Consumption under Uncertainty: Full Insurance and Price Variation in Vietnam *

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Abstract

Households in developing countries live in high risk environments and are potentially vulnerable to weather shocks, illness and other causes of income variability. We draw on the full-insurance literature and look at the ability of households in Vietnam to smooth consumption when faced with idiosyncratic shocks to income, but we modify the standard model in several ways. Instead of looking at consumption in terms of expenditures, the focus in this paper is on quantities consumed. We also allow households to consume different bundles of goods. These modifications allow us to investigate whether the apparent rejection of full insurance in the literature can be explained by spatial variation in prices. We develop a simple model that leads to an estimation equation which we test using panel data from Vietnam. We reject full insurance across all goods, although the degree of insurance varies across goods. This result is robust to controlling for selection and using either commune or household level prices. We also find little difference in the ability of poor and non-poor households to smooth consumption; however, we do find that households in the North are less able to smooth consumption than those in the South. These results suggest that policies to improve risk sharing in Vietnam must not only focus on improving mechanisms to share risk between locations, such as lowering transportation costs, but also look to strengthen institutions within a given location.

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1 Introduction

Many households in developing countries face a great deal of uncertainty about their future welfare. They live in high risk environments where they are extremely vulnerable to weather shocks, illness and other causes of income variability. Theory tells us that in a world with complete markets (Wilson, 1968) or other institutions that support a Pareto optimal allocation, an individual's consumption should not respond to idiosyncratic risk or income shocks. Households will fully share the risk of idiosyncratic shocks so that growth in household consumption will not depend on changes in household resources (controlling for changes in aggregate resources). However, in the context of a developing country it is likely that idiosyncratic risk does matter since institutions may fail or be completely missing (Benjamin, 1992; Townsend, 1994; Ligon, 1998; Rosenzweig and Stark, 1989; Rosenzweig and Wolpin, 1993; de Janvry et al., 1991; Paxson, 1993).

In order to investigate how households respond when faced with idiosyncratic risk we turn to the consumption smoothing literature which draws on the idea that institutions develop over time as a response to risk. This has long been an observation of non-economists (K.Polanyi et al., 1957), and over the past couple of decades has motivated a large body of economic research. The standard theory in this literature focuses on the idea that in an economy characterized by complete markets, individual consumption is determined by aggregate consumption, not individual outcomes (Diamond, 1967; Wilson, 1968). One prominent paper in this area, Townsend (1994), for example, looks at the ability of institutions in villages in southern India to insure people against risk. In this work the author tests the full insurance model and rejects full insurance. Many other paper's have used a similar approach, and have drawn analogous conclusions, generally rejecting full insurance for idiosyncratic shocks to income or health (Ligon, 1998; Rosenzweig and Stark, 1989; Gertler and Gruber, 1998; Wagstaff, 2005; Dercon and de Weerdt, 2004). We will describe these papers in more detail in the literature review.

Like Townsend (1994), this paper looks at the ability of households to smooth consumption over time, but we relax some of the restrictions imposed by Townsend's test of the full insurance model. This allows us to investigate whether the apparent rejection of full insurance in the literature can be explained by spatial variation in prices and nonhomothetic preferences.

In order to relax these assumptions, we make two important modifications to the Townsend (1994) style full insurance test. First, instead of focusing on consumption smoothing over expenditures, our model allows for differences in household responses to price changes and, second, instead of looking at consumption in terms of expenditures, the focus in this paper is on quantities consumed. Using quantities allow us to isolate the effect of prices, unlike in Townsend (1994) where idiosyncratic shocks to expenditures could be due to variation in quantities or prices. To further emphasize the distinction between quantities and expenditures, one can imagine that household expenditures may fluctuate quite a lot as the prices a household faces or the goods a household consumes change. On the other hand, the overall quantity a household consumes may remain relatively stable, once aggregate changes in quantity are accounted for. This sort of variation in expenditures could lead to rejection of the full insurance model, even though the quantity one consumes may be insured against. This is an important distinction because in terms of household welfare quantities, not expenditures, are what really matter.

Utilizing this approach we develop a testable model that connects spatial and temporal price variation to consumption behavior. We then derive an estimation equation that allows us to test whether the full insurance model holds once we allow for price variability.

It is important to note that other authors have made similar observations about tests of the full insurance model. Notably, Ogaki and Atkeson (1996, 1997) introduce wealth varying intertemporal elasticities of substitution and find economically significant differences in the intertemporal elasticity of substitution of consumption expenditures of poor and rich consumers in Indian panel data. In particular they find that the intertemporal elasticity of substitution rises with wealth. Specifically, this implies that the ratio of the consumption of the rich to that of the poor changes over time, and that the direction of the change depends on the path of intertemporal prices. The basic idea here is that the necessary goods that poorer households consume are less substitutable over time then are expenditure elastic goods. In this paper our focus is on spatial variation of prices, but we do not put any explicit restrictions on the intertemporal elasticity of substitution. Our model allows for variation in the goods that household's consume and we do not assume that household's face the same price. We will have to make some weak assumptions on the degree of substitutability between goods and the shape of the engel curve that we will address in the estimation strategy.

Our model leads to an estimation equation relating quantities to prices that provides an exclusion restriction that allows for a test of full insurance. If there is full insurance in the community idiosyncratic shocks, such as shocks to income, should not affect the quantity consumed, once aggregate changes are accounted for. What this suggests is if we fail to reject the full insurance model once we allow for spatial variation in prices, then households either do not face any idiosyncratic risk, or that idiosyncratic risk comes from other causes, such as illness. In terms of consumption smoothing, mechanisms could involve borrowing and saving over time, seasonal storage or mutual insurance across space. On the other hand, if we reject full insurance, it implies that even once we account for price variation, these households are still unable to smooth consumption. Even if we find full insurance within a community, one must remember that there may still be large differences in the quantities consumed across communities due to variation in supply, as well as potential differences in the prices faced by households within a community. This paper is not meant to provide a comprehensive analysis of the welfare consequences of price variation more generally, although this is a topic of future research.

In order to test our modified version of the full insurance model we take our estimation equation to panel data from Vietnam. Looking at this question in the context of Vietnam is of particular relevance for a number of reasons. Traditionally the Vietnamese government largely controlled agricultural policy, setting prices and limiting both domestic and international trade. However, beginning in 1986, the government began a series of renovation (Doi Moi) policies targeted at liberalizing agricultural markets. One of the primary avenues by which these reforms affected household behavior was through changes in agricultural prices. Although the real price of most agricultural crops increased between 1992 and 1998, the total variation in log prices increased (Benjamin and Brandt, 2002). Part of the reason for this is that Vietnam is a geographically diverse country with different crops growing in different regions with varied success. For example, in the same year it is possible that farmers in the North will only have one rice harvest, while those in the South have three. In addition, certain regions' climates support a greater variety of crops giving households in these regions more flexibility to shift to substitute foods when the price of one food rises. Households in areas where one crop dominates have limited opportunities to trade in other food crops making it more difficult to moderate domestic price instability. We will test for regional differences in the extent of full insurance with our data. Finally, with parts of the country bordering China, Cambodia and Laos, changing world prices may have vastly different effects on a household depending on the part of the country a household resides in. These observations suggest that in the context of Vietnam in particular ignoring spatial variation in prices and differences in the basket of goods that household's consume could lead to incorrect conclusions about the extent of full insurance in these communities.

The remainder of this paper is organized as follows. Section 2 summarizes the relevant literature. Section 3 presents a simple model connecting price variation to idiosyncratic risk. Section 4 discusses the data and provides some summary statistics. Section 5 outlines the estimation strategy. Section 6 gives our results. Section 7 concludes and discusses future extensions.

2 Literature Review

During the early part of last century anthropologists and economists alike recognized the importance of institutions in mitigating risk in both a developed and developing country context. Although the majority of this work is largely anecdotal, it provides a good contextual setting for a lot of the more recent theory and for the analysis to follow in this paper. In particular, this literature recognizes the role of institutions as a means of overcoming market failure. Looking at this idea in terms of prices anthropologists like Karl Polanyi believed that the integration of the economy determines all prices in all markets, thus prices in peripheral markets have little or no feedback effect on production decisions. To summarize this idea, Humphreys (1969) writes,

> "The peripheral market is isolated from other markets by poor communications, and insulated from affecting production decisions by an agricultural context in which the bulk of the harvest is consumed by the producer, by reluctance to depart from traditional patterns of production and by the fact that land and labor are not transacted in the market. Limited storage facilities as well as transport difficulties restrict the trader's opportunities of profiting from price fluctuations".

Drawing from these ideas in anthropology, economists saw the need to develop a rigorous analytical framework that looks at the nature of market integration in the specific institutional context of a rural developing economy (Bardhan, 1980). This recognition has led to a well established body of both theoretical and empirical economic work focusing on market failures and risk in developing country economies.

One line of research of relevance to this paper attempts both at more generally understanding consumption behavior, as well as specifically focusing on the ability of households to smooth consumption over time and across space. As mentioned earlier, the seminal paper in this area is Townsend (1994) which develops the full insurance model and then presents a strategy for testing the extent of consumption smoothing undertaken by households. To test for full insurance he regresses household level consumption, measured in expenditures, on aggregate village consumption, a demographic term, and other characteristics of the household. If households smooth consumption then only changes in aggregate village consumption should affect household level consumption. On the other hand, if households are unable to smooth consumption, then changes in household level variables will affect own consumption. In testing his model Townsend (1994) rejects full insurance. As mentioned before, we will use a similar strategy to look at the relationship between prices and consumption.

Additional authors use a similar framework, but focus on insurance over illness shocks as opposed to income. It is important to note that these authors also use expenditures as their dependent variable. Gertler and Gruber (1998) sharply reject the full insurance model for major health shocks. They claim that this rejection perhaps provides a lower bound on the extent of insurance, since they are looking at low probability high cost events. Using the same data we use in this analysis Wagstaff (2005) finds that households in Vietnam are unable to smooth either food consumption or non-food consumption in the face of BMI shocks, but are better able to smooth food consumption. We can see how these results compare to our results on full insurance for specific goods in the face of income shocks. Dercon and de Weerdt (2004) use data from Tanzania and cannot reject full insurance for food consumption over illness shocks. What these results illustrate is a general rejection of full insurance in the literature when expenditures are used as a dependent variable.

Drawing from the ideas in Townsend (1994), Ligon (1998) looks at how well three different economic models–permanent income, full insurance, and private information–are able to capture the consumption behavior in three village economies in Southern India. His results suggest that different models fit consumption patterns in different villages, possibly pointing to variation in the institutional mechanisms available in each village. He also concludes that private information may be an important influence in determining allocations and institutions in rural economies. Paxson (1993) focuses specifically on seasonal consumption patterns and finds that these patterns are not based on an inability of households to use savings behavior to smooth consumption, but rather are the result of seasonal variations in preferences or prices common to all households. This result is particularly relevant for this paper since it points to the potentially important role of prices in influencing changes in consumption, which we need to tease out to isolate the effects of idiosyncratic shocks.

There is also an important line of literature that looks at the effects of different shocks, as well as differences in households ability to respond to shocks. Dercon et al. (2005) looks at risk faced by rural Ethiopian households. They find that certain shocks are more important for certain households, and that some shocks seem to have long lasting effects. For example, they find that illness shocks are more important for households where the head has no schooling. Udry and Duflo (2004), although focusing on within household allocation, find that rainfall induced fluctuations in income from yams are transmitted to expenditures on education and food, not to expenditures on private goods such as alcohol and tobacco. Dercon and Krishnan (2000) look at data on adult nutrition and find that poor households are affected by household specific shocks in agriculture. In this paper we will also look at whether households are able to smooth consumption of some goods better than others, as well as whether the degree of full insurance varies across household type.

Now we turn from the consumption smoothing literature to the role of prices and market failures more broadly. de Janvry et al. (1991) develop a simple model that looks at how market failures constrain the ability of peasants to respond to price incentives. The authors test the model through simulations and find that in order for peasants to respond to price incentives villages need infrastructure investments, increased competitiveness among local merchants, better circulation of price information, and a means of transporting goods. The authors also point out that the magnitude of the price variation found in a village depends on transportation costs, mark ups by merchants, the opportunity cost of time involved in selling and buying, and the risk associated with uncertain prices and availabilities. These results suggest that geography and institutions not only play a role in determining the amount of price variation a household faces, but also influence a household's ability to respond to these price changes. This result indicates that perhaps the extent of insurance we find will depend on the degree of price changes faced in a given area.

