Migration and Land Rental as Risk Response in Rural China

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Abstract

Households in developing countries take various actions to smooth income or consumption as a means of managing or responding to risk. One of the principal means of smoothing income is through the diversification of income sources, including nonfarm employment and rural-urban migration. An important consumption smoothing strategy involves the accumulation and depletion of assets. We examine migration and land rental market participation as responses to risk in rural China. Using a longitudinal data set comprised of households in nine provinces in China from 1991 through 2006, we are able to test for the effect of various manifestations of underlying idiosyncratic and covariate income risk on household responses. We find that covariate risks increase land rental market participation, but decrease participation in migration. Idiosyncratic income risks do not affect household rental market participation, perhaps suggesting that intra-village risk sharing is sufficient for households to smooth consumption after experiencing idiosyncratic shocks. Because the death of a household reduces a household's redundant labor, these idiosyncratic labor shocks significantly lower the likelihood that a household will participate in migration.

JEL codes: O15, R23, Q15,

Keywords: China, risk, consumption smoothing, income smoothing

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1 Introduction

In this paper we analyze two important forms of risk management and coping strategies undertaken by households in rural China, namely participation in land rental markets and rural-urban migration. Because migration can serve to diversify income sources in the face of underlying risks, we consider migration to be an income smoothing risk management strategy. Land rentals, on the other hand, can serve as risk coping strategies if rental decisions are made in response to shocks. For this reason, land rentals may be considered consumption smoothing strategies. In this paper we identify the factors that lead to the utilization of these mechanisms, paying specific attention to the types of shocks and underlying risks that elicit these responses.

Rural agricultural households in developing countries face considerable risk. Not only do incomes generally hover around subsistence levels, but these incomes typically suffer from a high degree of variability. There are several sources of risk that contribute to income variability for rural agricultural households. One important source is yield risk, which can be associated with weather variability, the incidence of diseases, pests, and many other less obvious factors (Bardhan and Udry, 1999). Other important sources of risk include economic fluctuations, changes in input and output prices, shocks that can affect the stock or productivity of various forms of productive capital, including both human and physical capital, and other random factors that affect the states and dynamics of demographic variables (Dercon, 2005; Townsend, 1995). Without appropriate means of mitigating or coping with this risk or responding to the shocks inherent in these risks, households are vulnerable to significant declines in overall welfare; even transitory declines in income can have large and lasting consequences for household consumption.

The literature on risk, particularly in the context of developing countries, distinguishes between two broad classifications of risk (see, for example, the review in Dercon, 2005). Covariate risks are common, or aggregate risks: they affect all members of a community. These include risks such as climate risk, macroeconomic fluctuations, policy shocks, and disease epidemics. Idiosyncratic risks, on the other hand, are individual risks: they affect only a particular individual or household. Examples of idiosyncratic risks include risks such as the death of a breadwinner or asset losses (e.g., through fire or theft). While these risks may be identified as either covariate or idiosyncratic, they are surely not purely such; there is often both an idiosyncratic and a covariate component. Few risks are purely idiosyncratic or purely covariate (Dercon and Krishnan, 2000; Dercon, 2002, 2005). Even weather risks, which may be thought of as covariate due to the distribution of weather over a relatively large geographic area, cannot be considered purely covariate because other heterogeneous factors (e.g., soils) can dampen or intensify the effects of weather shocks. Risks can be thought of as occupying a continuum with, at one end, purely covariate risks, and at the other end, purely idiosyncratic risks. Most risks faced by households, then, would be on the interior of this continuum, but certain types of risks may be more threatening to certain households than others. Several studies have suggested that the idiosyncratic component of total risk can be large relative to the covariate component. Dercon and Krishnan (2000) use a three-period panel from Ethiopia and decompose the variation of income from fourteen types of shocks. None of the fourteen shocks considered have a large covariate component. The only shock for which village level variation in income explains in excess of 40% of household variation in income is rainfall. Using data from the Ivorian Living Standard Survey, Deaton (1997) performs a simple test whether income and consumption changes are more similar within villages than between villages. His results suggest that common village components do not explain much of the variation in household income or consumption changes. This implies that idiosyncratic components are significantly more important in explaining variations in income or consumption than covariate components. Morduch (2005) uses the ICRISAT data and decomposes observed household income into a base income level, a factor that scales the base income level up or down due to covariate shocks, and a factor which scales the base income up or down due to idiosyncratic shocks. He finds that between 75% and 96% of total variation in household income can be explained by idiosyncratic elements. Udry (1990), on the other hand, finds that only 42% of the variation in farm yields in a sample of Northern Nigerian farms can be attributed to idiosyncratic risks, while the remaining 58% is due from a combination of covariate shocks and other village-level effects.

Rural households in developing countries can cope with risk at two stages (Morduch, 1995). Ex ante, risk averse households can smooth income, trading off higher expected incomes for less variable incomes. This is generally accomplished through the process of diversification, including both product diversification and the division of household labor among farm and non-farm employment. Income smoothing is generally considered an ex ante risk management decision because diversification occurs in anticipation of a shock. Ex post, risk averse households can smooth consumption through various channels. These include formal and informal insurance arrangements (including risk-sharing within villages and social safety nets), borrowing or saving, and accumulation or depletion of productive assets. In the complete absence of insurance markets, credit, or adequate liquidity, or where households simply do not utilize these consumption smoothing tools, household consumption can be closely tied to income. Farm households strive to decouple income from consumption to reduce the volatility in household consumption that could result in transitory consumption poverty in the event of an adverse income shock. Consumption smoothing is therefore generally considered an ex post risk management strategy because decisions to access insurance or credit, or to accumulate or deplete productive assets are generally made in response to a shock that threatens consumption.

The nature of exposure to risk affects people's ability to manage risks. Small, frequent shocks such as transient illnesses, are much easier for households to manage than large, infrequent shocks such as a disability or chronic illness (Dercon, 2005). Additionally, idiosyncratic shocks can often be managed through intra-village insurance arrangements such as risk-sharing arrangements or social safety nets. These strategies work primarily because the shocks that are insured through these strategies are not widespread. These strategies may be based on cultural values and mores which are presumably shared amongst members in a community. For example, Udry (1990) found evidence of state-contingent load repayments, where the repayment schedule was dependent upon both the borrower's and the lender's production and consumption experiences. The state-contingent nature of these credit contracts allowed risk-sharing to occur more effectively while also conforming to Islamic prohibitions on fixed interest charges. Popkin (1979) criticizes this "moral economy" interpretation of risk-sharing arrangements in rural societies, instead preferring a political economy interpretation of these institutions. Foster (1988) has shown that social-risk sharing mechanisms may be self-reinforcing. In essence, the short-term benefits of shirking responsibility when it is one's turn to supply payments do not exceed the expected costs of forgoing future receipts (see also Alderman and Paxson, 1994). Numerical simulations by Coate and Ravallion (1993), however, suggest that informal risk-sharing arrangements within villages may be very sensitive to certain behavioral parameters. They suggest that small changes in risk aversion or intertemporal discount factors may lead to the collapse of these arrangements. The wide persistence of these informal risk-sharing arrangements in a wide variety of rural settings suggests that either the empirical model in Coate and Ravallion (1993) is misspecified such that the results are overly sensitive to these underlying behavioral parameters, or perhaps that these behavioral parameters are themselves persistent and contribute to the self-reinforcing nature of these arrangements.

Managing covariate risks through intra-village risk-sharing arrangements is much more difficult, and may be impossible for covariate shocks with wide effects. Since these covariate shocks affect most or all of the villagers, these risks cannot be shared effectively within a village. Instead, these risks must be managed either through intertemporal transfers (i.e., accumulation and depletion of savings or other stocks) or insurance or credit from outside the village. Alderman and Paxson (1994) suggest that inter-village credit markets could exist to protect against covariate shocks, but the effectiveness of such markets would be limited by the extent of the covariation between inter-village incomes. A drought, for example, which affects incomes in multiple villages spread over a wide geographic area, would not be insured by inter-village credit markets. Additionally, Udry (1990) finds very little evidence of inter-village credit market activity in his Northern Nigerian data. He suggests that asymmetric information may be the principal culprit for the absence of these markets,[1] but also suggests that village-based traders may provide sufficient financial intermediation.

A large literature has been devoted to understanding precautionary savings and other consumption smoothing strategies undertaken by rural households. These have often been framed in terms of the permanent income hypothesis (see, for example, Deaton, 1992), which suggests that household consumption decisions are not made in response to current income–which can be extremely volatile, especially in developing countries–but rather that households base current consumption decisions on permanent income. The empirical results of studies testing the smoothness of consumption

[1] Indeed, Udry (1990) suggests that one of the reasons for the state-contingent nature of loan repayments in his Northern Nigerian villages is because information regarding the production outcomes of borrowers and lenders flows freely within the community. Outsiders would not have access to this free flow of information, and this asymmetry can lead to the collapse or nonexistence of inter-village risk sharing.

(e.g., Wolpin, 1982; Bhalla, 1979; Meng, 2003) generally support the hypothesis that consumption smoothing mechanisms are important, but incomplete. Deaton (1991) developed a theoretical model to explain saving behavior under credit constraints. His model is able to show that asset accumulation and depletion helps to smooth consumption. Rosenzweig and Wolpin (1993) find that bullock sales allow farmers in the ICRISAT villages in India to smooth consumption during times of poor weather outcomes. This is a particularly interesting result, since bullocks are not merely a risk-free financial asset (as is the asset in Deaton, 1991), but is rather a risky, productive asset. The accumulation and depletion of bullocks, therefore, not only affects current consumption through being a store of wealth, but also affects current and future income through the productive nature of bullocks. This is not surprising, as the buying and selling of cattle is recognized as a common consumption smoothing strategy in many rural areas (see, e.g., Binswanger and McIntire, 1987). Nevertheless, despite their role in improving the efficiency of agricultural production, Rosenzweig and Wolpin (1993) find that there is underinvestment in bullocks, primarily due to farmers' overall aversion to risk, as well as their generally low incomes and constraints on borrowing.

Morduch (1995) notes that the assumption of complete credit or insurance markets implicitly precludes income smoothing, since the existence and completeness of these markets imply that households are able to sufficiently smooth consumption such that consumption and income are effectively independent. If credit and insurance markets are complete, then households ought to make production and labor allocation decisions to maximize expected profits (or income) and access these markets as an ex post response to transitory income shocks. In other words, under the assumption of complete markets, income smoothing violates expected profit maximization. If markets are incomplete, then income and consumption remain coupled to some degree, and we would expect to observe risk-averse households undertaking some actions to reduce the volatility in income. Important methods of smoothing income include the diversification of cropping patterns (i.e., choosing crops whose yields or prices exhibit low correlation), planting crops on scattered plots that are subject to different weather shocks, using a variety of production techniques, and blending farm and non-farm income sources (Alderman and Paxson, 1994). Traditional theories of income smoothing suggest that risk averse households will be willing to accept lower incomes to ensure lower variability of incomes. As long as the returns from the different diversified activities do not perfectly covary, combining diversified activities should increase expected utility for risk averse households. An extreme example would be two activities that have the same expected returns and the same variance in returns. Assuming at least some covariation in returns, moving from one single activity to a diversified portfolio of both activities would simply reproduce a mean-preserving spread of expected incomes, which would both first- and second-order stochastically dominate other feasible distributions. But even if the diversified activities do not have the same expected outcomes, the diversification of income such that overall risk exposure is reduced results in a distribution that second-order stochastically dominates other feasible distributions. The diversification of income sources is an income smoothing strategy observed in many developing countries. Reardon et al. (1992) finds evidence that households in Burkina Faso smooth income through participating in livestock husbandry, non-farm income and migration as well as traditional agriculture. This allows households to maintain food security despite recurrent crop failures. Kochar (1995, 1999) found increased male labor supply among households in the ICRISAT villages, though his results suggest that income diversification was an ex post response to yield shocks. Not all households will be able to respond to risks or participate in income smoothing in the same fashion. Theory would suggest that relative risk aversion declines with incomes, and therefore wealthier households should be more willing to invest in activities with more variable returns. Additionally, one would expect that wealthier households would not be bound by the same credit constraints as poorer households. Dercon and Krishnan (1996) suggests that, while risk aversion and credit constraints may play a role in a household's ability to participate in income diversification, a more important determinant may be skill or ability constraints that effectively exclude poorly endowed households from different activities. These additional constraints may explain the findings in Townsend (1995), suggesting that relatively few households in the ICRISAT villages hold a diversified portfolio of soils, crops, or occupations.

