Trade Liberalization and the Allocation of Labor between Households and Markets in a Poor Country[*]

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Abstract

We consider the relationship between relative price changes and the allocation of labor between households and the formal wage labor market in the context of Vietnam's liberalization of its rice trade in the 1990s. Many individuals in poor economies work within their own household rather than in formal labor markets. We find that larger rice price increases in a community are associated with declines in hours adults devote to work within the household and increases in time spent in the wage labor market. We also observe increased specialization in household economic activities accompanying these shifts in hours towards wage work. Our results are consistent with the idea that a growth in the extent of the market shifts production and labor from households to markets during development, thereby inducing gains from specialization. Thus, the reallocation of labor between households and markets in response to a trade liberalization might be an important component in understanding the link between trade and growth in very poor economies, currently the focus of the Doha WTO negotiation round.

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1. Introduction

Although integration of poor economies into the global trading system is the central objective of the Doha "Development Round" of WTO negotiations, very little is know on how trade affects labor markets in these poor, predominately agrarian economies (see Dollar and Kraay 2001, Winters 2002, Winters et. al. 2004). Understanding the labor market effects of trade liberalization is important for assessing trade's impact on household welfare, aggregate income, and the distribution of income in an economy. The main purpose of this paper is to empirically examine whether a trade liberalization affects labor allocation between wage work and work within an individual's *own* household in a poor country. We pursue this question for several reasons.

First, one of the main features of labor markets in the poorest economies is that a large share of individuals works outside of the formal wage labor market. Instead, people work within their own household on a family farm, in a family business, or in domestic work. For example, in Vietnam in 1993, only 19 percent of adults ages 20-64 work for wages. In contrast, 90 percent of adults work within their own household.[1] Moreover, most individuals are employed in agriculture (73 percent in Vietnam in 1993) rather than manufacturing (7 percent in Vietnam in 1993). Yet research on the implications of trade reform for labor markets focuses largely on wage work in manufacturing in middle income countries (see Hanson and Harrison 1999a, Winters 2002, and Winters et.al 2004 for surveys), and the labor market consequences of agricultural trade reforms in poor economies are not well understood (Chen and Ravallion 2004 is an exception). This omission is important, because Vietnam is not unusual in its high agricultural employment rates and the rarity of wage employment.[2]

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[1] Moreover, wage work is predominately an urban phenomenon (78 percent of Vietnam's 1993 population is rural). In rural Vietnam, 15 percent (92 percent) of adults work for wages (within their own household) in 1993.
[2] The FAO (2004) estimates that 54 percent of the economically active population in developing countries (1.3 billion people) works in agriculture. While exact estimates do not appear to be available, the ILO (2003) argues that a majority of these agricultural workers are self-employed and that self-employment without wage work is especially prevalent in Asia. For example, in the 1999 Nepali Labor Force Survey, 15 percent of rural adults work

Second, there are strong theoretical reasons why an increase in trade induces a reallocation of time from inside to outside the household in poor economies but little evidence. Trade models usually emphasize specialization due to the division of labor across countries according to comparative advantage. Consequently, most empirical research on employment effects of trade has investigated to what extent relative price movements associated with liberalization affect the allocation of labor across industries (for examples see Ravenga 1992, Hanson and Harrison 1999b, and Attanasio et. al. 2004). Reallocation of labor can also occur at the household level in the poorest economies where households often engage in a large number of production activities.[3] Several recent papers (Locay 1990, Goodfried and McDermott 1995, Kelly 1997) formalize how a growth in the extent of the market affects the shift of production and labor from households to markets, thereby inducing gains from specialization. These models predict that so long as work outside the household (i.e. wage work) better captures gains associated with larger market demand, market expansion should increase time allocated to wage work and decrease time allocated to household work.

Trade liberalization leads to relative price changes, and we examine the association between variation in changes in the relative price of rice and the allocation of labor inside and outside of the household using panel data from Vietnam in the 1990s. Rice is the dominant commodity in the Vietnamese economy.[4] As discussed in greater detail in section 2, between 1993 and 1998, Vietnam lifted domestic and international restrictions on the trade of rice, and concurrent with these trade liberalizations, the price of rice increased nearly 30 percent relative

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for wages (author's calculation). In pre-crisis Indonesia, Smith et al (2002) report that less than 30% (45%) of rural (urban) Indonesian men and less than 12% (20%) of rural (urban) Indonesian females work in wage work. 46% of Indian labor force (rural and urban) reports working for wages (Tendulkar 2003).

[3] For example, the typical Vietnamese household farms rice. The household is also involved in most stages of post-harvest processing and will make noodles, flour, and popped rice that it may consume directly or sell in the market. It is not unusual to see rice farming households also growing and processing other crops in addition to keeping livestock. The household also collects its firewood and water and maintains its agricultural and household tools.

[4] Based on our calculations from the 1993 Vietnam Living Standards Survey, 70 percent of all cropland is devoted to rice and 86 percent of rural households or 70 percent of all households produce rice. Rice accounts on average for 28 percent of overall household expenditure and 44 percent of food expenditure.

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to the consumer price index. Because Vietnamese communities differ in the demand and supply of rice and the degree of integration into national and international markets, rice price changes vary across communities. We relate this regional and intertemporal variation in rice prices to hours devoted to wage work and work within the household using data from rural panel communities in the Vietnam Living Standard Surveys in 1992/93 and 1997/98, the time period that spans the episode of the liberalization of rice trade.[5]

We present our main findings in section 3 of the paper. We observe increases in time allocated to wage work and declines in time in household work in communities that experience larger increases in rice prices. The interpretation of this finding is explored in section 4. We argue that these patterns are consistent with predictions of models that emphasize the role of the extent of the market in shifting labor from households to markets, thereby rising household specialization. We observe corroborating evidence for this explanation in the specialization of activities households undertake: we find that larger increases in rice prices are also associated with declines in the proportion of households that produce rice, increases in the probability a rice producing household sells rice, increases in the quantity of rice sold, and declines in in-house processing of agricultural products. We conclude by discussing the implications of our findings in section 5.

2. Background and Data

Trade policy impacts the domestic economy by changing relative product prices. Consequently, much of the empirical work on how trade or globalization affects local labor markets focuses on correlating changes in relative prices with changes in labor market outcomes even if variation in trade policy is not the sole determinant of price variation (see Leamer and

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[5]While internal and external trade liberalization is not the only source of variation in rice prices across communities in Vietnam, the observed price changes and comparability of data across communities provide an excellent setting to study a trade policy change that would have lead to the price changes captured in the data. In addition, the detail of our data enables us to examine (and ultimately rule out) several sources of spurious correlation between rice prices and labor supply that could provide alternative explanations for our findings.