Some recent work suggests that these issues of geography and institutions may be particularly important for Vietnam. Dollar (2002) finds that although Vietnam carried out significant economic reforms in the 1980's and 1990s, they started at a very low level of institutional and policy development. He argues that there are serious institutional weaknesses that need to be addressed in order for a high growth rate to be sustained. One can imagine that these sort of weaknesses may limit the ability of households to insure against idiosyncratic shocks. Benjamin and Brandt (2002) focus on the impact of two main policy changes in the 90's, the increase in the rice export quota, which increased the price of rice, and the liberalization of the fertilizer market, which caused a sharp drop in fertilizer prices. They find that these policy changes led to a decrease in price variability across regions in 1998, with the changes disproportionably benefiting the South. Note, however, that overall variation in log prices increased. Mino and Goletti (1998) focus on the effect of export liberalization on paddy and rice prices in seven regions in Vietnam and find that the resulting increase in prices would potentially hurt many Vietnamese households since less than one third of households are net sellers. They also find complex distributional results that vary by region. This result again points to the importance of space and market integration in determining economic outcomes and suggests that accounting for these price differences may be important.

Overall, these anecdotes and existing literature provide the motivation and platform for the model and analysis developed in the rest of the paper. These works highlight the relationship between market failures, prices, consumption smoothing and welfare and sheds light on the role of prices in influencing consumption behavior. The rest of this paper attempts to characterize this relationship more formally and test the extent to which households can insure against idiosyncratic shocks once controlling for price changes.

3 Model

We formulate a structural dynamic model that characterizes full insurance, allowing for spatial variation in prices. In particular, we model the relationship between consumption, measured in quantities, and prices that leads to an estimation equation that we test using panel data from Vietnam. This model allows for aggregate shocks, but otherwise characterizes consumption in a world with perfect consumption smoothing both over time and across space. Potential mechanisms for this smoothing include saving and borrowing over time (i.e. no credit market constraints), storage, mutual insurance and numerous non-market institutions. We allow for aggregate shocks since this more accurately reflects the environment of a low income economy. For example, one can imagine in the case of a drought there will be an aggregate decrease in agricultural production. Accounting for this aggregate change, we then want to see if there is full insurance in these communities once we allow for price variation.

We set up a two stage budgeting problem where in the first stage we look at a household's decision to allocate expenditures over time to maximize lifetime indirect utility given different possible states of the world. In the second stage we take the optimum choice of expenditures as given and look at the within period consumption decisions. This framework leads to demand equations that we can estimate and allows us to test the extent of insurance in a setting with volatile prices.

3.1 Stage One: Optimal Allocation of Expenditures

In order to determine a household's allocation of expenditures over time, we first take time as finite with some initial date $t = 0$ and some end date $t = T$. In every period a state of the world is realized, denoted $l_t \in \{1, \ldots, L\}$. The history of these realized states can be written as $h_t = (h_{t-1}, l_t)$ where the initial condition is given, $h_{-1} = \emptyset$, and $\{h_t\} \in H_t$. With this setup, we write the probability of state l_t occurring at time t as $Pr(l_t|h_{t-1}) = Pr(h_t|h_{t-1})$, which we will denote as $Pr(h_t)$. At each date t state l_t, and hence history h_t, is revealed which includes the realization of random variables such as shocks associated with weather and changes in prices. Consumption, measured in quantities, by household i in time t given history h_t is denoted $c_t^i(h_t)$, where households are indexed from $i = 1, ..., n$ and the expenditures of household i in time t is denoted $X_t^i(h_t)$. Denote the wealth transferred from time t to $t + 1$ as $A_{t+1}^i(h_t)$. Initial assets are given and we impose a terminal asset condition such that $A_T^i \geq 0$ for all i. Prices vary over space S and we denote each location as $s \in S$. We will remain agnostic right now as to the specific characterization of the location. The price of good j in time t at location s is denoted as $p^s_{tj}(h_t), j = 1, \ldots, m$. The price at a given location at a given time period depends on the history and thus all realized shocks. We also allow transfers between households i and k denoted $\tau^{ik}_t(h_t)$. Income is denoted $Y^i_t(h_t)$. Given an indirect utility function, $V_t\left(X^i_t(h_t); p^s_{tj}(h_t)\right)$ and a set of state dependent prices, $p^s_{tj}(h_t)$, households choose expenditures over time to maximize their indirect utility by solving:

$$\max_{X^i_t(h_t)} \sum_{t=1}^{T} \beta^t \sum_{h_t \in H_t} Pr(h_t) V_t\left(X^i_t(h_t); p^s_{t1}(h_t), \ldots, p^s_{tm}(h_t)\right) \tag{1}$$

subject to the dynamic asset accumulation constraint:

$$A^i_{t+1}(h_t) = (1 + r_t)A^i_t(h_{t-1}) + Y^i_t(h_t) + \tau^{ik}_t(h_t) - X^i_t(h_t) \tag{2}$$

where β is a common discount factor for all households and r_t is the interest rate in period t. Equations (1) and (2) tell us that a household chooses expenditures to maximize expected utility given the probability of a given history occurring at time t, a history that also determines all prices. The timing of the problem is such that state l_t occurs, at which time a household's income and vector of prices are realized. Based on these realizations, the household then chooses its expenditures.

Taking first order conditions of this problem with respect to $X^i_t(h_t)$ gives us the following condition:

$$\beta^t \frac{\partial V_t\left(X^i_t(h_t); p^s_{tj}(h_t)\right)}{\partial X^i_t(h_t)} = \lambda^i_t \tag{3}$$

where λ^i_t is the multiplier associated with equation (2), the marginal utility of wealth. Since we have an intertemporal budget constraint there is a multiplier associated with each period t and for each household i which, using the envelope theorem, gives us equation (4),

$$\lambda^i_t = E_t[(1 + r_t)\lambda^i_{t+1}|h_t] \tag{4}$$

where $E(.|h_t)$ denotes expectations conditional on history h_t. This equation shows us that λ^i_t provides a link between current and other period decisions and captures the evolution of future variables. Combining equations (3) and (4) gives us the following euler equation,

$$\frac{\partial V_t\left(X^i_t(h_t); p^s_{tj}(h_t)\right)}{\partial X^i_t(h_t)} = \beta E_t[(1 + r_t)\frac{\partial V_t\left(X^i_{t+1}(h_{t+1}); p^s_{tj}(h_{t+1})\right)}{\partial X^i_{t+1}(h_{t+1})|h_t}] \tag{5}$$

which tells us that, up to a discount factor, the marginal rate of substitution between two periods should reflect the relative opportunity cost of expenditures in the two periods. In other words, each household should allocate expenditures over time such that the marginal utility of expenditures at time t equals the expected value of next period's marginal utility of expenditures, adjusting for the interest rate, discount factor and changes in commodity prices. This means that a household will choose to save and borrow over time so that this condition holds. This solution is equivalent to one where you maximize expected lifetime utility subject to an intertemporal budget constraint, thus the marginal utility of wealth is equal to the marginal utility of expenditures (for a more detailed explanation see Kim (1993)).

Given this setup, the static demand functions can now be given an intertemporal interpretation since expenditures in t, $X_t^i(h_t)$, capture the influence of both past and future variables on current decisions through the effect of λ_t^i, the marginal utility of wealth. Since we are trying to characterize consumption in a world with full insurance, lambda does not change over time so, thus $\lambda_{t+1}^i = \lambda_t^i = \lambda_i$. Therefore, we take $X_t^i(h_t)$, the expenditures by household i in period t, as given and turn to stage two of the budgeting decision, allocating consumption across goods within a period.

3.2 Stage 2: Allocation of Consumption

Now that households have decided on how to allocate their expenditures across periods, household i in period t takes as given prices $p_{jt}^s(h_t)$, and total household expenditures $X_t^i(h_t)$. Assuming Constant Relative Risk Aversion (CRRA) utility, each household i has preferences over the m goods in the economy in time t as follows,

$$U_t^i(c_t^i(h_t)) = \sum_{j=1}^{m} f_j(x_t^i) \left(\frac{(g_j(x_t^i) + c_{jt}^i(h_t))^{(1-\gamma_j)} - 1}{1 - \gamma_j} \right) \tag{6}$$

where γ is the coefficient of relative risk aversion and x_t^i are household characteristics. The utility function includes two functions, $f_j(x_t^i)$, which relates household characteristics to the demand for good j in the form of a scalar, and $g_j(x_t^i)$, which translates the utility around the origin. The inclusion of $g_j(x_t^i)$ is important because it allows a household to have a finite marginal utility even when they consume zero of a good (which could happen if a household does not like a good, the good is unaffordable, or the good may not have been bought during the period of question due to storage).

Given the preferences expressed in equation (6), we set up the second stage as a social planner's problem where the planner assigns consumption allocations of good j subject to the constraints imposed by the vector of prices and the overall resource constraint. In particular, for each good j the social planner in a community solves:

$$\max_{c^i_{jt}} \sum_{i=1}^{n} \lambda^i f_j(x^i_t) \left(\frac{(g_j(x^i_t) + c^i_{jt}(h_t))^{(1-\gamma_j)} - 1}{1-\gamma_j} \right) \tag{7}$$

subject to the overall resource constraint for that good:

$$\sum_{i=1}^{n} p^s_{jt}(h_t) c^i_{jt}(h_t) \leq \sum_{i=1}^{n} X^i_{jt}(h_t) \tag{8}$$

where the λ^i's are the planner's weights. Taking first order conditions with respect to $c^i_{jt}(h_t)$ we derive the following expression

$$\lambda^i f_j(x^i_t)(g_j(x^i_t) + c^i_{jt}(h_t))^{-\gamma_j} \leq p^s_{jt}(h_t)\mu_{jt}(h_t) \tag{9}$$

where $j = 1, ..., m$ and $t = 1, ..., T$ and $\mu_{jt}(h_t)$ is the Lagrange multiplier associated with the resource constraint for good j in period t with history h_t in a particular community.

Assuming the constraint is binding and rearranging equation (9) we express consumption of good j at time t as follows

$$c^i_{jt}(h_t) + g_j(x^i_t) = \left[\frac{f_j(x^i_t)\lambda^i}{p^s_{jt}(h_t)\mu_{jt}(h_t)} \right]^{\frac{1}{\gamma_j}} \tag{10}$$

This expression tells us that consumption of good j by household i in period t is a function of the household's characteristics, the coefficient of relative risk aversion, the planner's weight, the price of good j and the aggregate resource constraint, which works through the lagrange multiplier $\mu_{jt}(h_t)$. Notice that only $\mu_{jt}(h_t)$ and $p^s_{jt}(h_t)$ depend on the random history, thus the only risk born by households in an efficient allocation will be aggregate risk from the commune resource constraint and prices. With some additional assumptions on $f_j(x^i_t)$ and $g_j(x^i_t)$ our estimation equation will be derived from equation (10).

4 The Data

Before turning to our estimation strategy we will briefly discuss the data used in this paper[1]. We employ data from the Vietnam Living Standard Surveys (VLSS) for 1992-1993 and 1997-1998. These nationally representative surveys provide extensive household and commune level[2] data for 4799 households in 1992-1993 and 5999 households in 1997-1998.[3] Of these households, 4267 create a nationally representative panel (representative in 1993) which we utilize in our estimation strategy.[4]

To give some sense of the households in the dataset, Table 1 provides some basic household characteristics. These summary statistics show that the majority of households are rural farm households, with these percentages dropping slightly between the two survey rounds. The average household size also drops, while the sex of the household head remains fairly constant over time. Given that this is a largely rural sample, fluctuations in food prices may have important ramifications for household welfare. The summary statistics in Table 1 also point to a 'better off' population in 1997-1998, with total expenditures per capita and income per capita increasing in real terms between the two years. Average food expenditures also increased in real terms between the two survey rounds from 1255('000 dong) to 1431('000 dong).

