

The Rural Non-Farm Economy, Livelihood Strategies and Household Welfare

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Abstract:

In this paper, we examine the relationship between rural nonfarm employment and household welfare using nationally representative data from Madagascar. In doing so, we focus our attention on labor outcomes in the context of household livelihood strategies that include farm and nonfarm income earning opportunities. We identify distinct household livelihood strategies that can be ordered in welfare terms, and estimate multinomial logit models to assess the extent to which there exist barriers to choosing dominant strategies. Individual employment choice models, as well as estimates of earnings functions, provide supporting evidence of these barriers.

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1. Introduction

The rural nonfarm sector is often seen an important pathway out of poverty (Lanjouw, 2001). Indeed, an empirical regularity emerging from studies of the nonfarm economy in developing countries is that there exists a positive relationship between nonfarm activity and welfare on average (Barrett, et al., 2001). In addition, nonfarm employment has the potential to reduce inequality, absorb a growing rural labor force, slow rural-urban migration, and contribute to growth of national income (Lanjouw and Feder, 2001).

The supply of labor to the nonfarm sector in rural areas, however, is perhaps best understood in the context of households' decision-making based on livelihood strategies (Reardon, 1997). After all, "diversification is the norm" (Barrett, et al., 2001), especially among agricultural households whose livelihoods are vulnerable to climatic uncertainties. For households facing substantial crop and price risks and consequently agricultural income risks, there is a strong incentive to diversify their income sources. In principle, such diversification could be accomplished through land and financial asset diversification. But, the absence of well-functioning land and capital markets in developing countries often means that these diversification strategies are not feasible. Consequently, many rural households find themselves pursuing second-best diversification strategies through the allocation of household labor (Bhaumik, et al., 2006). In this setting, household labor supply/allocation decisions are not simply made

on the basis of productivity calculations. Rather, they involve weighing both productivity and risk factors (Barrett, et al., 2008).

Given the multitude of constraints faced by households and the heterogeneity of nonfarm employment opportunities available to them, livelihood/diversification strategies vary widely (Barrett, et al., 2005). This heterogeneity can make generalizations problematic and has contributed to our general lack of knowledge about the rural nonfarm economy (Haggblade et al., 2007). Nonetheless, some broad characterizations are helpful.

One such characterization is based on the existence of both *push* and *pull* factors that influence the choices made by households regarding nonfarm employment. First, there is an incentive, or *push*, for households with weak non-labor asset endowments and who live in risky agricultural zones to allocate household labor to nonfarm activities. Although households frequently do turn to the nonfarm sector as an *ex ante* risk reduction strategy, distress diversification into low-return nonfarm activities is also observed as an *ex post* reaction to low farm income (Von Braun, 1989; Haggblade, 2007). In this way, there are benefits to low-return nonfarm activities which serve as a type of safety net which “helps to prevent poor [households] from falling into even greater destitution” (Lanjouw, 2001). Second, such factors as earnings premia from high productivity/high income activities may attract, or *pull*, some household labor into nonfarm employment (Dercon and Krishnan, 1996; Barrett et al., 2001; Lanjouw and Feder, 2001; Reardon et al., 2001; Haggblade, 2007). These high-return nonfarm jobs may serve as a genuine source of upward mobility (Lanjouw, 2001).

Another characterization is based on the type of livelihood strategies adopted. Identifying distinct livelihood strategies built on labor allocations can be informative, especially if certain strategies are found to offer higher returns than others. For example, the co-existence of high- and low-return strategies is an indication that there exist barriers to adopting the former. As Brown et al. (2006) explain,

“...a simple revealed preference argument suggests that, where different asset allocation strategies yield different income distributions that can be ordered in welfare terms..., any household observed to have adopted a lower return strategy must have faced a constraint that limited its choice set relative to those of its neighbors...”

Indeed, the positive correlation commonly found between household income and nonfarm participation is consistent with access to these high-return strategies being limited to a subpopulation of well-endowed households.¹ After all, it is those who begin poor who typically face difficulties raising the funds required for investment and overcoming other entry barriers to participating in the type of nonfarm activities that may raise their standards of living. (Dercon and Krishnan, 1996; Barrett et al., 2005; Bhaumik et al., 2006).

In this paper, we examine the relationship between rural nonfarm employment and household welfare using nationally representative data from Madagascar. In doing so, we focus attention on labor outcomes in the context of household livelihood strategies that include farm and nonfarm income earning opportunities. We identify distinct

¹ The effect of nonfarm participation is thus ambiguous. On the one hand, entry barriers that limit the accessibility of those with limited asset endowments to high-return nonfarm activities tend to result in more inequality. On the other hand, the “safety-net” role of the nonfarm sector tends to buoy these same households and consequently have an equalizing effect (Lanjouw, 2001; Haggblade et al., 2007).

household livelihood strategies that can be ordered in welfare terms, and estimate multinomial logit models to assess the extent to which there exist barriers to choosing dominant strategies. Individual employment choice models, as well as estimates of earnings functions, provide supporting evidence of these barriers.

A weakness in the extensive and growing literature on household income diversification strategies is that the empirical analyses have generally been confined to limited geographical areas (Dercon and Krishnan, 1996; Ellis, 1998; Barrett et al., 2001; Little et al., 2001; Brück, 2004; Bhaumik et al., 2006; Barrett et al., 2005; Brown et al. 2006). This paper aims to fill this gap and to complement the extent literature by employing nationally representative household survey data in order to generalize the results more broadly.

The remainder of the paper proceeds as follows. In the next section, we provide a brief description of the main data source and important definitions. This is followed in Section 3 by an overview of individual labor market outcomes in Madagascar. This serves as a lead in to the identification of household livelihood strategies. In section 4, we estimate the determinants of the distinct livelihood strategies identified in the previous section to test for the existence of barriers that may prevent certain households from adopting high return strategies associated with nonfarm employment. Given that household strategy choices are limited by the characteristics of their members, we estimate the determinants of individual employment choice in Section 5. The determinants of individual earnings are also estimated in this section. We wrap up with concluding remarks in Section 6.

2. Data and Definitions

This section provides a brief description of the main data source and clarifies the definitions of employment, rural and nonfarm used in this paper.

Data

Our main source of information in this analysis is the 2005 Madagascar *Enquête Prioritaire Auprès des Ménages* (EPM), a nationally representative integrated household survey of 11,781 households, 5,922 of which live in rural areas. The data were collected by the Institut National de la Statistique (INSTAT) between the months of September and December, 2005. The sample was selected through a multi-stage sampling technique in which the strata were defined by the region and *milieu* (rural, secondary urban centers, and primary urban centers), and the primary sampling units (PSU) were *fokontany*.² Each of the *fokontany* was selected systematically with probability proportional to size (PPS), and sampling weights defined by the inverse probability of selection to obtain accurate population estimates.

The multi-purpose questionnaires include sections on education, health, housing, agriculture, household expenditure, assets, non-farm enterprises and employment. Employment and earnings information are available in the employment, non-farm enterprise and agriculture sections. For a measure of household well-being, in this analysis we use the estimated household-level consumption aggregate constructed by the Institut National de la Statistique (INSTAT).

² There are 17,433 *fokontany* in Madagascar.

Definitions: Employment, Rural, and Farm vs. Nonfarm

Although workforce participation is high in Madagascar, formal labor markets are thin in rural areas. Fewer than 6 percent of those involved in income generating activities are compensated in the form of wages or salaries (Stifel, et al., 2007). Given the agricultural orientation of the economy along with the importance of family-level production units, most rural workers in this country are “self-employed.” As such, for this analysis we adopt a broad definition of labor markets that includes self-employment. If a labor market is a place where labor services are bought and sold, then self-employed individuals are envisioned as simultaneously buying and selling their own labor services.

There are two concepts related to the term “rural nonfarm” that need clarification. First, when we refer to “rural” income (or employment), we mean income earned by rural households. This definition allows for income to be earned anywhere, including urban areas (Barrett et al., 2001).³

Second, we follow Reardon et al. (2001) and Haggblade et al. (2007) in defining “nonfarm” activities as any activities outside agriculture (own-farming and wage employment in agriculture). This definition requires further clarification of what is meant by agriculture. As described by Reardon et al. (2001),

...agriculture produces raw agrifood products with one of the production factors being natural resources (land, rivers/lakes/ocean, air); the process can involve “growing” (cropping, aquaculture, livestock husbandry, woodlot production) or “gathering” (hunting, fishing, forestry).

³ The data do not provide enough information to distinguish if employment is in urban areas, but questions are asked regarding distance to the place of work. In 2005, for example, only 18 percent of wage workers employed in industrial and service jobs traveled more than 5 kilometers to their places of work.

Thus, in addition to cropping, agriculture includes livestock husbandry, fishing and forestry. Nonfarm production, therefore, includes industry (e.g. mining, wood products, energy, food and beverages, textiles and leather and construction materials) and services (e.g. commerce, handicrafts, hotels and restaurants, transportation, public works and private health). Note that although agroprocessing is closely linked to agriculture (e.g. by transforming raw agricultural products) it is classified as nonfarm (Haggblade, et al., 2007).