Levinsohn 1995). The justification for looking at price variation is that even if all of the variation in prices is not singularly attributable to trade or trade policy, price variation is still informative because it is the channel through which trade influences local markets.[6] In the present case, we consider changes in household labor supply that are associated with regional and intertemporal variation in rice prices in Vietnam.

2.1 Rice Prices

Vietnam dramatically liberalized trade in rice in the 1990s along two dimensions. Vietnam regulated its *international* rice trade with an export quota. It implemented the quota in the late 1980s out of a concern for domestic food security in order to suppress the domestic price of rice. During the 1990s, the government gradually liberalized the quota so that by 1997, it was no longer binding. In particular, the government raised the quota from less than 1 million metric tons in 1992 to 4.5 million tons in 1998. Goletti and Minot (1997) document that wholesale domestic rice prices were significantly lower during the late 1980s and early 1990s than in the mid to late 1990s as one would expect with the easing of rice export quota. In addition to the lifting of the quota, a second, major liberalization of rice trade occurred in early 1997 when the government lifted restrictions on the *internal* trade of rice. The purpose of the internal restrictions was to induce self-sufficiency in rice production in each region of Vietnam. Prior to 1997, communities that would become rice exporters in 1998 observed relatively lower prices than rice importers, because they were not permitted to export their crop freely to other regions of the country. The easing of restrictions on the flow of rice across communities, then allowed price changes that are largest in the net exporting regions. Benjamin and Brandt (2004) and Nimi, Vasudeva-Dutta, and Winters (2002) describe these reforms in greater detail. They suggest that the lifting of these two restrictions was associated with both large changes in the

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[6]This statement holds as long as one can rule out spurious correlation between changes in prices and outcomes of interest. Our robustness analysis in section 3.3 investigates (and ultimately rules out) several potential sources of spurious correlation.

average price of rice and considerable diversity across communities in the magnitude of these price changes during the 1990s.

We relate variation in changes in rice prices across communities to changes in the allocation of labor between the formal wage labor market and the household using data from two rounds of the Vietnam Living Standards Survey ("VLSS") that span the period of rice market liberalizations.[7] The VLSS includes detailed price survey of local markets conducted concurrently with the household interviews and there are 115 rural communities where price surveys are conducted in both 1993 and 1998.[8] Because our empirical work relies on rice price changes within a community for identification, our analysis is restricted to households living in these rural panel communities. Edmonds and Pavcnik (2004) use the same source of identifying variation to examine the response of child labor supply to these rice price changes.

At the time of each round of the household survey, an enumerator surveyed the community's local market to find the market price of a kilogram of ordinary rice.[9] We deflate the price of rice by the monthly consumer price index so that all prices are in 1998 (January) Dong.[10] This is our measure of community rice prices. We use community (rather than household) measure of rice prices because community-level prices are likely exogenous to a household (and thus not affected by household labor supply decision or individual household

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[7]The first round of the VLSS was conducted between September 1992 and October 1993. The second round of the VLSS was conducted between December 1997 and December 1998.

[8] The population of Vietnam is organized into communes, and communes are the primary sampling unit for the VLSS. This study uses the words "commune" and "community" interchangeably even though there may be multiple villages within a given commune. All price and community level information used in this study is available at the commune level only.

[9]As discussed in Edmonds and Pavcnik (2004), community rice prices reported in the price survey are highly correlated with the average community rice prices based on unit values of purchased rice from the household survey. The correlation between the two price measures in .68. Moreover, 2 rural communities (and 6 overall) do not report a price in at least one of the survey rounds. For these communities, we impute the rice prices. Based on the unit value of rice purchased by households reported in the VLSS, we calculate the mean unit value of a kg of rice for a community in a given survey year. We regress the price of rice reported in the price survey on a third order polynomial of the mean unit value of rice in a community. We replace the missing price data with the predicted community price based on this regression.

[10] The price deflator does not vary by region. Thus, the variation in real rice prices observed in the data stems from movements in rice prices rather than the price index.

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characteristics). The mean price in 1993 was 2,600 dong per kilogram of ordinary rice.[11] As

table 1 suggests, the average domestic price of ordinary rice increases by 29% relative to the rise

in the consumer price index between 1993 and 1998. We relate variation in the magnitude of the

rise in rice prices across communities to changes in adult labor allocation between markets and

own household.

2.2 Labor Supply

The household survey in the VLSS includes questions on household demographics, the

labor activities of adults and children, education, landholdings, and agricultural activities. The

questionnaires are similar in the two rounds of the VLSS, although there are some substantive

differences we discuss later. In our analysis, we focus on adults ages 20-64 living in households

in rural panel communities. There is also a household panel in the data. In some of our

robustness checks, we condition our results on unobserved time-invariant household

characteristics and thus restrict our analysis to individuals living in panel households in rural

communities. Households in the community-level panel that we use throughout differ from the

ones in the household panel that we use in the robustness check, because households that were

not re-captured in panel communities were replaced with randomly selected households from the

original sampling frame.

Since our interest is primarily in the movement of labor between households and markets,

we focus on the division of total work between the individual's own household and the formal

labor market (i.e. wage work). Wage work includes both cash and in-kind work. The important

identifying factor is that the employer is not the individual's own household. Work within the

household is the composite of questions that collect information on hours in the household's

business, hours in direct farming activities, and hours in domestic work. Work in domestic work

is based on a single question that groups together time spent in repair and maintenance work,

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[11] One U.S. dollar corresponds to approximately 14,000 Dong in 1998, so the price of rice in 1993 is approximately
19 cents per kilogram.

collecting wood and water, and household duties such as food preparation, cleaning, cooking, and maintaining the household.

Table 1 provides summary statistics for hours worked for wages and hours worked within the individual's own household per week. Average hours worked per week for wages increase by 23 percent between 1993 and 1998 in our data. This rise in part reflects increased participation in wage work (from 15 to 16.5 percent between 1993 and 1998) and an increase in average hours worked conditional on participation (from 22 to 26 hours per week). Average hours worked per week within the household increase by 3 percent between 1993 and 1998 to a total of 40 hours. Because participation in within household work is constant between years (92 percent of adults work within the household), the slight overall increase in hours worked reflects an increase in total hours worked. Taken together, the average adult spends 43 hours per week working in 1992 and 45 hours per week working in 1998.[12] Overall, then changes in total hours worked seem fairly small between 1993 and 1998. However, masked beneath this is substantive heterogeneity in changes in the allocation of non-leisure time between work inside and outside of the household associated with changes in rice prices. The relationship between rice price changes and shifts in work time from inside to outside of the household is the focus of section 3. Before we turn to our results, we discuss several important data issues.

