



## Social Protection Discussion Paper Series

### Shocks and Coffee: Lessons from Nicaragua

by Renos Vakis, Diana Kruger and Andrew D. Mason

July 2004

Social Protection Unit

Human Development Network

The World Bank

Social Protection Discussion Papers are not formal publications of the World Bank. They present preliminary and unpolished results of analysis that are circulated to encourage discussion and comment; citation and the use of such a paper should take account of its provisional character. The findings, interpretations, and conclusions expressed in this paper are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations or to members of its Board of Executive Directors or the countries they represent.

For free copies of this paper, please contact the Social Protection Advisory Service, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433 USA. Telephone: (202) 458-5267, Fax: (202) 614-0471, E-mail: [socialprotection@worldbank.org](mailto:socialprotection@worldbank.org). Or visit the Social Protection website at <http://www.worldbank.org/sp>.

## SHOCKS AND COFFEE: LESSONS FROM NICARAGUA

Renos Vakis, Diana Kruger and Andrew D. Mason\*

July 2004

---

\* The World Bank. For comments contact [rvakis@worldbank.org](mailto:rvakis@worldbank.org)

The authors are grateful to Caridad Araujo, Natalia Caldes, David Coady, Carlos Felipe Jaramillo, Bryan Lewin, Alessandra Marini, Hans Hoogeveen, John Maluccio, Pedro Olinto, Carlos Sobrado and Panos Varangis for helpful comments and insights. Excellent research assistant work was done by Kalpana Mehra.

## **Abstract**

Using household level panel data from Nicaragua, this paper explores the impact of the recent coffee crisis on rural households engaged in coffee production and coffee labor work. Taking advantage of the panel structure of the data, a number of findings emerge: (i) while overall growth between 1998 and 2001 was widespread in rural Nicaragua, coffee households saw large declines in various socioeconomic outcomes; (ii) among coffee households, it is small farm households that were affected the most and not poor labor households as previously expected; (iii) even though coffee households used various risk management strategies to address the shock, it was pre shock, ex-ante strategies (like income diversification) that were the most effective in allowing coffee households insulate against the shock. By contrast, the coffee households that used ex-post coping instruments did not manage to mitigate the adverse impact as well, with additional potential long run implications via extensive uses of harmful coping strategies (like increases in child labor); and (iv) the coffee shock affected upward mobility and downward poverty vulnerability of coffee households. Such findings seem to confirm the widespread impact of shocks on overall household behavior and indicate the importance of incorporating risk management in the policy agenda of poverty reduction.

## Contents

1. <i>INTRODUCTION</i> .....	4
2. <i>DATA, COFFEE TYPOLOGY AND A BASELINE PROFILE OF COFFEE HOUSEHOLDS</i> .....	6
3. <i>ASSESSING THE IMPACT OF THE COFFEE SHOCK</i> .....	9
4. <i>RISK MANAGEMENT STRATEGIES AND RESPONDING TO SHOCKS</i> ..	15
5. <i>SHOCKS, VULNERABILITY AND MOBILITY</i> .....	26
6. <i>PUBLIC RESPONSE TO THE COFFEE CRISIS</i> .....	31
7. <i>MOVING FORWARD: LESSONS FOR CONSTRUCTING A POLICY AGENDA</i> .....	34
8. <i>REFERENCES</i> .....	38
9. <i>Appendix 1: TABLES AND FIGURES</i> .....	40
10. <i>Appendix 2: Attrition and panel construction</i> .....	82

## 1. INTRODUCTION

**Coffee is by far the most important crop for the Nicaraguan economy.** It is the highest source of agricultural export revenues in Nicaragua. Specifically, during the last 5 years, coffee exports have averaged \$140 million (24 percent of total export earnings).<sup>1</sup> It is estimated that total employment in coffee production accounts between 20 and 40 percent of the rural labor force,<sup>2</sup> and that more than 65% of those employed in the sector are seasonal workers.<sup>3</sup>

**Nonetheless, for the last few years the coffee industry has been undergoing a worldwide structural change.** The entry of a number of new producers in the late nineties (such as Vietnam), as well as technological improvements leading to increases in production in Latin American countries (e.g. Brazil) have dramatically increased production and as such, international coffee prices have been severely depressed.

**The collapse in prices has resulted in significantly lower revenues for coffee producers in Nicaragua.** Between 1998 and 2001, average price received by coffee exporters decreased from \$151 to \$59 per hundredweight - a decrease of 61%.<sup>4</sup> By 2001, the price received by coffee producers (between \$45 and \$50 per hundredweight) was barely sufficient to cover production costs, which are estimated to be \$35, \$45, and \$55 (per hundredweight) for low, medium and high-technology farms.<sup>5</sup>

**This has seriously affected the Nicaraguan coffee economy.** Many farmers have been forced to reduce and even abandon coffee production altogether. In addition, there is concern about the social impact of the crisis on the coffee laborers. Initial estimates suggested that 35,000 permanent and more than 100,000 seasonal coffee plantation workers may have lost their coffee jobs.<sup>6</sup>

---

<sup>1</sup> Source: Banco Central de Nicaragua. *Indicadores Economicos Mensuales*. [www.bcn.gob.ni](http://www.bcn.gob.ni)

<sup>2</sup> From LSMS data on employment and agricultural production, about 20 percent of the rural labor force is estimated to be directly employed in the coffee sector while MAGFOR (2002) estimates this to be 40 percent.

<sup>3</sup> Inter American Development Bank (2001). The remaining 35% are permanent farm workers or farm owners.

<sup>4</sup> Government of Nicaragua, Ministry of Industry and Commerce (MIFIC) and Center of Export Transactions. These refer to international prices.

<sup>5</sup> Cf. 3.

<sup>6</sup> Ibid.

**Still, the lack of in depth empirical evidence to understand the magnitude of the crisis impedes informed policy formation.** Not only there is a need to better measure the impact of the shock but also identify the households that were affected the most and explore the various strategies utilized by these households to prevent, cope and mitigate the adverse effect of the crisis. A better understanding of these issues will be crucial in designing appropriate instruments for policy response.

**This paper addresses these gaps in knowledge.** Using a household panel data that was collected in two periods (1998 where prices were relatively high and 2001 when they were at their lowest) and by specifically exploring the sample heterogeneity to distinguish between coffee and non-coffee households, the paper describes the evolution of household-level socio-economic welfare measures between the two periods and explores the various mechanisms and strategies employed to deal with the crisis.

**The paper is divided as follows:** the next section describes the data and the various typologies and classifications used to define the coffee sector. An evaluation of the impact of the coffee crisis on a number of socio-economic outcomes is examined in section III, while section IV explores risk management strategies available to affected households. Section V addresses how the coffee shock may have influenced poverty mobility and vulnerability while a discussion of public policy interventions to address the crisis is presented in section VI. Section VII concludes.

## 2. DATA, COFFEE TYPOLOGY AND A BASELINE PROFILE OF COFFEE HOUSEHOLDS

### 2.1 Data sources and coffee typology

The main data source is from the *Living Standards Measurement Surveys* collected in Nicaragua in 1998 and 2001. The first survey was implemented in the summer of 1998, while the second during the summer of 2001. By then coffee prices had reached more than 60 percent of their 1998 level (Figure 1). More than 4,000 households were surveyed each year, and approximately 3,000 of those surveyed in 1998 were also interviewed in 2001. Taking advantage of the panel nature of the data, 2,993 panel households are identified for which data on aggregate consumption and income exists in both years. Since the main focus is to understand the impact of the coffee crisis (a mainly rural phenomenon), the analysis is limited largely to rural households only and focuses on a final rural panel data of 1,355 households.<sup>7</sup>

In order to understand the impact of the coffee shock on households, a number of definitions are used to define how a household relates with coffee. The first definition focuses on household employment activities and classifies a household between “coffee” and “non coffee” based on whether any member of a household worked in the coffee sector, either as a wage earner or as a producer. Specifically, a household is defined as:

- (i) *non-coffee* if it was not involved in any coffee activities in either year;
- (ii) *exiting coffee* if it was only involved in coffee activities in 1998;
- (iii) *entering coffee* if it was only involved in coffee activities in 2001;<sup>8</sup> and
- (iv) *coffee* if it was involved in coffee activities both years.

---

<sup>7</sup> Preliminary analysis also included urban households to assess whether or not to incorporate them in the analysis. While it is likely that seasonal migration from urban to rural regions occurs during coffee harvests, the household survey reveals that most of this migration occurs within rural areas. In addition, since isolating the impact of the coffee crisis per se is a challenging issue, focusing on rural areas alone facilitates this by eliminating any systematic biases in welfare and other socioeconomic changes that could be due to urban-specific shocks.

<sup>8</sup> While observing households enter the coffee sector during this period is counterintuitive, there are two possible explanations: (i) households were already in coffee before the first survey but did not have coffee income reported in 1998 due its perennial nature; (ii) households entered immediately after the 1998 survey, when coffee prices were still high. Of the 117 households that entered the coffee sector between 1998 and 2001, 62 are labor households and 55 are small farmers.

**The rural panel classifies 293 households involved in coffee activities in at least one of the years of the survey (Tables 1 and 2).** This represents 24 percent of the rural panel households out of which one third (8 percent of the rural panel) remained in the coffee sector over the period.<sup>9</sup>

**The first definition further distinguishes *coffee households* between “labor” and “farm”.** This additional division is crucial as one of the key questions that this study tries to address is how the impact of the crisis compares among different types of coffee households. Using this distinction, there are 31 coffee-labor households and 59 coffee-farm households that remained in coffee both periods (Table 2). It is important to note that this latter category corresponds mainly to small-scale family farms with an average farm-size of 13 hectares and median of 5.6 hectares.<sup>10</sup>

**A third typology defines coffee households based on their activity during the baseline year.** Since households may have entered or exited the coffee sector as a response to the shock, attributing changes in various outcomes such as poverty and consumption to the coffee shock cannot be separated from the strategy to “exit” or “stay” in coffee. In this sense, the two definitions above are “endogenous” to the outcome, which poses a challenge in measuring the coffee shock’s impact. While this is not always the case, classifying households based on the first year’s (1998) affiliation to coffee is used in the empirical analysis as an instrument for the two previous definitions:

- (i) *non-coffee* if it was not involved in any coffee activities in 1998;
- (ii) *coffee labor* if it was involved in coffee labor activities in 1998; and
- (iii) *coffee farm* if it was involved in coffee farming activities in 1998

Based on this definition, in 1998 there were 108 coffee-labor households, 108 coffee-farm households and 1139 non-coffee households (Table 2).

---

<sup>9</sup> While these are weighted estimates using the rural panel, none of the two surveys was designed to represent coffee households at the national or any sub-national level, and as such these estimates should only be treated as indicative.

<sup>10</sup> As neither of the two household surveys was designed to represent coffee households at the national or any sub-national level, any conclusions should not be interpreted strictly as representing all coffee households in Nicaragua.



**A final broader coffee classification that also serves for robustness checks is established using a geographical based index of coffee intensity.** The small sample size of coffee households using the previous definitions raises a concern about empirical inferences that could be made. In addition, given that there are possibly spillover effects between the coffee and non-coffee sectors, it is important to be able to assess the impact of the coffee crisis on a more heterogeneous group of households irrespective of their direct involvement in coffee.<sup>11</sup> As such, using the 2001 *Censo Nacional Agropecuario* (Agricultural Census), a municipality-level intensity of coffee production is defined as the share of land dedicated to coffee cultivation. The benefit of such geographical definition is that it addresses the concerns above and serves as robustness check for the results obtained from the household definitions but can also look at the geographical aspects of the impact (if any). Using the distribution of coffee intensity three coffee regions are defined (low, medium, high).<sup>12</sup> Based on the regional coffee definition, 288 households (21 percent of the rural panel) reside in the high coffee region (Table 3). Box 1 summarizes the four definitions above.

<b>11. Box 1. Typology of rural coffee households</b>			
Household definitions			Regional definition
1	2	3	4
Any household member affiliated in coffee sector:			Coffee production
Using both years	Using both years	Using initial year 1998	intensity in municipality
Non-coffee both years	Both years:	Non-coffee	Low intensity region
Coffee-exit	Coffee-labor	Coffee-labor	Medium intensity region
Coffee-enter	Coffee-farmer	Coffee-farmer	High intensity region
Coffee both years			
Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001.			

<sup>11</sup> For example, while the coffee crisis may directly affect the incomes of agricultural workers, producers and anyone else involved in the production and marketing chain of coffee, it may also affect the local non-coffee economy via lower demand for other goods or increases in the labor supply for non-coffee jobs.

<sup>12</sup> A municipality is defined as *Low coffee intensity* if less than 1.3 percent of the farmland is dedicated to coffee (corresponding to the first 3 quintiles of the coffee intensity variable); *medium coffee intensity* is a municipality where 1.4-10.7 percent of farmland is used for coffee production (corresponding to the fourth quintile of the coffee intensity variable); and *high coffee intensity* is a municipality where 10.8 percent or more of the total farmland is dedicated to coffee production.

### 3. ASSESSING THE IMPACT OF THE COFFEE SHOCK

#### *3.1 Baseline Profile: 1998*

**The rural panel suggests that coffee labor households were among the poorest rural groups during 1998, while coffee farmers were the wealthiest.** In particular, coffee labor households were the poorest group based on consumption and income levels as well as land assets (Table 4).<sup>13</sup> In fact, practically all coffee labor households were poor (Table 6). By sharp contrast, coffee farmers were by far the better-off group before the crisis in terms of welfare and wealth, even compared to non-coffee households. Still, coffee farmers were the least diversified in terms of income sources (with almost 80 percent of their income derived from farming), suggesting that they would be potentially less able to protect themselves from a coffee shock.

#### *3.2 Impact on poverty*

**Overall, the years between 1995 and 2001 are characterized by high economic growth in Nicaragua.** Real GDP averaged annual growth rates of about 5 percent between 1995 and 2001, while GDP per capita grew at a rate of 2.1 percent per year.<sup>14</sup>

**Partially in response to economic growth, overall poverty declined over this period.** In particular, between 1998 and 2001, overall poverty in Nicaragua declined by 4 percent to a headcount rate of 46 percent (Table 5). Even though poverty is still an overwhelmingly rural phenomenon (as more than two-thirds of the Nicaragua's poor live in rural areas), poverty rates declined faster in rural areas than in urban areas. In 2001, 64 percent of the rural were poor (a decline of six percent from 1998), compared with only 29 percent among the urban population (a decline of less than 2 percent). Similarly, almost 25 percent of the rural population was classified as extreme poor in 2001 (a decline of 15 percent from 1998), while only six percent were extreme poor in urban areas (a decline of less than 2 percent).

---

<sup>13</sup> All group comparisons presented in this paper are statistically significant at the 90 percent level or more unless otherwise noted.

<sup>14</sup> Cf. footnote 1.

**Nonetheless, the rural panel reveals that coffee-sector households did not benefit from these advances.**<sup>15</sup> In particular, the poverty rate among households involved in the coffee sector in both years increased by 1.8 percentage points to more than 75 percent (Table 5 and Figure 2). Similarly, households that entered the coffee sector before 2001 observed a moderate decline in poverty of almost two percent. By contrast, poverty rates among households not involved in coffee in both years and among households that exited coffee after 1998 decreased by more than ten percentage points to 55 and 63 percent, respectively. In fact, attributing (naively) the poverty rates differences between coffee and non-coffee households on the coffee shock alone would suggest that the crisis resulted in a poverty increase of 11.9 percentage points.

**Similarly, reduction in extreme poverty was not shared among households involved in coffee activities.** While extreme poverty decreased by 47 percent among non-coffee households, and by about 22 percent in households that entered and exited coffee, it increased by 5 percent among households involved in coffee in 1998 and 2001. A similar trend was observed with the regional coffee definition.<sup>16</sup>

**Still, differentiating between farm and labor households within the coffee sector reveals that while both were affected negatively farm households were hit the most.** In fact, only coffee farm households experienced increases in poverty rates (seven percent). By contrast, poverty among labor households decreased by four percent even though it did at a lower rate compared to non-coffee households (Tables 5 and 6). This implies that while coffee labor households were poorer as noted earlier, the coffee crisis shock affected them less compared to coffee farm households. Understanding and comparing the various coping strategies between the two groups is therefore crucial.

**The regional coffee definition confirms the above patterns.** During both 1998 and 2001, poverty in the high coffee intensity region was high compared to low and medium coffee intensity regions (Table 5 and Figure 3). Poverty rates among households in high coffee intensity regions remained above 75 percent while among households in low and medium

---

<sup>15</sup> Note that from this point forward, all comparisons refer to the panel estimates.

<sup>16</sup> Extreme poverty declined in all regions, but the increase was more than 5 times greater among low-intensity coffee regions (56 percent) vis-à-vis high-intensity coffee regions, where extreme poverty fell by 10 percent.

intensity regions decreased by 13 and 6 percentage points, respectively. These trends and the corresponding impact of the coffee shock on poverty rates using this definition (a suggested impact of 11.7 percentage points) are both consistent with the household definitions discussed above.

### ***3.3 Consumption***

**Between 1998 and 2001, real consumption per capita in rural areas increased an average of 11.7 percent, or 470 Cordobas (Table 7).** This increase was driven mainly by an increase in consumption of non-food items (e.g., non-durable household goods, clothing, transportation, etc.) of 28.1 percent (or 9.4 percent per year). By contrast, average food consumption practically remained the same, increasing by less than 1 percent over the three-year period.

**In contrast, households that were involved in the coffee sector in both years experienced significant declines in per capita consumption.** While consumption per capita increased 15 percent among non-coffee households, it decreased more than 16 percent among coffee households (Table 7 and Figure 4). Households that exited coffee production between 1998 and 2001 experienced an increase of consumption of 15 percent, whereas consumption remained unchanged among households that entered the coffee sector after 1998.

**Consistent with the poverty trends above, the consumption decline was more severe among farm as opposed to labor coffee households.** Consumption per capita decreased more than 25 percent among farm households while consumption among coffee labor households remained the same (Table 9).

**Similar patterns are observed using the regional coffee definition.** In particular, total consumption per capita in low-intensity coffee areas increased by almost 16 percent between 1998 and 2001, in contrast with a 3 percent decrease in high-intensity regions (Figure 5).<sup>17</sup> This finding is consistent with the evolution of poverty within these regions.

---

<sup>17</sup> This decrease was not statistically significant.

**The drop in overall consumption of coffee households was driven by a decline in food consumption.** Decomposition of consumption per-capita into its food and non-food components allows the identification of the source in consumption changes. For non-coffee households, while food consumption was similar between 1998 and 2001, the non-food component increased by more than 30 percent (Figure 4 and Table 5). Conversely, while coffee households experienced drops in both consumption components, the largest drop was in food consumption (23 percent). Similar patterns hold using the regional coffee definition.

### *3.4 Income*

**Mirroring the previous patterns, coffee households experienced large declines in incomes.** Overall, between 1998 and 2001 real rural incomes per capita increased by 30 percent. Still, comparisons using the coffee definitions reveal distinct differences for each subgroup. For example, income per capita increased by 40 percent for non-coffee households (Table 8 and Figure 6). Similar increases are found in the low intensity coffee region. By sharp contrast, households involved in coffee in both periods suffered a decrease in per capita income of more than 25 percent.