Finally, wage earnings are measured in the survey by asking wage-employed individuals how much they earned in terms of cash and in-kind payments. Nonwage (family) farm earnings are measured by estimating household agricultural earnings as a residual (total household consumption less all non-agricultural earnings and transfers). Household agricultural earnings are then divided through by the number of household members working on the family farm and deflated regionally to approximate individual non-wage agricultural earnings. We caution that an implicit assumption underlying the use of this approximation of agricultural earnings is that household net savings are zero.⁴

3. Characteristics of Rural Labor Markets & Household Livelihood Strategies

In this section, we begin by briefly examining the characteristics of rural labor markets in Madagascar from the perspective of individuals. This sets the scene to analyze these individual outcomes within the context of household livelihood strategies.

⁴ Another approach, to value agricultural production, was also taken but the unit prices used to value unsold production proved to be problematic.

3.1 Individual Outcomes

Rural labor markets in Madagascar are characterized predominantly by agricultural activities. Some 93 percent of economically active adults (age 15-64) are employed in agriculture in some form or another whether it is their primary or secondary jobs. Among primary jobs, 89 percent are agricultural (see Table 1), nearly all of which involved non-wage work on the family farm. Only 4 percent are wage positions.⁵ Further, 71 percent of second jobs (held by 32 percent of all employed adults) are in agriculture. Unlike primary jobs, however, secondary jobs in agriculture are more likely to be wage positions (64 percent).

[Place Table 1 here]

Nearly 20 percent of active adults are employed in some form of nonfarm activities. Only 11 percent of first jobs are in the nonfarm sector, whereas 29 percent of second jobs are non-agricultural (Table 1). This finding is consistent with the notion that individuals are drawn to nonfarm employment for their second jobs during periods of slack demand for agricultural labor. Unfortunately, this cannot be verified with the data at hand.

As is commonly found in other African countries (Barrett, et al., 2001), a positive relationship exists between rural nonfarm employment and welfare as measured by per capita household expenditure.⁶ The percentage of workers with nonfarm employment

⁵ Employment in the questionnaire is defined as activities for which the individual received remuneration. This may explain the low percentage of agricultural wage labor as reciprocal agricultural labor is not included. In the comprehensive agricultural module of the 2001 EPM survey, we find that reciprocal labor was used on 44 percent of the plots.

⁶ Household expenditures are more accurately defined as consumption as they include not only expenditure items but also own-consumption of household agricultural and non-agricultural production as well as the

rises by expenditure quintile, with 11 percent in the poorest quintile and 31 percent in the richest quintile employed in this sector, respectively. Among primary employment activities, only 5 percent were nonfarm for those in the poorest quintile, while nearly a quarter were so for those in the richest quintile (Table 1).

As noted earlier, there may exist substantial barriers to entry to high-return nonfarm activities (Barrett, et al., 2001). One such barrier may be lack of skills and education among the poor. As illustrated in Table 1, there is a strikingly strong positive relationship between educational attainment and nonfarm activities among first jobs. For example, only 6 percent of those with no education are employed in the nonfarm sector, compared to 44 percent of those with upper secondary and 73 percent with post secondary education, respectively. The biggest differences are for wage activities where 2 percent of those with no education had nonfarm wage employment compared to 34 percent and 62 percent among those with upper secondary and post secondary education, respectively. The education-nonfarm employment gradient is not as steep for secondary employment which is likely related to the evidence that most nonfarm employment among second jobs is in the form of non-wage activities (85 percent), not wage activities.

The general attraction of nonfarm wage employment suggested in Table 1 is further illustrated by the relatively high earnings in this sector (Table 2). With a median of Ar 78,000 per month (approximately US\$37)⁷, earnings for nonfarm wage workers are more than double those not only in the farm sector (Ar 31,000 for non-wage, and Ar 38,000 for wage), but also those in the nonfarm non-wage sector (Ar 37,000). Interestingly, based on earnings alone, nonfarm non-wage employment is not

imputed stream of benefits from durable goods and housing. The consumption aggregate for the EPM 2005 was constructed by INSTAT (2006).

⁷ At the time of the 2005 survey, the exchange rate was approximately Ar 2,100 per US dollar.

unambiguously preferred to farm activities since there is no clear pattern of which sector has higher earnings. As is characteristic of nonfarm sectors throughout the developing world, and as will become clearer in this paper, nonfarm employment activities in Madagascar are highly heterogeneous (Haggblade et al., 2007).

[Place Table 2 here]

The evidence in Table 2 suggests that, in general, individuals may be pressed into nonfarm non-wage employment as part of household income diversification strategies designed to reduce risk. Since it is not clear that earnings alone are enough to attract individuals to this sector, *push* factors such as land constraints, risky farming and weak or incomplete financial systems may instead be the forces compelling households to diversify their income sources by allocating household labor to nonfarm non-wage employment. Conversely, *pull* factors such as higher earnings appear to be attracting labor to the nonfarm wage.

Push factors may also motivate individuals to take on second jobs, particularly those in farming and in nonfarm non-wage activities where median earnings are roughly two-thirds those of first jobs. Although earnings for second jobs in the nonfarm wage sector are approximately half of those for first jobs (Ar 39,000 compared to Ar 78,000), they remain attractive relative to all other earnings whether they are for first or second jobs.

Monthly farm wage earnings for first jobs are surprisingly high compared to family farm earnings (median of Ar 38,000 compared to Ar 31,000). There are two reasons why this might be so. First, it may be a result of measurement issues due to small sample size (only 4 percent of economically active adults) or to differences in the

definitions of wage and non-wage earnings. Second, the seasonal nature of agricultural wage employment may be a factor. Indeed, median monthly earnings for seasonally wage employed individuals in agriculture are higher than for those with permanent employment (Ar 42,000 compared to Ar 31,000), and among wage employed individuals with permanent jobs, median earnings are similar to those of family farm workers.

3.2 Household Outcomes

As noted previously, in the presence of weak land and financial markets, household nonfarm labor supply decisions are made by weighing both productivity and risk factors in the context of household livelihood strategies. Nonetheless, not all activities are available to all households. Diversification strategies may be affected by the constraints that exist for many activities. As Dercon and Krishnan (1996) note, “the ability to take up particular activities will distinguish the better off household from the household that is merely getting by.” Thus in this section, we explore household patterns of labor diversification and identify strategies that can be ordered in welfare terms.

Given that households typically have more than one economically active member, we find that household income sources are more diversified than individual income sources (Table 3). While the percentage of households with at least one member employed in agricultural is the same as the percentage of individuals working in agriculture (93 percent), households are more likely than individuals to also derive labor income from nonfarm sources. For example, whereas 20 percent of economically active individuals in rural areas have some sort of nonfarm employment, 31 percent of households have at least one member employed in nonfarm activities.

[Place Table 3 here]

This pattern is consistently seen across the household expenditure distribution. While only 11 percent of individuals in the poorest quintile are employed in nonfarm activities, 22 percent of households have nonfarm income. Similarly, 31 percent of economically active individuals in the richest quintile have nonfarm jobs compared to 41 percent of households.

The rural nonfarm economy is also a relatively important source of household income (Table 4). Non-farm income accounts for 22 percent of household income on average. This is greater than the percentage of individuals who are employed in this sector (20 percent). Conversely, although 93 percent of economically active adults spend at least some time working in agriculture, only 78 percent of household income derives from farm activities.

[Place Table 4 here]

As with employment, there is a strong positive relationship between nonfarm income shares and welfare. For those in the poorest quintile, 15 percent of income derives from nonfarm earnings, whereas nonfarm earnings account for more than twice this much (32 percent) among households in the richest quintile. A consequence of this may be that with nonfarm incomes accruing largely to the non-poor, the nonfarm economy may contribute to a widening of the income distribution and higher inequality (Lanjouw and Feder, 2001).

Livelihood Strategies

Is there a way that we can broadly define households in rural Madagascar in a manner that distinguishes them by their livelihood strategies and that provides insights into choices available to them? If so, what types of distinct livelihood strategies do households adopt and can they be ordered in welfare terms? Identifying livelihood strategies in an informative manner is not so straightforward since a precise operational definition of livelihood remains elusive. Consequently methods of identifying livelihoods have been varied (Brown et al., 2006).⁸ The approach adopted here is a simple one, but one that effectively delineates households into categories that facilitate welfare orderings.

