Migrant Labor Markets and the Welfare of Rural Households in the Developing World: Evidence from China*

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Abstract

In this paper, we examine the impact of reductions in barriers to migration on the consumption of households in rural China. We find that increased migration from rural villages leads to significant increases in consumption per capita, and that this effect is stronger for poorer households within villages. Household income per capita and non-durable consumption per capita both increase with out-migration, and increase more for poorer households. We also establish a causal relationship between increased out-migration and investment in housing and durable goods assets, and these effects are also stronger for poorer households. We do not find robust evidence, however, to support a connection between increased migration and investment in productive activity. Instead, increased migration is associated with two significant changes for poorer households: increases both in the total labor supplied to productive activities and in the land per capita managed by the household. In examining the effect of migration, we pay considerable attention to developing and examining our identification strategy.

Key Words: Migration, Migrant Networks, Consumption, Poverty, Wealth, Rural China
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1 Introduction

In developing countries, barriers to the movement of labor are a common institutional feature which may contribute to geographic poverty traps. Whether maintained by formal institutions, by cultural or linguistic differences across regions, or simply by high transaction costs associated with finding migrant employment, constraints on the movement of labor within developing countries may reinforce an inefficient allocation of resources across regions and influence levels of investment in poor areas.[1] When barriers to cross-regional mobility of labor are removed, the resulting improved efficiency of resource allocation may have important consequences for the well-being and living standards of rural residents in the developing world.[2] Remittances to household or family members remaining in rural areas may supplement income earned locally and directly reduce exposure to poverty. Migration may also have indirect effects on welfare within the communities which migrants are leaving, either in the form of increased wages with the depletion of the local labor force, or through remittances from migrant employment that are invested in local production.[3]

While a growing body of research examines the impact of international migration on investment and growth in migrant home countries, the impact of internal migration on home communities has received relatively little recent attention.[4] In some cases, researchers have documented *correlations* between migration of a family member and household economic outcomes, existing research on the impact of internal migration generally lacks strategies that identify a robust *causal* relationship between ability to migrate and outcomes in migrant home communities.

In this paper, we examine the impact of rural-urban migration on consumption in rural areas of China. We first extend a standard household model to include a migrant labor market, and use this model to frame the possible mechanisms through which migration may affect consumption outcomes in migrant sending communities. By focussing on how the ability to migrate from a village affects household outcomes, we avoid endogeneity problems related to selection on unobservables that typically complicate efforts to analyze the effects of household participation in migrant labor markets on household level outcomes.[5]

[1] Jalan and Ravallion (2002) demonstrate that geographic poverty traps may have played a significant role in limiting the scope for household consumption growth in China's poor areas during the 1980s.

[2] Yang (2008) finds that remittances to the Philippines from migrant family members are positively associated with human capital investment and investment in more capital-intensive household enterprises.

[3] Woodruff and Zenteño (2007) examine effects of international migration from Mexico to the US on investment levels in Mexico. They find that attachment to migrant networks in the US is associated with higher levels of investment and higher profits of entrepreneurs in migrant home communities.

[4] An earlier literature explores the consumption-smoothing and household risk-management motivations for internal migration (e.g., Rosenzweig and Stark, 1989).

[5] One must be concerned that unobserved characteristics facilitating household participation in the migrant labor

We first show that migration is positively associated with household consumption per capita, and then examine the distributional effects of migration within sending communities. Finally we explore evidence on mechanisms through which migration raises consumption. We briefly preview several results important for understanding how migration affects well-being in China's migrant-sending communities.

First, expanded migration is associated with decreasing inequality within villages.[6] Poorer households within sending communities experience higher consumption growth when the cost of migration falls. This finding is consistent with descriptive evidence from Benjamin et al (2005), which suggests that remittance income is inequality-reducing within China's rural villages. Increases in out-migration also lead to increases in household income per capita, and poorer households supply more labor to productive activities and experience more rapid income growth.

A second important finding relates to the impact of migration on investment in rural areas. Increases in migration from rural China are associated with increased accumulation of housing wealth and consumer durables, but we do not find evidence of a significant relationship between migration and investment in productive assets. Evidence that migration might affect investment in agriculture and promote specialization among poorer households is mixed. While we find no significant increases in investments related to agricultural production, poorer households are observed to increase their land holdings per capita, and thus expand their scale of agricultural production. Contrary to assertions in the China literature and evidence from the literature on Mexico-US migration, we do not find any indication that rural-urban migration in China is associated with increases in household investment in non-agricultural production.

Our empirical analysis pays careful attention to identifying the causal effects of migration on sending communities. To this end, we develop an instrumental variables (IV) strategy that takes advantage of a reform in China's residential registration (*hukou*) system making it easier for rural migrants with national identification cards (IDs) to legally reside in cities after 1988. National IDs, which were first available to urban residents in 1984, were not available in all rural counties as of 1988. While allowing for the possibility that the timing of ID distribution may be related to fixed unobserved characteristics of villages, we show that the annual change in the share of the village population working as migrants outside the village is a non-linear function of the time since

market may have an independent impact on consumption growth. For an extended discussion of this issue, and an example of research that attempts to use a randomized lottery to avoid this form of selection bias, see McKenzie, Gibson and Stillman (2006).

[6] McKenzie and Rapoport (2006) document a similar effect of international migration on rural communities in Mexico.

residents of a county received IDs. After controlling for village-fixed effects and village-specific trends, we identify the change in cost of migrating by exploiting differences in the timing of access to IDs and the non-linearity in the relationship between the annual change in the village migrant share and the time since IDs were distributed. To ensure that IDs were not distributed in response to demand for ID cards, we show that the timing of ID card distribution is not related to exogenous rainfall shocks affecting both earnings in the local economy and migrant labor supply. We further show that the timing of ID distribution is not systematically related to changes in variables proxying for time-varying local policies, which may affect the returns to labor or self-employment locally, or to time-varying proxies reflecting local administrative capacity, which could be related to village leader responsiveness to local demand for IDs.

To better identify differences in rate of migrant network growth across villages, we interact the non-linear function of years since IDs were distributed with the variance of county rainfall. Under the assumption that a village fixed effect controls for inherent riskiness of the local environment, the interaction facilitates identification by allowing for differences across villages in how IDs affect the growth of migrant networks. We also examine the plausibility of this expanded set of instruments.

The paper proceeds as follows. In section 2 we provide additional background on rural-urban migration in China and introduce the RCRE Household and Village surveys used in the analyses. Section 3 introduces the household model which provides a framework for the empirical methodology discussed in section 4. In section 5, we present our results and a final section concludes.

2 Background

2.1 Rural-Urban Migration in China

Over the 1990s, rapid growth in the volume of rural migrants moving to urban areas signalled that a dramatic change in the nature of China's labor market was taking place. Estimates using the one percent sample from the 1990 and 2000 rounds of the Population Census and the 1995 one percent population survey suggest that the inter-county migrant population grew from just over 20 million in 1990 to 45 million in 1995 and 79 million by 2000 (Liang and Ma, 2004). Surveys conducted by the National Bureau of Statistics (NBS) and the Ministry of Agriculture include more detailed retrospective information on past short-term migration, and suggest even higher levels of labor migration than those reported in the census (Cai, Park and Zhao, 2007).

Before labor mobility restrictions were relaxed, households in remote regions of rural China faced

low returns to local economic activity, reinforcing geographic poverty traps (Jalan and Ravallion, 2002). A considerable body of descriptive evidence related to the growth of migration in China raises the possibility that migrant opportunity may be an important mechanism for poverty reduction. Studies of the impact of migration on migrant households suggest that migration is associated with higher incomes (Taylor, Rozelle and de Brauw, 2003; Du, Park, and Wang, 2006), facilitates risk-coping and risk-management (Giles, 2006; Giles and Yoo, 2007), and is associated with higher levels of local investment in productive activities (Zhao, 2002).

The use of migrant networks and employment referral in urban areas are important dimensions of China's rural-urban migration experience. Rozelle et al (1999) emphasize that villages with more migrants in 1988 experienced more rapid migration growth by 1995. Zhao (2003) shows that number of early migrants from a village is correlated with the probability that an individual with no prior migration experience will choose to participate in the migrant labor market. Meng (2000) further suggests that variation in the size of migrant flows to different destinations can be partially explained by the size of the existing migrant population in potential destinations.[7]

Descriptive evidence from a survey of migrants living in urban China confirms the likely importance of migrant networks for lowering the cost of finding employment. In a survey of rural migrants conducted in five of China's largest cities in late 2001, more than half of the migrants reported that they secured employment before their first migration experience, and more than 90 percent had an acquaintance from their home village living in the city when arriving (Table 1).[8] Notably, before migrating over half of migrants surveyed had a member of their extended family living in the city, and over 65 percent knew hometown acquaintances in the city other than family members.[9]

[7] Referral through one's social network is a common method of job search in both the developing and developed world. Carrington, Detragiache, and Vishnawath (1996) explicitly show that in a model of migration, moving costs can decline with the number of migrants over time, even if wage differentials narrow between source communities and destinations. Survey-based evidence suggests that roughly 50 percent of new jobs in the US are found through referrals facilitated by social networks (Montgomery, 1991). In a study of Mexican migrants in the US, Munshi (2003) shows that having more migrants from one's own village living in the same city increases the likelihood of employment.

[8] We use the migrant sub-sample of the China Urban Labor Survey (CULS), which was conducted in late 2001 by the Institute for Population and Labor Economics at the Chinese Academy of Social Sciences (CASS-IPLE) working in collaboration with local National Bureau of Statistics Survey Teams. Researchers from Michigan State University and the University of Michigan collaborated in funding, designing, implementing and monitoring the survey. Using the 2000 Population Census as a guide, neighborhoods were selected using a proportional population sampling procedure. Sample frames were then assembled from residents' committee records of migrant households, and public security bureau records of migrants living on construction sites. Very short-term migrants are unlikely to have been included in the sample frame.

[9] Categories of acquaintance type shown in Table 1 are not exclusive because many migrants were preceded to cities by both family members and other hometown acquaintances.

2.2 The RCRE Household Survey

The primary data sources used for our analyses are the village and household surveys conducted by the Research Center for Rural Economy at China's Ministry of Agriculture from 1986 through the 2002 survey year. We use data from 88 villages in eight provinces (Anhui, Jilin, Jiangsu, Henan, Hunan, Shanxi, Sichuan and Zhejiang) that were surveyed over the 16-year period, with an average of 6305 households surveyed per year. Depending on village size, between 40 and 120 households were randomly surveyed in each village. Each village in the sample is in a different county, so county level policies affect each village in this sample differently.

The RCRE household survey collected detailed household-level information on incomes and expenditures, education, labor supply, asset ownership, land holdings, savings, formal and informal access to credit, and remittances.[10] In common with the National Bureau of Statistics (NBS) *Rural Household Survey,* respondent households keep daily diaries of income and expenditure, and a resident administrator living in the county seat visits with households once a month to collect the diaries.

Our measure of consumption is the sum of annual expenditures on non-durable goods and an imputed flow of services from household durable goods and housing. In order to convert the stock of durables into a flow of consumption services, we assume that current and past investments in housing are "consumed" over a 20-year period and that investments in durable goods are consumed over a period of 7 years.[11] We also annually "inflate" the value of the stock of housing and durables to reflect the increase in prices of durable goods over the period. Finally, we deflate all income and expenditure data to 1986 prices using the NBS rural consumer price index for each province.

There has been some debate over the representativeness of both the RCRE and NBS surveys, and concern over differences between trends in poverty and inequality generated from these surveys. These issues are reviewed extensively in Appendix B of Benjamin et al (2005), but it is worth summarizing some of their findings here. First, when comparing cross sections of the RCRE and NBS surveys with overlapping years from other cross sectional surveys that did not use a diary method, it is apparent that high and low income households are somewhat under-represented.[12] Poorer illiterate households are likely to be under-represented because enumerators find it difficult

[10] One shortcoming of the survey is the lack of individual-level information. However, we know the numbers of working-age adults and dependents, as well as the gender composition of household members.

[11] Our approach to valuing consumption follows the suggestions of Chen and Ravallion (1996) for the NBS Rural Household Survey, and is explained in detail in Appendix A of Benjamin et al (2005).

[12] The cross-sections used were the rural samples of the 1993, 1997 and 2000 China Health and Nutrition Survey (CHNS) and a survey conducted in 2000 by the Center for Chinese Agricultural Policy (CCAP).

to implement and monitor the diary-based survey, and refusal rates are likely to be high among affluent households who find the diary reporting method a costly use of their time. Second, much of the difference between levels and trends from the NBS and RCRE surveys can be explained by differences in the valuation of home-produced grain and in the treatment of taxes and fees.

2.3 Trends in Migration, Consumption Growth and Poverty

One of the benefits of the accompanying village survey are questions asked annually of village leaders about the number of registered village residents working and living outside the village. In our analysis, we consider all registered village residents who work outside the home county to be migrants.[13] Both the tremendous increase in migration from 1987 onward and heterogeneity across villages are evident in Figure 1. In 1987 an average of 3 percent of working age laborers in RCRE villages worked outside of their home counties, and this share rose steadily to 23 percent by 2003. Moreover, we observe considerable variability in the share of working age laborers working as migrants. Whereas, for some villages, only a small share of legal residents are employed as migrants, from other villages more than 50 percent of working age adults are employed outside their home county by 2003.

The relationship between migration and consumption is of central concern for our analysis. The linear fit of the relationship between annual changes in share of the village workforce employed as migrants (village migrant share) and growth in village average consumption in the RCRE data suggest a positive relationship (Figure 2). The lowess fit, however, suggests the presence of non-linearities, particularly around zero. The prospect that out-migration may be driven by negative shocks or return migration by positive shocks, which are correlated with movements in consumption, should raise concern that migration and consumption are endogeneous.

Even if consumption grows with an increase in the number of residents earning incomes from migrant employment, it is of particular policy interest to understand which residents within villages are experiencing increases in consumption. Changes in the village poverty headcount are negatively associated with the change in the number of out-migrants, suggesting that poverty declines with increased out-migration (Figure 3). Nonlinearities in the bivariate relationship are again evident in the lowess plot of the relationship. Whether obvious nonlinearities are related to the simultaneity of shocks and increases in out-migration and poverty for some villages or to the simple fact that

[13] From follow up interviews with village leaders, it is apparent that registered residents living outside the county are unlikely to be commuters and generally live and work outside the village for more than six months of the year.

we have not controlled for other characteristics of villages, establishing a relationship between migration and increased consumption of poorer households within villages requires an analytical approach that allows us to eliminate bias due to both simultaneity and unobserved heterogeneity.

3 Model

In this section, we present a simple model to highlight the direct and indirect mechanisms through which expanded migrant opportunity may affect household consumption. The model illustrates the relationship between the size of the migrant network, family income from earnings in local and migrant labor markets, and the impact of migrant networks on credit constraints that may influence a household's ability to invest in self-employed productive activity. Essentially the model highlights the potential effects of the migrant network on permanent household income and thus also on household consumption.

