Risk Sharing and Temporary Migration: The Information Role of Kinship Networks

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Abstract

This paper studies the role of kinship networks in sustaining informal set-ups of risk-sharing transfers across Chinese rural households, especially in the face of rapid structural transformation. Using panel data of Chinese households between 1986 and 2008 and exploiting exogenous variation in rural migration induced by agricultural price shocks, I find that temporary migration by village members significantly undermines the extent of cross-household risk sharing in Chinese villages, but only among villages with no active kinship networks. Further investigation on the mechanisms suggests that the undermining effect of migration on cross-household risk sharing in villages without kinship networks does not arise from these villages' lower ability to enforce transfers on migrant households, but reflects primarily an insurance loss by migrant households due to information problems. My results therefore support kinship networks' effects in facilitating information flow over long distances and highlight an important channel through which kinship networks encourage migration: by reducing rural households' migration costs due to informal insurance loss. Evidence on the heterogeneous migration patterns across Chinese villages further supports these hypothesized effects: as China relaxed administrative restrictions on temporary migration, villages with active kinship networks experienced a significantly higher increase in temporary migration compared to other villages, and this pattern is especially salient among households facing high income risks and therefore more averse to losing the insurance benefits of informal cross-household transfers.

Keywords: Migration, Risk sharing, Kinship networks, Asymmetrical information
JEL Classification: O12, O15, O17, O43, Q12, D14, D82

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1 Introduction

With large differences in labor productivity between agriculture and non-agriculture widely perceived to be a key determinant of productivity and income differences across countries (Caselli, 2005; Restuccia et al., 2008; McMillan and Rodrik, 2011; Gollin et al., 2013; Bryan et al., 2014), a better understanding of the costs and barriers deterring temporary migration by rural residents informs policies that could have large productivity impacts in many developing countries. Relatedly, prevalent market imperfections due to information, enforcement, and coordination problems in a developing context has led to a large emerging literature studying the effects of social networks on migration (see Munshi (2020) for a review). However, while a robust literature has documented the information, job referrals, and support benefits of social networks in facilitating migrants' entry into specific destinations (Munshi, 2003; Zhang and Li, 2003; Dolfin and Genicot, 2010; Beaman, 2012; Tang, 2024), much less attention has been paid to how strong social networks can also interact with migrants' home or origin institutions to shape people's desire to leave.

In this paper, I rely on panel data between 1986 and 2008 from China's National Fixed-Point Survey (NFS) and data from the Village Democracy Survey (VDS) (Padro-i Miquel et al., 2006) to examine not only how rural households' migration decisions interact with their incentives to obtain insurance from local communal risk-sharing institutions, but also how the presence of strong kinship networks within the rural communal significantly alters that interaction.[1] In line with Munshi and Rosenzweig (2016) and Morten (2019), my paper identifies the interaction between rural households' temporary migration decisions and their informal insurance incentives as a cause for cross-sectoral labor misallocation. Specifically, I show that, in the absence of formal insurance market, rural Chinese households heavily relied on communal set-ups of informal transfers across each other to insure themselves and rural household often incur substantial informal insurance loss when they choose to migrate. Such loss of informal insurance is a major migration cost that significantly deters households from optimally supplying labor to migrant jobs and non-agriculture.

[1] Kinship networks, formed by close kins residing in close proximity and bound by regular ritualistic activities to worship common patrilineal ancestors, are some of the strongest social networks in rural China. Existing literature has documented kinship networks' positive role in property rights protection (Zhang and Zhao, 2014), entrepreneurship (Peng, 2004), public good provision (Tsai, 2007), income redistribution (Foltz et al., 2020), and disaster relief (Cao et al., 2022).

This paper also moves beyond existing literature to show that the presence of strong kinship-based networks within a rural community significantly reduces rural households' migration costs due to informal insurance and hence alleviates cross-sectoral labor misallocation. Guided by a simple model of two agents voluntarily exchanging informal transfers, which illustrates how enforcement problems and information challenges lead to drastically different effects on agents' optimal transfer patterns, I present evidence to show that the main mechanism through which presence of kinship networks can do so is by mitigating the information problems that members' migration poses for communal risk-sharing institutions. My paper therefore also presents novel and rigorous evidence for an important channel through which social networks facilitate migration: by maintaining information flows across members even over long distances, strong kinship networks in a rural community not only sustain the resilience of many informal communal institutions in the face of rapid structural transformation, but also, by doing so, significantly reduce rural households' migration costs and reluctance to shift labor to higher productivity urban sectors.

To demonstrate these relationships between temporary migration, risk sharing and kinship networks, my analysis proceeds in several steps. First, I empirically examine how households' temporary migration decisions affect the extent of cross-household risk sharing within a village. Following Townsend (1994), I measure the extent of cross-household risk sharing in a village by the correlation between households' consumption and their own income, after controlling for village-year fixed effects. To address the concern that households' temporary migration decisions may endogenously respond to the extent of risk sharing and the amount of informal insurance, I combine shocks in world prices of agricultural commodities with variation in crop suitability across villages to isolate exogenous components of villages' over-time change in migration rate, which helps identify the causal effect of migration. Based on my estimates, exogenous changes in the migration rate significantly reduce the extent of cross-household risk sharing in a village, but only among villages without kinship networks (*non-kinship villages*).

To better understand the mechanisms through which migration undermines risk sharing in *non-kinship villages* and how kinship networks help mitigate this undermining effect, I construct a theoretical model, in which temporary migration either increases households' outside options, and therefore weaken their commitment to fulfill transfer responsibilities, or impose greater information barriers against verifying migrant households' income. The model predicts that both

limited commitment and information problems could cause temporary migration to undermine cross-household risk sharing. However, while limited commitment will tend to increase the net transfers received by migrant households conditional on income, information problems will have the opposite effect: a household's received conditional-on-income net transfers will need to decrease after migration to compensate the risk-sharing network for its higher income verification costs. In addition, information problems will cause a migrant household's net transfers to be more responsive to its income at lower income realizations compared to higher income realizations, but limited commitment will not.

I then use data on households' informal cross-household transfers to test the model's predictions. Consistent with migration undermining risk sharing in *non-kinship villages*, my results show that migrant households incur significantly higher insurance loss in *non-kinship villages*: the income elasticity of net transfers received by a household is significantly lower for migrant households compared to non-migrating households, but only in *non-kinship villages*. Two pieces of evidence suggest that information problems, rather than limited commitment, may be the reason why migration undermines risk sharing in *non-kinship villages*. First, consistent with migration imposing information barriers against verifying a household's income, the loss of responsiveness of migrant households' net transfers to income in *non-kinship villages* is significantly more severe at these households' higher income realizations. Second, inconsistent with migrant households losing insurance due to their lower commitment to fulfill transfer obligations, migrant households in *non-kinship villages* in fact issue higher out-transfers to other households and receive lower net transfers from other households conditional on income compared to other households within the same village.

Altogether, these results strongly support the model's predictions and suggest that the main mechanism by which kinship networks mitigate the undermining effect of migration on risk sharing is by lessening the information problems for informal insurance setups posed by migration. They also imply that kinship networks, by reducing rural households' informal insurance loss due to migration, may be an important factor influencing rural households' migration decisions. Patterns in China's structural transformation process indeed lend further support to these hypothesized effects of kinship networks: although all Chinese villages experienced major increase in migration starting from the early 1990s when China relaxed administrative restrictions on tempo-

rary migration, migration increased at a significantly faster rate in villages with kinship networks (*kinship villages*). In addition, the bigger migration increase in *kinship villages* is particularly salient among households facing higher income risks and, therefore, more averse to losing the insurance benefits of informal cross-household transfers.

The paper contributes to several strands of literature. First, the paper relates to a large literature examining the roles of kinship ties and social networks in shaping economic outcomes (Coleman, 1988; Fukuyama, 1996; Cox and Fafchamps, 2007; Greif and Tabellini, 2010; Jackson, 2011; Alesina and Giuliano, 2014; Enke, 2019). Existing literature widely recognizes the importance of social networks for information transmission (Bandiera and Rasul, 2006; Cai et al., 2015; Beaman et al., 2021), collaboration (La Ferrara, 2003; Angelucci et al., 2018; Chandrasekhar et al., 2018), and mutual insurance (Rosenzweig, 1988; Foster and Rosenzweig, 2001; Murgai et al., 2002; Fafchamps and Lund, 2003; Attanasio et al., 2015), but tends to regard strong family and kinship ties as impediments for labor mobility, structural transformation, and formal market participation (Munshi and Rosenzweig, 2006; Alesina and Giuliano, 2010; David et al., 2010; Alesina et al., 2015; Ghosh et al., 2023).[2] My paper, however, finds a positive role of kinship networks in facilitating rural-urban migration and efficient movement of labor out of agriculture. Previous literature establishing a positive link between community networks and migration usually emphasizes the information, job referrals, and support benefits of networks in facilitating access to destination labor markets (Dolfin and Genicot, 2010; Winters et al., 2001; Munshi, 2003; Zhang and Li, 2003; Beaman, 2012; Foltz et al., 2020). I, on the other hand, provide evidence for a different channel: the presence of strong kinship ties directly affects the resilience of communal risk-sharing institutions at origin villages, reducing informal insurance loss incurred by rural households when they migrate.