To determine these strategies, we begin by categorizing households according to permutations of choices among farm-nonfarm and wage-non-wage activities. As illustrated in Table 5, there are three broad categories – farm activities only, nonfarm activities only, and combinations of farm and nonfarm activities. The distribution of the rural population among these strategies is as follows: 67 percent live in households that allocate all of their labor to agricultural activities, 27 percent have some members who work in agriculture and some work off farm⁹, while only 5 percent rely solely on nonfarm activities for their labor earnings.¹⁰

[Place Table 5 here]

Although there is some overlap within these three categories, there is also a clear overall welfare ordering. Poverty rates are highest among households that rely

⁸ A common method is to group households by income shares (e.g. Dercon and Krishnan, 1996, and Barrett et al., 2005). Brown et al. (2006) use cluster analysis to identify livelihood strategies in the rural Kenyan highlands. While the cluster analysis approach is intuitively appealing, a similar exercise carried out with the EPM data resulted in strategies for which no stochastic dominance orderings could be established.

⁹ This is consistent with Haggblade's (2007) observation that "most rural nonfarm activities are undertaken by diversified households that operate farm and nonfarm enterprises simultaneously."

¹⁰ We ignore those households whose sole source of income is non-labor income since these are made up mostly of the elderly and do not actively participate in the labor market.

exclusively on farming (78 percent), and lowest among those that rely solely on nonfarm activities (39 percent). Although the poverty rate for households that adopt both farm and nonfarm activities is lower than the rural poverty rate, it is still high at 70 percent.

What is most striking is that despite seemingly high agricultural wage earnings (Table 2), households with members involved in agricultural wage activities tend to be the among poorest. For example, households that combine family farming with agricultural wage farming have the highest poverty rates (85 percent) and are concentrated at the lower end of the income distribution (e.g. 22 percent of the poorest expenditure quintile compared to 9 percent in the richest quintile). Further, for the one percent living in households relying solely on agricultural wage labor, 83 percent are poor. Indeed these households are poorer than any other group as measured by the depth of poverty.¹¹ This suggests that households may be resorting to agricultural wage activities as an *ex post* reaction to low farm income or because of various *ex ante* push factors. As such, a distinct livelihood strategy in which households resort to agricultural wage activities (“any agricultural wage” or AW) is defined for this analysis. This category of households includes those with family farm and/or nonfarm activities, as long as at least one member of the household worked for a wage in agriculture. Nearly a quarter of the rural population lives in a household in this category, 83 percent of whom are poor.

The other three distinct strategies follow naturally from Table 6 and are illustrated along with AW in Table 6. The first of these identifies households that rely solely on family farming (FF). These households account for 47 percent of the rural population, 75 percent of whom are poor. The next includes the 22 percent of the rural population that

¹¹ This is the P_1 measure in the Foster, Greer and Thorbecke (1984) class of poverty measures.

live in households with members involved in both family farm and nonfarm activities (FFNF). As illustrated in Table 5, the nonfarm activities undertaken by such households are primarily nonwage family enterprises (72 percent). The poverty rate for this group is even lower at 69 percent. Finally, 5 percent of the rural population, 39 percent of whom are poor, live in households that earn incomes solely from nonfarm activities (NF). Unlike for FFNF households, those living in NF households are predominantly employed in wage positions (73%).

[Place Table 6 here]

In addition to differing poverty levels, the returns offered by these strategies differ across nearly the entire distribution of income. This suggests a clear welfare ordering in that some strategies are superior to others in terms of income levels. Appealing to dominance analysis as a way of testing for the existence of such superior strategies (Brown, et al., 2006), we plot the cumulative frequencies of per capita household consumption for each of the four household types in Figure 1. The idea is that dominance tests permit us to make ordinal judgments about livelihood strategies based on the entire distribution of household wellbeing, not just particular points (e.g. the poverty line). Specifically, pairs of livelihood-specific distributions are compared over a range of consumption values. One distribution is said to first-order dominate the other if and only if the cumulative frequency is lower than the other for every possible consumption level in the range (Ravallion, 1994). The implication of this lower distribution is that there is a greater likelihood that households adopting this strategy will have higher consumption levels.

[Place Figure 1 here]

Figure 1 illustrates that at very low levels of consumption, there is no clear ordering of strategies.¹² However, for the 91 percent of households with per capita consumption levels of Ar 120,000 and above, NF first-order dominates all of the other three strategies.¹³ In other words, NF is a superior strategy based on this criterion. Similarly, the FFNF strategy dominates FF up to a value of Ar 375,000. Further, since FF dominates AW for all consumption values above Ar 150,000 (these two distributions are indistinguishable for values below this), AW is inferior to all of the other strategies. Thus, strategies that include some nonfarm employment are superior to those that rely solely on farming or some form of farm wage employment.

4. Analysis of Rural Household Livelihood Strategies

“The positive wealth-nonfarm correlation may also suggest that those who begin poor in land and capital face an uphill battle to overcome entry barriers and steep investment requirements to participation in nonfarm activities capable of lifting them from poverty.” (Barrett, Reardon & Webb, 2001)

The evidence from Section 3 indicates that there exist superior household livelihood strategies associated with nonfarm employment activities. This naturally leads to the questions as to why so few rural households choose the dominant strategies (5

¹² This follows partly because there are so few households at the lower tails. Note further that because the distributions cross multiple times at the lower tails, tests of second and third order dominance also prove inconclusive in terms of ordering the distributions. These tests place more weight on differences at the lower end of the distribution than the test of first order dominance does.

¹³ We also statistically test the vertical difference between the NF distribution and each of the other distributions (Davidson and Duclos, 2000, and Sahn and Stifel, 2002). For 100 test points between Ar 120,000 to Ar 400,000, the null hypothesis that the difference in the cumulative frequencies is zero was rejected. We thus conclude that the frequency distributions are different over this range.

percent for NF and 22 percent for FFNF). The underlying question is if there exist barriers preventing households from adopting these strategies.

To address this, we analyze rural household livelihood strategy choice using multinomial logit models. The choices, ordered from inferior to superior, are those described in the previous section: (a) any agricultural wage (AW), (b) family farming only (FF), (c) family farm and nonfarm activities (FFNF), and (d) nonfarm activities only (NF). The estimated effects in these models should not be interpreted literally as *determinants* of choices for two reasons. First, unobserved household characteristics such as motivation and entrepreneurship may be correlated with both the observed characteristics (e.g. access to credit, ownership of durable goods, etc.) and the chosen livelihood strategy. In such cases, the endogeneity bias of the parameter estimates cannot be ruled out. Second, since all of the choices may not necessarily be available to each household, the parameters should be interpreted as reduced form estimates of how household and community characteristics affect the probabilities that households are *able* to choose one of the four livelihood strategies. The household and community covariates used in the estimates are summarized in Table 7.

[Place Table 7 here]

The estimated marginal effects that appear in Table 8 are interpreted as the average change in the probability of a household selecting a particular livelihood strategy corresponding to a one unit change in the independent variables. Because the average marginal effects are shown instead of the estimated coefficients, all four livelihood

strategies (including the left-out category) can be shown. The marginal effects sum to zero across the categories.¹⁴

[Place Table 8 here]

Three potential barriers to participation in high return nonfarm activities by households are highlighted in the model estimates. First, household with higher levels of educational attainment tend to be those who choose the dominant NF and FFNF strategies. The measure of household education used here is the education level of the most educated member of the household based.¹⁵ Households in which the most educated member attained a lower (upper) secondary level of education are 14 percent (20 percent) more likely to adopt a FFNF strategy than those with no education at all. Households with less education are most likely to adopt the least remunerative AW and FF strategies. Given the positive relationship between household welfare and education in Madagascar (Amendola and Vecchi, 2007), poor households with low levels of education generally face greater barriers than the nonpoor in their choices of high-return livelihood strategies.

Second, households without access to formal credit¹⁶ tend to adopt inferior AW strategies, and are less likely to combine family farming with nonfarm activities. For those households adopting AW strategies, credit market failures may be a barrier to

¹⁴ The left-out category in the estimation is FF. Note that the sample does not include those households without any labor income.

¹⁵ In doing so, we assume that there are household public good characteristics to education. Basu and Foster (1998) suggest that literacy may have public good characteristics in the household and formalize an “effective” literacy rate based on this public good aspect of education (See also Valenti (2001) and Basu et al (2002)). Sarr (2004) finds evidence from Senegal that illiterate members of households benefit from literate household members in terms of their earnings. Almeyda-Duran (2005) also finds that in some situations there are child health benefits to village level proximity to literate females.