2.3 Data related concerns

There are four limitations of the VLSS that merit mention in the present context. First, the VLSS's coverage of the illegal migrant population is debated as is the size of the overall illegal migrant population in Vietnam (see Glewwe, Gragnolati, Zaman 2003 for discussion). Any effect of liberalization of the rice trade on unregistered migrants that do not reside within a registered household may be missed in our data. Second, attrition is a concern. Glewwe and

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[12] There are gender differences in total hours worked. Women spend on average 47 hours per week working while men spend 41 hours per week in 1998. This difference in total hours worked is reflected in the additional time women spend in domestic work. However, we do not in general find significant gender differences in how men and women respond to relative price movements and hence do not discuss gender differences further.

Nguyen (2004) argue that the restricted sample of panel households appears nationally representative in terms of descriptive statistics. 90 percent of households targeted for recapture were found. In our study, we focus primarily on panel communities rather than panel households. When households were not found in 1998, they were replaced by a randomly selected household from the original registry list. Thus, our data are representative for each community-year observation.

Third, selective migration between 1993 and 1998 of adult workers might be a problem. For example, if rice price increases are associated with the departure of individuals who work a large number of hours within the household, then it will appear that total hours worked inside the household declines with rice price increases. We do not find any evidence that this is a substantive problem. In panel households, we can observe whether individuals are recaptured. Thus, we focus our discussion of this selective migration problem in panel households. First, the correlation between the probability an individual is recaptured and the percentage change in rice prices is statistically insignificant and small in magnitude (-0.02). Second, in regressions of an indicator for whether an individual is recaptured on hours worked inside and outside the household (separately), we find that individuals who work more inside of the household in 1993 are more likely to be recaptured in 1998, and individuals who work more outside of the household are less likely to be recaptured. Thus, the data suggest that if anything selective migration works against our findings below, because the people who work less inside the household are more likely to leave. However, the magnitudes of the changes in recapture rates associated with variation in hours worked are not substantive.[13] Hence, we do not find any evidence that selective migration is driving our findings in section 3.

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[13] Each hour of work inside the household raises the probability an individual is recaptured by 0.003 percentage points. Each hour in work outside the household lowers the probability an individual is recaptured by 0.0004 percentage points.

The final issue with the VLSS that deserves discussion is a substantive change between 1993 and 1998 in the questions about hours worked in own farm agriculture. The questions about hours in all other types of work are identical between survey rounds, but the 1998 questionnaire is considerably more detailed than the 1993 questionnaire in its inquiries about own farm work.[14] This change in questionnaire might affect how individuals report hours worked in household agriculture. If the measurement change is not correlated with changes in rice prices, it will only bias the coefficient on the survey year effect (because the measurement change is correlated with the survey year) and increase the standard error of the estimated coefficients like neoclassical measurement error in the dependent variable. However, if the biases in the measurement of hours worked in household agriculture are correlated with changes in the price of rice, our empirical findings that rely on hours worked in agriculture might be biased by the questionnaire change. As a result, all findings based on hours worked within the household that include hours worked in household agriculture will be interpreted with caution.

In our empirical work, we address this potential problem in several ways. Most importantly, note that our analysis relies on hours worked inside the household *and* hours worked in wage work. Thus, only the within household aspect of our discussion is affected by the change in questionnaire. Second, only time spent directly in farming activities within the household is affected. Hence, we can check whether our within household results are reproduced in other within household activities. If each within household activity has a separate production function and labor's marginal product in each activity is positive and diminishing, then within household equilibrium implies that real changes in total hours worked within the household will be spread across activities. Third, we use information on various household activities (see

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[14] The 1993 questionnaire asks how many hours on average the respondent works in self-employed agriculture in the last 7 days and (separately) as an agricultural worker on another household's farm. The 1998 questionnaire asks the identical question for work in agriculture outside of the respondent's own household. However, no such question is asked for self-employed agricultural work. Instead, the 1998 questionnaire disaggregates the within the household agricultural work into 4 different tasks (planting and harvesting, livestock maintenance, processing, marketing) and 3 different categories of agricultural production (crop and fruit production, aquatic cultivation, and forestry), asking hours worked in peak and non-peak seasons over the last twelve months in each of these categories.

section 4.3) and not just information on hours worked to check whether rice price changes are associated with greater household specialization. In particular, the survey provides information on the various agricultural activities of a household. For example, we can identify whether a household sells rice, the total amount of rice sold, the share of non-rice sales in total agricultural sales, and whether a household sells processed agricultural products.[15] These data are summarized in Table 1.

3. Rice Price Variation and the Allocation of Labor

3.1 Descriptive Evidence

Our empirical strategy is to relate changes in rice prices to change in the allocation of labor between households and markets. We adopt a regression approach to control for factors that might be responsible for a spurious correlation between rice prices and the allocation of labor. Before we do that, we consider the basic association between rice price changes and the allocation of labor in the raw data at the community level.

Figure 1 plots the changes in mean hours worked in wage work by an adult 20-64 in a community against the change in rice price observed in that community across 115 rural panel communities. The raw data are indicated by circles. The line in figure 1 is from the regression of the change in mean hours worked in wage work in a community on the change in rice price (we will adopt a different but analogous specification below). There are two important aspects of figure 1 for our discussion below. First, there is substantial heterogeneity in rice price changes across communities so that we can identify the link between rice prices and total hours worked in wage work. Second, communities that experience larger rice price increases also observe larger increases in total wage hours.

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[15]Sales of processed agricultural products involve the following activities: extracting vegetable oils, making noodles, grinding products into flour, popping rice or corn, drying fruit or vegetables, making juice from cane of molasses, packaging fruit or vegetables, drying tea leaves, drying coffee beans, making gin cotton or weave fabric, distilling liquor, and making weave mats, jute bags, or bamboo/rattan products.

These increases in wage work are associated with declines in work inside the household. In figure 2A, we plot the change in mean hours worked inside the household by adults 20-64 in a community against the change in rice prices. Hours worked increase by less (and actually decline) in communities where rice price increases are largest. Thus, conditional on the overall increase in hours worked in the household in the data, higher rice prices are associated with less work inside the household. We suspect that the questionnaire change in own farm agriculture may be important for why we observe more work inside the household in most communities in 1998. The questions on domestic work are identical in both rounds of the survey.[16] Hence, in figure 2B we plot the change in mean hours worked inside the household in domestic work against the change in rice prices. We see large declines in domestic work in much of Vietnam, but these declines are increasing with the change in rice prices. In the next sections, we find that these basic patterns in the raw data are observed in all of our empirical work.