Second, the paper adds to a literature that examines how rural households' informal insurance incentives interact with their labor allocation and migration decisions (Munshi and Rosenzweig, 2016; De Weerdt and Hirvonen, 2016; Lagakos et al., 2018; Morten, 2019; Meghir et al., 2022). Existing literature has shown that, depending on the underlying risk environment, members' migration can generate either positive (Meghir et al., 2022) or negative (De Weerdt and Hirvonen,

[2] A separate literature also highlights how re-distributive pressure within family networks often acts as informal "kinship taxes" that create all kinds of allocative and productive distortions and deter efficiency and growth (Baland et al., 2011; Di Falco and Bulte, 2011; Platteau, 2014; Jakiela and Ozier, 2016; Squires, 2024).

2016; Morten, 2019) effects on the extent of risk sharing within rural networks. In the context of China, this paper finds a significant negative effect of rural households' temporary migration on cross-household risk sharing, mostly due to risk-sharing networks' declined responses to income shocks experienced by migrant households. The finding resonates with Attanasio et al. (2022) in identifying rapid structural transformation as a major force eroding consumption insurance in rural China during the 1990s and 2000s. In addition, the paper goes a step further to pinpoint the mechanisms through which migration undermines risk sharing: it theoretically illustrates the contrasting effects of limited commitment and information problems on optimal transfer contracts and empirically identify informational difficulties in observing migrant households' income as a main reason for the underming effect of migration in China's context. In this way, the paper also extends the literature by proposing empirical tests that can distinguish meachisms through which migration undermines risk sharing and supplements a literature that empirically supports private information on income as a major barrier to efficient risk sharing within risk-sharing networks (Ligon, 1998; Chandrasekhar et al., 2011; Seshan and Zubrickas, 2017; Kinnan, 2022; Baseler, 2023).

Last but not least, the paper speaks to a large literature on resource misallocation (Banerjee and Duflo, 2005; Hsieh and Klenow, 2009; Restuccia and Rogerson, 2017; Gollin and Udry, 2019). Although scholars generally perceive factor misallocation, most notably gap in (marginal) labor productivity between agriculture and non-agriculture, to be a key determinant of productivity and income differences across countries (Caselli, 2005; Restuccia et al., 2008; Vollrath, 2009; Gollin et al., 2013), relatively less is known about the cause of misallocation itself. Consistent with evidence from other contexts (Munshi and Rosenzweig, 2016; Morten, 2019), this paper argues that the lack of formal insurance and the challenges that migration poses for informal risk-sharing arrangements can be a major explanation for why rural households often sub-optimally supply labor to migrant jobs. More generally, the paper highlights the absence of formal markets and rural residents' reluctance to forego benefits provided by communal set-ups, often designed to substitute for formal market to exclusively distribute benefits within close-knit communities, as a cause for cross-sector labor misallocation in developing economies (Munshi and Rosenzweig, 2016; Zhao, 2020).

The rest of the paper proceeds as follows. Section 2 presents background information. Section 3 describes the data. Section 4 presents evidence for the undermining effect of migration on risk

sharing in *non-kinship villages*. Section 5 theoretically and empirically examine the mechanisms through which migration undermines risk sharing and kinship networks help mitigate such undermining effect. Section 6 presents evidence of heterogeneous migration patterns across Chinese villages to further support the positive effect of kinship networks on migration, especially for households facing high income risks. Section 7 concludes.

2 Background

2.1 Kinship Networks in China

The prolonged intellectual and spiritual dominance of Neo-Confucianism, which argued for kinship solidarity and ancestor worship, helped promote the moral internalization of kinship norms in much of the Chinese population (Tohru, 2008). Kinship networks, organized around patrilineal descent groups who often reside within geographical proximity, played a major role in organizing all aspects of social, political and economic life of the Chinese population throughout imperial Chinese history. By the 18th and 19th Centuries, after a long series of favorable government policies, lineages and other forms of kinship groups have assumed enormous political power and obligation, often superseding village and even county-level government administrations as the primary unit of socioeconomic regulation and control. Important social and economic decisions, including substantial land transactions, marriages, funerals, and so on, were expected to be made in consultation with kinship network seniors. [3]

Massive historical upheavals during the 20th and early 21st centuries and the strong penetration of bureaucratic apparatus and state control by the modern Communist regime up to the township level significantly weakened the political authority and organizational power of kinship networks in contemporary China, particularly in the urban settings. However, extensive sociological surveying of rural villages during the 1990s and 2000s suggests that kinship networks continue to be a major, perhaps dominant, organizing role in many Chinese villages (Bian, 1997;

[3] In Southern China, where kinship groups often expanded into large lineages with significant amount of corporate property, it was not uncommon for a village to be demographically and politically dominated by one large lineage with a significant proportion of the village's land owned directly by the lineage (Zhang, 2006; Huang, 1990). Even on the North China Plain, where kinship networks were smaller and substantially less powerful than elsewhere, major kinship networks still dominated most villages, occupying the great majority of political appointments (Huang, 1985; Pomeranz, 1993; Zhang, 2017).

Yang, 1999). Much empirical literature has also documented strong empirical evidence on the continued importance of kinship networks in helping to facilitate sharing of resources, provision of public goods, and coordinating actions against unwanted external interference, whether from other villages, outlaws, or the local governments (Chan et al., 1992; Qian, 1994; Zhang and Zhao, 2014; Cao et al., 2022).

Contemporary kinship networks maintain their solidarity through a variety of ways. Most simply, relatives are socially required to see each other on certain festivals and occasions, spread across the year. Strong kinship networks also engage in collective activities of considerable cost and complexity, most notably the maintenance of an ancestral hall or lineage genealogy (Wang, 1991; Yang, 1999). Both of these activities, which grew substantially in popularity during the 1990s, require large investments of money and time, in return for greater psychological unity, better sharing of demographic and financial information between relatives, and a stronger signal of status, cohesion and wealth to other kinship networks. Following existing literature (Tsai, 2007; Foltz et al., 2020; Martinez-Bravo et al., 2022), I use a dummy of whether an ancestral hall or lineage genealogy exists in a village to indicate the presence of kinship networks within the village. Based on data in my sample, kinship networks existed in villages of almost all Chinese provinces,[4] with southeastern provinces, like Fujian, Jiangxi and Hainan, displaying the largest share of villages with kinship networks. The heterogeneous distribution of kinship networks across provinces reflects primarily historical path dependency, as the cross-province distribution of kinship networks in China has been fairly stable since the Song dynasty (Cao et al., 2022).

2.2 Temporary migration in China

Although China kick started major marketization reforms as early as 1978, internal flows of migrants, especially those by rural residents, were heavily constrained throughout the early periods of reform. It was not until 1992, when Deng Xiaoping's southern tour speech signaled the government's further resolve to open up the economy and relax administrative controls, that China initiated a series of administrative reforms which clarified legal procedures for temporary rural-urban migration. In addition, Deng Xiaoping's southern tour fueled a booming export sector in

[4]The only exceptions are three Municipalities directly under the control of the central government, Beijing, Tianjin and Shanghai, which cover mostly urbanized areas , and provinces like inner Mongolia, Ningxia and Xinjian, which are resided predominantly by ethnic minorities who are less influenced by kinship norms and traditions.

coastal China, which further accelerated the growth in temporary migration, particularly long-distance cross-provincial migration by rural residents.

Based on data from China's census and 1% population surveys, between 1990 and 1995, China's floating population increased from 30 million to 56 million, a 87% increase within a mere 5 years. In addition, during the same time period, the destinations of rural migrants experienced drastic changes. Based on China's 1% population surveys, while 41 percent of rural migrants were working in surrounding towns in 1987, the corresponding statistic has decreased to a mere 9% by 1995. While only 18 percent of rural temporary migrants were working outside their home province in 1987, the proportion of inter-provincial migration among rural residents has increased more than twice to 39 percent by 1995.

These statistics support the accelerating effect of Deng's southern tour in 1992 on China's growth in temporary migration, particularly long-distance inter-provincial migration, by rural residents. Figure 1, which plots villages' annual percentage labor working as temporary migrants based on panel household survey data collected in the National Fixed-point Survey (NFS), further confirm this hypothesis. Based on Figure 1, growth in rural migration among Chinese villages was fairly modest throughout the pre-1992 period but began to drastically accelerate after 1992. In addition, Figure 2, which plots the same statistics separately for two subgroups—villages with and without kinship networks, shows that the effect of the policy shift in 1992 was quite heterogeneous across the two subgroups. Throughout the pre-1992 period, when most rural migrants work in surrounding towns near their home village, migration rate was fairly similar across *kinship* and *non-kinship villages*. However, when long-distance inter-provincial migration became much more prevalent after 1992, *kinship villages* experienced a sharp relative jump in migration rate compared to *non-kinship villages*.[5]

One of the central motivations of this paper is to provide an explanation for the higher increase in migration rate for *kinship villages* after long-distance rural-urban migration became feasible and prevalent,[6] and I seek an explanation in kinship networks' role in mitigating the undermining effect of long-distance migration for local risk-sharing institutions and thereby reducing rural

[5]The same pattern of heterogeneous post-1992 migration increase across *kinship* and *non-kinship villages* is also documented by (Foltz et al., 2020).

[6]In Section 6.1, I provide additional evidence to show that the relative increase in migration in kinship villages after 1992 cannot be explained by macroeconomic changes at the province level or kinship villages' relative closeness to major migration destinations in the coastal areas.

households' migration costs.