**Nonetheless, coffee farm households were hit the worst.** In fact, while they had the highest average incomes per capita in 1998, by 2001 it was among the lowest. Using the household coffee definition, income per capita for coffee farm households was 6,031 Cordobas, compared to 3,697 for non-coffee households in 1998 (Tables 8 and 9). This pattern completely reversed in 2001 with coffee farm households experiencing a 40 percent decrease in incomes while non-coffee households saw a 40 percent increase in incomes. On the other hand, incomes for coffee labor households changed little between the 2 periods (Table 9), to a large part reflecting the price effect on agricultural income.

### *3.5 Health and Education*

**Child malnutrition remained unchanged within coffee regions between 1998 and 2001.** Despite the fact that overall, incidences of various malnutrition measures such as stunting, wasting and underweight showed improvement during the period (national declines of 35, 11,

and 73 percent, respectively), these gains were not enjoyed equally by children of all regions.<sup>18</sup> As figures 7 and 8 reveal, the Central Rural region - where more than 80 percent of Nicaragua's coffee production is concentrated - the incidence of underweight children changed very little while for chronic malnutrition (stunting) actually appears to have slightly increased. Both malnutrition incidences for the Central Rural region were the highest in the country during both periods and these trends suggests that the coffee crisis had a negative effect on the nutritional status of children younger than 5 years in the region (in the sense of at not enjoying the gains experienced elsewhere).

**In educational outcomes, despite large increases in enrollment rates at both the primary and secondary levels, overall, primary enrollment rates among coffee households fell and secondary enrolment rates hardly changed between 1998 and 2001.** Among non-coffee households, primary net enrollment rates increased from 78 to 86 percent (Figure 9). By contrast, enrollment rates among households involved in the coffee sector in both periods decreased from 77 to 72 percent. At the same time, secondary net enrollment rates almost doubled among non-coffee (to 40 percent), while remaining essentially unchanged among coffee-sector households over the period (at around ten percent; Figure 10). While not attributing these differences solely on the coffee crisis, it is possible that these patterns reflect harmful coping strategies among coffee households. The next session addresses this issue in more detail.

**In summary, descriptive statistics suggest that households related to coffee activities did not benefit from an otherwise period of growth in Nicaragua.** In fact, most socio-economic indicators for these households have worsened between 1998 and 2001, a period that saw coffee prices declined by more than half. While accurately quantifying the impact that the coffee shock may have had is challenging, the big magnitude cast little doubt that the coffee shock had a strong impact on coffee farm households and to a smaller effect coffee

---

<sup>18</sup> Stunting (height-for-age) reflects chronic malnutrition, which results from years of retarded skeletal growth and is associated with poor economic conditions; wasting (weight-for-height) captures deficiencies in fat tissue and indicates food loss from a short-term, emergency situation; and underweight (weight-for-age) combines the previous two measures and reflects total malnutrition. A child (of usually 5 years or less) is considered "stunted", "wasted" or "underweight" if his/her corresponding anthropometric measure is two or more standard deviations below the median of the internationally recognized reference population. Also see Marini and Gagnolati 2002, and Chawla 2001.

labor households. The next section explores the various strategies that these households used to mitigate, cope or prevent the shock and the extent by which informal insurance mechanisms to smooth consumption were available.

## 4. RISK MANAGEMENT STRATEGIES AND RESPONDING TO SHOCKS

### 4.1 Do households self-insure?

**The role of risk and insurance on household behavior is well documented in the literature.**<sup>19</sup> As poor households make consumption decisions in uncertain environments, they face many risks: idiosyncratic risks that affect a specific household (illness, death, unemployment); or covariate risks that affect everyone within a particular region or group (droughts, hurricanes, terms of trade shocks or macroeconomic volatility). The question as to whether some households are better able to use formal or informal mechanisms to minimize the impact of such risks on their consumption is therefore key in designing policies that provide insurance or safety nets mechanisms.

**The previous section revealed that coffee households were adversely affected by the coffee shock in terms a number of different welfare dimensions.** In the context of the coffee shock a number of questions arise: were affected households able to protect against the negative income decline? How does their ability to insure (or not) compares with non-coffee households? Are there differences among coffee households?

**A number of empirical approaches have been used that address these questions of self-insurance and consumption smoothing.** The most common is to fit an equation that looks at how changes in consumption correlate with income changes.<sup>20</sup> The typical specification is derived from a consumption equation of the initial form:

$$\ln C_{it} = \mathbf{a} + \mathbf{b} \cdot \ln Y_{it} + \mathbf{g} \cdot X_{it} + \mathbf{h}_i + \mathbf{w}_{it} \quad (1)$$

where  $\ln C_{it}$  is the log of consumption per capita of household  $i$  in period  $t$ ,  $\ln Y_{it}$  is the log of income at time  $t$ ,  $X_{it}$  is a vector of socio-economic characteristics,  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{g}$  are parameters to be estimated,  $\mathbf{h}_i$  is a household fixed effect and  $\mathbf{w}_{it}$  is an i.i.d. error term.

By differencing equation 1 (between the two years), the specification becomes:

---

<sup>19</sup> For example, Alderman and Paxson (1992), Townsend (1994), Jalan and Ravallion (1999).

<sup>20</sup> See Townsend (1994), Ravallion and Chaudhuri (1997) and Grimard (1997) for some examples.



$$\Delta \ln C_i = \mathbf{a} + \mathbf{b} \cdot \Delta \ln Y_i + \mathbf{g} \cdot \Delta X_i + w_i \quad (2)$$

where  $\Delta$  denotes changes over the two periods of the respective variables. Estimating equation 2 will give unbiased estimates of the coefficients.

**The basic test of consumption insurance is the extent to which household income covaries with consumption.** If households are fully insured against income shocks, then changes in income do not affect consumption and  $\beta = 0$ . The extent to which  $\beta$  differs from zero indicates how insulated (or exposed) a household's consumption is to income shocks.<sup>21</sup>

**In the case of the coffee shock, an additional empirical challenge is to correctly model the coffee crisis since it is a covariate shock that only affects a subgroup of the population.** Specifically, it is important to be able to test for differentiated impacts on consumption among different types of households, based on whether they participated in coffee activities or resided in a coffee region (as defined earlier). Nonetheless, two of the coffee definitions are endogenous in the sense that the decision to enter, exit or stay in coffee is endogenous to consumption changes. As such, the final empirical strategy implemented here is to estimate coffee-group specific models using equation 2. That is, for each coffee classification, a consumption change is regressed on income changes ( $\Delta Y$ ) and household size changes ( $\Delta X$ ).<sup>22</sup> This avoids the endogeneity issue since the only interest is to test the specific group's ability to self-insure.<sup>23</sup>

**The overall results reject the full insurance hypothesis.** Estimating Equation (1) suggests that more than fourteen percent of an income shock is passed onto current consumption (Table 10).<sup>24</sup> These effects are similar by estimating this on food and non-food consumption.

---

<sup>21</sup> The intercept  $\mathbf{a}$  captures aggregate income risk.

<sup>22</sup> This is a similar estimation strategy adopted by Jalan and Ravallion (1999).

<sup>23</sup> An alternative approach would be to estimate an augmented equation 2 using coffee dummies interacted by income changes to test the full insurance model and exploring differentiated insurance ability among various coffee categories. This approach has the advantage of using the entire sample, which is attractive due to the small sample sizes of coffee categories using the specification of equation 2. While estimating this specification resulted in similar results, they are not reported due to concerns on the endogeneity of some of the coffee classifications.

<sup>24</sup> These magnitudes are consistent with the ones typically found in the literature. See also Skoufias and Quisumbing (2002).

**Estimation of equation 2 using coffee-specific models suggests that income shocks have a heterogeneous impact among different rural subgroups.** For example, using the first two coffee definitions, given an overall impact of income shocks on consumption that is similar for coffee and non-coffee households, the former are significantly less able to self-insure (Table 10). Specifically, for every dollar of income decrease, coffee-labor households decrease consumption by 22 cents while coffee labor households by 20 cents.

**Comparing self-insurance abilities for food consumption, the results indicate that coffee-labor households are vulnerable to insuring food consumption while coffee-farm households are not.** Specifically, more than 43 percent of an income shock among coffee-labor households is passed through food consumption decreases. By contrast, among coffee-farm households, the effect is not significant suggesting that income shocks do not translate into food consumption decreases. To the extent that coffee-labor households were the poorest in both periods, these findings imply that they were also the most vulnerable to income risks. As such in improving insurance mechanisms and risk reduction in rural Nicaragua, special attention on the poorer and more vulnerable populations (such as coffee labor households) may be a priority. This finding is consistent with literature from other countries that suggest that the poorest households are also those least able to smooth consumption.<sup>25</sup>

**The ability to insure non-food consumption against income shocks is smaller among coffee-farm households.** For example, among households that remained in coffee farming in both periods, non-food consumption changes decreased by 34 cents for every dollar decrease in income. A similar pattern is observed using the other coffee household definition (even though the overall magnitude is smaller).

**Interestingly, households that exited and entered the coffee sector seem to be able to “insure” against income fluctuations.** The non-significance of the income coefficient for both groups suggests that these households were better able to insulate their consumption from income shocks (Table 10).<sup>26</sup> While for households that exited the coffee sector, this could be suggesting that mobility and adaptability to changing economic conditions may be important in determining how households insure against shocks, it is unclear as to why that

---

<sup>25</sup> Jalan and Ravallion (1999).

<sup>26</sup> Similar results were obtained with changes in food and non-food consumption.

may be the case for household that entered coffee (but the small sample sizes for both groups may explain these results). Nonetheless, as discussed below, income diversification in non-agricultural activities seems to have allowed some households to stabilize consumption patterns. Understanding the process of coffee entering or exiting may therefore be important.

#### ***4.2 Risk management strategies***

**Exposure to risk in general does not necessarily translate in adverse outcomes.** In fact, if households have access to a sufficient portfolio of options that can allow them to manage the realization of risk (the shock), then exposure to risk is not an issue. This is not the case in most cases and the results above do suggest that rural households in Nicaragua are not able to fully protect themselves against risk exposure.

**As such, a better understanding of the various risk management strategies employed by rural households to cope with risks is important.** Typically it is useful to separate such strategies into ex-ante and ex-post.<sup>27</sup> Ex-ante mechanisms address what households (and to that extent, public and private instruments) can do to reduce or prevent the occurrence of risks and mitigate the impact of risk if an adverse event occurs. Some examples of ex-ante mechanisms are crop insurance, exiting a risky occupation, income diversification. On the other hand, ex-post mechanisms address the ability of households to respond after a risk has been realized (for example taking children out of school or selling assets). Exploring whether these risk management strategies and mechanisms exist or vary across different households is also instrumental for policy design.

**This section explores what strategies, if any, have allowed rural households to address exposure to various risks, with emphasis on the coffee shock.** To facilitate the analysis, in addition to ex-ante and ex-post strategies, risk management strategies are further grouped in: (i) labor market adjustments; (ii) precautionary savings; and (iii) informal insurance. In principle, all three strategies can be both ex-ante and ex-post. Finally exiting the coffee sector as a response to the shock is also considered as a coping strategy.

**Empirically, there are a number of approaches to explore the role of various risk management mechanisms on household welfare.** Typically, data on a household's

---

<sup>27</sup> Holzmann and Jorgensen (2000).

response as a result of realized risks can be used to assess the existence and use of the various mechanisms mentioned above. Since the Nicaragua survey did not collect such information a few alternative methodological strategies are implemented. Denoting  $Z$  to be a vector of potential risk management instruments available to the household the initial period (for example assets, labor supply), the first approach entails estimating a consumption growth model of the form:

$$\Delta \ln C_i = \mathbf{d}_0 + \mathbf{d}_1 \cdot X_i + \mathbf{d}_2 \cdot Z_i + \mathbf{n}_i \quad (3)$$

where  $X_i$  and  $Z_i$  are as previously defined above,  $\mathbf{d}_0, \mathbf{d}_1$  and  $\mathbf{d}_2$  are parameters to be estimated and  $\mathbf{n}_i$  is an i.i.d. error term.

**Estimating equation 3 can allow indirect inferences on the existence of a particular risk management instrument vis-à-vis consumption growth.** Specifically, testing whether a specific instrument  $Z$  is correlated with consumption growth over the period is interpreted as weak evidence of a positive role for that instrument in addressing risk. For example, finding a positive relationship between the initial level of remittances and consumption growth is interpreted as evidence that migration was a potentially important strategy for households (and possibly against exposure to risk). As with the insurance models above and due to the similar endogeneity concerns, equation 3 is estimated for each of the coffee definitions separately so as to assess the existence of risk management instruments among each specific subgroup. The results are presented in Tables 11 through 19, the dependent variable being the change in total, food, and non-food consumption, respectively.

**A second approach is to directly test whether a household used a specific coping instrument.** Empirically this can be implemented by estimating a probability model of the form:

$$\text{Prob}(\Delta Z_i = 1) = f\left(\sum_{k=1}^{K-1} \mathbf{q}_k \cdot \text{Coffee}_{ik} + \mathbf{x}_i\right) \quad (4)$$

where  $\Delta Z_i$  denotes a positive use of that risk management instrument. For example,  $\Delta Z_i$  could be the change in a household's child labor allocation over the period. In this case, by

differentiating among households based on their affiliation with coffee activities, a positive  $q$  for say, coffee laborers, would suggest that these households were more likely to engage in harmful coping mechanisms such as child labor due to the coffee shock. To further explore coping abilities among coffee households, equation 4 is also estimated controlling for whether a household was poor in 1998, capturing heterogeneous coping ability between poor and less poor coffee households. The results for these estimations are presented in Tables 20 through 23.

The results from both approaches described above, complimented by descriptive statistics are summarized below.<sup>28</sup>

### ***4.3 Labor market adjustments***

**Household diversification in non-agricultural activities plays an important role for rural welfare and coping with shocks.** Non-coffee households that were more income diversified in 1998 (measure by the number of different agricultural and non-agricultural income sources in the household) were more likely to experience consumption growth (for example Tables 11, 13 and 14).<sup>29</sup> By contrast, diversification among coffee labor and farm households did not affect consumption growth. One important distinction that may explain these patterns is the observation that while non-coffee households were diversified in both agricultural and non-agricultural activities, coffee households were mainly “diversified” only within the agricultural sector (Tables 4 and 8, Figures 11-13). As such, these patterns suggest that access to non-agricultural activities may be a key instrument for both risk mitigation and consumption growth in general.

**Consistent with the above, examination of income portfolio adjustments indicates that households that increased non-agricultural incomes fared better.** For example, among households that exited coffee over the period, the main income increases were due to

---

<sup>28</sup> All models discussed in this section also control for municipality level fixed effects, and whether the household resides in a hurricane Mitch affected municipality, the other covariate shock during this period.

<sup>29</sup> This is consistent with Beneke and Gonzalez-Vega (2000) who find positive effects of income diversification on income growth in El Salvador.

increases in non-agricultural income (Table 8 and Figure 13). In addition, while coffee labor households who exited coffee mainly diverted their efforts to non-agricultural labor (wage) activities, coffee farm households that exited coffee shifted labor to non-agricultural enterprises (self-employment). This is indicative of the constraints for poorer households (coffee labor) to take advantage of higher return occupations in the non-agricultural sector. Nonetheless, the fact that these households did exit coffee highlights the importance of understanding the determinants of both upward income mobility and the ability to diversify into non-agricultural activities.

**The empirical results also imply that coffee households engaged in harmful coping activities via increases in child labor, directly affecting school enrollment.** Over the period of the study, child labor incidence increased in rural Nicaragua by 24 percent (Figure 14). While this incidence has decreased among coffee households (Figure 14), the average total weekly hours worked by children among coffee households significantly increased compared with a decrease for child workers in non-coffee households (Figure 16 and 17).<sup>30</sup> In addition, households residing in the high coffee intensity region were significantly more likely to increase child labor (Table 21). Consistent with these trends, school attendance decreased among children in coffee households while it increased for non-coffee households (Figures 9, 10 and 18).

**The use of child labor as a coping strategy was more prevalent among coffee farm households.** In particular, even though children working in labor and farm households both worked more and went to school less, the impact in terms of increases in hours worked was stronger among coffee farm households (Figure 16 and 17). This is also confirmed by looking at the results in equation 4 that imply that coffee farm-households were up to 21 percent more likely than non-coffee households experience child-labor increases (Tables 20 and 21). These patterns raise serious issues about the need of policy interventions that can protect children's human capital against adverse shocks.

---

<sup>30</sup> The labor force participation among coffee households may be due to a shrinking demand for labor, corroborated by the higher unemployment rate among coffee households (Figure 15).

**While partial evidence seems to suggest that remittances are important for consumption smoothing, migration per-se does not seem to be a widespread strategy adopted among coffee households.** While the empirical results of equations 3 suggest that both coffee and non-coffee households receiving remittances in 1998 were more likely experience non-food consumption growth (Tables 13, 16 and 19), the results from the coping equation 4 imply that migration was not a coping strategy implemented by coffee households (Tables 20-23).<sup>31</sup>

#### **4.4 Precautionary savings**

**In addition to adjustments to income portfolios, precautionary savings can help households cope with shocks allowing them to liquidate available assets.** Still, coffee labor households were the most asset-poor among all households in rural Nicaragua. As such, their ability to use such assets to cope with shocks was limited. By contrast, coffee farmers during 1998 were among the wealthier households in terms of asset holdings. Exploring the changes of various assets like land or livestock indicates that some of these assets were used as coping mechanisms, still in a limited way (Figures 19-22).

**Furthermore, equation 4 suggests that poor farmers were less likely to use assets in response to the coffee shock.** By differentiating between coffee poor and non-poor households based on their 1998 classifications, the results suggest that poor coffee farmers were 13 percent less likely to sell land and 9 percent less likely to sell (or consume) cattle compared to non-poor coffee farm households (Table 21). Interestingly, poor coffee households were more likely to experience decreases in the number of poultry owned, suggesting partial coping via own animal consumption (Tables 20, 21 and Figure 21). These trends overall indicate the importance of assets and highlight the limited capacity among poorer households to use physical assets as a major coping strategy.<sup>32</sup>

---

<sup>31</sup> Nonetheless, migration as a coping strategy was suggested during various informal interviews in rural Nicaragua and it consistent with similar studies such as Beneke and Gonzalez-Vega (2000) who find that the existence of international migrants within a household was correlated with higher income growth during a downturn in agricultural production in El Salvador.

<sup>32</sup> This finding is similar to results in Conning, Olinto and Trigueros (2000) who find that households owning land or other productive assets were better able to protect their income during economic downturns.

#### 4.5 Informal insurance

**The use of informal insurance mechanisms can be another instrument by which household may use to address shocks.** For example, informal social networks established by households through memberships in civic, religious, or neighborhood organizations can provide them an alternative source of resources in the event of an adverse shock. In addition, strong ties with migrant household members of relatives may result help in the form of remittances or informal gifts during crises.