3.2 Methodology

We investigate the relationship between labor allocation and rice prices empirically in the following regression model:

(1) $$l_{ijt} = \beta rp_{jt} + \gamma D_{ijt} + \tau T_{jt} + \lambda_j + \varepsilon_{ijt}$$

where l_{ijt} is hours worked (either hours in wage work or hours in household work) by individual i in community j at time t and rp_{jt} is the log of rice prices in community j at time t. The empirical framework controls for several additional individual or community characteristics. First, the vector D_{ijt} includes a measure of an individual's education (i.e. number of completed years of schooling) and a third order polynomial in an individual's age and gender to allow hours worked by an individual to vary based on these demographic characteristics. Second, the allocation of hours worked between wage work, within household work, and rice prices might vary because of economy-wide shocks and the seasonality of agricultural activity. We control for these time-

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[16] See section 2.2 for detailed definition of domestic work.

varying shocks by vector T_{jt} in (1), which includes survey year indicator, indicators for the season during which the interview took place, an indicator for whether the interview took place during the rice harvest, and an indicator for whether the interview took place during rice planting time. Third, communities differ in many observable and unobservable characteristics that might affect rice prices and labor supply independently. We capture the time-invariant heterogeneity across communities with a community fixed effect λ_j. Our empirical framework thus identifies the relationship between rice prices and hours worked relying on differences across communities in how community rice prices change over time. Finally, our standard errors correct for general forms of heteroskedasticity and clustering at the community/survey year.

3.3 Results

Table 2 presents our basic findings. The top of each column indicates the dependent variable (hours worked in wage work, hours worked in household work) used in each specification. The table reports the coefficient on (log) rice prices and the year indicator. We observe that labor moves away from own household towards wage work in areas where changes in rice prices are greater. First, in column 1, we find a positive and significant association between rice prices increases and hours in wage work. The magnitude of the relationship in the data is large. A 30 percent increase in rice prices is associated with an additional 1.1 hours per week in wage work. This is 25 percent of the baseline average hours worked in wage work in 1993. Second, the decline in hours in within household work in column 2 is equally significant. A 30 percent increase in rice prices is associated with 5 fewer hours worked per week within the household. This corresponds to a 13 percent decline relative to the 1993 baseline. The much larger decline in hours worked within the household suggests that overall, total hours worked per week decline with rice price increases. In columns 3 and 4 of Table 2, we estimate equation (1) using total hours worked in wage work and within the household by *all adult* household

members by estimating (1) using a household (rather than an individual) as an observation.[17] While the greater magnitudes of the coefficients in absolute value reflect that total hours worked are aggregated across adults within each household, the signs of the coefficients on rice prices are consistent with what we observe at the individual level.

Our empirical strategy exploits the *panel* nature of the data at the *community* level by inclusion of community fixed effects. Since rice prices are measured at a community level and we control for time-invariant community characteristics, it is very unlikely that unobserved, time invariant household (or individual) characteristics could create the patterns we observe in the data. Nevertheless, because some of the individuals reside in panel households we also estimate specifications that control for unobserved household heterogeneity with household fixed effects. These results are reported in columns 5 and 6. Because the inclusion of household fixed effects limits our source of identifying variation to panel households, regression coefficients change slightly but not substantively relative to our findings based on community fixed effects in columns 1 and 2.

As discussed in section 2.3, hours worked within the household might potentially suffer from a measurement problem attributed to the change in the questionnaire for hours spent in household agriculture. The change in measurement of the dependent variable might affect our result like neoclassical measurement error, or it might bias our within household results if the measurement change is correlated with changes in rice prices. While it is not possible to check whether the measurement change affects hours worked or if this effect is correlated with changes in rice prices, other evidence suggests that our results are not driven by measurement alone. First, the change in questionnaire asks hours worked at a more disaggregated level. We suspect that this would increase reported hours, but we find a negative association between rice price increases and hours within the household. If our suspicion is correct, then the measurement

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[17] In these regressions, the vector of demographic characteristics includes the information on age, gender, and education of the head of the household and the size of the household.

change implies our results are attenuated. Second, hours in domestic work, a component of work within the household, is not affected by the change in survey questionnaire.[18] We thus also estimate equation (1) with hours in domestic work as a dependent variable. Those results are reported in column 7. Equilibrium in the allocation of labor within the household suggests that we should see movements in all within household activities if the effects we observe in column 2 are real. In fact, we observe that a 30 percent increase in rice prices is associated with a statistically significant 1.2 fewer hours worked per week in domestic work. This corresponds to a 10 percent decline in hours worked in domestic work relative to the 1993 baseline. Thus, we view the results of column 7 as suggesting that the decline in hours worked within the household are not driven purely by changes in measurement.

A final concern in our basic results is that hours worked are censored at zero. Censoring is especially problematic in wage work, because only 15 percent of our sample works for wages in 1993. Columns 8 and 9 report the results when equation (1) is estimated with Tobit model. The flavor of our results does not change in the Tobit specification. Increased rice prices are associated with increased time in wage work and declines in time within the household.

3.4 Robustness Analysis

In the previous section, we have been careful not to assert that the regression results necessarily imply a causal impact of changes in rice prices on adult labor supply. In this section, we examine the data for evidence that would imply that our Table 2 findings reflect a spurious correlation between rice prices and the allocation of adult time. We do not find any evidence that suggests our findings represent anything other than the impact of changes in rice prices on the allocation of adult labor between markets and the household.

First, we consider the hypothesis that our findings in Table 2 are driven by changes in community infrastructure during our sample that directly (i.e. not through rice prices) influence

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[18] See section 2.2 for detailed definition of domestic work.

individual's decision to work for wages. Community specific improvements in roads and irrigation are of particular concern. We need to be clear about how infrastructure improvements could bias the causal impact of changes in rice prices. If, for example, a community improves roads and is thus better integrated with the other markets, this might increase rice prices and lead to more work for wages if increases in rice prices increase the marginal value of wage work relative to work within the household. This is exactly the type of change we hope to capture with rice price variation. However, a problem arises if improved roads are associated with more wage work for reasons that have nothing to do with higher rice prices. For example, improved roads could be associated with more wage work and less work within the household because they increase effective wages by lowering the commuting costs. We do not want our estimates to capture the latter effect that is *not* the result of relative price changes.

The 1998 community questionnaire asks whether the community has experienced various types of infrastructure improvements since 1993. We allow communities with infrastructure improvements in roads and irrigation to experience differential changes in hours worked through time. To do this, we estimate a specification of (1) that includes an interaction of the indicators for whether community improved roads (irrigation) with the year indicator. If the results in columns 1 and 2 of table 2 are driven by unobserved time-varying community specific infrastructure improvements, we would expect the coefficient on rice prices to change significantly. However, the results from the specifications that account for this time-varying heterogeneity are reported in columns 1 and 2 of Table 3[19] and yield similar coefficients on rice prices to those in columns 1 and 2 of Table 2.[20]

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[19]Tobit results for all specifications in Table 3 are in the Appendix Table A.1. Because the results in Table 3 and its appendix yield similar conclusions, we focus our discussion mostly on those reported in Table 3.
[20] The coefficient on road improvements (.541 (standard error is .318)) and irrigation improvements (.621 (standard error is .290)) suggest that these infrastructure improvements are associated with increases in hours devoted to wage work. The two controls don't enter the hours in household work regressions significantly. Of course, it is hard to interpret these coefficients since the placement of infrastructure improvements is likely not random across communities.