Assume that in each period t households may choose to invest in physical capital, K_t, used in agriculture or in non-agricultural household self-employment. Households earn income from some or all of the following activities: agricultural production, non-agricultural self-employment, and employment in local and migrant labor markets. Income from home production, indexed by h, encompasses agricultural production and any other self-employment activities and is a function of household physical and human capital: $y_t^h = \theta_t F\left(K_t, H_t, L_t^h\right)$, where θ_t is a multiplicative productivity shock with a mean of one, where H_t is the current stock of human capital, and L_t^h is the labor used in all self-employment activities. Similarly, household income from the local (l) and migrant (m) labor markets is $y_t^l = w^l(H_t, M_{jt})L_t^l$ and $y_t^m = w^m(H_t, M_{jt})L_t^m$, respectively. Above, L_t^l and L_t^m denote the labor allocated to local and migrant employment, M_{jt} is a measure of the size of the network of migrants working outside the village, and $w^l(H_t, M_{jt})$ and $w^m(H_t, M_{jt})$ are the corresponding wages that can be earned in the local and migrant labor markets.[14] We assume that as M_{jt} increases, the cost of migrating falls. The household will thus accumulate physical capital according to:

$$K_{t+1} = K_t + \theta_t F\left(K_{t-1}, H_t, L_t^h\right) + w^l(H_t, M_{jt})L_t^l + w^m(H_t, M_{jt})L_t^m - c_t \tag{1}$$

[14] We consider wages earned in the migrant labor market as net returns to the household from migrant employment. The migrant network may influence net income from migration by both lowering the cost of migration and by facilitating matches to higher quality jobs. These effects will be observationally indistinguishable, as they both raise the net return to participating in the migrant labor market. The positive effect of the village migrant share derives from the importance of referral for job search (Montgomery, 1991) and specifically, on the role of networks for the placement of migrants (Munshi, 2003).

where c_t is household consumption. We further restrict $K_t, K_{t+1} \geq 0$, which allows households to liquidate capital for consumption, but not to borrow beyond their capital stock for current expenditures on consumption. We expect the size of the migrant network to be positively associated with the net return to migrant employment, w_t^m, by lowering the cost of participating in the migrant market and improving the quality of job referrals for migrants.[15] The migrant network may have two general equilibrium effects on wages in the local economy. First, as labor shifts into migrant activities, the local non-agricultural labor supply decreases, putting upward pressure on the local off-farm wage. Second, to the extent that migrant employment relaxes household credit constraints, new investments in productive activities and housing construction may stimulate local labor demand, also potentially increasing local wages.

Current utility is an additively separable concave function of consumption, c_t, and the leisure of household members ($l_t = 1 - L_t^h - L_t^l - L_t^m$). The household's objective function is to maximize

$$E_0 \left[\sum_{t=0}^{T} \delta^t U\left(c_t, l_t\right) \right] \tag{2}$$

subject to (1) and the borrowing constraint, where δ^t is the subjective discount factor and E_0 is the expectations operator. Households are uncertain about future values of θ_t, $w(\cdot,\cdot)$, and T.

The first-order conditions for an interior solution are:

$$U_c\left(t\right) = \lambda_t \tag{3}$$

$$U_l\left(t\right) = \lambda_t \left(\theta_t F_{L_t^h}\left(K_{t-1}, H_t, L_t^h\right) + w^l(H_t, M_{jt}) + w^m(H_t, M_{jt}) \right) \tag{4}$$

where λ_t is the time-varying shadow value of physical capital that will be scaled by the discount factor, δ^t. Solving the system of equations yields a consumption demand function of the form:

$$c_t^* = c^* \left(\lambda_t, \theta_t F_{L_t^h}\left(K_{t-1}, H_t, L_t^h\right), w^l(H_t, M_{jt}), w^m(H_t, M_{jt}) \right) \tag{5}$$

Because preferences are additively separable, current period decisions depend on past decisions and expected future prices only through the shadow price of physical capital, λ_t. Further, after

[15] These effects are observationally indistinguishable, as they both raise the net return to participating in the migrant labor market.

controlling for λ_t, the borrowing constraint only influences intertemporal decisions through the intertemporal Euler equation and does not affect intratemporal decisions.

Using equations (3) and (4), we can trace out the potential effect of an increase in the village migrant labor network on demand for leisure and consumption goods. First, income earned in both the local and migrant labor markets increases, so the shadow price of physical assets, λ_t, falls. The wealth effect eases credit constraints associated with accumulating assets for productive activities (both agricultural and non-agricultural) and non-productive uses (e.g., investments in housing and durable goods). In addition, household consumption may increase by relaxing a credit constraint that led households to consume less and save more in each period as a precaution against potential future production shocks.

The second effect of an increase in size of the village migrant network operates through the shadow price of household labor time. If leisure is a normal good, the net effect on family labor supply is indeterminate. A substitution effect will lead families to supply more labor to productive activities, but an income effect may lead to a reduction in family labor supply. Our analyses below focuses on the net effect of migration on household consumption and income per capita, and also on household investment in productive and non-productive assets. To provide further understanding of the relationship between migration and household specialization, we will also examine impacts of migration on farm size and household labor supply.

We further simplify the consumption demand function by recognizing that household productivity will be a function of time varying household endowments and other characteristics, $\mathbf{X}_{it}$, that are related to wealth, skills, and human capital, which affect the potential returns that family members may earn both in the labor market and through household activities (e.g. Yang, 2004). Furthermore, capital endowments and local labor market returns will be influenced by factors that vary at the village level, $\mathbf{Z}_{jt}$, and we will consider unobservables, u_i, related to risk preferences and competencies of the household. We thus rewrite a reduced form of the demand function as:

$$c_{it}^{*} = c^{*}\left(w_{it-1}, \theta_t, \mathbf{X}_{it}, \mathbf{Z}_{jt}, M_{jt}, u_i\right) \tag{6}$$

where consumption of household i in period t is a function of the determinants of household income. The determinants include household wealth at the end of the previous period, w_{it-1}, which is a combination of the value of productive assets and financial wealth affecting the shadow price of physical capital, productivity shocks, household endowments and characteristics, village characteristics, the

size of the migrant network, and household unobservables, u_i.

4 Empirical Methodology

4.1 Estimating the Effect of Migration on Consumption

The theoretical framework above suggests the following empirical specification for household consumption, c_{it}:

$$c_{it} = \beta_1 w_{it-1} + \beta_2 M_{jt} + \beta_3 (w_{it-1} \cdot M_{jt}) + \mathbf{X}'_{it}\alpha + \mathbf{Z}'_{jt}\gamma + u_i + v_j + \mathbf{t}_j + \varepsilon_{ijt} \tag{7}$$

The logarithm of per capita household consumption in period t will be a function of measured household physical and financial wealth per capita at the end of period $t-1$, w_{it-1}, and the relative size of the migrant labor force from village j, M_{jt}. Household characteristics, $\mathbf{X}_{it}$, influence consumption through endowments**,** such as human capital, which affect household permanent income, and through demographic characteristics which influence consumption preferences. Since ability to participate in or benefit from the migrant labor market may affect households differently depending on their wealth level, we are also explicitly interested in the interaction, $w_{it-1} \cdot M_{jt}$. We include time-varying village variables to pick up heterogeneity across villages in policies and economic conditions, $\mathbf{Z}_{jt}$, that may influence consumption through effects on productivity. We use village dummy variables, v_j, to control for other observable and unobservable fixed characteristics of villages that may affect consumption, such as location, connections to off-farm markets and proximity to employers. Additionally, village specific trends, $\mathbf{t}_j$, related to underlying endowments and initial conditions in the village, may further affect consumption. At the household level, we also expect that fixed unobservables, u_i, will be related to consumption preferences and to the ease with which the household participates in the migrant labor market.

Household wealth is typically difficult to measure accurately because the valuation of productive asset stocks depends upon assumptions about depreciation and the useful life of assets, and the value of financial assets is frequently under-reported in household surveys. Moreover, access to transfers and informal loans from non-resident family members and friends will have an impact on expected lifetime wealth and current consumption, but the ability to receive transfers and loans will be unobservable to the econometrician. To proxy for lagged household wealth in equation (7), we use lagged household consumption, implicitly assuming that lagged consumption is strongly

correlated with perceptions of lifetime wealth at the start of period t.[16] Thus, we rewrite equation (7) as:

$$c_{it} = \beta_1 c_{it-1} + \beta_2 M_{jt} + \beta_3 (c_{it-1} \cdot M_{jt}) + \mathbf{X}'_{it}\alpha + \mathbf{Z}'_{jt}\gamma + u_i + v_j + \mathbf{t}_j + \epsilon_{it} \tag{8}$$

To control for fixed effects at the household and village level, we first-difference equation (8). We further add province-year interactions, $\mathbf{p} \otimes \mathbf{t}$, to control for the effects of province-wide macroeconomic shocks, and obtain:

$$\Delta c_{it} = \beta_1 \Delta c_{it-1} + \beta_2 \Delta M_{jt} + \beta_3 \Delta (c_{it-1} \cdot M_{jt}) + \Delta \mathbf{X}'_{it}\alpha + \mathbf{\Delta Z}'_{jt}\gamma + \mathbf{d}_j + \mathbf{p} \otimes \mathbf{t} + \Delta\epsilon_{it} \tag{9}$$

Differencing the village-specific trend leaves us with a vector of village dummy variables, $\mathbf{d}_j$, that control for differences in consumption growth trends across villages.

We will be most interested in coefficients β_2 and β_3, which capture the effect of the migrant labor market on consumption at different lagged consumption levels. For any given level of lagged consumption, the marginal effect of migration on present consumption is $\eta = \beta_2 + \beta_3 c_{it-1}$. If out-migration has a positive effect on household per capita consumption, we expect β_2 to be positive, and the sign of β_3 will indicate which households within the village experience faster consumption growth as the size of the migrant network expands. If β_3 is positive, wealthier households have faster consumption growth, *ceteris paribus*, whereas if β_3 is negative, poorer households within villages experience faster consumption growth with migration.

4.2 Endogeneity Concerns

The first three terms in equation (9), Δc_{it-1}, ΔM_{jt}, and $\Delta(c_{it-1} \cdot M_{jt})$ suffer from well known endogeneity problems. Errors in the measurement of lagged log consumption, c_{it-1}, will be present in both the dependent variable ($\Delta c_{it} = c_{it} - c_{it-1}$) and a regressor ($\Delta c_{it-1} = c_{it-1} - c_{it-2}$), and these will be correlated with the differenced error term, $\Delta\epsilon_{it}$. We instrument Δc_{it-1} with c_{it-3} under the assumption that c_{it-3} is correlated with Δc_{it-1} but not $\Delta\epsilon_{it}$. We then use an additional lag, c_{it-4}, to provide for over-identification.[17]

Change in our proxy for the cost of migration, the village migrant share, ΔM_{jt}, is endogenous as

[16] This approach is common in empirical estimation of dynamic models of consumption decisions. See Banks, Brugiavinni and Blundell (2001) for another example and additional references.

[17] Anderson and Hsiao (1982) actually suggest that the $t-2$ lag might be sufficient, but since shocks to consumption may have long memory in some villages, we use the $t-3$ lag. In a GMM framework, Arellano and Bond (1991) showed that all available lags back to period 1 may be used. Wooldridge (2002) cautions, however, that if correlation between the regressor Δc_{it-1} and distant lags are weak, then adding large numbers of additional weak instruments may introduce bias.

it reflects factors affecting both change in demand for migrant labor and change in labor supply decisions of migrants and potential migrants. Disruptions to the local economy, for example, decrease household consumption per capita while increasing the relative return to migrant employment in more distant locations, potentially leading to an observed negative relationship between increases in migration and consumption growth. To identify the effect of migration on consumption, it is necessary to find an instrument that is correlated with the share of village residents working as migrants, but otherwise unrelated to factors affecting growth or negative shocks experienced by the village.

To instrument for migration, we make use of two policy changes that, working together, affect the strength of migrant networks outside home counties but are plausibly unrelated to average village consumption growth. First, a new national ID card (*shenfen zheng*) was introduced in 1984. While urban residents received IDs in 1984, residents of most rural counties did not receive them immediately. In 1988, a reform of the residential registration system made it easier for migrants to gain legal temporary residence in cities, but a national ID card was necessary to obtain a temporary residence permit (*zanzu zheng*) (Mallee, 1995). While some counties made national IDs available to rural residents as early as 1984, others distributed them in 1988, and still others did not issue IDs until several years later. In a follow-up survey conducted with RCRE in 2004, we asked local officials when IDs had actually been issued to rural residents of the county. In our sample, 41 of the 88 counties issued ID cards in 1988, but cards were issued as early as 1984 in three counties and as late as 1997 in one county. It is important to note that IDs were not necessary for migration, and large numbers of migrants live in cities without legal temporary residence cards. However, migrants with temporary residence cards have a more secure position in the destination community, hold better jobs, and thus plausibly make up part of a longer-term migrant network in migrant destinations.[18] Thus, ID distribution had two effects after the 1988 residential registration (*hukou*) reform. First, the costs of migrating to a city should fall after IDs became available. Second, if the quality of the potential migrant network improves with the years since IDs are available, then the costs of finding migrant employment should continue to fall over time.[19]

[18] Migrants without temporary residents permits could be subject to detention, fines and repatriation to their rural homes. While relatively rare during most of the period after 1988, this practice took place in some cities where migrants were viewed as competing with local displaced workers during the economic retrenchment that followed state sector restructuring in the late 1990s (Solinger, 1999).

[19] Our identification strategy makes no attempt to explicitly identify the direct effect of the migrant network, as in Munshi (2003). Our purpose in using a function of years-since-IDs-issued is to identify the net effect of migration under the plausible assumption that networks of earlier migrants with legal residence may contribute to reducing the cost of migration.

As a result, the relative size of the migrant network should be a function of both whether or not cards have been issued and the time since cards have been issued in the village. Given that the size of the potential network has an upper bound, we expect years-since-IDs-issued to have a non-linear relationship with the share of the village labor force working as migrants, and growth in the size of this potential migrant network should decline after initially increasing with distribution of IDs. In Figure 4, we show a lowess plot of the relationship between years since IDs were distributed and the change in the share of village residents working as migrants from year $t-1$ to t. Immediately after IDs are distributed, the share of the village labor force working as migrants grows sharply, and then slows after seven years. This pattern suggests non-linearity in the relationship between ID distribution and new participants in the village migrant labor force. We thus specify our instrument as a dummy variable indicating that IDs had been issued interacted with years since issue, and then experiment with quadratic, cubic and quartic functions of years-since-IDs were issued. We settle on the quartic function for our instruments because we find it fits the pattern of expanding village migrant share better than the quadratic or the cubic functions.[20]

In order to exploit additional heterogeneity across villages in how the timing of ID card distribution affects the growth of migrant networks, we interact the quartic with the variance of historic village rainfall during important periods of the crop calendar.[21] Whether or not it is appropriate to interact the years-since-IDs were issued with the rainfall variance merits careful consideration. We expect that in villages with low rainfall variance, households would be less likely to respond to ID cards with migration and IDs will have less impact on growth of the migrant network from these villages. The interaction terms are valid instruments under the assumption that a village fixed effect controls for fixed differences across villages in the riskiness of the local environment, and that the rainfall variance interactions pick up differences in the rate of growth in networks across villages subsequent to distribution of IDs.

Since the differenced interaction term in equation (9), $\Delta(c_{it-1} \cdot M_{jt})$ is comprised of two endogenous regressors, we also include instruments for this term. We identify it using interactions between consumption in periods $t-3$ and $t-4$ and the eight instruments for the size of the migrant

[20] Results in the paper are robust to using the quadratic or cubic functions of years-since-IDs were issued.

[21] Giles and Yoo (2007) analyze the crop calendar and different combinations of monthly rainfall shocks, and demonstrate that for the villages and households of Anhui, Jiangsu, Henan and Shanxi, negative shocks between July and November are the strongest predictor of negative shocks to agricultural production during the following year. We have similarly examined the relationship between rainfall and the crop calendar for Hunan, Sichuan and Zhejiang, and found the shock from April to November to be more important, which makes some sense due to the longer growing season in these areas. Jilin's crop calendar is more similar to Henan and Shanxi, so we use the July-November period for Jilin.

network, M_{jt}. The coefficient on this term will be of interest for identifying the impact of migration at different levels of the wealth distribution within villages.

Finally, the regressors included in $\Delta\mathbf{X}_{it}$ and $\mathbf{\Delta Z}_{jt}$ might not be strictly exogenous. For example, income shocks that affect household consumption decisions may also have an impact on household composition, land characteristics or village policy. Below, we first estimate models that exclude $\Delta\mathbf{X}_{it}$ and $\mathbf{\Delta Z}_{jt}$, then successively add village and household regressors, treating them as exogenous and then as pre-determined but not strictly exogenous. For models in which regressors are treated as pre-determined, we use a standard panel data approach to control for possible endogeneity bias. Specifically, we instrument first-differenced predetermined variables with their $t-2$ lagged levels $[\mathbf{X}_{it-2}, \mathbf{Z}_{jt-2}]$ in specifications which include these regressors. $\mathbf{X}_{it-2}$ and $\mathbf{Z}_{jt-2}$ will be valid instruments as long as they are correlated with $\Delta\mathbf{X}_{it}$ and $\mathbf{\Delta Z}_{jt}$, but uncorrelated with any time-varying household unobservables included in the differenced error term, $\Delta\epsilon_{it}$.[22]

4.3 Understanding the Years-Since-IDs Instrument

ID distribution was the responsibility of county level offices of the Ministry of Civil Affairs, and these are distinctly separate from the Ministries of Agriculture and Finance which set policies affecting land, credit, taxation and poverty alleviation. Therefore it is plausible that ID distribution was not systematically related to unobservable policy decisions that have a direct effect on household consumption. Still, a function of the years since IDs were issued is not an ideal strategy for identifying village out-migration. Ideally, a policy would exist that was randomly implemented, affecting the ability to migrate from some counties but not others. As the differential timing of ID card distribution was not necessarily random, we must be concerned that counties with specific characteristics or that followed specific policies were singled out to receive ID cards earlier than other counties, or that features of counties receiving IDs earlier are systematically correlated with other policies affecting consumption growth. These counties, one might argue, were "allowed" to build up migrant networks faster than others.