**The empirical analysis shows that at least partially, the role of family networks is important.** As discussed earlier, remittances (used as a proxy for the existence of a family network) were positively correlated with non-food consumption growth for both coffee labor and labor households (Table 16). The impact seems to be stronger for coffee labor households implying that informal coping mechanisms may be more important for the poorer coffee households.

#### 4.6 Exiting coffee

**As indicated earlier, a significant number of households in the survey exited the coffee sector during this period.** This “exit option” was higher among coffee laborers partially explained by the short run inability of coffee farmers to exit the coffee sector due to their land commitment to the coffee production (Table 24). The observation that households that exited coffee did overall better in terms of (socio)-economic outcomes suggests that that it would be useful to explore the attributes of those exiting in order to understand the characteristics associated with higher mobility to get out of coffee. While the data does not permit the distinction between those households that exited coffee due to lack of jobs or farm business failure with those that have used exit as a risk management strategy, a model exploring a number of initial (1998) characteristics and how they correlate with the exit decision of the following is estimated as follows:

$$\text{Prob}(\text{ExitCoffee}_{i,2001} | \text{Coffee}_{i,1998} = 1) = \mathbf{I}_0 \cdot \mathbf{W}_i + \mathbf{I}_1 \cdot \text{Coffee}_k \mathbf{b} + \mathbf{I}_2 \cdot (\mathbf{W}_i' \cdot \text{Coffee}_k) + \mathbf{p}_i \quad (5)$$

where  $\mathbf{W}$  is a vector of initial (1998) household and regional attributes and  $\text{Coffee}_k$  is a dummy identifying coffee farmers capturing a differentiated impact of an attributing between



coffee labor and farm households. As earlier,  $I_0$ ,  $I_1$  and  $I_2$  are parameters to be estimated while  $P_i$  is an i.i.d. error term. The estimation also uses municipality level fixed effects. Table 25 presents the results.

**Assets, wealth status and income diversification in non-agricultural jobs are important correlates with a household's ability to exit coffee.** Less poor households were more likely to exit coffee suggesting that poorer households are less mobile. In addition, conditional on whether a household is a coffee laborer or farmer, higher consumption increases the probability for coffee laborers to exit coffee compared to farm coffee households (see also Figure 25). Similarly, while farm households were less likely to exit (since by definition their land investment in the production process is fixed), after controlling for land size, larger farmers were more likely to exit the coffee sector, indicating that if land can be interpreted as wealth, assets are important in allowing households engage in new activities. Finally, coffee households that were more income diversified in non-agricultural activities were more likely to exit coffee. This is consistent with the earlier findings that show that the ability to enter the non-agricultural sector has been key in mitigating the negative shocks of the shock.

**Access to credit is associated with a higher probability to exit coffee.** The role of credit can be crucial in mitigating the impact for shocks by both helping to cope and diversify in other activities. Credit has a stronger impact on the probability to exit coffee among labor coffee households as opposed to farmers, perhaps highlighting the lack of assets among coffee labor households.

**Finally, a number of attributes describing the local economic context are correlated with exiting coffee.** For example, distance to Managua or residing within the coffee region are both negatively correlated with the probability to exit coffee. Both of these attributes capture the existence of non-coffee activities and opportunities (in addition to controlling for the shock for the latter). Interestingly, residing in a region affected by hurricane Mitch also decreases the probability of exiting the coffee sector, presenting an example of the adverse effect of multiple shocks on households.<sup>33</sup>

---

<sup>33</sup> Hurricane Mitch hit the region in October 1998, right after collection of the first survey.

**While separating the decision to exit from a forced exit is challenging, these findings seem to indicate the critical importance of assets and opportunities on upward mobility and coping capacity.** They reinforce the fact that in the presence of shocks, those households that can protect themselves using instruments that either detach them from exposure to risk or minimize its impact if the risk is realized, are better able to cope.

#### ***4.7 The role of ex-ante risk management***

**To summarize the results in this section, coffee households have used a mixture of coping mechanisms in response to the coffee crisis.** While harmful coping mechanisms such as increases in child labor and - to a lesser extent - selling or consuming physical and animal assets were utilized among coffee households, a number of ex-ante management instruments such as exiting coffee, receiving remittances or income diversification were also used (Table 26).

**While a formal test cannot explicitly compare the two, the findings suggest that households that used ex-ante as opposed to ex-post mechanisms were better insulated from the coffee shock.** For example, since much of the explanatory variables in the consumption growth models are all based on the initial pre-crisis household income strategies, their positive role on consumption growth can be interpreted as the realization of ex-ante risk management actions taken by these households. For example, by diversifying the income sources or having migrant members before the coffee shock, coffee households were better able to mitigate the adverse impact of the crisis. Similarly, higher education (using the maximum level of education in the household in 1998) was associated with a four percent increase in consumption growth, which -while not testable - is consistent with the hypothesis that human capital may have allowed households to mitigate the negative impact from the crisis by either finding higher return occupations or increasing farm efficiency. Comparing the effectiveness of ex-ante and ex-post strategies is beyond the scope of this study. Still, the dominant role of ex-ante strategies among coffee households for consumption smoothing and the observation that households that predominantly used ex-post coping mechanisms did worse suggests that, at least qualitatively, ex-ante strategies have been more effective.

## 5. SHOCKS, VULNERABILITY AND MOBILITY

**The previous sections outlined the extent by which the coffee crisis has affected rural households and explored the various mechanisms affected households utilized to cope with the shock.** While households do not seem to be able to fully insure against unanticipated income fluctuations, a number of coping strategies were used among rural coffee households that mitigated the impact of the coffee shock. For households affected by the coffee crisis, a heterogeneous set of mechanisms such as ex-ante income diversification or ex-post increases in child labor have allowed households to deal partially with the shock.

**Nonetheless, prioritizing among the identified strategies and mechanisms explored above is a complex task.** For example, the results suggest that the coffee shock had a bigger impact on farmers rather than labor households. Still, coffee farmers had the lowest poverty rates, highest level of assets while labor households are chronically poor. As such, further exploring the linkages between shocks and poverty dynamics may allow building a more comprehensive policy agenda.

### *5.1 Poverty dynamics*

**To this end, this section provides an analysis on the impact of shocks on poverty dynamics.** Specifically, two questions are addressed: (i) has the coffee shock increased household vulnerability to decreases in welfare; and (ii) did the ability of households to escape poverty (mobility) changed due to the shock?

**In the case of rural Nicaragua, poverty is dynamic.** For example, between 1998 and 2001, almost a third of non-coffee households moved in and out of poverty (Table 27, Figures 23 and 24). In addition, non-coffee households were less likely to exit poverty (upward mobility) than falling into poverty, consistent with the overall poverty rate decreases observed during this period.

**In addition, a number of interesting patterns related to the coffee shock emerge with respect to poverty changes.** First, while almost a third of coffee farm households experienced similar movements in and out of poverty compared with the overall trends

above, they were more likely to enter poverty (Table 27). In addition, coffee labor households were virtually trapped in chronic poverty. Almost 90 percent of coffee labor households remained in poverty and experience little upward mobility.

**Coffee households were also more likely to experience a consumption decrease.** Only ten percent of non-coffee experienced a fall in their “ranking” in terms of consumption quintiles (Table 28). This compares with a quarter of coffee labor households and half of the coffee farmers. In addition, comparing households based on whether consumption in general decreased over the period, while almost 40 percent of non-coffee household experienced consumption decreases, more than two thirds of coffee farm households and 56 percent among coffee labor households suffered a drop in consumption.

**These results indicate that the coffee shock may have affected coffee households’ ability to enter or exit poverty.** Further exploring how the coffee shock may have affected these dynamics is addressed below.

## *5.2 Vulnerability to poverty*

**Vulnerability is a dynamic concept capturing the probability that a household will experience a negative loss in its welfare.**<sup>34</sup> The main idea of vulnerability is that it measures a household’s ability to insure or protect against exposure to risk. In fact, while exposure per se is not sufficient to infer vulnerability, observing a differential behavior among exposed households or between exposed and non-exposed households is indicative of the degree that a household will suffer welfare losses in the event of the risk being realized, therefore measuring its vulnerability to risk exposure.

**For the purposes of the study, three definitions for vulnerability are used:** (i) the likelihood that a household’s consumption fell below the poverty line during the two periods covered by the data; (ii) the probability that a household’s experienced a decrease in its consumption level; and (iii) the probability that a household’s initial ranking based on consumption quintiles decreased. To address the first definition, the following model of the

---

<sup>34</sup> Holzmann 2001.

probability that a household - which was *not* poor in 1998 - entered poverty in 2001 is estimated:

$$\text{Prob}(C_{i,2001} < \text{PovLine}_{2001} \mid \text{Poor}_{1998} = 0) = \sum_{k=1}^{N-1} \mathbf{V}_k \cdot \text{Coffee}_k + \mathbf{r} \cdot X_i + \mathbf{y} \cdot Z + \mathbf{t}_i \quad (6)$$

where  $\text{Coffee}_k$ ,  $X_i$  and  $Z_i$  are as defined earlier,  $\mathbf{t}_i$  is an i.i.d. error term. In addition, while  $\mathbf{V}_k$  tests whether a household's exposure to the coffee crisis increase the probability (and therefore vulnerability) to fall into poverty,  $\mathbf{r}$  and  $\mathbf{y}$  reveal the extent where a number of household attributes are correlated with vulnerability to poverty.<sup>35</sup>

**Similarly, using the second definition, the probability that household  $i$  experienced a fall in consumption level is given by:**

$$\text{Prob}(C_{i,2001} < C_{i,1998}) = \sum_{k=1}^{N-1} \mathbf{V}_k \cdot \text{Coffee}_k + \mathbf{r} \cdot X_i + \mathbf{y} \cdot Z_i + \mathbf{t}_i \quad (7)$$

while for the last definition, the probability that a household's consumption ranking fell can be estimated using:

$$\text{Prob}(\text{Quintile}_{i,2001} < \text{Quintile}_{i,1998}) = \sum_{k=1}^{N-1} \mathbf{V}_k \cdot \text{Coffee}_k + \mathbf{r} \cdot X_i + \mathbf{y} \cdot Z_i + \mathbf{t}_i \quad (8)$$

The results from these models are presented in Table 29.

**Households residing in the coffee region were more vulnerable to welfare losses, suggesting that the coffee shock increased vulnerability.** While participation in the coffee sector (using the initial coffee classification) did not have statistically significant effect in household's vulnerability to welfare loss, the regional coffee definition suggest that households in the coffee region were more likely to experience a fall in consumption (Table 29). This finding implies that exposure to the coffee shock risk has increased vulnerability to welfare losses among exposed households.

---

<sup>35</sup> To control for municipal-level characteristics related to the coffee crisis, the regression also includes the municipality-level intensity in coffee production.

**Exploring further the concept of vulnerability to poverty and consumption loss, a number of interesting points arise.** For example, higher levels of education significantly reduce vulnerability to poverty. This reinforces the importance of human capital accumulation as an ex-ante instrument to minimizing vulnerability. In addition, residing in a municipality affected by hurricane Mitch increases the probability that a household will experience reductions in welfare. Again, this confirms the hypothesis that shocks negatively influence poverty dynamics, in this case vulnerability.

### *5.3 Upward mobility*

**An alternative exercise in understanding poverty dynamics is to explore the factors that are correlated with households' mobility to exit poverty.** To address this, a model of the probability that a household exited poverty in 2001 conditional on being poor in 1998 is estimated:

$$\text{Prob}(C_{i,2001} > \text{PovLine}_{2001} | \text{Poor}_{1998} = 1) = \sum_{k=1}^{N-1} \mathbf{V}_k \cdot \text{Coffee}_k + \mathbf{r} \cdot X_i + \mathbf{y} \cdot Z + \mathbf{t}_i \quad (8)$$

where the regressors are the same as in equation 6 and 7. The results are discussed below.

**Households residing within coffee regions were less likely to exit poverty.** Mirroring the results on vulnerability, while the household-level classifications of affiliation in coffee activities were not significant, this finding illustrates the aggregate impact of the exposure to the coffee crisis in upward mobility (Table 29).

**A number of other factors are correlated with the ability to exit poverty.** First, income diversification increases the probability to exit poverty (Table 29). This provides empirical support to the current policy efforts to promote diversification in rural areas, as it indicates that it is not only a successful coping strategy (among coffee farmers) but also important in enhancing upward income mobility.<sup>36</sup> It is also important to point out, however, that the diversification measure used here refers to income from different sources (agriculture, non-agriculture, wage and self-employment), and not to diversification in agricultural production.

---

<sup>36</sup> Ministerio Agropecuario y Forestal (2003), Varangis et. al (2003).

Indeed, an alternative specification using crop diversification found no significant correlation with poverty dynamics.

**In addition, households receiving remittances were more likely to exit poverty.** This result indicates that migration as a strategy to access higher-return opportunities, is important for economic mobility and reinforces the role of social capital and informal networks in poverty alleviation. Furthermore, both human capital (education) and physical (land) assets were also positively correlated with exiting poverty. Finally, distance from Managua is inversely related to the ability to exit poverty. To the extent that this captures the local economic environment, it shows that more isolated areas offer fewer income options for households.

**To summarize the poverty dynamics analysis vis-à-vis the coffee crisis, predicted probabilities to fall or escape poverty are calculated.** First, households affiliated with the coffee sector were the most vulnerable to decreases in welfare and least mobile to exit poverty compared to non-coffee households, suggesting that the coffee crisis has indeed affected their mobility and vulnerability (Table 30). These results are robust as they hold independent of the coffee definition or typology used.<sup>37</sup>

**Finally, while coffee laborers –the poorest rural group in the survey - were the most adversely affected with respect to vulnerability and mobility with respect to poverty, coffee farmers were mostly affected in terms of the probability to experience consumption declines.** These results, suggest that while for coffee farmers the shock may have been more transitory in nature, it may have accentuated poverty traps among the chronically poor coffee laborers. This raises the need for distinct policy interventions for each of the two groups.

---

<sup>37</sup> The probability to exit poverty among non-coffee households is not statistically significant with that of coffee-farm households using the initial coffee classification.

## 6. PUBLIC RESPONSE TO THE COFFEE CRISIS

While Government and private support for the coffee sector was significantly delayed in Nicaragua, a number of programs addressing the coffee crisis have since been established. A short summary is presented below.

### *6.1 Debt restructuring*

**By 2002, coffee-farm debts totaled approximately US\$105 million in Nicaragua.**<sup>38</sup> As the ability of coffee farmers to repay these loans diminished, it presented a potential crisis in the country's already stressed financial system. As such, the Government intervened by promoting, coordinating and providing funds for different debt-restructuring programs.

**These programs varied according to the type of debt held by a coffee producer, with the following main restructuring categories being created:** (i) debts to solvent commercial banks (US\$55 million – 684 cases); (ii) debts to bankrupt commercial banks (US\$32 million – 665 cases); (iii) debts to micro-finance organizations (US\$6 million – 7,520 cases); and (iv) debts to exporting firms (US\$12 million – 2,300 cases). The first two categories targeted mainly medium and large coffee farmers (with farms sizes of at least 20 manzanas), the third focused on small farmers (5 manzanas or less) while the final category did not distinguish based on farm size. It is important to note that the majority of the government restructuring schemes (more than 80 percent) has focused on large coffee farmers.

**As of May 2003, 100% of the debts in categories (i) and (iii) had been resolved, where the Government played an active role.** While the Government did not get involved in restructuring producers' debts to exporting firms (category iv), these appear to be getting resolved in an efficient manner by the stakeholders (usually an exporting firm and a producer).

---

<sup>38</sup> Nicaraguan Coordination and Strategy Secretariat of the Presidency (SECEP).



## *6.2 Social protection interventions*

**The Government of Nicaragua implemented a “Food-for-work on Coffee Farms” program through the Ministry of Agriculture (MAGFOR).** The program took place in 2002 in 21 coffee municipalities, costing US\$574,336 and providing family food rations to 8,212 households: 6,317 of them were small coffee farm owners (6 *manzanas* or less), and 1,895 were coffee farm workers. Participating households received the food complement in exchange for working on various activities on coffee farms.<sup>39</sup>

## *6.3 Indirect benefits from existing (non-coffee specific) programs*

**A number of existing public programs may have indirectly mitigated the impact of the coffee crisis.** First, the Government’s “Libra por Libra” program which started in 2002 has led to higher productivity of small farmers’ production of basic grains for own-consumption via the disbursement of genetically improved and certified seeds for basic grain production, and technical assistance. An estimated 72,000 small farmers, many of which reside in coffee regions have participated in the program. During 2003, and in part due to the coffee crisis, MAGFOR doubled the amount of seed distributed in some coffee regions.<sup>40</sup>

**In addition, the “Red de Proteccion Social”, a conditional cash program in Central Nicaragua that supplements poor rural households’ incomes seems to have mitigated the adverse impact of the coffee shock.** In particular, a recent impact evaluation of the program finds that program beneficiary households involved in the coffee sector have fared better in a number of socio-economic outcomes compared to non-participating coffee households.<sup>41</sup>

## *6.4 Support from other agencies*

**USAID financed a US\$2.5 million coffee relief, food-for-work initiative in 2002.** The program’s objectives was to provide relief to unemployed coffee laborers, provide incentive

---

<sup>39</sup> Prior to this program, the Government financed a small scale workfare program benefiting 300 coffee workers (representing about 1,000 family members) in 2001.

<sup>40</sup> MAGFOR.

<sup>41</sup> Maluccio (2003).

to coffee farmers to continue employing their full-time labor force on a full-time basis, ensure that essential crop maintenance is performed and provide limited support to rehabilitate public infrastructure. An estimated 13,394 coffee laborers in ten coffee municipalities benefited from the USAID program.

**Finally, the German government's assistance agency (KDR) financed a large infrastructure project to increase the supply of potable drinking water in the departments of Jinotega and Matagalpa. This project was initiated in 2001, and it generated approximately 10,000 to 15,000 temporary jobs, potentially coffee laborers.**

**While the programs described above may have temporarily alleviated some of the adverse impacts of the coffee crisis, it is unclear as to whether they have fully addressed its structural nature. In fact, none of the coffee-specific programs discussed above seem to have had a long-term objective but instead aimed at addressing the short run coping capacity of affected households. In addition, the majority of the public resources were targeted in a regressive way, mainly directed to medium and large coffee farmers.**

## 7. MOVING FORWARD: LESSONS FOR CONSTRUCTING A POLICY AGENDA

Using household level panel data from Nicaragua, this paper explores the impact of the recent coffee crisis on rural households engaged in coffee production and coffee labor work. Taking advantage of the panel structure of the data, a number of findings emerge: (i) while overall growth between 1998 and 2001 was widespread in rural Nicaragua, coffee households saw large declines in various socioeconomic outcomes; (ii) small coffee-farm households were affected the most, and not poor labor households as previously expected; (iii) among the various risk management strategies coffee households used to address the shock, pre-shock, ex-ante strategies (like income diversification) were more effective in allowing coffee households insulate against the shock. By contrast, the coffee households that used ex-post coping instruments did not manage to mitigate the adverse impact as well, with additional potential long run implications via extensive uses of harmful coping strategies (like increases in child labor); and (iv) the coffee shock affected upward mobility and downward poverty vulnerability.

