultural sectors, another intuitive finding. Among non-agricultural sectors, being in the self-employed sector or 'others' sector is more likely than being in the wage sector. This is also intuitive since it is necessary for the self-employed to save up for capital outlay for their entrepreneurial programs while those in 'others' include older people

who may have savings. In a related study, Lanzona [1998] also found that for men, the presence of non-land earning assets induced less probability of engaging in a wage job and increases the probability of being self-employed.

5.9. Facilities and services

An attempt to determine the likelihood of being employed in one sector over another, using the facilities and services dummy variables, gives some insignificant results while using the composite index always gives highly significant results, suggesting that many of these facilities and services are complementary.

5.10. Street patterns and highways

Street patterns always come out insignificant, suggesting that this may not be a good proxy. Access to national highways is significantly greater than 1.0000. It follows that there is more likelihood to being employed in the non-agricultural sector than in the agricultural sector. This result can imply that farm-to-market roads are still deficient. Among the non-agricultural sectors, highways become insignificant.

5.11. Elementary schools

Generally, one would expect that schools are very much associated with the non-agricultural sector but the regression result gives the opposite and is significantly different from 1.0000. One also notes the increasing number of schools in predominantly agricultural areas the past few years. Among non-agricultural sectors, the presence of a school usually leads to employment choice other than the wage sector.

5.12. Market

Local market places, similar to schools, surprisingly increase the probability of being employed in the agricultural sector over any of the non-agricultural sectors. This is tenable if one thinks of local market places as incentive for people to sell their produce. However, this explanation is not always defensible given that market places are not common in rural areas. Among the non-agricultural sectors, market is not very significant and results in higher probability of being self-employed, which is intuitive. Hardly anyone who works in the market earns from wages.

5.13. Housing project

Housing projects are generally associated with non-agricultural sector employment, especially wage earners, and are significantly different from 1.0000.

5.14. Health center

Barangay Health Centers come out very insignificant in many comparisons but are generally not far from 1.0000. The interpretation is that health centers are fast becoming a common sight in many *barangays* and are equally accessed by all employment sectors. Even in agricultural areas, health centers are becoming abundant.

5.15. Water works and electricity

As expected, utilities affect the choice of employment in favor of non-agricultural sectors. While a water works system carries a likelihood ratio of 1.24 on the average in favor of the non-agricultural sectors, electricity is almost twice that ratio at 2.42. Among the non-agricultural sectors, both utilities are generally insignificant but when significant, electricity makes it more likely to be employed in the wage sector. This can be understood in relation to manufacturing enterprises and certain wage-paying service sector establishments that rely critically on electricity for their operations. Water works are insignificant but are very close to 1.0000.

5.16. Village characteristic composite index

The base model reveals that *barangays* endowed with more relevant facilities and services result in heads more likely to be employed in wage, self-employed or 'others', in that order, when compared with agriculture. This is intuitive because the more developed a rural area is, the more the employment possibility set shifts out to include non-agricultural employment opportunities. However, one notes that the likelihood ratios are not too far from 1.0000, which signals that primarily agricultural areas are also catching up. Among non-agricultural areas, one sees that better facilities and services make the head more likely to be employed in the wage sector. This makes sense especially if one considers factories being set up in more developed rural areas. It is not significant when self-employed is compared to 'others'.

5.17. Manufacturing

Manufacturing establishments turn out to be insignificant in most comparisons except that it makes a head more likely to be employed in the agricultural sector than in the self-employed sector. Two reasons are proposed. First, there is a general lack of rural industries. A majority of *barangays* (52.74 percent) do not even have a single manufacturing establishment. Second, when manufacturing establishments do exist, they are mostly in the line of *agri*-industry (i.e. food processing, rice or corn mills).

5.18. Financial

Financial establishments make it more likely for a head to move out of agriculture and be employed in non-agricultural work. With a high significance and an average likelihood ratio of 1.54 over the agricultural sector, one can infer that formal credit facilities are shifting the employment possibility set away from agriculture and may create a bias in favor of non-farmers. Among non-agricultural sectors, the financial sector is insignificant in all pairwise comparisons. The limitation of using the current dataset is that it fails to capture the effects of informal credit facilities. Another study, perhaps using localized household survey, can capture the dynamics of the informal credit market as well as the rest of the informal sector.