To evaluate the plausibility of using years-since-ID-distribution as an instrument, we first categorize villages as receiving cards prior to 1988, in 1988, or after 1988, and look for significant differences in observable average village characteristics measured in 1988 (Table 2). In the third row of each characteristic, we report the p-value of t-tests of the equality of the mean within each

[22] Wooldridge (2002) provides a helpful introduction to standard panel data approaches to control for endogeneity bias of regressors that are predetermined but not strictly exogenous.

category with the combined mean of the other two categories. Several significant differences appear between villages that were early and late recipients of IDs, and we observe a general pattern consistent with the likelihood that early recipients of IDs were less remote, had smaller households, were less concentrated in agriculture and had higher consumption levels. In the fourth line for each item of Table 2, we report p-values of t-tests for the equality of means across categories after partialing out province fixed effects and geographic dummies for hilly or mountainous locations. After controlling for these variables, we observe fewer differences across villages in 1988 that are systematically related to timing of ID availability. Still, the existing differences suggest that we must control for these and other unobserved differences across villages by including village fixed effects in all our estimated models, and identifying the effect of migrant networks off of nonlinearities in the years since ID cards were distributed.

Even after controlling for village location with village fixed effects, one might be concerned that the timing of ID card receipt was endogenous. Specifically, the recognition that rural residents were migrating may have led county officials to issue IDs in response to a sharp rise in migration. If true, issuing IDs would have little to do with new migration, but might be correlated with existing migrant flows. The lowess plot of change in village migrant share versus years-since-IDs were issued indicates that out-migration accelerates immediately after or as IDs are issued and then slows by 10 years after issue (Figure 4). The pattern also suggests non-linearity in the relationship between the changes in the size of the village migrant outflow and the years since ID cards were issued.[23]

Although Figure 4 appears to demonstrate a pattern consistent with ID cards facilitating increased migration, a common time trend could be driving the observed relationship between receipt of IDs and change in out-migration. To address this possibility, we separate the sample into villages receiving IDs in 1988 or earlier and those receiving IDs after 1988, and plot the relationship between change in migration and ID receipt across these two groups of villages (Figure 5). While the estimated rate of increase in migration with ID distribution is not as steep for villages that were later recipients, this difference is not statistically significant, leading us to conclude that the apparent impact of ID distribution is not simply the result of a common trend.

In order to motivate allowing the effects of ID distribution to vary with riskiness of the local economy, we next use the lowess estimator to plot changes in the number of migrants in each village against years-since-IDs were issued by terciles of rainfall variance (Figure 6). For villages in the first

[23] One might be concerned that the pattern shown in Figure 4 is driven exclusively by the 41 villages receiving IDs in 1988, and so we plotted this relationship excluding villages receiving IDs in 1988 and observed no difference in the bivariate relationship.

and second tercile, with a lower rainfall variance, we find that migrant networks take longer to build up after the introduction of ID cards; the slope of the relationship between changes in migration and years-since-IDs is not as steep as for the third tercile, for which the village migrant network responds rapidly after the introduction of ID cards. These patterns suggest that, once we have controlled directly for riskiness of the local economy through a fixed effect, then interactions of rainfall variance with the quartic in years since IDs were issued will allow us to pick up additional differences across villages in the effect of the existing village migrant network on subsequent migration.

The observed lowess plots in Figures 4 through 6 still do not rule out the possibility that local village level effects, such as shocks to the village economy, may affect both household incentives to migrate and ID distribution decisions. To directly address this possibility, we estimate a discrete time duration model for ID distribution and test whether exogenous rainfall shocks, which make migration more attractive, are also significantly related to the distribution of IDs. Rainfall shocks affect local agricultural productivity and returns to labor in both local agricultural and non-agricultural sectors. Large shocks will be positively associated with household decisions to supply labor to the migrant labor market, and if these decisions drive distribution of IDs, then we should observe an impact of rainfall shocks on ID distribution.[24] To implement this test, we estimate a logit hazard model using village level data in which the dependent variable is equal to one in the year that IDs are distributed and zero prior to distribution. After IDs are distributed, the village drops from the sample for subsequent years. Regressors include province dummies and rainfall shocks for year $t-1$ and $t-2$ (Appendix Table A.1). We find no significant relationship between exogenous shocks to the local economy and distribution of IDs, and thus we have some confidence that household desire to supply labor to migrant destinations is not driving the timing of ID distribution.[25]

[24] Note that in this test we use the actual value of lagged shocks, rather than variance, which is a proxy for risk. In a Appendix, Giles and Yoo (2007) show the $t-1$ July-November rainfall shock, calculated as either an absolute or squared deviation from mean, is systematically related to negative shocks to earnings from the winter wheat crop harvested in year t. They also show that this shock is strongly related to increased participation in migrant labor markets, increases in the number of days in migrant employment and increased migrant remittances.

[25] Neither the $t-1$ nor $t-2$ rainfall shocks have a statistically significant independent effect on ID distribution. Moreover, the p-value on a chi-square statistic of the joint significance of rainfall shocks for years $t-1$ and $t-2$ is 0.26.

5 Results

5.1 The First-Stage

Before estimating equation (9), we first establish that our instruments, period $t-2$ values of a polynomial function of the years since ID cards were issued and interactions with rainfall variance, are significantly related to the change, from period $t-1$ to t, in the share of village residents working as migrants. We estimate the relationship with only province-year and village dummies included along with years-since IDs were issued specified as a quadratic, cubic, and quartic function (Table 3, columns 1 through 3) and then include interactions with the rainfall variance (columns 4 through 6). Each potential specification suggests a strong relationship between our candidate instruments and the change in the size of the village migrant network. We favor the quartic function and interactions with rainfall variance for two reasons. First, this instrument set (with the quartic) allows for additional flexibility in the functional form of the effects of ID card distribution on the migrant network.[26] Second, the partial R^2 increases significantly from the quadratic to the quartic, thus reducing the potential for bias in instrumental variables regression.[27]

In columns 7 and 8 we add controls for village and household level economic conditions that vary over time and may be related to both consumption growth and migration. Anticipating models in which we control for endogenous changes in village or household variables, we sequentially add village controls in column 7 and household controls in column 8, both lagged two periods. At the village level, we include the size of the village labor force to control for local returns to labor, the cultivable share of village land, total village land, and the share of land planted in orchards, which control for village land endowment and specialization in high value crops, and the share of village assets controlled by collectives to control for the returns to capital outside agriculture as well as local government involvement in the economy. At the household level, we include the number of working age members of the household, the share of household members that are male and female, respectively, land per capita, and the average education level of adults in the household. These variables control for the household labor, physical capital, and human capital endowments, respectively. In both cases, the relationship between the migrant network variable and the instruments for migration remain strong, and the F-statistic suggests that the complete

[26] The quartic was first favored in studies of empirical age earnings profiles as far less restrictive than the typical second order polynomial in age (Murphy and Welch, 1990).

[27] Since the bias in instrumental variables estimation is inversely proportional to the partial R^2, a higher partial R^2 also implies lower bias so long as each additional instrument is strongly correlated with the endogenous variable.

set of instruments has sufficient power to ease concerns over weak instrument bias.

5.2 The Timing of ID Distribution and Changes in Village Policy and Administrative Capacity

Results shown in Table 3 suggest that the timing of ID distribution is significantly related to changes in the share of village residents working as migrants. Although policies likely to affect consumption were set by local bureaus of the Ministries of Agriculture and Finance rather than the Ministry of Civil Affairs, one might still be concerned that the set of instruments is systematically related to changes in other time-varying village level policies or administrative capabilities. In turn, these policies may affect both changes in migration and per capita consumption. For example, village leaders have considerable control over implementation of grain procurement policy and land use by village residents, so it is important to know whether or not changes in variables reflecting policy changes are systematically related to the timing of ID distribution. If a systematic relationship exists, the instruments may proxy for factors other than migration that influence consumption growth within the village. A further concern is that changes in village administrative capacity might be systematically related to timing of ID distribution within the county, even though IDs became available at the county level and each county typically includes hundreds of villages.

To ensure that the instruments are not correlated with variables reflecting other policy changes that might affect consumption, we construct proxy variables for changes in time-varying village policy and administrative capacity, ΔVP_{jt}, and regress them on period $t-3$ and $t-4$ log consumption per capita, which are our instruments for the change in lagged log consumption in our main models, the quartic in years since IDs (ID_{jt-2}), and interactions with village rainfall variance (RV_j), period $t-2$ lagged household and village regressors, village fixed effects and province-year fixed effects:

$$\begin{aligned}\Delta VP_{jt} = {} & \gamma_1 c_{it-3} + \gamma_2 c_{it-4} + \alpha_1 ID_{jt-2} + \alpha_2 ID_{jt-2}^2 + \alpha_3 ID_{jt-2}^3 + \alpha_4 ID_{jt-2}^4 \\ & + \alpha_5 (RV_j \cdot ID_{jt-2}) + \alpha_6 (RV_j \cdot ID_{jt-2}^2) + \alpha_7 (RV_j \cdot ID_{jt-2}^3) + \alpha_8 (RV_j \cdot ID_{jt-2}^4) \\ & + \mathbf{Z}'_{jt-2}\alpha_8 + \mathbf{X}'_{jt-2}\alpha_9 + \mathbf{v}_j + \mathbf{p} \otimes \mathbf{t}_t + e_{ijt}\end{aligned} \tag{10}$$

In Table 4, we report F-tests on the quartic in years-since IDs were issued and interactions in specifications that both exclude household and village characteristics other than lagged consumption per capita (column 1) and the full reduced form which includes vectors of $t-2$ household and

village level characteristics (column 2). We first examine the relationship between our instruments and evidence on changes in implementation of grain policy. Rural farm households faced a grain quota that was effectively a tax, as households were required to provide grain to the government at below market price.[28] Households providing a relatively large share of their grain production to the government at quota price were more likely to be producing grain simply to meet quota requirements. For such households, production of grain crops to meet the quota may reflect a constraint on household production decisions that also affects income and consumption. In row 1, we show that the change in the share of grain sold at the quota price has no systematic relationship with the instruments, and so we conclude that changes in quota policy are not confounded with the timing of ID distribution and also driving consumption growth.

We next test whether changes in indicators of land tenure security are systematically related to the instruments. While farmers nominally had fifteen and then thirty year "leases" over the period from 1986 to 2003, leases were treated as policy recommendations, and village leaders often reallocated land more frequently for a variety of reasons.[29] The share of land in the village which households rent in or out reflects perceptions of long-term land tenure security. Land rental will not occur in areas where a rental transaction signals that a household no longer needs its land, and may thus find that the land it rents out is expropriated. Alternatively, some villages place excessive administrative procedures and conditions on rental transactions. We do not observe any sign of a statistically significant relationship between changes in land rental behavior of households and the timing of ID card distribution, suggesting that our instruments are not systematically related to changes in village policies toward land which also affect local investment or labor supply decisions, nor any subsequent consumption or income growth.

Next, we examine the relationship between changes in the weighted average local tax rate paid by households and the instruments. During the study period, villages charged several different administrative fees to support investment in local public goods and to cover village administrative costs. The weighted average village tax rate is a useful indicator of village administrative capacity. If village administrative capacity is related to timing of ID distribution, as village leaders lobby higher levels of government for IDs, this capacity could affect motives for migration and observed consumption growth. We find that the weighted average village tax rate is not systematically

[28] In the surveyed villages, as well as throughout rural China, the quota was phased out between 2001 and 2004.

[29] Local variation in land policy and in land tenure security in rural China has been documented by numerous scholars. A helpful selection of useful papers discussing the land tenure system, its consequences and village level policy include Kung (1995); Benjamin and Brandt (2002); Jacoby, Li, and Rozelle (2002); Brandt, Rozelle and Turner (2004); and Deininger and Jin (2005).

related to the timing of ID distribution (Table 4, row 4).

Finally, we examine whether changes in the log value of assets managed by the village collective are associated with the time since IDs were issued. Villages operating enterprises or otherwise managing village productive assets may differ systematically in their implementation of administrative policy and in the timing of ID distribution. A major divestment of assets by the village with bankruptcy of an enterprise, for example, might lead to an increase in village unemployment and decision by a local leader to facilitate migration by distributing IDs. Again, after controlling for other village characteristics, we find no evidence that ID distribution is systematically related to changes in village management of local enterprises and other production assets (Table 4, row 5).

5.3 The Effect of Migration on Household Consumption

To begin our examination of the effects of migration on consumption, we estimate OLS models of the effects of migration on consumption in both levels and first-differences. As one might expect if unobserved local shocks are an important factor driving initial migration decisions, the coefficient on migration is negative and insignificant in the OLS levels model (Appendix Table A.2). When estimated in first differences, we observe the negative coefficient on the differenced lagged dependent variable which is consistent with measurement error in consumption for period $t-1$ that is present in both dependent variable Δc_{it} and with the opposite sign in the lagged dependent variable, Δc_{it-1}. We therefore focus our analyses on IV-GMM models in which we control for simultaneity bias and other unobservables potentially related to our measure of migration and for mechanical forms of bias created by the lagged dependent variable. The weighting matrix used in the GMM estimator accounts for arbitrary heteroscedasticity and intracluster correlation, and it is asymptotically efficient in the presence of heteroscedasticity (Wooldridge, 2002; Baum, Schaffer, and Stillman, 2003).

We first estimate equation (9) removing unobservables at the household and village level through differencing, capturing village specific time trends with village dummy variables, and controlling for province-wide shocks with a set of province-year dummy variables (Table 5). We begin by restricting β_3 to zero, implying that the coefficient β_2 can be interpreted as the average effect of migration on the logarithm of consumption over all households within a village. We initially observe significant persistence in household consumption, and find that increasing out-migration has a positive effect on consumption that is significant at the 5 percent level. An over-identification test suggests that there is no statistical evidence against the validity of our instruments. In this

specification, the Cragg-Donald F-Statistic indicates that the bias in the IV coefficient is less than five percent of the bias in OLS.[30] We next add village and household controls, treating them first as exogenous (column 2) and then as predetermined (column 3), using $t-2$ levels of the household and village controls as instruments. Whereas the coefficient estimate $\hat{\beta}_2$ remains positive, its magnitude decreases and is no longer statistically significant.

We next relax the constraint that $\beta_3 = 0$, and allow the effect of migration on consumption to differ with lagged household consumption (Table 5, columns 4 through 6). The estimated coefficient $\hat{\beta}_2$ remains positive, and the estimated coefficient $\hat{\beta}_3$ is negative and statistically significant. The negative sign on the differenced interaction term suggests that increased access to migrant labor markets benefits poorer households within the village relative to well-off households. At the mean level of consumption for any specific year, the estimates imply that migration has a positive effect on consumption, and that the effect is larger for poorer households. The significance and relative magnitude of the coefficient estimates of interest do not change as differenced household and village controls are added (column 5), nor when they are treated as pre-determined (column 6). The potential endogeneity of changes to the village population and contemporaneous shocks is evident as the estimated coefficient on the change in the village labor force is close to zero when treated as exogenous, but positive and significant when treated as pre-determined. The effect of contemporaneous shocks from either the local economy or migrant destinations is more apparent when examining changes in household demographic characteristics. When household composition is treated as exogenous, we observe significant negative coefficients on change in number of working age laborers in the household. This negative coefficient estimate suggests that adults moving into the household may be associated with shocks experienced by these individuals in the previous period, and then lead to apparent declines in household consumption per capita. Once household size and demographic characteristics are treated as pre-determined but not strictly exogenous, we no longer observe significant negative effects of the number of laborers on consumption per capita.[31]

In order to examine the effects of migration on consumption at different points in the consumption distribution within villages we plot the predicted effect of a 10 percent increase in the village

[30] Stock and Yogo (2005) compute critical values of the Cragg-Donald F-Statistic when there are two and three endogenous regressors. In all of the models presented in this paper, we reject the hypothesis that the bias in IV coefficients is larger than 10 percent of the bias in OLS, and in most models we can reject the hypothesis that the bias is larger than 5 percent of the bias in OLS. To ensure that our estimates do not suffer from weak instrument bias, we follow Stock and Yogo's approach and re-estimated each model using Nagar's (1959) bias corrected two stage least squares, and found that our coefficient estimates did not differ (results available upon request).