2 Background on Migration and Land Rental Markets in China

Rural China presents an interesting context within which to examine household responses to risk, especially in light of the dramatic reforms in rural organization that have taken place there over the past 30 years. One of the most important reforms has involved the nature of the rural economic system. Starting in the late 1970s, as the whole of China's economy became more market-oriented, the former system of collective farming began to collapse, and the primary form of agricultural production once again became the family farm. Collectives divided up the land amongst the various households, allocating land on the basis of the number of workers and household size. This was apparently a smooth transition, and has been called "the most egalitarian land reform in history" (Walder, 2000, quoted in Naughton, 2007). An important aspect of these reforms is that farmers were given more productive and management autonomy (Lin et al., 2003). This "household responsibility system", beginning in the early 1980s, marked the beginning of the end of the collective work team system of farming, and transferred more of the responsibility for labor allocation and the marketing of agricultural surplus to the household rather than the collective. By 1984, nearly all farming in China was under this system. As a result of these reforms, agricultural output growth in China was dramatic. Lin et al. (2003) reports that total agricultural output grew by 42% between 1978 and 1984, and average annual agricultural growth was 6.05% over that span. Brandt et al. (2002) report that the gross value of agricultural output rose by an annual rate of 7.6% from 1979 to 1984, and grain production rose by 4.9% annually over the same span. Lin (1992) estimated that nearly 47% of this growth in agricultural production can be attributed to the introduction of the household responsibility system, even after controlling for other factors such as higher procurement prices and lower agricultural input prices. Since households were able to control the marketing of their output after satisfying government procurment quotas, there were greater incentives in place to increase production.

Despite the preeminence of family farming in China, households still have no legal ownership of the land they farm. Ownership of the land remains with the collective. Households have land use rights to the land, granted to them under contracts signed with the collectives. These contracts essentially guarantee households the rights to use the land for whatever purposes they so choose, sometimes for periods as long as 50 years. But because the ownership remains with the collective, these rights are not absolute. In most villages, these contracts have been upheld, but in some villages, village leaders have negated the contracts and redistributed the land or have intervened in the uses of the land (Brandt et al., 2002). With no private ownership of land, there is very little landlessness in rural China. The security of at least some access to land provides many rural families a form of social insurance (Naughton, 2007). But the lack of private ownership also diminishes the incentives for farmers to make investments in the land which would improve the long-run productivity of the land. Why would a farmer invest in the land if there was a possibility that the land could be redistributed in the near future? This has led some to suggest that the lack of tenure security may explain the slowdown in output growth that came after the initial dramatic increases in output growth following the wide scale adoption of the household responsibility system. Brandt et al. (2002) reports that grain output grew only 0.9% per year from 1985 through 1994, despite the central government's efforts to improve the marketing environment. Legislation passed in the late 1990s directed that land contracts would be for 30 years, and subsequent legislation in 2003 guaranteees farmers' land-usage rights.

Under a system of private ownership, households are able smooth consumption through the accumulation and depletion of assets. Productive assets, such as land and livestock, are important components of this form of consumption smoothing, since they act not only as stores of wealth but also as factors of production contributing to current and future incomes. Accumulating productive assets during boom periods can positively alter a household's long-term growth trajectory, while depleting productive asset stocks in lean periods can have a negative effect on the growth trajectory. In addition, the transferral of land through market transactions should contribute to overall efficiency, since households with relatively low marginal productivities of land could transfer land to households with higher marginal productivities of land, which would allow both sets of households to pursue activities for which they can take advantage of higher marginal productivities. In an economy in which there is no private ownership, the management of productive assets such as land can still play an important role in smoothing consumption, but not through the purchase and sale of land, but rather through land rentals. Yet because of tenure insecurity and poorly-defined property and land-use rights, the development of land rental markets in China has been relatively slow, despite a nearly widespread allowance of these rentals. Using data from a a survey conducted in the Chinese provinces of Hebei and Liaoning during 1995, Benjamin and Brandt (2002) found that, on average, only about 3% of land exchanged hands in land rental markets. The results of their empirical analysis suggest that a system of secure property rights that support land rental markets can serve both efficiency and equity objectives. Recent legislation (including the Rural Land Contracting Law of 2003) seem to be concerned with improving the functioning of land markets, and as a result recent studies seem to suggest that land markets are developing rapidly, particularly in coastal regions and to a lesser degree in the poorer, inland regions.

Reforms regarding labor mobility have also had a significant impact on rural organization and the welfare of rural households. In the early- to mid-1950s, the Chinese government instituted a registration system, largely to monitor—not control—the dynamics of population and demographic change (Chan and Zhang, 1999). Households were required to be officially registered in their permanent home, and were therefore demarcated as either possessing a "rural" or "urban" household registration, or *hukou* . Beginning in the late 1950s, in an attempt to slow the burden of a massive influx of peasants into the coastal cities, the central government imposed rather rigid restrictions on the movement of people from the countryside to the cities. Yet even despite these regulations, geographic mobility was permissible—if it was in line with the central government's economic priorities. The Great Leap Forward, which began in 1958, emphasized the acceleration of industrial growth, led to significant increases in the movement of labor from the countryside to the cities, as farmers migrated to take advantage of better-paying factor jobs. As the Great Leap Forward collapsed, however, living in the city had significant advantages over living in the countryside. Despite severe food shortages, the government continued to extract agricultural output from the countryside to provide urban dwellers with their grain rations. It was during this period that the *hukou* system, as it is now understood, came into prominence. Registration status was nearly impossible for an individual to change, and during the worst parts of China's famine, one's household registration could literally mean the difference between life and death. The mobility restrictions defined by *hukou* status essentially imposed a barrier between rural workers and urban workers.

The *hukou* system remains in place, and to this day only those with an urban residence permit have the right to permanently live in cities. This residence permit is more than just a license to live in a particular location; it also provides one with access to public services. Naughton (2007) also notes additional benefits of urban residence: (i) job security; (ii) guaranteed access to low-price food grains; (iii) health care; (iv) pension and other retirement benefits; (v) primary and middle school education for children; and (vi) low-cost housing, supplied by the work unit. In addition to lacking access to public services and these additional benefits, migrants also face a great deal of discrimination in employment. While recent reforms have not made it any easier to obtain an urban residence permit, reforms have made it somewhat easier for migrants to live and work in the cities. China's rapid economic growth, particularly in manufacturing, has led to increased demand for cheap unskilled labor, leading the government to relax some of their restrictions on labor mobility. In 2005, legislation was passed suggesting that migrants have a right to live and work in the city, and that they ought to have access to the social services available to them there.

Structural transformation is a widely-observed phenomenon in economic development, and a key component of this process is the migration of redundant rural labor to urban centers. Such urbanization, however, has been constrained in China primarily due to these strict limitations on labor mobility that has made it very difficult for rural laborers to move in search of employment. Not only does this reallocation of labor lead to increased economic efficiency, it is also a means by which households can diversify their income sources (Rosenzweig, 1988; Paulson, 2000; Jalan and Ravallion, 2001). Remittances from urban workers back to the countryside can constitute an important part of a household's total income (e.g., Du et al., 2005; Zhu and Luo, 2010), one that has a low correlation with agricultural incomes further serving to lower income variability. Yet not all risks should be assumed to have the same effect on migration. Using data from Guangdong province in China, Jalan and Ravallion (2001) find that income risk serves as a significant impediment to migration, while medical risk has a small positive effect on migration.[2]

[2] Jalan and Ravallion (2001) define income variance as the variance of estimated innovations from a serially-correlated, household-specific error component in the household's income equation. In other words, if household log-income is specified as $\ln Y_{it} = x_{it}'\beta + \eta_i + \nu_{it}$, and the serially-correlated idiosyncratic error component follows an AR(1) process such that $\nu_{it} = \rho\nu_{it} + \omega_{it}$, then the household-specific measure of income risk is the variance of the

3 Theoretical Model

Conceptually, we proceed along the lines of Yao (2000) and Feng and Heerink (2008). Consider a risk-averse peasant household with utility function $U(c, \ell; Z_h)$ such that the household derives utility from a composite consumption good (c) and leisure (ℓ) with household-specific preference-shifters Z_h. In general, these preference-shifters could be thought of as household demographic features. For the purposes of this simple theoretical framework, we assume that Z_h incorporates any household-specific factor that affects household preferences. We assume that $U_y > 0$, $U_\ell > 0$, $U_{yy} < 0$, $U_{\ell\ell} < 0$, and that the utility function is strictly concave in both arguments. Households have a total endowment of time ($\overline{L}$) which can be used to earn income locally from one of two sources: agricultural production or wage labor.

Agricultural production uses inputs of land (A) and farm labor (L_f) in a concave production function ($f(\cdot)$) to produce agricultural output. We assume that technology is homogeneous across households, but that household characteristics act as production-shifters (Q_h) conditioning final output. While it is very likely that many of the household-specific production-shifters also serve as preference-shifters in the household's utility function, the vectors could be completely independent. The production shifters could include such factors as ownership of various forms of agricultural capital, soil quality, etc. We assume that agricultural technology is defined such that land and agricultural labor are complementary, with $f_{L_f A} > 0$ and $f_{AL_f} > 0$. Agricultural production is stochastic, subject to exogenous shocks such as weather variability, pests and disease, etc. To control for the stochastic nature of farm output, we allow for an independent and identically distributed random shock term, $\varepsilon_f \sim IID(0, \sigma_f^2)$ to condition agricultural production. While we assume the distribution of this random variable is known in advance, the actual realization is not known until

ω_{ij}, estimated as $\hat{\sigma}_{i,y} = \sum_{t=1}^{T} (\omega_{it} - \overline{\omega})^2 / T$. If measurement error in reported income is non-systematic, but instead is independent and identically distributed, then the income risk term is computed as $\hat{\sigma}_{i,y} = \sum_{t=1}^{T} (\omega_{it} - \overline{\omega})^2 / T + \sigma_\mu^2$, where σ_μ^2 is the variance of the measurement error. Medical risk is calculated as the variance of the residuals from a regression of household expenditures on medicine, medical articles, and medical treatment on the same factors that explain income. In other words, if M_{it} captures household expenditures on these medical items, then medical risk can be computed as $\hat{\sigma}_{i,m} = \sum_{t=1}^{T} (\upsilon_{it} - \overline{\upsilon})^2 / T$, where $M_{it} = x_{it}'\beta + \eta_i + \upsilon_{it}$.

after all resource allocation decisions have been made.

The amount of land used in production (A) is a function of the household's endowment of land ($\overline{A}$) plus any land rented in (A_I) less any land rented out (A_O). Unlike Carter and Yao (1999, 2002), we assume that the effective land rental price (r) is the same regardless of whether the household is renting in land or renting out land. Their theoretical model allows for a wedge to be driven between the supply price and the demand price, where the wedge is a function of institutional restrictions on land rentals. In this case, households that wish to rent in land must pay more than the simple rental rate, while households that rent out land receive net rental payments less than the pure rental rate. Carter and Yao (1999) suggest that, for households that rent land out, the differential can be viewed as political redistribution costs, while the excess cost for households that rent land in can be interpreted as search costs. While we assume that the effective rental rate is the same regardless of whether households rent in or rent out land, we do allow for institutional rigidities to limit a household's participation in the land rental market. This is captured by local restrictions on the volume of the various land rental transactions ($\overline{A_I}(Z)$ and $\overline{A_O}(Z)$), which act as upper bounds on households' rental market activity.

Local off-farm labor (L_o) is employed in wage-paying collectives or enterprises at an exogenously determined rate w. In addition to allocating labor locally, households can choose to send household members to the city to remit a portion of earnings back to the countryside, where remittances are a function of the household's migrant labor, $h(L_m)$. We assume that remittances are increasing in migrant labor ($h'(L_m) > 0$), but make no assumptions about higher-order curvature. As with the land rental market, we assume that local institutional rigidities limit a household's ability to engage in off-farm labor and migration. These are captured by $\overline{L_o}(Z)$ and $\overline{L_m}(Z)$, which again restrict the volume of off-farm labor and migration in which households engage.