5.19. Service

The increasing number of service establishments makes it more likely for a head to work in the non-agricultural sector. The likelihood ratios between wage and self-employed when compared to agriculture is very close, suggesting that the service sector provides opportunities for both wage earners and self-employed. Within the non-agricultural sector, more service establishments make it more likely for the head to be a wage earner than be self-employed or in 'others'. This is in contrast with Arif's [2000] findings for rural Pakistan wherein most non-farmers were self-employed and had difficulty in extending their enterprises in providing jobs to wage seekers. One implication of this is that the service sector is accommodating more wage seekers than it had in the past. The growth of the service sector can result in multiple equilibria. This can either point to growth of the rural formal sector since the capacity to provide wage labor correlates highly with the entry of new capital and enterprises that can afford to pay higher wages, or point to the growth of the rural informal sector, which is not necessarily bad for growth in the short run.

5.20. Agriculture

This variable checks if a critical mass of farmers is capable of influencing others to farm as well. The results show that this is true with a likelihood ratio significantly very far from 1.0000. This is more likely to occur in specialized rural areas where farming is the major source of income or in some cases, the only source of income. Another strand of thought is that with the influx of ARCs, more heads remain as farmers or choose to begin farming to take advantage of better farming conditions. Among the non-agricultural sectors, a bigger share of population in agriculture makes it more likely for heads to choose self-employment or 'others' than wage.

5.21. ARC age

First, note that the older the ARC is, the more likely it is for households to engage in or hold on to farming. The results are significant but are near 1.0000 when agricultural sector is compared to each of the three non-agricultural sectors. This is comparable to Evenson [1996] in which a larger farm size increases the likelihood of remaining a farmer in the same *barangay* and decreases the likelihood of obtaining a non-farm job. The implication is that households in *barangays* that have been included in ARCs tend to continue farming given better farming conditions (Reyes [2001]). Moreover, government and NGOs direct their effort to primarily improve farming conditions in ARCs rather than to provide them with other means of employment, which gradually arises as a result of locally sustained development. Within the non-agricultural sectors, ARC age, as expected, is insignificant all throughout.

6. Conclusion

This study is a preliminary attempt to empirically model rural employment choice and patterns using a nationally representative dataset consolidated from FIES, CPH5 and ALDA. The study finds that the lack of facilities, services and formal establishments is primarily responsible for keeping the rural dwellers in the agricultural and informal service sectors, which are prone to poverty. The study also shows that individual and household attributes are generally in accord with theory and other empirical studies. The result of this study also validates intuition and recreates rural employment patterns with the aid of a complete set of village characteristics from the new dataset.

This paper also attempts to answer the following question: How can rural income and living conditions be improved? A shift of the employment opportunity set to a higher level is the key to raising income and living conditions. To begin with, government institutions like ARCs, assisted heavily by non-government organizations, are forefront aid to rural development. Alleviating poverty in the rural sector by expanding the employment opportunity set requires a coordinated and comprehensive package that includes providing them land, jobs, education, credit, infrastructure and other facilities and services deemed necessary. With a budget constraint, alleviating rural poverty through rural employment generation should focus attention on a few key elements such as education, credit and social services.

Table 13. Multinomial logit for 4-category employment choice regressed on all variables and using village index

Likelihood ratio and *z* value

Employment Choice Likelihood	*Sex*	*Age*	*Marital Status*	*Educ Years*	*HH Employed*	*Children Age<1*	*Children Age<7*
P_1/P_0	0.7173	0.9940	0.7939	1.2478	1.5971	1.1664	0.9271
	-2.88**	-2.69**	-2.33**	31.58**	19.38**	2.24**	-2.96**
P_2/P_0	0.4364	1.0029	1.0562	1.1750	1.2496	1.1000	0.9227
	-6.31**	1.11	0.45	19.48**	7.44**	1.12	-2.56**
P_3/P_0	0.1986	1.0517	1.3503	1.1850	0.6989	0.9140	0.8881
	-13.31**	18.98**	2.58**	19.18**	-9.18**	-0.82	-3.18**
P_0/P_1	1.3941	1.0060	1.2596	0.8014	0.6261	0.8573	1.0787
	2.88**	2.69**	2.33**	-31.58**	-19.38**	-2.24**	2.96**
P_2/P_1	0.6085	1.0090	1.3303	0.9416	0.7824	0.9430	0.9953
	-3.66**	3.11**	2.25**	-7.02**	-8.09**	-0.67	-0.14
P_3/P_1	0.2769	1.0580	1.7008	0.9497	0.4376	0.7836	0.9580
	-9.8**	19**	4.19**	-5.56**	-20.4**	-2.16**	-1.08
P_0/P_2	2.2912	0.9971	0.9468	0.8511	0.8002	0.9091	1.0837
	6.31**	-1.11	-0.45	-19.48**	-7.44**	-1.12	2.56**
P_1/P_2	1.6435	0.9911	0.7517	1.0620	1.2781	1.0604	1.0047
	3.66**	-3.11**	-2.25**	7.02**	8.09**	0.67	0.14
P_3/P_2	0.4551	1.0486	1.2785	1.0085	0.5593	0.8309	0.9625
	-5.44**	14.49**	1.72*	0.83	-13.23**	-1.5	-0.87
P_0/P_3	5.0345	0.9509	0.7406	0.8439	1.4308	1.0940	1.1260
	13.31**	-18.98**	-2.58**	-19.18**	9.18**	0.82	3.18**
P_1/P_3	3.6112	0.9451	0.5880	1.0530	2.2851	1.2761	1.0438
	9.8**	-19**	-4.19**	5.56**	20.4**	2.16**	1.08
P_2/P_3	2.1973	0.9537	0.7822	0.9915	1.7880	1.2035	1.0390
	5.44**	-14.49**	-1.72*	-0.83	13.23**	1.5	0.87