Second, we examine the data for evidence on the hypothesis that our findings reflect that communities that have better access to external and national markets might have experienced differential increases in hours worked and bigger price changes independently. In order to check whether our results reflect trending in prices and hours worked across communities based on accessibility, we allow for differential trends in the accessible communities in equation (1) by including an interaction of the indicator for whether a community is accessible with the year indicator.[21] Columns 3 and 4 of Table 3 present the results and yield similar coefficient on rice prices to those in column 1 and 2 of Table 2.

Third, we test the hypothesis that the patterns we observe in the data reflect regional trends in labor allocation and rice prices. Benjamin and Brandt (2004) show that changes in rice prices vary widely across regions of Vietnam. For example, as discussed in the data section, rice price increases are largest in rice exporting communities. These rice exporting communities are concentrated in three areas of Vietnam (the Red River Delta, the Mekong River Delta, and the Southeast). Regions are also somewhat segmented and mobility restrictions are in place so that it is difficult for labor to move across regions. The relationship between rice prices and adult labor supply in Table 2 could reflect different regional trends in economic activities that happen to be correlated with rice prices. We control for region specific time-varying shocks by the inclusion of region indicators interacted with year indicators in equation (1).[22] Columns 5 and 6 present these results. The coefficients on rice prices are similar to those reported in column 1 and 2 of Table 2 and suggest that our basic results are not driven by unobserved region specific time-varying shocks. We continue to find that higher rice prices are associated with more wage work and less work within the household.

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[21] We measure commune accessibility based on information in the community questionnaire from the second round of the survey. Specifically, we interact the year dummy with an indicator for if the commune is accessible by road or waterway year round and an indicator for if there is a road to the commune that is either cement or tar.

[22] There are between 4 and 35 sampled communities per region (the mean and the median are both 25 communities per region).

Fourth, our findings might be driven by unobserved *income* changes (stemming from sources other than rice production such as fishing, manufacturing, coffee production,…) that might affect rice prices and labor supply independently. For example, expansion of coffee production or another activity in a region might increase labor supply and potentially also increase rice prices independently (because individuals might now demand more rice because they are better off). To the extent other industries are regionally concentrated, we already control for such shocks by inclusion of region-specific time trends in our regressions. Moreover, we address this potential source of spurious correlation more directly by inclusion of a 3rd order polynomial of household income as a control in our regressions.[23] Obviously, income is endogenous to labor supply. We thus view the specification that includes income simply as a robustness check and treat income as a conditioning variable (we are not interested in the coefficient on income per se). The comparison of the coefficients on rice prices in column 7 and 8 in table 3 that control for household income with those in column 1 and 2 of table 2 suggest that our results likely do not reflect changes in household income (separate from rice price changes) since the coefficients on rice prices do not change substantively. Moreover, columns 9 and 10 address all four of these concerns simultaneously, and they do not present any evidence suggesting that the findings reported in Table 2 are driven by something other than the relationship between rice prices and the allocation of adult labor.

Finally, household landholdings likely affect how much time a household allocates to work outside household. Land markets had not developed in Vietnam by the mid 1990s, and the major land redistribution program (the 1988 Land Act) was largely complete before the first round of our panel. If a household did not change its household landholdings over time, household fixed effect controls for its land allocation and our findings are robust to inclusion of household fixed effects (for example, compare column 1 and 3 of table 2). However, between

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[23] Our income measure comes from Benjamin and Brandt (2004). We use what they label "Total Income 1" which imputes income to capital services in addition to wage income and net income from self-employment.

1993 and 1998 some communities in the VLSS redistributed land across households. If this redistribution affects the allocation of labor supply *and* is likewise associated with rice price increases, our results in columns 1 and 2 of table 2 may confound the impact of redistribution with that of rice prices. To rule of this possibility we do the following. We bifurcate our sample into households in communities that redistribute land between 1993 and 1998 and households in communities that do not.[24] We reproduce the main findings of this paper for households living in communities that did not redistribute land between 1993 and 1998. These results are presented in column 1 and 2 of table 4. The coefficients on rice prices are well within a statistical confidence band of the full sample results. Thus it is unlikely that land reallocation drives our findings.

4. Discussion

Our results suggest that higher rice prices following national and international market liberalization are associated with a movement of labor away from work within the household towards wage work. What might explain this association between a community's exposure to a trade liberalization and the shift of production outside of the household?

Consider a setting where production can occur within an individual's household or in the wage labor market. When labor inside and outside of the household can freely substitute, profit maximization implies that the worker allocates time between wage work and work inside home to equalize the value of his marginal product in each activity.[25] The effect of an increase in product prices on employment within the household relative to employment outside of the household thus depends on the impact of price changes on market wages relative to the value of the marginal product of labor in production at home. If the increase in market wages is greater than the increase in the value of labor's marginal product at home, the worker will devote more

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[24]The community questionnaire in the second round of the VLSS records the date in which land was last redistributed in the commune. We label a community as having redistributed land between survey rounds if the date recorded in answer to this question falls between survey rounds.

[25] This statement implicitly assumes that there are no binding constraints on off-farm employment.

time to wage work and cut back hours spent in work within the household in order to maintain equilibrium.

In the data, we do not observe wages in self-employment and, more generally, the value of an individual's time inside the household. Thus, it is impossible to identify whether rice market liberalization in Vietnam is associated with changes in the *relative* return to work outside of the household. However, increases in labor market wages concurrent with rice price increases would be suggestive at least. Measuring market wages is problematic, though, because there is selection into wage work that we believe is associated with rice price changes (and trade liberalization in general). With these caveats about interpretation and selection bias in mind, we plot community-level changes in the mean reported market wage against rice price changes in figure 3.[26] The raw data are pictured as circles and the line is from the linear regression of the change in mean wages on the change in rice prices. Higher rice prices appear to be associated with higher observed market wages in the data.

Why market wages may increase more than the value of household labor's marginal product is closely related to why production moves out of the household to begin with. The idea that production moves out of the household with economic development has been first developed by Adam Smith. He attributes this process to gains from specialization that is limited by the extent of the market. Locay (1990), Goodfriend and McDermott (1995), and Kelly (1997) provide contemporary formalizations of this idea. These models consider a setting where most production initially occurs within the household. Market liberalization expands the market.[27] Market expansion in turn shifts production and labor from households to markets and increase the degree of specialization within the economy. The larger the growth in trade in a community, the greater the scope for specialization (see Locay 1990, Goodfried and McDermott 1995, Kelly

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[26] The employment module of the household survey asks for earnings in kind and in cash in the last seven days for the each working individual in their main activity. We sum these two to create a weakly wage for an individual. The mean weakly wage in a commune is the average of these responses.

[27] In general, the extent of the market is driven by population growth rather than trade liberalizations in these models. Kelly (1997) is an exception in that she also allows markets to growth through declining transport costs.