[31] Jalan and Ravallion (1999) first noted the potential importance of treating household composition as endogenous when examining consumption smoothing in rural China.

migrant share from 1995 levels on consumption against prior year consumption (Figure 7). We calculate both the short-term effects (Panel A) and the long-term effects (Panel B), using the delta method to compute standard errors and 95 percent confidence intervals.[32] For values of consumption less than median per capita consumption in 1995, the point estimate for the effect of migration is positive and statistically significant at the 5 percent level. Therefore we can be confident that migration is positively associated with consumption growth among those households.

At the median level of per capita consumption in 1995, the coefficient estimates imply that if the migrant share of the village labor force increases by 10 percent, in the next period per capita consumption will increase by slightly more than 0.5 percent, *ceteris paribus*. The long term increase in consumption associated with the same one-time increase in migration is quite a bit higher, at 1.2 percent. Clearly, migration was a significant factor in increasing living standards in rural China. Finally, it is worth noting that although estimates are not statistically significant for the whole consumption distribution, point estimates are positive for nearly the entire distribution, so we can be reasonably confident that migration opportunity had a positive effect on consumption for most households.

5.3.1 Specification Issues

Although our main result suggests that increasing migration has a larger impact on poor households than richer ones, it is possible that the interaction term that which yields this finding is actually proxying for nonlinearities in the effect of past shocks on current consumption growth. Such nonlinearities might arise, for example, in the presence of credit constraints. If the interaction term is proxying for nonlinear effects of past shocks and we control for them, then the negative coefficient on the interaction term should disappear.

To examine whether our results are robust to such nonlinearities, we re-estimate equation (9) including $\Delta(c_{it-1}^2)$ as a regressor. We instrument this term with $t-3$ and $t-4$ values of log consumption squared and include it in a new estimate of equation (9) (Table 6). Whether we estimate the basic model (column 1) or the full model (column 2), we find virtually no change in the coefficients of interest, β_2 and β_3. We thus conclude that nonlinearities related to past shocks are not behind our finding that migration raises consumption of poorer households more than well off households. Therefore nonlinearities are not driving the findings in Table 5.

[32] The long-term effect of a one-time 10 percent increase in the share of the village employed as migrants is calculated as $\gamma = \frac{\beta_2}{1-\beta_1-\beta_3 M_j^{95}}$, where M_j^{95} is the village migrant share in village j in 1995.

A second specification issue arises from descriptive studies examining the relationship between migration and poverty in rural China. For example, Du, Park and Wang (2005) examine correlations between household participation in migrant employment and poverty status, and find that the probability of migration first increases with household income, and then begins to decrease. We are concernced with the general equilibrium effects of village migration on household consumption, and it is not necessary for a household to directly participate in the migrant market to benefit from increased migration. Nevertheless, an inverted-U relationship between migration and income may be present and masked by the assumption of a linear relationship in equation (9). If so, migration should have less effect on household consumption at low levels, increase and peak, and finally decrease for higher levels of consumption. We examine this possibility by including the square of the lagged consumption level interacted with the migration variable, and find some evidence of a quadratic relationship (Table 6, columns 3 and 4).[33] The coefficient on the squared consumption-migrant share interaction suggests a concave relationship between migration and consumption, but the coefficient estimates are not significant after adding household and village controls. Moreover, the overall effects of migration on household consumption are positive at all consumption levels observed in the dataset, suggesting that even if we allowed some non-linearity in the observed effect of migration on consumption, the effect would still be positive for the poor. Perhaps more troubling, the Cragg-Donald F statistic falls dramatically in these specifications, indicating that the larger instrument set is weaker after adding instruments for the second interaction term. Given both concern over weak instrument bias and only modest evidence that a quadratic relationship might be important, we continue to use only the interaction between migration and lagged consumption in further models.

5.4 Out-Migration and Income Per Capita

A strong effect of out-migration on the consumption of poor households might simply reflect a higher marginal propensity to consume out of additional income for poor households, or alternatively, may reflect a decline in the precautionary saving of poorer households.[34] In this case, increases in consumption with migration from villages may not reflect increases in household permanent income. To test whether incomes are also rising in response to migration, we re-estimate equation (9) using

[33] To instrument for the second interaction term, we interact the $t-3$ and $t-4$ levels of lagged consumption squared with the eight instruments for the number of village migrants.

[34] Giles and Yoo (2007) find, for example, that a larger migrant network is associated with a decline in precautionary saving, and that this effect is stronger for households below the poverty line.

the first-difference of log income per capita as the dependent variable and lagged income per capita as our proxy for wealth (Table 7).[35] The coefficients of interest have the same sign as when we used consumption as the dependent variable, and the statistical significance of the coefficients remains. Increases in out-migration lead to a significant increase in income per capita, and that the increase is also greater among poorer households.

We use the coefficients on migrant share and migrant share interacted with income to show the predicted effects of increasing village migration on household income per capita across the income per capita distribution for 1995 (Figure 8). Household income per capita rises faster for poor households within villages. As with consumption, migration has a statistically significant positive effect on income growth for households below median levels of income per capita in 1995. Finally, point estimates for the effect of migration on income are somewhat larger than for consumption, and so it is unlikely that reduced precautionary savings explain the rise in consumption associated with increasing out-migration.

Our results thus suggest that out-migration from the village is leading to growth in income and consumption per capita, and that migrant opportunity is contributing to more rapid growth among poorer households within villages. This result is consistent with Benjamin et al's (2005) observation that income from migrant employment was relatively equalizing within villages, and sheds light on the different dimensions of "ability" that may be important for employment in local versus migrant labor markets. Since it is reasonable to expect that individuals with higher observed ability are capable of benefiting from off-farm opportunities, it is not surprising that early research on inequality in rural China emphasized that differential access to local non-agricultural employment was a significant source of increased interpersonal inequality within villages (Rozelle, 1994; Morduch and Sicular, 2000). One might expect that migrant labor markets would also favor individuals with higher ability and contribute to further increases in inequality within villages. Declines in within village income inequality with migration raise the possibility that the dimensions of ability important for employment in local and migrant off-farm employment may differ. Local employment early in China's economic reform period was primarily in township and village enterprises (TVEs) managed by local cadres, and personal or family connections with these cadres may have been important for securing employment. While migrant employment is also likely se-

[35] We use the lagged income per capita to facilitate calculation of the long-term effects of a ten percent increase in the village migrant share. We estimated the effects on income using lagged consumption per capita as our proxy for wealth (Appendix Table A.3), and found that the direct short-term effects, reflected in the estimated coefficients on the migration and the interaction term are consistent with estimates shown in Table 7.

cured by referral, friends or relatives making referrals will be under less family pressure to refer individuals who lack the skills, drive or innate ability to prefer tasks on the job. The equalizing effect of migrant opportunities on within village inequality raises the possibility that high ability individuals, lacking the personal connections necessary to secure local employment, use migration to raise their households income relative to those households with members already employed in the local non-agricultural labor market.

5.5 Migrant Networks, Investment and Specialization

Taken together, the results in Tables 5 and 7 show that increases in household per capita consumption and income are associated with increasing out-migration, and that these effects are stronger among the poor. However, they do not shed light on the mechanisms by which migration affects consumption or income. First, the migrant labor market may relax credit constraints locally through remittances, resulting in higher productive investment either in agriculture or non-agricultural self-employment which contributes to increased earnings. Alternatively, households may respond to the relaxation of credit constraints by investing proceeds from migration in housing or consumer durables. Second, income may increase because migration makes it possible for households to supply more labor to productive activities, either directly as employees in migrant destinations, or through local employment as out-migration reduces the local labor supply. Third, households who have a comparative advantage in agriculture may find it easier to expand their land holdings and earn more income from agriculture.

Understanding these mechanisms may have quite significant implications for rural policy in China. For example, if labor market policies relaxing restrictions on living in urban areas increase agricultural investment, policy makers charged with designing agricultural policy should take these increases into account. Alternatively, if loosening labor market restrictions does not affect agricultural investment, and agricultural policy makers have reason to believe there are still important failures in credit markets which lead to low investment in high return activities, then these failures should be approached more directly. To learn about these mechanisms, we next directly examine the relationship between migration and factors which may drive income generation: investment, labor supply, and land use.

5.5.1 Investment

To observe whether credit constraints are relaxed by migration, we examine whether out-migration affects either productive investment or investment in housing or durables. We do so using the following specification:

$$\Delta K_{it} = \beta_1 \Delta c_{it-1} + \beta_2 \Delta M_{jt} + \beta_3 \Delta (c_{it-1} \cdot M_{jt}) + \Delta \mathbf{X}'_{it}\alpha + \mathbf{\Delta Z}'_{jt}\gamma + \mathbf{d}_j + \mathbf{p} \otimes \mathbf{yr} + \Delta \epsilon_{it} \qquad (11)$$

where in alternate models ΔK_{it} is the change in log value of productive assets, the change in ln(1+value of productive assets related to agriculture), the change in ln(1+value of productive assets for non-agricultural activities), and the change in log of the imputed value of housing and durable goods. The coefficient β_2 measures how each type of investment changes with the share of the village labor force employed as migrants, and β_3 measures differences in the effect of the village migration at different points in the initial consumption distribution. Instrument sets and identification strategies in equation (11) are identical to those employed in our consumption models, regardless of the dependent variable.

We initially estimate the effect of migration on aggregate productive investment (Table 8, columns 1 through 4). When we estimate the average effect of migration on productive investment by setting $\beta_3 = 0$, we find a positive coefficient that is statistically significant at the 5 percent level when we include pre-determined household and village controls. However, when we allow the effect to vary with initial consumption (columns 3 and 4), the estimated coefficient on the interaction term is positive and has a large standard error, indicating that richer households are more likely to invest in productive investment than poorer ones with increasing out-migration. This finding is at odds with the hypothesis that poorer households are able to alleviate credit constraints on production with expansion of migrant networks. Furthermore, when we predict the effect of migration on investment across the consumption distribution (Figure 9A), we find no indication that migration has a significant impact on productive investment by households at any point in the lagged consumption distribution, except for those at the very high end of the distribution. Finally, when we examine investment behavior separately for agricultural and non-agricultural investment (columns 5 through 12), we find no significant effects of migration on either type of productive investment. In sum, the evidence that migration has a positive effect on productive investment is weak at best. This result is somewhat at odds with other results found in the literature on migration in China (e.g. Murphy, 1999; Zhao, 2002). As we avoid selection on unobservables and treat

the endogeneity of migration more seriously than previous papers, one might conclude that the suggestive correlations found in other research on rural-urban migration in China can be explained by other, unobserved factors.

Rural residents remaining behind may well use remittances for investment in housing and durable goods, and this effect appears to be evident when we allow for housing and durable goods investment to vary with initial consumption. In the model that includes a full set of village and household controls, column (16) of Table 8 and shown in Figure 9B, we find a significant positive effect of out-migration on investment by households in the lower 25 percent of the consumption distribution.[36] While migration does not appear to lead to additional investment in local productive activities, at least when we interact village level migration with initial consumption, households in the lowest quartile of the consumption distribution do seem to invest proceeds from additional migration in housing and durables, improving their living conditions.

5.5.2 Labor Supply

Increases in the ability to earn income from the migrant labor market may have negative effects on household labor supply if the wealth effect of higher incomes dominates the substitution effect of leisure for labor. Households may have initially faced constraints in their ability to supply labor to the market, and if so, the expansion of migrant opportunity may allow them to increase income through expanded employment. Direct effects through supply of labor to the migrant labor market may be complemented by indirect effects through depletion of the local labor force or demand for labor in the local construction and service sectors.

To investigate this hypothesis, we modify equation (11) and use the change in the logarithm of labor days supplied (+1) as the dependent variable (Table 9). The results show the same pattern as the results for consumption and income; as the point estimate for the coefficient on the interaction term is negative (columns 3 and 4), households with lower levels of initial consumption appear to supply additional labor to the market when migration is more prevalent. When we graph the combined effects and calculate standard errors, we find that a ten percent increase in the village migrant share led to a significant increase in labor supply for households below median per capita consumption in 1995 (Figure 10A), and that magnitudes were greater for poorer households. Our

[36] Because migration increases investment in housing and durable goods, one might conclude that it is possible the whole increase in consumption found in Table 6 can be attributed to the increase in the imputed use value of housing and durables. When we use non-durables consumption as the dependent variable in equation (9), we find results largely consistent with Table 6, indicating that increased migration leads to both an increase in the imputed use value of housing and durables and an increase in non-durable consumption (Appendix Table A.4).

results are consistent with the hypothesis that poorer households are able to raise incomes by supplying more labor to productive activities as migrant opportunities expand.

5.5.3 Land Use

When rural residents leave for the city, land per capita available in the village will increase. However, to understand how out-migration affects poorer households within villages, it is important to know also how migration affects land distribution within villages. During much of the period under study, China lacked tradeable use rights and secure tenure and it is uncertain who benefitted from informal land transfers among family members or formal adjustments and reallocations presided over by village cadres. Benjamin and Brandt (2002), for example, have shown that village leaders substitute for the market in their reallocation decisions by redistributing land to those who could use it most productively.

To examine the impact of migration on the size of land holdings across the wealth distribution, we use the change in ln(land per capita) as the dependent variable in equation (11) (Table 10; Figure 10B).[37] The results are consistent with the hypothesis that the poorer households increased the land per capita under their management subsequent to increasing migration; the graphical representation of the results shows that land per capita increased for the poorest 25 percent of households in the sample (Figure 10B). Therefore poorer households do indeed benefit as other households specialize more in non-agricultural activities. While evidence shown in Table 8 suggests that actual productive investment in agriculture does not increase as a result of migration, poorer households benefit from increases in farm size with increases in the share of the village labor force employed in migrant activities.

5.5.4 Summary

Our main results suggest that poorer households increase consumption and income as working age laborers find employment as migrants living and working outside the village. Household incomes increase as poorer households increase labor supplied to productive activities and benefit from increases in farm size with out-migration. While we do not find robust evidence that households increase investment in productive activities, poorer households show significant increases in their investment in housing and durable goods.

[37] For regressions in Table 10 controlling for household characteristics we remove land per capita from the included control variables.

6 Conclusions

In this paper we demonstrated the positive effect that internal migration in China has had on the consumption per capita of households remaining in migrant sending communities, and also showed that these effects are stronger for poorer households within villages. Indeed, increased ease of migration from villages of rural China is associated with decreasing inequality within communities.[38] Increases in out-migration also lead to more pronounced increases in the income of poorer households, and poorer households supply more labor to productive activities and experience more rapid income growth.

With respect to the impact of migration on investment in rural areas, we find that increases in migration from rural China are associated with increased accumulation of housing wealth and consumer durables, but we do not find evidence of a significant relationship between migration and investment in productive assets. Evidence that migration might affect investment in agriculture and promote specialization among poorer households is mixed. While we find no significant increases in investments related to agricultural production, poorer households are observed to increase their land holdings per capita, and thus expand their scale of agricultural production. Contrary to assertions in the China literature and evidence from the literature on Mexico-US migration, we do not find any indication that rural-urban migration in China is associated with increases in household investment in non-agricultural production. The lack of a robust impact of migration on productive investment stands in contrast to recent findings from the literature examining the impacts of international flows of labor (Woodruff and Zenteno, 2007; Yang, 2008).