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13941
LR Chi Square (45)	4295
p > Chi Square	0.0000
Pseudo-R^2	0.1264

Table 13. Multinomial logit for 4-category employment choice regressed on all variables and using village index (continued)

Likelihood ratio and *z* value

Employment Choice Likelihood	*Financial Asset*	*Land Asset*	*Barangay Charac Index*	*Services*	*Finance*	*Manufacturing*	*Agriculture*	*ARC Age*
P_1/P_0	1.0000	0.8287	1.0572	1.0347	1.5576	0.9884	0.5539	0.9542
	3.29**	-3.73**	11.55**	7.89**	4.91**	-1.02	-10.35**	-3.72**
P_2/P_0	1.0000	0.9725	1.0423	1.0329	1.5477	0.9712	0.6888	0.9711
	3.58**	-0.45	7.17**	6.23**	4.68**	-2.08**	-5.32**	-1.95*
P_3/P_0	1.0000	1.0896	1.0401	1.0147	1.4269	0.9887	0.7186	0.9685
	4.68**	1.23	6.41**	2.56**	3.44**	-0.74	-4.33**	-1.97**
P_0/P_1	1.0000	1.2067	0.9459	0.9665	0.6420	1.0117	1.8055	1.0480
	-3.29**	3.73**	-11.55**	-7.89**	-4.91**	1.02	10.35**	3.72**
P_2/P_1	1.0000	1.1735	0.9859	0.9982	0.9936	0.9826	1.2436	1.0177
	0.76	2.45**	-2.33**	-0.34	-0.16	-1.27	3.12**	1.07
P_3/P_1	1.0000	1.3148	0.9838	0.9807	0.9161	1.0003	1.2975	1.0149
	2.75**	3.67**	-2.47**	-3.34**	-1.37	0.02	3.34**	0.83
P_0/P_2	1.0000	1.0283	0.9594	0.9682	0.6461	1.0296	1.4518	1.0297
	-3.58**	0.45	-7.17**	-6.23**	-4.68**	2.08**	5.32**	1.95*
P_1/P_2	1.0000	0.8522	1.0143	1.0018	1.0064	1.0177	0.8041	0.9826
	-0.76	-2.45**	2.33**	0.34	0.16	1.27	-3.12**	-1.07
P_3/P_2	1.0000	1.1205	0.9978	0.9824	0.9220	1.0180	1.0433	0.9973
	1.66*	1.37	-0.3	-2.73**	-1.19	1.02	0.48	-0.14
P_0/P_3	1.0000	0.9177	0.9615	0.9855	0.7008	1.0114	1.3916	1.0326
	-4.68**	-1.23	-6.41**	-2.56**	-3.44**	0.74	4.33**	1.97**
P_1/P_3	1.0000	0.7606	1.0165	1.0197	1.0916	0.9997	0.7707	0.9853
	-2.75**	-3.67**	2.47**	3.34**	1.37	-0.02	-3.34**	-0.83
P_2/P_3	1.0000	0.8925	1.0022	1.0179	1.0847	0.9823	0.9585	1.0027
	-1.66*	-1.37	0.3	2.73**	1.19	-1.02	-0.48	0.14

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13941
LR Chi Square (45)	4295
p > Chi Square	0.0000
Pseudo-R^2	0.1264

Table 14. Multinomial logit for 4-category employment choice regressed on all variables and using village dummy variables