1997, Ades and Glaeser 1999). So long as work outside the household (i.e. wage work) better captures these gains from specialization, wages will rise more than the value of household labor's marginal product. Thus, individuals will devote more time to market work and less time to work within own household.

Why might the gains from specialization be greater outside of the household in these models? In Locay's model, for example, production is subject to economies of scale, and households face lower costs in monitoring workers than firms (as in Becker 1981). These lower monitoring costs imply that when markets are small, production is concentrated within households.[28] However, as markets expand, the scale economies outside of the household outweigh the relatively high monitoring costs in firms, and production and labor moves away from households to markets. This move is accompanied by increases in production specialization across firms (and households). Note that in this setting, a shift in production towards specialized firms can lower product prices for the good formerly produced by the household, further reducing the value of labor's marginal product in the household and reinforcing the shift of production outside the household.

Note that our reading of this literature does not lead us to think that increases in rice prices somehow benefit wage agriculture over family farms. Rather, the increases in rice prices proxy for the growth in trade in a community, and households can specialize as a result of this growing trade. If this Smithian specialization story is behind the patterns we observe in the data on labor allocation, we would expect to see other evidence of an increase in specialization in the data on household production. We thus consider whether there is corroborative evidence that product market liberalization is associated with increased specialization in other household activities.[29]

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[28]In Devereux and Locay (1992), work within the household avoids the fixed costs associated with trading.
[29]To the extent that rice price changes are not completely correlated with a community's exporting status, we might expect greater increases in wage work and declines in household work in exporting communities. That is, if exporting communities experience greater market expansion (conditional on rice prices), we would expect labor

In particular, we consider how household engagement in several activities is associated with changes in rice prices using the framework of equation (1):

$$A_{hjt} = \beta rp_{jt} + \gamma H_{hjt} + \tau T_{jt} + \lambda_j + \varepsilon_{hjt}$$

where A_{hjt} is an outcome variable for household h living in community j at time t, H_{hjt} is a vector of demographic characteristics of the head of the household (i.e. years of complete education, third order polynomial in age and gender, household size), and all other notation follows that of equation (1).

Table 5 presents our findings. The headings in the top row denote the dependent variable used in each column. First, in column 1, we observe that rice price increases are associated with a decline in the probability a household produces rice. We expect to see this with market expansion if there is some heterogeneity in farmer ability. Increased prices create incentives for relatively better farmers (or better farm managers) to raise their output. The resulting increase in input prices may induce relatively poorer farmers to specialize in the production of other goods (other businesses, working for other farmers, etc.) along the lines of their comparative advantage. Farmers that stay in rice production should then produce more rice for sale and specialize more in the production of rice.

We observe these patterns in the remaining columns of Table 5 which focus on rice producing households. We find that rice producing households increase the probability they sell rice and their sales of rice with rice price increases. The fraction of their sales that come from

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supply in wage work to go up more there and household production to decline by more. One could check this by inclusion of a variable in our basic specification that is an interaction of an indicator for whether a community exports rice in 1992/93 with a year indicator (thus allowing for differential response of exporting communities through time). Considering whether exporting communities have a greater growth in wage work is hard, because we do not observe whether a community is a net exporter of rice. We can make a guess at this by adding together the net production of rice in *sampled* households within a community. But there is no way we can check whether these communities are actually exporting rice outside of the community. Nevertheless, we have included such interaction in our basic specification. The coefficient on export*year was positive but statistically insignificant (i.e. .762 with standard error .476) in regressions with hours in wage work as a dependent and negative and significant (i.e. -3.177 with standard error 1.163) in regressions with hours in household work as a dependent variable. This suggest that conditional on rice prices and other regressors, communities that export rice are associated with greater increases in wage work (albeit not in a statistically significant way) and bigger decline in household work relative to importing communities.

other crops declines as does the probability that they sell processed agricultural products. In column 2 of table 5, the dependent variable is an indicator for whether the household sells rice. We find that a 30 percent increase in rice prices is associated with a 7 percentage point increase in the probability that a rice-producing household sells rice. This is a 16 percent increase over the 1993 baseline mean in Table 1. In column 3, we observe a dramatic increase in sales of rice with rice price increases. A 30 percent increase in rice prices is associated with an additional 843,500 Dongs per year in sales. This is a 93 percent increase over the 1993 baseline mean (Table 1). This increase in rice sales is not matched by other agricultural products: the fraction of total sales accounted by other products declines in rice producing households with rice price increases (column 4). Finally, in column 5, we find that the probability that a household does some reprocessing, then reselling of agricultural products declines with rice price increases. In Locay's (1990) model of growth through specialization, he highlights that households will move out of these intermediate stages of production with market expansion. In our data, a 30 percent increase in rice prices lowers the probability of these processed agricultural product sales in rice producing households by 5 percentage points or 66 percent of the 1993 baseline.

In sum, the above patterns in changes in other household activities associated with rice price changes are consistent with the idea that the increase in wage work and decrease in within household work that we observe with an easing of domestic and international trade restrictions in section 3 is occurring in the context of increased household specialization.

5. Conclusions

This paper explores the relationship between product market liberalization and the allocation of labor between *own* household work and market work in a poor economy. Our data surrounding the easing of restrictions on domestic and international trade in rice in Vietnam suggests that in communities where the impact of trade liberalization appears greater, there are declines in work within the household and increases in hours worked for wages. Moreover, we

find that households in communities that experiences greater rice price increases also specialize household activities. In particular, greater rice prices are associated with declines in probability that a household produces rice. However, rice producing households are more likely to sell rice (the probability of selling rice and the quantity sold increases with rice price increases), sell relatively fewer other agricultural products, and are less likely to participate in post harvest processing of agricultural products. This evidence on household activities is consistent with the idea that product market liberalization is associated with a move of labor resources from households toward the market and household specialization in a poor economy like Vietnam.

The results of our analysis are thus in line with the predictions of models such as Locay (1990), Goodfriend and McDermott (1995) and Kelly (1997) that emphasize the extent of the market as the driving force for the reallocation of labor from households to the market and toward greater specialization in poor economies. The movements of labor away from household to wage work provide the key mechanisms, in these models, through which very poor countries improve living standards. These improvements reflect both gains due to economies of scale and specialization. While the potential gains from household specialization have not received much attention in trade literature, they might be quite important when very poor economies that are currently the focus of the Doha round of the WTO negotiations integrate into the global economy.

Finally, our results suggest a possible future research topic that fits in the recent debate on the relationship between globalization, growth, and poverty in very poor countries (see Dollar and Kraay 2001, 2002, Chen and Ravallion 2001, and Rodriguez and Rodrik 2001). Given the dominant role of *own* household work in many poor economies the reallocation of labor between households and markets in response to market liberalization might be an important component in the link between integration, growth, and poverty in these economies. For example, Edmonds and Pavcnik (2004) examine how child labor responds to the same rice price changes considered

herein. While they document large, important income effects on child labor associated with rice price changes, they also observe significant substitution effects in domestic work that contribute to the dramatic decline in child labor. Increasing household specialization may be important in these substitution effects. Understanding the mechanisms behind the relationship between integration and growth in Vietnam and other very poor economies remains an important topic for future research.