[1]For more detailed information on the data collection see (World Bank, 2000; World Bank, 2001)

[2]Communes are smaller than regions and larger than villages. There are about 9012 communes in Vietnam with an average of 9000 people per commune, but a lot of variation in commune size both in terms of population and size.

[3]The 1992 survey design involved a nationally representative sampling framework which was stratified into two groups, urban and rural, with sampling carried out separately in each. A total of 150 communes (30 urban, 120 rural) were chosen where the probability of a commune's selection was proportional to its population size. Within a commune two villages were chosen in proportion to their village size and 16 households were selected from each village (World Bank, 2000). In 1998, the sample design followed a similar structure; however, an additional 1200 households were added. The selection of these additional households was not proportional to population since they were selected specifically to over-sample certain domains (World Bank, 2001).

[4]In terms of attrition in VLSS, if households in the original sample were not found they were replaced by another household selected randomly in the village. A total of 495 households were not re-interviewed in 1997 for various reasons. These reasons included a change in the sample design (96), moved away from the original village (281), temporarily away from the commune (19), dissolved due to death (1), refused to answer (12), and no

Table 2 provides some regional and seasonal characteristics of the data. These numbers show that there is good regional coverage for the most part, although the Central Highlands is largely under sampled, only representing 2% of the data. The sample of households from the Central Highlands increased in 1998, but can not be used as part of the panel analysis. Since we also want to control for seasonal variation in prices, we create a quarterly time of survey indicator so that we can adjust prices accordingly. The variables in Table (1) and (2) both serve as explanatory variables in the analysis and help us further explore the price variation seen in the data.

Of particular importance to our estimation strategy, the VLSS contain detailed information on prices and consumption at both a household and commune level. At the commune level, a price survey was administered in both years that collected both food and non-food commune level prices for rural communes in 1992 and for all communes in 1998.[5] Three observations were made for each good and we utilize the average of these values in our analysis.[6] Unfortunately, we can not match these prices to the specific village from which they were taken.

At the household level the surveys contain detailed information on household expenditures on the quantity and value of both food and non food purchases as well as home production consumed. Focusing on food expenditures, we use this raw data to calculate annual household good specific consumption following the procedure detailed in the survey documentation.[7] We summarize this information in Appendix 1. Price measures were then derived by dividing the value of consumption by the quantity consumed. We identify outliers as those that are more than five standard deviations from their means (Cox and Wohlgenant, 1986) and replace them with the means of the nearest aggregated area.[8] We will address problems associated with using unit values as a measure of price later in this section.

information (46).

[5]A similar survey was carried out by the General Statistics Office (GSO) for urban communes in 1992. Efforts were made so that this data collection coincided with the time of the survey so that the numbers are comparable (World Bank, 2000).

[6]Following Niimi (2005), when the commune price is missing, the mean price for the urban/rural sector of each region interviewed in the same quarter is assigned to the households in that commune as long as at least one households in the commune purchased that particular good.

[7]We also calculated measures of total food expenditures to compare with the preconstructed values in the VLSS and found them comparable.

[8]Outliers make up 0.24% of observations in 1992-1993 and 0.30% data in 1997-1998

We choose to utilize both the household and commune level prices in our analysis, although we recognize there are concerns with both measures. In many ways it is desirable to use the household level data since it contains a lot more information than the commune level data and allows us to look at within commune variation in prices. However, given that these prices are obtained from self-reported information there may be significant measurement error and quality differences which can bias our estimation (Deaton, 1997). We will return to these issues momentarily. The commune level data, on the other hand, may not suffer from this problems, but it may also not be that reliable given that these prices did not necessarily involve actual purchase and were not collected by a local person (World Bank, 2001). We will keep these issues in mind during the analysis.

As the set of goods listed in the surveys is very large, the empirical analysis will focus on a subset of goods that both (1) has corresponding commune price data and (2) comprises the bulk of consumption for Vietnamese households. Table 3 lists these goods and shows the percent of households that consumed the good, the mean budget share of the good, and the percent of households that were net sellers of the good. Table 3 clearly shows that the bulk of consumption is of rice, although budget shares drop from 0.442 to 0.397 between the two survey rounds. Fruit, vegetable and meat consumption increase between the two years, both in terms of the budget share and the percent of the households that consumed the good. This reflects the changing food demand patterns occurring in Vietnam at this time.

The majority of the households are net buyers in the case of every crop, suggesting that although this is a largely rural population, households are still buying food to supplement what they grow. This result suggests that the prices these households face as buyers may very well affect their consumption levels. If we found, on the other hand, that the majority of the households were net sellers it may have suggested taking a different modeling approach.

Table 4 lists both the household and commune level prices for these goods. The household and commune level prices are comparable in virtually all cases Prices generally increased in real terms between the two survey years, with the commune price of rice, for example, rising from 2.917 ('000 dong) to 3.314 ('000 dong) per kilogram expressed in January 1998 dong. The exchange rate in 1998 was approximately 13,900 dong/$. We look at whether there were significant changes in the mean commune price and see that for the majority of goods there is a significant change in price, although the sign of the change varies. The standard errors on the commune price suggest there is a great deal of between commune heterogeneity in price. We also see a lot of within commune variation in price suggesting that a commune level analysis might miss important within commune heterogeneity in prices. On the other hand, as mentioned previously, the within commune variation could simply be a result of measurement error and quality. It is well documented in the literature that there are a number of problems that come up whenever you divide expenditures by quantities to get prices. These values are not exactly prices but are 'unit values' which may differ across households that face identical prices due to differences in quality. Secondly, unit values are contaminated by errors in measurement of both expenditures and quantities (Deaton, 1997).

Looking at the issue of quality, consumers choose the quality of their purchases and unit values reflect this choice. Moreover, quality choice may itself reflect the influence of prices as consumers respond to price changes. As suggested by Deaton (1988) one can uncover the presence of quality effects by running an OLS regression of the log of the unit value on the log of total expenditures, household demographics, other household characteristics, and a village indicator. The slope coefficient on the log of total expenditures is referred to as the quality elasticity. Results from Deaton (1988) show that although quality effects are real, they are fairly modest. This result suggests that if we ignore the possibility of substituting away from relatively more expensive goods, we will get an upper bound on the predicted impact of the price changes.

Turning to the issue of the measurement error found in expenditures and quantities, it can lead to a spurious negative correlation between unit values and measured quantities. For example, if households recall expenditures correctly but have difficulty in recalling quantities the covariance between the quantity and the unit value will be negative. Under certain conditions, the estimated price elasticity will be biased toward negative one (Deaton, 1997). In the part of the analysis where we use unit values we will return to some of these issues in more detail.

Finally, in terms of addressing both quality and measurement error, Deaton (1988) uses the assumption that all within cluster variation is due to quality effects and measurement error. He then uses this assumption to back out the true price elasticities. We will initially take this assumption as true and use a commune level analysis. We are lucky since we have access to a commune level price as well as the unit value. However, making this assumption of one commune price seems to disregard a lot of possibly important within commune price heterogeneity so we will also look at the household specific prices. Recent work by Niimi (2005) using the VLSS data finds that Deaton's method generates very different price elasticities than using the commune data directly, but that the household data produces fairly similar results to the commune data. Moreover, recent work by Attanasio and Frayne (2006) attribute price differences within a geographic area to bulk discounting and suggest that these price differences reflect real price differences. These results suggest that perhaps we should look at both the commune price and the unit value in our analysis. These issues will be addressed further in our estimation strategy.

5 Estimation Strategy

The model outlined in section (3) gave us the following characterization of consumption:

$$c^i_{jt}(h_t) + g_j(x^i_t) = \left[\frac{f_j(x^i_t)\lambda^i}{p^s_{jt}(h_t)\mu_{jt}(h_t)}\right]^{\frac{1}{\gamma_j}} \tag{11}$$

This equation lends itself to a consumption smoothing regression in the vein of Townsend (1994). If households are hedging risk across space and over time then one would expect that once we control for prices, idiosyncratic shocks will not affect the quantity consumed in that location. On the other hand, if households are not able to hedge risk across space and over time, then these idiosyncratic shocks will affect the local quantity consumed. In order to estimate equation (11) we need to define a functional form for $f_j(x^i_t)$. We follow Dubois and Ligon (2005) and allow f to depend on the coefficient of relative risk aversion, γ_j, and an additional preference parameter, δ_j, that reflects a household's preferences for a certain good. These preferences are measured with error which we denote ϵ^i_{jt}. Thus we characterize $f_j(x^i_t)$ as $f_j(x^i_t) = e^{(x^i_t\delta_j + \epsilon^i_{jt})\gamma_j}$. What $f_j(x^i_t)$ basically allows for is differences in the growth of household consumption within a community due to intertemporal differences in preferences, such as age and household size, for example. However, we assume stable preferences in the sense that idiosyncratic shocks to income will not affect taste.

In addition we need to characterize $g_j(x^i_t)$. As mentioned earlier $g_j(x^i_t)$ allows for people with zero consumption. We will address this in a number of ways in our estimation: (i) simply drop households that do not consume a particular good in one of the two periods and (ii) model $g_j(x_t^i)$ as a function of household and geographic characteristics such as those shown in Table (1) and Table (2). The former of these models consumption conditional on consuming the good, while the latter models unconditional consumption. We will explain each of these in more detail in the results section. Finally, we need to define household level prices for those households that did not consume anything. For these households we replace the missing price with the price of the nearest aggregated area.[9] We exclude from the analysis households where we have neither a household price estimate or a commune price estimate.[10]

With this formulation of $f_j(x_t^i)$ and taking logs of equation (11) one can write $\log(c_{jt}^i(h_t) + g_j(x_t^i))$ as follows:

$$\log(c_{jt}^i(h_t)+g_j(x_t^i)) = x_t^i\delta_j - \frac{1}{\gamma_j}\lambda^i - \frac{1}{\gamma_j}\log(p_{jt}^s(h_t)) - \frac{1}{\gamma_j}\log(\mu_{jt}(h_t)) + \epsilon_{jt}^i \quad (12)$$

Equation (12) allows for aggregate shocks through $\mu_{jt}(h_t)$ and $p_{jt}^s(h_t)$ These shocks impose an additional commune resource constraint on our estimation with a multiplier α_j^c for each period t. Assuming that $\mu_{jt}(h_t)$ has a log normal distribution we write $\log(\mu_{jt}(h_t)) = \alpha_{jt}^c$. We make this assumption since $\mu_{jt}(h_t)$ is related to the aggregate supply of the good in the commune and so really enters as a commune-time fixed effect This commune level resource constraint relates to the household level resource constraint through the household weight λ^i. With these adjustments we rewrite equation (12) as follows:

$$\log(c_{jt}^i(h_t) + g_j(x_t^i)) = x_t^i\delta_j - \frac{1}{\gamma_j}\lambda^i - \frac{1}{\gamma_j}\log(p_{jt}^s(h_t)) - \frac{1}{\gamma_j}\alpha_{jt}^c + \epsilon_{jt}^i \quad (13)$$

We can then estimate equation (13) using data on consumption and prices for a variety of goods as well as commune and household level characteristics. In order to estimate equation (13) we first take first differences of equation (13) over the two time periods to difference out the household level fixed effect. This transformation results in the following estimation equation:

[9] If the household specific unit value is missing, it is replaced by the commune-quarterly mean, and if that is missing, it is then replaced with the commune mean etc.

[10] If neither price is available we assume the good is not available in the area and thus it is difficult to assign them a price. This accounts for about 4% of observations in 1993 and 2.4% of observations in 1998.

$$\Delta \log(c^i_{jt}(h_t) + g_j(x^i_t)) = \Delta x^i_t \delta_j - \frac{1}{\gamma_j}\Delta \log(p^s_{jt}(h_t)) - \frac{1}{\gamma_j}\Delta\alpha^c_{jt} + \Delta\epsilon^i_{jt} \quad (14)$$

Manipulating equation (14) we calculate within commune time averages and then undertake the following operation (denoted W),

$$W_{x^i_{jt}} = x^i_{jt} - \frac{1}{h^c_t}\sum_{k \in c_t} x^k_{jt} \quad (15)$$

where h^c_t is the number of households in commune c in year t and k indexes households in commune c in time t. This is simply a within transformation. Applying this transformation to (14) we have:

$$W\Delta \log(c^i_{jt}(h_t) + g_j(x^i_t)) = W\Delta x^i_t \delta_j - \frac{1}{\gamma_j} W\Delta \log p^s_{jt}(h_t) + W\Delta\epsilon^i_{jt} \quad (16)$$

which relates household level consumption to household and commune level characteristics.