Based on the finding above, a number of lessons emerge in terms of pushing forward the policy agenda related to the coffee crisis and shocks in general. They are discussed below.

### 7.1 *“Understand the shock and those affected”*

**Initial attention on the coffee crisis focused on the impact of the shock on labor employment.** The analysis shows that it was small coffee farmers, rather than poor coffee laborers, that appear to have experienced the most serious effects from the crisis. This was partly due to the fact that while labor workers were mobile in moving from coffee employment to other low paying labor jobs, coffee farm households were stuck in long-term perennial investments with little flexibility to complement their incomes.

**These insights have important implications about the choice of a short-run safety net one could potentially consider.** While shocks that result in open unemployment are typically addressed through workfare programs by providing support to unemployed workers until renewed labor demand draws them back into the labor market, the fact the laborers were able to substitute for potential labor losses via alternative low paying job opportunities seems to imply that such

interventions were not necessarily critical. By contrast, while the immediate debt relief efforts discussed above may have allowed large farmers to cope with falling coffee prices and cost increases, the low participation in such programs by small scale farmers and the lack of alternative coping mechanisms for them seems to explain to a large extent the large welfare impacts of the crisis on these small, immobile farm households. As such, understanding which populations shocks affect and how is key for designing appropriate interventions.

### ***7.2 “While households use a diverse set of informal risk management instruments, they are only partially effective”***

**Coffee households used a multitude of risk management mechanisms to address the crisis.** Some examples include informal support systems such as receiving remittances from family, income diversification to sales of assets (land or animals) or sending children to work. Nonetheless, the absence of formal insurance instruments available to these households implies that such self-insurance and risk management instruments are unlikely to be fully effective in protecting them from risk exposure. Indeed, the results indicate that coffee households, especially the poorer coffee-labor ones, were extremely vulnerable to insuring food consumption, with more than 43 percent of the income shock among coffee-labor households being passed through food consumption decreases (and 13 percent among coffee-farm households). Such findings reinforce the need for improving formal insurance mechanisms and enhancing informal risk management instruments. They also suggest that interventions should pay special attention on the poorer and more vulnerable populations.

### ***7.3 “Enhancing households’ ex-ante set of risk management instrument base is crucial”***

**The findings suggest that households that used ex-ante as opposed to ex-post mechanisms were better insulated from the coffee shock.** For example, coffee household that diversified their incomes, invested in human capital or exited the coffee sector altogether before the crisis hit (and thus fully dissociated themselves from the coffee risk exposure) were better positioned to deal with the coffee crisis. By contrast, coffee households that did not have the ability or did not use such risk management instruments were not only affected worse, but they also used some coping mechanisms with potential long-term adverse

implications (such as taking children out of school). Policies that enhance the ability and adoption of ex-ante risk management strategies should therefore be at the center of the policy agenda.

#### *7.4 “Shocks influence long run welfare dynamics”*

**Coffee households were the most vulnerable to fall into poverty and the least mobile to exit poverty by taking advantage of the overall growth in rural Nicaragua over the period of the study.** Still, while coffee farmers were affected the most in terms of levels, even after the crisis hit they were still among the wealthiest rural groups in Nicaragua. By sharp contrast, coffee laborers – by far the poorest rural group in the survey - were the most adversely affected with respect to their increased probability to fall and lower probability to exit poverty. These insights seem to indicate the distinction between the impact of shocks with respect to chronic and transient poverty. To some extent, while for coffee farmers the shock may have been more transitory in nature, it may have accentuated poverty traps among the chronically poor coffee laborers. This raises the need for distinct policy interventions for each of the two groups better addressing structural versus transient poverty. Some potential areas for further exploration on this comes out of the analysis by observing the various factors that are correlated with the ability to fall or exit poverty. Such factors include the role of human capital and its importance as an ex-ante instrument to minimizing vulnerability and enhance upward mobility, the ability to have a diverse income portfolio by including non-agriculture income sources or the role of the local context and infrastructure in providing alternative income opportunities to risk exposed households.

#### *7.4 “Long-run investments for short-run protection?”*

**While not a direct outcome from the study, some of the insights seem to suggest that longer-term** interventions such as cash transfers conditional on household investments in household members’ (such as children) health and education can partially allow households affected by shocks to better cope with shocks by insulating them from their adverse impacts. Indeed, “Red de Protection Social” beneficiary households involved in the coffee sector seem to have fared better in a number of socio-economic outcomes compared to non-participating coffee

households (such as the significant higher children's education attainment outcomes among beneficiary households).<sup>42</sup>

**Such programs are not designed to deal with shocks and are not “insurance” schemes per se.** Still, the observed positive impact in the coffee crisis example suggests that by incorporating risk exposure in the design of such programs' eligibility rules, or by allowing additional flexibility in terms of scaling up or down such interventions to address large shocks on-demand is worth further examination to understand whether these programs can serve as alternative risk management instruments.

### ***7.5 “Agricultural interventions: structural shocks require structural changes”***

**While this is beyond the scope of the paper, a number of insights with respect to the potential role of agricultural or coffee-industry specific interventions can be outlined.**

First, improving crop insurance schemes seems to be an important direction for further analysis. Introduction of such a market based ex-ante instrument can greatly improve households' ability to make decisions under uncertainty. This issue still remains highly understudied. Second, promoting product differentiation in coffee is another area for policy discussion. In fact, the fact that only ten percent of the current coffee production in Nicaragua is specialized (e.g. organic, fair trade) suggests that at least exploring its feasibility and pre-requisites of scaling up such practices is crucial.<sup>43</sup> In addition, enhancing marketing practices and channels by promoting local and external demand also seem important areas for policy design and intervention. Finally, as the analysis shows, facilitating coffee households to exit the coffee sector altogether may be a desired policy. To the extent that such a policy can be targeted at small farmers that engage in lower quality coffees or farm in marginal lands, complemented by promoting alternative livelihoods for such households seems to be a direction by which policy can strengthen household adaptability and mobility. Such structural changes can only be part of large comprehensive vision for rural development, poverty reduction and risk management schemes and as such, adapting these to the specifics parameters of regional and household realities will be essential.

---

<sup>42</sup> Maluccio (2003).

<sup>43</sup> Varangis (2003).

## REFERENCES

- Beneke de Sanfeliu, Margarita and Claudio Gonzalez-Vega. 2000. "Dynamics of Rural Household Incomes in El Salvador: 1995 – 1997 Panel Results," Mimeo.
- Chawla, Mukesh. 2001. "Malnutrition Among Pre-School Children." Background paper for *Nicaragua Poverty Assessment, Vol. II*, Report No. 20488-NI, The World Bank, Washington, D.C.
- Conning, Jonathan, Pedro Olinto, and Alvaro Trigueros. 2001. "Managing Economic Insecurity in Rural El Salvador: The role of asset ownership and labor market adjustments," Williams University – Economics Department Working Paper Series, Williamstown, Ma.
- Davis, Benjamin and Marco Stampini. 2002. "Pathways towards prosperity in rural Nicaragua; or why households drop in and out of poverty, and some policy suggestions on how to keep them out," FAO and Scuola Sant'Anna, Pisa.
- Glewwe, Paul and Gilette Hall. 1998. "Are some groups more vulnerable to macroeconomic shocks than others? Hypothesis tests based on panel data from Peru." *Journal of Development Economics*. Vol. 56, pp.181-206.
- Grimard, F. 1997. "Household Consumption Smoothing Through Ethnic Ties: Evidence from Cote d'Ivoire," *Journal of Development Economics*, 53, August 1997: pp. 391-422.
- Holzmann, R. and Steen Jorgensen. 2000. "Social Risk Management: a New Conceptual Framework for Social Protection and Beyond." Social Protection Discussion Series No. 0006. The World Bank, Washington, D.C.
- Inter American Development Bank. 2001. *Transición Competitiva para el Café Centroamericano: Crisis Internacional del Café y su Impacto en Nicaragua*, Mimeo, Washington, D.C.
- Jalan, Jyotsna and Martin Ravallion. 1999. "Are the poor less well insured? Evidence on vulnerability to income risk in rural China," *Journal of Development Economics*, Vol.58, pp. 61-81.

- Klugman, Jeni, Diana Kruger and Kate Withers. 2002. "Consumption Risk and Smoothing During Disasters: The Case of Hurricane Mitch in Nicaragua." The World Bank, Mimeo.
- Lardé de Palomo, Anabella, Claudio Gonzalez-Vega, and Aida Argüello de Morera. 2000. "Household Integration to the Market as a Determinant of Rural Incomes in El Salvador," Working Paper No.00P15, Ohio State University, Department of Agricultural, Environmental, and Development Economics, BASIS Research.
- Maluccio, J. 2003. "Coping with the Coffee Crisis: in Central America: the Role of the Nicaraguan Social Safety Net Program. IFRPI mimeo.
- Marini, Alessandra and Michele Gragnolati. 2002. "Malnutrition and Poverty in Guatemala." Policy Research Working Paper No.2967, The World Bank.
- Ministerio Agropecuario y Forestal. 2003. "Estrategia para reconversión y la Diversificación Competitiva de la Caficultura en Nicaragua." Mimeo.
- Narayan, Deepa. 1999. "Bonds and Bridges: Social Capital and Poverty." The World Bank, Poverty Group PREM.
- Ravallion, M. and S. Chaudhuri. 1997. "Risk and Insurance in Village India: Comment," *Econometrica*, 65 (1), January 1997: pp. 171-184.
- Skoufias, Emmanuel and Agnes R. Quisumbing. 2002. "Consumption Insurance and Vulnerability to Poverty: A Synthesis of the Evidence from Bangladesh, Ethiopia, Mali, Mexico, and Russia." Mimeo.
- The World Bank. 2003. *Nicaragua Poverty Assessment: Raising Welfare and Reducing Vulnerability*. Report No. 26128-NI, The World Bank, Washington D.C.
- Townsend, Robert M. 1994. "Risk and Insurance in Village India," *Econometrica*, 62, May 1994, pp. 539-91.
- Varangis, Panos, Paul Siegel, Daniele Giovannucci, and Bryan Lewin. 2003. "Dealing with the Coffee Crisis in Central America: Impacts and Strategies." The World Bank, Policy Research Working Paper No. 2993.



## Appendix 1: TABLES AND FIGURES

**Table 1: Rural households coffee typology (sample sizes)**

Non coffee - no household involvement in coffee activities in either year	1022
Exit coffee – involved in coffee activities in 1998 not in 2001	104
Enter coffee – not involved in coffee activities in 1998, yes in 2001	117
In coffee – both 1998 and 2001	112
Total	1355

Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001.

**Table 2: Rural sample structure, extended coffee categories (sample sizes)**

		2001			Total
		Non-coffee	Coffee-labor	Coffee farmer	
1998	Non-coffee	1022	62	55	1139
	Coffee-labor	66	31	11	108
	Coffee farmer	38	11	59	108
	Total	1126	104	125	1355

Sources: Nicaragua LSMS 1998 and 2001

**Table 3: Regional coffee definition using coffee intensity (sample sizes)**

Low coffee intensity (< 1.3 % of total cultivated land)	765
Medium coffee intensity (between 1.4 and 10.7 % of total cultivated land)	302
High coffee intensity (> 10.8 % of total cultivated land)	288
Total	1355

Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001.

The cultivated land percentages correspond to the quintiles of municipalities' share of cultivated land in coffee. In particular, the first 3 quintiles define the low intensity region, the fourth the medium and the fifth (highest) the high intensity region.

**Table 4: Selected household characteristics, 1998**

	Non-Coffee	Exit Coffee	Enter Coffee	Coffee both years	
				Labor	Farmer
Consumption per capita (cordobas)	4180	3309	3074	2259	5099
Income per capita (cordobas)	3697	3695	2820	3073	6031
Main income sources (%)					
Wage agriculture	12	37	21	65	3
Self-employment agriculture	20	29	29	11	78
Wage non-agriculture	31	17	18	7	1
Self-employment non-agriculture	14	6	8	4	2
Non labor	22	11	25	14	15
Total	100	100	100	100	100
Mean farm size (hectares)	6.5	10.0	6.4	0.7	12.8
Median farm size (hectares)	4.2	4.0	4.2	2.1	5.6

Sources: Nicaragua LSMS 1998 and 2001

**Table 5: Poverty evolution, by coffee definitions**

	Extreme Poverty				General Poverty			
	Headcount		Level	%	Headcount		Level Change	%
	rate		Change	Change	rate			Change
	1998	2001			1998	2001		
All Households (full LSMS comparisons)								
All	17.3	15.1	-2.2	-12.7	47.9	45.8	-2.1	-4.4
Urban	7.6	6.1	-1.5	-19.7	30.5	28.7	-1.8	-5.9
Rural	28.9	24.7	-4.2	-14.5	68.5	64.3	-4.2	-6.1
Panel households								
All	21.4	12.7	-8.7	-40.7	46.8	40.1	-6.7	-14.3
Urban	10.1	5.6	-4.5	-44.6	30.2	26.3	-3.9	-12.9
Rural	35.1	21.4	-13.7	-39.0	67.2	58.5	-8.7	-12.9
Household Coffee Definition (rural panel)								
Non-Coffee (both years)	31.3	16.5	-14.8	-47.3	64.7	54.6	-10.1	-15.6
Coffee – Enter	56.7	43.8	-12.9	-22.8	77.8	76.4	-1.4	-1.8
Coffee – Exit	41.8	32.8	-9.0	-21.5	76.1	62.5	-13.6	-17.9
Coffee (both years)	35.3	37	1.7	4.8	73.6	75.4	1.8	2.4
Regional Coffee Definition (rural panel)								
Low Coffee Intensity	31	13.8	-17.2	-55.5	66.1	53.5	-12.6	-19.1
Medium Coffee Intensity	35.3	22	-13.3	-37.7	60.5	54.6	-5.9	-9.8
High Coffee Intensity	46.3	41.6	-4.7	-10.2	76.9	76	-0.9	-1.2

Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001.

**Table 6: Poverty Evolution by Coffee Definitions**

	General Poverty			
	Headcount rate		Level Change	% Change
	1998	2001		
Coffee labor, then exit	80.5	63.1	-17.4	-21.6
Coffee labor both years	95.5	91.9	-3.6	-3.8
Coffee farmer, then exit	69.3	61.7	-7.6	-10.9
Coffee farmer both years	60.9	67.2	6.3	10.3

Sources: Nicaragua LSMS 1998 and 2001.

**Table 7 - Nicaragua: changes in per capita consumption, by coffee definitions**

Type of Household	1998	2001	% Change
All Rural			
Total Consumption	4,010	4,480	11.7
Food Consumption	2,440	2,457	0.7
Non-Food Consumption	1,570	2,012	28.1
Household Coffee Definition <sup>a</sup>			
Non-Coffee (both years)			
Total Consumption	4,180	4,806	15.0
Food Consumption	2,515	2,609	3.7
Non-Food Consumption	1,664	2,185	31.3
Coffee - Exit			
Total Consumption	3,309	3,812	15.2
Food Consumption	2,242	2,334	4.1
Non-Food Consumption	1,066	1,478	38.6
Coffee - Enter			
Total Consumption	3,074	3,113	1.3
Food Consumption	2,019	1,763	-12.7
Non-Food Consumption	1,055	1,336	26.6
Coffee (both years)			
Total Consumption	3,881	3,248	-16.3
Food Consumption	2,285	1,771	-22.5
Non-Food Consumption	1,596	1,477	-7.5
Regional Coffee Definition <sup>b</sup>			
Low Coffee Intensity			
Total Consumption	4,074	4,723	15.9
Food Consumption	2,485	2,596	4.4
Non-Food Consumption	1,589	2,109	32.7
Medium Coffee Intensity			
Total Consumption	4,363	4,911	12.5
Food Consumption	2,576	2,605	1.1
Non-Food Consumption	1,787	2,304	28.9
High Coffee Intensity			
Total Consumption	3,491	3,395	-2.7
Food Consumption	2,183	1,933	-11.5
Non-Food Consumption	1,308	1,463	11.8

Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001. All values are in 1998 *córdobas* (C\$) per capita. Average exchange rate 1998: C\$10.58 / US\$ 1.00.

<sup>a</sup> Household coffee definitions are based on the household's involvement in the coffee sector in either years. Specifically, a household is defined as: (i) coffee household if it was involved in the coffee sector in both years (112 observations); (ii) non-coffee household if it was not involved in any coffee activities in both years (1,022 observations); (iii) exiting coffee if the household was involved in coffee activities in 1998 but not in 2001 (104 observations); and (iv) entering coffee if a household was not involved in the coffee sector in 1998 but was in 2001 (117 observations).

<sup>b</sup> Regional coffee definitions are based on the municipal-level average of proportion of farm size dedicated to coffee production. Low = 0-1.3% (765 observations), medium = 1.4-10.7% (302 observations) and high = 10.8% or more of average farm size is dedicated to coffee (288 observations)

**Table 8 - Nicaragua: Changes in per capita income, by coffee definitions and income sources**

Source of Income	Household Coffee Definition <sup>a</sup>											
	Non-Coffee			Exit			Entry			Coffee		
	1998	2001	% Change	1998	2001	% Change	1998	2001	% Change	1998	2001	% Change
Wage agriculture	452	567	25.4	1,367	901	-34.1	598	1,104	84.6	864	829	-4.1
Self-employment agriculture	736	1,359	84.6	1,058	1,155	9.2	806	1,165	44.5	2,688	1,358	-49.5
Wage non-agriculture	1,163	1,446	24.3	622	1,050	68.8	506	648	28.1	134	181	35.1
Self-employment non-agriculture	532	918	72.6	235	434	84.7	212	333	57.1	139	381	174.1
Non labor	814	894	9.8	413	600	45.3	698	493	-29.4	705	563	-20.1
<b>Total</b>	<b>3,697</b>	<b>5,184</b>	<b>40.2</b>	<b>3,695</b>	<b>4,140</b>	<b>12.0</b>	<b>2,820</b>	<b>3,743</b>	<b>32.7</b>	<b>4,530</b>	<b>3,312</b>	<b>-26.9</b>
Source of Income	Regional Coffee Definition <sup>b</sup>											
	Low Intensity			Medium Intensity			High Intensity			All Rural		
	1998	2001	% Change	1998	2001	% Change	1998	2001	% Change	1998	2001	% Change
Wage agriculture	471	613	30.1	476	558	17.2	898	852	-5.1	563	652	15.8
Self-employment agriculture	846	1,583	87.1	605	891	47.3	1,454	1,067	-26.6	925	1330	43.8
Wage non-agriculture	1,018	1,221	19.9	1,322	1,813	37.1	592	800	35.1	990	1254	26.7
Self-employment non-agriculture	504	839	66.5	542	958	76.8	234	516	120.5	455	795	74.7
Non labor	785	863	9.9	871	887	1.8	621	617	-0.6	768	816	6.3
<b>Total</b>	<b>3,624</b>	<b>5,119</b>	<b>41.3</b>	<b>3,816</b>	<b>5,107</b>	<b>33.8</b>	<b>3,799</b>	<b>3,852</b>	<b>1.4</b>	<b>3,703</b>	<b>4,849</b>	<b>30.9</b>

Sources: Nicaragua LSMS 1998 and 2001; and National Agricultural Census 2001.