Feng and Heerink (2008) suggests that community-level characteristics (Z) condition participation in land and labor markets. These could include such institutional factors as tenure security, transfer rights, and social networks that affect rental market participation as well as off-farm and migrant labor market participation. We also suggest that, since the structural transformations that have precipitated active land rental markets have not been uniformly distributed over time and space, these heterogeneities can be captured through these institutional characteristics. Because of the stochastic nature of farm incomes, households must maximize utility subject to a stochastic budget constraint. With these definitions in place, we can summarize the household's static utility maximization problem as:

$$\max_{\{L_f, L_m, L_o, l, A_I, A_O\}} \quad U(c, \ell; Z_h) \tag{1}$$

such that:

$$c = E\left[f(L_f, A; Z_h, \varepsilon_f)\right] + wL_o + h(L_m) - (A_I - A_O)r \tag{2a}$$

$$\overline{L} = L_f + L_o + L_m + \ell \tag{2b}$$

$$A = \overline{A} + A_I - A_O \tag{2c}$$

$$L_o \leq \overline{L_o}(Z) \tag{2d}$$

$$L_m \leq \overline{L_m}(Z) \tag{2e}$$

$$A_I \leq \overline{A_I}(Z) \tag{2f}$$

$$A_O \leq \overline{A_O}(Z) \tag{2g}$$

$$c, A_I, A_O, L_f, L_m, L_o \geq 0. \tag{2h}$$

We assume that the non-negativity constraints given in equation (2h) are slack. If we substitute equation (2a) into the utility function (1), the Lagrangian can be written as:

$$\begin{aligned} \mathscr{L} &= U\left\{E\left[f(L_f, A; Z_h, \varepsilon_f)\right] + wL_o + g(L_s) + h(L_m) - (A_I - A_O)r, \ell; Z_h\right\} - \\ &\lambda_1\left(L_o - \overline{L_o}(Z)\right) - \lambda_2\left(L_m - \overline{L_m}(Z)\right) - \lambda_3\left(A_I - \overline{A_I}(Z)\right) - \lambda_4\left(A_O \leq \overline{A_O}(Z)\right) \end{aligned} \tag{3}$$

The solution to this problem can be characterized by the following four first-order necessary conditions:

$$\mathscr{L}_{L_o} : U_c \{-E[f_L(\varepsilon_f)] + w\} - \lambda_1 \leq 0 \tag{4a}$$

$$\mathscr{L}_{L_m} : U_c \left\{-E[f_L(\varepsilon_f)] + h'(L_m)\right\} - \lambda_2 \leq 0 \tag{4b}$$

$$\mathscr{L}_{A_I} : U_c \{E[f_A(\varepsilon_f)] - r\} - \lambda_3 \leq 0 \tag{4c}$$

$$\mathscr{L}_{A_O} : U_c \{-E[f_A(\varepsilon_f)] + r\} - \lambda_4 \leq 0 \tag{4d}$$

Assuming an interior solution, equation (4a) can be written:

$$E[f_L(\varepsilon_f)] = w - \frac{\lambda_1}{U_c} \tag{5}$$

This suggests that, if the constraint on off-farm labor is binding ($\lambda_1 > 0$), then the expected marginal value product of labor on the farm (i.e., the shadow wage of farm labor) is less than the off-farm wage. The imperfection of labor markets thus implies an excess supply of labor on the farm.

Since we do not allow households to simultaneously rent in and rent out land, there can not arise a situation in which both $A_I > 0$ and $A_O > 0$, and so we cannot assume an interior solution for both (4c) and (4d). If we assume that the household participates in the land rental market, then either:

$$U_c \{E[f_A(\varepsilon_f)] - r\} = \lambda_3 \tag{6a}$$

or

$$U_c \{-E[f_A(\varepsilon_f)] + r\} = \lambda_4 \tag{6b}$$

If the constraints on land rentals are binding, then $\lambda_3 > 0$ for a household renting in land and $\lambda_4 > 0$ for a household renting out land. In either case, the quantity of land that is transacted is less than the household would choose under free market conditions. If the household is renting in land, then equation (6a) can be written as $E[f_A(\varepsilon_f)] = r + \lambda_3/U_c$, suggesting that the expected marginal value product of land is greater than the market rental rate. In this case, the household would optimally desire to rent in additional land until the expected marginal value product of land is equated to the rental rate on land. The restrictions on land rental transactions prohibits this optimal behavior. Similarly, if the household is renting out land, then equation (6b) can be written as $E\left[f_A(\varepsilon_f)\right] = r - \lambda_4/U_c$, and the expected marginal value product of land is less than the land rental rate. The household would optimally desire to rent out land, driving up the marginal value product of land until it was equated with the rental rate; again, the restrictions on these transactions precludes this possibility.

Finally, we move to equation (4b). If we assume an interior solution, this condition can be written as $h'(L_m) = \lambda_2/U_c + E\left[f_L(\varepsilon_f)\right]$. This suggests that the change in overall remittances that results from an incremental unit of migrant labor exceeds the expected marginal value product of farm labor, even when migration is constrained. In fact, the theoretical model suggests that, at the very least, the change in remittances associated with an incremental migrant worker are equal to the expected marginal value product of farm labor. However, this limiting example only holds when the constraints on additional migration are non-binding, which is not likely to hold in practice. This result has at least one important implications. The fact that the incremental change in remittances is at least as great as the expected marginal value product of farm labor implies that the contribution to household income is at least as large for individuals that migrate as it is for individuals who remain on the farm. This is consistent with literature suggesting that pull forces dominate migration decisions in China, rather than push forces (such as landlessness, which has been thought to dominate migration decisions in other contexts.) Additionally, we can write the remittance function as:

$$h(L_m) = \int \frac{\lambda_2}{U_c} + E\left[f_L(\varepsilon_f)\right] dL_m \tag{7}$$

Remittances are therefore a function of the expected proportional increase in utility arising from an additional unit of migrant labor (λ_2/U_c) above and beyond the expected marginal value product of farm labor. While we are primarily interested in migration decisions, rather than remittances, these first-order conditions allow us to write a migration rule as a function of these right-hand side terms. Specifically, we can write:

$$L_m = h^{-1}\left\{\int \frac{\lambda_2}{U_c} + E\left[f_L(\varepsilon_f)\right] dL_m\right\} \tag{8}$$

The optimal migration decision would maximize the right-hand side of this expression. Operationally, estimation of (8) would require specification of the functional form of $h(\cdot)$. Since we do not specify this functional form, and for computational ease, we proceed with specifying a reduced form linear model that allows us to estimate the determinants of household migration decisions.

4 Data

The data used in this paper come from the China Health and Nutrition Survey (CHNS), a longitudinal household survey conducted by the Carolina Population Center at the University of North Carolina, Chapel Hill and the National Institute of Food Safety at the Chinese Center for Disease Control and Prevention. The survey was designed to examine the effects of health, nutrition, and family planning policies implemented by various local and national governmental organizations, as well as to examine the economic and social transformations of Chinese society and how these transformations are manifesting themselves in the health and nutritional status of the population. The survey covers roughly 4,400 households overall, with some 19,000 individuals included in these households. The first round of the survey was collected in 1989, with additional waves completed in 1991, 1993, 1997, 2000, 2004, and 2006. The CHNS data cover nine provinces in China, mostly in Eastern or East-Central China. The provinces included in the survey are Heilongjiang, Liaoning, Shandong, Henan, Jiangsu, Hubei, Hunan, Guizhou, and Guangxi.[3] These provinces are shaded in Figure 1. A multistage, random cluster process was used to draw the samples in each province. Within each province, counties were stratified by income (low, medium, and high) and a weighted sampling scheme was used to select four counties in each province. While the survey is not nationally-representative, the selected communities and survey participants demonstrate a

[3]The survey initially covered only eight provinces. In 1997, Heilongjiang was included in the survey when, for unspecified reasons, communities in Liaoning were unable to participate in the survey. Communities in Liaoning were included in subsequent waves, as were the communities in Heilongjiang that were surveyed in 1997. Because we do not have complete coverage for Heilongjiang or Liaoning, we omit observations from these provinces.

great deal of variation on many important socioeconomic characteristics.

The survey collects information at three distinct levels. First, information is collected at the household level. At this level, information such as household income, asset holdings, subsidies received, as well as information on household utilization of health and medical services is compiled. Within households, the survey collects information on individual time and labor allocations, as well as information on food consumption, nutritional intake, and daily activity levels. For individual children within the household, an additional physical examination is given to measure factors associated with childhood health and nutrition. Finally, data are collected at the community level. At the community level, survey enumerators collect information from knowledgeable respondents on such issues as community infrastructure, services, population, prevailing wages, and other related variables. One of the most comprehensive aspects of the community data is the vast collection of food price data. In the early years of the survey, data were collected on state and free market prices for a representative basket of commodities, including such staples as rice, various types of fruits and vegetables, and various meats. By 1997, however, there were no longer separate state prices, so from that year on, the community surveys collected information on prices from free market stores and large stores.

While the initial purpose of the survey was primarily to help researchers understand nutritional transformations that have occurred in China, the socioeconomic factors that have been included in the survey design allow for a wider set of investigations. Of particular interest to economists is the wide variety of information collected on both individual- and household-level sources of income, time allocations and asset holdings, and the wide variety of commodity price information collected at the community level. For analysis of migration and land rental market participation at the household level, we use an unbalanced panel of 5,353 observations on 1,589 households between 1991 and 2006.[4] While roughly 4,400 households participated in the survey at one point or another, only about 30% of the total households appear in each panel. Summary statistics for the data used in this analysis are reported in Table 1.

[4]The sample is restricted to the 1991, 1993, 1997, 2000, 2004, and 2006 waves because (a) there is no available information by which we can identify migrants in 1989 and (b) there are no land rentals in 1989 because, for many observations, area under cultivation in 1989 was characterized as the household's land endowment.

There are no specific questions in the CHNS that directly address rural-urban migration. To determine whether an individual was a migrant during a particular survey year, we use responses to three questions asked of the household head regarding the various members of the household. First, household heads were asked where individual household members lived if they were not currently living in the household. If responses to this question indicated that the household members were living in the same county (but a different city, village, or neighborhood), in the same province (but in a different county), in another province, or in another country, we classified members as migrants. Second, starting in 1997 respondents were asked whether family members were still in the house, and provided with a series of options for respondents classifying the members' status. A follow-up question asked how long such individuals had lived outside the household. Third, a follow-up question asked how long these absentee members had been away from the household. If household members were reported absent because they were seeking employment elsewhere or had gone abroad, these individuals are identified migrants if they had been gone for any period of time. If, on the other hand, household members were absent because they were in school or were serving in the military, these members were not considered migrants. It is somewhat difficult to disentangle off-farm wage labor from migrant labor, since migration can take the form of simply moving to another village or city within the same county, which respondents might simply consider a variety of non-farm labor. For this reason, our empirical analysis is forced to ignore equation (9a) and instead focus on migration and land rental market participation. Our definition of "migrant" is perhaps a little loose in this regard. Whereas the term "migrant" usually refers only to those who leave their homes on a permanent basis, the operational definition of "migrant" used in this analysis encapsulates both temporary and permanent workers living outside one's official hometown or village. These workers might fall more appropriately under the Chinese heading *liudong renkou* ("floating population"), the term given to people living and working away from their place of residence registration for six months or more.[5]

Traditional migration theory (e.g., Todaro, 1969; Harris and Todaro, 1970) suggests that indi-

[5] While the "official" definition only counts those that have been away from their place of registration for six months or more, we consider anyone who has been absent for any amount of time. Our justification for doing so is that the surveys were conducted on a rolling schedule, and migration decisions may have been made within the relatively recent history prior to the survey.

viduals, viewed as rational, expected utility maximizers, base migration decisions on the expected urban-rural real wage differential. This expected differential is a function of both the actual urban-rural wage differential and the probability of securing employment in the urban formal sector. Converting urban and rural wages from nominal to real controls for the opportunity costs associated with migration, such that lower costs of migration are associated with higher real urban wages. Among individual decision-makers, migration has become an increasingly common phenomenon as both the constraints on mobility become less rigid and, as a result, network effects in the receiving communities lower the costs associated with migration. Figure 2 shows the increase in migration from rural segments of the CHNS survey regions as reported across the latter six waves of CHNS data. The figures for the year 2000 are roughly consistent with official figures for that year. Applying our definition of migrants to the CHNS data, we classify 13.4% of individuals as migrants during 2000.[6] Statistics from the 2000 Chinese census report over 144 million individuals (roughly 12% of the population) living for at least 6 months in a place other than where their household is officially registered (Liang and Ma, 2004). Of these 144 million, roughly 65 million (about 45%) were intracounty migrants; while they lived away from their place of registration, they remained in the same county. The remaining workers (nearly 79 million, or roughly 55%) were intercounty migrants, those moving generally either to other counties within the same province (intraprovincial migrants) or to other provinces (interprovincial migrants). The intracounty migrants are slightly over-represented in the CHNS data, as we estimate roughly 58% of individuals fall into this category. The proportion of households that participate in migration (i.e., the proportion of households that have at least one member that migrates) is significantly greater than the proportion of the population that migrates. This suggests that migration is a fairly well-dispersed phenomenon, not merely isolated to a relatively small number of households or clustered within a few particular provinces. In Table 2, we compare the characteristics of households that participate in migration with those households that do not participate. These simple summary statistics suggest that the characteristics of households that participate in migration are significantly different from those that

[6] This figure uses data from all nine CHNS provinces. The summary stastics reported in Table 1 omit observations from Liaoning and Heilongjiang, since there is incomplete coverage of these provinces across survey waves. We use this restricted sample in the stasticial analysis that follows

do not. Households with migrants typically have more working-age household members, a generally older household structure, fewer dependents, more education, and more farm capital. They also tend to live in communities with higher wages (for both males and females) and a higher proportion of inhabitants that have worked outside the community for an extended period of time.