[38] McKenzie and Rapoport (2006) document a similar effect of international migration on rural communities in Mexico.

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Figure 1
Share of Village Labor Force Employed
as Migrants By Year

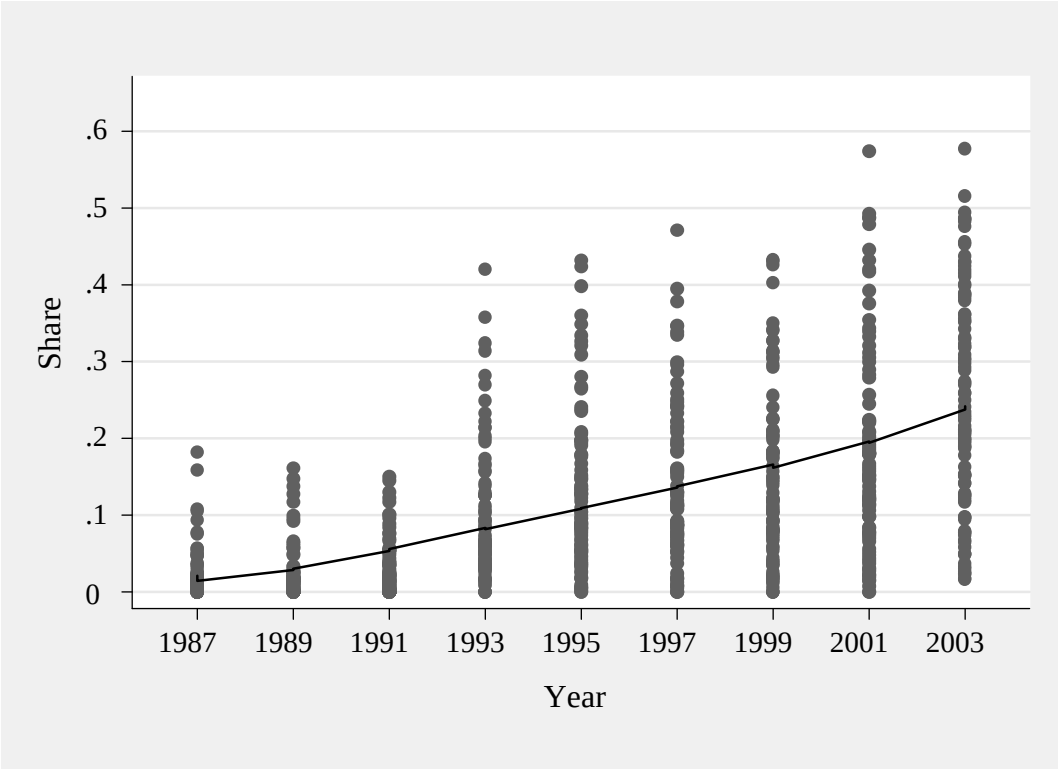


Figure 1 shows the share of registered village residents who live and work outside the village and home county. Source: RCRE Village Surveys, 1987-2003.

Figure 2
Village Average Consumption Growth and Change in Migrant Share of Village Population

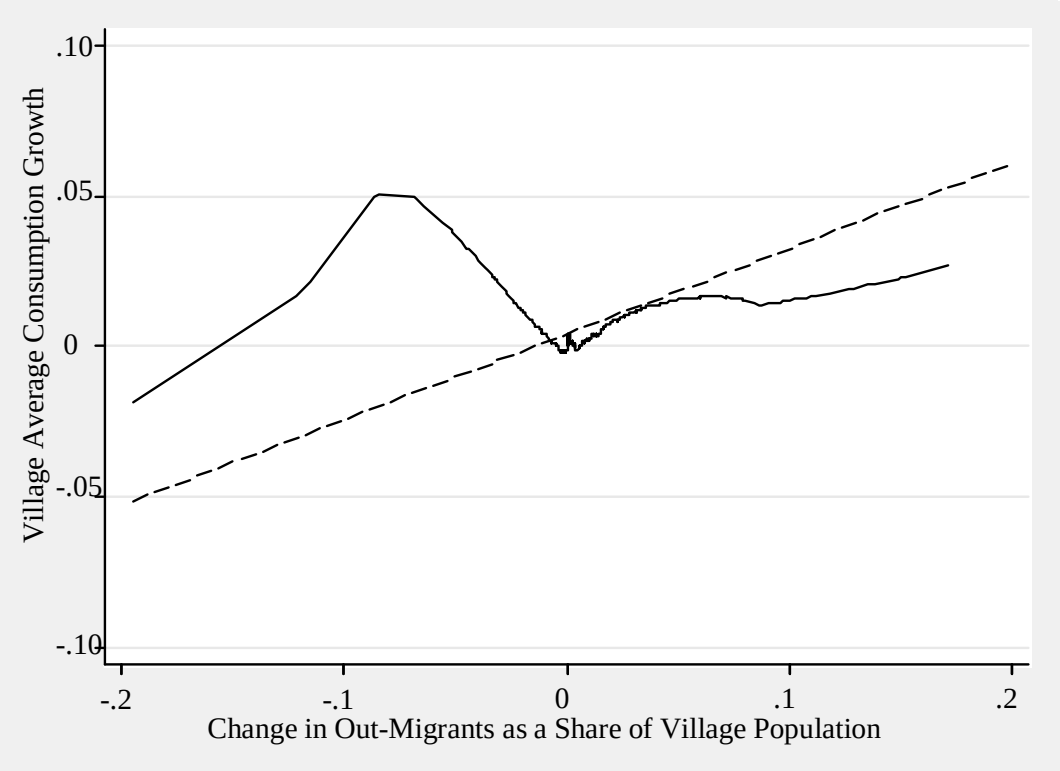


Figure 2 shows the linear and lowess fits of the relationship between annual village average consumption growth and annual changes in the share of migrants from the village. Migrants are registered residents of the village who live and work outside the village and home county. Source: RCRE Village and Household Surveys, 1986-2003.

Figure 3
Change in Poverty Headcount as a Function of the Change in the Migrant Share of the Village Population

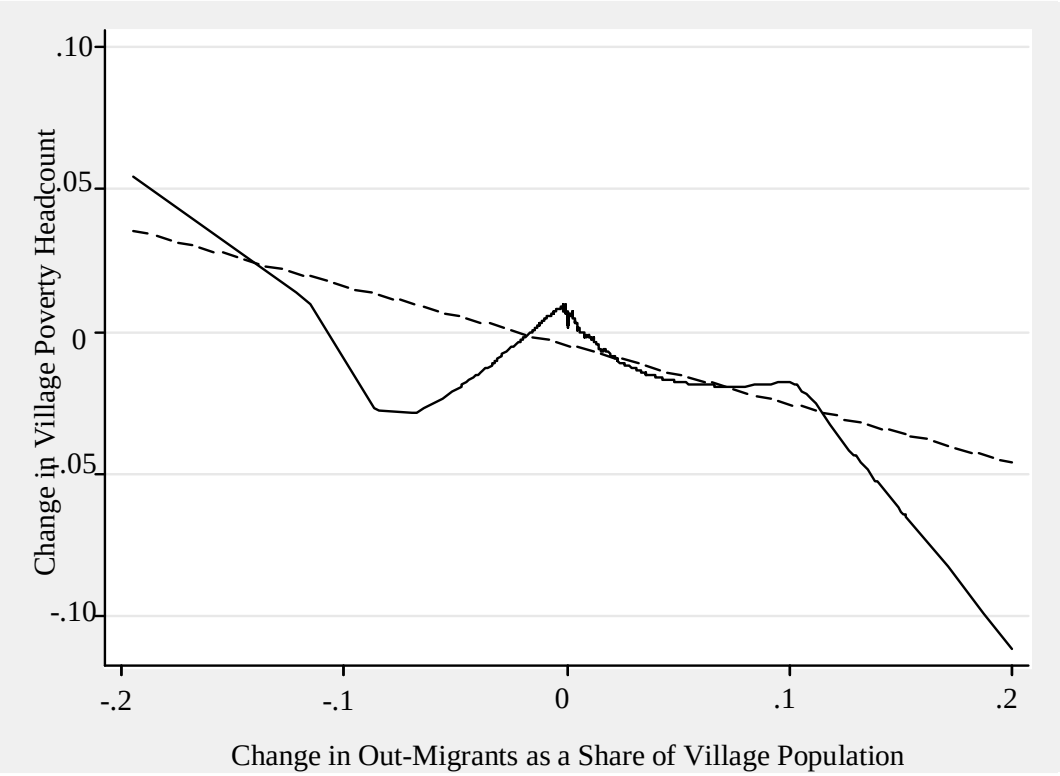


Figure 3 shows the linear and lowess fits of the relationship between the annual change in the village poverty headcount ratio and the change in share of migrants from the village. Migrants are registered residents of the village who live and work outside the village and home county.
Source: RCRE Village and Household Surveys, 1986-2003.

Figure 4
Change in Village Share Out-Migrants versus
Years-Since-IDs were Distributed

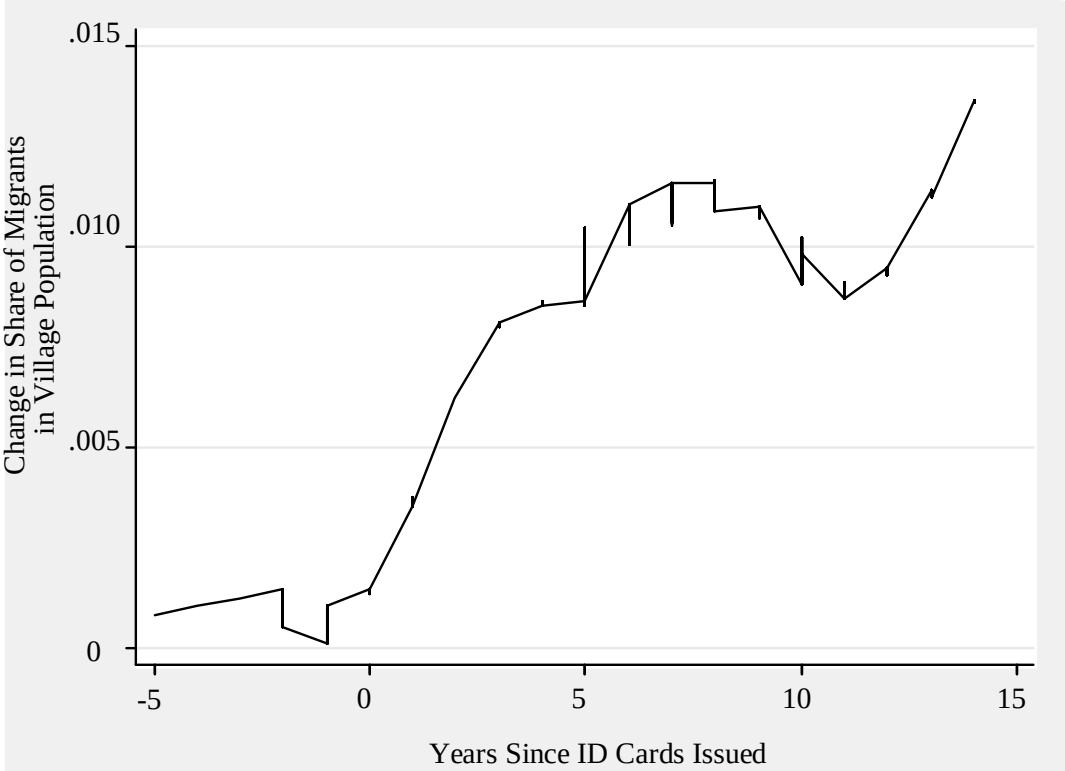


Figure 4 shows the relationship between change in annual share of migrants from the village and number of years since ID cards became available in the county.
Sources: RCRE Village Surveys, 1986-2003 and Supplementary Village Governance Survey (2004).

Figure 5
Change in Village Share of Out-Migrants Versus Years-Since-IDs for Early and Late Recipients of IDs

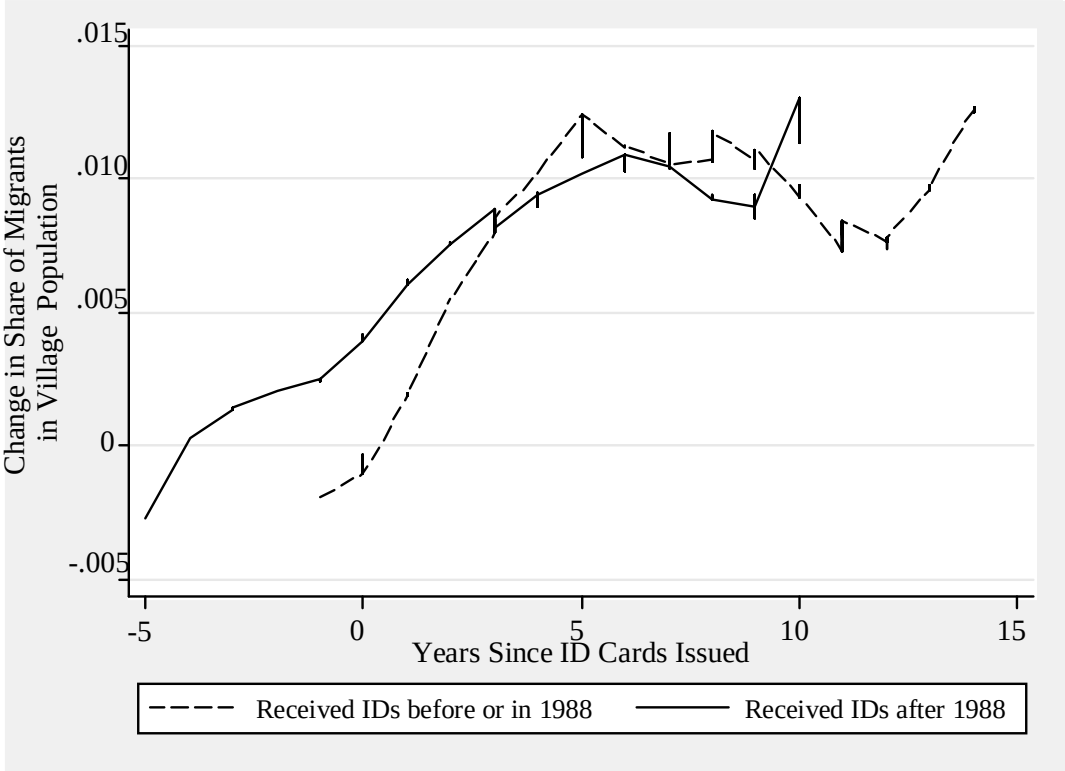


Figure 5 contrasts the relationship between annual change in share of migrants and availability of ID cards for counties that were early and late recipients of IDs.
Sources: RCRE Village Surveys, 1986-2003 and Supplementary Village Governance Survey (2004).