Equation (16) can be straightforwardly estimated by OLS, but this does not constitute a test of full insurance. To construct a test of full insurance we use data on income (Y^i_t), an idiosyncratic variable, that should not affect consumption if there is full insurance. Turning back to our initial specification in equation (13) and adding in income we can write our estimation equation as follows,

$$\log(c^i_{jt} + g_j(x^i_t)) = \beta_0 + \beta_1 x^i_t + \beta_2 \log p^s_{jt}(h_t) + \beta_3\alpha^c_{tj} + \beta_4\lambda^i + \beta_5 Y^i_t + \epsilon^i_{jt} \quad (17)$$

where we use reduced form notation to elucidate the form of the equation we are estimating. Full insurance implies the exclusion restriction that $\beta_5 = 0$. We will take first differences and undertake a within commune-time transformation to estimate (17).

Our final step is to determine what prices to use in the estimation. We consider two alternatives. First we assume that everyone in a commune faces the same price. This means that the second term in this equation ($\beta_2 logp^s_{jt}(h_t)$) is swept out with the commune-time fixed effect. Second, we allow for price variation within a commune and use the household specific price. In this case our estimation includes the deviation of the household price from the commune average. If households are fully insured once we account for spatial price variation, our theory implies that income (Y^i_t) will not enter into our estimation. That is we would expect the coefficient on income to be zero under the null hypothesis.

6 Results

As mentioned in the previous section, in order to estimate (17) we employ a number of approaches to try and capture the effect of idiosyncratic shocks to income on consumption, measured in quantities. Before proceeding with this, we want to first undertake the traditional consumption smoothing approach to help in framing the subsequent results. Table (5) shows the results from a traditional Townsend (1994) style regression. After controlling for changes in commune means, we see that a 1000 dong increase in income leads to a 35 dong increase in expenditures per capita. This estimate is significant at the 99% level and reflects a strong rejection of full insurance.

Now we will turn to estimation of equation (17). We first choose to use commune prices in our estimation and thus postpone concerns over the use of unit values. Since we account for within commune averages in our estimation, these prices drop out. This leaves us with a regression of changes in quantities consumed on changes in household size, age and income, all accounting for aggregate changes. This leaves us with the exclusion restriction that changes in income should not affect changes in the quantity consumed.

We first estimate (17) simply using the sub-sample of observations that consume the good in both periods. That is we estimate conditional demand. This is clearly a select sample, but gives us a good baseline estimate that ignores the issue of selection. We can then compare this to the results where we control for selection. Table (6) shows the results of estimation of equation (17) using a seemingly unrelated regressions framework across the 23 goods listed in Table 3. We use a seemingly unrelated regression framework to allow for correlation between errors across equations. The coefficient of interest is on income. What we find is that for the majority of goods, the coefficient on income is positive, but the significance varies. For example, for ordinary rice a 10% increase in income leads to a .11% increase in ordinary rice consumption. This number is not only small in size, but also insignificant. However, when we look at chicken, for example we see that a 10% increase in income leads to a 1.19% increase in chicken consumption and is significant at the 1% level. The general trend one sees from this table is that households seem better able to smooth consumption of normal goods, than more luxury goods such as meats and processed foods. What this perhaps suggests is that there is some element of consumption that is necessary and households to some extent have to smooth, while consumption of more luxury goods fluctuates with income. A joint test across all goods strongly rejects full insurance with a p-value of 0.0000. So even once we allow for spatial variation in prices at the commune level we still reject full insurance, but we are able to uncover some differences across goods in the extent of smoothing.

Two questions might arise when one looks at these results, the first has to do with substitution and the second with the shape of the engel curves. First, in terms of substitution, our model allows for substitution based on changes in the aggregate price at the commune level, that is we allow for gross substitutes. For example, if there is less ordinary rice available in the commune, thus driving up the price, our model allows households to substitute to relatively cheaper goods. What our model does not allow for is differential substitution within the commune based on the idiosyncratic shock. For example, one might imagine that if a household faces a negative income shock it will substitute away from more luxury foods, such as chicken, and instead consume ordinary rice. However, if this household was fully insured, it should not have to make these changes since its choice over how to allocate expenditures in this period should not depend on the household's realized income, but on its lifetime expectations. The fact that we reject full insurance perhaps suggests that households are consuming more meat when times are good for them, and less in bad years, thus indicating that they are vulnerable to idiosyncratic shocks.

The second issue is that perhaps the shape of the engel curve differs across goods. What this would mean is that as a commune gets richer the change in quantity consumed would vary across the different goods. Again, our model allows for this in the sense that as the commune gets richer, its demand patterns can change. What our model, or the notion of full insurance, does not allow for is for a household who experiences a negative income shock to substitute across goods as a result. That is a household should not be moving up and down its engel curve in response to idiosyncratic shocks. One reason that we reject full insurance may be because households do respond to their individual income shock and do move up and down their engel curves accordingly. This behavior would lead to a significant coefficient on income.

So far we have ignored the issue of selection into consumption in each period, which we will model now. We model both the choice over whether or not to consume, as well as the choice over how much to consume. This basically involves modeling $g_j(x_t^i)$ from our estimating equation as a function of household and geographic characteristics such as those shown in Table (1) and Table (2). This allows us to capture the decision in and out of the market, as well as the decision on how much to consume. To do this we use a Heckman selection approach. Following Wooldridge (2002) and Semykina and Wooldridge (2005) we first use a probit estimation to model the binary choice of consumption in 1993 and 1998. From this we calculate the inverse Mills ratio in each period, which is simply the ratio of the probability distribution function over the cumulative density function. In the second stage we run the OLS regression on the selected sample and include the differenced inverse Mills ratio as a regressor. Under the null of no selection bias the coefficient on the differenced inverse Mills ratio should be zero. Note that this procedure is still valid if the set of regressors are the same in both stages; the coefficients in the second stage are identified due to the nonlinearity of the inverse Mills ratio. If the inverse Mills ratio is significant in the second stage we must correct the standard errors accordingly.

Table (7) shows the first and second stage selection equations for demand for one of our goods, water morning glory. Columns (2) and (3) of Table (7) show the marginal effects for the probit regression of the consumption choice in 1993 and 1998 respectively. One can see that income is clearly a strong determinant of whether a household chooses to consume a good or not, particularly in 1998, where a 1% increase in income leads to a 5% greater likelihood of consuming the good. The region a household resides in is important, particulary in 1993, as is whether the household head is an ethnic minority and whether the household is a farm household. It is interesting that price plays a strong role in 1993, but does not seem to play a role in 1998. Perhaps improved market integration explains the difference in the role of prices in the two years.

In the second stage the time invariant variables drop out and we are left with the key time varying variables as well as the differenced inverse Mills ratio which we denote lambda. These results are shown in column (1) of Table (7). One can see that even once we control for selection, households' demand for water morning glory still appears to be insured against income shocks. Moreover, the coefficient only changes slightly from -0.008 in the results where we ignore selection to -0.006 here. Second, the differenced lambda is insignificant suggesting that selection was not significantly biasing our results that looked at conditional demand.

Table (8) shows the second stage Heckman estimates for all goods. Once again we estimate the quantity demanded using a seemingly unrelated regression framework making sure to bootstrap the standard errors to account for the fact that the inverse Mills ratio is itself an estimate. There are two important things to take away from this table. The first is that the coefficient on income does not change dramatically across all goods once we account for selection. For example, the coefficient on chicken drops from 0.119 to 0.116. Second, only in the case of two goods is the coefficient on the inverse Mills ratio significantly different than zero, and we adjust the standard errors accordingly. These goods are salt and MSG which are consumed by almost all households, thus perhaps it is the small sample size that is driving the selection. Thus it does not seem that selection is the driving force behind our results in Table (6) that ignored selection. Even once we account for selection, we still reject full insurance across all goods.

Thus far we have focused on the commune level price, and rejected full insurance across all goods, although good specific results vary. However, it could be the case that we are not correctly adjusting for the price a household faces and to do this we should instead be using the unit value. We now include as a dependent variable in our regression the deviation of the household price from the commune level price. This introduces a host of additional issues that we want to briefly address before proceeding with the estimation.

Table (9) shows the extent of within and between commune price variation seen in the data. This table is simply meant to show that there is a lot of price variation within the communes that we can potentially exploit. For some goods, including ordinary rice, beef and cabbage over 60% of the price variation is explained by between commune variation, while other goods like oranges, bananas and fish sauce have over 50% of the variation explained by within commune variation. Now that we see that this within commune variation exists, there are two questions we need to think about. The first is whether these differences are meaningful, or simply reflect measurement error and quality differences. The second is whether it matters for our interpretation of the coefficient on income, our coefficient of interest.

To investigate the first point, we look at whether this cross sectional within commune price variation is related to certain observable household characteristics. The idea being that if these price differences are simply driven by measurement error then we would expect that the coefficients on these household and geographic characteristics would be zero. In terms of quality, we would perhaps expect that wealthier households would face larger positive deviations since they consume higher quality goods.

In a seemingly unrelated regression framework, we regress the deviation of the unit value from the commune mean for each crop on a large number of household characteristics to see what, if anything, explains the within commune variation. Tables (10) and (11) report the results from the 1992-1993 survey and the 1997-1998 survey respectively. The results are somewhat similar in the two years so we will focus on Table (6). We choose to look at a subset of the goods that we think is representative of the basket as a whole to help focus the discussion. First, one sees that there are significant determinants of the deviation of the unit value, suggesting that these deviations reflect more than just measurement error. However, the R-squared is small ranging from 0.021 to 0.063 in 1993 so we are not able to explain much of the variation in household price with the characteristics that we include. Second, we see that measures associated with wealth such as food expenditures and the quintile that a household falls in are positively related to the deviation. This could suggest that wealthier households choose higher quality foods and thus face a higher price. However, we also see that in the case of ordinary rice in 1997-1998 a larger household size leads to a significantly lower unit value, which could perhaps reflect some sort of bulk discounting. Tables (10) and (11) provide some evidence that the unit values reflect more than simply measurement error and quality, although the evidence is not conclusive. To fully investigate this issue would require an in depth analysis that is beyond the scope of this paper, but a question of future research interest.

The question then remains how quality and measurement effects in the household price affect our interpretation on the coefficient on income. If the deviation of the household price from the commune price is simply measurement error then this should not affect the interpretation of the coefficient on income, unless the measurement error was somehow correlated with income. If it is all driven by quality differences we would expect the coefficient on household price to be zero since it should not affect the within commune quantity consumed, since it reflects differences in quality. If we think that the unit value reflects quality choice and that higher quality is correlated with income, then this will lead to a loss of precision but again should not bias our coefficient on income. Given this, even if the unit values do not contain any useful information, although we believe they do, we should still get unbiased estimates for the coefficient on income.

We now proceed with the estimation including the household price. Table (12) shows the results from the regression of log transformed consumption on household characteristics, household price and income, all expressed as deviations from the commune average. As one can see from Table (12), the results on income are fairly similar to Table (6), with the magnitudes virtually identical to those where we controlled for the commune price. However, our estimates are now more precise, thus leading to a stronger rejection of full insurance across all goods. For example, in the case of ordinary rice the coefficient changes from 0.011 to 0.012, while the standard error drops from 0.007 to 0.006. It is somewhat interesting that the estimates get more precise, since one would think that if we were simply adding noise to the regression by introducing household price, then our estimates would become less precise. Once again we reject full insurance across all goods. For all goods, the sign on the coefficient on the household price is negative and significant, indicating that the higher the price you face compared to the average, the less you consume of the good. If we thought that the differences in these unit values were driven solely by quality effects, then we would expect the coefficient on household price to be zero. If differences were driven entirely by measurement error then under certain conditions the coefficient is biased toward negative one. A joint test across all household prices rejects that these coefficients are equal to negative one. The fact that these coefficients are significant perhaps suggests that there are meaningful differences in the prices that households face. Overall, results from Table (12) show that even once we allow for within commune variation in prices, we still reject full insurance.