Likelihood ratio and *z* value

Employment Choice Likelihood	*Sex*	*Age*	*Marital Status*	*Educ Years*	*HH Employed*	*Children Age<1*	*Children Age<7*	*Financial Asset*	*Land Asset*	*Market*	*hsproj*
P_1/P_0	0.7314	0.9935	0.8095	1.2351	1.5647	1.1421	0.9503	1.0000	0.8595	0.6498	1.6039
	-2.65**	-2.86**	-2.08**	29.26**	18.06**	1.88*	-1.95*	4.57**	-2.92**	-6.52**	6.37**
P_2/P_0	0.4430	1.0020	1.0651	1.1662	1.2213	1.0655	0.9337	1.0000	1.0002	0.7718	1.2439
	-6.11**	0.73	0.52	18.18**	6.54**	0.73	-2.15**	4.88**	0	-3.35**	2.39**
P_3/P_0	0.2058	1.0496	1.3595	1.1762	0.6752	0.8864	0.8924	1.0000	1.1378	0.6979	0.9009
	-12.76**	17.89**	2.59**	17.83**	-9.82**	-1.07	-2.99**	6.05**	1.8*	-4.19**	-0.96
P_2/P_1	0.6058	1.0086	1.3158	0.9442	0.7805	0.9330	0.9825	1.0000	1.1637	1.1877	0.7756
	-3.66**	2.92**	2.15**	-6.57**	-8.02**	-0.79	-0.52	0.93	2.28**	2.07**	-2.9**
P_3/P_1	0.2814	1.0566	1.6795	0.9523	0.4315	0.7761	0.9390	1.0000	1.3238	1.0741	0.5617
	-9.58**	18.22**	4.05**	-5.14**	-20.29**	-2.2**	-1.56	3.33**	3.68**	0.76	-5.36**
P_3/P_2	0.4646	1.0476	1.2764	1.0086	0.5528	0.8319	0.9558	1.0000	1.1376	0.9043	0.7242
	-5.27**	14**	1.7*	0.81	-13.23**	-1.46	-1.02	2.04**	1.53	-0.99	-2.69**

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13614
LR Chi Square (45)	4615.41
p > Chi Square	0.0000
Pseudo-R^2	0.1393

Note: To find other likelihood ratios, simply apply algebraic properties. Example: $P_i/P_j=P_i/P_k*P_k/P_j$

Table 14. Multinomial logit for 4-category employment choice regressed on all variables and using village dummy variables (continued)

Likelihood ratio and *z* value

Employment Choice Likelihood	*School*	*Street*	*Hway*	*Health*	*Water*	*Elec-tricity*	*Services*	*Finance*	*Manu-facturing*	*Agri-culture*	*ARC Age*
P_1/P_0	0.6073	0.9490	1.3150	1.0062	1.2327	2.5743	1.0397	1.7479	1.0190	0.5773	0.9472
	-7.01**	-1.07	3.86**	0.11	4.35**	12.8**	8.84**	5.26**	1.57	-9.22**	-4.2**
P_2/P_0	0.6266	1.0057	1.1852	0.9782	1.3029	1.9587	1.0356	1.7714	0.9882	0.7060	0.9686
	-5.58**	0.1	2.06**	-0.32	4.6**	7.96**	6.66**	5.2**	-0.82	-4.79**	-2.09**
P_3/P_0	0.7280	0.9752	1.2506	0.8552	1.2165	2.4936	1.0189	1.6165	1.0208	0.7064	0.9582
	-3.5**	-0.4	2.52**	-2.2**	3.18**	9.75**	3.22**	3.86**	1.31	-4.4**	-2.55**
P_2/P_1	1.0318	1.0598	0.9013	0.9723	1.0570	0.7609	0.9960	1.0134	0.9698	1.2229	1.0226
	0.36	0.93	-1.11	-0.38	0.91	-2.74**	-0.77	0.28	-2.14**	2.78**	1.34
P_3/P_1	1.1986	1.0277	0.9510	0.8499	0.9869	0.9687	0.9800	0.9249	1.0018	1.2237	1.0117
	1.91*	0.4	-0.5	-2.09**	-0.2	-0.29	-3.42**	-0.95	0.11	2.5**	0.63
P_3/P_2	1.1617	0.9697	1.0552	0.8742	0.9337	1.2731	0.9839	0.9126	1.0330	1.0007	0.9894
	1.44	-0.41	0.49	-1.56	-0.93	2.08**	-2.48**	-1.04	1.8	0.01	-0.53

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13614
LR Chi Square (45)	4615.41
p > Chi Square	0.0000
Pseudo-R^2	0.1393

Note: To find other likelihood ratios, simply apply algebraic properties. Example: $P_i/P_j=P_i/P_k*P_k/P_j$

Table 15. Multinomial logit 4-category employment choice regressed on village index and establishments