In addition, the CHNS data do not explicitly provide information on households' rental activities. Because there is no private ownership of land, land rentals represent temporary deviations of cultivated land from a household's land endowment. While there is no explicit coverage of land endowments, the data do provide information on the land area cultivated in a given year. We are able to use this information to construct a land endowment variable, from which we can determine both participation in land markets as well as the overall size of land rental transactions. To assign the household's land endowment, we use the earliest observation on cultivated land.[7] With this definition of land endowment, we measure land rental transactions as any deviation from this initial measurement. Land rentals have been and remain a relatively small portion of total cultivated area. Based on our definition of land endowments, we estimate that, on average, about 18% of land changed hands in rental markets in 1991. This is a higher estimate than appeared in Benjamin and Brandt (2002). We note a couple of potential reasons for the discrepancy. First, the geographic coverage is quite different. While Benjamin and Brandt (2002) only analyze data from Hebei and Liaoning, two provinces in Northeast China, the CHNS data cover a much larger and much more heterogeneous geographic area. Second, we note that the size of land transactions are of a similar magnitude to those reported in Benjamin and Brandt (2002), but the differences in the proportions of land represented by these land transactions can be attributed to the fact that the average size of farms in the CHNS data is significantly lower than the size of farms in their sample. In Table 3, we compare the characteristics of households that participate in land rental markets with those that do not. Households that participate in land rental markets typically have larger land endowments, more working-age household members, fewer dependents, and more farm capital. As the legal framework reinforcing property rights has evolved, land rental activity has

[7]While this measure of the household's land endowment is almost surely measured with error, this measurement error is likely to be time invariant, and will likely be subsumed in the time-invariant error component in any panel regressions. Assuming that this time-invariant error component is distributed independently of any explanatory variables we may consider, then this measurement error should not introduce any significant complications.

increased. In 2006, we estimate that roughly 26% of land exchanged hands. Figure 3 traces out the evolution of land rentals over the last six waves of the CHNS data.

5 Empirical Model and Methodology

The first-order conditions given by equations (4a)-(4d) provide a series of reduced-form equations that serve as the basis for the empirical analysis. If we ignore stochastic shocks for the moment, then we can re-write the first-order conditions in a deterministic framework. Specifically, we can write household off-farm labor supply, migrant labor supply, and land rental functions as:

$$L_o = L_o\left(Z_h, Q_h, \overline{L}, \overline{A}, w, r, Z, \varepsilon_f\right) \tag{9a}$$

$$L_m = L_m\left(Z_h, Q_h, \overline{L}, \overline{A}, w, r, Z, \varepsilon_f\right) \tag{9b}$$

$$A_I = A_I\left(Z_h, Q_h, \overline{L}, \overline{A}, w, r, Z, \varepsilon_f\right) \tag{9c}$$

$$A_O = A_O\left(Z_h, Q_h, \overline{L}, \overline{A}, w, r, Z, \varepsilon_f\right) \tag{9d}$$

Given that our theoretical model is static, we assume that households make land rental decisions and labor allocation decisions so as to maximize a single period utility function. This implies no evolution in the household's land endowment or labor endowment over time. Since land is not directly owned by the households in China, but is rather owned by the local agricultural collective, the assumption of a fixed household land endowment is realistic. The assumption of a fixed household labor endowment is more restrictive, since migration decisions can have lasting impacts on the household's available supply of labor with which to allocate to farm and off-farm activities. In addition, household compositions evolve; children grow-up to become adults, adults enter retirement, and people inevitably pass away. While we can control for this latter aspect using the number of working-age household members as a proxy for the household's labor endowment, we cannot control for the dynamic effects of migration decisions on the household's labor endowment in such a static model. The model can be interpreted as assuming that migration decisions are made on a periodic basis. At the beginning of the period, household's make their land rental participation and labor allocation decisions to maximize single period utility. Migrants leave the countryside and send remittances back to the household throughout the course of the period. At the end of the period, migrants return to the countryside and the process begins anew. While this assumption is made to simplify the model, we stress that the maintained relationships and interconnections between the migrant and the rural household, as well as the frequency with which migrants return to their places of origin, make this assumption plausible.

Beginning from the theoretical predictions implied by traditional migration theory, we can write an individual's migration decision as:

$$M_{it}^{*} = f\left(E(w_t^u), \tilde{w}_t^f; x_{it}, z_t^h, z_t^c\right) \tag{10}$$

where $E(w_t^u)$ is the individual's expected urban wage, which takes into consideration the probability of securing formal sector employment, $\tilde{w}_t^f$ is the individual's shadow wage representing the opportunity cost of time, and x_{it} is a vector of individual characteristics, z_t^h is a vector of household characteristics, and z_t^c is a vector of community characteristics. We can treat individual migration, M_{it}^{*}, as an unobserved latent variable and choose to focus on an observed binary outcome M_{it}, such that:

$$\begin{aligned} M_{it} &= 1 \quad \text{if } M_{it}^{*} > 0 \\ M_{it} &= 0 \quad \text{if } M_{it}^{*} \leq 0 \end{aligned} \tag{11}$$

Empirically, this model can be specified as:

$$\Pr\left(M_{it} = 1\right) = \Phi\left(E(w_t^u), \tilde{w}_t^f; x_{it}', z_t^h, z_t^c\right) \tag{12}$$

where $\Pr\left(M_{it} = 1\right)$ is the probability that individual i migrates during period t, $w_t^u, \tilde{w}_t^f, x_{it}, z_t^h$, and z_t^c are as defined before, and the link function $\Phi\left(\cdot\right)$ is the normal cumulative distribution function. Data limitations render estimating this empirical relationship challenging. Essentially, once individuals migrate, they are only tracked in the CHNS data inasmuch as they are still counted as members of the households being surveyed. However, no information exists on other relevant factors that may have conditioned their migration decision or that condition their decision not to return to the countryside. In addition, there are reasons to suspect that migration decisions should more appropriately be viewed as a household decision, rather than an individual decision.

Recent contributions in the theoretical and empirical literature studying migration in developing countries have suggested that migration decisions are not made in isolation, and that the connections with the migrant's location or household of origin are not severed once the migrant has moved to the city (Bardhan and Udry, 1999). Stark (1991) in particular emphasized the role of the household as the decision-making unit for rural-urban migration decisions. Studies in this new economics of labor migration (NELM) literature have highlighted the importance of the maintained relationship migrants and the communities from which they emigrate (e.g., Stark, 1991; Taylor and Martin, 2001). Indeed, several studies have found that a large number of migrants often return to their place of origin, perhaps to satisfy other lifetime ambitions such as marriage and rearing children. Migrants often provide a valuable service to their rural counterparts who operate under imperfect capital markets or who are otherwise constrained by inadequate liquidity, insurance, or credit. In another study, Rozelle et al. (1999) found that, while the number of migrants in a household significantly lowers yields (suggesting that farm households can't simply replace migrants with hired workers), remittances from migrants increase household's access to farm capital, which helps to offset the yield declines of lost labor. In this case, again, the migrants play the role of intermediary, providing to rural households what they could not obtain on their own. The increased access to capital suggests that, when the migration decision is made at the level of the household, it may be viewed as both a household income diversification strategy and perhaps a growth strategy, since the increased access to capital may permanently alter the household's growth path. We therefore proceed to model migration decisions as household decisions, rather than individual decisions. If we view migration as a household decision, then equation (9b) provides an empirical framework to test for factors that condition the household migration decision. We can write an empirical model demonstrating the migration decision as a household decision as:

$$\Pr(M_{hjt} = 1) = \Phi\left(x_{hjt}, \overline{A}_h, \overline{L}_h, z_{jt}, t\right) \tag{13}$$

where $\Pr(M_{hjt} = 1)$ is the probability that household h residing in community j sends migrants in period t, x_{hjt} is a vector of household characteristics unique to household h residing in community j in period t, $\overline{A}_h$ is the land endowment of household h (presumed fixed), $\overline{L}_h$ is the labor endowment of household h (presumed fixed), z_{jt} is a vector of characteristics unique to community j in period t, and t is a time trend. The link function $\Phi(\cdot)$ is the normal cumulative distribution function. As was the case when we considered individual decision-making, we can control for unobserved heterogeneity in our unbalanced panel through the use of household-specific random effects. The results from estimating equation (13) are reported in Table 4. Household per capita gross income and an individual's migration decision might be jointly determined, and therefore household per capita gross income might be an endogenous regressor in equation (13). The intuition behind this is straightforward: per capita household income could influence the household decision to participate in labor migration, but assuming some remittances are transferred from the migrant back to the countryside, the migration decision could affect contemporaneous household income, since remittances are one of the income sources used to construct the household income data. This would bias estimates upward. While we are unaware of any straightforward method for incorporating a continuous endogenous regressor in this nonlinear panel data model, we can use standard instrumental variables techniques in both a panel linear probability model (LPM) and standard probit estimated over pooled cross-sections. For this latter regression, we control for clustering of standard errors within household observations over survey waves. We use lagged gross household income per capita (i.e., gross household per capita income in the previous survey wave) as an instrument in these regressions. Assuming some form of autoregressive income process, these lagged per capita incomes should be correlated with the endogenous, contemporaneous per capita income terms. Because of the lagged nature of these instruments, however, these terms should not be correlated with the contemporaneous innovations implied by equation (13). Estimates from the instrumental variable LPM are reported in column (5) of Table 4. Estimates of the instrumental variable pooled cross-sectional probit are reported in column (6).

Most studies examining migration in China have focused on the individual determinants of migration, and have generally found that migrants are more likely to be male, un-married, well educated, coming from male-headed families with more working-age members, less land, and fewer dependents (Zhao, 2003). Our results generally support these findings, even when we consider the migration participation decision at the household level rather than at the individual level. The size of the household labor force has a significant impact on whether households participate in migration. Households that have more working-age individuals are more likely to participate in migration. For these households, migration is seen as a way of freeing up redundant labor. Also consistent with previous studies, we generally find that households with larger land area in cultivation are less likely to participate in migration. Individuals from households with more area under cultivation are more likely to have higher marginal value products of farm labor (assuming the area under cultivation is not *too* large), which shrinks the differential between the expected urban wage and the opportunity cost of farm labor. Additionally, we find that households with a larger number of dependents relative to working-age individuals are less likely to participate in migration. Somewhat surprising, we find that households with a higher average level of education are less likely to participate in migration. From Table 2, we see that households that have migrants generally have higher average levels of education than households that do not have migrants (5.67 years compared to 5.35 years).[8] This negative regression coefficient could partly be explained in that households with higher average levels of education generally have higher marginal productivities, which translates into higher wages or shadow wages.

In columns (1) through (4), gross household income is included in the models, despite concerns about potential endogeneity. These results suggest that per capita income has no significant effect on the household's decision to participate in migration. When we control for endogeneity bias, however, we find that gross household income per capita does have a significant effect. Households with lower per capita incomes are more likely to participate in migration, suggesting that households might view migration as a path out of poverty. Taken in conjunction with previous findings, we find support for both "push" and "pull" forces in household migration participation decisions. Redundant labor and land constraints apparently push migrants, while the prospects for higher urban wages and escape from poverty pull migrants to the cities.

Additionally, several studies have pointed to "network effects" that act as pull forces in migration

[8] This difference is statistically different from zero at greater than the 0.001 level.

decisions. Feng and Heerink (2008) and Zhao (2003), for example, both found a positive relationship between a social network and the probability that an individual migrates. Having an existing social network would be expected to lower a migrant's employment search costs and improve a migrant's probability of securing urban employment. The results in Zhang and Li (2003) seem to confirm this hypothesis, finding that social networks, or *guanxi* , improved individuals' probability of securing nonfarm employment.[9] The lower search costs and the increased probability of securing urban employment lower the costs of migration, which increases the expected differential between urban and rural employment. While the summary statistics in Table 2 suggest that migrant households typically reside in communities with stronger migrant networks, we find no statistical support that these network effects have any impact on a household's likelihood of migrating.

Equations (9c) and (9d) suggest that participation in land rental markets can be written as a function of household characteristics, total land and labor endowments, the off-farm wage rate, land rental rates, and community characteristics.[10] Since the CHNS data do not explicitly address land rental markets, we do not have information on land rental rates. Since there is likely a great deal of spatial correlation in rental rates, much of the variation in household land rental decisions that would otherwise be attributable to rental rates will likely be absorbed into community binary variables. While the magnitude of land rental transactions is roughly continuous, we can model household land rental market participation as a dichotomous decision. Households are deemed to have participated in the land rental market if $A \neq \overline{A}$; their land currently under cultivation is not equal to their endowment of land. We can estimate land rental market participation through a binary choice model, whcih is well-suited for empirically estimating reduced-form equations this sort. Taking the reduced-form equations (9c) and (9d), we can write an estimable empirical model as:

$$\Pr(R_{hjt} = 1) = \Phi\left(x_{hjt}, \overline{A}_h, \overline{L}_h, z_{jt}, t\right) \tag{14}$$

[9]This hypothesis is universally accepted. Kung and Lee (2001), for example, found that utilizing social connections did not significantly increase the probability of securing nonfarm employment.