To be complete, we also use a Heckman selection approach to estimate both the binary decision on whether or not to consume a good in the year as well as the decision on how much to consume as we did with our first specification. Table (13) shows both stages for water morning glory. The results are very similar to those that used the commune price, where in the second stage the coefficient on income remains unchanged from the results in Table (12) and the coefficient on the differenced inverse Mills ratio is insignificant. Compared to the results in Table (7) the coefficient on income drops from -0.006 to -0.010, suggesting that ignoring the within commune variation in price leads to an upward bias of the coefficient on income. This suggests that income and household price are negatively correlated, perhaps reflecting bulk discounting. Wealthier households may be able to buy more at a time which may lead them to face a lower per-unit price.

Table (14) shows the second stage of the Heckman selection equation for all the goods, and you can see that once again in the majority of cases the correction for selection into consumption is insignificant. Interestingly, unlike when we used the commune price, we now see a significant coefficient on lambda for our three fruit categories (oranges, bananas and mangoes). Although interpretation of lambda can be tricky, what this suggests is that there is something driving selection that is negatively correlated with the quantity consumed of these goods. Perhaps this has to do with the region that a household lives in. Why we find this result with the household price and not the commune price is unclear.

Thus far we have focused on the average consumption smoothing across all Vietnam, but it may be the case that this hides important heterogeneity across different types of households and different areas of the country in the ability to smooth consumption. We first investigate whether there are differences in the ability of households to smooth consumption in the north of the country versus the south. Qualitative evidence suggests that perhaps the South would be better able to smooth consumption since they have better options for crop diversification. We move back to our specification that uses commune price and ignore selection, since we found that it was insignificant. We include in our regression an indicator variable for whether the household lives in the North and also include the interaction of this with the household income deviation from the commune mean income. Results are shown in Table (15). What the results show is that there is not a significant difference between the North and South in the degree of variation in the quantity consumed around the commune mean. However, we do find significant differences in the ability to insure against idiosyncratic shocks to income. A joint test on the interaction between North and income across all goods strongly rejects that it is equal to zero in favor of a positive coefficient. This suggests that those households in the North who face larger income shocks face greater deviations in quantity, suggesting they are less insured. Further investigation of what drives this result may provide important information to policy makers about what mechanisms help households in the South to insure against shocks that are unavailable to households in the North.

Second, we compare the ability of poor vs. non-poor households to smooth consumption. We define a household as poor in 1998 if its total food expenditures fell below the food poverty line which is set at 1287 ('000 Dong). We include in the regression an indicator for whether the household was a poor household and then an interaction with the deviation of income from the commune mean. These results are shown in Table (16). For many goods the coefficient on poor is positive, and we find that across all goods it is significantly different than zero. What this suggests is that poor households are consuming an increasingly larger fraction of the total. This does not mean that they are consuming more in 1998 compared to 1993, but that their growth in consumption is faster than wealthier households. However, when we look at the coefficient on the interaction of poor with the income, it is generally insignificant and a joint test across all goods can not reject that both poor and non-poor households are able to equally smooth shocks to income with a p-value of 0.4820. So we do not find evidence that poor households are worse off than rich households in smoothing consumption. This is somewhat contrary to what we would have expected and perhaps conceals differences in the mechanisms that poor and non-poor households use to smooth consumption as well as differences in the effect of aggregate changes.

7 Conclusions

Many households in developing countries live in high risk environments where they face a great deal of uncertainty about their future welfare. This uncertainty stems from vulnerability to aggregate shocks, such as a country wide drought, as well as from idiosyncratic shocks, such as shocks to income and illness. A large literature in development economics investigates the ability of households to smooth consumption when faced with idiosyncratic shocks using a full insurance approach. The overwhelming finding in this literature is a rejection of full insurance.

In this paper we restrict some of the assumptions used in the general test of full insurance in the literature to see if the apparent rejection of full insurance in the literature can be explained by spatial variation in prices. The novelty of our approach is that instead of looking at consumption in terms of expenditures, the focus in this paper is on quantities consumed. This is an important distinction since in terms of household welfare, quantities, not expenditures, are what really matter. We also allow for a non-unitary income elasticity of demand which perhaps more accurately reflects changing demand patterns in Vietnam.

Utilizing this approach we developed a testable model that allowed us to test for full insurance using data from Vietnam. Our results showed that even accounting for price variation, at either a commune or household level, we still rejected full insurance across a set of 23 goods, although the degree of insurance varied across goods. In particular the results suggested that households are better able to smooth consumption over normal goods, as opposed to luxury goods. These results held once we adjusted the results to control for selection.

In addition, we investigated whether there was any heterogeneity across households or geographic areas in the degree of full insurance. We do not find any significant differences between poor and non-poor households in the ability to insure against idiosyncratic shocks. We do however, find that households in the North are significantly less able to insure against idiosyncratic shocks than those in the South.

Overall, our results suggest that households in Vietnam are susceptible to idiosyncratic fluctuations in income, although the magnitude of the effect is often small. Since we focus on quantities we are able to see that the ability of a household to smooth consumption seems to depend on the good in question. We have focused on the consumption of various food items in this analysis, and found differences in the ability of households to smooth consumption of different types of food. These results may also differ dramatically from the ability to smooth other types of goods, such as health expenditures or alcohol consumption. We have also made the point that it is important to allow for consumption of different baskets of good, and control for variation in prices, since these things vary a lot across households.

Given that we reject full insurance across a large number of food items, it suggests the need for further investigation into the heterogeneity in the degree of insurance across communes. Perhaps communes with a micro-finance organization are better able to smooth consumption than those without, or perhaps it simply has to do with the variety of crops that grow in a certain location. If we had instead found that all the risk these households faced was captured by the commune fixed effect, we would look to explanations such as transportation costs to explain deviations from full insurance. Further research can investigate the degree of failure of insurance that comes from aggregate shocks, as opposed to idiosyncratic shocks. From a policy perspective, it is important to see whether limited funds should be invested into village specific activities or to improving infrastructure between locations.

Appendix 1

Data were obtained on the number of months (in the 12 proceeding the survey administration) each food item was purchased, the number of times purchases were made during those months, the quantity purchased each time and the value purchased. These numbers were collected both for normal expenses, normal home production consumed, holiday expenses, and holiday home production consumed. The holiday expenses section is designed to take into account the unusually high spending patterns often observed during Tet, the lunar new year celebration. To come up with a measure for annual consumption, we convert the purchase frequency information on the number of purchases per time period, and the unit of the time period to a single 'purchases per month' variable. If the recall period was a month or less and a household also had holiday expenses for a certain good, normal expenses were scaled down by a factor of 11.5/12. Otherwise, no changes were made. To come up with annual numbers the purchases per month variable was multiplied by the number of months and quantity and value numbers were adjusted accordingly. The values for home production consumed were also converted to take account of the holiday expenses. Once again a frequency per month variable was constructed and if the number of months this product was consumed was greater than six, values for normal home production consumed were adjusted by a factor of 11.5/12 and were added to holiday production consumed.

Using these various household level measures for the quantity and value of goods purchased, one can construct a number of consumption and unit value measures. From the survey consumption measures were constructed by adding the quantity of home production consumed to the quantity bought. From the crop data, a measure of home production consumed was derived by taking the amount of the good harvested and subtracting the amount sold, the amount given to laborers, the amount used for seed, the amount given to livestock and the amount destroyed by disaster.

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Table 1: Household Level Characteristics (N=4267)

	1992-1993		1997-1998	
	Mean	**Std**	**Mean**	**Std**
Expenditure Variable (1998 Prices)				
Per Capita Food Expenditures (1000 Dongs)	1255	728	1431	742
Per Capita Total Expenditures (1000 Dongs)	1997	1387	2823	2188
Per Capita Income (1000 Dongs)	1762	2614	3065	3366
Demographic Variables				
Female Headed Household	0.260	0.439	0.272	0.445
Age of Head of Household	45.6	14.6	48.4	13.8
Farm Household	0.713	0.452	0.633	0.482
Household Size	5.028	2.156	4.764	1.964
Ratio of Males age 65+	0.030	0.097	0.042	0.123
Ratio of males age 18-64	0.243	0.162	0.246	0.167
Ratio of Females age 60+	0.068	0.158	0.090	0.192
Ratio of Females age 18-59	0.265	0.162	0.266	0.171
Ratio of Children age 12-17	0.125	0.161	0.145	0.171
Ratio of Children age 6-11	0.143	0.165	0.131	0.160
Ratio of Children age 5 or less	0.139	0.172	0.083	0.131
Illness	0.334	0.472	0.507	0.500
Years of Education	6.26	4.32	6.89	4.32
No Schooling	0.129	0.335	0.099	0.298
Ethnic Minority (non-Kinh)	0.142	0.349	0.142	0.349
Main Language Vietnamese	0.930	0.255	0.975	0.155
No Religion	0.636	0.481	0.729	0.444
Married	0.818	0.386	0.801	0.399

Table 2: Geographic and Seasonal Characteristics (N=4267)

	1992-1993		**1997-1998**	
	Mean	**Std**	**Mean**	**Std**
Geographic Variables				
Residence in an urban area	0.187	0.390	0.187	0.390
Red River Delta	0.228	0.419	0.228	0.419
Northeast	0.147	0.354	0.147	0.354
Northwest	0.025	0.156	0.025	0.156
North Central Coast	0.142	0.349	0.142	0.349
South Central Coast	0.097	0.296	0.097	0.296
Central Highlands	0.019	0.138	0.019	0.138
Southeast	0.138	0.344	0.138	0.344
Mekong River Delta	0.204	0.403	0.204	0.403
Seasonality				
Interviewed 1st Quarter	0.270	0.444	0.150	0.357
Interviewed 2nd Quarter	0.155	0.362	0.304	0.460
Interviewed 3rd Quarter	0.304	0.460	0.284	0.451
Interviewed 4th Quarter	0.271	0.445	0.262	0.440

Table 3: Budget Shares and Percent Consumption (N=4267)

Goods	1992-1993			1997-1998		
	Percent Buy	Budget Share	Net Seller	Percent Buy	Budget Share	Net Seller
Ordinary Rice (kg)	1.000	0.442	0.293	1.000	0.397	0.351
Sticky Rice (kg)	0.926	0.021	0.293	0.885	0.019	0.351
Maize (kg)	0.255	0.007	0.062	0.252	0.003	0.066
Cassava (kg)	0.279	0.006	0.060	0.208	0.002	0.053
Sweet Potato/Potato (kg)	0.519	0.008	0.026	0.531	0.005	0.015
Arrowroot Noodles (kg)	0.694	0.005	n.a.	0.316	0.003	n.a.
Pork Meat (kg)	0.986	0.101	n.a.	0.987	0.130	n.a.
Beef (kg)	0.205	0.006	n.a.	0.301	0.007	n.a.
Chicken (kg)	0.832	0.038	0.245	0.888	0.041	0.250
Duck (kg)	0.406	0.009	0.053	0.485	0.009	0.070
Fresh Fish/Shrimp (kg)	0.939	0.090	n.a.	0.959	0.086	n.a.
Chicken/Duck Eggs (egg)	0.739	0.011	n.a.	0.879	0.015	n.a.
Tofu (kg)	0.643	0.012	n.a.	0.779	0.015	n.a.
Water Morning Glory (kg)	0.883	0.013	0.037	0.942	0.012	0.046
Cabbage (kg)	0.782	0.006	0.049	0.823	0.006	0.042
Tomatoes (kg)	0.794	0.006	0.024	0.873	0.007	0.019
Oranges (kg)	0.334	0.003	0.044	0.578	0.006	0.049
Banana (kg)	0.725	0.010	0.161	0.864	0.011	0.191
Mangoes (kg)	0.282	0.003	0.022	0.487	0.004	0.023
Fish Sauce (liter)	0.948	0.019	n.a.	0.961	0.015	n.a.
Salt (kg)	0.992	0.005	n.a.	0.981	0.004	n.a.
MSG (package)	0.981	0.025	n.a.	0.986	0.022	n.a.
Sugar/Molasses (kg)	0.936	0.015	n.a.	0.936	0.017	n.a.