Likelihood Ratio and z Value

Employment Choice Likelihood	*Village Characteristic Index*	*Services*	*Finance*	*Manufacturing*	*Agriculture*	*ARC Age*
P_1/P_0	1.0707	1.0414	1.5339	0.9932	0.5235	0.9481
	15.19**	9.99**	4.93**	-0.64	-12.1**	-4.46**
P_2/P_0	1.0525	1.0366	1.5243	0.9756	0.6611	0.9691
	9.12**	7.11**	4.65**	-1.8*	-6.05**	-2.13**
P_3/P_0	1.0501	1.0166	1.3560	0.9933	0.7018	0.9670
	8.52**	3.07**	3.01**	-0.46	-4.95**	-2.19**
P_0/P_1	0.9340	0.9603	0.6519	1.0069	1.9101	1.0547
	-15.19**	-9.99**	-4.93**	0.64	12.1**	4.46**
P_2/P_1	0.9830	0.9955	0.9937	0.9824	1.2627	1.0221
	-2.84**	-0.89	-0.16	-1.3	3.38**	1.34
P_3/P_1	0.9808	0.9762	0.8840	1.0002	1.3405	1.0199
	-3.13**	-4.39**	-1.94*	0.01	4.03**	1.17
P_0/P_2	0.9501	0.9647	0.6560	1.0250	1.5126	1.0319
	-9.12**	-7.11**	-4.65**	1.8*	6.05**	2.13**
P_1/P_2	1.0173	1.0045	1.0063	1.0180	0.7919	0.9784
	2.84**	0.89	0.16	1.3	-3.38**	-1.34
P_3/P_2	0.9977	0.9807	0.8896	1.0181	1.0616	0.9979
	-0.32	-3.1**	-1.7	1.06	0.71	-0.11
P_0/P_3	0.9523	0.9837	0.7375	1.0067	1.4248	1.0341
	-8.52**	-3.07**	-3.01**	0.46	4.95**	2.19**
P_1/P_3	1.0196	1.0244	1.1312	0.9998	0.7460	0.9805
	3.13**	4.39**	1.94*	-0.01	-4.03**	-1.17
P_2/P_3	1.0023	1.0197	1.1241	0.9822	0.9420	1.0021
	0.32	3.1**	1.7	-1.06	-0.71	0.11

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13967
LR Chi Square (18)	1317.71
p > Chi Square	0.0000
Pseudo-R^2	0.0387

Table 16. Multinomial logit for 4-category employment choice regressed on village characteristic dummy variables and establishments

Likelihood Ratio and z Value

Employment Choice Likelihood	*Market*	*Housing Project*	*School*	*Street*	*Hway*	*Health*
P_1/P_0	0.5777	1.7159	0.5702	0.9999	1.4143	1.0699
	-8.78**	7.71**	-8.41**	0.00	5.15**	1.25
P_2/P_0	0.7087	1.3116	0.6025	1.0433	1.2517	1.0223
	-4.55**	3.04**	-6.2**	0.74	2.77**	0.33
P_3/P_0	0.6495	0.9048	0.6847	0.9815	1.3075	0.8772
	-5.3**	-0.97	-4.47**	-0.31	3.19**	-1.96**
P_0/P_1	1.7311	0.5828	1.7539	1.0001	0.7071	0.9347
	8.78**	-7.71**	8.41**	0.00	-5.15**	-1.25
P_2/P_1	1.2268	0.7644	1.0567	1.0434	0.8851	0.9555
	2.48**	-3.1**	0.65	0.69	-1.32	-0.63
P_3/P_1	1.1243	0.5273	1.2009	0.9816	0.9245	0.8199
	1.32	-6.31**	2.07**	-0.29	-0.82	-2.72**
P_0/P_2	1.4111	0.7624	1.6598	0.9585	0.7989	0.9782
	4.55**	-3.04**	6.2**	-0.74	-2.77**	-0.33
P_1/P_2	0.8151	1.3082	0.9464	0.9584	1.1298	1.0465
	-2.48**	3.1**	-0.65	-0.69	1.32	0.63
P_3/P_2	0.9165	0.6899	1.1365	0.9408	1.0446	0.8580
	-0.88	-3.2**	1.27	-0.84	0.41	-1.84*
P_0/P_3	1.5397	1.1052	1.4605	1.0188	0.7648	1.1400
	5.3**	0.97	4.47**	0.31	-3.19**	1.96**
P_1/P_3	0.8894	1.8963	0.8327	1.0187	1.0816	1.2197
	-1.32	6.31**	-2.07**	0.29	0.82	2.72**
P_2/P_3	1.0911	1.4496	0.8799	1.0630	0.9573	1.1654
	0.88	3.2**	-1.27	0.84	-0.41	1.84*

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13640
LR Chi Square (39)	1916.94
p > Chi Square	0.0000
Pseudo-R^2	0.0577