Figure 6
Change in Share of Village Migrants by Years Since IDs Issued
By Variance of Village Rainfall

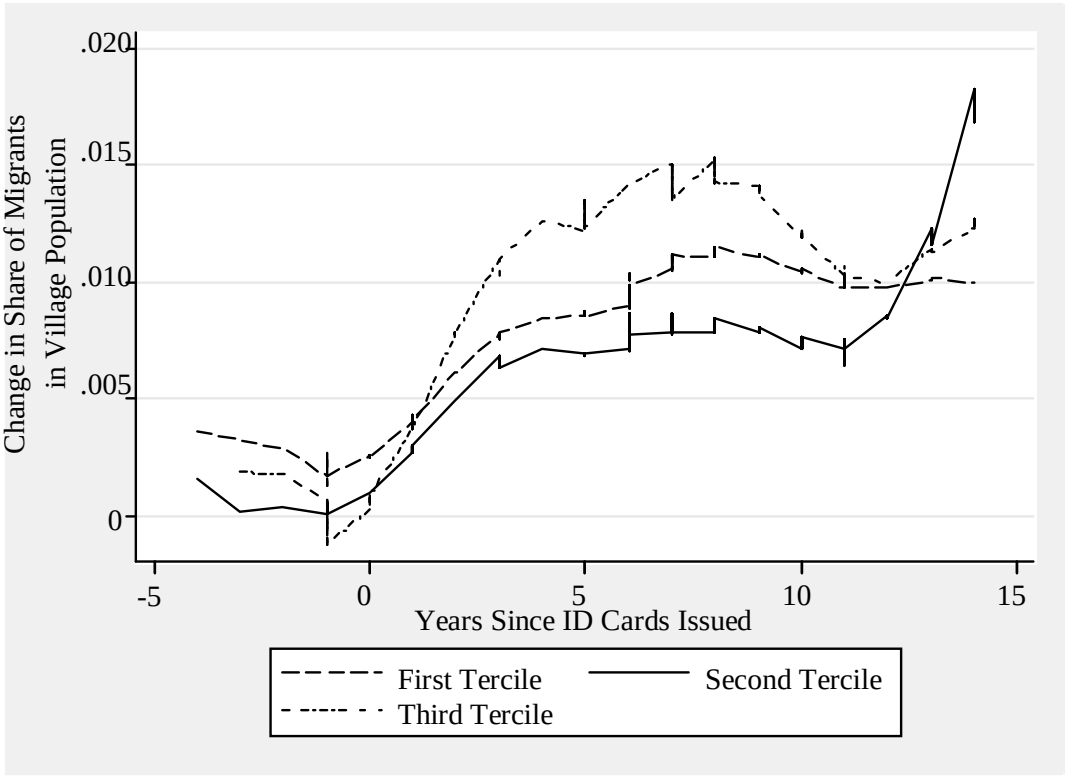
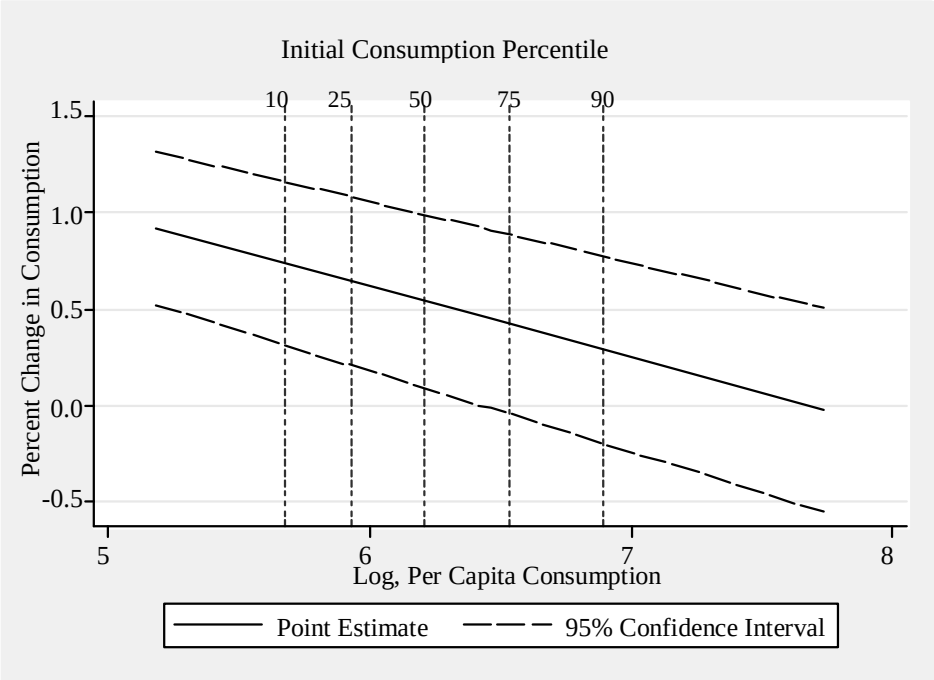


Figure 6 contrasts the relationship between change in migration and availability of ID cards for counties that had *low* (first tercile) versus *high* (third tercile) variability of rainfall.
RCRE Village Surveys, 1986-2003, Supplementary Village Governance Survey (2004), monthly rainfall data for the period 1978 to 2000 collected from county weather stations.

Figure 7
Effects on Consumption Per Capita of a 10 Percent Increase in Migrant Share of Village Population From Different Levels of Initial Consumption
(Using 1995 Levels of Consumption and Mean 1995 Village Migrant Share)

A. Short-Term



B. Long-Term

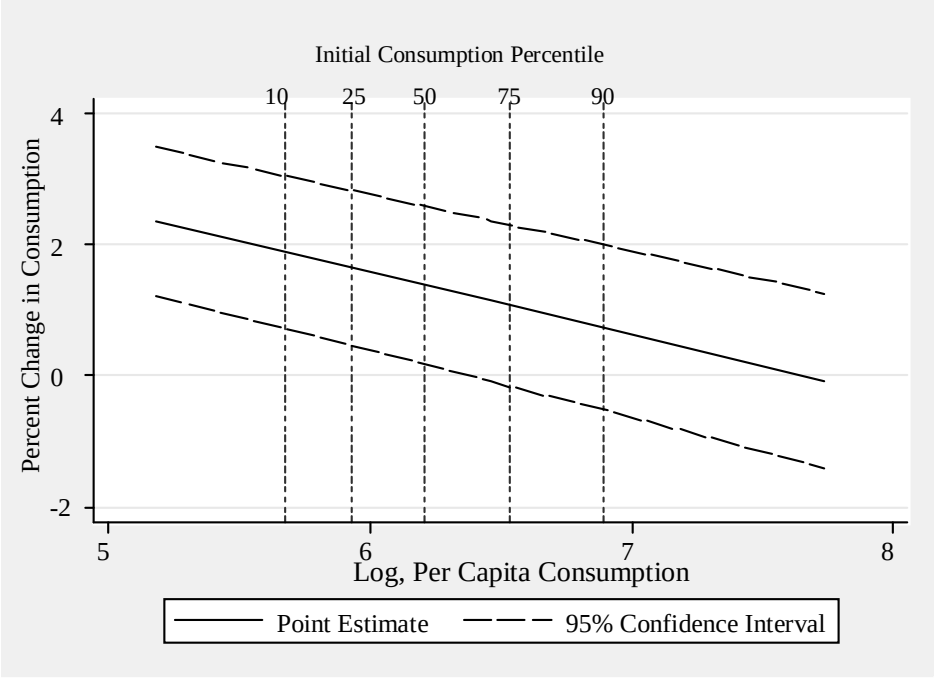
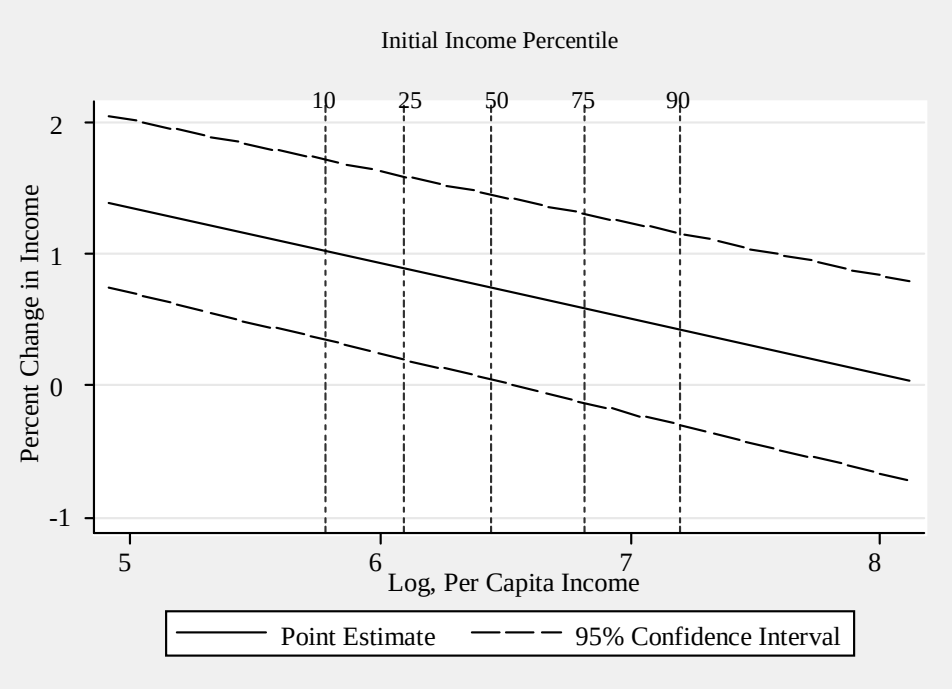


Figure 8
Effects on Income Per Capita of a 10 Percent Increase in Migrant Share of Village Population at Different Levels of Initial Income
(Using 1995 Levels of Income Per Capita)

A. Short-Term



B. Long-Term

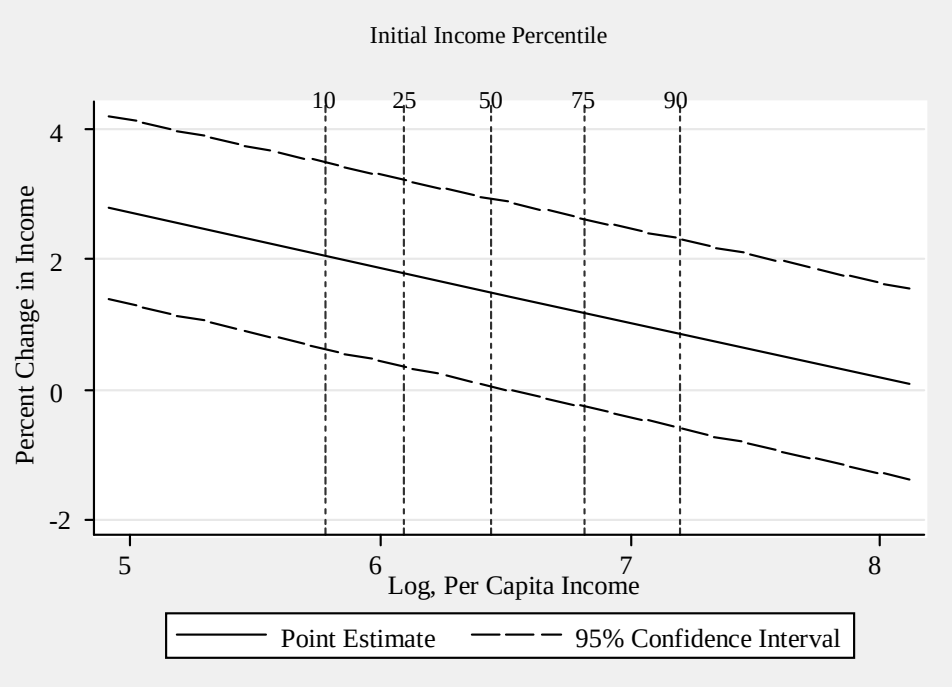
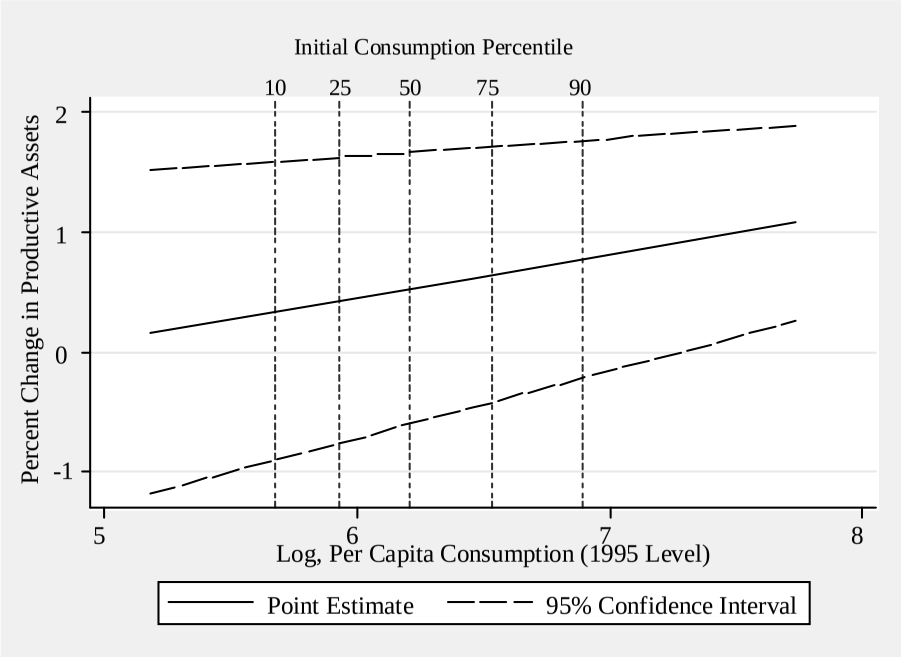


Figure 9
Effects on Investment Per Capita of a 10 Percent Increase in Migrant Share of Village Population at Different Levels of Consumption Per Capita
(Using 1995 Levels of Consumption Per Capita)

A. Investment in Productive Assets



B. Investment in Housing and Durable Goods

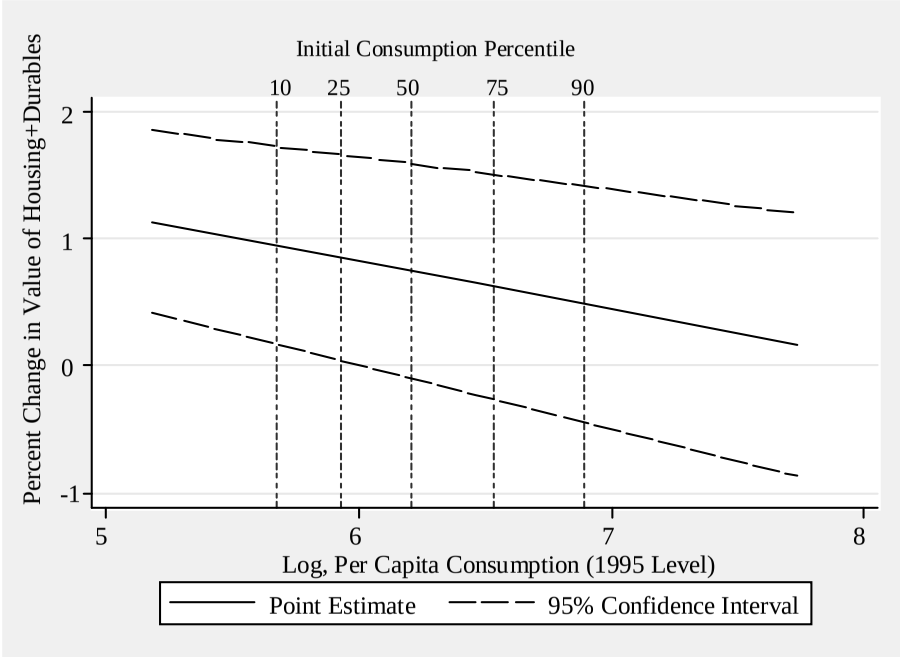
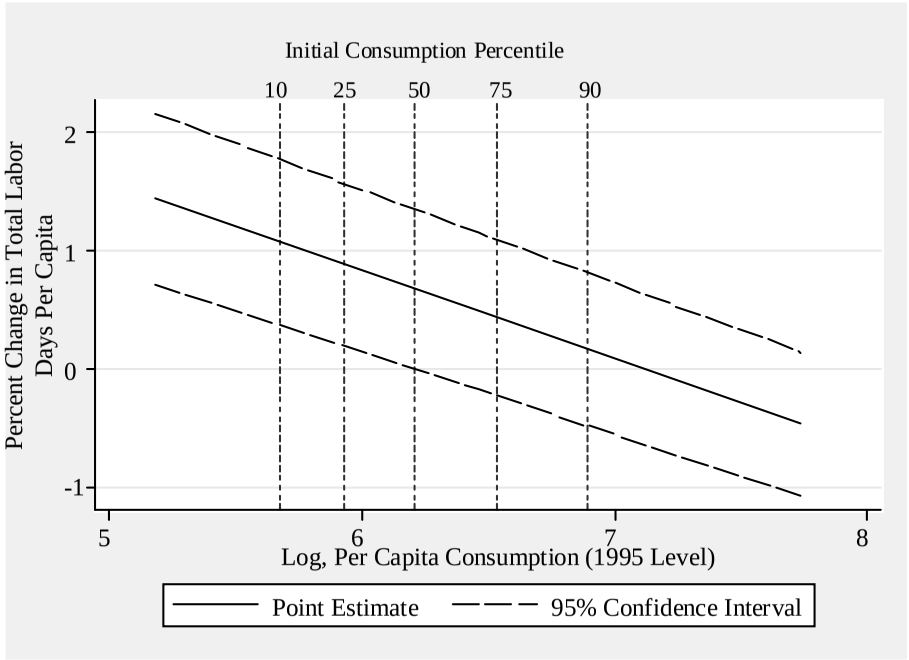