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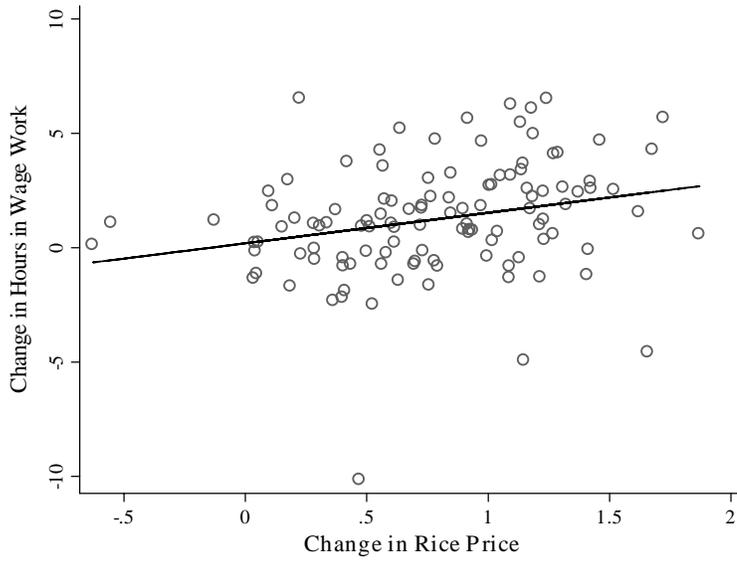**Figure 1: Community Changes in Rice Prices and Changes in Mean Hours in Wage Work**

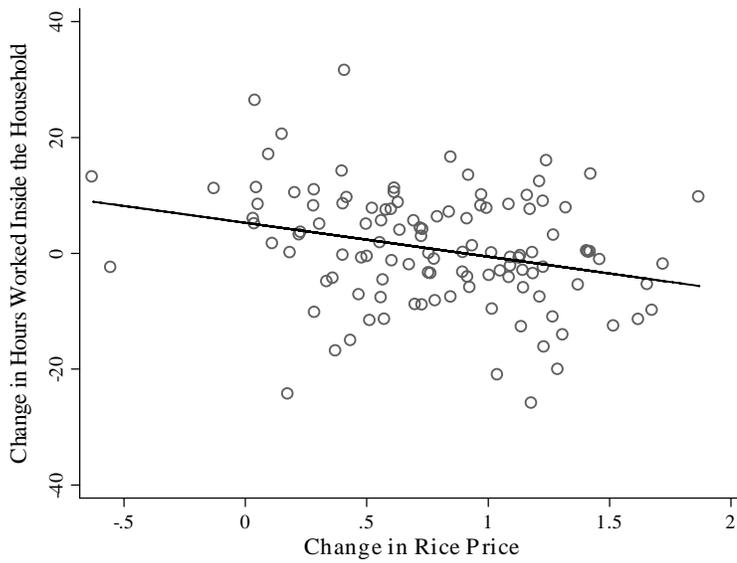**Figure 2A: Community Changes in Rice Prices and Hours Worked inside the Household**

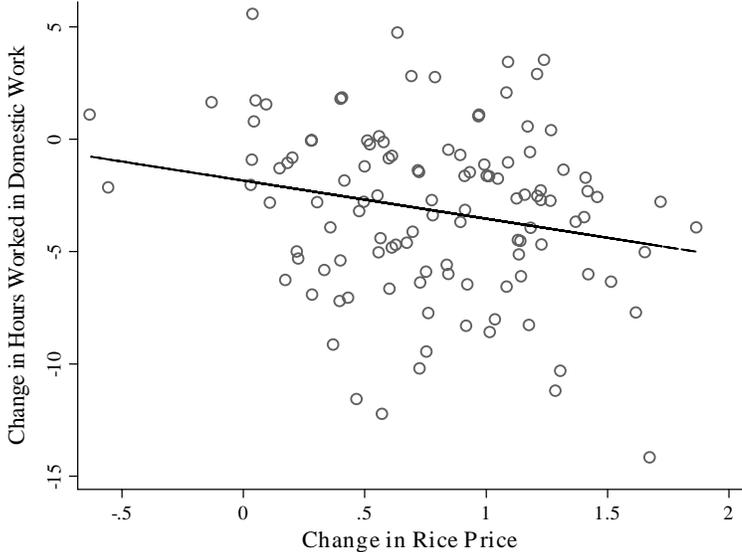**Figure 2B: Community Changes in Rice Prices and Hours Worked in Domestic Work**

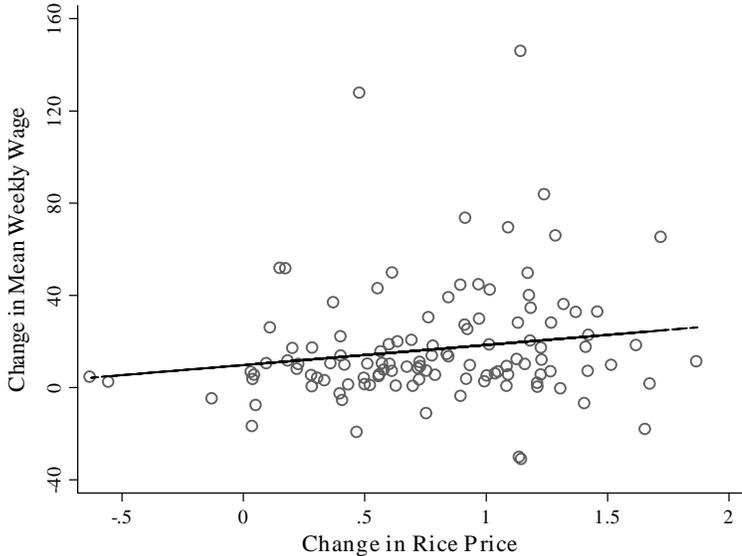**Figure 3: Community Changes in Rice Prices and Changes in Wages**

Table 1: Descriptive Statistics for Rural Households

	1993		1998	
	mean	s.e.	mean	s.e.
Number of Individuals	8,039		8,124	
Number of Households	3,634		3,639	
Number of Communities	115		115	
ln(Rice Price)	0.92	0.01	1.19	0.01
Male	0.47	0.00	0.47	0.00
Age	36.69	0.16	37.76	0.17
Education	5.98	0.17	6.60	0.17
Hours worked in wage work	4.39	0.30	5.41	0.34
Hours worked within household	38.44	0.79	39.61	1.12
Hours worked in domestic work	12.44	0.29	9.38	0.25
Household Produces Rice	0.86	0.02	0.83	0.02
Household Sells Rice	0.43	0.03	0.48	0.03
Household Sales of Rice (00,000 98 Dong)	9.07	1.42	18.48	2.95
Household Non-rice sales share	0.63	0.03	0.61	0.03
Household Sells Processed Agr. Products	0.07	0.02	0.05	0.02

All means are weighted to reflect sample design.