All values are in 1998 córdobas (C\$) per capita. Average exchange rate 1998: C\$10.58 / US\$ 1.00.

**Table 9: Consumption and income among coffee households**

---

	Consumption			
	1998	2001	Level Change	% Change
Coffee labor, then exit	3,071	3,620	549	27.6
Coffee labor both years	2,259	2,219	-40	-1.8
Coffee farmer, then exit	3,679	4,113	434	11.8
Coffee farmer , both years	5,099	3,790	-1,309	-25.7
	Income			
Coffee labor, then exit	4,019	3,990	-29	-0.7
Coffee labor both years	3,074	2,976	-98	-3.2
Coffee farmer, then exit	3,190	4,381	1,191	37.3
Coffee farmer, both years	6,031	3,696	2,335	-38.7

---

Sources: Nicaragua LSMS 1998 and 2001.

**Table 10: Consumption smoothing: income changes coefficients**

	Total	Food	Non-Food
All rural	0.14***	0.14***	0.13***
Coffee definitions			
Non-Coffee	0.14***	0.14***	0.13***
Exited Coffee	0.07	0.12	-0.01
Entered coffee	0.07	0.01	0.13
Coffee labor both years	0.22*	0.43*	0.08
Coffee farmer both years	0.20**	0.12	0.34**
Initial coffee classifications			
Non-Coffee in 1998	0.14***	0.13	0.13***
Coffee labor in 1998	0.12*	0.18**	0.14
Coffee farmer in 1998	0.19***	0.16**	0.24*
Regional coffee definitions			
Low coffee intensity	0.14***	0.14***	0.12***
Medium coffee intensity	0.14***	0.12**	0.13***
High coffee intensity	0.13***	0.11*	0.16***

Dependent Variable: Log of change in consumption per capita

Each coefficient comes from estimating a fixed effects model of consumption per capita changes regressed on income per capita changes and household size changes for the corresponding coffee classification. Both regressors are treated as exogenous. The municipal level fixed effects are jointly significant for all the specifications.

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



**Table 11: Consumption growth and coping, by coffee household definition**

	Non-Coffee	Exited	Entered	Labor-both	Farm-both
				year	years
Baseline period household characteristics (1998)					
Family size	0.04***	0.07	0.04	0.04	0.03
Maximum years of education in household	0.02**	0.02	-0.01	0.01	-0.01
Number of kids workers	-0.01	0.00	0.03	-0.03	-0.12
Number of adult workers	-0.02	-0.13	0.07	-0.23	0.03
Number of income sources	0.04*	0.13	-0.21**	0.04	-0.17
Land owned (hectares)	0.00	-0.00	0.00	0.04	0.01
Received remittances (yes=1)	0.06	0.08	0.14	-0.15	-0.30
Distance to Managua (10 minute intervals)	-0.00	0.02	0.02	0.08	0.03
Elevation (100 meters)	0.00	0.01	0.05	-0.08	0.09
Affected by Mitch (yes=1)	0.00	0.00	0.00	0.00	0.00
Constant	-0.27**	-1.20	-0.59	-0.97	-1.35
Observations	1022	104	117	31	59
R-squared	0.23	0.55	0.74	0.86	0.55

Dependent Variable: Change in (log) per capita consumption. Additional controls: municipality fixed effects.

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

**Table 12: Food consumption growth and coping, by coffee household definition**

	Non-Coffee	Exited	Entered	Labor-both	Farm-both
				year	years
Baseline period household characteristics (1998)					
Family size	0.04***	0.05	0.06**	0.02	0.01
Maximum years of education in household	0.02**	0.04	0.03	0.02	0.00
Number of kids workers	-0.00	-0.02	-0.06	0.11	0.05
Number of adult workers	-0.01	-0.07	-0.13	-0.18	0.03
Number of income sources	0.04	0.10	-0.20	0.07	-0.12
Land owned (hectares)	0.00	-0.00	0.01	-0.01	-0.01
Received remittances (yes=1)	-0.02	-0.08	0.19	-1.05	-0.36
Distance to Managua (10 minute intervals)	-0.00	0.04	0.01	0.10	0.03
Elevation (100 meters)	0.00	0.05	0.10	-0.14	0.09
Affected by Mitch (yes=1)	0.00	0.00	0.00	0.00	0.00
Constant	-0.41**	-1.79	-0.93	-1.27	-1.66
Observations	1022	104	117	31	59
R-squared	0.22	0.50	0.77	0.79	0.59

Dependent Variable: Change in (log) per capita food consumption. Additional controls: municipality fixed effects.

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

**Table 13: Non-food consumption growth and coping, by coffee household definition**

	Non-Coffee	Exited	Entered	Labor-both year	Farm-both years
Baseline period household characteristics (1998)					
Family size	0.04***	0.11**	0.00	0.10	0.07*
Maximum years of education in household	0.00	-0.01	-0.05	-0.05	-0.02
Number of kids workers	-0.01	-0.01	0.17	-0.29	-0.38***
Number of adult workers	-0.04	-0.23*	0.31**	-0.49	0.06
Number of income sources	0.04*	0.17	-0.24	0.15	-0.29
Land owned (hectares)	0.00	-0.00	-0.00	0.15	0.02**
Received remittances (yes=1)	0.15**	0.39	0.20	0.99	-0.23
Distance to Managua (10 minute intervals)	-0.01	0.00	0.02	-0.00	0.04
Elevation (100 meters)	0.01	-0.06	-0.04	-0.04	0.10
Affected by Mitch (yes=1)	0.00	0.00	0.00	0.00	0.00
Constant	-0.02	-0.23	0.35	0.55	-1.25
Observations	1022	104	117	31	59
R-squared	0.23	0.65	0.61	0.80	0.56

Dependent Variable: Change in (log) per capita non-food consumption. Additional controls: municipality fixed effects.

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

**Table 14: Consumption growth and coping, by 1998 coffee household definition**

	Activity in 1998		
	Non-Coffee	Coffee labor	Coffee farmer
Baseline period household characteristics (1998)			
Family size	0.02	0.02	0.04***
Maximum years of education in household	-0.01	0.03	0.02**
Number of kids workers	-0.00	-0.06	-0.01
Number of adult workers	-0.14	0.05	-0.01
Number of income sources	0.03*	-0.11	0.03
Land owned (hectares)	0.04	-0.00**	0.00
Received remittances (yes=1)	-0.03	0.34	0.07
Distance to Managua (10 minute intervals)	0.02	0.01	-0.00
Elevation (100 meters)	-0.01	0.09*	-0.01
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	-0.10	-0.97	-0.20
Observations	108	108	1139
R-squared	0.61	0.44	0.22

Dependent Variable: Change in (log) per capita consumption. Additional controls: municipality fixed effects.

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

**Table 15: Food consumption growth and coping, by 1998 coffee household definition**

	Activity in 1998		
	Non-Coffee	Coffee labor	Coffee farmer
Baseline period household characteristics (1998)			
Family size	0.00	0.02	0.04***
Maximum years of education in household	-0.00	0.01	0.02***
Number of kids workers	-0.01	-0.01	-0.00
Number of adult workers	-0.11	0.04	-0.01
Number of income sources	-0.03	-0.01	0.02
Land owned (hectares)	0.05	-0.00*	0.00
Received remittances (yes=1)	-0.19	0.11	-0.01
Distance to Managua (10 minute intervals)	0.01	0.03	-0.00
Elevation (100 meters)	0.02	0.15**	-0.02
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	-0.17	-2.24***	-0.29*
Observations	108	108	1139
R-squared	0.59	0.49	0.20

Dependent Variable: Change in (log) per capita food consumption. Additional controls: municipality fixed effects.

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

**Table 16: Non-food consumption growth and coping,  
by 1998 coffee household definition**

	Activity in 1998		
	Non-Coffee	Coffee labor	Coffee farmer
Baseline period household characteristics (1998)			
Family size	0.07*	0.05	0.04***
Maximum years of education in household	-0.03	0.05	0.00
Number of kids workers	0.01	-0.17*	-0.00
Number of adult workers	-0.25**	0.06	-0.03
Number of income sources	0.15	-0.27*	0.03
Land owned (hectares)	0.03	-0.00*	0.00
Received remittances (yes=1)	0.15	0.76*	0.15**
Distance to Managua (10 minute intervals)	0.01	-0.02	-0.01
Elevation (100 meters)	-0.10	0.00	0.01
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	0.38	0.77	0.00
Observations	108	108	1139
R-squared	0.56	0.40	0.22

Dependent Variable: Change in (log) per capita non-food consumption. Additional controls: municipality fixed effects.

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

**Table 17: Consumption growth and coping, by regional coffee definition**

	Coffee intensity in municipality		
	Low	Medium	High
Baseline period household characteristics (1998)			
Family size	0.04***	0.05***	0.02*
Maximum years of education in household	0.01	0.01	0.03**
Number of kids workers	-0.01	-0.03	-0.00
Number of adult workers	-0.01	-0.01	-0.04
Number of income sources	0.03	0.01	0.03
Land owned (hectares)	0.00	-0.00	-0.01***
Received remittances (yes=1)	0.06	0.10	-0.02
Distance to Managua (10 minute intervals)	-0.00	-0.03**	0.00
Elevation (100 meters)	0.02	-0.04	0.01
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	-0.26*	0.20	-0.47
Observations	765	302	288
R-squared	0.21	0.21	0.25

Dependent Variable: Change in (log) per capita consumption. Additional controls: municipality fixed effects.

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

**Table 18: Food consumption growth and coping, by regional coffee definition**

	Coffee intensity in municipality		
	Low	Medium	High
Baseline period household characteristics (1998)			
Family size	0.03**	0.05***	0.02
Maximum years of education in household	0.02*	0.00	0.02*
Number of kids workers	0.00	-0.03	0.00
Number of adult workers	0.02	-0.04	-0.03
Number of income sources	0.01	0.04	0.03
Land owned (hectares)	0.00	-0.00	-0.01***
Received remittances (yes=1)	-0.04	0.06	-0.15
Distance to Managua (10 minute intervals)	-0.00	-0.02	0.02
Elevation (100 meters)	0.03	-0.04	0.02
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	-0.40**	0.12	-0.86**
Observations	765	302	288
R-squared	0.19	0.19	0.26

Dependent Variable: Change in (log) per capita food consumption. Additional controls: municipality fixed effects.

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



**Table 19: Non-food consumption growth and coping, by regional coffee definition**

	Coffee intensity in municipality		
	Low	Medium	High
Baseline period household characteristics (1998)			
Family size	0.04***	0.06**	0.04**
Maximum years of education in household	-0.00	-0.00	0.01
Number of kids workers	-0.00	-0.03	-0.03
Number of adult workers	-0.04	-0.01	-0.03
Number of income sources	0.04	-0.02	-0.01
Land owned (hectares)	0.00	0.00	-0.01***
Received remittances (yes=1)	0.20**	0.18	0.12
Distance to Managua (10 minute intervals)	-0.00	-0.03**	-0.01
Elevation (100 meters)	0.01	-0.02	0.00
Affected by Mitch (yes=1)	0.00	0.00	0.00
Constant	-0.00	0.49	0.20
Observations	765	302	288
R-squared	0.22	0.19	0.19

Dependent Variable: Change in (log) per capita non- food consumption. Additional controls: municipality fixed effects.

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

**Table 20: Coping mechanisms, by initial coffee household definition**

	Household experienced						
	Increases in child labor	Increases in adult labor	Migrating members	Decreases in school enrollment	Decreases in land owned	Decreases in cattle owned	Decreases in poultry owned
Coffee labor in 1998	0.03	-0.05	-0.01	0.02	-0.13***	-0.09**	0.11**
Coffee farmer in 1998	0.16***	-0.09*	-0.01	0.12***	0.10**	0.12***	0.22***
Affected by hurricane Mitch	-0.01	0.03	0.00	-0.00	-0.00	-0.04**	-0.03
Observations:	1355	1355	1355	1355	1355	1355	1355
Log likelihood:	-795	-863	-240	-788	-683	-521	-818
Adjusted percentage of correct prediction:	0.76	0.70	0.96	0.78	0.78	0.86	0.70

**Table 21: Coping mechanisms, by initial coffee household definition**

	Household experienced						
	Increases in child labor	Increases in adult labor	Migrating members	Decreases in school enrollment	Decreases in land owned	Decreases in cattle owned	Decreases in poultry owned
Coffee labor in 1998	-0.08	0.18	0.01	-0.07	-0.04	-0.04	-0.14
Coffee farmer in 1998	0.21**	0.02	-0.02	0.17**	0.25***	0.26***	0.21***
Poor in 1998	0.16***	0.10***	-0.01	0.05	0.06**	0.02	0.04
Coffee labor * Poor in 1998	0.10	-0.23**	-0.01	0.11	-0.13	-0.07	0.34**
Coffee farmer * Poor in 1998	-0.06	-0.16*	0.02	-0.06	-0.14**	-0.09**	0.01
Affected by Hurricane Mitch	-0.02	0.03	0.00	-0.01	-0.00	-0.04**	-0.03
Observations:	1355	1355	1355	1355	1355	1355	1355
Log likelihood:	-795	-863	-240	-788	-683	-521	-818
Adjusted percentage of correct prediction:	0.76	0.70	0.96	0.78	0.78	0.86	0.70

**Table 22: Coping mechanisms, by regional coffee intensity definition**

	Household experienced						
	Increases in child labor	Increases in adult labor	Migrating members	Decreases in school enrollment	Decreases in land owned	Decreases in cattle owned	Decreases in poultry owned
Medium coffee intensity region	0.02	-0.09***	-0.01	-0.06*	-0.01	-0.02	0.02
High coffee intensity region	0.06*	-0.07**	-0.01	-0.02	-0.00	-0.02	0.11***
Affected by Hurricane Mitch	-0.01	0.03	0.00	-0.00	-0.01	-0.04**	-0.03
Observations:	1355	1355	1355	1355	1355	1355	1355
Log likelihood:	-795	-863	-240	-788	-683	-521	-818
Adjusted percentage of correct prediction:	0.76	0.70	0.96	0.78	0.78	0.86	0.70

**Table 23: Coping mechanisms, by regional coffee intensity definition**

	Household experienced						
	Increases in child labor	Increases in adult labor	Migrating members	Decreases in school enrollment	Decreases in land owned	Decreases in cattle owned	Decreases in poultry owned
Medium coffee intensity region	-0.01	0.01	-0.04	0.01	-0.10**	-0.11***	-0.07
High coffee intensity region	0.08	0.10	0.03	-0.00	0.04	-0.01	-0.03
Poor in 1998 (=1)	0.15***	0.15***	-0.00	0.07**	0.01	-0.03	-0.02
Medium coffee intensity region * Poor in 1998	0.07	-0.14**	0.07	-0.10*	0.16**	0.22***	0.16**
High coffee intensity region * Poor in 1998	-0.05	-0.21***	-0.03	-0.02	-0.05	-0.01	0.18**
Affected by Hurricane Mitch	-0.02	0.04	0.00	-0.00	-0.01	-0.04**	-0.04
Observations:	1355	1355	1355	1355	1355	1355	1355
Log likelihood:	-795	-863	-240	-788	-683	-521	-818
Adjusted percentage of correct prediction:	0.76	0.70	0.96	0.78	0.78	0.86	0.70

**Table 24: Transition matrix between coffee and non-coffee work (in %)**

		2001			
		Coffee-labor	Coffee-farmer	Non-coffee	Total
1998	Coffee-labor	35	9	56	100
	Coffee-farmer	10	54	37	100
	Non-coffee	5	4	91	100

**Table 25: Mobility out of coffee: who can exit?**

	Model 1	Model 2	Model 3	Model 4
interacted with coffee farmer dummy	No	No	Yes	Yes
With fixed effects	No	Yes	No	Yes
<hr/>				
Baseline period household characteristics (1998)				
Coffee farmer	-0.22***	-0.20*	-0.71*	-0.68
Number of adults aged 19-64	0.04	0.03	0.09*	0.03
Interaction			-0.05	0.06
Age of head of household	-0.003	-0.004	-0.01	-0.003
Interaction			0.003	-0.0002
Average years of education in households	-0.02	-0.02	-0.03	-0.06
Interaction			0.01	0.02
Cultivated land owned (in hectares)	0.0001	-0.002	-0.04**	-0.08*
Interaction			0.04**	0.09*
Received credit (yes=1)	0.10	0.12	0.43**	0.54**
Interaction			-0.39*	-0.49**
Income diversification index (0=not diversified)	0.27*	0.40*	-0.10	0.11
Interaction			0.78**	0.50
Annual per capita consumption (in cordobas x1000)	-0.01	0.01	0.01**	0.07*
Interaction			-0.12***	-0.1*
Affected by Hurricane Mitch (yes=1)	-0.14*	0.14	-0.33**	0.36
Interaction			0.35*	0.40
Coffee farm intensity (% of total cultivable land)	-1.43***		-2.62***	
Interaction			1.76**	1.33
Distance to Managua (in 10 minute intervals)	-0.01**	-0.01	-0.01**	-0.04*
Interaction			0.01	0.01
<hr/>				
Log likelihood:	-122	-85	-107	-75
Adjusted percentage of correct prediction:	0.39	0.33	0.50	0.44
Observations:	216	151	216	151

Dependent variable: Coffee activity status in 2001 conditional on being in coffee in 1998.

Marginal effects reported

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

**Table 26: Use of risk management mechanisms and rural heterogeneity,  
by coffee definitions**

		Type of strategy	Non coffee	Coffee labor	Coffee farmer
	Income diversification	ex-ante	Yes		
Labor market adjustments	Child labor	ex-post		Yes	Yes
	Ex-post migration	ex-post			
	Exit coffee	ex-ante/ ex-post		Yes	Yes
Precautionary savings	Sale of physical assets	ex-post			Yes
	Consumption of owned animals	ex-post		Yes	Yes
Informal insurance	Remittances	ex-ante	Yes	Yes	Yes



**Table 27: Rural poverty dynamics, by coffee definitions (% of households)**

		Poverty in 2001		
		Poor	Non Poor	Total
Poverty in 1998	Non-Coffee			
	Poor	46	19	65
	Non Poor	9	26	35
	Total	55	45	100
	Exit			
	Poor	67	11	78
	Non Poor	9	13	22
	Total	76	24	100
	Enter			
	Poor	52	24	76
	Non Poor	11	14	24
	Total	63	37	100
	Both years-Labor			
	Poor	90	5	95
	Non Poor	2	3	5
	Total	92	8	100
	Both years- farmer			
	Poor	51	10	61
Non Poor	17	23	39	
Total	67	33	100	

Sources: Nicaragua LSMS 1998 and 2001.