2.3 Cross-household risk sharing and informal transfers

Another empirical fact that I want to establish about my setting is that, as is the case in many other developing contexts (Platteau and Abraham, 1987; Ravallion and Dearden, 1988; Udry, 1994; Fafchamps and Lund, 2003), informal cross-household transfers perform important insurance roles in Chinese rural villages. Based on my data, 80% of rural Chinese households participated in informal cross-household transfers each year during the sample period of 1986-2008, and, on average, the transfers received from other rural households account for 13% of a rural households' annual expenditure.

To illustrate that these cross-household transfers perform important insurance functions, I run the following regression using my household-level data from the NFS :

$$\tau_{ivt} = \alpha y_{ivt} + \delta_i + \gamma_{vt} + \epsilon_{ivt}, \tag{1}$$

where τ_{ivt} is the net transfers received by household i in village v at year t; y_{ivt} is household income; and δ_i and γ_{vt} are a household fixed effect and a village-year fixed effect respectively. Without further elaboration, standard errors in all regressions in the paper, including this one, are clustered at the village level.

Column (1) and (3) of Table 1 present my results when I run equation (1) in levels and in first differences respectively. In both specifications, I estimate a significantly negative coefficient on own income, indicating that transfers provide insurance. In columns (2) and (4), I further add, $\overline{y}_{vt}$, the average household income in village v at year t as an additional regressor. My results indicate that the net transfers received by a household not only negatively respond to the household's own income but significantly increase with the average income in the village. These results are highly consistent with the risk-sharing role of cross-household transfers and suggest that the insurance networks in China, as in many other countries, are likely organized within villages.

3 Data

The data in my empirical analysis come from two major sources. The first is the Chinese Ministry of Agriculture's National Fixed Point Survey (NFS), which is the largest panel household survey on rural China and reports detailed income, expenditure and labor information of the surveyed households. The survey began in 1986, and it tracks a nationally representative sample of about about 300 villages, covering all of the continental Chinese provinces, for every year except 1992 and 1994. Within each village, the households selected to answer the household survey were randomly sampled, and the number of households surveyed ranged from 50 to more than 100 to reflect the population share of each geographic region in a province. The household survey used in this paper covers a sub-sample: it consists of a panel of 8000 households across 130 villages for every year between 1986 and 2008, and another 3000 households across 36 villages for the 1986-2003 period. [7]

Throughout the survey period, the NFS asked each selected respondent household to maintain daily diaries of income, expenditure and labor activities, and a resident administrator living in the county seat visited each household once a month to collect information from the diaries. The unusual rigor applied to the collection, checking and processing of the NFS data help to significantly reduce reporting and measurement errors in the data. I rely on the NFS to obtain detailed information on each household's income, labor allocation decisions and transfers to and from other households in each period. Another important thing to note is that, in enumerating residents in a household, the NFS includes household members who work elsewhere as temporary migrant workers, even if those members may reside outside the household for a majority of the year. The NFS also requires households to include activities and income of those members when reporting their aggregate labor activities and income. Therefore, throughout the paper, my measures of household income or labor allocation include income and labor activities of members who work as temporary migrant workers.

The other main source of data is the Village Democracy Survey (VDS), conducted by Gerard Padro-i-Miquel, Nancy Qian and Yang Yao in 2006, and specifically designed to cover the same villages as the NFS. The VDS records many important social and demographic outcomes, such as the

[7] If a village is included in the sample in any year, all surveyed households of that village are included in the paper's sample for that year.

number of ancestral halls and genealogy records maintained in each village, which is information I rely on to measure the presence of kinship networks within a village.[8]

4 Effects on risk sharing

One of the central goals of this paper is to illustrate how the presence of kinship networks affects the interaction of rural households' temporary migration and risk sharing incentives in order to provide an explanation for the heterogeneous temporary migration pattern documented in Figure 2. To achieve this goal, I first, in Section 4, empirically examine how temporary migration by rural households affects the extent of risk sharing within a village and how the effect of migration on risk sharing varies depending on whether strong kinship networks exist within a village.

4.1 Estimation strategy

To measure the extent of cross-household risk sharing in a village, I follow a commonly-used method by (Townsend, 1994), which suggests that under full risk sharing within a village, a household's consumption should be independent of its own contemporaneous income conditional on the total resources available in the village. I therefore estimate the following regression:

$$logc_{ivt} = \quad \beta logy_{ivt} + \delta_i + \gamma_{vt} + \epsilon_{ivt} \ , \tag{2}$$

where c_{ivt} is the consumption of household i in village v at year t; y_{ivt} is household income; δ_i is a household fixed effect; and γ_{vt} is a village-year fixed effect that captures the total resources available in the village at time t. The estimated β in equation (2), which indicates the correlation between a household's consumption and its contemporaneous own income shock after controlling for a village-year fixed effect, gives us a measure of the extent to which a village deviates from full risk sharing.

To examine how temporary migration undermines risk sharing, I run the following regression:

[8] In this paper, I assume that a village's kinship culture and organizational capacity, accumulated over a long historical period, is highly persistent. Therefore, data collected in 2006 is indicative of villages' kinship network presence and strength throughout the sample period (1986- 2008).

$$logc_{ivt} = \beta_1 logy_{ivt} + \beta_2 logy_{ivt} \times m_{vt} + \delta_i + \gamma_{vt} + \epsilon_{ivt} \ , \tag{3}$$

where m_{vt} refers to the percentage of labor working as temporary migrants in village v at year t; and all other variables are as defined in equation (2). [9] The coefficient on the interaction term $logy_{ivt} \times m_{vt}$ therefore measures how the extent of risk sharing varies with the migration rate in a village.

4.2 Predicted migration rate instrument

One major empirical challenge for the estimation is that rural households' migration decisions could themselves be influenced by to the extent of risk sharing within the village. My estimate of β_2 in equation (3), therefore, could reflect not only the causal effect of migration on risk sharing but also endogenous responses of a village's migration rate to the extent of risk sharing.

To overcome this problem of reverse causality, I rely on villages' initial migration rate in 1986 and exogenous agricultural price innovations, which heterogeneously affect villages' agricultural income, to estimate a village- and year- specific predicted migration rate. The predicted migration rate measure, which captures no changes in migration due to endogenous responses to villages' internal market and institutional environment, can act as a instrument for m_{vt} to to help address the reverse causality concern.[10]

I follow Imbert et al. (2022) to construct exogenous shocks to each village's agricultural income in several steps. First, I rely on data from the Food and Agriculture Organization, and calculate the international price of each crop (indexed by c) in each year (indexed by t) as the average "at-the-farm-gate" price across all producing countries (excluding China) weighted by their share in global exports. I then calculate the annual innovation in the logarithm of nominal prices, p_{ct}, as the residual $\widehat{\varepsilon}_{ct}$ from the following AR(1) specification:

$$log(p_{ct}) = \theta log(p_{c,t-1}) + \eta_t + v_c + \varepsilon_{ct}, \tag{4}$$

[9] I do not need to include m_{vt} as a regressor in equation (3), as the main effect of m_{vt} will be subsumed in the village-year fixed effect that I control for.

[10] The agricultural income shocks have been used as instruments for migration flows by (Imbert et al., 2022) to study the effects of rural-urban migration on production outcomes of Chinese manufacturing firms.

where η_t and v_c indicate a year fixed effect and a crop fixed effect respectively.

Second, I collect data on potential yield of each crop in each village, $yield_{cv}$, from the Global Agro-Ecological Zones Agricultural Suitability and Potential Yields (GAEZ) database. I then rely on the potential yield data and the cropping patterns data from the NFS to compute the potential agricultural output for each crop in each village, q_{cv}, as the product between each crop's initial sown area in each village, a_{cv}, and the respective potential yield. That is $q_{cv} = a_{cv} \times yield_{cv}$. By construction, the potential agricultural output, q_{cv}, is time-invariant and is measured at the beginning of the sample period.

Next, I combine innovations in crop prices with the potential output share of each crop in each village to construct a village- and year- specific shock to agricultural income. The agricultural income shock in village v and year t, denoted by i_{vt}, is the average of the percentage deviation in crop prices, $\widehat{\varepsilon}_{ct}$, weighted by the expected share of each crop in the agricultural revenue of village v:

$$i_{vt} = (\sum_{c} \overline{p}_c q_{cv} \widehat{\varepsilon}_{ct}) / \sum_{c} \overline{p}_c q_{cv}, \tag{5}$$

where $\widehat{\varepsilon}_{ct}$ is each crop's contemporaneous price innovation; $\overline{p}_c$ and q_{cv} are respectively each crop's international price and village-specific potential output at the beginning of the sample period. i_{vt} varies over time, due to fluctuations in world prices of various crops, and across villages, due to villages' different suitability for different crops.

To test that agricultural income shocks indeed affect households' migration decisions, I calculate $\triangle_{1993-t} m_{ivt}$, the change in the migration rate of each household (indexed by i) between 1993, the initial year in which both migration and price innovation data is available, and year t.[11] I then regress $\triangle_{1993-t} m_{ivt}$ against s_{vt}, the sum of i_{vt}s over the period between 1993 and year t:

$$\triangle_{1993-t} m_{ivt} = \rho_0 + \rho_1 s_{vt} + \mu_t + \lambda_i + e_{vt}. \tag{6}$$

where I control for a household fixed effect, λ_i, and a year fixed effect, μ_t, to eliminate the influence of time-invariant household characteristics or common shocks on my estimates.

[11] The producer prices data of FAO starts in 1991, so 1992 is the first year in which price innovations can be measured. However, the NFS does not report data in 1992, so 1993 is the first year in which both migration and price innovation data is available.