Table 16. Multinomial logit for 4-category employment choice regressed on village characteristic dummy variables and establishments (continued)

Likelihood Ratio and z Value

Employment Choice Likelihood	*Water*	*Electricity*	*Services*	*Finance*	*Manufacturing*	*Agriculture*	*ARC Age*
P_1/P_0	1.1972	3.0308	1.0475	1.7543	1.0283	0.5504	0.9361
	3.96**	15.88**	11.19**	5.55**	2.47**	-10.59**	-5.36**
P_2/P_0	1.2713	2.2597	1.0400	1.7624	0.9960	0.6793	0.9622
	4.26**	9.85**	7.67**	5.36**	-0.28	-5.44**	-2.56**
P_3/P_0	1.2795	2.8974	1.0218	1.5345	1.0288	0.6999	0.9550
	4.26**	11.96**	3.96**	3.56**	1.91*	-4.81**	-2.92**
P_0/P_1	0.8353	0.3299	0.9546	0.5700	0.9725	1.8167	1.0683
	-3.96**	-15.88**	-11.19**	-5.55**	-2.47**	10.59**	5.36**
P_2/P_1	1.0618	0.7456	0.9928	1.0046	0.9687	1.2341	1.0279
	0.99	-2.98**	-1.41	0.10	-2.24**	2.93**	1.67
P_3/P_1	1.0687	0.9560	0.9754	0.8747	1.0005	1.2715	1.0202
	1.07	-0.43	-4.47**	-1.66*	0.03	3.19**	1.16
P_0/P_2	0.7866	0.4425	0.9615	0.5674	1.0040	1.4721	1.0393
	-4.26**	-9.85**	-7.67**	-5.36**	0.28	5.44**	2.56**
P_1/P_2	0.9418	1.3412	1.0072	0.9954	1.0323	0.8103	0.9728
	-0.99	2.98**	1.41	-0.10	2.24**	-2.93**	-1.67
P_3/P_2	1.0065	1.2822	0.9825	0.8707	1.0329	1.0303	0.9925
	0.09	2.19**	-2.78**	-1.59	1.84*	0.34	-0.39
P_0/P_3	0.7816	0.3451	0.9787	0.6517	0.9720	1.4288	1.0471
	-4.26**	-11.96**	-3.96**	-3.56**	-1.91*	4.81**	2.92**
P_1/P_3	0.9357	1.0460	1.0252	1.1432	0.9995	0.7865	0.9802
	-1.07	0.43	4.47**	1.66*	-0.03	-3.19**	-1.16
P_2/P_3	0.9936	0.7799	1.0178	1.1485	0.9682	0.9706	1.0076
	-0.09	-2.19**	2.78**	1.59	-1.84*	-0.34	0.39

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	13640
LR Chi Square (39)	1916.94
p > Chi Square	0.0000
Pseudo-R^2	0.0577

Table 17. Multinomial logit for 4-category employment choice regressed on individual attributes only

Likelihood ratio and z value

Employment Choice Likelihood	*Sex*	*Age*	*Marital Status*	*Educ Years*	*HH Employed*	*Children Age<1*	*Children Age<7*	*Financial Asset*	*Land Asset*
P_1/P_0	0.6862	0.9945	0.8309	1.2740	1.6235	1.1677	0.9095	1.0000	0.7429
	-3.37**	-2.56**	-1.93*	35.93**	20.81**	2.34**	-3.85**	4.01**	-6.17**
P_2/P_0	0.4172	1.0035	1.0927	1.1910	1.2560	1.1091	0.9125	1.0000	0.9083
	-6.8**	1.33	0.75	21.71**	7.75**	1.25	-2.97**	4.17**	-1.59
P_3/P_0	0.1914	1.0526	1.4102	1.1972	0.7090	0.9001	0.8822	1.0000	1.0440
	-13.84**	19.58**	2.99**	20.78**	-8.96**	-0.96	-3.4**	5.11**	0.62
P_0/P_1	1.4572	1.0056	1.2035	0.7849	0.6160	0.8564	1.0995	1.0000	1.3461
	3.37**	2.56**	1.93*	-35.93**	-20.81**	-2.34**	3.85**	-4.01**	6.17**
P_2/P_1	0.6079	1.0090	1.3151	0.9349	0.7737	0.9498	1.0033	1.0000	1.2227
	-3.7**	3.16**	2.18**	-8.02**	-8.54**	-0.6	0.1	0.61	3.13**
P_3/P_1	0.2790	1.0585	1.6971	0.9397	0.4367	0.7708	0.9700	1.0000	1.4053
	-9.85**	19.42**	4.22**	-6.85**	-20.76**	-2.3**	-0.78	2.37**	4.64**