¹⁶ Households are categorized as such when they have sought loans from formal institutions (banks or microfinance institutions) and were turned down, or if they report not applying for loans because (a) procedures are too complicated, (b) interest rates are too high, (c) they do not know the procedures, (d) they do not have collateral, or (e) they do not know of a lending institution.

adopting any of the higher return livelihood strategies. For the FFNF, some households may indeed engage in nonfarm activities because they have access to credit as the model estimates suggest. But given the measure of credit access used in this model, the result is also consistent with the notion that farm households may engage in nonfarm activities as a means of generating cash to substitute for the absence or high cost of credit. The idea is that they do this in order to purchase agricultural inputs or to make farm investments (Ellis, 1998). In the measure of access used here, households that are not classified as “having difficulty accessing formal credit” in the EPM data include those who report not seeking credit because they either (a) did not need it (9%) or (b) did not want to have any debt (33%). Indeed, the source of start-up financing for household nonfarm enterprises is predominantly household saving (78 percent). It may be households such as these who rely on nonfarm activities to accumulate cash savings as a substitute for the absence of credit markets.¹⁷

In an effort to address the potential endogeneity of the household-specific credit access measure and to measure an independent effect of credit availability, a community-level variable is included in the model to indicate the presence of a microfinance institution (MFI).¹⁸ As expected, the presence of a MFI is associated with lower probabilities of households adopting AW strategies. However, it is also associated with a 1 percent decrease in the probability of adopting the preferred NF strategy. Indeed, households living in communities with MFIs present are 6 percent more likely to adopt FF strategies. This result is consistent with nonfarm activities substituting for the

¹⁷ Although their livelihood strategies differ slightly from those identified here, Brown et al. (2006) similarly found that liquidity constraints appear to hamper the ability of households in the rural Kenyan highlands to diversify into high return activities.

¹⁸ The presence of a formal sector bank has no effect.

absence of credit markets. However, it may also be due to the targeting of poorer communities on the part of MFIs (Zeller et al., 2003). Such targeting can lead to biased estimates of the effect of MFI availability on livelihood choice (Pitt et al., 1993).

Third, households with access to forms of outside communication have a greater likelihood of choosing the dominant livelihood strategies. For example, households owning a radio are 6 percent more likely to have members undertaking a preferred strategy of participating in both family farming and nonfarm activities. Similarly, those that live in villages in which at least one household has a phone, are 11 percent more likely to have members involved in nonfarm activities. Admittedly, owning a radio could be a consequence of higher earnings associated with the dominant strategy.¹⁹ As such, we proceed with caution with regard to radio access, and emphasize the effect of village access to telecommunications as measured by at least one household owning a phone.²⁰ This form of communication represents access to information on price and market conditions outside of the community. Households living in communities without such access are more likely to allocate labor to farming activities that are geared toward home consumption and the local market – i.e. those activities that are likely to have lower remunerative rewards.²¹

Turning to other correlates of household livelihood strategy choice, it is interesting to note that, although households living in rural communities with electrification are slightly more likely to adopt the dominant NF strategies (1 percent),

¹⁹ Radio ownership has been used as a proxy for household welfare either as an asset (Stifel and Sahn, 2000) or as a predictor of household consumption (Stifel and Christiaensen, 2007).

²⁰ The model was also estimated using various measures of community radio access in an effort to address the endogeneity issue. One variant included a dummy variable for villages with at least one radio. Since over 98 percent of villages fall into this category, little effect was found. Similarly, no effect was found when using a variable indicating the share of households in the community with radios.

²¹ This is consistent with Randrianarisoa et al's (2009) finding using 2001 data, that demand for hired nonfarm labor in rural Madagascar is stimulated by similar access to information.

they are even more likely to concentrate solely on family farming (6 percent). Households living in such communities are *less* likely to adopt the second best strategy of mixed family farming and nonfarm activities (6 percent). Despite the mixed results, one lesson emerging from the data is that although households adopting NF strategies tend to be situated in communities with electricity access (e.g. 54 percent of NF households have electricity compared to 9 percent for all other households; see Table 7), such access is not a sufficient condition for participation in nonfarm employment activities. This may be due to endogenous placement of electrification and/or the bundling of electrification with other infrastructure variables.

Remoteness may affect the choice set of livelihood strategies available to households by affecting transaction costs and by determining the degree of access to markets and to market information. This is consistent with the multinomial logit model estimates where travel time to the nearest city serves as a proxy for remoteness and transaction costs. With increased travel times, households are less likely to rely on family farming alone and more likely to combine family farming activities with nonfarm activities. For example, households that live 15-24 hours away from a major city are 10 percent less likely to adopt FF strategies and 5 percent more likely to adopt FFNF strategies. This is consistent with the notion that agricultural surplus can more easily be marketed to urban areas in less remote areas, while competition in the nonfarm sector is greater in the vicinity of urban areas (Lanjouw and Feder, 2001). Finally, households living more than 15 hours away from the nearest city are 1 to 2 percent less likely to undertake wage-dominated NF strategies.

Access to land has differential effects on household strategy choice. As such, these estimates neither confirm nor refute the claim that those poor in land holdings face entry barriers. For example, while households with more land are less likely to adopt AW strategies, they are more likely to concentrate their household labor solely in family farming. This is not surprising since land is an important agricultural input for farming households.²²

Not only are landless households 7 percent more likely to adopt inferior AW strategies than smallholder households (less than 1 hectare), they are also 33 percent more likely than any landed households to adopt superior NF strategies. Whether inferior AW strategies or superior NF strategies are chosen by landless households likely depends on other characteristics of households that enable them to overcome extant barriers to participation in nonfarm activities.²³

The relationship between land holdings and the choice of the mixed FFNF strategy are nonlinear. Households that are more likely to adopt this strategy are either those with small land holdings (less than 3 hectares) or large land holdings (10 or more hectares). Those with medium-sized land holdings (3-5 hectares) are 5 to 6 percent less likely to combine family farming with nonfarm employment. This may follow from household labor constraints on the farm, with more land requiring more household labor input. Although large holders also are affected by these constraints, they are also more likely to be wealthier and more capable of hiring labor. Such households are in a better

²² Similarly, households with more non-land agricultural assets are also less likely to concentrate all of their labor efforts on nonfarm activities.

²³ These estimates may also suffer from endogeneity bias as lack of land ownership may be correlated with unobserved household characteristics that are themselves correlated with advantages available to those working in nonfarm wage employment.

position to invest in the human capital of their family members and to diversify into nonfarm activities.

5. Analysis of Rural Employment and Labor Earnings

The ability of households to diversify their income sources depends in large part on the characteristics of their economically active members. As such we now use regression analysis to address rural employment patterns and earnings. This permits us to tackle the question of how barriers to participation in nonfarm activities are associated with individual as well as household characteristics. We also assess the characteristics associated with earnings once employment choices are made by estimating earnings functions. In this context, we are able to further disaggregate the nonfarm sector further into non-wage and wage activities (Malchow-Møller and Svarer, 2005).

5.1. Rural Employment

We start with multinomial logit choice models similar to those in the previous section. In this case, however, instead of households, the sample is made up of all 13,339 economically active individuals living in rural areas. Their employment is characterized as (a) agricultural wage, (b) family farming, (c) nonfarm non-wage, or (d) nonfarm wage. Although there is considerable overlap in the distribution of earnings among these four employment types, they are roughly ordered in welfare terms (lowest annual earnings to highest on average). Separate models are estimated for primary and secondary employment, though only the former are presented here (Table 9).²⁴

[Place Table 9 here]

²⁴ The secondary employment estimates are available upon request from the author.

As with the household livelihood choice models, education is associated with higher probabilities of nonfarm employment. Individuals with a lower (upper) secondary education is 7 percent (19 percent) more likely to work in nonfarm wage activities than an individual with no education. Such individuals are particularly less likely to work on the family farm for their primary employment. In the context of household livelihood strategies, this suggests that in households adopting mixed family farming-nonfarm (FFNF) strategies, members with less education are more likely to remain on the farm, while those with more education perform higher-paying nonfarm wage activities. Interestingly, members with higher levels of education are also more likely to help out on the family farm for their second jobs – perhaps contributing their labor services during peak agricultural demand periods (e.g. field preparation, planting, transplanting, and harvest).

Although statistically significant, the relationship between credit and individual employment is small. Those living in households without access to credit are 1 percent more likely to be involved in agricultural wage employment, and 2 percent less likely to work on the family farm (nonfarm non-wage). These small individual effects nonetheless do add up for the household unit as a whole given that this is a household-level constraint. The finding that individuals in credit constrained households are those who are more likely to resort to agricultural wage labor (associated with low return household livelihood strategies) is consistent with the household choice models in Section 4 and with previous research on the importance of credit to household livelihood choice and welfare (Dercon and Krishnan, 1996; Ellis 1998; Brown et al., 2006).

Access to communication devices (radio and phone) has similar relationships with individual employment as with household livelihood strategies. Those with such access are more likely to engage in higher return nonfarm activities, and are less likely to work on the family farm as their primary forms of employment.

The individual choice models shed additional light on the relationship between rural electrification on employment opportunities. Electricity access in the community is associated with more nonfarm wage employment, but not with nonfarm nonwage activities. This is consistent with the household livelihood models in which a positive relationship was found between electricity access and nonfarm-only livelihood strategies (NF) where the bulk of nonfarm jobs undertaken by these households are wage activities (73 percent). It is also consistent with the negative relationship found between combined family farming-nonfarm strategies (FFNF) and electricity access given that the nonfarm activities for these households are predominantly nonwage (72 percent).