Table 4: Prices (1000 Dong)

	1992-1993				1997-1998			
Goods	Commune	Std	Household	Std	Commune	Std	Household	Std
Ordinary Rice***	2.917	0.401	2.942	0.387	3.314	0.378	3.043	0.499
Sticky Rice***	4.218	0.764	4.287	0.880	4.537	0.814	4.397	0.811
Maize	2.324	0.796	2.428	1.606	2.272	0.656	2.414	1.966
Cassava*	1.431	2.649	0.808	0.567	0.993	0.405	1.030	0.779
Sweet Potato/Potato***	0.986	0.316	1.075	0.666	1.333	0.514	1.726	1.307
Arrowroot Noodles***	7.670	3.042	7.710	2.761	9.041	2.657	6.549	2.505
Pork Meat***	22.238	4.941	20.255	4.974	19.770	3.649	17.291	3.816
Beef***	26.865	6.196	25.982	7.629	28.907	4.667	26.099	6.699
Chicken***	20.476	3.325	19.708	4.275	19.579	2.986	18.974	3.461
Duck***	12.594	3.598	12.267	4.419	11.752	2.482	11.832	3.237
Fresh Fish/Shrimp***	15.571	5.406	9.992	4.024	8.558	2.097	9.267	3.764
Chicken/Duck Eggs***	1.099	0.192	0.999	0.188	0.933	0.102	0.933	0.203
Tofu***	4.414	1.752	4.921	2.575	3.687	1.103	4.011	1.639
Water Morning Glory	1.220	0.697	1.046	0.596	1.139	0.504	1.104	0.521
Cabbage	2.149	1.241	1.603	1.133	2.162	0.891	2.059	1.097
Tomatoes	3.491	2.207	2.108	1.599	3.658	1.300	3.048	1.400
Oranges	6.375	2.258	5.518	2.464	6.511	2.293	5.433	1.891
Banana	2.093	0.890	1.653	0.865	2.122	0.764	1.569	0.769
Mangoes**	10.100	5.547	5.037	3.439	11.485	3.802	7.150	3.374
Fish Sauce***	4.048	1.601	3.824	1.666	4.826	2.160	3.812	1.856
Salt	1.006	0.360	1.039	0.460	0.962	0.262	1.331	0.648
MSG***	32.025	6.542	35.601	6.323	11.825	0.759	24.949	3.685
Sugar/Molasses***	7.607	1.303	6.292	1.630	6.733	0.406	6.328	0.843

Prices are all in January 1998 '000 Dong. A monthly deflator is used to adjust prices for seasonal differences. We use a t-test to look at significant differences in the mean commune price between the survey years. *90% level **95% level ***99% level.

Table 5: Townsend Style Regression, Dependent Variable is Change in Food Expenditures Per Capita, Controlling for Commune Averages

Change in Income ('000 Dong)	0.035
	[0.006]***
Change in household size	-80.935
	[6.778]***
Change in age	-0.408
	[1.892]
Constant	0.000
	[0.000]**
Observations	4267
R-Squared	0.086

Robust standard errors in brackets. Errors are clustered at the commune level.
*90% level ** 95% level *** 99% level

Table 6: Seemingly Unrelated Regression System, Dependent Variable is Transformed Log Consumption of the Specified Good

	Income	HH Size	Age	N
Ordinary Rice	0.011	0.165	0.001	4267
	[0.007]	[0.005]***	[0.001]	
Sticky Rice	0.072	0.108	0.004	3623
	[0.017]***	[0.011]***	[0.002]**	
Maize	0.008	0.037	0.011	369
	[0.087]	[0.034]	[0.007]	
Cassava	0.104	0.096	0.005	365
	[0.077]	[0.042]**	[0.007]	
Sweet Potato/Potato	0.065	0.124	-0.004	1256
	[0.039]*	[0.022]***	[0.004]	
Arrowroot Noodles	0.082	0.077	-0.001	1121
	[0.046]*	[0.026]***	[0.005]	
Pork Meat	0.112	0.09	0.003	4196
	[0.015]***	[0.010]***	[0.002]*	
Beef	0.21	0.104	0.002	548
	[0.056]***	[0.033]***	[0.005]	
Chicken	0.119	0.063	0.002	3298
	[0.020]***	[0.012]***	[0.002]	
Duck	0.082	0.083	-0.002	1166
	[0.028]***	[0.017]***	[0.003]	
Fresh Fish/Shrimp	0.109	0.129	0.000	3957
	[0.017]***	[0.011]***	[0.002]	
Chicken/Duck Eggs	0.097	0.065	0.999	2889
	[0.025]***	[0.015]***	[0.003]	
Tofu	0.039	0.084	-0.005	2436
	[0.027]	[0.016]***	[0.003]*	
Water Morning Glory	-0.008	0.120	0.002	3628
	[0.019]	[0.012]***	[0.002]	
Cabbage	0.010	0.099	0.002	2870
	[0.020]	[0.013]***	[0.002]	
Tomatoes	0.044	0.105	0.001	3065
	[0.020]**	[0.013]***	[0.002]	
Oranges	0.112	0.098	0.005	1056
	[0.038]***	[0.022]***	[0.005]	
Banana	0.066	0.085	0.000	2715
	[0.023]***	[0.013]***	[0.002]	
Mangoes	0.063	0.081	0.005	907
	[0.043]	[0.021]***	[0.003]	
Fish Sauce	0.004	0.114	0.002	3945
	[0.011]	[0.008]***	[0.001]*	
Salt	0.012	0.108	0.000	4155
	[0.012]	[0.007]***	[0.001]	
MSG	0.035	0.096	0.000	4132
	[0.012]***	[0.007]***	[0.001]	
Sugar/Molasses	0.065	0.084	0.002	3911
	[0.016]***	[0.010]***	[0.002]	

Robust standard errors are in brackets and are clustered at the commune level. Each row is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. A joint test across all goods on whether the coefficient on income is zero is rejected with a p-value of 0.000.
* 90% level; ** 95% level; *** 99% level

Table 7: Heckman Selection Equation for Water Morning Glory, Both Stages

	Quantity Decision	Consumption Decision 93	Consumption Decision 98
Income	-0.006	0.01	0.05
	[0.018]	[0.003]***	[0.018]***
Household Size	0.121	0.007	0.004
	[0.011]***	[0.002]***	[0.002]**
Age	0.002	0.000	0.000
	[0.002]	[0.002]	[0.003]
Differenced Lambda	0.062	-	-
	[0.140]	-	-
Commune Price	0.007	-0.018	0.007
		[0.008]**	[0.007]
Northeast		-0.086	0.008
		[0.028]***	[0.010]
Northwest		-0.107	-0.002
		[0.051]**	[0.017]
North Central Coast		-0.046	0.017
		[0.025]*	[0.009]*
South Central Coast		-0.335	-0.062
		[0.043]***	[0.020]***
Central Highlands		-0.555	-0.019
		[0.066]***	[0.028]
Southeast		-0.325	-0.037
		[0.040]***	[0.017]**
Mekong River Delta		-0.116	-0.051
		[0.027]***	[0.015]***
=1 if No Religion		-0.008	-0.004
		[0.009]	[0.006]
=1 if Married		-0.024	-0.003
		[0.010]**	[0.007]
=1 if Ethnic Minority		-0.099	-0.091
		[0.018]***	[0.017]***
=1 if Farm Household		-0.027	-0.004
		[0.009]***	[0.006]
Observations	3628	4214	4224

Robust standard errors are in brackets and are clustered at the commune level. Columns (2) and (3) show the marginal effect from a probit regression of the binary consumption choice in 1993 and 1998 respectively. The region that is left out is the Red River Delta. Column (1) shows the second stage results, using the inverse Mills ratio (lambda) from the first stage. We bootstrap the standard errors.
*90% level; **95% level; *** 99% level

Table 8: Second Stage of Heckman Selection Equation, Dependent Variable is Transformed Log Consumption of Specified Good

	Income	HH Size	Age	Lambda	N
Ordinary Rice	0.011	0.165	0.001	-	4267
	[0.006]*	[0.004]***	[0.001]	-	
Sticky Rice	0.073	0.105	0.004	-0.172	3623
	[0.016]***	[0.010]***	[0.002]**	[0.119]	
Maize	-0.009	0.038	0.009	0.037	369
	[0.078]	[0.030]	[0.007]	[0.152]	
Cassava	0.078	0.066	0	-0.161	365
	[0.073]	[0.034]*	[0.006]	[0.195]	
Sweet Potato/Potato	0.06	0.117	-0.004	0.027	1256
	[0.037]	[0.021]***	[0.004]	[0.103]	
Arrowroot Noodles	0.061	0.07	-0.001	-0.092	1121
	[0.040]	[0.024]***	[0.004]	[0.168]	
Pork Meat	0.109	0.089	0.003	-0.171	4196
	[0.013]***	[0.009]***	[0.001]*	[0.204]	
Beef	0.171	0.092	0.003	0.042	548
	[0.062]***	[0.033]***	[0.006]	[0.174]	
Chicken	0.115	0.062	0.003	0.039	3298
	[0.022]***	[0.011]***	[0.002]	[0.140]	
Duck	0.069	0.074	-0.002	-0.051	1166
	[0.027]**	[0.017]***	[0.003]	[0.126]	
Fresh Fish/Shrimp	0.107	0.13	0	0.025	3957
	[0.016]***	[0.011]***	[0.002]	[0.213]	
Chicken/Duck Eggs	0.09	0.064	0.001	-0.045	2889
	[0.025]***	[0.015]***	[0.003]	[0.131]	
Tofu	0.035	0.084	-0.005	0.022	2436
	[0.026]	[0.015]***	[0.003]*	[0.133]	
Water Morning Glory	-0.007	0.119	0.002	0.028	3628
	[0.018]	[0.011]***	[0.002]	[0.137]	
Cabbage	0.019	0.104	0.003	-0.004	2870
	[0.023]	[0.014]***	[0.002]	[0.113]	
Tomatoes	0.033	0.104	0.001	-0.108	3065
	[0.021]	[0.012]***	[0.002]	[0.111]	
Oranges	0.065	0.084	0.004	-0.162	1056
	[0.042]	[0.022]***	[0.004]	[0.124]	
Banana	0.056	0.083	0	-0.065	2715
	[0.024]**	[0.014]***	[0.002]	[0.116]	
Mangoes	0.011	0.076	0.006	-0.194	907
	[0.045]	[0.027]***	[0.004]	[0.132]	
Fish Sauce	0.005	0.114	0.002	0.084	3945
	[0.012]	[0.008]***	[0.001]*	[0.166]	
Salt	0.006	0.112	0	1.462	4155
	[0.011]	[0.007]***	[0.001]	[0.468]***	
MSG	0.034	0.096	0	0.397	4132
	[0.011]***	[0.007]***	[0.001]	[0.105]***	
Sugar/Molasses	0.058	0.083	0.002	-0.213	3911
	[0.016]***	[0.010]***	[0.002]	[0.183]	

Robust standard errors are in brackets and are clustered at the commune level. Each row in each specification is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. Lambda refers to the differenced inverse Mills ratio which was calculated in a first stage regression of the consumption decision. The standard errors are bootstrapped.
* 90% level; ** 95% level; *** 99% level