**Table 28: Consumption decreases, by coffee definitions (% of households)**

	% of households experiencing a consumption decrease:	
	Level	Quintile
Coffee typology		
Non coffee both years	38	11
Exit coffee	46	27
Enter coffee	48	30
Coffee both years	61	39
Coffee farmers both years	56	47
Coffee labor both years	65	23
Regional coffee definition		
Low	36	15
Medium	43	8
High	52	25

Sources: Nicaragua LSMS 1998 and 2001.

**Table 29: Poverty dynamics: examining vulnerability and mobility**

	Probability to:			
	Fall into poverty	Experienced a fall in consumption		
		Level	Quintile	Exit poverty
Baseline period household characteristics (1998)				
Coffee labor	0.07	0.07	0.05	0.09
Coffee farm	-0.09	0.01	-0.00	0.14
Family size	0.01	0.01	0.01	-0.04***
Maximum years of education in household	-0.03***	-0.03***	-0.03***	0.03***
Number of kids workers	0.03	0.00	-0.01	-0.00
Number of adult workers	0.01	-0.02	0.00	0.03*
Number of income sources	-0.02	-0.01	-0.02	0.05**
Land owned (hectares)	-0.00	-0.00	-0.00	0.00***
Received remittances (yes=1)	-0.03	-0.03	-0.01	0.06*
Distance to Managua (10 minute intervals)	0.00**	0.00	0.00	-0.00**
Coffee farm intensity in municipality	0.33	0.67***	0.43***	-0.78***
Affected by Mitch (yes=1)	0.03	0.07**	0.06**	-0.06**
Sample	Non-poor in 1998	All rural	All rural	Poor in 1998
Observations	505	1355	1355	850
Log likelihood:	-306	-936	-880	-481
Adjusted percentage of correct prediction:	0.72	0.59	0.65	0.77

Dependent Variable for model 1: Poverty status in 2001 conditional on being non poor in 1998.

Dependent Variable for model 2: Dummy on whether a household experienced a decrease in consumption level between 1998 and 2001.

Dependent Variable for model 3: Dummy on whether a household experienced a decrease in consumption quintile ranking between 1998 and 2001.

Dependent Variable for model 4: Poverty status in 2001 conditional on being poor in 1998.

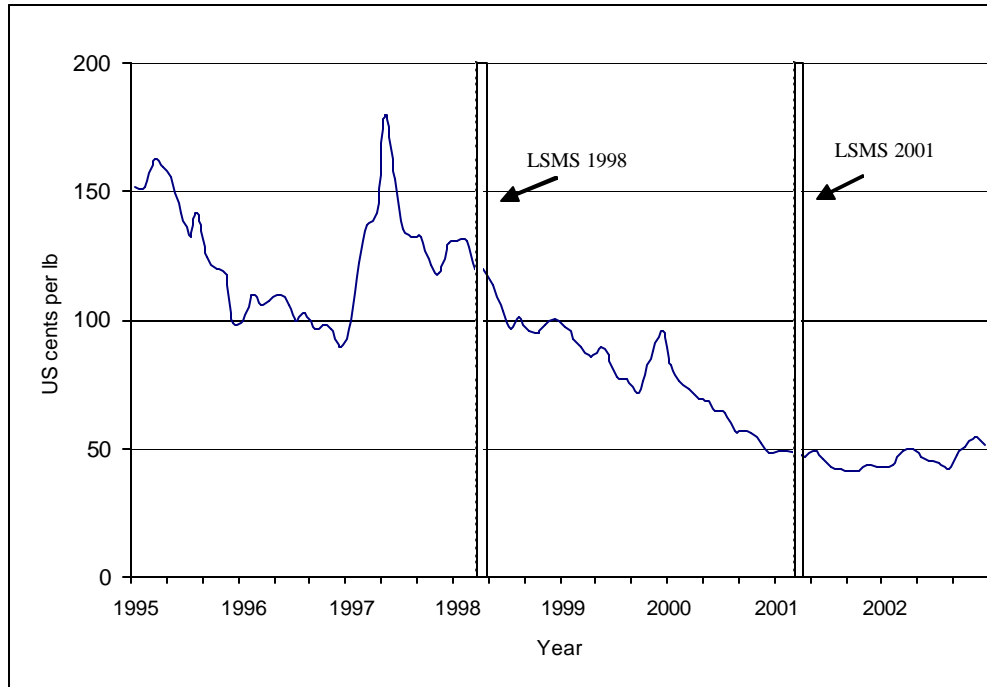
Additional controls: initial period consumption quintile ranking for 2nd and 3rd models.

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

**Table 30: Poverty dynamics: predicted probabilities, by coffee Household (% of households)**

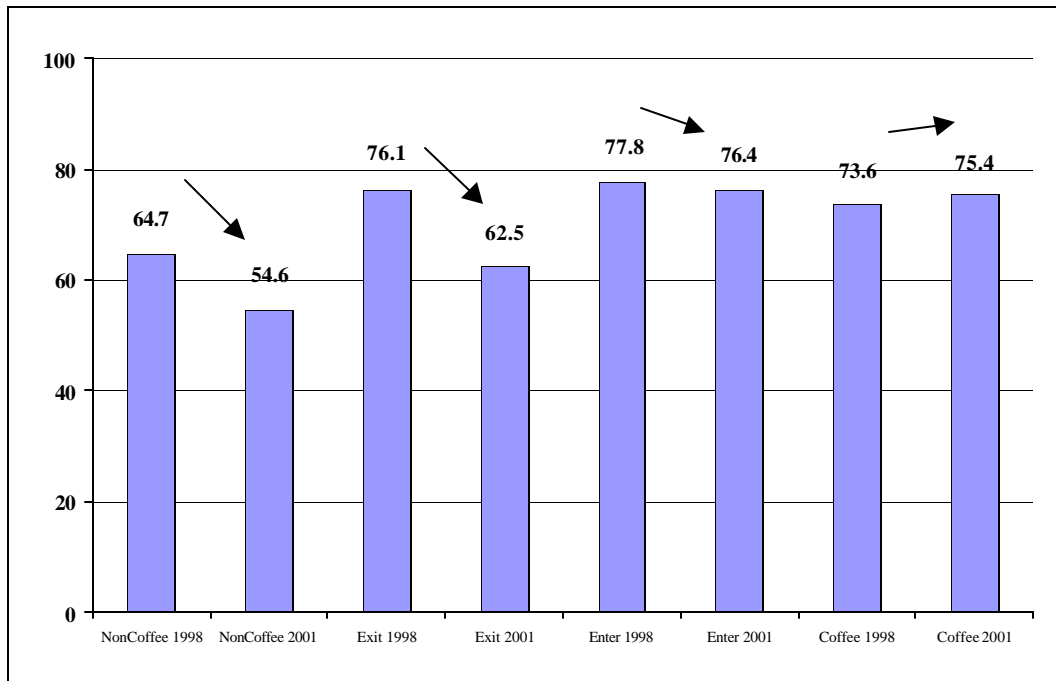
	Predicted probability to:			
	Experienced a fall in consumption:			
	Fall into poverty	Level	Quintile	Exit poverty
<b>Household definition</b>				
Non coffee both years	27	45	33	24
Exit coffee	32	52	39	27
Enter coffee	36	47	34	16
Coffee labor both years	44	55	40	17
Coffee farmer both years	30	61	47	17
<b>Initial year classification</b>				
Non coffee in 1998	27	45	34	23
Coffee-labor in 1998	39	52	38	19
Coffee-farm in 1998	29	59	45	23
<b>Regional definition</b>				
Low coffee intensity	27	43	32	27
Medium coffee intensity	26	46	35	23
High coffee intensity	33	56	41	14
Overall	28	47	35	22

**Figure 1: Panel timing and coffee prices (composite index)**



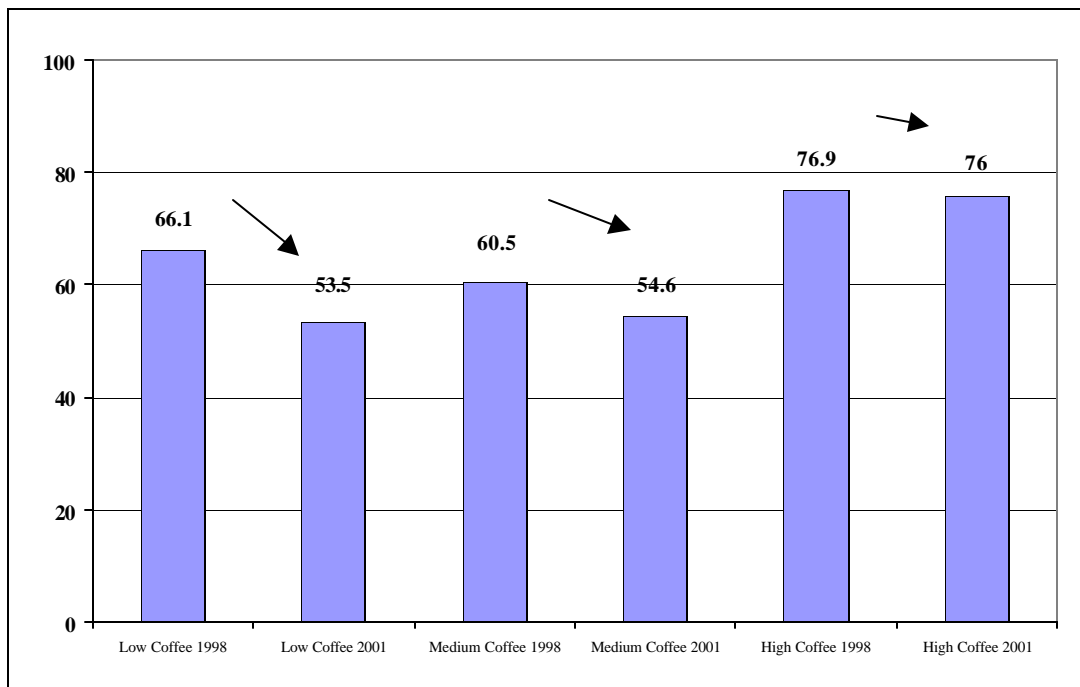
Source: International Coffee Organization

**Figure 2: Poverty rate changes by coffee household definition**



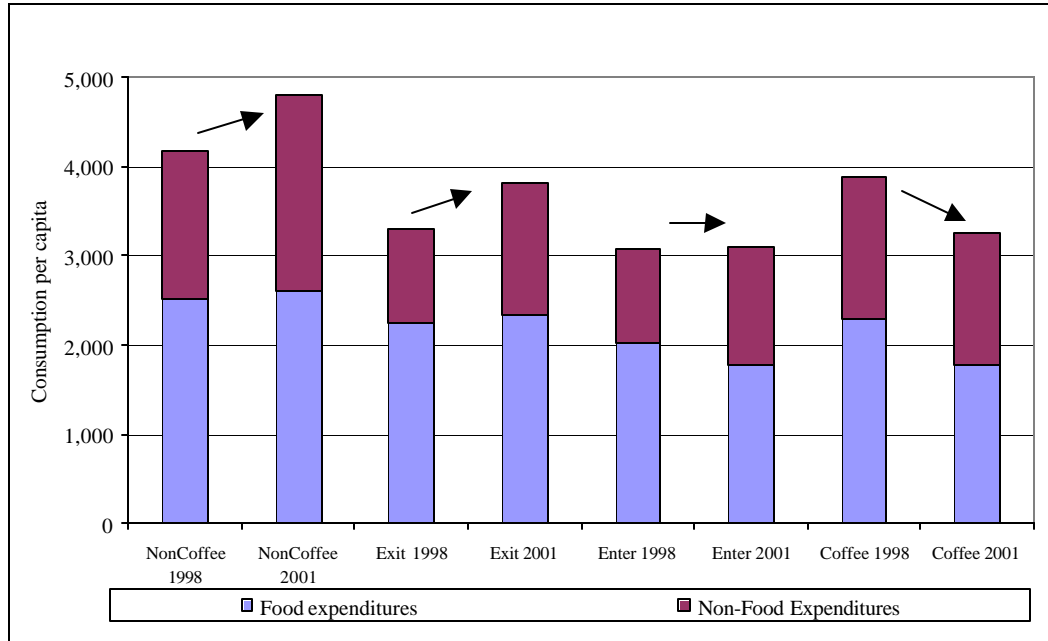
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 3: Poverty rate changes by regional coffee**



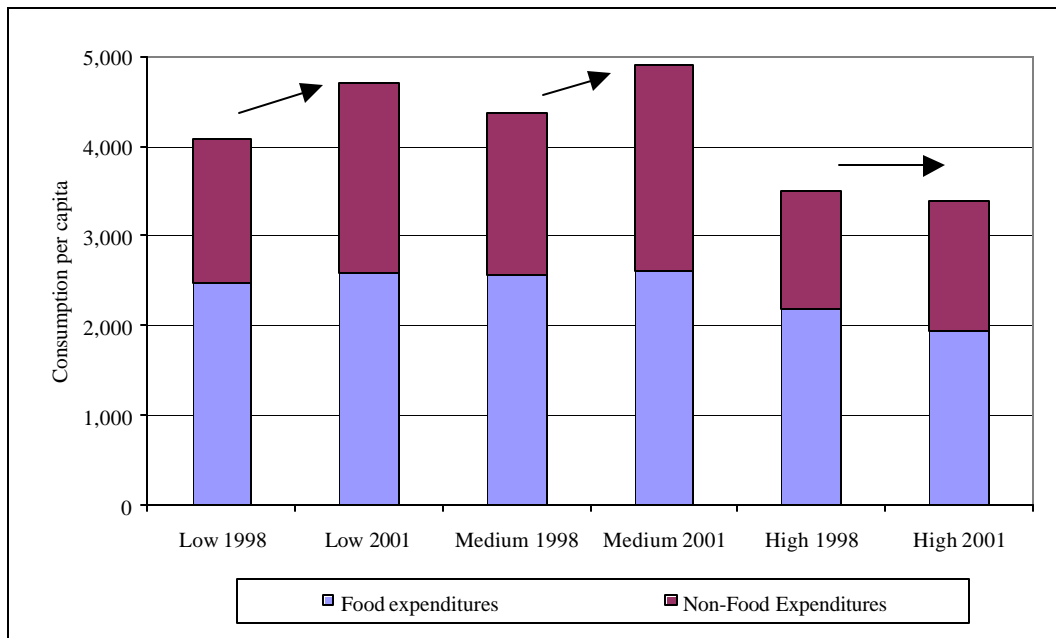
Sources: Nicaragua LSMS 1998 and 2001 and National Agricultural Census 2001.

**Figure 4: Rural consumption per capita by household coffee definition**



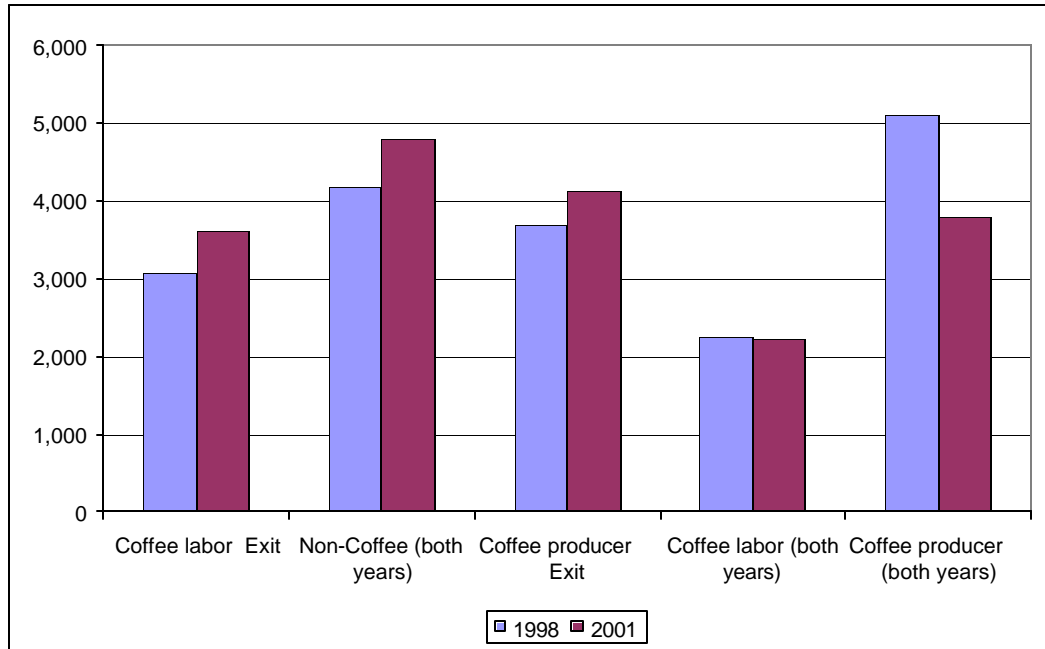
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 5: Rural consumption per capita by regional coffee definition**



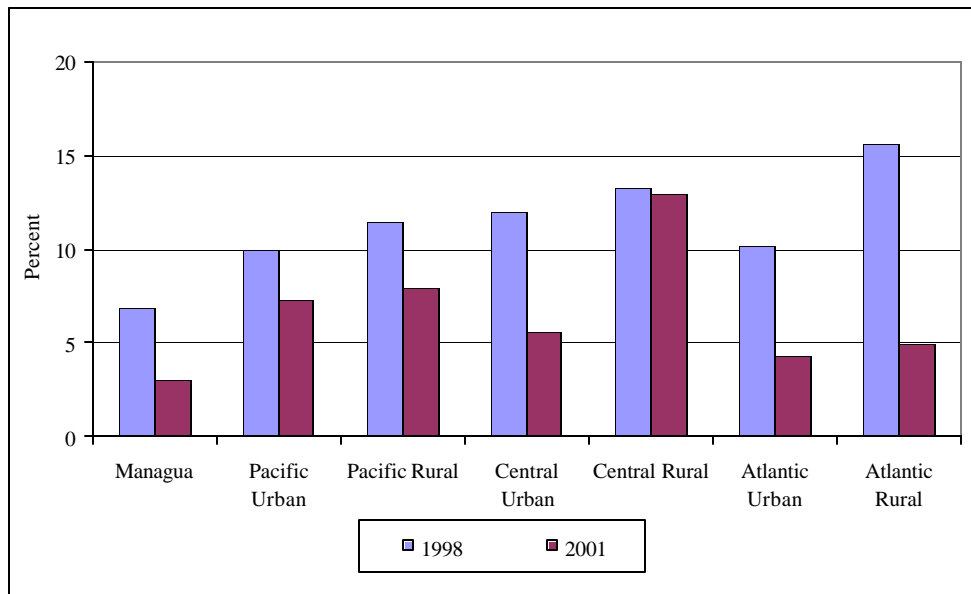
Sources: Nicaragua LSMS 1998 and 2001 and National Agricultural Census 2001.

**Figure 6: Changes in per capita income**



Sources: Nicaragua LSMS 1998 and 2001.