For the 90 percent of the rural population living in villages without electricity, high-return nonfarm employment opportunities are more limited. 36 percent of those with higher paying nonfarm wage jobs live in communities with electricity access, compared to less than 10 percent of those with lower-return nonfarm wage employment. Nonetheless, because electrification in communities is most certainly not randomly placed, it is difficult to establish the causal relationship. For example, while access to electricity may create more nonfarm employment opportunities, dynamic communities with more nonfarm employment may be better positioned to establish electricity connections in the first place.

Interestingly, although we find no clear pattern with regard to remoteness (travel time to city) and first jobs, there appears to be a more systematic relationship with second jobs. In the most remote areas, secondary employment tends to be concentrated in nonfarm non-wage activities that are more likely to be geared toward providing services in the local market. These nonfarm activities may fill a void created by the high transaction costs associated with remoteness and the consequential restricted access to major markets. Further, this pattern of diversification may also be driven by the seasonal nature of agricultural calendar as individuals seek out employment opportunities during the slack periods of demand for agricultural labor (Ellis, 1998).

Because households in the lesser remote areas (2-5 hours) are more likely to specialize in family farming, individuals in these areas are 10 percent more likely to only have one job (i.e. on the family farm) than those who live 5-10 hours away from major cities. This may follow from higher returns to agriculture in less remote areas (Stifel and Minten, 2008) inducing households to concentrate their household labor in family farming.

Except for those individuals who live in households with large land holdings (10 hectares or more), there is a positive association between land holdings and family farming. For example, those with between 1 and 10 hectares of land are 4 to 5 percent more likely to work on the family farm than are small holders (under 1 hectare), while those who are landless are 45 percent less likely to do so. With landless individuals 18 percent and 15 percent more likely to work off farm in nonwage and wage activities, respectively, nonfarm employment for these individuals appears to be a result of “push” factors. However, landless individuals are 25 percent *more* likely to only have one job

compared to small holders. This suggests that the relative returns to employment for the landless (e.g. nonfarm activities) are higher than for small holders who are most likely to be family farmers. These individuals may in fact be landless because of their abilities to find high return employment.

Regarding other individual correlates, we find that women are significantly more likely to be employed as non-wage workers in the nonfarm sector (3 percent more than for men), but are less likely to undertake nonfarm wage work.²⁵ As individuals get older, they are less likely to work on the family farm and are more likely to undertake non-wage employment off the farm. While household heads and their spouses are less likely to work as agricultural wage laborers, household heads are more likely to find nonfarm wage work, while their spouses are more likely to remain on the family farm. Those who migrated to their current location within the past five years are more likely to be involved in nonfarm activities and less likely to work on a family farm.

5.2. Rural Labor Earnings

We now turn to econometric estimates of earnings and, by extension, the correlates of employment quality once an individual has ‘chosen’ a sector. In particular, earnings functions are estimated separately for those who are employed in (a) agricultural wage, (b) family farming, (c) nonfarm non-wage, or (d) nonfarm wage activities (Table 10). The dependent variable in each of these models is the log of real daily earnings.²⁶

The explanatory variables are typical of those found in standard Mincerian earnings

²⁵ Lanjouw (2001) had a similar finding based on probit models for El Salvador where women were more likely than men to be employed in low-productivity nonfarm activities. He did not find a significant difference, however, for high productivity jobs.

²⁶ Since we use the log of earnings, the estimated coefficients represent a percentage change in earnings for a one unit change in the independent variable.

functions and include experience²⁷, levels of education, hours worked, a dummy variable that takes on a value of one if the individual is female, and controls for location (not shown). We also control for selection bias by using a correction method proposed by Bourguignon, Fournier and Gurgand (2002). This correction method is an extension of Lee's (1983) method in which the selectivity is modeled as a multinomial logit, rather than as a probit (Heckman, 1979). The multinomial logit selection models are based on those that appear in the previous section.

[Place Table 10 here]

We find positive and significant estimates of schooling that are substantial, but that are varied across employment types. We caution that these returns are likely to be overestimated because the correlation between education and earnings do not necessarily represent causation. For example, because adolescents residing in households with more education are more likely to attend school (Stifel et al., 2007), schooling is not distributed randomly among the individuals in the sample, and the parameter estimates are likely biased.²⁸ Thus we proceed with caution.

Returns to schooling are largest among those in the nonfarm sector in general, and among wage employed in particular. They are significant for secondary education in family farming, though not so for primary education. For agricultural wage workers, the

²⁷ Experience is difficult to measure because we do not know when individuals began working. Here we use the difference between individual's age and the number of years of schooling plus 5 years. It is important to account for experience because experience and educational attainment are negatively correlated. Since experience is likely to contribute positively to earnings (up to some point), the error terms in the estimated models are likely to be negatively correlated with educational attainment if experience is not included as an explanatory variable. The result is likely to be a downward bias in the estimates of returns to schooling.

²⁸ As Behrman (1999) notes, "individuals with higher investments in schooling are likely to be individuals with more ability and more motivation who come from family and community backgrounds that provide more reinforcement for such investments and who have lower marginal private costs for such investments and lower discount rates for the returns to those investments and who are likely to have access to higher quality schools."

positive returns to education are only significant for those with primary education. This is likely due to the fact that the sample of agricultural wage workers is small and very few have a secondary education or higher. As expected, returns to schooling for nonfarm employment are considerably larger than in farming. For example, while the returns to lower secondary education are 71 percent (higher earnings than those without schooling), the returns are 48 percent and 10 percent for nonfarm non-wage and for family farming, respectively.²⁹

In short, education is not only an important factor that is associated with nonfarm employment opportunities to the rural population in Madagascar, but it is also associated with higher earnings among those employed in the nonfarm sector. It appears that those individuals and households with little to no education face barriers not only to acquiring nonfarm jobs, but also to fully reaping the benefits of the potentially high return nonfarm sector.

Controlling for education, experience and other factors associated with employment selection, we find that women's non-agricultural wage and non-wage earnings are 42 percent and 20 percent lower than those of men, respectively. Although we do not find a significant difference between the earnings of men and women in agriculture, this does not imply that the earnings are necessarily equal because our

²⁹ The level of education used in the non-wage models is the highest level of education attained by a household member working in the family farm/nonfarm enterprise. The rationale for this measure is that nonwage earnings are measured by total farm/enterprise earnings and then are distributed equally among those working on the farm/enterprise. Given intra-household (in this case intra-farm or intra-enterprise) education externalities, the most appropriate measure of education is that of the member with the highest level of education.

measure of agricultural earnings is based on equal sharing of total household agricultural earnings.³⁰

6. Concluding Remarks

In this paper we examine the relationship between rural nonfarm employment and household welfare using nationally representative data from Madagascar. In doing so, we focus our attention on labor outcomes in the context of household livelihood strategies that include farm and nonfarm income earning opportunities. We identify distinct household livelihood strategies that can be ordered in welfare terms, and estimate multinomial logit models to assess the extent to which there exist barriers to choosing dominant strategies. Individual employment choice models, as well as estimates of earnings functions, provide supporting evidence of these barriers.

We find that the nonfarm sector may indeed provide an important pathway out of poverty. As is commonly found in other African countries (Barrett, et al., 2001), a positive relationship exists between rural nonfarm employment and welfare as measured by per capita household expenditure. The percentage of workers with nonfarm employment rises by expenditure quintile, with 11 percent in the poorest quintile and 31 percent in the richest quintile employed in this sector, respectively.

It is perhaps best, however, to understand rural nonfarm employment in the context of household livelihood strategies. After all, “diversification is the norm” (Barrett, et al., 2001), especially among agricultural households whose livelihoods are

³⁰ There are two sources of error implicit in this measure of agricultural labor earnings. The first is the assumption of equal productivity among all household agricultural labor. The second is the assumption of equal sharing of resources within the household which is not necessarily the case (Quisumbing and Maluccio, 2000; Sahn and Stifel, 2002).

vulnerable to climatic uncertainties. In principle, diversification could be accomplished through land and financial asset diversification. But, the absence of well-functioning land and capital markets often means that these diversification strategies are not feasible. Consequently, many rural households find themselves pursuing second-best diversification strategies through the allocation of household labor (Bhaumik, et al., 2006). Household labor supply/allocation decisions among farm and nonfarm activities are thus made by weighing both productivity and risk factors.

The four distinct household livelihood strategies identified for rural Madagascar, ordered from inferior to superior, are (a) any agricultural wage (AW), (b) family farming only (FF), (c) family farm and nonfarm activities (FFNF), and (d) nonfarm activities only (NF). Multinomial logit model estimates of household strategy choice indicate that there may be barriers to participation in high return nonfarm activities (FFNF and NF). First, household with higher levels of educational attainment tend to be those who choose the dominant strategies. It appears that poor households with low levels of education generally face greater barriers than the nonpoor in their choices of high-return livelihood strategies. Second, households without access to formal credit tend to adopt inferior strategies, and are less likely to combine family farming with nonfarm activities. Third, households with access to telecommunication – and by extension information on price and market conditions outside of the community – have a greater likelihood of choosing the dominant livelihood strategies. Households living in communities without such access are more likely to allocate labor to farming activities that are geared toward home consumption and the local market – i.e. those activities that are likely to have lower remunerative rewards.