Figure 10
Effects on Labor Supply and Household Farm Area of a 10 Percent Increase in Migrant Share of Village Population at Different Levels of Consumption Per Capita
(Using 1995 Levels of Consumption Per Capita)

A. Household Labor Supply



B. Household Managed Land

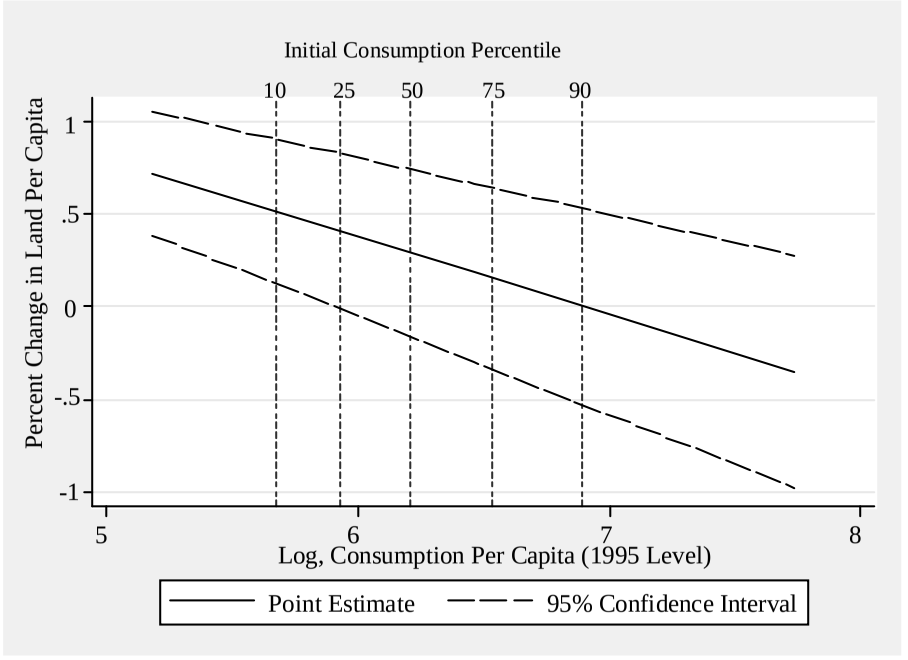


Table 1
Local Networks of Rural-Urban Migrants at Time of Migration
Five-City CULS Migrant Survey*

	Source Community Location	
	All Provinces	RCRE Provinces
Share of Migrants with:		
Job Arranged Before *First* Migration Experience	0.52	0.57
Job Arranged Before *Current* Migration Experience	0.53	0.56
Some Acquaintance from Home Village in City Before Migrating	0.91	0.94
**Close Family Member in City Before Migration	0.35	0.35
**Extended Family Member in City Before Migration	0.52	0.58
**Hometown Acquaintances	0.65	0.67
Five or Fewer Hometown Acquaintances	0.39	0.44
More than Five Hometown Acquaintances	0.27	0.24
At Least One Local Acquaintance	0.09	0.08
Number of Migrants	2,463	481

*Respondents are holders of rural registration (*hukou*). The survey was conducted in Fuzhou, Shanghai, Shenyang, Wuhan and Xian during late 2001. Sample frames were assembled using information on distribution of migrants within cities from the 2000 Population Census. After selecting neighborhoods through a proportional population sampling procedure, sample frames were assembled using residents' committee records of migrant households and registers of migrants living on construction sites and held by local by police stations. Very short-term migrants, who lack a residence that falls under the jurisdiction of either of these authorities, are unlikely to have made it into the sample frame.

**A *close family member* is adult sibling or member of nuclear family (e.g., spouse, child, parent). An *extended family member* refers to cousins or other relatives. *Hometown acquaintances* are unrelated, but known by the respondent. Note that migrants may have acquaintances in several categories, so that subcategories of acquaintances will add to more than 100.

Table 2
Average Village Characteristics in 1988
by Timing of ID Card Distribution

		Year ID Cards Were Issued		
		prior to 1988	in 1988	after 1988
Share of Productive Assets Owned by the Village Collective	mean	0.38	0.28	0.27
	std. dev	0.29	0.23	0.26
	p-value	0.074	0.367	0.118
	p-value, loc	0.392	0.560	0.309
Mean Consumption Per Capita	mean	513.6	398.7	413.9
	std. dev	209.1	140.9	139.7
	p-value	0.005	0.057	0.438
	p-value, loc	0.060	0.159	0.707
Mean Income Per Capita	mean	724.6	529.0	598.8
	std. dev	333.9	207.4	395.1
	p-value	0.017	0.036	0.895
	p-value, loc	0.522	0.206	0.444
Cultivable Share of Total Land Area	mean	0.64	0.518	0.526
	std. dev	0.315	0.285	0.278
	p-value	0.081	0.266	0.567
	p-value, loc	0.132	0.613	0.315
Share in Mountains	mean	0.148	0.195	0.318
	std. dev	0.362	0.401	0.477
	p-value	0.344	0.737	0.160
Share Near a City	mean	0.148	0.026	0.045
	std. dev	0.362	0.160	0.213
	p-value	0.048	0.161	0.630
	p-value, loc	0.051	0.205	0.545
Average Household Size	mean	3.763	4.113	4.201
	std. dev	0.482	0.459	0.602
	p-value	0.002	0.179	0.077
	p-value, loc	0.194	0.979	0.176
Total Village Land	mean	4014	5169	6589
	std. dev	4386	5320	7830
	p-value	0.218	0.999	0.189
	p-value, loc	0.877	0.438	0.291

Note: We report p-values for t-tests of the hypothesis that the mean is the same as the joint mean of the other two categories. *P-value, loc* reports the p-value of the t-test after partialing out province and terrain (location in mountains and hills) fixed effects.

Table 2 Continued On The Next Page

Table 2 (Continued)

		Year ID Cards Were Issued		
		prior to 1988	in 1988	after 1988
Village Cadres Share of Village Population	mean	0.007	0.005	0.006
	std. dev	0.006	0.003	0.006
	p-value	0.233	0.419	0.734
	p-value, loc	0.819	0.477	0.567
Share of Households Primarily in Agriculture	mean	0.679	0.840	0.823
	std. dev	0.324	0.240	0.300
	p-value	0.019	0.121	0.494
	p-value, loc	0.585	0.643	0.961
Village Population	mean	1359	1330	1511
	std. dev	870	597	918
	p-value	0.839	0.557	0.372
	p-value, loc	0.479	0.454	0.916
Village Consumption Per Capita Gini	mean	0.176	0.161	0.162
	std. dev	0.033	0.025	0.031
	p-value	0.030	0.173	0.469
	p-value, loc	0.239	0.311	0.928
Village Income Per Capita Gini	mean	0.231	0.227	0.223
	std. dev	0.067	0.050	0.073
	p-value	0.734	0.985	0.733
	p-value, loc	0.250	0.444	0.733
Village Cultivable Land Per Capita Gini	mean	0.226	0.161	0.197
	std. dev	0.109	0.059	0.094
	p-value	0.011	0.006	0.690
	p-value, loc	0.302	0.047	0.244
Village Poverty Headcount, Using Official poverty line	mean	0.070	0.091	0.041
	std. dev	0.201	0.155	0.080
	p-value	0.936	0.319	0.290
	p-value, loc	0.940	0.741	0.646
Village Poverty Headcount, Using Chen-Ravallion Poverty Line	mean	0.174	0.325	0.235
	std. dev	0.279	0.333	0.255
	p-value	0.091	0.057	0.711
	p-value, loc	0.195	0.101	0.622
Share of Households in Largest Patrilineal Clan	mean	0.379	0.376	0.355
	std. dev	0.260	0.315	0.282
	p-value	0.879	0.902	0.762
	p-value, loc	0.821	0.971	0.843
Observations		27	39	22

Note: P-values test the hypothesis that the mean is the same as the joint mean of the other categories; P-Value Loc: Tests the same hypothesis after partialing out provincial and terrain (mountain or hill effects) fixed effects.

Table 3
Developing the First-Stage: Timing of ID Card Distribution and Change in Share of Migrants in Village Population

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(Years Since IDs Issued)$_{t-2}$	-0.023	-0.008	0.087	-0.004	-0.026	0.031	0.042	0.041
	(0.002)	(0.004)	(0.006)	(0.002)	(0.005)	(0.009)	(0.009)	(0.009)
[(Years Since IDs Issued)$_{t-2}$]^2/10	0.011	-0.016	-0.335	-0.003	0.051	-0.117	-0.149	-0.146
	(0.001)	(0.006)	(0.018)	(0.002)	(0.008)	(0.028)	(0.028)	(0.028)
[(Years Since IDs Issued)$_{t-2}$]^3/100		0.013	0.360		-0.028	0.140	0.171	0.169
		(0.003)	(0.018)		(0.004)	(0.029)	(0.029)	(0.030)
[(Years Since IDs Issued)$_{t-2}$]^4/1000			-0.119			-0.054	-0.063	-0.063
			(0.006)			(0.010)	(0.010)	(0.010)
(Variance of Rainfall) * (Years Since IDs Issued)$_{t-2}$				-0.655	1.138	2.674	2.480	2.584
				(0.054)	(0.124)	(0.234)	(0.235)	(0.239)
(Variance of Rainfall) * [(Years Since IDs Issued)$_{t-2}$]^2/10				-0.496	-3.328	-9.473	-8.942	-9.244
				(0.046)	(0.239)	(0.803)	(0.804)	(0.815)
(Variance of Rainfall) * [(Years Since IDs Issued)$_{t-2}$]^3/100					1.947	9.327	8.847	9.123
					(0.117)	(0.892)	(0.893)	(0.904)
(Variance of Rainfall) * [(Years Since IDs Issued)$_{t-2}$]^4/1000						-2.728	-2.576	-2.656
						(0.315)	(0.315)	(0.319)
Two Period Lag Village Contols Included?	No	No	No	No	No	No	Yes	Yes
Two Period Lag Household Controls Included?	No	No	No	No	No	No	No	Yes
Number of Obs.	53106	53106	53106	53106	53106	53106	53019	52174
R^2	0.006	0.008	0.016	0.013	0.02	0.039	0.045	0.046
F statistic	41.501	40.059	61.141	49.609	57.102	83.684	81.389	71.306
Partial $R^{2,}$, Instruments	0.0038	0.0046	0.0119	0.0048	0.0079	0.0124	0.0130	0.0137

Notes: (1) All models include jointly significant controls for village and province*year effects, as well as other included instruments. (2) Dependent variable is change in number of the migrants from the village between year t-1 and t divided by 100. (3) Robust standard errors are cluster corrected at the village, and there are 90 village clusters. (4) Two-period lag village controls include: total number of working age laborers in registered village labor force, total village land, share of land in village in orchards, share of total assets owned by the village collective. (5) Two-period lag household controls include: number of working age laborers in the household, male working age laborer share of household population, female working age laborer share of household population, household land per capita, value of household productive assets, average years of education of working age laborers.

Table 4
Are the "Years-Since IDs" Instruments Correlated with Changes in Time-Varying Village Policies?
F-Statistics on Instruments (p-values in parentheses)

	Explanatory Variables Included	
Policy Variable	Instruments (Years Since ID cards issued in quartic, plus interactions)	Instruments + Household and Village Controls
Share of Grain Sold at Quota Price (Calculated by value)	0.72 (0.67)	0.35 (0.941)
Share of Households Renting-in Land	1.59 (0.14)	1.63 (0.127)
Share of Households Renting-out Land	1.72 (0.104)	1.43 (0.195)
Average Village Per Capita Tax Rates Paid by Households	1.17 (0.327)	1.61 (0.133)
Logarithm, Value of Assets Managed by the Village Collective	0.68 (0.704)	0.77 (0.629)

Notes: Each policy variable listed is the dependent variable in regression models and we report the F-statistic for the hypothesis that the coefficients on the instruments are jointly equal to zero. The instruments are the quartic in years since ID cards were issued, and interactions of the quartic with the village variance of rainfall. The number in parentheses is the p-value for the F-statistic. All regressions used the policy variable in as the dependent variable, and all variables in all regressions are differenced to control for household fixed effects. All regressions also included village and province-year dummies to account for village specific trends and province level macroeconomic shocks. Village controls lagged two periods include the total number of working age laborers in the registered village labor force; total village land area; the share of village land in orchards; and the share of total assets owned by the village collective. Twice lagged household controls include the number of working age laborers in the household; the share of the household that is male and of working age; the share that is female and of working age; household land per capita; and the average years of education among adults. All regressions also include the third and fourth lags of household consumption per capita to control for wealth effects.

Table 5
Migration and Household Consumption in Migrant-Sending Villages
(All Models in First Differences)

	Dependent Variable: ln(Household Consumption Per Capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
$\ln(\text{Household Consumption Per Capita})_{t-1}$	0.596	0.506	0.540	0.614	0.53	0.568
	(0.036)	(0.036)	(0.054)	(0.030)	(0.030)	(0.036)
$\ln(\text{HH Consumption Per Capita})_{t-1}$ * (Share of Migrants in Village Population)				-0.729	-0.313	-1.17
				(0.345)	(0.356)	(0.414)
Share of Migrants in Village Population	1.736	1.407	1.170	5.102	2.262	7.156
	(0.904)	(0.836)	(0.901)	(2.067)	(2.142)	(2.456)
Village Level Control Variables						
Village Labor Force		0.001	0.037		0.001	0.036
		(0.004)	(0.018)		(0.003)	(0.015)
Cultivable Share of Village Land		0.292	0.551		0.132	0.271
		(0.116)	(0.403)		(0.074)	(0.284)
Total Village Land		0.018	0.045		0.008	0.012
		(0.010)	(0.026)		(0.007)	(0.029)
Share of Assets Owned by Village Collective		-0.054	-0.426		-0.046	-0.181
		(0.032)	(0.220)		(0.026)	(0.112)
Share of Village Land in Orchards		0.121	-0.486		0.236	0.066
		(0.170)	(0.989)		(0.099)	(0.500)
Household Level Control Variables						
Working-Age Male Share of Household Population		0.553	0.302		0.555	0.336
		(0.028)	(0.122)		(0.025)	(0.093)
Working-Age Female Share of Household Population		0.546	-0.054		0.542	0.057
		(0.029)	(0.167)		(0.023)	(0.130)
Number of Working Age Laborers in the Household		-0.106	<0.001		-0.106	-0.008
		(0.007)	(0.020)		(0.006)	(0.015)
Cultivable Land Per Capita		0.062	0.007		0.064	0.008
		(0.007)	(0.018)		(0.006)	(0.013)
Household Average Years of Education		-0.002	-0.013		-0.002	-0.014
		(0.002)	(0.005)		(0.002)	(0.005)
Village, HH Controls Predetermined?		No	Yes		No	Yes
Regression Statistics						
Hansen J Statistic	9.66	10.57	10.65	21.77	22.08	30.8
P-value, J statistic	0.29	0.227	0.223	0.534	0.516	0.128
Shea partial R^2, migration	0.0106	0.0106	0.0091	0.0216	0.0207	0.0213
Cragg-Donald F-Statistic	53.099	52.108	14.907	23.774	24.01	9.942
Number of Clusters	88	88	88	88	88	88
Number of Observations	53106	51826	51608	53106	51826	51608

Notes: All models are run in first-differences and include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. Standard errors clustered at the village level. Lagged consumption, the interaction between consumption and migration, and migration are treated as endogenous.