Table 2: Hours Worked and Rice Prices

	Wage work	Household Work	Household Wage Work	Household work	Household Wage Work	Household Work	Household Domestic work	Wage work	Household work
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rice Price	3.602	-16.663	9.925	-34.095	4.03	-16.205	-3.905	9.936	-16.865
	[0.936]**	[3.793]**	[2.360]**	[9.438]**	[1.095]**	[4.359]**	[1.295]**	[4.076]**	[1.838]**
Time=1997/98	0.209	5.195	0.531	14.355	0.06	5.232	-1.991	0.641	5.148
	[0.289]	[1.239]**	[0.691]	[3.139]**	[0.330]	[1.405]**	[0.434]**	[1.365]	[0.594]**
Community Fixed Effects	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Season Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household Fixed Effects	No	No	No	No	Yes	Yes	No	No	No
Tobit	No	No	No	No	No	No	No	Yes	Yes
Unit of Observation	Individual	Individual	Household	Household	Individual	Individual	Individual	Individual	Individual
Number of Observations	16141	16135	6989	6989	16141	16135	16157	16141	16135
R-squared	0.13	0.25	0.16	0.31	0.46	0.52	0.25	n.a.	n.a.

Note: * and ** denote significance at 10% and 5% level, respectively. Standard errors that correct for clustering on community/survey time are reported in parenthesis. The number of observations is smaller in columns 2,6, and 9 for household work, because 6 individuals had missing observations for hours worked in household work. Similarly, 22 people answer the question about "domestic work" that did not answer questions on either own farm work or own business questions (column 7). The number of household-year observations in columns 3 and 4 is limited to households where we are not missing any labor information on any adult 20-64. Dependent variable in columns 3 and 4 is total hours worked in the last week in the indicated category by all household members age 20-64.

Table 3: Hours Worked and Rice Prices--Robustness Analysis

	(1) Wage work	(2) Household Work	(3) Wage Work	(4) Household work	(5) Wage Work	(6) Household Work	(7) Wage Work	(8) Household work	(9) Wage Work	(10) Household work
Rice Price	3.38	-16.417	3.497	-15.908	3.34	-9.819	3.873	-17.557	3.253	-11.246
	[0.948]**	[3.746]**	[1.003]**	[3.790]**	[0.930]**	[3.457]**	[0.944]**	[3.966]**	[1.010]**	[3.489]**
Time=1997/98	-0.243	5.497	0.338	7.134	-0.447	-1.159	0.09	4.591	-1.295	0.282
	[0.359]	[1.586]**	[0.295]	[1.255]**	[0.404]	[1.655]	[0.302]	[1.285]**	[0.612]**	[2.089]
Community Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Season Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure Improvements *Time Effects	Yes	Yes	No	No	No	No	No	No	Yes	Yes
Accessibility*Time Effects	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Region*Time Effects	No	No	No	No	Yes	Yes	No	No	Yes	Yes
Income polynomial	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	16141	16135	16141	16135	16141	16135	15157	15152	15157	15152
R-squared	0.13	0.25	0.13	0.26	0.13	0.26	0.13	0.25	0.13	0.26

Note: * and ** denote significance at 10% and 5% level, respectively. Standard errors that correct for clustering on community/survey time are reported in parenthesis. The number of observations is smaller in columns 2,4, and 6, 8 for household work, because 6 individuals had missing observations for hours worked in household work. Number of observations is smaller in column 7-10 because total household income is missing for some individuals.

Table 4: Hours Worked and Rice Prices in Communities not Affected by Land Redistribution

	Wage work	Household Work
	(1)	(2)
Rice Price	3.42	-20.839
	[1.311]**	[4.625]**
Time=1997/98	0.534	5.784
	[0.371]	[1.481]**
Community Fixed Effects	Yes	Yes
Season Effects	Yes	Yes
Demographic Controls	Yes	Yes
Observations	9855	9853
R-squared	0.11	0.26

Note: * and ** denote significance at 10% and 5% level, respectively. Standard errors that correct for clustering on community/survey time are reported in parenthesis. The number of observations is smaller in column 2 because 2 individuals had missing observations for hours worked in household work.

Table 5: Rice Prices and Shifts in the Structure of Production

	Hh Produces Rice (1)	Hh Sells Rice (2)	Sales of Rice (3)	Non-rice sales share (4)	Hh Sells Processed Agr Products (5)
Ln(Rice Price)	-0.16	0.237	28.134	-0.234	-0.153
	[0.062]**	[0.073]**	[7.752]**	[0.058]**	[0.068]**
Time=1997/98	-0.001	0.032	4.48	0.018	0.018
	[0.013]	[0.022]	[1.700]**	[0.018]	[0.024]
Commune Fixed Effects	Yes	Yes	Yes	Yes	Yes
Season Effects	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes
Observations	7273	5562	5562	5144	5562
R-squared	0.38	0.39	0.36	0.54	0.28

Robust standard errors clustered at community/time level in brackets. * significant at 10%; ** significant at 5% level. Columns 2-5 are restricted to households that produce rice. 418 Households do not sell agricultural products and are missing from column 4. Column 4 dependent variable is (Agr Sales-Rice Sales)/Agr Sales.

Appendix Table A.1: Hours Worked and Rice Prices, Robustness Analysis for Tobit Specification of Table 3

	Wage work	Household Work	Wage Work	Household work	Wage Work	Household Work	Wage Work	Household work	Wage Work	Household work
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Rice Price	9.689	-16.613	9.849	-16.147	8.466	-9.997	13.41	-17.697	10.796	-11.415
	[4.089]**	[1.844]**	[4.171]**	[1.897]**	[4.410]*	[1.969]**	[4.243]**	[1.907]**	[4.711]**	[2.111]**
Time=1997/98	-0.151	5.462	1.695	7.084	-2.384	-1.26	0.78	4.532	-3.909	0.171
	[1.543]	[0.675]**	[1.566]	[0.660]**	[1.863]	[0.867]	[1.429]	[0.620]**	[2.971]	[1.351]
Community Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Season Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Infrastructure Improvements *Time Effects	Yes	Yes	No	No	No	No	No	No	Yes	Yes
Accessibility*Time Effects	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Region*Time Effects	No	No	No	No	Yes	Yes	No	No	Yes	Yes
Income polynomial	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	16141	16135	16141	16135	16141	16135	15157	15152	15157	15152

See notes to table 3.