Nonetheless, although these potential barriers may mean that high-return strategies are limited to a subpopulation of well-endowed households, the nonfarm sector can still benefit the poor. On the one hand, entry barriers limit the accessibility of those with limited asset endowments to high-return nonfarm activities (e.g. wage sector). On the other hand, low-return nonfarm activities tend to provide opportunities for *ex ante* risk reduction, as well as for *ex post* coping with shocks. The nonfarm nonwage sector tends to play this safety-net role in Madagascar. In addition, nonfarm activities may also have an indirect effect on poverty by affecting agricultural wages. Increased nonfarm employment may tighten the agricultural wage market leading to higher wages that are an important source of income for the poorest households.³¹

³¹ The author would like to thank Peter Lanjouw for making this point.

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Figure 1:
Cumulative Frequency of Household Consumption by Livelihood Strategy

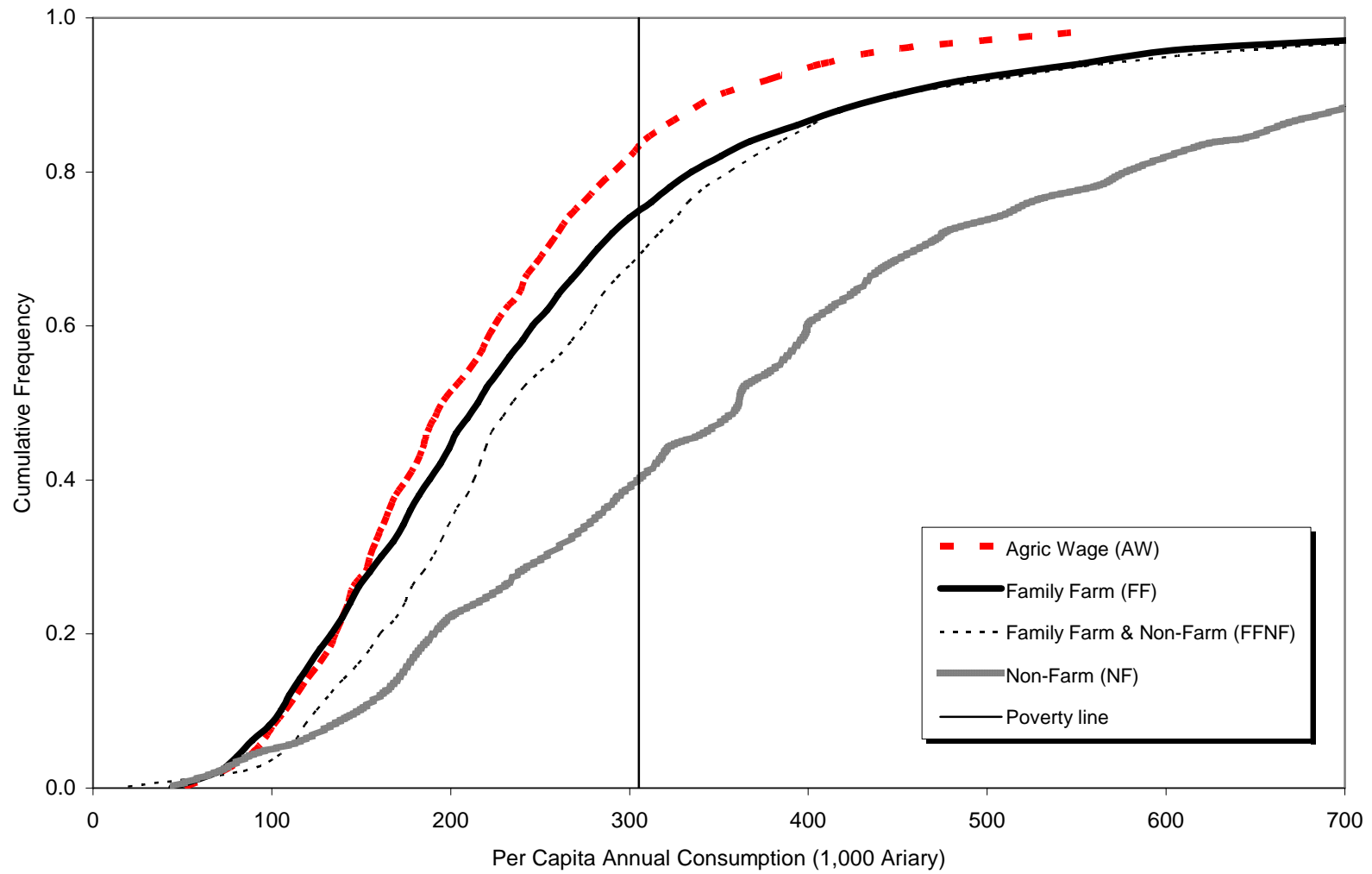


Table 1: Employment Among Economically Active Adults (15-64) in Rural Madagascar (2005)

	<i>Percent with 1st or 2nd Job</i>	Percent employed in...					
		Farm			Non Farm		
		Non Wage	Wage	Total	Non Wage	Wage	Total
1st Job	100	85	4	89	5	6	11
<i>Expenditure Quintile</i>							
Poorest	100	90	4	95	3	3	5
Q2	100	87	5	91	5	4	9
Q3	100	89	4	93	4	4	7
Q4	100	85	3	88	6	7	12
Richest	100	75	3	77	10	12	23
<i>Education Level</i>							
None	100	90	4	94	4	2	6
Primary	100	86	3	89	6	5	11
LowSecondary	100	71	4	75	11	14	25
UpperSecondary	100	53	3	56	11	34	44
PostSecondary	100	25	3	28	10	62	73
2nd Job	32	26	46	71	24	4	29
<i>Expenditure Quintile</i>							
Poorest	29	18	61	78	17	4	22
Q2	35	21	53	74	22	4	26
Q3	33	25	47	73	23	4	27
Q4	33	25	42	67	28	5	33
Richest	28	43	21	65	30	5	35
<i>Education Level</i>							
None	32	21	51	73	24	3	27
Primary	32	28	43	71	25	5	29
LowSecondary	29	37	30	67	24	9	33
UpperSecondary	36	50	17	67	23	9	33
PostSecondary	27	63	4	67	26	7	33

Source: Author's calculations from EPM 2005

Table 2: Median Monthly Earnings of Adults (15-64) in Rural Madagascar (2005)

<i>Thousands of Ariary</i>	Farm			Non Farm		
	Non Wage	Wage	Total	Non Wage	Wage	Total
First Job	31	38	31	37	78	67
<i>Expenditure Quintile</i>						
Poorest	17	36	18	25	48	28
Q2	26	38	27	21	66	41
Q3	31	38	32	32	69	47
Q4	39	42	39	37	78	63
Richest	58	44	58	67	100	89
<i>Education Level</i>						
None	29	37	30	28	49	36
Primary	33	42	33	26	72	48
LowSecondary	41	37	40	70	89	84
UpperSecondary	45	29	45	75	100	91
PostSecondary	38	*173	45	195	150	151
Second Job	24	20	21	22	39	24
<i>Expenditure Quintile</i>						
Poorest	12	17	17	16	29	18
Q2	17	22	20	20	39	21
Q3	23	22	22	23	39	24
Q4	29	18	20	21	37	22
Richest	37	30	35	32	57	35
<i>Education Level</i>						
None	23	19	20	21	30	21
Primary	22	22	22	22	35	24
LowSecondary	27	25	26	31	58	37
UpperSecondary	29	*30	30	24	*57	37
PostSecondary	*28	*40	*28	*73	*57	60

Source: Author's calculations from EPM 2005

* Fewer than 20 observations

Table 3: Household Employment Activities* in Rural Madagascar (2005)

<i>Percent</i>	Farm			Non Farm		
	Non Wage	Wage	Total	Non Wage	Wage	Total
Total	92	24	93	22	13	31
<i>Expenditure Quintile</i>						
Poorest	94	28	96	15	8	22
Q2	94	29	95	22	10	29
Q3	96	26	97	23	10	31
Q4	92	21	93	25	16	37
Richest	81	12	82	26	21	41

Source: Author's calculations from EPM 2005

* Percent of households with at least one member employed in the respective categories.