[10]The land rental market participation decision can also be framed within a latent variable context. Assume, for the moment, that land rentals R^*_{hjt} are unobserved, but what is observed is a binary variable, R_{hjt}, indicating that a household participated in land rental markets. This binary variable serves as the basis for the empirical analysis that follows.

where $\Pr(R_{hjt} = 1)$ is the probability that household h residing in community j participates in the land rental market in period t, and as before, x_{hjt} is a vector of household characteristics unique to household h residing in community j in period t, $\overline{A}_h$ is the land endowment of household h (presumed fixed), $\overline{L}_h$ is the labor endowment of household h (presumed fixed), z_{jt} is a vector of characteristics unique to community j in period t, and t is a time trend. The link function $\Phi(\cdot)$ is the normal cumulative distribution function. The results of estimating equation (14) are reported in Table 5. We present instrumental variable regressions in columns (4) and (5) in Table 5 to control for the endogeneity of per capita household income.[11] It is plausible that household income may be jointly determined with participation in land rental markets, since those that participate in land rental markets may have higher incomes than those that do not participate.[12] Indeed, we see from Table 3 that households participating in land rental markets typically have higher incomes than those that do not (2,945 RMB compared to 2,267 RMB per person).

The results reported in Table 5 suggest that households with larger land endowments are more likely to participate in land rental markets, though simple participation does not inform whether these individuals are renting in or renting out land. Because the land allocations are typically based upon the number of farm laborers or the household size, it is possible that households with larger land endowments may also be running up against land constraints for their laborers. If this is the case, then larger land endowments and larger farm labor supplies could be correlated with renting in additional land. We find some support for this hypothesis, as the number of working-age household members is positively correlated with land rental market participation. One could also surmise that households with excess land endowments (i.e., more than their farm labor supply can manage) would want to rent out land. This also would contribute to the positive coefficient on the household's land endowment. The household demographic structure suggests that households may rent in land as a means of allowing dependents to contribute to household income. These

[11] We fail to reject the exogeneity of per capita household income in equation (14), based on simple Wald tests. Nevertheless, we present the instrumental variables regressions to demonstrate the consistency of results across model specifications.

[12] Those that rent in land may have higher farm incomes than those that do not, and those that rent out land may have higher off-farm incomes than those that do not. In either case, participation in land rental markets could result in higher incomes. By the same token, households with higher incomes are less credit constrained, and may be more likely to rent in land.

dependents may not be able to secure wage income elsewhere because they are in school during the day or may be retired, but can still contribute to farm production.

Contrary to expectations, we find little support for the hypothesis that ownership of farm capital significantly affects a household's land rental decisions. Only ownership of garden tractors and irrigation equipment seem to increase the probability that a household participates in land rental markets, and the statistical support for these findings is somewhat inconsistent across model specifications. Part of this result could reflect that we examine the participation decision only, rather than the nature of rental transactions. Owning farm capital may increase the area of land rented in, but the lack of capital may increase the area of land rented out. In either case, households would be participating in the land rental markets. Countervailing forces of farm asset ownership may be confounding these coefficient estimates.

Feng and Heerink (2008) found evidence that participation in land rental markets and migration are inter-related. To reach this conclusion, the authors specified and estimated a seemingly unrelated bivariate probit model. Since they suggest that land rental decisions are made specifically by the household head, while migration decisions are made by the household as a whole, they use the age and education of the household head to identify the land rental decision, while the average adult age and average adult education are used to identify the migration equation. Specifically, since they find a negative correlation coefficient between the errors in the land rental and migration equations, they determine that participation in land rental markets and participation in migration are negatively correlated: households that are more likely to send migrants are less likely to participate in land rentals, and vice versa. This suggests a substitutability between these two behaviors. If we consider these behaviors as responses to risk, we can take this result as implying that households choose to either smooth household income through migration or smooth household consumption through participation in land rental markets. Using a similar specification, we also estimate a seemingly unrelated bivariate probit model to examine whether land rental market participation and migration are inter-related in the CHNS data. We find a positive correlation coefficient among the error terms in these two equations, suggesting that, contrary to the findings from their cross-sectional study, households that participate in migration are more likely to also participate in land rental markets. This estimated correlation coefficient is not statistically different from zero at standard significance levels, but the tetrachoric correlation coefficient between these two binary variables is both positive and statistically significant. This suggests that, at least among the provinces represented in the CHNS data, households participating in land rental markets are also more likely to be sending labor off farm. From the perspective of anticipating risk, this implies that perhaps migration and rental market participation are complementary behaviors, and may contribute to an overall risk management portfolio.

The empirical analysis conducted up to now has generally considered only deterministic determinants of households' land rental market and migration participation decisions. If households are sending migrants to earn income in urban formal sector employment, then such action could be viewed as an ex ante income smoothing mechanism, made in anticipation of income variability arising from various forms of idiosyncratic and covariate shocks. Similarly, if households are participating in land rental markets, these transactions involving productive assets may be a form of ex post consumption smoothing. There are many forms of shocks that rural households encounter. In this analysis, we focus on a select few, but acknowledge others may exist. While there are no direct measures of the occurrence or severity of covariate shocks in the CHNS data, we follow an approach similar to Carter et al. (2007) and identify covariate shocks based on the proportion of surveyed households in a community whose incomes are subject to a shortfall in a particular year. To create poverty lines, we use the official National poverty lines for China and inflate these using community-specific price indices provided in the CHNS data. We then compare real household per capita income (in 2006 RMB) to these poverty lines. Assuming that households are randomly drawn from their communities, the proportion of households in a community experiencing real income poverty in a particular year should be a good proxy for community-wide income shocks. The idiosyncratic income shocks we consider include the illness of a working-age household member, the death of a household member, and whether a household member had to pay for a wedding, dowry, or funeral. The frequency of these shocks are reported in Table 6. We can include each of these shocks into the migration and land rental regressions in a piecewise fashion to see how these shocks affect the probability that a household participates in these various activities. We estimate these regressions using instrumental variable probit models using pooled cross-sections, clustering the standard errors by households over the various waves. These results are reported in Tables 7 and 8.

From Table 7 we see that both covariate and idiosyncratic shocks influence household migration decisions. Households residing in communities that experienced covariate income shocks in a particular year are significantly less likely to participate in migration. This is somewhat surprising, as it suggests that households do not attempt to smooth income through migration when confronted with covariate risks. Households are more likely to participate in migration if they face a large, unanticipated expense (e.g., paying for a wedding, a dowry, or a funeral) or if a working-age household member experienced an illness, but less likely to participate in migration if a household member dies. These results may suggest that, as well as being an ex ante income diversification strategy, migration might also be viewed by households as an ex post strategy for earning higher incomes. This may especially be true in light of the positive and significant coefficient associated with paying for a large unanticipated expense. Because these expenses are unanticipated, it is not likely that the significant result is due to ex ante motives. Rather, it is perhaps more likely that migration is in response to these unanticipated expenses, and may be income enhancing, rather than smoothing.

From Table 8, we see that households are more likely to participate in land rental markets if they experience a covariate shock, but this effect is not significantly different from zero at standard confidence levels. Since the dependent variable simply indicates participation in land rental markets, we cannot know for sure whether experiencing a covariate shock results in households renting in or renting out land. If households desire to smooth consumption when confronted with a covariate shock, one would expect to find households renting out land, temporarily depleting a productive asset to secure additional income with which to purchase consumption goods. The nature of these land rentals will be tested below. None of the idiosyncratic shocks have a significant impact on households' participation in land rental markets. This could be due to the existence of risk-sharing among community members, which provides a form of social insurance for households experiencing an idiosyncratic shock. Such risk-sharing within the village or community could provide enough consumption smoothing that households would not need to engage in land market transactions to fill in any consumption gaps.

It is also of interest to abstract from the dichotomous migration and land rental market participation decisions and instead consider the effects of these shocks on the number of migrants and the area of land rented in or out. Table 9 reports the average number of household migrants and the average area of land rented in and out per survey wave. The inclusion of these variables requires some modifications to the econometric models that have been specified thus far. To begin with, we recall that household migrants and areas of land rented in or out, which were previously cast as unobserved latent variables M^*_{hjt} and R^*_{hjt}. Since the dependent variables will be roughly continuous, we move from nonlinear probit specifications to simple linear specifications. In estimating the effects of various household and community characteristics on the number of migrants a household sends, consider the simple linear specification:

$$M^*_{hjt} = x^M_{hjt}\beta^M + z^M_{jt}\gamma^M + \alpha\varepsilon_{hjt} + \delta t + \upsilon^M_{hj} + u^M_{hjt} \tag{15}$$

In estimating the effects of various household and community characteristics on the area of land rented in or out, the simple linear specification can be written:

$$R^*_{hjt} = x^R_{hjt}\beta^R + z^R_{jt}\gamma^M + \alpha\varepsilon_{hjt} + \delta t + \upsilon^R_{hj} + u^R_{hjt} \tag{16}$$

In equation (15), M^*_{hjt} is the number of migrants from household h residing in community j during time period t, while in equation (16), R^*_{hjt} is the area of land rented in (+) or rented out (-) by household h residing in community j during period t. In both equations, x^i_{hjt}, $i = M, R$, is a row vector of time-varying, household-specific characteristics for household h, z^i_{jt}, $i = M, R$, is a row vector of time-varying characteristics for community j, ε_{hjt} is an exogenous income shock experienced by household h in time t, t captures a time trend, υ^i_{hj}, $i = M, R$, is a time-invariant, household-specific unobserved error component, and u_{hjt} is an innovation independent and identically distributed across households as well as time. We have previously specified the household and community characteristics that condition the decision to participate in land rental markets or migration, and we assume that the same characteristics condition the magnitude of migration and land rentals. These models could simply be estimated using simple linear panel regressions, or, assuming endogenous household per capita income, instrumental variables panel regressions. Alternatively, it may be the case that migration and land rentals are inter-related. If this is the case, then u^M_{hjt} and u^R_{hjt} may be correlated. Previously, we examined whether the decisions to participate in migration and land rental markets were inter-related, but the statistical support for this inter-relationship was rather weak. We proceed under the maintained hypothesis that the magnitudes of migration and land rentals, rather than simply participation, are inter-related. Household migration and land rentals are negatively correlated, suggesting that a higher number of household migrants is associated with households renting out land. To proceed, we estimate this system of equations using three-stage least squares on the pooled cross-sectional data. We begin by regressing gross household per capita income on the full set of exogenous variables included in $\left[x^{M\prime}_{hjt}, z^{M\prime}_{jt}, t\right]$ and $\left[x^{R\prime}_{hjt}, z^{R\prime}_{jt}, t\right]$ as well as lagged gross household per capita income. Based on the estimates of this first-stage regression, we obtain fitted values for gross household per capita income $\hat{y}^M_{hjt}$ and $\hat{y}^R_{hjt}$, which are included in an iterated seemingly unrelated regression (SUR) specification which assumes cross-equation correlation in the disturbances. We begin by restricting $\varepsilon_{hjt} = 0$, so there are no exogenous shocks that condition household behavior. The estimates of the model parameters under this assumption are reported in Table 10.

As we found when we examined households' migration participation decisions, household demographic structure significantly influences the number of migrants in a household. As before, households with redundant excess labor supply tend to send more migrants, as do those with lower average household education. Contrary to earlier findings, we see that households with a higher proportion of dependents relative to working-age adults tend to send more migrants. This might suggest that these dependents can be suitable substitutes for the migrating individuals in farm work. If there is a high degree of redundant labor on the farm due to land constraints, then each individuals marginal value product of farm labor will generally be rather low. Freeing up some of this redundant labor through migration can raise marginal productivities for the household members that remain, and any labor shortages may be compensated for by these dependents.

We also find that households that cultivate larger areas of land send fewer migrants. This suggests a substitutability between specialization in farming versus nonfarm activities, of which migration is an example. If households choose to specialize in farming, then land area under cultivation increases and they send fewer migrants to remit urban income. If they choose to send migrants to remit income, they will generally cultivate less land.

It was earlier confirmed that poorer households are more likely to participate in migration than wealthier households. The results in Table 10 suggest that household income per capita is positively correlated with the number of migrants in a household. While this seems to contradict our earlier findings, we suggest that this positive correlation is primarily due to the fact that households that have more migrants will typically have higher remittance income, which directly translates into higher incomes per capita.

In column (2) of Table 10, we see that, as before, a household's land endowment has a significant effect on land rental market participation. However, since these regressions consider a continuum of land rentals, we are able to ascertain the nature of land rental market transactions for households with different characteristics. We see, therefore, that households with larger land endowments tend to rent out more land, possibly because the allocated land is greater than the household can manage. Household structure is also a significant determinant of rentals. Households with a larger number of working-age individuals rent out more land, as do households with a larger proportion of dependents to working-age individuals.

We find significant evidence from these results that farm capital ownership significantly affects land rental transactions. Households with more tractors, more garden tractors, more irrigation equipment, and more water pumps tend to rent in additional land. Ownership of these forms of capital allow households to take advantage of economies of scale, increase the returns to labor and make farming more profitable.