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	14237
LR Chi Square (27)	3564.21
p > Chi Square	0.0000
Pseudo-R2	0.1028

Table 17. Multinomial logit for 4-category employment choice regressed on individual attributes only (continued)

Likelihood ratio and z value

Employment Choice Likelihood	*Sex*	*Age*	*Marital Status*	*Educ Years*	*HH Employed*	*Children Age<1*	*Children Age<7*	*Financial Asset*	*Land Asset*
P_0/P_2	2.3972	0.9966	0.9151	0.8396	0.7962	0.9017	1.0959	1.0000	1.1010
	6.8**	-1.33	-0.75	-21.71**	-7.75**	-1.25	2.97**	-4.17**	1.59
P_1/P_2	1.6450	0.9910	0.7604	1.0697	1.2925	1.0529	0.9967	1.0000	0.8179
	3.7**	-3.16**	-2.18**	8.02**	8.54**	0.6	-0.1	-0.61	-3.13**
P_3/P_2	0.4589	1.0490	1.2905	1.0052	0.5644	0.8116	0.9668	1.0000	1.1494
	-5.43**	14.76**	1.8*	0.52	-13.17**	-1.69*	-0.78	1.47	1.7*
P_0/P_3	5.2239	0.9500	0.7091	0.8353	1.4105	1.1110	1.1336	1.0000	0.9579
	13.84**	-19.58**	-2.99**	-20.78**	8.96**	0.96	3.4**	-5.11**	-0.62
P_1/P_3	3.5849	0.9447	0.5892	1.0641	2.2899	1.2973	1.0310	1.0000	0.7116
	9.85**	-19.42**	-4.22**	6.85**	20.76**	2.3**	0.78	-2.37**	-4.64**
P_2/P_3	2.1792	0.9533	0.7749	0.9948	1.7716	1.2322	1.0344	1.0000	0.8700
	5.43**	-14.76**	-1.8*	-0.52	13.17**	1.69*	0.78	-1.47	-1.7-*

0 = Agriculture, 1 = Wage, 2 = Self-Employed, 3 = Others

* = Significant at 10%, ** = significant at 5% or better

Number of Observations	14237
LR Chi Square (27)	3564.21
p > Chi Square	0.0000
Pseudo-R2	0.1028

Appendix

Multinomial logit model

The multinomial logit model is a discrete dependent variable model that uses the logistic distribution to predict the value of the regress. It is of the form:

$$P_{ij}\left(Y_i = j \setminus X_i\right) = \frac{e^{\beta' z_{ij}}}{\sum_{j=1}^{J} e^{\beta' z_{ij}}}, \tag{1}$$

where w_i is a vector of variables and β is a vector of coefficients. In general, when the 0th choice is used as a base category, the form is:

$$P_{ij}\left(Y_i = 0 \setminus X_i\right) = \frac{1}{1 + \sum_{k=1}^{J} e^{\beta_k' x_i}}. \tag{2}$$

The unordered multinomial logit model can be motivated by a random utility model. For the *i*th individual, with *J* choices, the utility of choice *j* is:

$$U_{ij} = \beta' z_{ij} + \varepsilon_{ij}. \tag{3}$$

The method of estimation is via the Newton-Raphson maximum likelihood estimation. It maximizes the following log-likelihood function:

$$L = \sum_i \sum_j Y_{ij} \ln P_{ij}. \tag{4}$$

The marginal effects are given by

$$\delta_i = \frac{\partial P_j}{\partial x_i} = P_j\left(\beta_j - \sum_{k=0}^{J} P_k \beta_k\right) = P_j\left(\beta_j - \bar{\beta}\right). \tag{5}$$

The marginal effects are very hard to interpret[2]. In most studies, reporting the log likelihood makes more sense. The log likelihood gives the probability of choosing option *j* over option *k*:

$$\ln\left[\frac{P_{ij}}{P_{ik}}\right] = x_i'\left(\beta_j - \beta_k\right). \tag{6}$$

If option k has a value of zero, called the base category, then the form is:

$$\ln\left[\frac{P_{ij}}{P_{i0}}\right] = \beta_j' x_i. \tag{7}$$

To measure goodness of fit, the *pseudo-*R^2 is used:

$$pseudo\text{-}R^2 = 1 - \frac{l}{l_r}, \tag{8}$$

where $0 < pseudo\text{-}R^2 < 1$, l is log-likelihood of model and l_r is log-likelihood where all parameters are zero except the constant. Although commonly used, it does not have the same interpretation as the linear regression R^2. It is only used for comparison purposes and it is not surprising and uncommon in the literature to get a very low *pseudo-*R^2.