Table 2 present my estimates of ρ_1. I measure a household's migration rate in two ways: a dummy of whether a household has any temporary migrants in columns (1)-(3), and the percentage of labor-days that a household allocates to temporary migrant work in columns (4)-(6). In columns (1) and (4), I restrict the sample to 1995, the first post-1993 year that migration data is available, so that the estimates capture only a short-term effect of price innovations on households' change in migration rate. In columns (2) and (5), on the other hand, I restrict the sample to 2008, the last year of my sample, so that the estimates reflect how the sum of price innovations between 1993 and 2008 affects the cumulative change in migration rate over the same period. Finally, columns (3) and (6) show the results when the sample include all years. Across all columns and specifications, my estimated ρ_1 is significantly negative, verifying the negative effect of agricultural income shocks on the over-time changes in households' temporary migration rates.

Finally, I rely on my estimates of s_{vt} and ρ_1 and villages' initial migration rates in 1986 to construct a predicted migration rate measure, $\widehat{m}_{vt}$, at the village-year level:

$$\widehat{m}_{vt} = \overline{m}_v + \hat{\rho}_1 s_{vt}, \tag{7}$$

where $\overline{m}_v$ refers to the initial percentage of labor working as temporary migrants in village v in 1986; $\hat{\rho}_1$ is my estimate of ρ_1 in column (6) of Table 2.

The predicted migration rate measure in (7) acts as a good instrument for m_{vt} for my purpose. First, results in Table 2 supports the strength of the instrument in predicting the migration rate in a village. Second, the international price innovations of various crops are determined by global demand and supply shocks exogenous to villages' internal market or institutional environment. Therefore, $\widehat{m}_{vt}$ captures only variation in migration due to villages' initial migration tendency and changes due to exogenous agricultural income shocks, both of which are unlikely to endogenously respond to changes in the extent of risk sharing within a village.

4.3 Effect of migration on risk sharing

Columns (1) and (2) of Table 3 present my results examining the effects of migration on risk sharing for villages without and with presence of kinship networks respectively. Panel A first present the reduced-form estimates when I estimate how cross-household risk sharing within a village

varies the village's predicted migration rate, $\widehat{m}_{vt}$. Panel B then present the 2SLS estimates when I use $\widehat{m}_{vt}$ as an instrument for m_{vt} to re-estimate equation (3).[12] Based on my estimates, the contemporaneous migration rate in a village significantly increases the correlation between a household's consumption and its own income (conditional on average income within the village) in *non-kinship villages*, supporting the undermining effect of migration on the extent of cross-household risk sharing within a village. However, such undermining effect exists only among *non-kinship villages*: a village's migration rate has no significant impact on the correlation between a household's consumption and own income in villages with kinship networks.

In column (3), I also pool both the kinship and non-kinship villages together to directly estimate how the effect of migration on risk sharing differs across the two types of villages. Based on my estimated coefficient on $logy_{ivt} \times m_{vt} \times kinship_v$, the effect of migration on cross-household risk sharing significantly differs across kinship and non-kinship villages: the undermining effect of village migration rate on cross- household risk sharing is significantly stronger among non-kinship villages.

5 Mechanisms

Section 4 shows that temporary migration undermines the extent of cross-household risk sharing within a Chinese village, but only among villages without kinship networks. The objective of this section is to better understand the exact mechanism through which migration undermines risk sharing non-kinship villages and how presence of kinship networks helps mitigate such undermining effect.

There are two major hypotheses that one can propose to explain why migration by members can pose challenges for informal risk-sharing institutions. First, migration may increase the outside options of rural households,[13] decreasing the cost of default for migrant households and making it harder for other households to enforce transfer responsibilities on migrant households (limited commitment). Alternatively, migration can make it much harder for other households to

[12] Table A.1 present the first-stage results for all 2SLS regressions in Table 3 and show that, for all 2SLS regressions, the instruments are strong and strongly predict the endogenous variables.

[13] For instance, a more stable non-agricultural income may significantly increase households' ability to self insure. Migration may also give migrant households access to new markets, new social networks, and new support systems that make being excluded from their old risk-sharing network much less costly.

observe and verify migrant households' income (private information), giving migrant households incentives to misreport.

To understand which mechanism better explains my findings in Section 4, I construct a simple model of two agents voluntarily exchanging informal transfers with each other following a set-up similar to Townsend (1979). While Townsend (1979) focuses exclusively on characterizing optimal contracts under private information with costly verification, my model extends Townsend (1979) by introducing agents' limited commitment into the same model. This enables me to illustrate within a single model how private information and limited commitment, though both undermining efficiency of risk sharing, can lead to drastically different effects on optimal transfers across agents. The model's predictions on the different effects of limited commitment and information problems then provide guidance for my empirical tests to differentiate and pinpoint the exact mechanism through which migration undermines risk sharing in non-kinship villages.

5.1 Model

Consider a simple setting with two agents. Agent 1 is an insurer, who, in this context, is a coalition of identical households within the village. Agent 1 has an endowment of y_1, which is the average income among the coalition and therefore less risky than the endowment of any individual household. For simplicity, assume y_1 is certain and riskless, and $y_1 > 0$. Agent 2 is an individual household seeking insurance from the insurer or the risk-sharing coalition. The endowment of agent 2, denoted by y_2, is a random variable with cumulative probability distribution $F(y_2)$.

Each agent, $j \in \{1, 2\}$, possesses a von Neumann-Morgenstern utility function $\int U_j(c_j(y_2))dF(y_2)$, where $c_j(y_2)$ denotes the consumption of agent j as a function of 2's income and $c_1(y_2) + c_2(y_2) = y_1 + y_2$ for any y_2. Each agent j's utility function over riskless consumption, U_j, is continuously differentiable, concave and strictly increasing. Assume also that agent 2 is risk-averse so U_2 is strictly concave.

Let P denote the penalty costs that agent 1 can impose on agent 2 if agent 2 defaults on her transfer promise. In practice, P can indicate the costs that agent 2 incurs through losing the trust of her fellow villagers and being excluded from all future cooperative interactions. In addition, suppose y_2 is private information of agent 2 unless there is verification. If there is verification,

agent 1 pays a fixed verification cost of V,and y_2 is known without error to agent 1.

5.1.1 Complete information and full enforcement

First, as a baseline for comparison, consider a complete-information and full-enforcement model. This is the case, in which 1) V is zero so agent 1 always verifies and knows without error agent 2's income realization, y_2; and 2) P is very large so that agent 2 has no incentive to default.

Then, prior to the realization of y_2 (state), agents will agree to a state-contingent transfer with each other in order to maximize the sum of the two agents' expected utilities. Let $g(y_2)$ denote the post-state net transfer agent 2 receives from agent 1 as a function of y_2, i.e. $g(y_2) = y_1 - c_1(y_2)$. Then, $g^*(y_2)$, the optimal pre-state contractual choice of the function $g(\cdot)$ by the two agents, must solve the following problem:

$$\begin{aligned} max_{g(\cdot)} \quad & \int U_2(y_2 + g(y_2))dF(y_2) \\ s.t. \quad & \int U_1(y_1 - g(y_2))dF(y_2) \geq K \geq U_1(y_1) \end{aligned}$$

where the constraint requires that the expected utility of agent 1 be no less than than a constant, K, that is no less than his utility in autarky.

Given that U_2 is strictly concave, we will expect agent 2 to want to use the transfers to redistribute her income towards more equalized consumption across states. We therefore expect $g^*(\cdot)$ to be a decreasing function of y_2. That is the optimal choice, $g^*(\cdot)$, satisfies $g^{*\prime} < 0$ and agent 2 receives more transfers in her low income states. In addition, the participation constraint of agent 1 determines that $g^*(\cdot)$ cannot be positive for all states. Therefore, we expect $g^*(y_2)$ to be positive for all realizations of y_2 below a threshold y_2^0, and negative for all y_2s with $y_2 > y_2^0$.

In fact, based on the first-order conditions of the optimization problem, I can derive that, for any realization of agent 2's income, $y_2 \in [\underline{y_2}, \overline{y_2}]$,

$$\frac{U_2^{'}(y_2 + g^*(y_2))}{U_1^{'}(y_1 - g^*(y_2))} = k \tag{8}$$

for some constant, k.

5.1.2 Private information with costly verification and full enforcement

Next, consider a case in which P remains to be very large, but temporary migration of agent 2 makes it much harder for agent 1 to observe agent 2's income and therefore V has increased to be a positive number.

In this setting of private information with costly verification, the pre-state contract should specify not only a schedule of state-contingent net transfer from agent 1 to agent 2, $g(y_2)$, but also a choice of a verification region S (with complement S') which is a set of realizations of y_2 such that there is verification. Let $[\overline{S}, \overline{g}(\cdot)]$ denote the optimal pre-state contract chosen by the two agents in this environment.

Theorem 1: the optimal contract must satisfy:

$$\overline{g}(y_2) = \overline{C} \text{ for some constant } \overline{C} \text{ whenever } y_2 \in \overline{S}'.$$

This is because, when no verification takes place, agent 2 may ask for a transfer from agent 1 of any amount consistent with agent 1 not doing a verification. Of course agent 2 will ask for the highest amount possible. Then, in order for agent 2 not to have any incentive to misreport y_2, the function $\overline{g}(\cdot)$ must be identically equal to the maximum transfer possible in the non-verification region, $\overline{S}'$.