We relax the restriction that $\varepsilon_{hjt} = 0$ and proceed to estimate the previously specified model allowing exogenous shocks to condition households' migration and land rental decisions. These estimates are reported in Table 11. The regression in column (1) incorporates a covariate income shock. Households that experience a covariate shock tend to rent in additional land, but there is no significant effect on the number of migrants. This is a somewhat surprising result, as it suggests that land is not rented out as a consumption smoothing response to covariate shocks. One of the primary covariate shocks discussed in the literature is a weather shock affecting agricultural production over a wide geographic area. Unfortunately, the nature of the covariate shock we consider does not explicitly cover this possibility, but instead is more a measure of community-wide poverty. This covariate shock proxy, therefore, could capture macroeconomic fluctuations or policy shocks rather than weather shocks. This positive and significant coefficient could be explained by the fact that covariate shocks typically have negative effects on asset prices, which have direct implications for household terms of trade. The positive coefficient may suggest that the households represented in the CHNS may take advantage of the lower rental rates on land as households in their community scramble to rent out land in response to the covariate income shock. It may also indicate that households view agricultural production as a safe haven income source during periods in which poverty is widespread in their community, which may lead them to renting in additional land so as to increase farm production.

We find that, under this specification, the only idiosyncratic shock that influences household behavior is the death of a household member. While the death of a household member has no effect on renting in or renting out land, it reduces the number of migrants that a household sends to earn urban income. When household members die, the extent of the redundancy of household labor is reduced, and marginal productivity may be high enough that the expected benefits of migration are lessened.

The lack of a significant effect of illness on migration is consistent with previous findings. Debela et al. (2011), for example, found households to be relatively unresponsive to illnesses in Uganda. Reallocating labor to other activities is a commonly observed response to shocks, but when the shock itself affects the household's stock of labor, as would be the case when a household member falls ill, then the reallocation of effort is more difficult. As a result, they find that households do not change their behaviors to a large degree when affected by labor shocks.

6 Conclusion

In this paper we examine household responses to risk using a unique longitudinal data set in China collected at various intervals from 1991 through 2006. Development theory suggests that household can respond to risk at two distinct stages. Ex ante, household can smooth income by diversifying income sources or production methods. Ex post, households can smooth consumption by utilizing insurance or credit markets, or by depleting assets. In this paper, we consider both income smoothing and consumption smoothing mechanisms. Specifically, we examine household participation in migration and land rental markets as responses to risk.

Over the last 30 years, there have been significant reforms in China that have increased labor mobility and the functioning of rural land markets. While limitations still remain, the reforms have to date increased the efficiency of the allocation of these important factors of production. We present a simple theoretical model with stochastic farm income. Reduced form equations of the first-order conditions from a static household utility maximization problem frame migration and land rentals as responses to risk, conditional on household and community characteristics.

Our empirical work suggests that households are generally more likely to participate in migration as an income smoothing response to risk if they experience household illnesses or unanticipated household expenditures, but are less likely to participate in migration if a household member dies or if the community in which they reside experiences a covariate income shock. Households engage in land market rentals as a response to covariate shocks, but not in response to any of the idiosyncratic shocks considered. This may reflect well-functioning intra-village risk-sharing arrangements. These arrangements can only protect against idiosyncratic shocks, and the fact that land rentals are not affected by these idiosyncratic shocks suggests that sufficient consumption smoothing is available such that households are not forced to deplete a valuable, productive asset to smooth consumption.

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Figure 1: China Health and Nutrition Survey (CHNS) Regions

Source: CHNS (http://www.cpc.unc.edu/projects/china/proj_desc/chinamap)

Table 1: Sample Averages of CHNS Households by Survey Wave

	1991	1993	1997	2000	2004	2006
Household Characteristics						
HH Migrant (=1)	0.107	0.123	0.327	0.404	0.523	0.654
	(0.310)	(0.329)	(0.469)	(0.491)	(0.500)	(0.476)
HH Participates in Land Rental Market (=1)	0.421	0.563	0.650	0.677	0.716	0.741
	(0.494)	(0.496)	(0.477)	(0.468)	(0.451)	(0.439)
Land Endowment (mu)	4.348	4.640	4.746	4.516	4.749	4.723
	(3.087)	(3.376)	(3.390)	(3.170)	(3.647)	(3.691)
# Working-age HH Members	3.028	3.153	3.281	3.253	3.407	3.939
	(1.316)	(1.373)	(1.344)	(1.205)	(1.227)	(1.436)
Avg. Age of HH Members	29.294	30.668	32.922	34.921	37.939	37.578
	(10.072)	(10.097)	(9.772)	(9.845)	(9.938)	(8.500)
Dependency Ratio	0.644	0.627	0.521	0.430	0.308	0.243
	(0.572)	(0.582)	(0.552)	(0.486)	(0.472)	(0.415)
Gross HH Income/Capita (1,000 RMB)	1.058	1.308	2.835	3.257	4.701	5.266
	(0.832)	(1.055)	(2.307)	(2.860)	(4.498)	(5.384)
Avg. Edu. Of HH Members	4.810	5.091	5.519	6.047	6.059	5.868
	(2.199)	(2.041)	(2.108)	(2.211)	(2.219)	(2.340)
# Tractors Owned by HH	0.036	0.039	0.053	0.060	0.094	0.121
	(0.185)	(0.193)	(0.224)	(0.239)	(0.292)	(0.326)
# Garden Tractors Owned by HH	0.049	0.046	0.090	0.109	0.129	0.142
	(0.216)	(0.209)	(0.287)	(0.311)	(0.336)	(0.349)
# Irrigation Equip. Owned by HH	0.048	0.053	0.067	0.080	0.140	0.195
	(0.221)	(0.240)	(0.263)	(0.276)	(0.364)	(0.529)
# Power Threshers Owned by HH	0.034	0.037	0.009	0.005	0.084	0.100
	(0.202)	(0.250)	(0.095)	(0.070)	(0.277)	(0.300)
# Water Pumps Owned by HH	0.059	0.054	0.087	0.128	0.237	0.230
	(0.239)	(0.234)	(0.290)	(0.335)	(0.457)	(0.551)
Community Characteristics						
% Migrants in Community	14.662	21.978	24.532	31.778	32.038	31.095
	(16.390)	(19.207)	(19.426)	(22.610)	(24.106)	(19.802)
% Comm. Farmland With Irrigation	66.032	68.522	74.037	59.942	68.389	71.172
	(30.525)	(39.811)	(28.776)	(33.759)	(31.771)	(36.761)
Avg. Male Wage in Comm.	4.704	5.773	15.419	14.459	20.836	30.916
	(2.221)	(3.000)	(6.189)	(7.667)	(6.229)	(7.392)
Avg. Female Wage in Comm.	3.697	4.940	11.727	11.162	16.913	23.253
	(2.021)	(4.669)	(5.461)	(6.897)	(6.260)	(5.989)
Provincial Characteristics						
Jiangsu	0.166	0.177	0.179	0.210	0.201	0.230
	(0.372)	(0.381)	(0.383)	(0.407)	(0.401)	(0.421)
Shandong	0.150	0.117	0.116	0.127	0.166	0.177
	(0.357)	(0.322)	(0.321)	(0.333)	(0.372)	(0.382)
Henan	0.143	0.164	0.191	0.168	0.153	0.179
	(0.350)	(0.370)	(0.393)	(0.374)	(0.361)	(0.383)
Hubei	0.152	0.115	0.174	0.142	0.167	0.140
	(0.359)	(0.320)	(0.379)	(0.349)	(0.373)	(0.347)
Hunan	0.097	0.105	0.067	0.042	0.084	0.048
	(0.296)	(0.306)	(0.250)	(0.201)	(0.277)	(0.215)
Guangxi	0.140	0.157	0.107	0.112	0.131	0.164
	(0.348)	(0.364)	(0.310)	(0.316)	(0.337)	(0.371)
Guizhou	0.152	0.166	0.166	0.199	0.099	0.061
	(0.359)	(0.372)	(0.372)	(0.399)	(0.299)	(0.240)
# Observations	1,267	1,110	885	810	658	621

Note: Standard deviations in parentheses. The percent of migrants in the community is computed as the percentage of the community (e.g., village or neighborhood) workforce that worked out of town for more than a month in the preceding year. The average male and female wages in the community are daily wages, reported in Renminbi. The provincial characteristics summarize the occurrence of binary provincial indicator variables, and can be interpreted as the proportion of the total sample residing in each of the seven provinces considered.

Figure 2: Migration in CHNS Provinces

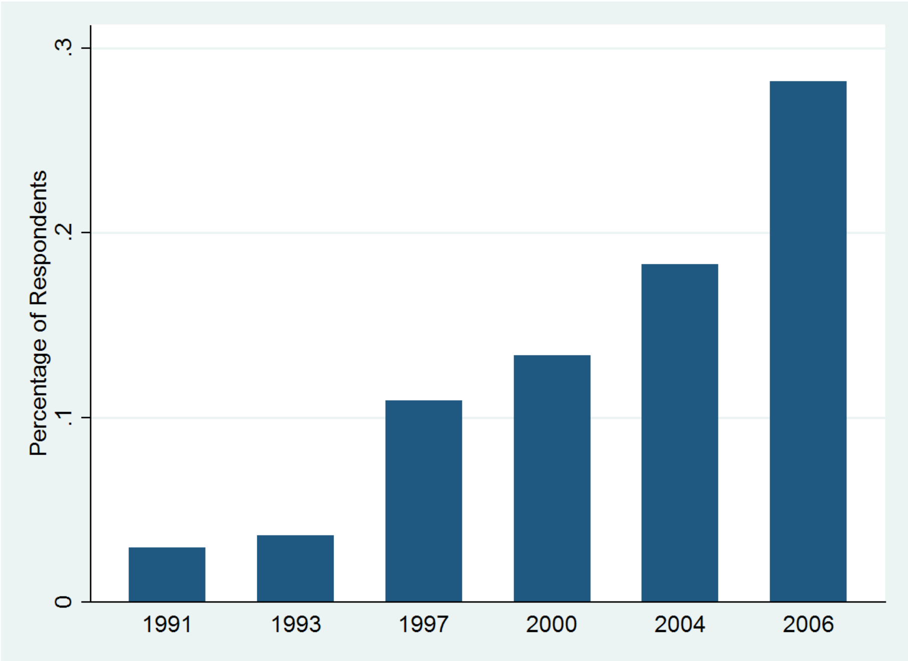

Figure 3: Cultivated Area and Land Rentals in CHNS Provinces

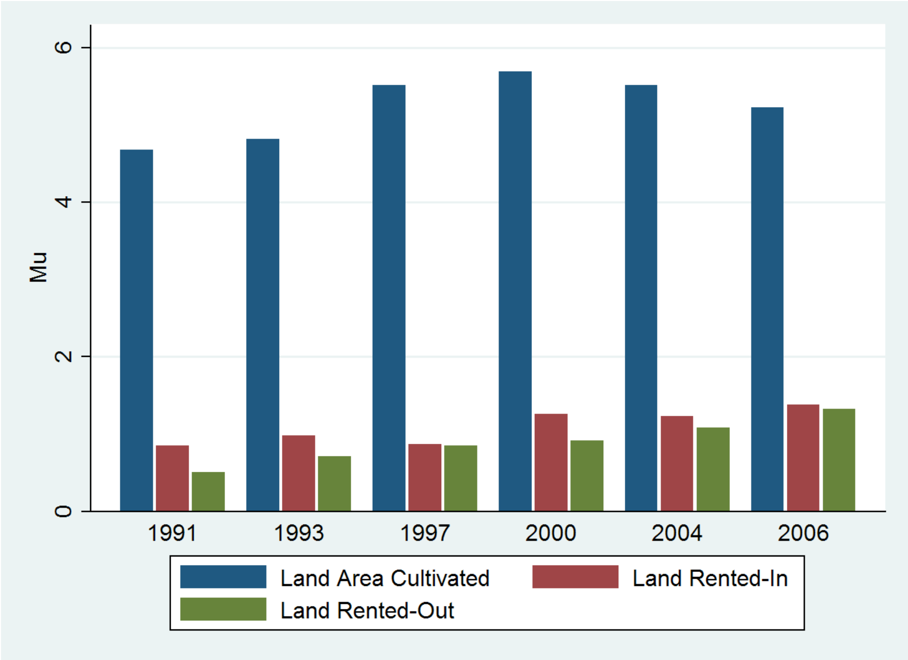

Table 2: Characteristics of Migrant and Nonmigrant Households in CHNS Provinces

	Households w/o Migrants	Households w/ Migrants
Household Characteristics		
Land Area Under Cultivation (mu)	4.618	4.684
	(3.166)	(3.233)
# Working-age HH Members	2.888	4.182***
	(1.188)	(1.237)
Avg. Age of HH Members	31.900	35.666***
	(11.277)	(7.073)
Dependency Ratio	0.614	0.237***
	(0.577)	(0.366)
Gross HH Income/Capita (1,000 RMB)	2.247	3.614***
	(3.008)	(3.604)
Avg. Edu. Of HH Members	5.353	5.672***
	(2.285)	(2.027)
# Tractors Owned by HH	0.053	0.074***
	(0.225)	(0.262)
# Garden Tractors Owned by HH	0.080	0.095*
	(0.271)	(0.294)
# Irrigation Equip. Owned by HH	0.076	0.106***
	(0.274)	(0.383)
# Power Threshers Owned by HH	0.034	0.055***
	(0.204)	(0.235)
# Water Pumps Owned by HH	0.103	0.140***
	(0.343)	(0.359)
Community Characteristics		
% Migrants in Community	22.494	28.911***
	(20.384)	(21.838)
Avg. Male Wage in Comm.	10.794	18.420***
	(8.893)	(10.553)
Avg. Female Wage in Comm.	8.449	14.339***
	(7.392)	(8.487)
Provincial Characteristics		
Jiangsu	0.190	0.188
	(0.392)	(0.391)
Shandong	0.153	0.110***
	(0.360)	(0.313)
Henan	0.164	0.162
	(0.371)	(0.368)
Hubei	0.142	0.158
	(0.349)	(0.365)
Hunan	0.088	0.054***
	(0.283)	(0.226)
Guangxi	0.128	0.155***
	(0.334)	(0.362)
Guizhou	0.136	0.173***
	(0.343)	(0.378)
# Observations	3,692	1,647

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard deviations in parentheses.