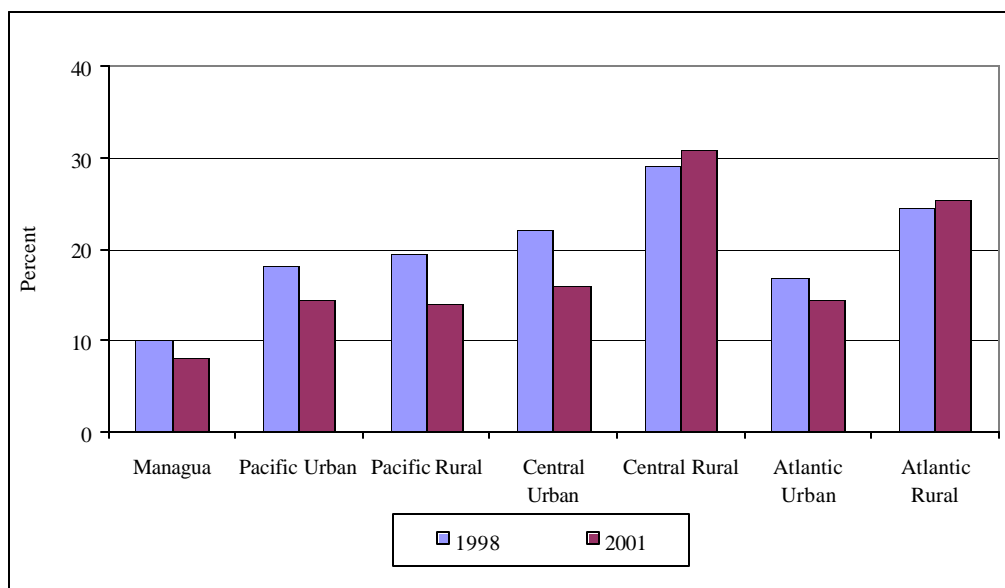
**Figure 7: Incidence of Underweight Children, 1998 – 2001**



Sources: Nicaragua LSMS 1998 and 2001.

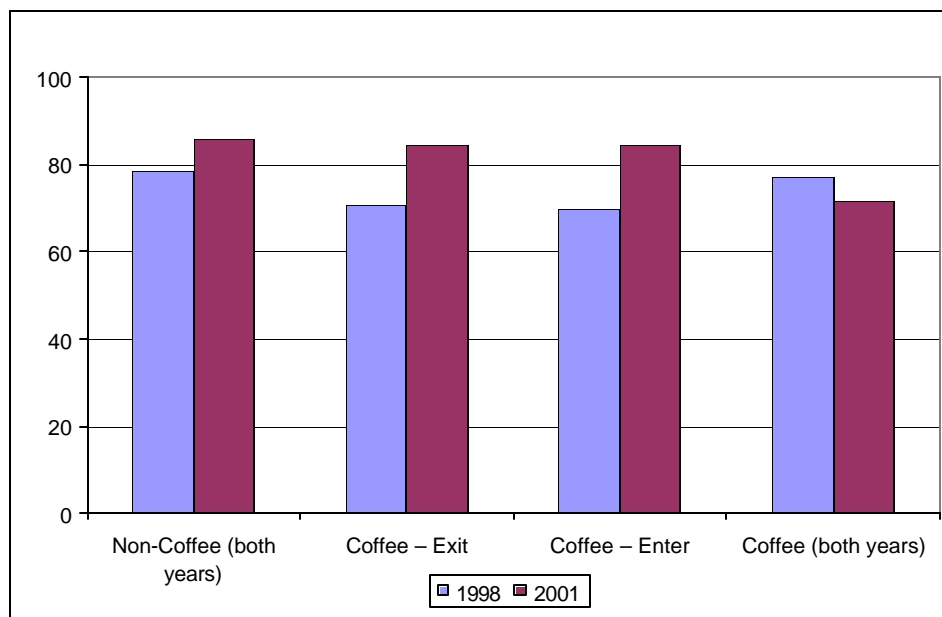


**Figure 8: Nicaragua - incidence of Stunting, 1998 – 2001**



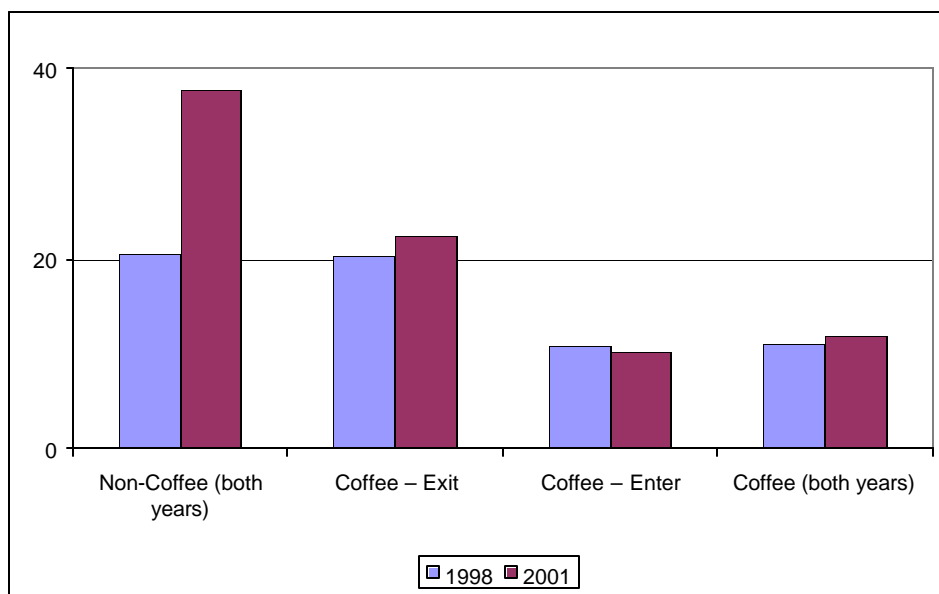
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 9: Rural net primary enrollment rates (7-12 year olds)**



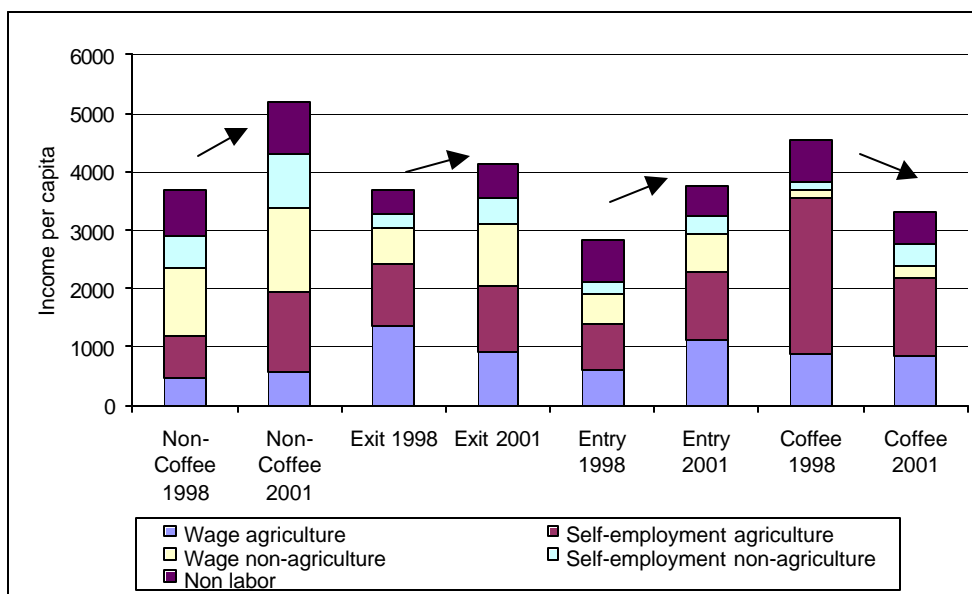
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 10: Rural net secondary enrollment rates,(13-17 year olds)**



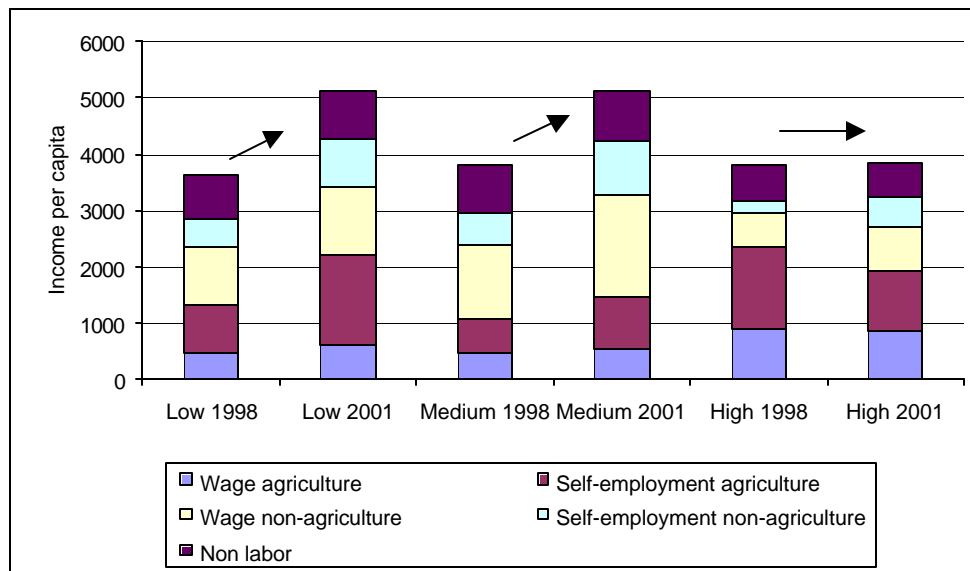
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 11: Sources of rural income per capita by household coffee definition**



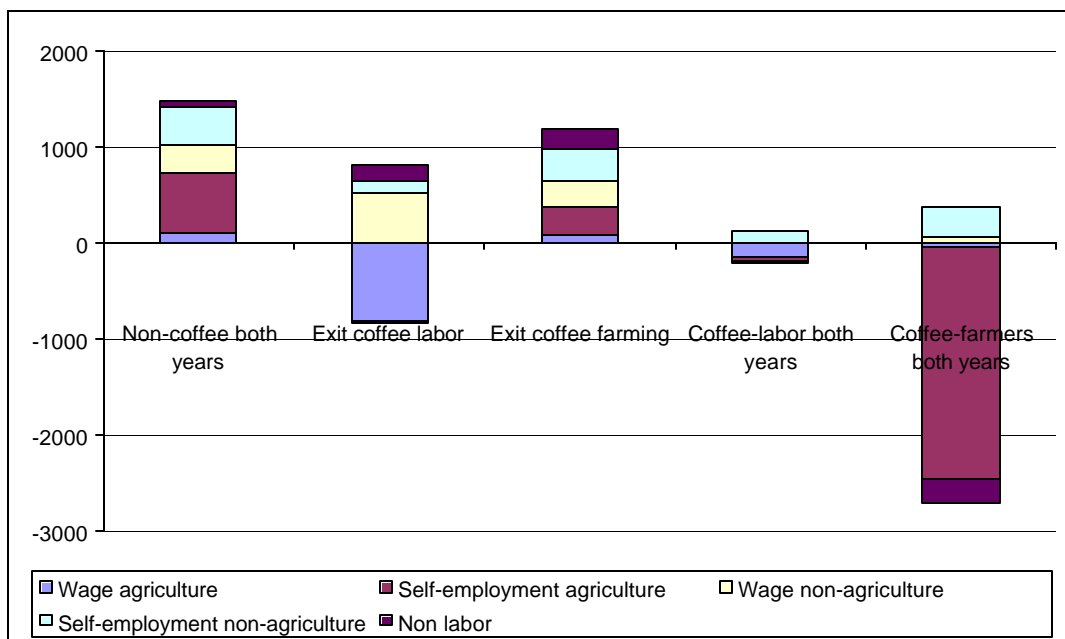
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 12: Sources of rural income per capita by regional coffee definition**



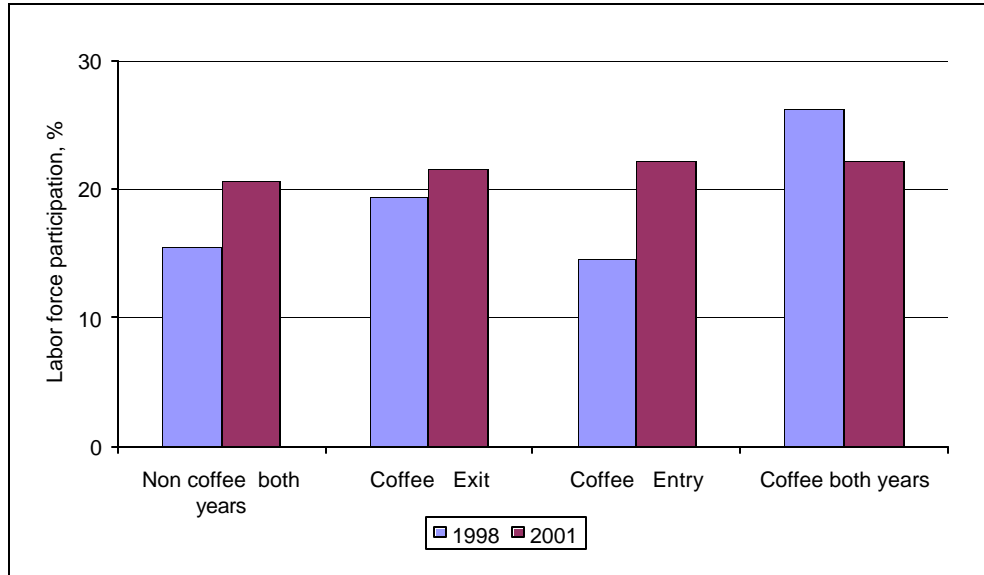
Sources: Nicaragua LSMS 1998 and 2001 and National Agricultural Census 2001.

**Figure 13: Adjustments to income by income source**



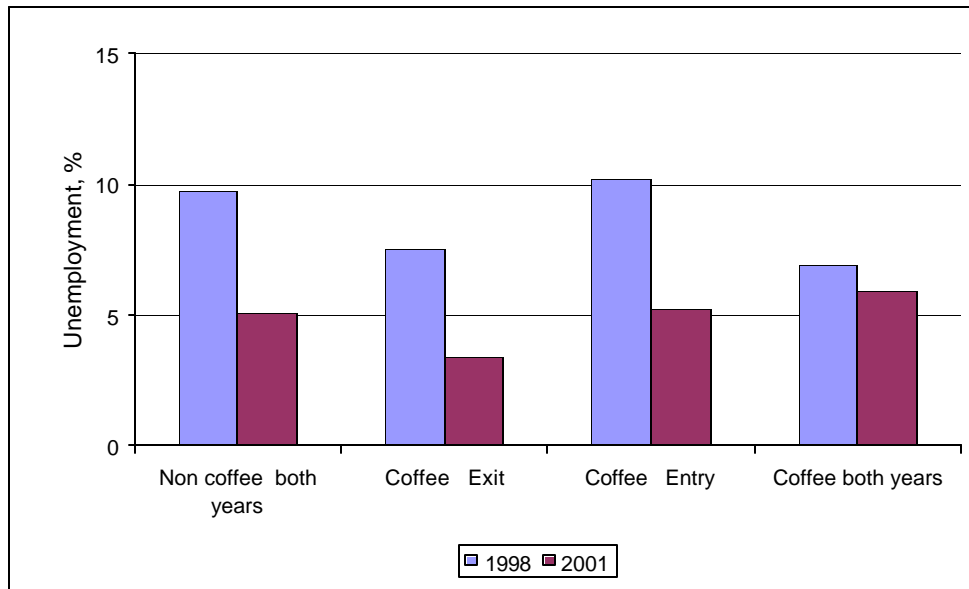
Sources: Nicaragua LSMS 1998 and 2001 and National Agricultural Census 2001.

**Figure 14: The coffee crisis and child labor: labor force participation (ages 6-14)**



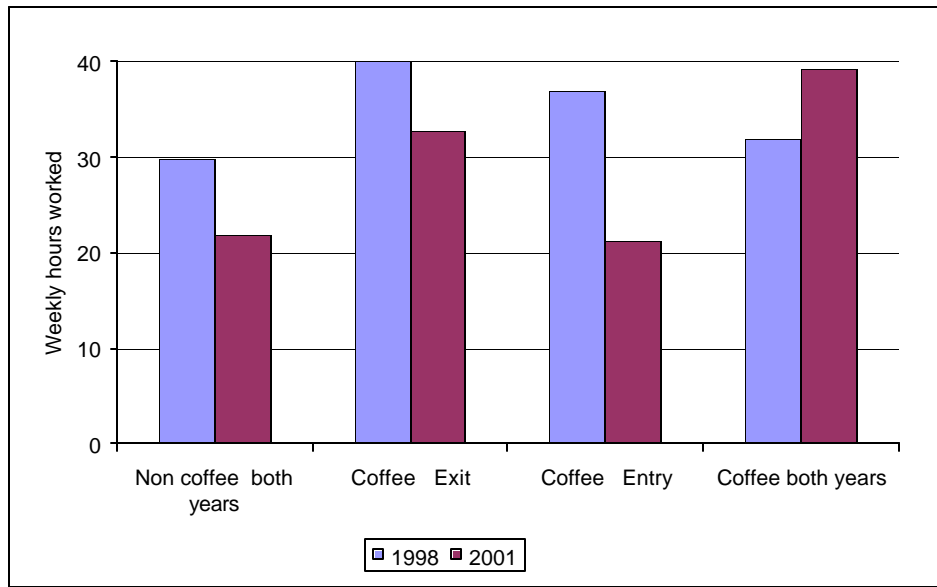
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 15: The coffee crisis and child labor: unemployment (ages 6-14)**



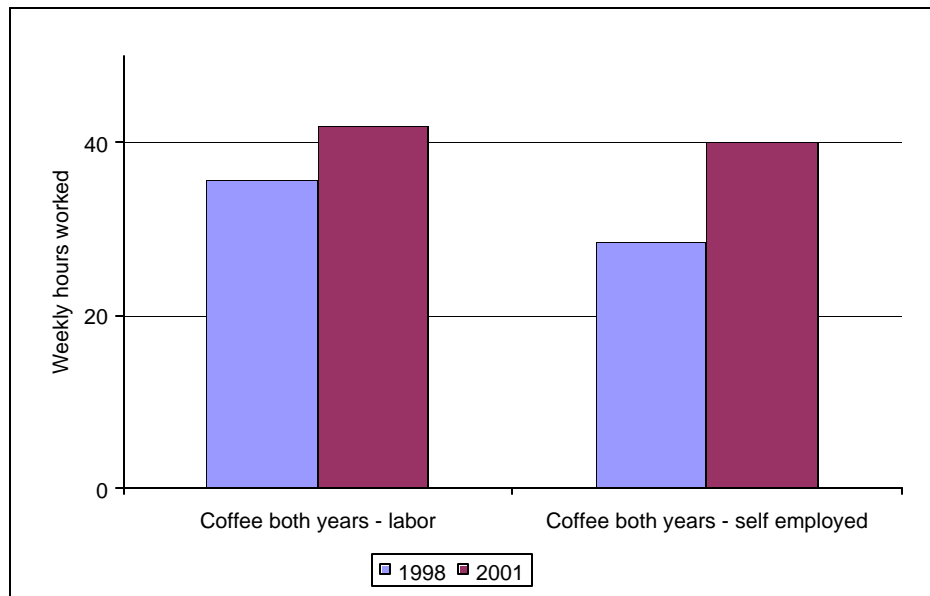
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 16: The coffee crisis and child labor: hours worked (ages 6-14)**