With theorem 1, we can set up the contract choice problem of the two agents as the following:

$$\begin{aligned} \max_{S, g(\cdot), C} \quad & \int_S U_2(y_2 + g(y_2))dF(y_2) + \int_{S'} U_2(y_2 + C)dF(y_2) \\ s.t. \quad & \int_S U_1(y_1 - g(y_2) - V)dF(y_2) + \int_{S'} U_1(y_1 - C)dF(y_2) \geq K \geq U_1(y_1) \end{aligned}$$

Theorem 2 (Townsend, 1979): $\overline{S} = \{y_2 : y_2 < \overline{\gamma}\}$ for some parameter $\overline{\gamma}$, with $\overline{g}(y_2) > \overline{C}$ on $\overline{S}$.

Townsend (1979) proves that, when the verification cost is either fixed or a convex function of transfer, it is optimal for agents to specify an income threshold $\overline{\gamma}$ such that verification takes place if and only if y_2 is less than $\overline{\gamma}$. The optimal risk-sharing contract will be such that agent 1 incurs the verification cost, V, and transfers the utility-maximizing amount to agent 2 when $y_2 < \overline{\gamma}$; and no verification takes place and agent 1 transfers a constant amount, $\overline{C}$,when $y_2 \geq \overline{\gamma}$. We therefore

expect the optimal transfer scheme under private information with costly verification to differ from the optimal transfer scheme under complete information in two major ways. First, we expect the transfer that agent 2 receives conditional on her income to decrease on average under costly verification. This is because, in order to maintain the expected utility of agent 1 to be no less than his utility in autarky, agent 1 will transfer less to agent 2 in all states to compensate himself for the higher ex-ante verification costs that he pays. Second, compared to the complete information case, we will expect agent 1's transfer to agent 2 under private information with costly verification to be less responsive to agent 2's income, but only when agent 2 reports a high income realization and agent 1 chooses not to verify 2's income.

Prediction 1: If migration increases V, compared to a household that does not migrate, a migrant household

1. on average receives lower net transfers from other households conditional on its income;
2. has net transfers that are less responsive to its income, but primarily for states with high income realizations.

5.1.3 Complete information but limited commitment

Now, suppose V remains zero, so that agent 1 always verifies and knows without error agent 2's income realization. However, temporary migration by agent 2 significantly improves 2's outside options and therefore reduces P, the opportunity costs that 1 can impose on 2 when 2 defaults. When P is small enough, not all transfer schedules are enforceable without agent 2 wanting to default. Then, $\widetilde{g}(y_2)$, the pre-state contractual choice of the function $g(\cdot)$ solves:

$$\begin{aligned} max_{g(\cdot)} \quad & \int U_2(y_2 + g(y_2))dF(y_2) \\ s.t. \quad & \int U_1(y_1 - g(y_2))dF(y_2) \geq K \quad \geq U_1(y_1) \\ \& \quad & U_2(y_2) - P \leq U_2(y_2 + g(y_2)) \quad \forall y_2 \in [\underline{y_2}, \overline{y_2}]. \end{aligned}$$

Compared to the baseline model in Section 5.1.1, agents in this case face exactly the same problem except that $\widetilde{g}(y_2)$ need to satisfy an additional set of ex-post participation constraints:

for each state (i.e. y_2 realization), the value $\widetilde{g}(y_2)$ cannot be so negative that agent 2 is better off defaulting on the contracted amount and receiving penalty from agent 1.

In other words, the ex-post participation constraints basically require that, $\forall y_2 \in [\underline{y_2}, \overline{y_2}]$, $\widetilde{g}(y_2) \geq f(y_2, P)$, where $f(y_2, P)$, the minimum (negative) transfer that agent 2 will accept without defecting, is a function of y_2 and P implicitly defined by:

$$U_2(y_2) - U_2(y_2 + f) = P. \tag{9}$$

With strictly increasing U_2 and $P > 0$, equation (9) implies that $f(y_2, P) < 0$ for all y_2s. In addition, conditional on y_2, $f(\cdot)$ must decrease with P: a larger penalty cost allows agent 1 to sustain a more negative minimum transfer to agent 2 in any state.

Given that $g^*(y_2) > 0 > f(y_2, P)$ for all $y_2 < y_2^0$, the ex-post participation constraints for agent 2 are not binding for the lowest realizations of y_2. Assume that agent 2's ex post participation constraints are monotonically more binding as y_2 increases. That is, $\frac{\partial}{\partial y_2}[g^*(y_2) - f(y_2, P)] < 0 \; \forall y_2 \in [\underline{y_2}, \overline{y_2}]$.[14] Consider the more interesting case that the ex-post participation constraints are binding for at least some y_2 realizations and let $y_2^B \in [\underline{y_2}, \overline{y_2}]$ be the highest realization of y_2 such that agent 2's ex-post participation constraint does not bind. This implies that y_2^B satisfies $g^*(y_2^B) = f(y_2^B, P)$ and $y_2^B > y_2^0$.[15]

Then, for all $y_2 > y_2^B$, $\widetilde{g}(y_2) \geq f(y_2, P) > g^*(y_2)$. With agent 1's utility maintained at K, there must exist at least some $y_2 < y_2^B$ such that $\widetilde{g}(y_2) < g^*(y_2)$. However, for all $y_2 s$ at which the ex-post participation constraints are not binding, the optimal transfer schedule satisfy equation (8). Therefore, the optimal transfer at all realizations with $y_2 < y_2^B$ must decrease simultaneously in accordance to (8), until the ex-post participation constraints start to bind.

Theorem 3: The optimal transfer schedule under limited commitment, $\widetilde{g}(y_2)$, will be such that, for some $y_2^B \in [y_2^0, \overline{y_2}]$

[14] The assumption holds if either P is small, or the village coalition is much better than agent 2 at withstanding risk so that efficient transfer is highly responsive to y_2. For instance, the assumption is trivially satisfied when agent 1 is risk-neutral and agent 2 is risk-averse. When both agents are equally risk-averse and $U_1(\cdot) = U_2(\cdot) = ln(\cdot)$, the assumption also holds for all P values small enough to allow the ex-post participation constraints to be binding for at least some y_2 realizations.

[15] With $f(.)$ increasing in P and $g^*(.)$ increasing in y_2, y_2^B must increase with P.

$$\begin{cases} \widetilde{g}(y_2) \geq f(y_2, P) > g^*(y_2) & \forall y_2 \in (y_2^B, \overline{y_2}] \\ \widetilde{g}(y_2) = g^*(y_2) & if \;\; y_2 = y_2^B \\ \widetilde{g}(y_2) < g^*(y_2) & \forall y_2 \in [\underline{y_2}, y_2^B) \end{cases} .$$

In other words, the optimal transfer schedule in this limited commitment case must involve agent 2 receiving higher net transfers (relative to the full commitment baseline) at all her highest income states (when $y_2 > y_2^B$), while receiving lower net transfers (relative to the full commitment baseline) at her low income realizations ($y_2 < y_2^B$). However, given that a dollar of transfer is associated with a higher marginal utility at a lower income state, to maintain agent 1's expected utility at K, the decrease in transfers to agent 2 at low income states will in expectation have a lower expected value than that for the increase in transfers to agent 2 at high income realizations.

Therefore, compared to the baseline case with full commitment, limited commitment will tend to increase the average net transfers received by agent 2 in expectation. In addition, limited commitment decreases the responsiveness of cross-agent transfers to agent 2's income, but the lower responsiveness applies to all income states with no clear distinction between high and low income realizations.

Prediction 2: If migration decreases P, compared to a household that does not migrate, a migrant household

1. on average receives higher net transfers conditional on its income;
2. has net transfers that are less responsive to its income at both high and low income realizations.

5.2 Tests on mechanisms

As illustrated by my model, both an increase in V and a decrease in P can cause the pre-state transfer contract adopted by agents to deviate from the Pareto efficient contact, decreasing the extent of risk sharing between the agents and the amount of insurance that individual household (agent 2) receives from the risk-sharing network (agent 1). The model helps explain the undermining effect of migration on risk sharing in *non-kinship villages*, and suggest that the undermining effect could

reflect loss of informal insurance by migrant households in these villages. In addition, the model predicts that migration by individual households can generate very different changes in transfer patterns, depending on whether migration mainly increases households' outside option (i.e. reducing P) or increasing the difficulty for risk-sharing networks to accurately observe households' income (i.e. increasing V).

To further support my model and to rely on the model's predictions to pinpoint mechanisms behind my results in Table 3, I conduct several tests.

5.2.1 Average effects on transfers

First, I run the following specification, separately for *kinship* and *non-kinship villages*, to examine how levels of transfers and responsiveness of transfers to income vary with a household's migration rate within a risk-sharing network (i.e. village):

$$\tau_{ivt} = \omega_1 y_{ivt} + \omega_2 m_{ivt} + \omega_3 y_{ivt} \times m_{ivt} + \delta_i + \gamma_{vt} + \epsilon_{ivt}, \tag{10}$$

where τ_{ivt} is the net transfers received by household i in village v at year t; y_{ivt} and m_{ivt} are household income and percentage of labor-days allocated to temporary migration respectively for household i in year t; δ_i is a household fixed effect; I also control for γ_{vt}, a village-year fixed effect, so that each household's transfers are compared only against those of other households within the same risk-sharing network (i.e. village).