Table 3: Characteristics of Land Rental Market Participants and Non-participants in CHNS Provinces

	Households Not Participating in Land Rental Mkts.	Households Participating in Land Rental Mkts.
Household Characteristics		
Land Endowment (mu)	0.984	1.330***
	(0.707)	(1.232)
# Working-age HH Members	3.107	3.411***
	(1.299)	(1.360)
Avg. Age of HH Members	31.427	34.186***
	(10.105)	(10.308)
Dependency Ratio	0.554	0.459***
	(0.560)	(0.538)
Gross HH Income/Capita (1,000 RMB)	2.267	2.945***
	(2.432)	(3.706)
Avg. Edu. Of HH Members	5.458	5.447
	(2.206)	(2.219)
# Tractors Owned by HH	0.044	0.071***
	(0.204)	(0.257)
# Garden Tractors Owned by HH	0.069	0.095***
	(0.253)	(0.294)
# Irrigation Equip. Owned by HH	0.059	0.103***
	(0.249)	(0.348)
# Power Threshers Owned by HH	0.043	0.038
	(0.235)	(0.199)
# Water Pumps Owned by HH	0.096	0.128***
	(0.300)	(0.378)
Community Characteristics		
% Comm. Farmland With Irrigation	66.983	68.430
	(34.784)	(33.422)
Avg. Male Wage in Comm.	11.463	14.304***
	(9.212)	(10.468)
Avg. Female Wage in Comm.	9.034	11.113***
	(7.661)	(8.464)
Provincial Characteristics		
Jiangsu	0.217	0.170***
	(0.412)	(0.376)
Shandong	0.126	0.149**
	(0.331)	(0.356)
Henan	0.137	0.182***
	(0.344)	(0.386)
Hubei	0.141	0.151
	(0.348)	(0.358)
Hunan	0.077	0.077
	(0.267)	(0.267)
Guangxi	0.153	0.124***
	(0.360)	(0.330)
Guizhou	0.149	0.146
	(0.356)	(0.353)
# Observations	2,175	3,164

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Standard deviations in parentheses.

Table 4: Probability of Participating in Labor Migration

	Random Effects Panel Estimation					Pooled
	Probit Models				LPM (IV)	Probit (IV)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-3.628^{***}	-3.645^{***}	-3.644^{***}	-3.547^{***}	-0.434^{***}	-3.452^{***}
	(-18.754)	(-18.946)	(-18.687)	(-17.650)	(-10.013)	(-16.764)
Area Cultivated (mu)	-0.030^{***}	-0.025^{***}	-0.030^{***}	-0.026^{***}	-0.007^{***}	-0.022^{***}
	(-4.126)	(-3.236)	(-3.973)	(-3.252)	(-3.485)	(-2.812)
# Working Age	0.496^{***}	0.493^{***}	0.495^{***}	0.482^{***}	0.127^{***}	0.445^{***}
	(20.948)	(20.931)	(20.909)	(20.003)	(23.504)	(17.476)
Avg. Age (HH)	0.006^{**}	0.006^{**}	0.006^{**}	0.007^{**}	0.001	0.007^{**}
	(2.221)	(2.154)	(2.204)	(2.282)	(0.963)	(2.466)
Dependency Ratio	-0.117^{*}	-0.117^{*}	-0.118^{*}	-0.138^{**}	-0.019	-0.161^{**}
	(-1.879)	(-1.889)	(-1.895)	(-2.216)	(-1.326)	(-2.029)
HH Income/Capita	0.003	0.002	0.002	0.001	-0.008	-0.049^{**}
	(0.381)	(0.327)	(0.332)	(0.188)	(-1.006)	(-1.975)
Avg. Education	-0.041^{***}	-0.040^{***}	-0.042^{***}	-0.037^{***}	-0.007^{**}	-0.022^{*}
	(-3.550)	(-3.483)	(-3.593)	(-3.202)	(-2.413)	(-1.870)
Trend	0.362^{***}	0.370^{***}	0.364^{***}	0.370^{***}	0.102^{***}	0.385^{***}
	(21.158)	(21.256)	(15.079)	(15.055)	(13.751)	(14.138)
# of Tractors		-0.063		-0.050	-0.001	-0.057
		(-0.635)		(-0.498)	(-0.059)	(-0.562)
# of Gard. Tractors		-0.038		-0.023	-0.017	-0.040
		(-0.457)		(-0.274)	(-0.831)	(-0.518)
# of Irrig. Equip.		-0.095		-0.022	-0.003	-0.018
		(-1.332)		(-0.292)	(-0.172)	(-0.258)
# of Water Pumps		-0.130^{**}		-0.107^{*}	-0.027^{*}	-0.096
		(-2.014)		(-1.675)	(-1.662)	(-1.485)
% Migrants in Comm.			0.001	0.000	-0.000	0.000
			(0.803)	(0.230)	(-0.258)	(0.258)
Avg. Male Wage			-0.005	-0.003	-0.000	-0.002
			(-0.908)	(-0.491)	(-0.068)	(-0.268)
Avg. Female Wage			0.006	0.003	0.001	0.005
			(0.863)	(0.462)	(0.872)	(0.703)
# Obs	$5,339$	$5,339$	$5,339$	$5,339$	$4,931$	$4,931$
# Groups	$1,590$	$1,590$	$1,590$	$1,590$	$1,548$	
Log-Like.	$-2,314.282$	$-2,310.243$	$-2,313.484$	$-2,297.858$		
Pseudo Log-Lik.					$-1,3590.755$	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Z-statistics in parentheses. Column (6) represents probit estimates from pooled cross sections. Standard errors have been adjusted for clustering within households over the various survey waves. The regressions in columns (4)–(6) contain provincial dummy variables.

Table 5: Probability of Participating in Land Rental Markets

	Random Effects Panel Estimation					Pooled
	Probit Models				LPM (IV)	Probit (IV)
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-1.346^{***}	-1.337^{***}	-1.432^{***}	-1.400^{***}	0.129^{**}	-1.074^{***}
	(-7.814)	(-7.777)	(-8.042)	(-7.467)	(2.115)	(-6.004)
Land Endowment	0.212^{***}	0.208^{***}	0.209^{***}	0.214^{***}	0.056^{***}	0.202^{***}
	(7.718)	(7.575)	(7.623)	(7.664)	(6.632)	(5.994)
# Working Age	0.124^{***}	0.121^{***}	0.125^{***}	0.116^{***}	0.030^{***}	0.100^{***}
	(5.591)	(5.466)	(5.633)	(5.158)	(4.200)	(4.665)
Avg. Age (HH)	0.009^{***}	0.009^{***}	0.009^{***}	0.010^{***}	0.003^{***}	0.007^{***}
	(3.157)	(3.261)	(3.164)	(3.468)	(3.007)	(2.596)
Dependency Ratio	0.203^{***}	0.201^{***}	0.202^{***}	0.185^{***}	0.037^{**}	0.118^{**}
	(3.605)	(3.565)	(3.580)	(3.260)	(1.970)	(2.168)
HH Income/Capita	0.008	0.008	0.009	0.014^{*}	-0.000	0.015
	(0.930)	(0.941)	(1.089)	(1.676)	(-0.031)	(0.531)
Avg. Education	-0.013	-0.013	-0.013	-0.013	-0.004	-0.013
	(-1.069)	(-1.088)	(-1.103)	(-1.105)	(-1.004)	(-1.112)
Trend	0.155^{***}	0.149^{***}	0.200^{***}	0.188^{***}	0.058^{***}	0.149^{***}
	(9.889)	(9.283)	(8.675)	(8.058)	(5.439)	(5.417)
# of Tractors		0.085		0.034	0.017	0.067
		(0.859)		(0.337)	(0.542)	(0.719)
# of Gard. Tractors		0.074		0.103	0.047^{*}	0.131^{*}
		(0.890)		(1.236)	(1.785)	(1.694)
# of Irrig. Equip.		0.144^{*}		0.093	0.037	0.107
		(1.809)		(1.157)	(1.593)	(1.491)
# of Water Pumps		0.018		0.003	0.004	-0.002
		(0.281)		(0.044)	(0.207)	(-0.026)
% Comm. Land w/ Irrig.			0.000	0.000	0.000	0.001
			(0.695)	(0.699)	(1.294)	(1.148)
Avg. Male Wage			-0.005	-0.006	-0.001	-0.004
			(-0.881)	(-1.026)	(-0.802)	(-0.782)
Avg. Female Wage			-0.006	-0.004	-0.002	-0.005
			(-0.936)	(-0.676)	(-0.830)	(-0.900)
# Obs	$5,339$	$5,339$	$5,339$	$5,339$	$4,931$	$4,931$
# Groups	$1,590$	$1,590$	$1,590$	$1,590$	$1,548$	
Log-Lik.	$-3,292.962$	$-3,289.885$	$-3,289.167$	$-3,269.756$		
Pseudo Log-Lik.					$-14,627.534$	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Z-statistics in parentheses. Column (6) represents probit estimates from pooled cross sections. Standard errors have been adjusted for clustering within households over the various survey waves. The regressions in columns (4)–(6) contain provincial dummy variables.

Table 6: Frequency of Idiosyncratic and Covariate Shocks in CHNS Provinces

	Illness of HH Member	Death of HH Member	Wedding/Dowry/ Funeral	Covariate Income Shock
1991	24.12%	3.65%	80.44%	20.18%
1993	17.06%	4.99%	80.25%	17.48%
1997	17.61%	7.24%	80.53%	15.74%
2000	18.77%	6.18%	82.28%	11.24%
2004	30.63%	4.70%	77.31%	22.69%
2006	26.02%	5.67%	74.39%	26.16%
Total	22.23%	5.26%	79.30%	18.91%

Table 7: The Effect of Exogenous Shocks on the Probability of Participating in Labor Migration—Pooled Cross-Section Instrumental Variables Probit Estimation

	(1)	(2)	(3)	(4)	(5)
Constant	-3.363^{***}	-3.608^{***}	-3.452^{***}	-3.507^{***}	-3.564^{***}
	(-16.233)	(-17.225)	(-16.764)	(-16.641)	(-16.575)
Area Cultivated (mu)	-0.022^{***}	-0.023^{***}	-0.022^{***}	-0.023^{***}	-0.023^{***}
	(-2.784)	(-2.921)	(-2.780)	(-2.846)	(-2.887)
# Working Age	0.451^{***}	0.443^{***}	0.442^{***}	0.450^{***}	0.453^{***}
	(17.688)	(17.389)	(17.316)	(17.415)	(17.382)
Avg. Age (HH)	0.007^{**}	0.008^{***}	0.007^{**}	0.008^{***}	0.008^{***}
	(2.391)	(2.644)	(2.423)	(2.724)	(2.793)
Dependency Ratio	-0.154^{*}	-0.162^{**}	-0.164^{**}	-0.143^{*}	-0.140^{*}
	(-1.957)	(-2.035)	(-2.069)	(-1.792)	(-1.748)
HH Income/Capita	-0.052^{**}	-0.050^{**}	-0.049^{**}	-0.049^{**}	-0.054^{**}
	(-2.083)	(-2.035)	(-1.983)	(-1.997)	(-2.158)
Avg. Education	-0.028^{**}	-0.023^{*}	-0.022^{*}	-0.021^{*}	-0.026^{**}
	(-2.324)	(-1.938)	(-1.809)	(-1.724)	(-2.161)
# of Tractors	-0.035	-0.065	-0.054	-0.050	-0.032
	(-0.342)	(-0.642)	(-0.533)	(-0.492)	(-0.321)
# of Gard. Tractors	-0.059	-0.036	-0.037	-0.036	-0.047
	(-0.763)	(-0.461)	(-0.480)	(-0.462)	(-0.605)
# of Irrig. Equip.	-0.019	-0.013	-0.016	-0.018	-0.012
	(-0.267)	(-0.191)	(-0.228)	(-0.253)	(-0.177)
# of Water Pumps	-0.096	-0.101	-0.099	-0.095	-0.102
	(-1.482)	(-1.561)	(-1.531)	(-1.468)	(-1.576)
% Migrants in Comm.	-0.000	0.000	0.000	0.000	-0.000
	(-0.216)	(0.164)	(0.257)	(0.274)	(-0.271)
Avg. Male Wage	0.000	-0.001	-0.001	-0.002	0.001
	(0.074)	(-0.145)	(-0.249)	(-0.280)	(0.183)
Avg. Female Wage	0.002	0.004	0.004	0.005	0.002
	(0.245)	(0.686)	(0.666)	(0.729)	(0.236)
Trend	0.398^{***}	0.386^{***}	0.385^{***}	0.385^{***}	0.397^{***}
	(14.293)	(14.148)	(14.120)	(14.127)	(14.259)
Covariate Income Shock	-0.582^{***}				-0.562^{***}
	(-3.667)				(-3.538)
HH Paid for Wedding/ Dowry/Funeral (=1)		0.158^{***}			0.142^{**}
		(2.826)			(2.519)
HH Member Experienced Illness (=1)			0.076		0.071
			(1.358)		(1.270)
Death of HH Member (=1)				-0.168	-0.179
				(-1.539)	(-1.639)
# Obs	$4,931$	$4,931$	$4,931$	$4,931$	$4,931$
# Groups	$1,548$	$1,548$	$1,548$	$1,548$	$1,548$
Log-Lik.	$-13,554.695$	$-13,583.849$	$-13,589.453$	$-13,586.053$	$-13,544.563$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Z-statistics in parentheses. Standard errors have been adjusted for clustering within households over the various survey waves. All regressions contain provincial dummy variables.