Table 4: Sources of Income by Sector of Activity in Rural Madagascar (2005)

<i>Share of Total Labor Income</i>	Farm	Nonfarm			Total
		Total	Industry	Services	
2005	78	22	3	19	100
Poorest	85	15	3	12	100
Q2	82	18	2	16	100
Q3	82	18	4	15	100
Q4	79	21	2	19	100
Richest	68	32	4	28	100

Source: Author's calculations from EPM 2005

Table 5: Household Livelihood Strategies in Rural Madagascar (2005)

	<i>Percent pursuing each strategy</i>						<i>Poverty</i>	
	<i>Expenditure Quintile</i>					<i>Total</i>	<i>Headcount</i>	<i>Depth</i>
	<i>Poorest</i>	<i>Q2</i>	<i>Q3</i>	<i>Q4</i>	<i>Richest</i>			
<i>Livelihood strategies</i>								
Only farm	77	71	66	64	55	67	78	31
Family & wage farm	22	25	19	19	9	19	85	34
Wage farm only	1	1	1	0	0	1	83	42
Family farm only	53	45	47	46	46	47	75	30
Farm & non-farm	20	25	30	30	29	27	70	25
Family & wage farm and non-farm	3	4	5	3	3	4	79	30
Wage farm and non-farm	1	1	0	1	1	1	71	30
Family farm and non-farm	16	19	25	26	25	22	69	25
- Non-wage non-farm	11	14	16	16	15	14	71	26
- Non-wage & wage non-farm	1	2	1	2	1	1	69	23
- Wage non-farm	4	4	8	8	8	6	63	22
Only non-farm	2	3	2	4	13	5	39	15
Non-wage & wage non-farm	0	1	1	1	3	1	38	12
Non-wage non-farm	1	1	1	1	3	1	46	18
Wage non-farm	1	1	1	2	6	2	37	14
Non-labor income	2	2	1	1	3	2	57	24
Total	100	100	100	100	100	100	73	29

Source: Author's calculations from EPM 2005

Table 6: Aggregated Household Livelihood Strategies in Rural Madagascar (2005)

	<i>Percent pursuing each strategy</i>						<i>Poverty</i>	
	Expenditure Quintile					Total	Headcount	Depth
	Poorest	Q2	Q3	Q4	Richest			
<i>Livelihood strategies</i>								
Any farm wage	27	31	24	23	13	24	83	33
Family farm only	53	45	47	46	46	47	75	30
Family farm & non-farm	16	19	25	26	25	22	69	25
Non-farm only	2	3	2	4	13	5	39	15
Non-labor income	2	2	1	1	3	2	57	24
<i>Total</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>100</i>	<i>73</i>	<i>29</i>

Source: Author's calculations from EPM 2005

Table 7. Summary Statistics for Regression Analysis of Household Livelihood Strategy Choice in Rural Areas

<i>Sample: All households with labor income in rural areas</i>	Any agric wage		Family farm only		Family farm and non-farm		Non-farm only	
	mean	std dev	mean	std dev	mean	std dev	mean	std dev
	Age of household head	41.6	12.0	43.5	13.0	43.3	11.2	40.9
Female household head (dummy)	0.136	0.343	0.125	0.331	0.129	0.335	0.230	0.421
Migrant (dummy)	0.084	0.278	0.067	0.250	0.092	0.289	0.195	0.397
<i>Household Structure</i>								
Household size (number of members)	6.289	2.476	6.014	2.499	6.423	2.536	4.806	1.813
Share of children < 5	0.166	0.152	0.135	0.150	0.157	0.152	0.118	0.145
Share of children 5-14	0.327	0.194	0.332	0.201	0.323	0.192	0.306	0.216
Share of men 15-64 [†]	0.239	0.151	0.255	0.157	0.243	0.152	0.260	0.194
Share of women 15-64	0.252	0.129	0.257	0.137	0.268	0.139	0.306	0.172
Share of members 65+	0.015	0.061	0.020	0.075	0.010	0.045	0.010	0.058
<i>Education dummies - most educated member</i>								
Primary	0.558	0.497	0.498	0.500	0.459	0.499	0.272	0.445
Lower secondary	0.075	0.263	0.106	0.308	0.180	0.384	0.249	0.433
Upper secondary	0.032	0.176	0.040	0.196	0.089	0.284	0.189	0.392
Post secondary	0.007	0.081	0.008	0.086	0.037	0.189	0.170	0.376
Radio (dummy - HH owns one)	0.479	0.500	0.509	0.500	0.663	0.473	0.664	0.473
Non-labor income (log)	2.64	4.47	2.02	4.23	2.53	4.50	3.37	5.19
Value of agricultural assets (log)	2.14	1.40	2.53	1.80	2.52	1.57	0.57	1.16
<i>Land holding dummies</i>								
None	0.046	0.210	0.016	0.124	0.031	0.173	0.828	0.377
< 1 hectare [†]	0.530	0.499	0.238	0.426	0.350	0.477	0.069	0.254
1-3 hectares	0.318	0.466	0.502	0.500	0.441	0.497	0.081	0.273
3-5 hectares	0.072	0.259	0.140	0.347	0.095	0.294	0.007	0.083
5-10 hectares	0.021	0.142	0.057	0.231	0.045	0.208	0.008	0.091
10+ hectares	0.012	0.110	0.048	0.214	0.037	0.190	0.006	0.080
Difficulty accessing formal credit (dummy)	0.54	0.50	0.52	0.50	0.46	0.50	0.50	0.50
<i>Community Characteristics</i>								
MFI available in community	0.518	0.500	0.424	0.494	0.431	0.495	0.468	0.500
Phone (dummy at least one HH with a phone)	0.018	0.132	0.031	0.172	0.082	0.275	0.440	0.497
Electricity access (dummy)	0.072	0.258	0.083	0.275	0.076	0.266	0.541	0.499
Piped water access (dummy)	0.508	0.500	0.406	0.491	0.473	0.499	0.615	0.487
<i>Distance to nearest city (dummies)</i>								
<2 hours	0.051	0.220	0.053	0.224	0.091	0.287	0.351	0.478
2-5 hours	0.226	0.419	0.214	0.410	0.225	0.418	0.228	0.420
5-10 hours [†]	0.355	0.479	0.174	0.379	0.174	0.379	0.097	0.296
10-15 hours	0.095	0.293	0.104	0.306	0.099	0.299	0.082	0.274
15-24 hours	0.101	0.301	0.074	0.262	0.088	0.283	0.051	0.220
24+ hours	0.173	0.378	0.380	0.486	0.323	0.468	0.192	0.394
Percent with labor income in each category	24		48		23		5	
Sample size	1,085		3,065		1,143		366	

Data: EPM 2005

[†] Left out category in the estimates

Table 8. Regression Analysis of Household Livelihood Strategy Choice in Rural Areas

<i>Multinomial Logit</i>								
<i>Sample: All households with labor income in rural areas</i>								
	Any agric wage		Family farm only		Family farm and non-farm		Non-farm only	
	Marg Eff	t-value	Marg Eff	t-value	Marg Eff	t-value	Marg Eff	t-value
Age of household head	-0.001	-3.06 ***	0.000	0.79	0.001	1.52	0.000	0.93
Female household head (dummy)	0.01	0.40	-0.04	-2.32 **	0.02	1.28	0.01	2.10 **
Migrant (dummy)	0.02	1.16	-0.06	-3.17 ***	0.04	2.03 **	0.01	1.18
<i>Household Structure[†]</i>								
Household size (number of members)	0.012	4.67 ***	-0.013	-4.08 ***	0.006	2.02 **	-0.005	-3.30 ***
Share of children < 5	0.00	-0.03	0.00	-0.06	0.00	0.10	0.00	0.00
Share of children 5-14	0.00	-0.02	0.00	0.00	0.00	0.01	0.00	0.04
Share of women 15-64	0.00	-0.05	0.00	-0.05	0.00	0.10	0.00	-0.01
Share of members 65+	0.01	0.08	0.01	0.10	-0.02	-0.16	0.00	0.05
<i>Education dummies - most educated member</i>								
Primary	0.01	0.57	-0.04	-3.33 ***	0.03	2.63 ***	0.00	0.77
Lower secondary	-0.07	-4.77 ***	-0.12	-5.71 ***	0.14	6.03 ***	0.05	4.58 ***
Upper secondary	-0.06	-2.96 ***	-0.21	-7.33 ***	0.20	6.17 ***	0.07	4.19 ***
Post secondary	-0.10	-3.89 ***	-0.33	-7.71 ***	0.34	6.58 ***	0.09	3.64 ***
Radio (dummy - HH owns one)	-0.03	-3.14 ***	-0.04	-3.41 ***	0.06	5.25 ***	0.01	1.70 *
Non-labor income (log)	0.00	0.03	0.00	-0.02	0.00	-0.01	0.00	0.03
Value of agricultural assets (log)	0.00	0.09	0.00	0.43	0.00	0.32	0.00	-1.96 **
<i>Land holding dummies^{††}</i>								
None	0.07	2.75 ***	-0.29	-9.63 ***	-0.12	-6.49 ***	0.33	7.32 ***
1-3 hectares	-0.06	-6.60 ***	0.08	5.79 ***	-0.02	-1.53	0.00	0.08
3-5 hectares	-0.07	-5.28 ***	0.14	6.79 ***	-0.05	-3.22 ***	-0.01	-0.91
5-10 hectares	-0.09	-4.50 ***	0.13	4.64 ***	-0.06	-2.64 ***	0.01	0.91
10+ hectares	-0.07	-3.32 ***	0.07	2.45 **	0.00	-0.16	0.01	0.33
Difficulty accessing formal credit (dummy)	0.04	3.72 ***	-0.01	-1.11	-0.02	-1.99 **	0.00	-0.82
<i>Community Characteristics</i>								
MFI available in community	-0.03	-2.42 **	0.06	3.73 ***	-0.02	-1.19	-0.01	-2.75 ***
Phone (dummy at least one HH owns)	0.00	-0.11	-0.11	-3.91 ***	0.09	3.17 ***	0.03	2.62 ***
Electricity access (dummy)	-0.02	-1.23	0.06	2.84 ***	-0.06	-3.21 ***	0.01	1.70 *
Piped water access (dummy)	0.01	1.39	-0.03	-2.60 ***	0.01	0.87	0.01	1.82 *
<i>Distance to nearest city (dummies)^{†††}</i>								
< 2 hours	0.02	0.69	-0.05	-1.74 *	0.04	1.41	0.00	-0.42
2-5 hours	-0.01	-1.00	0.05	2.63 ***	-0.04	-2.36 **	0.00	0.26
10-15 hours	0.01	0.70	-0.06	-2.64 ***	0.05	2.16 **	0.00	0.00
15-24 hours	0.07	2.80 ***	-0.10	-3.82 ***	0.05	1.82 *	-0.01	-1.62
24+ hours	-0.03	-1.88 *	0.00	-0.24	0.05	2.49 **	-0.01	-2.10 **
Percent with labor income in each category	24		48		23		5	
Percent correctly predicted							63	
Number of observations							5,659	
Pseudo R-squared							0.31	