In this equation, ω_1 indicates how the net transfers received by a household vary with income when a household has no temporary migrants; ω_2 measures the effect of migration rate on net transfers when income is zero; and ω_3 measures how the responsiveness of a household's net transfers to own income varies with the household's migration rate. If a risk-sharing network provides less insurance to households with higher migration rates, we should expect ω_1 to be negative but ω_3 to be significantly positive. In addition, based on the model's predictions, we expect ω_2 to be positive if migrant households lose insurance due to limited commitment, and negative if migration mainly poses information challenges for risk sharing.

I also run the following triple-interaction regression on my full sample of villages:

$$\begin{aligned}\tau_{ivt} &= \pi_1 y_{ivt} + \pi_2 m_{ivt} + \pi_3 y_{ivt} \times m_{ivt} \\ &\quad + \pi_4 y_{ivt} \times Kinship_v + \pi_5 m_{ivt} \times Kinship_v + \pi_6 y_{ivt} \times m_{ivt} \times Kinship_v + \delta_i + \gamma_{vt} + \epsilon_{ivt} \quad (11)\end{aligned}$$

where $Kinship_v$ is a dummy variable indicating whether kinship networks, measured by presence of ancestral halls or lineage genealogies, exist in village v. All other variables are as defined in equation (10). My estimates of π_4, π_5, and π_6 in equation (11) allow me to directly test whether my estimates of ω_1, ω_2, and ω_3 in equation (10) significantly differ across villages with and without kinship networks.

Columns (1) and (2) of Table 4 show my results of equation (10) for villages without and with kinship networks respectively. Column (3), on the other hand, shows my estimates of equation (11). In both columns (1) and (2), my estimates of ω_1 are significantly negative, further supporting the insurance function of cross-household transfers in rural China. In addition, consistent with my model's predictions that migration undermines risk sharing due to networks' lower ability to provide insurance to migrant households, my estimate of ω_3 is significantly positive in column (1), indicating a significantly lower responsiveness of net transfers to income for households with a higher migration rate among *non-kinship villages*. However, ω_3 is significantly positive only among *non-kinship villages.* My results in column (2) shows that households with high migration rates do not suffer from informal insurance loss among *kinship villages*. If anything, net transfers are even more responsive to income among households with higher migration rates in *kinship villages*. My estimate of a significantly negative π_6 in column (3) further supports that the loss of informal insurance by migrant households is significantly weaker among *kinship villages*. These results are highly consistent with my results in Table 3, which shows that migration undermines risk-sharing only among *non-kinship villages*.

My estimate of ω_2 is significantly negative in column (1). This suggests that, in *non-kinship villages*, households with higher migration rates, while getting less insurance, on average also receive lower net transfers conditional on income compared to other households within the same risk-sharing network. At the mean income level, an increase in a household's migration rate from 0 to 100% decreases the annual net transfers received by a household by 198 yuan. The lower av-

erage net transfers received by migrant households, compared to non-migrant households within the same risk-sharing network, is inconsistent with Prediction 2 but consistent with Prediction 1. The results supports information challenges as the main mechanisms through which migration undermines risk sharing and migrant households incur insurance loss in *non-kinship villages*.

Columns (4)- (6) and (7)-(9) also repeat the regressions in columns (1)-(3) while using a household's total transfers from other households and the total transfers to other households respectively as the dependent variable. The results display a similar pattern of insurance loss among migrant households only in *non-kinship villages*. In addition, my estimates in columns (4) and (7) show that the lower net transfers received by migrant households in *non-kinship villages* is primarily driven by a significantly higher amount of out transfers that migrant households issue to other households conditional on their income. The higher average out-transfers issued by migrant households conditional on their income again rejects the hypothesis that migration undermines risk sharing in *non-kinship villages* due to migrant households' lower commitment to honor transfer responsibilities, but are consistent with migration increasing income verification costs for risk-sharing networks.

5.2.2 Heterogeneous effects by income realizations

To further support that migration undermines risk sharing primarily through causing information problems, I also separate all household-years into two groups based on whether a household is having a high or a low income realization in a year. I regress the logarithm of a households' income, y_{ivt}, against a household fixed effect and a village-year fixed effect, and define a household-year as having a high income realization ($\triangle^{+}_{ivt}$=1) if residual is positive, and as having a low income realization ($\triangle^{-}_{ivt}$=1) if otherwise. I then run the following regression to examine how migrant households' insurance loss differ depending on households' income realizations:

$$\tau_{ivt} = \lambda_1 y_{ivt} \times \triangle^{+}_{ivt} + \lambda_2 y_{ivt} \times \triangle^{-}_{ivt} + \lambda_3 m_{ivt} + \lambda_4 y_{ivt} \times \triangle^{+}_{ivt} \times m_{ivt} + \lambda_5 y_{ivt} \times \triangle^{-}_{ivt} \times m_{ivt} + \delta_i + \gamma_{vt} + \epsilon_{ivt}, \tag{12}$$

where $\triangle^{+}_{ivt}$ and $\triangle^{-}_{ivt}$ are dummies indicating a high and low income realization respectively for a household-year; all other variables are defined as in equation (10). λ_1 and λ_2 therefore estimate

how the net transfers received by a household varies with own income, at high and low income realizations respectively, for a household with a zero migration rate; λ_4 and λ_5, on the other hand, estimate how the response of net transfers to income, at a household's high and low income realizations respectively, varies with a household's migration rate.

Columns (1) and (2) of Table 5 present my results when I run equation (12) for *non-kinship* and *kinship villages* respectively. Consistent with migrant households incurring informal insurance loss only in *non-kinship villages*, column (1), but not column (2), reports estimates of λ_4 and λ_5 that are positive, indicating weaker response of net transfers to income as migration rate increases. In addition, if we focus on the results in *non-kinship villages* (column (1)), my estimate of λ_4 is significantly more positive than λ_5. In fact, only λ_4 is significantly positive. The results suggest that, in *non-kinship villages*, the loss of responsiveness of net transfers to income experienced by migrant households, relative to non-migrant households with the same village, happen primarily at migrant households' high income realizations.

In columns (3)-(4) and (5)-(6), I repeat the regressions in columns (1)-(2) but replace the dependent variable with the total transfers a household sends out and receives respectively. The results present a roughly similar picture as my results in columns (1) and (2). In both *non-kinship* and *kinship villages*, a household sends out more transfers but receive fewer transfers from other rural households when its income is higher. However, only in *non-kinship villages*, a household's migration rate will make both the out-transfers sent and the in-transfers received by a household be less responsive to income. In addition, the loss of responsiveness of transfers to income for migrant households in *non-kinship villages* happen predominantly when migrant households are experiencing high income realizations.

The results in Table 5, which are highly consistent with Prediction 1 but inconsistent with Prediction 2, supplement my results in Section 5.2.1 in further supporting information challenges posed by migration as the primary reason why migration undermines risk sharing in *non-kinship villages*.

6 Loss of insurance deters migration

Overall, my theoretical and empirical analysis in Section 5 presents a rather consistent story explaining the results in Table 3. I show that the main culprit for the undermining effect of migration on risk sharing in *non-kinship villages* is the challenge to observe migrant households' income. Therefore, the presence of kinship networks must have mitigated the undermining effect of migration mostly due to its role in facilitating information flow across members over long distances.

In addition, my results suggest that when migration poses information problems in *non-kinship villages*, risk-sharing networks will rationally respond by issuing migrant households net transfers that are less responsive to their income, causing migrant households to incur substantial informal insurance loss in these villages. Therefore, the bigger informal insurance loss by migrant households in *non-kinship villages* may be a major source of migration costs deterring efficient labor movement to non-agriculture and an explanation for the much lower increase in migration rate in *non-kinship villages* after China lifted administrative restrictions against long-distance inter-provincial temporary migration (Figure 2). To provide further support for this hypothesis, I conduct two additional tests.

6.1 Difference-in-differences estimates

First, I formally examine how changes in migration rates after China's policy shift in 1992 differ across *kinship* and *non-kinship villages* by running the following regression:

$$m_{ivt} = \kappa_o + \kappa_1 Post_t \times Kinship_v + \mu_t + \gamma_i + \epsilon_{ivt}, \tag{13}$$

where m_{ivt} is the percentage of labor-days that household i in village v works as migrant workers in year t; $Post_t$ is a dummy indicating that year t is after 1992; $Kinship_v$ is a dummy indicating presence of kinship networks in village v; μ_t and γ_i represent year and household fixed effects respectively. κ_1 in the regression estimates how the change in a household's migration rate after 1992 varies with the presence of kinship networks within the village. If kinship networks indeed help mitigate information problems caused by migration for risk sharing, we would expect households in *kinship villages,* less hindered in their migration decisions by informal insurance loss, to expe-

rience a bigger increase in migration rate after China relaxed administrative restriction against inter-provincial rural-urban migration. We therefore expect κ_1 to be positive.

One major concern with interpreting my estimate of κ_1 as reflecting the effects of kinship networks in reducing migration costs and facilitating the movement of labor to migrant jobs after China's policy shift in 1992 is that the presence of kinship networks may be correlated with other village characteristics that could lead to heterogeneous changes in migration rates around the same time. For instance, kinship villages may on average be located closer to coastal provinces where a large amount of job opportunities exist, causing *kinship villages* to face lower migration costs even if kinship networks do not mitigate information problems for risk sharing. To address this concern, I add a series of additional controls, including the interaction terms between all the year dummies and a village's distance to the coast or average distance to migration destinations, to test the robustness of my estimates.