Table 9: **Within and Between Commune Price Variation**

	1992-1993		1997-1998	
Goods	Within Commune	Between Commune	Within Commune	Between Commune
Ordinary Rice	36.26%	63.74%	33.08%	66.92%
Sticky Rice	39.03%	60.97%	43.67%	56.33%
Maize	40.18%	59.82%	31.59%	68.41%
Cassava	36.45%	63.55%	34.39%	65.61%
Sweet Potato/Potato	46.46%	53.54%	27.83%	72.17%
Arrowroot Noodles	47.61%	52.39%	50.47%	49.53%
Pork Meat	28.39%	71.61%	35.22%	64.78%
Beef	36.79%	63.21%	31.77%	68.23%
Chicken	38.50%	61.50%	61.12%	38.88%
Duck	44.06%	55.94%	55.28%	44.72%
Fresh Fish/Shrimp	61.08%	38.92%	47.91%	52.09%
Chicken/Duck Eggs	40.97%	59.03%	76.92%	23.08%
Tofu	56.81%	43.19%	54.08%	45.92%
Water Morning Glory	48.65%	51.35%	50.54%	49.46%
Cabbage	23.34%	76.66%	27.85%	72.15%
Tomatoes	41.79%	58.21%	42.32%	57.68%
Oranges	56.70%	43.30%	55.56%	44.44%
Banana	56.78%	43.22%	49.65%	50.35%
Mangoes	53.54%	46.46%	39.68%	60.32%
Fish Sauce	54.51%	45.49%	47.55%	52.45%
Salt	52.79%	47.21%	62.19%	37.81%
MSG	75.97%	24.03%	77.06%	22.94%
Sugar/Molasses	53.32%	46.68%	58.39%	41.61%

Table 10: OLS Regression of the Deviation of Household Price from the Commune Price 1992-1993

	Ordinary Rice	Pork Meat	Water Morning Glory	Bananas	Fish Sauce
=1 if Female	-0.003	0.012	-0.004	-0.01	-0.015
	[0.006]	[0.072]	[0.012]	[0.021]	[0.034]
Age	0	0.001	0	0.001	-0.002
	[0.000]	[0.002]	[0.000]	[0.001]	[0.001]**
=1 if Farm	-0.006	0.145	-0.005	-0.009	0.01
	[0.006]	[0.062]**	[0.010]	[0.018]	[0.028]
=1 if Ethnic Minority	0.009	0.025	0.021	0.008	0.124
	[0.007]	[0.079]	[0.014]	[0.024]	[0.040]***
=1 if No Schooling	0.005	-0.129	0.019	0.007	0.033
	[0.007]	[0.085]	[0.015]	[0.026]	[0.041]
=1 if No Religion	0.001	-0.023	-0.009	0.005	-0.016
	[0.005]	[0.056]	[0.009]	[0.017]	[0.027]
=1 if Married	-0.006	0.071	-0.017	-0.022	-0.019
	[0.008]	[0.085]	[0.014]	[0.025]	[0.041]
Household size	0	0.012	-0.005	0.008	0.008
	[0.001]	[0.013]	[0.002]**	[0.004]**	[0.006]
Food Expenditures PC	0.017	0.137	0.014	0.014	0.063
(1998 Prices)	[0.004]***	[0.045]***	[0.007]*	[0.013]	[0.021]***
Non-Food Expenditures PC	0.012	0.079	0	0.004	0.08
(1998 Prices)	[0.003]***	[0.037]**	[0.006]	[0.010]	[0.017]***
Budget Share of Good	0.15	2.336	2.775	3.333	8.011
	[0.018]***	[0.371]***	[0.306]***	[0.524]***	[0.642]***
Quintile (1=Poor, 5=Rich)	0.009	0.017	0.009	0.008	0.044
	[0.003]***	[0.027]	[0.004]**	[0.008]	[0.013]***
=1 if Net Seller of Crop	-0.011	-	-0.072	-0.042	-
	[0.005]**	-	[0.021]***	[0.018]**	-
Constant	-0.113	-0.786	-0.019	-0.119	-0.339
	[0.019]***	[0.169]***	[0.029]	[0.050]**	[0.081]***
Observations	4267	4208	3768	3092	4045
R-squared	0.027	0.028	0.035	0.021	0.063

Robust standard errors are in brackets and are clustered at the commune level.
Each column is a crop specific regression of the deviation of household price from a commune price on a number of household characteristics.
* 90% level; ** 95% level; ***99% level

Table 11: OLS Regression of the Deviation of Household Price from the Commune Price 1997-1998

	Ordinary Rice	Pork Meat	Water Morning Glory	Bananas	Fish Sauce
=1 if Female	0.02	-0.144	0.023	-0.01	-0.017
	[0.014]	[0.108]	[0.018]	[0.028]	[0.059]
Age	0	-0.003	0	-0.002	-0.003
	[0.000]	[0.003]	[0.000]	[0.001]**	[0.002]**
=1 if Farm	-0.032	0.247	-0.006	-0.011	0.146
	[0.012]***	[0.084]***	[0.014]	[0.022]	[0.045]***
=1 if Ethnic Minority	-0.011	-0.074	0.005	-0.029	0.083
	[0.016]	[0.118]	[0.020]	[0.032]	[0.066]
=1 if No Schooling	0.006	-0.031	-0.021	0.041	0.047
	[0.018]	[0.137]	[0.024]	[0.037]	[0.077]
=1 if No Religion	0.022	-0.022	-0.009	-0.058	-0.055
	[0.012]*	[0.088]	[0.015]	[0.023]***	[0.048]
=1 if Married	0	0.11	0.038	-0.056	0.068
	[0.017]	[0.128]	[0.021]*	[0.033]*	[0.069]
Household size	-0.005	-0.081	-0.001	-0.004	0.03
	[0.003]*	[0.022]***	[0.004]	[0.006]	[0.012]**
Food Expenditures PC	0.104	0.205	0.028	0.026	0.152
(1998 Prices)	[0.010]***	[0.074]***	[0.012]**	[0.020]	[0.040]***
Non-Food Expenditures PC	0.013	0.089	-0.004	0.011	0.12
(1998 Prices)	[0.004]***	[0.030]***	[0.005]	[0.007]	[0.016]***
Budget Share of Good	0.677	3.32	4.306	2.412	35.498
	[0.051]***	[0.549]***	[0.514]***	[0.796]***	[1.837]***
Quintile (1=Poor, 5=Rich)	0.011	0	0.003	-0.009	0.063
	[0.006]*	[0.042]	[0.007]	[0.011]	[0.022]***
=1 if Net Seller of Crop	-0.013	-	-0.077	-0.098	-
	[0.011]	-	[0.029]***	[0.024]***	-
Constant	-0.431	-0.675	-0.109	0.175	-1.197
	[0.046]***	[0.277]**	[0.047]**	[0.072]**	[0.152]***
Observations	4267	4213	4020	3687	4101
R-squared	0.068	0.037	0.022	0.016	0.125

Robust standard errors are in brackets and are clustered at the commune level.Each column is a crop specific regression of the deviation of household price from a commune price on a number of household characteristics.
* 90% level; ** 95% level; *** 99% level

Table 12: Seemingly Unrelated Regressions Controlling for Household Price, Dependent Variable is Transformed Log Consumption

	Income	HH Price	HH Size	Age	N
Ordinary Rice	0.012	-0.289	0.165	0.001	4267
	[0.006]**	[0.047]***	[0.004]***	[0.001]	
Sticky Rice	0.073	-0.683	0.109	0.004	3623
	[0.016]***	[0.091]***	[0.010]***	[0.002]**	
Maize	0.043	-0.612	0.046	0.01	369
	[0.086]	[0.140]***	[0.031]	[0.007]	
Cassava	0.102	-0.268	0.095	0.002	365
	[0.083]	[0.113]**	[0.040]**	[0.007]	
Sweet Potato/Potato	0.065	-0.443	0.126	-0.004	1256
	[0.038]*	[0.062]***	[0.021]***	[0.004]	
Arrowroot Noodles	0.084	-0.735	0.069	0	1121
	[0.040]**	[0.105]***	[0.025]***	[0.004]	
Pork Meat	0.111	-0.437	0.089	0.003	4196
	[0.013]***	[0.070]***	[0.008]***	[0.001]**	
Beef	0.195	-0.801	0.102	-0.001	548
	[0.056]***	[0.195]***	[0.034]***	[0.006]	
Chicken	0.119	-0.962	0.061	0.002	3298
	[0.017]***	[0.086]***	[0.011]***	[0.002]	
Duck	0.083	-0.309	0.085	-0.003	1166
	[0.026]***	[0.105]***	[0.017]***	[0.003]	
Fresh Fish/Shrimp	0.114	-0.545	0.127	-0.001	3957
	[0.016]***	[0.042]***	[0.010]***	[0.002]	
Chicken/Duck Eggs	0.098	-0.532	0.064	0.001	2889
	[0.022]***	[0.134]***	[0.015]***	[0.003]	
Tofu	0.04	-0.638	0.081	-0.005	2436
	[0.024]*	[0.055]***	[0.015]***	[0.003]**	
Water Morning Glory	-0.01	-0.477	0.117	0.003	3628
	[0.017]	[0.038]***	[0.011]***	[0.002]	
Cabbage	0.016	-0.415	0.097	0.002	2870
	[0.020]	[0.048]***	[0.013]***	[0.002]	
Tomatoes	0.047	-0.609	0.101	0.001	3065
	[0.019]**	[0.037]***	[0.012]***	[0.002]	
Oranges	0.106	-0.577	0.092	0.004	1056
	[0.035]***	[0.074]***	[0.022]***	[0.004]	
Banana	0.08	-0.737	0.093	0.001	2715
	[0.021]***	[0.042]***	[0.013]***	[0.002]	
Mangoes	0.106	-0.585	0.085	0.006	907
	[0.035]***	[0.062]***	[0.021]***	[0.004]	
Fish Sauce	0.009	-0.371	0.112	0.002	3945
	[0.012]	[0.027]***	[0.008]***	[0.001]	
Salt	0.013	-0.365	0.106	0	4155
	[0.010]	[0.026]***	[0.007]***	[0.001]	
MSG	0.032	-0.386	0.095	0	4132
	[0.010]***	[0.042]***	[0.007]***	[0.001]	
Sugar/Molasses	0.064	-0.149	0.084	0.001	3911
	[0.014]***	[0.061]**	[0.010]***	[0.002]	

Robust standard errors are in brackets and are clustered at the commune level. Each row in each specification is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. A joint test on whether the coefficient on income is equal to zero is rejected with a p-value=0.000.
* 90% level; ** 95% level; *** 99% level

Table 13: Heckman Selection Equation for Water Morning Glory.

	Quantity Decision	Consumption Decision 93	Consumption Decision 98
Income	-0.01	0.011	0.015
	[0.018]	[0.003]***	[0.003]***
Household Price	-0.452	-0.059	-0.008
	[0.040]***	[0.008]***	[0.007]
Household Size	0.117	0.007	0.004
	[0.011]***	[0.002]***	[0.002]**
Age	0.002	0.001	0
	[0.002]	[0.002]	[0.003]
Differenced Lambda	0.024	-	-
	[0.136]	-	-
Northeast		-0.074	0.01
		[0.026]***	[0.009]
Northwest		-0.059	-0.001
		[0.043]	[0.017]
North Central Coast		-0.043	0.016
		[0.024]*	[0.009]*
South Central Coast		-0.281	-0.062
		[0.041]***	[0.020]***
Central Highlands		-0.491	-0.007
		[0.070]***	[0.023]
Southeast		-0.262	-0.028
		[0.038]***	[0.015]*
Mekong River Delta		-0.092	-0.046
		[0.025]***	[0.014]***
=1 if No Religion		-0.009	-0.005
		[0.009]	[0.006]
=1 if Married		-0.023	-0.003
		[0.009]**	[0.007]
=1 if Ethnic Minority		-0.091	-0.087
		[0.017]***	[0.016]***
=1 if Farm Household		-0.036	-0.006
		[0.008]***	[0.006]
Observations	3628	4230	4224

Robust standard errors are in brackets and are clustered at the commune level. Columns (2) and (3) show the results from a probit regression of the binary consumption choice in 1993 and 1998 respectively. The region that is left out is the Red River Delta Column (1) shows the second stage results, using the inverse mills ratio from the first stage. The standard errors are bootstrapped.
*90% level; **95% level; *** 99% level

Table 14: Second Stage of Heckman Selection Equation, Dependent Variable is Transformed Log Consumption)