Data: EPM 2005

Note: Region dummies included by not shown.

Note: Marginal effects show the average change in the probability of chosen strategy resulting from a unit change in the independent variable.

Consequently the marginal effects sum to zero across the categories.

Note: Left out strategy in estimation is "Family farm only."

[†] Left out category is share of men 15-64

^{††} Left out category is < 1 hectare

^{†††} Left out category is 5-10 hours

Table 9. Regression Analysis of Primary Employment in Rural Areas

<i>Multinomial Logit</i>								
<i>Sample: First jobs held by adults (15+) in rural areas</i>								
	<u>Agric wage</u>		<u>Family farm</u>		<u>Nonfarm non-wage</u>		<u>Nonfarm wage</u>	
	Marg Eff	t-value	Marg Eff	t-value	Marg Eff	t-value	Marg Eff	t-value
<i>Individual Characteristics</i>								
Female (dummy)	-0.01	-1.23	-0.01	-1.54	0.03	4.15 ***	-0.01	-2.50 **
Age	0.000	1.68 *	-0.001	-2.86 ***	0.001	2.64 ***	0.000	0.13
Household head (dummy)	-0.02	-4.94 ***	0.02	1.43	-0.01	-1.74 *	0.02	1.95 *
Spouse of household head (dummy)	-0.02	-5.59 ***	0.02	2.17 **	0.00	-0.21	0.00	0.10
Migrant (dummy)	0.00	-0.28	-0.04	-3.68 ***	0.01	1.94 *	0.02	3.77 ***
<i>Education dummies[†]</i>								
Primary	-0.01	-3.85 ***	-0.02	-3.16 ***	0.02	3.06 ***	0.02	3.12 ***
Lower secondary	-0.01	-3.67 ***	-0.09	-7.20 ***	0.04	4.06 ***	0.07	6.75 ***
Upper secondary	-0.02	-2.29 **	-0.22	-8.24 ***	0.05	2.88 ***	0.19	8.06 ***
Post secondary	0.00	-0.22	-0.39	-8.18 ***	0.04	1.53	0.36	8.33 ***
<i>Household Characteristics</i>								
Female household head (dummy)	0.01	1.70 *	-0.06	-4.77 ***	0.04	4.03 ***	0.01	0.69
Age of household head	0.00	-2.76 ***	0.00	2.89 ***	0.00	-2.13 **	0.00	0.20
<i>Household Structure</i>								
Household size (number of members)	0.001	0.84	-0.002	-1.68 *	0.000	-0.31	0.002	2.10 **
Share of children < 5 ^{††}	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Share of children 5-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Share of women 15-64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Share of members 65+	0.00	0.00	0.00	0.01	0.00	0.01	0.00	-0.02
Radio (dummy - HH owns one)	0.00	-1.10	-0.03	-5.42 ***	0.03	5.43 ***	0.01	2.45 **
Non-labor income (log)	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.02
Value of agricultural assets (log)	0.00	-0.03	0.00	0.24	0.00	-0.13	0.00	-0.19
<i>Land holding dummies^{†††}</i>								
None	0.12	6.81 ***	-0.45	-19.15 ***	0.18	9.13 ***	0.15	8.30 ***
1-3 hectares	-0.01	-4.05 ***	0.04	7.13 ***	-0.01	-3.03 ***	-0.01	-3.37 ***
3-5 hectares	-0.01	-3.18 ***	0.05	7.45 ***	-0.02	-2.72 ***	-0.02	-4.64 ***
5-10 hectares	-0.01	-2.49 **	0.04	3.95 ***	-0.01	-0.93	-0.02	-2.51 **
10+ hectares	-0.01	-1.28	0.01	0.43	0.00	-0.13	0.01	0.62
Difficulty accessing formal credit (dummy)	0.01	3.67 ***	-0.02	-3.23 ***	0.00	0.27	0.00	0.90
<i>Community Characteristics</i>								
MF1 available in community	0.01	1.34	0.01	2.06 **	-0.01	-1.51	-0.01	-3.20 ***
Phone (dummy at least one HH with a phone)	0.01	0.82	-0.10	-5.60 ***	0.06	4.81 ***	0.02	2.96 ***
Electricity access (dummy)	-0.01	-2.41 **	-0.01	-0.72	-0.02	-2.70 ***	0.03	4.14 ***
Piped water access (dummy)	0.00	1.00	-0.03	-4.52 ***	0.02	3.26 ***	0.01	2.17 **
<i>Distance to nearest city (dummies)^{††††}</i>								
< 2 hours	0.01	1.17	-0.05	-3.24 ***	0.04	2.83 ***	0.01	0.63
2-5 hours	0.00	0.54	0.00	-0.31	-0.01	-0.91	0.01	0.98
10-15 hours	-0.01	-1.62	-0.02	-1.55	0.02	1.77 *	0.01	1.22
15-24 hours	0.01	1.78 *	-0.02	-1.78 *	0.00	-0.42	0.01	1.32
24+ hours	0.00	-0.81	0.00	0.36	0.00	-0.35	0.00	0.55
Percent in each category	4		85		5		6	
Number of observations	13,339							
Pseudo R-squared	0.30							

Data: EPM 2005

Note: Region dummies included by not shown.

Note: Marginal effects show the average change in the probability of "sector" of employment resulting from a unit change in the independent variable.

Consequently the marginal effects sum to zero across the categories.

Note: Left out category is "agricultural non-wage."

[†] Left out category is no education

^{††} Left out category is men 15-64

^{†††} Left out category is < 1 hectare

^{††††} Left out category is 5-10 hours

Table 10. Regression Analysis of Daily Labor Earnings in Rural Madagascar (2005)

<i>Dependent variable = log(daily earnings)</i>												
<i>Sample: Primary jobs of all rural adults (15-64)</i>												
	Agric wage			Family Farm			Nonfarm non-wage			Nonfarm wage		
	Coef.	t-value		Coef.	t-value		Coef.	t-value		Coef.	t-value	
Farm												
Hours worked per day	0.03	1.92	*	0.00	0.13		0.07	3.63	***	0.04	3.12	***
Experience	0.02	0.93		-0.01	-2.22	**	-0.03	-1.37		0.01	0.69	
Experience-squared	-0.0002	-0.66		0.0002	1.95	*	0.0005	1.13		0.0000	0.10	
<i>Education[†]</i>												
Primary education dummy	0.14	1.83	*	-0.02	-0.91		-0.09	-0.79		0.36	2.87	***
Lower secondary education dummy	0.22	1.32		0.10	2.92	***	0.48	2.51	**	0.71	2.93	***
Upper secondary education dummy	0.47	1.33		0.14	2.28	**	0.55	2.18	**	1.09	2.92	***
Post secondary education dummy	0.65	1.12		-0.06	-0.51		0.75	1.87	*	1.63	3.38	***
Female Dummy	-0.12	-2.25	**	0.00	0.07		-0.20	-2.05	**	-0.42	-6.22	***
Constant	7.44	8.70	***	7.40	79.22	***	8.47	6.54	***	6.29	8.28	***
Number of observations	455			10,409			666			692		
R-squared	0.20			0.04			0.10			0.31		

Data: EPM 2005

Note: Region dummies included by not shown.

Note: Estimates corrected for selection (Bourguignon, Fournier and Gurgand, 2002)

[†] Level of education for non wage models is the highest level of education attained by a household member working in the farm (or in the nfe)