Table 6
Migration and Household Consumption, Alternative Relationships

	Dependent Variable: ln(Household Consumption Per Capita)			
$\ln(\text{Household Consumption Per Capita})_{t-1}$	0.209	-0.289	-0.273	-0.279
	(0.345)	(0.359)	(0.294)	(0.545)
$(\ln(\text{HH Consumption Per Capita})_{t-1})^2$	0.033	0.072	0.07	0.065
	(0.028)	(0.030)	(0.024)	(0.045)
$\ln(\text{HH Consumption Per Capita})_{t-1}$ * (Share of Migrants in Village Population)	-0.792	-1.131	7.204	2.113
	(0.339)	(0.384)	(2.202)	(5.115)
$(\ln(\text{HH Consumption Per Capita})_{t-1})^2$* (Share of Migrants in Village Population)			-0.612	-0.221
			(0.171)	(0.409)
Share of Migrants in Village Population	5.659	7.222	-19.891	-4.161
	(2.040)	(2.281)	(6.886)	(15.673)
Village Level Control Variables				
Village Labor Force		0.031		0.029
		(0.014)		(0.008)
Cultivable Share of Village Land		0.348		0.199
		(0.263)		(0.218)
Total Village Land		0.033		0.025
		(0.025)		(0.019)
Share of Assets Owned by Village Collective		-0.094		-0.072
		(0.099)		(0.072)
Share of Village Land in Orchards		0.229		-0.002
		(0.433)		(0.347)
Household Level Control Variables				
Working-Age Male Share of Household Population		0.294		0.377
		(0.096)		(0.133)
Working-Age Female Share of Household Population		-0.046		0.018
		(0.139)		(0.162)
Number of Working Age Laborers in the Household		<0.001		-0.007
		(0.016)		(0.022)
Cultivable Land Per Capita		0.005		0.026
		(0.013)		(0.026)
Household Average Years of Education		-0.012		-0.016
		(0.005)		(0.007)
Village, HH Controls Predetermined?		yes		yes
Regression Statistics				
Hansen J Statistic	22.388	28.715	32.519	105.276
P-value, J statistic	0.556	0.231	0.759	0
Shea partial R^2, migration	0.0217	0.0215	0.0245	0.0204
Cragg-Donald F-Statistic	21.318	8.761	15.608	7.264
Number of Clusters	88	88	88	88
Number of Observations	53106	51608	53106	51608

Notes: All models are run in first-differences and include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. Standard errors clustered at the village level in columns 1-3 and are treated as robust in column 4 (cluster robust standard errors could not be estimated). The lagged consumption, the interaction between consumption and migration, and migration are treated as endogenous.

Table 7
Migration and Household Income Per Capita
(All Models in First Differences)

	Dependent Variable: ln(Household Income Per Capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Household Income Per Capita)$_{t-1}$	0.483	0.420	0.427	0.508	0.466	0.529
	(0.056)	(0.055)	(0.070)	(0.040)	(0.041)	(0.045)
Ln(HH Income Per Capita)$_{t-1}$ * (Share of Migrants in Village Population)				-0.980	-0.778	-1.424
				(0.362)	(0.358)	(0.453)
Share of Migrants in Village Population	2.300	2.128	1.816	7.117	5.498	9.323
	(1.156)	(1.158)	(1.305)	(2.265)	(2.298)	(2.835)
Village Level Control Variables						
Village Labor Force		0.013	0.006		0.017	0.011
		(0.005)	(0.019)		(0.004)	(0.014)
Cultivable Share of Village Land		0.137	1.245		0.025	1.253
		(0.198)	(0.810)		(0.180)	(0.585)
Total Village Land		-0.011	0.007		-0.023	0.05
		(0.018)	(0.060)		(0.014)	(0.045)
Share of Assets Owned by Village Collective		-0.033	-0.452		-0.023	-0.117
		(0.040)	(0.283)		(0.035)	(0.111)
Share of Village Land in Orchards		-0.374	-2.189		-0.218	-1.088
		(0.157)	(1.358)		(0.120)	(0.835)
Household Level Control Variables						
Working-Age Male Share of Household Population		0.546	0.734		0.508	0.797
		(0.037)	(0.150)		(0.032)	(0.108)
Working-Age Female Share of Household Population		0.442	0.668		0.421	0.611
		(0.037)	(0.192)		(0.033)	(0.127)
Number of Working Age Laborers in the Household		-0.032	-0.078		-0.031	-0.082
		(0.008)	(0.019)		(0.006)	(0.015)
Cultivable Land Per Capita		0.097	-0.061		0.102	-0.073
		(0.011)	(0.035)		(0.009)	(0.031)
Household Average Years of Education		0.009	-0.016		0.010	-0.022
		(0.003)	(0.006)		(0.002)	(0.006)
Village, HH Controls Predetermined?		No	Yes		No	Yes
Regression Statistics						
Hansen J Statistic	8.28	9.483	10.7	24.353	25.633	25.064
P-value, J statistic	0.406	0.303	0.219	0.384	0.318	0.347
Shea Partial R^2, Migrant Share	0.0105	0.0103	0.009	0.0146	0.0147	0.0142
Cragg-Donald F-Statistic	42.7	41.578	13.706	18.802	19.708	9.022
Number of Clusters	88	88	88	88	88	88
Number of Observations	52626	51358	51141	52626	51358	51141

Notes: All models are run in first-differences and include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. Standard errors clustered at the village level. Lagged income, the interaction between income and migration, and migration are treated as endogenous.

Table 8
Migration and Household Investment Behavior
(All Models Estimated in First Differences Using IV-GMM)

Panel A

Dependent Variable:	ln(Productive Assets Per Capita)				ln(Agricultural Assets Per Capita+1)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln(Household Consumption Per Capita)$_{t-1}$	0.248	0.079	0.336	0.241	0.224	0.092	0.440	0.362
	(0.098)	(0.114)	(0.070)	(0.074)	(0.103)	(0.129)	(0.069)	(0.077)
ln(HH Consumption Per Capita)$_{t-1}$ * (Share of Migrants in Vill. Population)			0.699	0.228			-0.105	-0.206
			(0.609)	(0.655)			(0.709)	(0.723)
Share of Migrants in Village Population	4.090	3.876	-3.400	-1.737	1.790	1.704	1.685	1.326
	(2.224)	(1.874)	(4.071)	(3.977)	(2.020)	(1.957)	(4.492)	(4.475)
Household, Village Controls?	no	Yes	no	yes	no	yes	no	yes
Cragg Donald F Statistic	53.099	14.907	23.774	9.942	53.099	14.907	23.774	9.942
P-value, Hansen J-Statistic	0.051	0.142	0.126	0.128	0.046	0.216	0.124	0.219
Number of Observations	53106	51608	53106	51608	53106	51608	53106	51608

Panel B

	ln(Non-Ag Assets Per Capita+1)				ln(Durables+Housing Per Capita)			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
ln(Household Consumption Per Capita)$_{t-1}$	0.206	0.013	0.200	0.014	0.488	0.452	0.507	0.529
	(0.092)	(0.112)	(0.083)	(0.083)	(0.057)	(0.063)	(0.050)	(0.051)
ln(HH Consumption Per Capita)$_{t-1}$ * (Share of Migrants in Vill. Population)			1.915	1.677			-1.086	-1.516
			(1.162)	(0.936)			(0.364)	(0.398)
Share of Migrants in Village Population	5.212	3.596	-11.257	-11.481	1.968	1.183	8.055	9.562
	(2.929)	(2.286)	(6.990)	(5.764)	(0.935)	(0.920)	(2.446)	(2.532)
Household, Village Controls?	no	Yes	no	yes	no	yes	no	yes
Cragg Donald F Statistic	53.099	14.907	23.774	9.942	53.213	14.964	15.55	9.963
P-value, Hansen J-Statistic	0.148	0.183	0.106	0.066	0.58	0.493	0.342	0.278
Number of Observations	53106	51608	53106	51608	53073	51585	53073	51585

Notes: Each model is estimated in first-differences. Models including household and village level controls use the full set of controls shown in Table 5, treat them as predetermined and instrument them with t-2 lag levels. All models include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. We show cluster corrected standard errors for 88 village clusters. Models are estimated using IV-GMM.

Table 9

Migration and Household Labor Supply

(All Models Estimated in First Differences Using IV-GMM)

	Log(Total Labor Days Per Capita+1)			
	(1)	(2)	(3)	(4)
$\ln(\text{Household Consumption Per Capita})_{t-1}$	0.111	0.137	0.132	0.157
	(0.070)	(0.074)	(0.052)	(0.055)
$\ln(\text{HH Consumption Per Capita})_{t-1}$ * (Share of Migrants in Vill. Population)			-1.471	-0.586
			(0.414)	(0.417)
Share of Migrants in Village Population	1.468	2.088	9.713	3.925
	(1.125)	(1.169)	(2.622)	(2.677)
Household, Village Controls?	no	yes	no	yes
Cragg Donald F Statistic	53.099	14.907	23.774	9.942
P-value, Hansen J-Statistic	0.179	0.655	0.094	0.472
Number of Observations	53106	51598	53106	51598

Each model is estimated in first-differences. Models including household and village level controls use the full set of controls shown in Table 5, treat them as predetermined and instrument them with t-2 lag levels. All models include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. We show cluster corrected standard errors for 88 village clusters. Models are estimated using IV-GMM.

Table 10
Migration and Land Per Capita
(all models in first differences)

	Dependent Variable: Logarithm, Land per Capita			
	(1)	(2)	(3)	(4)
ln(Household Consumption Per Capita)$_{t-1}$	0.217	0.178	0.173	0.129
	(0.030)	0.035	(0.025)	0.028
ln(HH Consumption Per Capita)$_{t-1}$ * (Share of Migrants in Village Population)			-0.827	-0.852
			(0.429)	0.381
Share of Migrants in Village Population	1.054	0.844	5.326	5.559
	(0.588)	(0.702)	(2.515)	(2.200)
Village and Household Controls Predetermined?	no	yes	no	Yes
Regression Statistics				
Hansen J Statistic	6.272	4.32	29.4	20.796
P-value, J statistic	0.617	0.827	0.167	0.594
Shea partial R^2, migration	0.012	0.011	0.015	0.015
Cragg-Donald F-Statistic	55.301	15.72	17.355	9.335
Number of Clusters	88	88	88	88
Number of Observations	49464	48595	49464	48595

Each model is estimated in first-differences. Models including household and village level controls use the full set of controls shown in Table 5, treat them as predetermined and instrument them with t-2 lag levels. All models include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. We show cluster corrected standard errors for 88 village clusters. Models are estimated using IV-GMM.

Appendix Table A.1
Logit Hazard Model for Distribution of ID cards

	Dependent Variable: 1 when card is issued; 0 otherwise					
	(1)		(2)		(3)	
	Coefficient	Marginal	Coefficient	Marginal	Coefficient	Marginal
Squared Rainfall Shock in Year *t-1*	-3.338	-0.033			-3.254	-0.032
	(2.610)	(0.026)			(2.571)	(0.025)
Squared Rainfall Shock, in Year *t-2*			-3.460	-0.034	-3.375	-0.030
			(3.993)	(0.039)	(3.912)	(0.039)
Number of Obs.	509		509		509	
Log Likelihood	-148.3		-148.3		-147.8	
Chi-Square Statistic					2.72	
p-value, est. coeffs. are jointly zero					0.26	

Notes: We alternatively use the squared rainfall shock in year t-1 and year t-2, and combine them in model (3). Provincial dummies and year dummies included in all equations. Hypothesis tests are chi-squared tests for the null hypothesis that all coefficients are jointly zero. Marginal effects are estimated at the mean values of squared rainfall shocks.

Table A.2
Household Consumption and Village Migration: OLS Models
Dependent Variable: Ln(Household Consumption Per Capita)

	OLS, Levels		OLS, Differences	
	(1)	(2)	(3)	(4)
$\ln(\text{Household Consumption Per Capita})_{t-1}$	0.614	0.618	-0.338	-0.305
	(0.011)	(0.014)	(0.008)	(0.010)
$\ln(\text{HH Consumption Per Capita})_{t-1}$ * (Migrant Share)		-0.055		-0.465
		(0.136)		(0.103)
Migrant Share of Village Population	-0.007	0.322	-0.081	2.706
	(0.108)	(0.879)	(0.135)	(0.638)
Number of Obs.	53106	53106	53106	53106

Notes: All models include village and province-year fixed effects. Standard errors clustered at the village level in parentheses.

Table A.3
Migration and Household Income with Lagged Consumption as a Proxy for Wealth
(All Models in First Differences)

	Dependent Variable: ln(Household Income Per Capita)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Household Consumption Per Capita)$_{t-1}$	0.356	0.301	0.314	0.349	0.285	0.296
	(0.057)	(0.055)	(0.072)	(0.049)	(0.051)	(0.060)
ln(HH Consumption Per Capita)$_{t-1}$ * (Share of Migrants in Village Population)				-0.675	-0.466	-0.996
				(0.466)	(0.507)	(0.489)
Share of Migrants in Village Population	2.544	2.508	2.031	6.130	4.280	7.118
	(1.291)	(1.274)	(1.282)	(2.801)	(3.007)	(2.965)
Village Level Control Variables						
Village Labor Force		0.013	0.024		0.014	0.022
		(0.005)	(0.017)		(0.003)	(0.012)
Cultivable Share of Village Land		0.214	1.238		0.159	0.604
		(0.154)	(0.800)		(0.133)	(0.424)
Total Village Land		-0.013	-0.029		-0.010	-0.020
		(0.015)	(0.058)		(0.011)	(0.033)
Share of Assets Owned by Village Collective		-0.014	-0.422		-0.015	-0.180
		(0.034)	(0.250)		(0.029)	(0.134)
Share of Village Land in Orchards		-0.35	-1.678		-0.234	-0.808
		(0.160)	(1.173)		(0.105)	(0.608)
Household Level Control Variables						
Working-Age Male Share of Household Population		0.538	0.893		0.514	0.982
		(0.035)	(0.169)		(0.029)	(0.136)
Working-Age Female Share of Household Population		0.439	0.651		0.424	0.737
		(0.033)	(0.235)		(0.027)	(0.175)
Number of Working Age Laborers in the Household		-0.030	-0.045		-0.028	-0.056
		(0.007)	(0.026)		(0.006)	(0.021)
Cultivable Land Per Capita		0.097	0.001		0.093	-0.014
		(0.010)	(0.031)		(0.008)	(0.026)
Household Average Years of Education		0.008	-0.010		0.010	-0.015
		(0.002)	(0.006)		(0.002)	(0.005)
Village, HH Controls Predetermined?		No	Yes		No	Yes
Regression Statistics						
Hansen J Statistic	7.812	9.232	9.986	20.36	23.838	23.515
P-value, J statistic	0.452	0.323	0.266	0.62	0.413	0.431
Shea partial R^2, migration	0.0105	0.0105	0.009	0.0217	0.0208	0.0219
Cragg-Donald F-Statistic	52.612	51.655	15.079	23.655	23.909	9.859
Number of Clusters	88	88	88	88	88	88
Number of Observations	52881	51610	51393	52881	51610	51393

Notes: All models are run in first-differences and include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. Standard errors clustered at the village level. Lagged consumption, the interaction between consumption and migration, and migration are treated as endogenous.

Table A.4
Migration and Household Non-Durable Consumption Per Capita
(All Models in First Differences)

	Dependent Variable: ln(Household Income Per Capita)			
	(1)	(2)	(3)	(4)
$\ln(\text{Household Consumption Per Capita})_{t-1}$	0.600	0.550	0.619	0.583
	(0.039)	(0.058)	(0.030)	(0.041)
$\ln(\text{HH Income Per Capita})_{t-1}$ * (Share of Migrants in Village Population)			-0.508	-1.033
			(0.358)	(0.437)
Share of Migrants in Village Population	1.412	1.05	3.556	6.069
	(0.881)	(0.878)	(2.144)	(2.605)
Regression Statistics				
Hansen J Statistic	8.043	10.094	18.316	29.49
P-value, J statistic	0.429	0.258	0.74	0.165
Cragg-Donald F-Statistic	53.052	14.922	23.468	9.853
Number of Clusters	88	88	88	88
Number of Observations	52626	51141	52626	51141

Notes: Notes: Each model is estimated in first-differences. Models including household and village level controls use the full set of controls shown in Table 5, treat them as predetermined and instrument them with t-2 lag levels. All models include jointly significant village fixed effects to control for village specific trends, and province-year effects to control for province-wide macroeconomic shocks. We show cluster corrected standard errors for 88 village clusters. Models are estimated using IV-GMM..