	Income	HH Price	HH Size	Age	Lambda	N
Ordinary Rice	0.011	-0.289	0.165	0.001	-	4267
	[0.006]*	[0.047]***	[0.004]***	[0.001]	-	
Sticky Rice	0.073	-0.665	0.106	0.003	-0.167	3623
	[0.016]***	[0.089]***	[0.010]***	[0.002]*	[0.120]	
Maize	-0.002	-0.252	0.041	0.008	0.047	369
	[0.076]	[0.107]**	[0.030]	[0.006]	[0.156]	
Cassava	0.063	-0.113	0.061	0.001	-0.239	365
	[0.072]	[0.077]	[0.033]*	[0.006]	[0.160]	
Sweet Potato/Potato	0.058	-0.376	0.116	-0.004	-0.012	1256
	[0.037]	[0.058]***	[0.021]***	[0.003]	[0.101]	
Arrowroot Noodles	0.057	-0.376	0.065	0.001	-0.166	1121
	[0.038]	[0.112]***	[0.024]***	[0.004]	[0.094]*	
Pork Meat	0.116	-0.49	0.09	0.003	0.286	4196
	[0.013]***	[0.074]***	[0.008]***	[0.001]*	[0.214]	
Beef	0.165	-0.568	0.098	0.001	-0.019	548
	[0.059]***	[0.205]***	[0.032]***	[0.005]	[0.120]	
Chicken	0.122	-0.94	0.063	0.002	0.046	3298
	[0.022]***	[0.089]***	[0.011]***	[0.002]	[0.135]	
Duck	0.065	-0.212	0.072	-0.002	-0.102	1166
	[0.027]**	[0.096]**	[0.017]***	[0.003]	[0.124]	
Fresh Fish/Shrimp	0.115	-0.551	0.126	0	0.044	3957
	[0.016]***	[0.044]***	[0.010]***	[0.002]	[0.130]	
Chicken/Duck Eggs	0.085	-0.409	0.063	0.001	-0.107	2889
	[0.025]***	[0.135]***	[0.014]***	[0.003]	[0.117]	
Tofu	0.036	-0.577	0.081	-0.005	0.01	2436
	[0.025]	[0.058]***	[0.015]***	[0.003]*	[0.123]	
Water Morning Glory	-0.012	-0.454	0.115	0.002	-0.015	3628
	[0.017]	[0.039]***	[0.011]***	[0.002]	[0.132]	
Cabbage	0.01	-0.388	0.095	0.002	-0.044	2870
	[0.020]	[0.048]***	[0.012]***	[0.002]	[0.100]	
Tomatoes	0.036	-0.553	0.099	0.001	-0.106	3065
	[0.019]*	[0.042]***	[0.012]***	[0.002]	[0.085]	
Oranges	0.05	-0.338	0.076	0.005	-0.199	1056
	[0.039]	[0.073]***	[0.021]***	[0.004]	[0.101]**	
Banana	0.055	-0.601	0.086	0.001	-0.196	2715
	[0.023]**	[0.047]***	[0.013]***	[0.002]	[0.097]**	
Mangoes	0.066	-0.355	0.073	0.005	-0.168	907
	[0.035]*	[0.065]***	[0.021]***	[0.004]	[0.075]**	
Fish Sauce	0.008	-0.369	0.111	0.002	0.001	3945
	[0.012]	[0.029]***	[0.008]***	[0.001]	[0.141]	
Salt	0.016	-0.382	0.103	0	-0.917	4155
	[0.011]	[0.028]***	[0.007]***	[0.001]	[0.489]*	
MSG	0.031	-0.383	0.095	0	-0.011	4132
	[0.010]***	[0.046]***	[0.007]***	[0.001]	[0.115]	
Sugar/Molasses	0.066	-0.145	0.084	0.002	0.037	3911
	[0.015]***	[0.068]**	[0.010]***	[0.002]	[0.126]	

Robust standard errors are in brackets and are clustered at the commune level. Each row in each specification is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. Lambda refers to the differenced inverse Mills ratio which was calculated in a first stage regression of the consumption decision. The standard errors are bootstrapped.
* 90% level; ** 95% level; *** 99% level

Table 15: Regional Differences, Dependent Variable is Transformed Log Consumption of Specified Good

	Income	North	North*Income	HH Size	Age	N
Ordinary Rice	0.011	0	-0.003	0.165	0.001	4267
	[0.007]	[0.013]	[0.012]	[0.004]***	[0.001]	
Sticky Rice	0.036	0	0.07	0.112	0.004	3623
	[0.019]*	[0.032]	[0.032]**	[0.010]***	[0.002]**	
Maize	0.041	0	-0.01	0.047	0	369
	[0.025]	[0.042]	[0.042]	[0.013]***	[0.002]	
Cassava	0.015	0	-0.005	0.044	-0.002	365
	[0.031]	[0.052]	[0.052]	[0.016]***	[0.003]	
Sweet Potato/Potato	0.085	-0.001	-0.07	0.101	0	1256
	[0.035]**	[0.060]	[0.059]	[0.018]***	[0.003]	
Arrowroot Noodles	0.033	0	0.04	0.04	0.001	1121
	[0.018]*	[0.031]	[0.031]	[0.010]***	[0.002]	
Pork Meat	0.088	0	0.034	0.089	0.003	4196
	[0.016]***	[0.026]	[0.026]	[0.008]***	[0.001]*	
Beef	0.064	-0.001	-0.015	0.029	-0.001	548
	[0.015]***	[0.026]	[0.026]	[0.008]***	[0.001]	
Chicken	0.085	0	0.08	0.067	0	3298
	[0.020]***	[0.034]	[0.033]**	[0.010]***	[0.002]	
Duck	0.034	0	0.07	0.049	0.003	1166
	[0.021]	[0.036]	[0.036]*	[0.011]***	[0.002]	
Fresh Fish/Shrimp	0.079	-0.001	0.061	0.131	0	3957
	[0.020]***	[0.035]	[0.034]*	[0.011]***	[0.002]	
Chicken/Duck Eggs	0.092	0	0.072	0.061	-0.001	2889
	[0.035]***	[0.060]	[0.059]	[0.018]***	[0.003]	
Tofu	0.047	0.002	0.07	0.064	-0.002	2436
	[0.026]*	[0.044]	[0.043]	[0.013]***	[0.002]	
Water Morning Glory	0.012	0	0.032	0.112	0.003	3628
	[0.026]	[0.045]	[0.044]	[0.014]***	[0.002]	
Cabbage	0.061	-0.001	-0.051	0.069	0.001	2870
	[0.026]**	[0.045]	[0.045]	[0.014]***	[0.002]	
Tomatoes	0.08	0.002	-0.049	0.081	0.001	3065
	[0.024]***	[0.040]	[0.040]	[0.012]***	[0.002]	
Oranges	0.124	0	-0.027	0.038	0.001	1056
	[0.022]***	[0.037]	[0.037]	[0.011]***	[0.002]	
Banana	0.142	0.001	-0.054	0.09	0.003	2715
	[0.034]***	[0.058]	[0.057]	[0.018]***	[0.003]	
Mangoes	0.101	0	-0.047	0.035	0.002	907
	[0.020]***	[0.034]	[0.033]	[0.010]***	[0.002]	
Fish Sauce	-0.007	-0.001	0.048	0.117	0.003	3945
	[0.017]	[0.028]	[0.028]*	[0.009]***	[0.002]**	
Salt	0.019	0	-0.021	0.099	-0.001	4155
	[0.014]	[0.023]	[0.023]	[0.007]***	[0.001]	
MSG	0.018	0	0.017	0.07	0	4132
	[0.010]*	[0.017]	[0.017]	[0.005]***	[0.001]	
Sugar/Molasses	0.059		0.017	0.076	0	3911
	[0.016]***		[0.028]	[0.009]***	[0.002]	

Robust standard errors are in brackets and are clustered at the commune level. Each row in each specification is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. Lambda refers to the differenced inverse Mills ratio which was calculated in a first stage regression of the consumption decision. The standard errors are bootstrapped. A joint test finds the coefficient on the interaction between North and Income to be significant with a p-value of 0.000.
* 90% level; ** 95% level; *** 99% level

Table 16: Differences Between Poor and Non-Poor, Dependent Variable is Transformed Log Consumption of Specified Good

	Income	Poor	Poor*Income	HH Size	Age	N
Ordinary Rice	0	0.153	0.01	0.167	0.001	4267
	[0.009]	[0.013]***	[0.012]	[0.004]***	[0.001]	
Sticky Rice	0.061	0.33	-0.016	0.117	0.003	3623
	[0.023]***	[0.033]***	[0.030]	[0.010]***	[0.002]**	
Maize	0	0.011	0.065	0.047	0	369
	[0.031]	[0.044]	[0.041]	[0.013]***	[0.002]	
Cassava	0.034	-0.052	-0.034	0.043	-0.002	365
	[0.038]	[0.055]	[0.050]	[0.016]***	[0.003]	
Sweet Potato/Potato	0.123	0.165	-0.116	0.104	0	1256
	[0.044]***	[0.063]***	[0.057]**	[0.018]***	[0.003]	
Arrowroot Noodles	0.059	0.2	-0.03	0.044	0.001	1121
	[0.023]***	[0.033]***	[0.030]	[0.010]***	[0.002]	
Pork Meat	0.066	0.412	0.039	0.097	0.003	4196
	[0.019]***	[0.027]***	[0.025]	[0.008]***	[0.001]*	
Beef	0.046	0.075	0.019	0.031	-0.001	548
	[0.019]**	[0.027]***	[0.025]	[0.008]***	[0.001]	
Chicken	0.086	0.303	0.032	0.072	0	3298
	[0.024]***	[0.035]***	[0.032]	[0.010]***	[0.002]	
Duck	0.035	0.24	0.03	0.053	0.003	1166
	[0.026]	[0.038]***	[0.035]	[0.011]***	[0.002]	
Fresh Fish/Shrimp	0.083	0.396	0.011	0.137	0	3957
	[0.025]***	[0.036]***	[0.033]	[0.010]***	[0.002]	
Chicken/Duck Eggs	0.064	0.561	0.066	0.07	-0.001	2889
	[0.043]	[0.062]***	[0.056]	[0.018]***	[0.003]	
Tofu	0.014	0.299	0.086	0.07	-0.002	2436
	[0.032]	[0.046]***	[0.042]**	[0.013]***	[0.002]	
Water Morning Glory	0.012	0.139	0.012	0.115	0.003	3628
	[0.033]	[0.047]***	[0.043]	[0.014]***	[0.002]	
Cabbage	0.053	0.304	-0.031	0.075	0.001	2870
	[0.033]	[0.047]***	[0.043]	[0.014]***	[0.002]	
Tomatoes	0.052	0.324	0.003	0.087	0.001	3065
	[0.029]*	[0.042]***	[0.038]	[0.012]***	[0.002]	
Oranges	0.117	0.183	-0.013	0.041	0.001	1056
	[0.027]***	[0.039]***	[0.036]	[0.011]***	[0.002]	
Banana	0.128	0.357	-0.026	0.097	0.003	2715
	[0.042]***	[0.060]***	[0.055]	[0.017]***	[0.003]	
Mangoes	0.087	0.068	-0.007	0.036	0.002	907
	[0.024]***	[0.035]*	[0.032]	[0.010]***	[0.002]	
Fish Sauce	0.014	0.175	-0.016	0.119	0.003	3945
	[0.020]	[0.029]***	[0.027]	[0.009]***	[0.002]**	
Salt	0.015	0.103	-0.01	0.101	-0.001	4155
	[0.017]	[0.024]***	[0.022]	[0.007]***	[0.001]	
MSG	0.021	0.143	-0.001	0.073	0	4132
	[0.012]*	[0.018]***	[0.016]	[0.005]***	[0.001]	
Sugar/Molasses	0.062	0.333	-0.011	0.081	0	3911
	[0.020]***	[0.029]***	[0.026]	[0.008]***	[0.001]	

Robust standard errors are in brackets and are clustered at the commune level. Each row in each specification is a separate regression, which is estimated with the rest of the rows in a seemingly unrelated regressions framework. Lambda refers to the differenced inverse mills ratio which was calculated in a first stage regression of the consumption decision. The standard errors are bootstrapped. A joint test on the significance of the interaction between poor and income is rejected with a p-value of 0.4581.
* 90% level; ** 95% level; *** 99% level