Table 8: The Effect of Exogenous Shocks on the Probability of Participating in Land Rental Markets—Pooled Cross-Section Instrumental Variables Probit Estimation

	(1)	(2)	(3)	(4)	(5)
Constant	−1.115***	−1.040***	−1.070***	−1.066***	−1.076***
	(−6.208)	(−5.613)	(−5.980)	(−5.901)	(−5.709)
Land Endowment	0.202***	0.202***	0.202***	0.202***	0.202***
	(6.002)	(5.980)	(5.989)	(5.983)	(5.971)
# Working Age	0.099***	0.101***	0.101***	0.099***	0.100***
	(4.602)	(4.688)	(4.733)	(4.584)	(4.606)
Avg. Age (HH)	0.007***	0.007**	0.007***	0.007**	0.007**
	(2.636)	(2.554)	(2.613)	(2.512)	(2.529)
Dependency Ratio	0.116**	0.118**	0.120**	0.115**	0.116**
	(2.135)	(2.174)	(2.211)	(2.088)	(2.099)
HH Income/Capita	0.016	0.015	0.015	0.015	0.017
	(0.569)	(0.540)	(0.556)	(0.538)	(0.607)
Avg. Education	−0.011	−0.013	−0.014	−0.013	−0.012
	(−0.956)	(−1.104)	(−1.143)	(−1.132)	(−1.003)
# of Tractors	0.059	0.069	0.065	0.067	0.057
	(0.626)	(0.736)	(0.697)	(0.714)	(0.615)
# of Gard. Tractors	0.135*	0.130*	0.129*	0.131*	0.132*
	(1.747)	(1.684)	(1.670)	(1.691)	(1.709)
# of Irrig. Equip.	0.106	0.107	0.105	0.107	0.105
	(1.487)	(1.491)	(1.467)	(1.492)	(1.464)
# of Water Pumps	−0.001	−0.001	−0.000	−0.002	0.001
	(−0.016)	(−0.014)	(−0.009)	(−0.027)	(0.010)
Avg. Male Wage	−0.005	−0.004	−0.004	−0.004	−0.005
	(−0.872)	(−0.800)	(−0.790)	(−0.781)	(−0.890)
Avg. Female Wage	−0.004	−0.005	−0.005	−0.005	−0.004
	(−0.745)	(−0.900)	(−0.880)	(−0.904)	(−0.732)
% Comm. Land w/ Irrig.	0.001	0.001	0.001	0.001	0.001
	(1.239)	(1.130)	(1.101)	(1.140)	(1.168)
Trend	0.146***	0.148***	0.148***	0.149***	0.146***
	(5.213)	(5.405)	(5.409)	(5.414)	(5.200)
Covariate Income Shock	0.185				0.180
	(1.368)				(1.330)
HH Paid for Wedding/ Dowry/Funeral (=1)		−0.034			−0.027
		(−0.703)			(−0.557)
HH Member Experienced Illness (=1)			−0.044		−0.043
			(−0.950)		(−0.927)
Death of HH Member (=1)				0.025	0.027
				(0.264)	(0.287)
# Obs	4,931	4,931	4,931	4,931	4,931
# Groups	1,548	1,548	1,548	1,548	1,548
Log-Lik.	−14,592.668	−14,622.518	−14,626.653	−14,625.292	−14,587.355

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Z-statistics in parentheses. Standard errors have been adjusted for clustering within households over the various survey waves. All regressions contain provincial dummy variables.

Table 9: Number of Migrants and Area of Land Rental Transactions in CHNS Provinces

	1991	1993	1997	2000	2004	2006
Avg. Number of Migrants per Household	0.1278	0.1697	0.5000	0.6042	0.8298	1.2931
Avg. Area Rented In (Mu)	0.6875	0.8545	0.9535	0.9863	1.1827	1.1515
Avg. Area Rented Out (Mu)	0.4516	0.7533	0.9675	1.0543	1.1743	1.3304
Number of Observations	1,268	1,108	884	811	658	621

Table 10: The Effect of Exogenous Shocks on Labor Migration and Land Rentals—Pooled Cross-Section 3SLS Estimates

	Migrants	Rentals
	1	2
Constant	$-1.129***$	$2.467***$
	(-14.428)	(8.618)
Land Area Cultivated (mu)	$-0.026***$	
	(-7.614)	
Land Endowment/Capita (mu)		$-1.598***$
		(-41.575)
# Working Age	$0.330***$	$-0.175***$
	(34.070)	(-5.164)
Avg. Age (HH)	-0.001	$-0.011**$
	(-0.634)	(-2.463)
Dependency Ratio	$0.149***$	$-0.340***$
	(5.731)	(-3.649)
HH Income/Capita	$0.029**$	-0.007
	(2.178)	(-0.142)
Average Education	$-0.031***$	$-0.064***$
	(-5.826)	(-3.272)
# of Tractors	-0.072	$1.214***$
	(-1.592)	(7.509)
# of Gard. Tractors	-0.050	$1.293***$
	(-1.357)	(9.972)
# of Irrig. Equip.	-0.021	$0.872***$
	(-0.621)	(7.194)
# of Water Pumps	$-0.087***$	$0.188*$
	(-2.948)	(1.763)
% Migrants in Comm.	-0.000	
	(-0.639)	
%. Comm. Farmland w/ Irrig.		0.001
		(0.993)
Avg. Male Wage	0.001	$-0.017*$
	(0.452)	(-1.822)
Avg. Female Wage	0.002	0.001
	(0.728)	(0.111)
Trend	$0.168***$	$0.100**$
	(12.636)	(2.042)
# Obs	4,931	
R^2: Migrants	0.388	
R^2 Land Rentals	0.319	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: t-statistics in parentheses. Estimates obtained assuming correlation in the error structures across equations. All regressions contain provincial dummy variables.

Table 11: The Effect of Exogenous Shocks on Labor Migration and Land Rentals—Pooled Cross-Section 3SLS Estimates

	(1)		(2)		(3)		(4)		(5)	
	Migrants	Rentals	Migrants	Rentals	Migrants	Rentals	Migrants	Rentals	Migrants	Rentals
Constant	−1.137***	2.388***	−1.148***	2.511***	−1.130***	2.467***	−1.161***	2.489***	−1.193***	2.445***
	(−14.367)	(8.242)	(−14.052)	(8.385)	(−14.445)	(8.617)	(−14.633)	(8.554)	(−14.195)	(7.915)
Land Area Cultivated (mu)	−0.026***		−0.027***		−0.026***		−0.027***		−0.027***	
	(−7.610)		(−7.692)		(−7.599)		(−7.714)		(−7.784)	
Land Endowment/Capita (mu)		−1.599***		−1.599***		−1.598***		−1.600***		−1.601***
		(−41.600)		(−41.587)		(−41.574)		(−41.566)		(−41.606)
# Working Age	0.329***	−0.179***	0.329***	−0.174***	0.329***	−0.175***	0.333***	−0.177***	0.331***	−0.180***
	(33.957)	(−5.270)	(34.022)	(−5.133)	(33.909)	(−5.147)	(34.142)	(−5.175)	(33.805)	(−5.244)
Avg. Age (HH)	−0.001	−0.010**	−0.001	−0.011**	−0.001	−0.011**	−0.000	−0.011**	−0.000	−0.011**
	(−0.609)	(−2.398)	(−0.578)	(−2.487)	(−0.655)	(−2.461)	(−0.103)	(−2.490)	(−0.040)	(−2.451)
Dependency Ratio	0.148***	−0.346***	0.149***	−0.340***	0.148***	−0.340***	0.160***	−0.347***	0.158***	−0.353***
	(5.703)	(−3.712)	(5.731)	(−3.644)	(5.683)	(−3.644)	(6.064)	(−3.666)	(5.986)	(−3.729)
HH Income/Capita	0.029**	−0.005	0.029**	−0.006	0.028**	−0.007	0.029**	−0.006	0.029**	−0.003
	(2.198)	(−0.093)	(2.173)	(−0.133)	(2.160)	(−0.141)	(2.176)	(−0.128)	(2.175)	(−0.070)
Average Education	−0.031***	−0.060***	−0.031***	−0.064***	−0.031***	−0.064***	−0.030***	−0.065***	−0.030***	−0.061***
	(−5.700)	(−3.031)	(−5.845)	(−3.263)	(−5.788)	(−3.272)	(−5.596)	(−3.300)	(−5.462)	(−3.063)
# of Tractors	−0.074	1.195***	−0.073	1.216***	−0.071	1.214***	−0.068	1.213***	−0.070	1.195***
	(−1.631)	(7.378)	(−1.603)	(7.521)	(−1.567)	(7.507)	(−1.511)	(7.499)	(−1.541)	(7.371)
# of Gard. Tractors	−0.049	1.304***	−0.049	1.292***	−0.049	1.293***	−0.047	1.293***	−0.044	1.302***
	(−1.316)	(10.046)	(−1.328)	(9.964)	(−1.332)	(9.968)	(−1.286)	(9.966)	(−1.188)	(10.028)
# of Irrig. Equip.	−0.021	0.872***	−0.021	0.872***	−0.020	0.872***	−0.021	0.872***	−0.019	0.872***
	(−0.617)	(7.195)	(−0.611)	(7.195)	(−0.592)	(7.190)	(−0.607)	(7.195)	(−0.567)	(7.194)
# of Water Pumps	−0.087***	0.189*	−0.088***	0.189*	−0.088***	0.188*	−0.087***	0.188*	−0.089***	0.189*
	(−2.944)	(1.770)	(−2.964)	(1.772)	(−2.974)	(1.763)	(−2.956)	(1.761)	(−2.996)	(1.775)
% Migrants in Comm.	−0.000		−0.000		−0.000		−0.000		−0.000	
	(−0.550)		(−0.684)		(−0.629)		(−0.618)		(−0.568)	
%. Comm. Farmland w/ Irrig.		0.001		0.001		0.001		0.001		0.001
		(1.096)		(0.978)		(0.987)		(0.974)		(1.057)
Avg. Male Wage	0.001	−0.019*	0.001	−0.018*	0.001	−0.017*	0.001	−0.017*	0.001	−0.019*
	(0.399)	(−1.949)	(0.471)	(−1.837)	(0.458)	(−1.822)	(0.433)	(−1.822)	(0.406)	(−1.957)
Avg. Female Wage	0.002	0.003	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.003
	(0.802)	(0.304)	(0.731)	(0.112)	(0.708)	(0.112)	(0.760)	(0.106)	(0.819)	(0.297)
Trend	0.167***	0.093*	0.168***	0.100**	0.168***	0.100**	0.168***	0.100**	0.167***	0.093*
	(12.508)	(1.908)	(12.642)	(2.037)	(12.633)	(2.042)	(12.601)	(2.040)	(12.478)	(1.903)
Covariate Income Shock	0.045	0.396*							0.046	0.392*
	(0.705)	(1.743)							(0.718)	(1.714)
HH Paid for Wedding/Dowry/Funeral (=1)			0.021	−0.044					0.024	−0.030
			(0.850)	(−0.496)					(0.962)	(−0.335)
HH Member Experienced Illness (=1)					0.024	−0.004			0.023	−0.002
					(1.037)	(−0.048)			(0.962)	(−0.028)
Death of HH Member (=1)							−0.114**	0.068	−0.113**	0.079
							(−2.441)	(0.404)	(−2.421)	(0.467)
# Obs	4,931		4,931		4,931		4,931		4,931	
R^2: Migration	0.388		0.388		0.388		0.389		0.389	
R^2: Land Rentals	0.320		0.319		0.319		0.319		0.320	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: t-statistics in parentheses. Estimates obtained assuming correlation in the error structures across equations in each model. All regressions include binary provincial indicator variables.