Independence of irrelevant alternatives (IIA) is tested via Hausman's specification test given the following statistic:

$$\chi^2(k) = \left(\hat{\beta}_s - \hat{\beta}_f\right)\left[\hat{V}_s - \hat{V}_f\right]^{-1}\left(\hat{\beta}_s - \hat{\beta}_f\right), \tag{9}$$

where s – restricted subset

f – full subset

v – estimate of the asymptotic covariance matrix

The null hypothesis being IIA is satisfied.

[2] See Greene's Econometric Analysis, 3rd ed., for a discussion on marginal effects.

References

Arif, G. M., H. Nazli and R. Haq. [2000] "Rural non-agricultural employment and poverty in Pakistan," *The Pakistan Economic Review* **39**(4): 1089-1110.

Balisacan, A.M. [1991] "Agricultural growth, landlessness, off-farm employment, and rural poverty in the Philippines," Research and Training Program on Agricultural Policy Working Paper Series No. 91-01.

Balisacan, A.M. and E. M Pernia [2001] "Probing beneath cross-national averages: poverty, inequality and growth in the Philippines", in: E.M. Pernia, ed. *Growth, poverty and institutions*. Houndmills, Basingstoke, Hants: Palgrave MacMillan.

Balisacan, A. M. [2003] "Pathways of poverty reduction: rural development and transmission mechanisms in the Philippines", in: C.M. Edmonds, ed. *Reducing poverty in Asia: emerging issues in growth, targeting and measurement.* Cheltenham, UK: Edward Elgar Publishing Co.

Bautista, G. M. [1986] "The structure of employment opportunities in three Philippine villages", in: S. Hirashima and M. Muqtada, eds. *Hired labour and rural labour markets in Asia.* New Delhi: International Labor Organization Asian Employment Programme [ARTEP].

Boskin, M.J. [1974] "A conditional logit model of occupational choice," *Journal of Political Economy* **82**:389-398.

Cook, S. [1998] "Who gets what jobs in China's countryside? A multinomial logit analysis," *Oxford Development Studies* **26**(2): 171-190.

Cruz-Dona, R. and A. Martina [2000] "Some links between education, household well-being and credit market: evidence from rural Philippines," *Oxford Development Studies* **28**(3):289-308.

Evenson, R. E. [1996] "Ability, schooling and occupational choice in Philippine rural households" in: E. de Dios & R. Fabella, eds. *Choice, growth and development: emerging and enduring issues: essays in honor of Jose Encarnacion.* Quezon City: University of the Philippines Press.

Fuwa, N. [2003] "Pathways from poverty towards middle class: determinants of socio-economic class mobility in the rural Philippines", Paper presented at the conference 'Staying Poor: Chronic Poverty and Development Policy' at University of Manchester.

Greene, W. H. [2002] *Econometric analysis*. Third Edition. Upper Saddle River, N.J.: Prentice-Hall.

Hare, D.M. [1992] "Rural non-agricultural employment, earnings and income: evidence from farm households in Southern China", Ph.D. Thesis, Stanford University.

Hayami, Y and M. Kikuchi [1999] "Does modernization promote inequality? Three decades of changes in a Philippine village," *Economic Review* (Kezai Kenkyu) **50**(2): 107-19.

Hausman, J. and D. McFadden [1984] "A specification test for the multinomial logit model," *Econometrica* **52**: 1219-1240.

Hentshcel, J., J. Lanjouw, P. Lanjouw and J. Poggi [2000] "Combining census and survey data to trace the spatial dimensions of poverty: a case study of Ecuador," *The World Bank Economic Review* **14**(1): 147-165.

Lanjouw, J. and P. Lanjouw [2001] "The rural non-farm sector: issues and evidence from developing countries," *Agricultural Economics* **26**(1): 1-23.

Lanzona, L. A. [1998] "Migration, self-selection and earnings in Philippine rural communities," *Journal of Development Economics* **56**:27-50.

Lim-Applegate, H., G. Rodriguez and R. Olfert [2002] "Determinants of non-farm labor participation rates among farmers in Australia," *Australian Journal of Agricultural & Resource Economics* **46**(1): 85-98.

Myrdal, G. [1971] *Asian drama: an inquiry into the poverty of nations*. New York: Vintage Books.

Reyes, C. M. [2001] "Impact of agrarian reform on poverty", Philippine Institute of Development Studies.

Schmidt, P. and R. P. Strauss [1975] "The prediction of occupation using multiple logit models," *International Economic Review* **16**: 471-486.

Theil, H. [1969] "A multinomial extension of the linear logit model," *International Economic Review* **10**: 251-59.