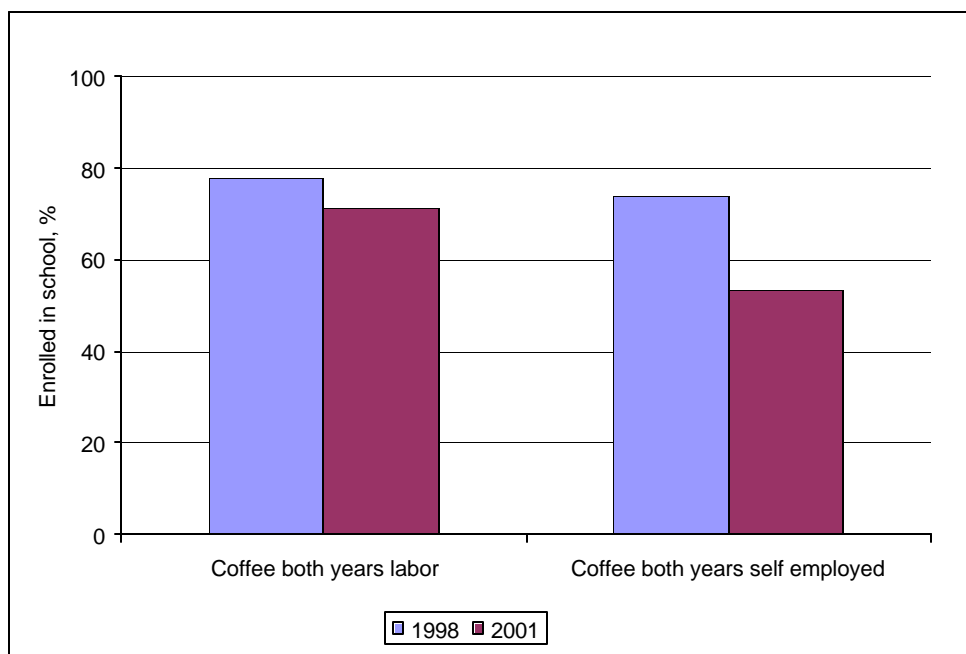
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 17: The coffee crisis and child labor: hours worked (ages 6-14)**



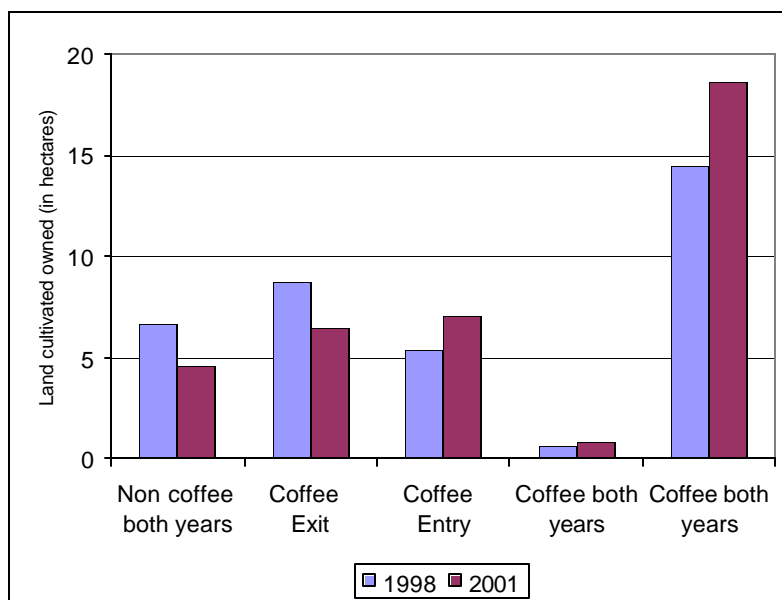
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 18: The coffee crisis and child labor: primary school enrolment (ages 6-14)**



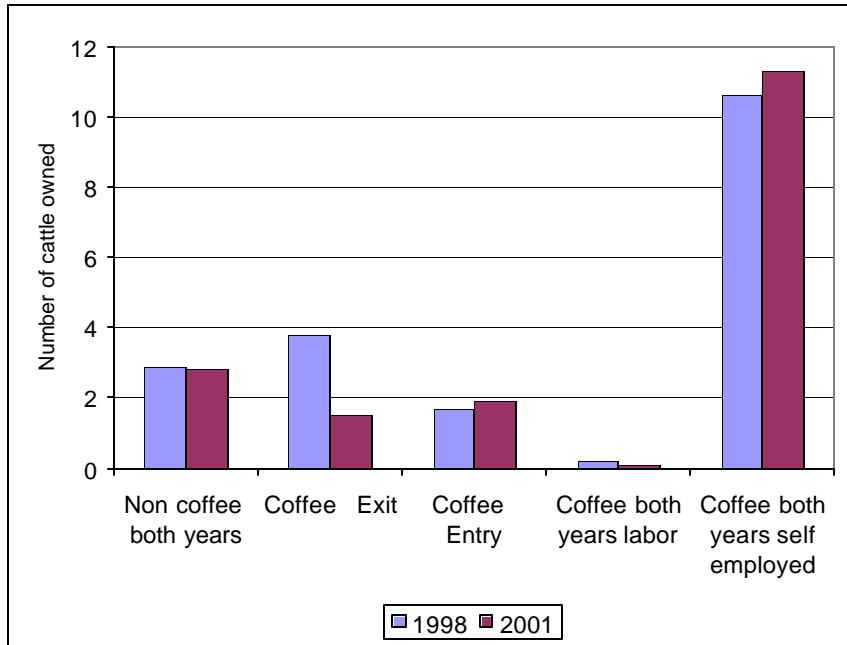
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 19: The coffee crisis and assets: land**



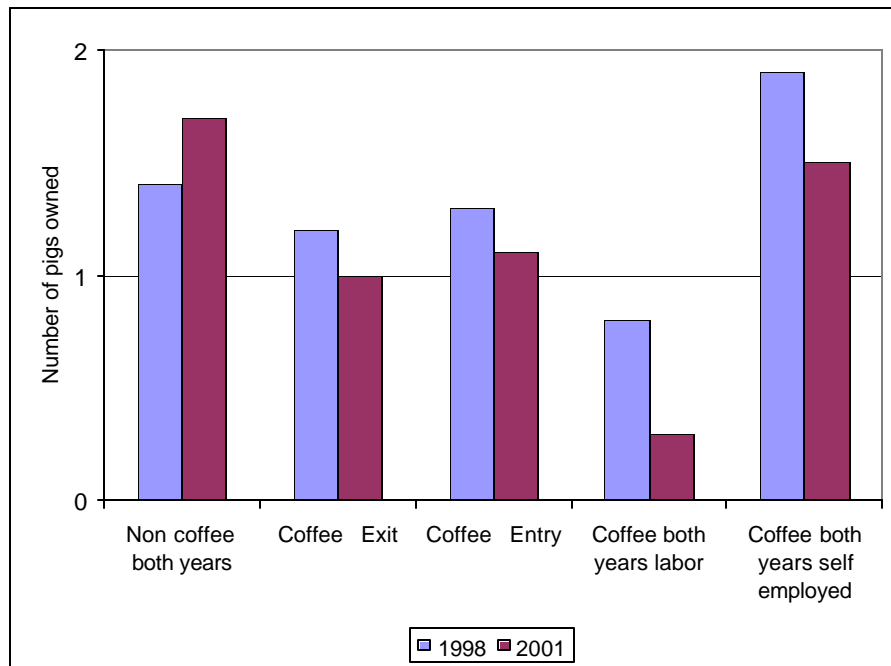
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 20: The coffee crisis and assets: cattle**



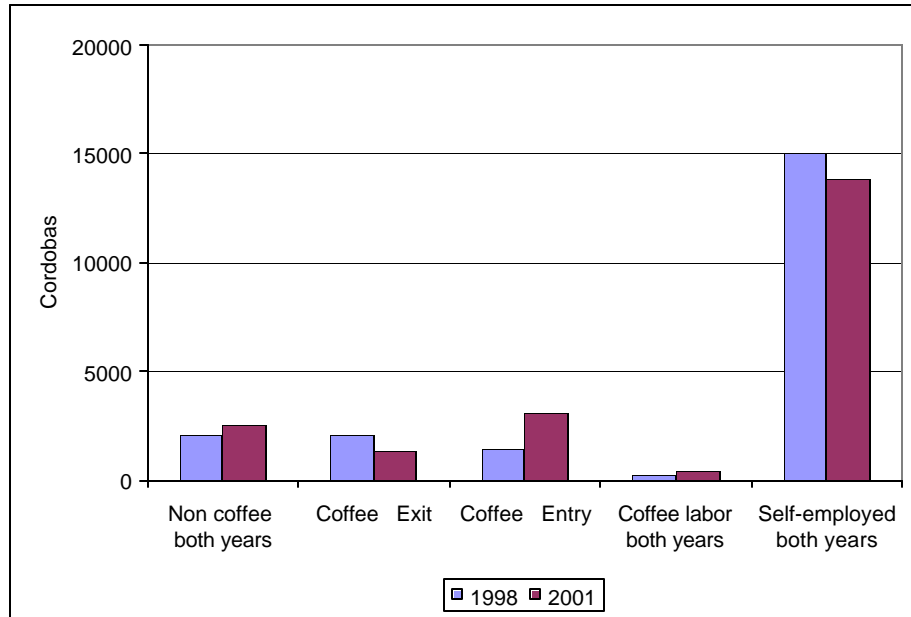
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 21: The coffee crisis and assets: pigs**



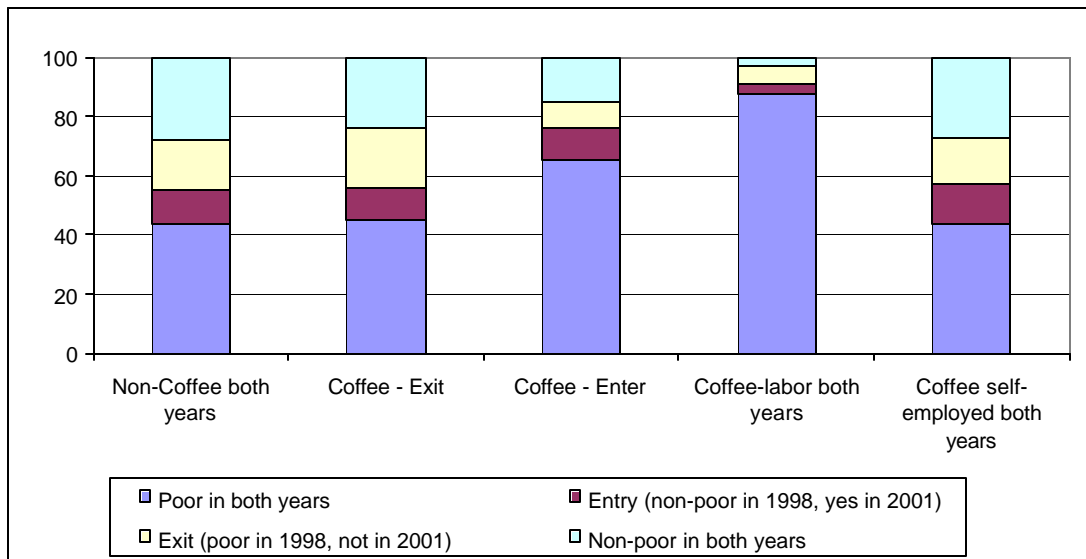
Sources: Nicaragua LSMS 1998 and 2001.

**Figure 22: The coffee crisis and assets: value of equipment**



Sources: Nicaragua LSMS 1998 and 2001.

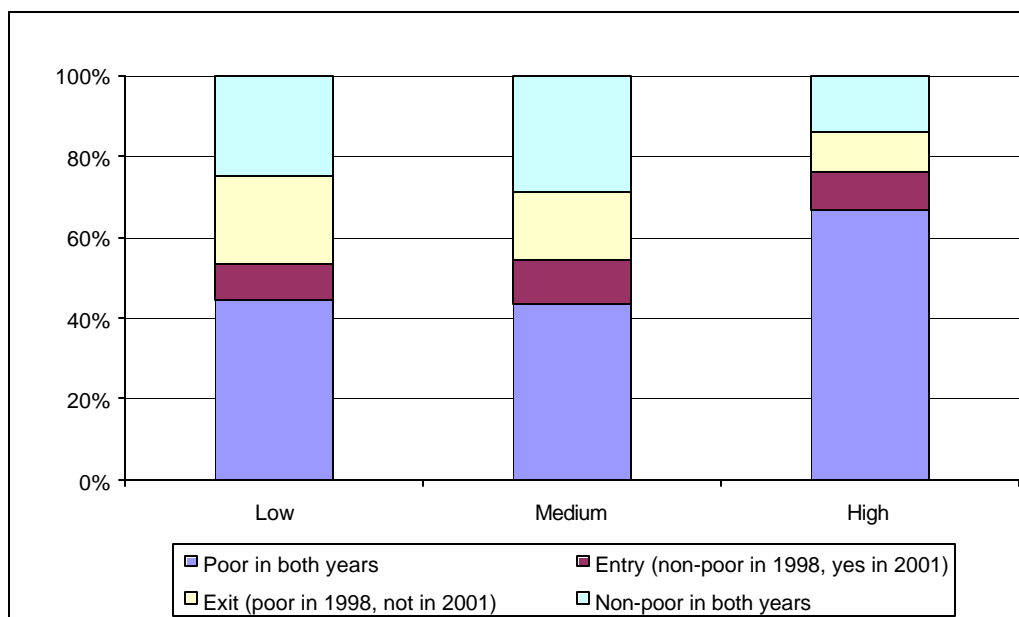
**Figure 23: Poverty mobility by household coffee definition**



Sources: Nicaragua LSMS 1998 and 2001.

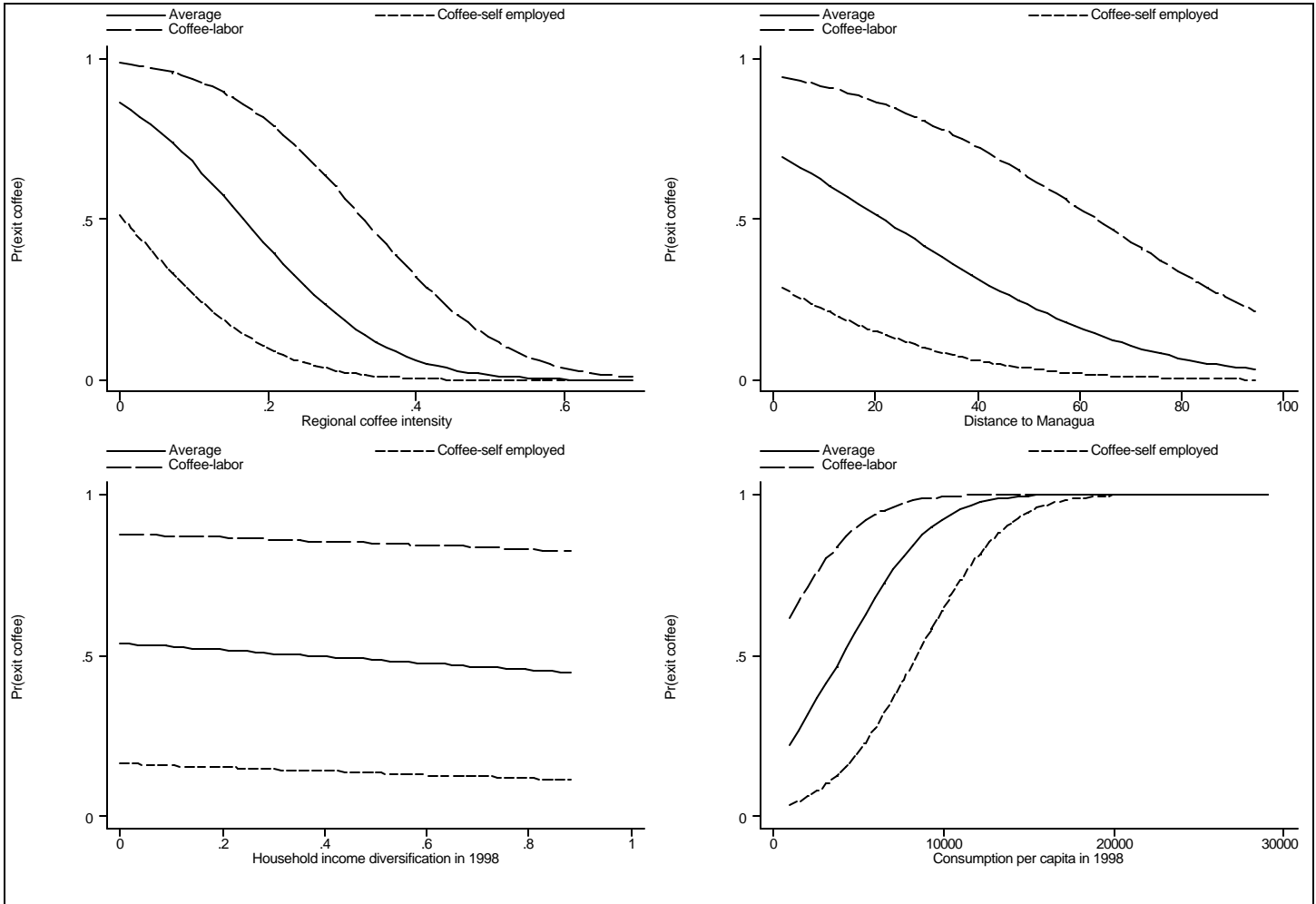


**Figure 24: Poverty mobility by regional coffee definition**



Sources: Nicaragua LSMS 1998 and 2001 and National Agricultural Census 2001.

**Figure 25: Mobility out of coffee**



## Appendix 2: Attrition and panel construction

An extensive analysis of the attrition in the Nicaragua panel used in this paper can be found in Davis and Stampini (2002). They conclude that while almost a third of the original sample was not interviewed in 2001, attrition is not a major problem in the sample. In fact, the only exception in their analysis is among urban non-poor households, where they find some weak evidence of non-random attrition. In addition, there does not seem to be a systematic difference between coffee households (both labor and farm) with non-coffee households (Table 31). As such, and since this paper focuses exclusively on rural households, attrition is not considered to be a problem.

**Table 31: Panel attrition**

	Non coffee Households		Coffee Households				All			
	Number	%	Labor		Farmer		All coffee			
			Number	%	Number	%	Number	%		
Dropped in 2001	1109	<b>28.8</b>	61	<b>30.5</b>	46	<b>28.1</b>	107	<b>29.4</b>	1216	<b>28.9</b>
In Panel	2736	71.2	139	69.5	118	71.9	257	70.6	2993	71.1
Total	3845	100	200	100	164	100	364	100	4209	100