Table 6 presents my estimates of κ_1 in equation (13). Column (1) shows the baseline estimate. Column (2) controls for X_{ivt}, a set of additional household controls, including the household's contemporaneous amount of arable land, number of residents, number of laborers, and number of male laborers. Column (3) adds the interaction terms between a village's physical distance to the coast and each of the year dummies as additional controls. Column (4), on the other hand, controls for the interaction terms between a village's average distance to all migration destinations and each of the year dummies. Specifically, I rely on China's 2000 population census data, and measure the attractiveness of each Chinese county as a temporary migration destination by the share of all rural temporary migrants in China in 2000 in the county. I then calculate each village's average distance to all migration destinations as the sum of the village's physical distance to each Chinese county weighted by each county's attractiveness as a temporary migration destination.

Finally, Zhao (2020) shows that the frequency at which village leaders conduct major land reallocations across households may be another factor deterring households' labor allocation to temporary migration. To mitigate bias driven by possible correlation between $kinship_v$ and villages' land reallocation policies, in column (5), I add the interaction terms between all the year dummies and each village's land reallocation frequency as additional controls.

In all columns, my estimates of κ_1 remain positive and significant, with the magnitude of the estimate hardly changes at all when I add in additional controls. The results strongly support the

effects of kinship networks in facilitating temporary migration and allowing households to better take advantage of the 1992 policy shift. It is unlikely that the higher increase in migration rate in kinship villages after 1992 simply reflect correlation between $kinship_v$ and villages' distance to migration destinations or land reallocation policies.

6.2 Heterogeneous effects

Second, informal insurance is more valuable for households facing higher income risks. If the presence of kinship networks indeed facilitates migration through reducing informal insurance loss of migrant households, we would expect presence of kinship networks to particularly affect the migration decisions of households facing higher income risks and, consequently, more averse to losing the insurance benefits of informal cross-household transfers. To provide further support for my argument that informal insurance loss by migrant households is a major source of migration costs hindering temporary migration in *non-kinship villages*, I also run the following trip-interaction specification:

$$m_{ivt} = \phi_o + \phi_1 Post_t \times Kinship_v + \phi_2 Post_t \times Kinship_v \times Risk_i + \mu_t + \gamma_i + \epsilon_{ivt}, \tag{14}$$

where $Risk_i$ is a measure of the baseline riskiness of household i's income before 1992. Specifically, $Risk_i$ is the coefficient of variation of household i's annual net income between 1986 and 1991. All other variables are as defined in equation (13).

ϕ_2 in equation (14) measures how the gap in migration growth between *kinship* and *non-kinship villages* vary depending on households' initial income risks. If presence of kinship networks indeed facilitate migration through reducing informal insurance loss of migrant households, we will expect stronger kinship-versus-non-kinship divergence in migration growth among households with high income risks. We therefore expect ϕ_2 to be positive.

Table 7 presents my estimates of equation (14). The controls in columns (1)- (5) of Table 7 correspond to the set of controls in columns (1)-(5) of Table 6. Across all columns, my estimates of ϕ_2 are significantly positive and highly robust, supporting that the higher increase in migration rate in *kinship villages* is indeed even more salient among households facing bigger income risks.

6.3 Flexible estimation

To further address concerns of confounding trends , I also estimate a fully flexible estimating equation that takes the following form:

$$m_{ivt} = \kappa_o + \sum_{\tau=1987}^{2008} \kappa_\tau Kinship_v \times I_t(year = \tau) + \mu_t + \gamma_i + \epsilon_{ivt}, \tag{15}$$

where I replace $Post_t \times Kinship_v$ in equation (13) with the interaction between $Kinship_v$ and each of the year indicator variables except that of 1986, the first year in the sample. κ_τ estimates how the correlation between the presence of kinship networks and a household's migration rate differs in year τ relative to the omitted baseline year, 1986.

I separate households into two groups (high-risk and low-risk) based on the rank of their $risk_i$ (i.e. the coefficient of variation in each household's annual net income between 1986 and 1991) within the village. Specifically, a household is defined as high-risk, if its $risk_i$ is in the top quintile within its village. Figure (3) plot my estimates of equation (13) separately for high-risk and low-risk households.

As seen from my results, throughout the pre-reform period, my estimates of κ_τs, for both high-risk and low-risk households, are mostly indistinguishable from zero, supporting lack of pre-trends. Instead, my estimates in Table 6 reflect a sharp relative increase in migration rates in kinship villages exactly around the time of the relaxation on restrictions against cross-provincial temporary migration. In addition, consistent with my estimates in Table 7, the post-1992 relative increase in migration in *kinship villages* is even stronger among high-risk households.

Consistent with presence of kinship networks mitigating informal insurance loss of migrant households, households in *kinship villages* experienced significantly higher increase in migration rates after the Chinese government relaxed restrictions against temporary migration, and this effect of kinship networks on migration rates is particularly salient among households facing higher income risks and, therefore, more averse to losing the insurance benefits of informal cross-household transfers.

7 Conclusion

Overall, the results from the various empirical exercises conducted in this paper put together a highly consistent story. They show that the main reason for why migration undermines risk sharing in *non-kinship villages* is that migration increases the difficulty for other households to accurately observe migrant households' income and therefore constrain these villages' ability to provide insurance to migrant households through cross-household transfers. However, the undermining effect of migration on risk sharing and the informal insurance loss suffered by migrant households are much weaker, if not non-existent, in Chinese villages with presence of kinship networks. This suggests a unique strength in kinship ties in facilitating information flow across members, even over long distances, and their positive roles in sustaining the resilience of informal risk-sharing institutions in the face of rapid structural transformation.

The results also suggest that the potential loss of informal insurance by migrant households in *non-kinship villages* may be a major source of migration costs constraining efficient labor allocation in these villages, and an explanation for the significantly lower migration rates in these villages. Therefore, policies aimed at providing formal insurance and decreasing agricultural households' reliance on informal set-ups for insurance could be effective policies to encourage migration and reduce cross-sectoral labor misallocation, at least in those villages without presence of kinship networks.

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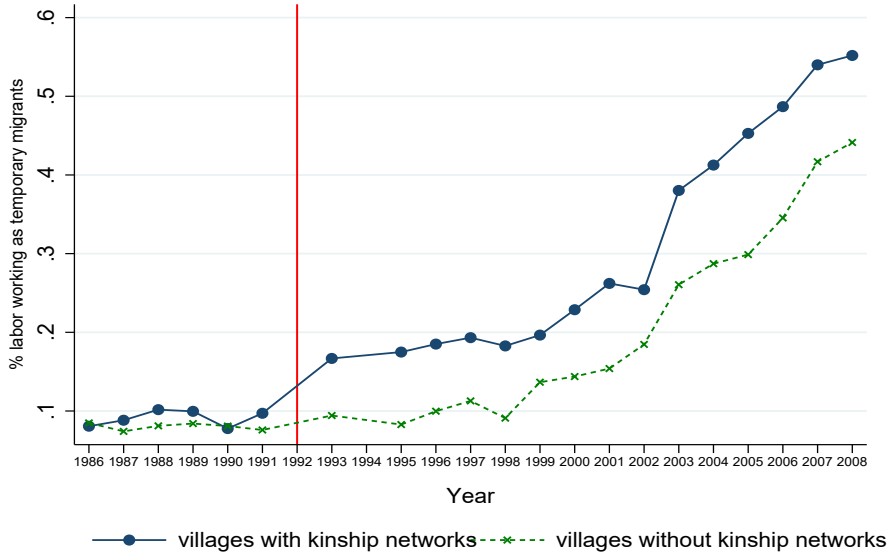
Figures and Tables

Figure 1: Villages' Mean Annual Migration Rate



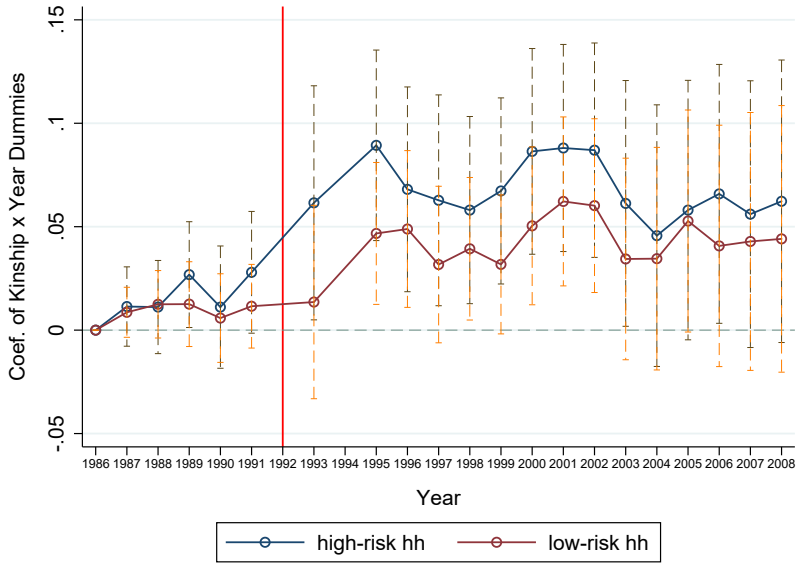
Notes: The data are reported by the NFS and the VDS. The sample consists of a balanced panel of 130 villages surveyed by the NFS and the VDS for the years between 1986 and 2008.

Figure 2: Mean Annual Migration Rate: Kinship Villages vs. Non-kinship Villages



Notes: The data are reported by the NFS and the VDS. The sample consists of a balanced panel of 130 villages surveyed by the NFS and the VDS for the years between 1986 and 2008. A village is defined as having kinship networks if the VDS reports the presence of either an ancestral hall or a lineage genealogy in the village.

Figure 3: Dynamic Effects of Kinship Network: High-risk vs. Low-risk Households



Notes: An observation is a village and a year. A village is defined as having kinship networks if the VDS reports the presence of either an ancestral hall or a lineage genealogy in the village. A household is defined to be high-risk if the coefficient of variation in the households' annual net income between 1986 and 1991 is in the top quintile within its village. Standard errors are clustered at the village level.

Table 1: Transfers are insurance

	In Levels		In First-differences	
	(1) Net transfers	(2) Net transfers	(3) Δ Net transfers	(4) Δ Net transfers
Own income	-0.040**	-0.040**		
	(0.017)	(0.017)		
Village average income		0.030**		
		(0.015)		
Δ Own income			-0.088***	-0.088***
			(0.029)	(0.029)
Δ Village average income				0.059**
				(0.024)
Household FE	Yes	Yes	No	No
Village-year FE	Yes	No	Yes	No
Year FE	No	Yes	No	Yes
Obs.	239903	239903	222747	222747
Adj. R-sq.	0.15	0.12	0.10	0.08

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 2: Agricultural price shocks affect migration

	Migration dummy			Migration rate		
	(1) $\Delta_{1993\text{-}1995}$	(2) $\Delta_{1993\text{-}2008}$	(3) $\Delta_{1993\text{-}t}$ in all years	(4) $\Delta_{1993\text{-}1995}$	(5) $\Delta_{1993\text{-}2008}$	(6) $\Delta_{1993\text{-}t}$ in all years
Agr. price shocks	-0.323*	-0.300***	-0.112*	-0.091	-0.201**	-0.112***
	(0.178)	(0.108)	(0.058)	(0.089)	(0.083)	(0.041)
Household FE	No	No	Yes	No	No	Yes
Year FE	No	No	Yes	No	No	Yes
Obs.	13693	9111	176316	13552	8373	171255
Adj. R-sq.	0.00	0.01	0.58	0.00	0.01	0.55
No. of clusters	199	148	203	199	148	203

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 3: Migration undermines risk-sharing in non-kinship villages

	Dep. Var.: Log(consumption)		
	(1) Non-kinship Villages	(2) Kinship villages	(3) All villges
	Panel A: Reduced-form estimates		
Log(income)	0.631***	0.685***	0.631***
	(0.023)	(0.034)	(0.023)
Log(income) × pred. migration	0.324*	-0.274	0.324*
	(0.180)	(0.247)	(0.180)
Log(income) × kinship			0.054
			(0.041)
Log(income) × pred. migration × kinship			-0.598*
			(0.304)
Adj. R-sq.	0.78	0.81	0.79
	Panel B: 2SLS estimates		
Log(income)	0.586***	0.723***	0.586***
	(0.046)	(0.066)	(0.046)
Log(income) × migration	0.359*	-0.236	0.359*
	(0.209)	(0.223)	(0.208)
Log(income) × kinship			0.138*
			(0.080)
Log(income) × migration × kinship			-0.595*
			(0.304)
Adj. R-sq.	0.37	0.39	0.38
F-stat.(first stage)	21.16	13.88	10.60
Anderson-Rubin test p-value (clustered)	0.071	0.262	0.105
Household FE	Yes	Yes	Yes
Village-year FE	Yes	Yes	Yes
Obs.	156812	73060	229872

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 4: Effects of migration on transfers

	Net transfers			Transfers from other rural hh			Transfers to other hh		
	(1) non-kinship	(2) kinship	(3) all	(4) non-kinship	(5) kinship	(6) all	(7) non-kinship	(8) kinship	(9) all
Income	-0.058***	-0.126***	-0.058***	-0.024**	-0.078***	-0.024**	0.032***	0.046***	0.032***
	(0.015)	(0.035)	(0.015)	(0.010)	(0.028)	(0.010)	(0.007)	(0.014)	(0.007)
HH migration rate	-669.999**	1791.643**	-669.999**	-232.353	442.462	-232.353	379.784**	-1408.323	379.784**
	(273.520)	(817.273)	(273.212)	(146.631)	(346.527)	(146.466)	(152.153)	(929.624)	(151.982)
Income × HH migration rate	0.041**	-0.088*	0.041**	0.018*	-0.017	0.018*	-0.023**	0.074	-0.023**
	(0.019)	(0.047)	(0.019)	(0.010)	(0.016)	(0.010)	(0.011)	(0.052)	(0.011)
Income × Kinship			-0.068*			-0.053*			0.014
			(0.038)			(0.029)			(0.016)
HH migration rate × Kinship			2461.642***			674.815*			-1788.107*
			(855.702)			(373.727)			(934.828)
Income × HH migration rate × Kinship			-0.129**			-0.035*			0.097*
			(0.050)			(0.019)			(0.053)
Effect of migration rate at mean income	-198.01	785.91		-28.74	251.94		115.16	-560.58	
P-value for the difference			.003			.149			.055
Village-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	155334	71619	226953	155334	71619	226953	155334	71619	226953
Adj. R-sq.	0.15	0.25	0.20	0.12	0.20	0.16	0.25	0.21	0.23

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 5: Asymmetries in responsiveness of transfers to income

	Net transfers		Transfers from other rural hh		Transfers to other hh	
	(1) non-kinship	(2) kinship	(3) non-kinship	(4) kinship	(5) non-kinship	(6) kinship
Income $\times \Delta_+$	-0.063***	-0.145***	-0.032**	-0.101***	0.031***	0.044***
	(0.017)	(0.041)	(0.013)	(0.033)	(0.007)	(0.013)
Income $\times \Delta_-$	-0.137**	-0.343***	-0.140**	-0.318***	-0.003	0.025*
	(0.065)	(0.107)	(0.061)	(0.118)	(0.009)	(0.013)
Income $\times \Delta_+ \times$ migration	0.044**	-0.088*	0.022*	-0.014	-0.022**	0.075
	(0.020)	(0.045)	(0.012)	(0.015)	(0.010)	(0.053)
Income $\times \Delta_- \times$ migration	-0.039	-0.076	-0.062	-0.018	-0.023	0.058
	(0.140)	(0.055)	(0.130)	(0.051)	(0.016)	(0.043)
Migration	-519.474	1604.887*	-186.743	243.054	332.731**	-1361.833
	(639.189)	(847.341)	(518.044)	(419.674)	(152.996)	(868.762)
Village-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	155334	71619	155334	71619	155334	71619
Adj. R-sq.	0.18	0.31	0.18	0.28	0.25	0.22

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 6: Divergence in migration pattern after 1992

	Dep. var: percent of hh labor as migrant workers				
	(1)	(2)	(3)	(4)	(5)
Post × Kinship	0.046**	0.042**	0.043**	0.037**	0.043**
	(0.018)	(0.017)	(0.018)	(0.018)	(0.017)
X_{ivt}	No	Yes	No	No	No
Yr FE × distance to coast	No	No	Yes	No	No
Yr FE × distance to migration destinations	No	No	No	Yes	No
Yr FE × reallocation frequency	No	No	No	No	Yes
Year FE	Yes	Yes	No	No	No
Household FE	Yes	Yes	Yes	Yes	Yes
Obs.	226964	226929	226964	226964	226964
Adj. R-sq.	0.47	0.48	0.47	0.47	0.47

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 7: Divergence stronger among households with high income risks

	Dep. var: percent of hh labor as migrant workers				
	(1)	(2)	(3)	(4)	(5)
Post × Kinship	0.015	0.013	0.013	0.006	0.015
	(0.020)	(0.020)	(0.021)	(0.021)	(0.020)
Post × Kinship × Income risk	0.068**	0.065**	0.065*	0.072**	0.067**
	(0.033)	(0.031)	(0.033)	(0.033)	(0.031)
X_{ivt}	No	Yes	No	No	No
Yr FE × distance to coast	No	No	Yes	No	No
Yr FE × distance to migration destinations	No	No	No	Yes	No
Yr FE × reallocation frequency	No	No	No	No	Yes
Year FE	Yes	Yes	No	No	No
Household FE	Yes	Yes	Yes	Yes	Yes
Obs.	196734	196703	196734	196734	196734
Adj. R-sq.	0.45	0.46	0.45	0.45	0.45

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table A.1: First-stage regressoions of the effect of predicted migration on actual migration

	Non-kinship Villages	Kinship villages	All villges	
	(1)	(2)	(3)	(4)
	Log(income) × migration	Log(income) × migration	Log(income) × migration	Log(income) × migration × kinship
Log(income) × pred. migration	0.903***	1.160***	0.903***	0.000
	(0.196)	(0.311)	(0.196)	(0.000)
Log(income) × pred. migration × kinship			0.256	1.160***
			(0.366)	(0.309)
Household FE	Yes	Yes	Yes	Yes
Village-year FE	Yes	Yes	Yes	Yes
Obs.	156812	73061	229873	229872
Adj. R-sq.	1.00	1.00	1.00	.9983
F-statistics	21.16	13.88	17.65	7.05
p-value for joint significance	.0000106	.0005418	1.00000000000e-07	.0008666

Notes: An observation is a household and a year. Coefficients are reported with standard errors clustered at the village level in parentheses. * , **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively.