

## Land Tenure Arrangements and Rural-Urban Migration in China

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### **Abstract**

Obstacles to internal migration in China contribute to inefficiency, inequality and land degradation. Academic and policy debate has primarily focused on discrimination against rural migrants on arrival in urban areas. Meanwhile, barriers to migration out of rural areas have received less attention. This paper examines the role of incomplete rural property rights in the migration decisions of rural households. We estimate the impacts of tenure insecurity and restrictions on land rentals on participation in outside labor markets. The results indicate that tenure insecurity reduces migration. This relationship is particularly pronounced on forest land, which has implications for the conservation of recently replanted forest areas.

JEL codes: J61, O15, P32

Keywords: land tenure security; land rental rights, rural-urban migration, China, Asia.

Forthcoming in *World Development*, doi:10.1016/j.worlddev.2010.08.009

# Land Tenure Arrangements and Rural-Urban Migration in China

## 1 Introduction

Despite the vast scale of migration in China<sup>1</sup>, there is evidence that constraints on labor mobility remain. These contribute towards both rural-urban and regional inequality and reduce overall labor productivity at a national level (Au & Henderson 2006). As an indication of the extent of such disparities, Yang and Cai (2003) estimate that the ratio of non-agricultural to agricultural incomes for a sample of 36 other countries is usually around 1.5. In comparison, the same ratio in China has varied between 2 and 3 since the early 1980s. Constraints on migration also increase the pressure on the rural environment, leading to land degradation and deforestation (Liu et al. 2005). To describe the source of obstacles to migration, the literature has mainly focused on the potential destinations of migrants. The household registration (*hukou*) system has been described as the major impediment to migration, by preventing rural migrants from accessing all the benefits associated with legal residence in cities. Whalley and Zhang (2007) argue that removing hukou restrictions would significantly increase migration flows and reduce regional income disparities<sup>2</sup>. Another widely described obstacle to migration relies on the extent of labor market segmentation and discrimination against rural migrants. For example, Meng and Zhang (2001) find significant evidence for occupational segregation, some of which may also be traced back to the *hukou* system (Lu & Song 2006).

As a result of awareness of the impacts that *hukou*-related constraints on labor mobility have on inequality, economic efficiency, and the rural environment, there have been reforms aimed at reducing these constraints<sup>3</sup>. These reforms will remove restrictions on migration, and should therefore increase flows of labor and reduce wage inequalities over time. However, as *hukou*

constraints are eased, labor mobility will not increase if other barriers to migration remain. This paper specifically considers whether rural land tenure arrangements act as a further constraint on migration. By focusing on ‘push’ factors at the origin of rural-urban migration, this paper fills a gap in the literature on migration, which has mainly focused on ‘pull’ factors<sup>4</sup>.

This paper also contributes to the literature on the impact of land rights on household decision making. China has a distinct system of land tenure for agricultural and forest land. Village collectives officially own the land, but individual households have fixed term contracts to use the land for their own production activities. Over time, these land use rights have become closer in nature to private property, with longer contracts, reduced frequency of land reallocations, and increased opportunity to rent land to others. However, this process is not complete, and questions remain about both how meaningful the impacts have been in practice and the extent to which further reforms are required (Deininger & Jin 2009). Furthermore, the increasing incidence of land expropriation for urban expansion and infrastructure development has compromised the effectiveness of the enhanced land-use contracts (Ding 2007). So far analysis of the land tenure reforms has mainly focused on the impact of rural land tenure *on investment and productivity* (e.g. Carter & Yao 1999; Jacoby et al. 2002; Deininger & Jin 2003). The second key contribution of this paper is to shed light on an alternative way in which land tenure may affect household welfare and economic productivity. In particular, this paper considers the impact of the current systems of rural property rights on household *migration* decisions.

Following Besley’s (1995) description of the positive link between land rights and investment decisions, we can identify two relevant arguments according to which land management arrangements would influence migration decisions in the context of China. First, migration is associated with a risk of expropriation since migration entails a decrease in household size. Hence,

under the current system of rural land tenure in China, this may induce redistribution of some of the household land in order to maintain egalitarian land holdings (Rozelle & Li 1998). Second, migration is encouraged by the development of land exchange rights. The ability to rent land while away reduces the opportunity cost of lost agricultural labor.<sup>5</sup> We develop a theoretical model in which we show that moving away from existing property rights arrangements towards those characterizing a market economy (and thus alleviating migration constraints) may in fact have countervailing effects on migration. This is then tested econometrically using household survey data on migration decisions and property rights to agricultural and forest land.

The rest of the paper is organized as follows. We begin in Section 2 by reviewing the literature on the determinants of, and constraints on, migration in China. In Section 3, we then consider how the current land tenure arrangements relating to agricultural and forest land may affect household migration decisions. Section 4 described the data while Section 5 presents the empirical strategy and the econometric results. Section 5 concludes.

## **2 Impacts and determinants of migration in China**

Evidence suggests that constraints on migration in China have multiple negative impacts. First, at the national level, Au and Henderson (2006) find that China is “under-urbanized”, due to substantial unexploited economies of scale. As a result, they estimate potential productivity gains of at least 35% for the majority of prefecture level cities. In addition to these productivity effects, Yang and Cai (2003) and Whalley and Zhang (2007) attribute high rural-urban inequality in China to restrictions on migration. At the level of individual households, Taylor et al. (2003) and Du et al. (2005) find that migration significantly reduces poverty in rural areas, through increases in income and relaxation of

credit and liquidity constraints. Lastly, there are also substantial environmental impacts of constraints on migration. Poor regulation and land scarcity in rural China have led to deforestation for timber and agricultural land creation, conversion of grasslands, and over-intensive use of agricultural land (Xu et al. 2006; Zhang et al. 2000). These have in turn resulted in soil erosion, flooding, landslides, droughts, sandstorms and losses of biodiversity (Liu et al. 2005; Wang et al. 2007). Attempts are being made to address the poor regulation of rural land use, through programs such as the Sloping Land Conversion Program and the Natural Forest Protection Program (Bennett 2008; Zhang et al. 2000). However, without economic development in rural areas, or migration to urban areas, incentives will remain unchanged, limiting the long term effectiveness of the programs. We look separately at the impacts of land tenure for both agricultural and forest land, as these have potentially different environmental implications.

The migration decision is generally modeled as a function of the difference between rural income and expected urban income, for either the individual migrant (Harris & Todaro 1970) or the migrant-sending household (Stark 1978; Stark & Bloom 1985). This basic model can be adjusted with other factors that affect the costs or benefits of migration such as transport costs, living costs in urban areas, risk aversion, and non-monetary costs and benefits.

The impact of land tenure on migration has received little attention in the international literature. However, it has been raised as a potentially important issue in the Chinese context. Zhao (1999) tests the permanent income hypothesis using household survey data, and finds that households treat remittances from migrants as temporary, and consume only a small proportion of the additional income. Based on similar evidence, it has been argued that rural-urban migrants in China are more likely than those in other countries to migrate temporarily due to the characteristics of the agricultural land tenure system (Yang 1997). This is because households risk losing their rights to

agricultural land if they migrate permanently, which creates an additional cost to migration in the form of lost future income. The hypothesis has not been tested empirically, but we use household survey data to test a similar model in the following sections of this paper. Other theoretical work focused on Chinese institutions has suggested that various market constraints (Groom et al. 2009; Uchida et al. 2009), and agricultural production quotas and taxes (Rozelle et al. 1999; Fleisher & Yang 2006; Zhao 1999) may also affect migration decisions.

Previous empirical studies on the determinants of migration have found that young, single adults without dependents are more likely to migrate; men migrate more frequently than women; and those with more agricultural land are less likely to migrate (Rozelle et al. 1999; Zhao 1999; Zhao 2005). Education and income have mixed impacts (Zhao 2005). However, Rozelle et al (1999) find that farmers from poor villages are more likely to migrate, and Zhao (1999) finds that a larger initial cash holding reduces the likelihood of migration. Due to a lack of social security provision in rural areas, ill health of elderly parents reduces the probability of migration for adult children (Giles & Mu 2007). Rozelle et al (1999) explore the impacts of a set of village level institutions including security of property rights and rights to transfer land, as well as access to credit, and whether farmers are subject to crop production quotas. They find that production quotas and tenure security are not important, while the ability to rent land and access credit both have positive impacts on migration. This paper updates the empirical analysis of land tenure impacts in light of reforms to the both *hukou* system and rural property rights. It also extends it to forest land, as well as agricultural land.

### **3 Role of land tenure in migration decisions**

This section discusses the characteristics of land tenure arrangements in China and formulates theoretical predictions regarding their impact on household migration decisions.

#### **(a) Rural land tenure in China**

Agricultural and forest land in China are subject to what may be described as ‘quasi-private’ property rights (Kung 2002). Although rural households have held individual rights to use the land since the 1980s, these rights are not complete, and households face multiple sources of tenure insecurity.

The first source of insecurity lies in the nature of the Household Responsibility System (HRS), through which households are allocated land-use rights. Under this system, land officially remains under collective ownership, but is allocated among village households to cultivate as they choose. The extent to which these rights approximate private property rights in practice has varied over time and space. When the HRS was initially introduced, land could not be transferred between households, and was subject to periodic reallocation at the discretion of the village leader. Reallocations were intended to account for changes in population and the formation of new households. The Rural Land Contracting Law (RLCL), implemented in 2002, aimed at strengthening the individual rights of households by enforcing 30 year land-use contracts; disallowing large-scale reallocations of land and limiting small-scale re-adjustments; and permitting transfers of land between households (Ping Li 2003). However, despite this, there is evidence that households face a continued risk of land reallocation: Deininger and Jin (2009) look at the incidence of land

reallocations that are not technically permitted under the RLCL. They find that in a sample of 8000 households from 800 villages across China, approximately 1/3 experienced reallocations of land between 2002 and 2004. Tao and Xu (2007) similarly found evidence of land reallocation continuing despite the introduction of the RLCL.

The tenure insecurity over agricultural land under the HRS is exacerbated by the risk of land expropriation for urban expansion and infrastructure development (Tao & Xu 2007). Rapid economic development, combined with high population density, has created high demand for rural land to be used for urban expansion and infrastructure projects. This has resulted in widespread use of compulsory land acquisition (Chan 2003), with what many argue to have been insufficient compensation (Guo 2001). Since 2004, the Chinese constitution has in fact had a clause stating that private property may be expropriated, but that it must be for 'public use' and that 'just' compensation must be provided (Liu 2005). However in practice, local governments have the authority to determine how 'public use' is defined, while at the same time they have strong incentives to expropriate land for urban development because of the high prices that the land can be sold to private developers for once the designation is changed from rural to urban (Deininger & Jin 2007). In addition, in most fully fledged market economies, the concept of 'just' compensation is related to the market value of the land, but in rural China, the lack of well-defined property rights or functioning land markets make this difficult, if not impossible to achieve (Ding 2007).

In addition to the problem of tenure insecurity, land transfer markets also continue to be thin. Land transfers that do not affect the underlying contract with the village collective are technically permitted, subject to notification of the village leader. However, although land rentals increased after the 2002 tenure reforms, Deininger and Jin (2007) find that contracts remain informal and unwritten, and are frequently made with relatives. In the case of both land reallocations and land transfers, one

factor in the incomplete implementation of the RLCL appears to be a lack of awareness of its provisions: Deininger et al. (2007) found that although both local governments and village leaders undertook extensive dissemination of information about the Law, only 21% of village leaders were aware that land transfers were permitted, and around half of village leaders and households were aware that reallocation of land was no longer permitted.

Land tenure arrangements relating to collective forest land in the south and southwest of China are similar to those concerning agricultural land, while forest land in the northeast of China is almost entirely state-owned (Wang et al. 2004). The HRS was applied to collective forest land in the mid-1980s, a few years after it was introduced in the agricultural sector. Households were allocated plots of forest land or waste land on which trees could be planted, as well as areas of forested land. Both of these land types are held under contract, and individual households have the rights to manage the land for timber. Any trees planted by the household belong to them, but trees planted previously by the collective do not, and the revenue from harvesting the latter is shared between the household and the collective (Liu 2001). The majority of villages also retain some forest land that is collectively owned and managed. The situation relating to forest land rental is similar to agricultural land, in the sense that it is permitted, but not common.

In the case of forest land, an additional source of tenure insecurity has been introduced by the Natural Forest Protection Program. This program prohibits harvesting of timber on forest land. It was intended to apply only to state-owned land. However, it has been expanded to cover collectively-owned land, which many describe as equivalent to a ‘taking’ of the property rights of the collectives and the households with land-use rights (Shen 2001; Katsigris 2002; Zuo 2002; Miao & West 2004).

(b) Theoretical hypotheses about the impact of land tenure on the household migration decision

We now consider how the land tenure arrangements described in the previous section might be expected to affect household decisions to migrate away from rural areas. There are two possible ways in which migration could be affected. These relationships are shown formally in Appendix 1.

The first link between land tenure and labor allocation decisions arises if migration results in an increased risk of land expropriation. Migration entails a decrease in household size. Due to the scarcity of rural land and the incomplete implementation of the RLCL, this may induce redistribution of some of the household land in order to maintain egalitarian land holdings (Deininger et al. 2007). The incentive for this becomes stronger as some land is requisitioned for urban or infrastructure development (Tao & Xu 2007). In this context, a household considering whether to allocate labor to migration will account for the increased risk of land expropriation in a future period, resulting from the reduction in household size. The effect of this increased risk may be viewed as similar to the effect of a tax on migration, and reduces the likelihood of migration.

However, we also consider the outcome if land rights are developed such that the overall risk of expropriation for all households is reduced. Here, the development of land rights has two countervailing effects on migration. A decrease in the probability of expropriation is akin to a reduction of the tax on migration, which boosts migration incentives. However, this positive effect is counterbalanced by a negative effect due to the complementarity between land and farm labor. A decrease in the overall probability of expropriation means that the household will keep more land, which necessitates farm labor and decreases migration incentives. Conversely, a high probability of expropriation raises the relative return to migration. Hence, in our simple model, the development of

land rights associated with an increase in tenure security may have a positive or negative net effect on migration.

The second aspect of land tenure that may affect migration decisions is whether households have the rights to rent land. If land cannot be rented, the loss of labor through migration results in a decline in the return to household land. This represents the opportunity cost of migration. However, if land can be rented out, the marginal productivity of land will always be equalized to the land rental rate, while the marginal productivity of labor will be equalized to the off-farm wage rate. As rights to rent land are increased, the opportunity cost of migration is reduced, resulting in higher rates of migration.

To sum up, the theoretical model of the household labor allocation decision predicts that improved land rental rights have an unequivocal positive effect on migration incentives; while increased tenure security has a countervailing effect on migration. This is because a lower risk of expropriation increases migration incentives due to the reduction of an implicit tax on migrant labor, but reduces migration incentives because of the complementarity between land and labor.

#### **4. Data**

This paper makes use of data from two household surveys carried out by University College London, Cambridge University, and Peking University in Summer 2004 and Summer 2005. Both surveys involved face-to-face interviews, with questions on land tenure; household labor allocation, including migration out of the village; and the demographic and economic characteristics of the household.

##### *Sample socioeconomic composition*

The first survey focused on rights to, and use of, agricultural land. It covered 131 households from 21 villages in Guizhou Province and 155 households from 23 villages in Ningxia Province. The

second survey, which focused on property rights relating to forest land, covered 285 households in Guizhou Province. In addition to the household level surveys, separate questionnaires were used to collect village level data from village leaders. We use data on both agricultural and forest land in order to investigate whether the responses to incomplete property rights differ between the two. There are two possible reasons why this might be the case: first, as described in Section 3.1, the details of the land tenure arrangements are different for the two land types; and second, the labor requirements on agricultural and forest land are not necessarily the same. We would also expect the environmental impacts of constraints on migration to differ across the two types of land. Hence, by using data from both agricultural and forest land users we aim to achieve a more comprehensive exploration of the links between migration and property rights highlighted in the previous section.

The two provinces were selected on the basis of their relatively low levels of industrial activities, and high levels of poverty: Ningxia ranks 22<sup>nd</sup> among the 31 Chinese provinces for GDP per capita, while Guizhou ranks 31<sup>st</sup> out of 31 (China Statistical Yearbook 2007). Furthermore, even within these provinces, the Guyuan region of Ningxia and the Bijie and Qiandongnan regions of Guizhou, where the surveys were carried out, are notable for being relatively inaccessible, with limited local economic opportunities aside from agriculture and forestry.

For each of the surveys, the villages were selected along with the local forest bureau, and then the households were selected at random from within each village to be interviewed. The interviews were conducted directly by the survey team, without interference from local officials, and the use of face-to-face methods ensured a high level of completeness and accuracy of the data.

As described above, the sample is split into agricultural and forest-based households. However, Table 1 shows that some of the former have small areas of forest land, while most forest-based households also have some agricultural land. Agricultural land is used primarily for the production of

staple food such as wheat, corn and potatoes, although 44% of agricultural households sell produce as well. On average, households consume crops valuing around ¥2000<sup>6</sup> per year, and earn a further ¥640 from sales. This involves a mean of 300 days allocated to cultivation per year. Households with forest land earn an average of only ¥770 p.a. from timber and non-timber forest products<sup>7</sup>. However, this requires only 25 days of labor per year. We would expect the differences in the ways that agricultural and forest land are used to mean that households respond differently to incomplete property rights in each case. On the one hand, the potential income losses if agricultural land is expropriated, or cannot be rented out, are higher than for forest land. However, the greater labor requirements for crop cultivation mean that the opportunity cost of migration in terms of lost agricultural labor is higher.

In both samples, households consist of approximately 5 members, including 3 to 4 adults and 1 to 2 children. Table 1 also shows that many of the households have at least one family member working outside the village. A significant feature of these regions is that it is common for young adults to migrate on a temporary basis while their children are cared for by grandparents. Individual members of the surveyed households have fairly low levels of education, with the majority of adult members not having progressed beyond primary schooling. However, levels of education tend to be higher among younger household members. They also have relatively low per capita incomes of ¥1700 p.a. for the agricultural households and ¥2600 p.a. for the forest-based households. Lastly, these regions are ethnically mixed, although the majority of households are Han in the agricultural survey area.

The villages included in our sample are fairly large, with an average of around 300-400 households. Table 1 shows that they are relatively remote. Buses are the most common form of transport, followed by motorcycles, while levels of car or truck ownership are low. However, local

infrastructure is reasonable, with all but one village having electricity, and the majority having at least a primary school.

[INSERT TABLE 1 ABOUT HERE]

### *Land tenure arrangements*

Households in our sample have had individual rights to use agricultural land since between 1979 and 1982. Arrangements are fairly similar across villages, with households being assigned an area of land, which they can cultivate as they choose. This land is allocated free of charge, generally in multiple small plots. Since 1999, significant areas of agricultural land have been entered into contracts with the national government under the Sloping Land Conversion Program. Under these contracts, households receive payment in return for planting trees on their crop land. 76% of households in our sample participate in the program, and those that participate have an average of 49% of their land enrolled.

As discussed in Section 3, forest land can be managed under various types of agreement. The most common is that households are allocated forest land by the village leader, in a similar manner to agricultural land. Sample households have a mean area of 17 mu<sup>8</sup> of forest land allocated by the collective, although the median area is substantially lower, at 7 mu per household. This is generally divided across multiple small plots, some of which were forested when initially allocated, while others were wasteland on which trees have since been planted. 31% of sample households also have access to collectively managed forest land. They benefit from this land in different ways: in some cases, households can use the land to collect non-timber products; alternatively, the land may be

collectively managed for timber, with the profits either shared among households or used to fund investment in village infrastructure and services. Around 13% of households participate in ‘private associations’, in which households manage their individual plots of forest land jointly with other households in the village. In addition, around 7% contract extra forest land, in addition to their allocated area, in order to plant trees for timber.

Rental agreements for agricultural and forest land exist among the surveyed households. 4% of households rent-out agricultural land, and 18% rent-in land from other households. Among forest-based households, 7% rent-in land and 4% rent-out land. Average areas of land rented-in are smaller than average areas of land rented-out. In the case of agricultural land, the average area of land rented-in is 4.67mu, while the average area of land rented-out is 6.33mu. This provides one explanation for the differences in the proportion of households engaged in each activity. Another factor is that whole households that have migrated may rent-out land, but are not included in the sample<sup>9</sup>. In practice, the majority of the agreements that occur are closer in nature to sharecropping than rental, as payment takes the form of a share of any profits. The rights of households to rent land, and the security of their land-use rights will be discussed further in Section 4.3.

## **5. Empirical analysis of the impact of land tenure on migration**

As well as asking households about their land-use rights, we also asked them about their behavior and preferences regarding migration. At the time of the surveys, 51% of the agricultural sample, and 59% of the forest-based sample had at least one household member working outside the village. Among households with at least one migrant member, forest-based households had just over two members employed outside the village on average, and agricultural households had an average of 1.6 migrants. When asked whether they would like to increase the share of household labor employed

outside the village, 64% of agricultural households and 45% of forest-based households said they would.

### *Estimation strategy*

The data described in the previous section are used to estimate the impacts of land tenure security and land transfer rights on migration in the sample households. We first estimate a Probit model using a binary dependent variable that takes the value 1 if any household member has left the village for employment purposes during the preceding year. This model assumes a latent variable specification in which the household decides whether any family members should migrate. Migration ( $y = 1$ ) occurs if the expected net utility from migrating rather than all members remaining within the village ( $y^*$ ), is positive. Otherwise, migration does not occur ( $y = 0$ ). The unobserved latent variable is

$$y^* = x' \beta + \varepsilon \tag{1}$$

and we observe

$$y = 1 \quad \text{if } y^* > 0 \tag{2}$$

$$y = 0 \quad \text{if } y^* \leq 0$$

The second model uses a count of the number of household members who have worked away from the village during the preceding year as the dependent variable. This consists of non-negative integer values with a large proportion of zero values in the sample (approximately half of the agricultural sample, and 40% of the forest-based sample). Due to this, we estimate the standard Poisson and Negative Binomial models (Cameron & Trivedi 1986), as well as the Zero-Inflated (Mullahy 1986) and Hurdle (Lambert 1992; Greene 1994) specifications of these models. The latter specifications

assume that the data are generated by two separate processes: the first process determines whether a non-zero observation is possible, and the second determines the count value of the observation.

The key independent variables are those indicating the security of households' rights to use agricultural and forest land, and whether the household is able to rent out land. Land reallocation occurs at the discretion of the village leader (Liu et al. 1998). For this reason, and because migration is expected to increase the risk of expropriation for individual households, we use the village level variable of the likelihood of expropriation as ascertained from the surveys of village leaders.

It is possible that there is some correlation in the migration decisions of village households. However, due to the large number of households per village, and the frequency of migration within all sample villages<sup>10</sup>, the migration decisions of an individual, randomly-sampled, household are unlikely to affect the village level probability of land expropriation. This variable is coded as a binary variable, with the value 1 if the village leader states that reallocation will not occur (i.e. household property rights are secure).

In contrast to the perceived security of property rights, which is based on expectations about what may happen in future, rights to rent land are apparent to households at the same time as the migration decisions are made. Land rental is also a village level, binary variable, with a value of 1 if renting land is permitted, and 0 if renting land is restricted.

The other independent variables used in the models are those that would be expected to affect household migration decisions. These are selected on the basis of previous literature on migration in China as discussed in Section 2 (e.g. Rozelle et al. 1999; Zhao 2005; Giles & Mu 2007). They include the number of children and elderly people in the household; the amount of agricultural or forest land that the household has rights to; household assets, proxied by whether the household has a

telephone; and the remoteness of the village, as measured by the distance to the main township. Ideally the off-farm wages of the migrants would be included in the model. However, many households do not provide information on off-farm wages, and poorly functioning rural labor markets make the estimation of a predicted wage equation unreliable. We therefore use education as a household level proxy for wages. This is supplemented with the inclusion of county level dummy variables to account for local variation in wage rates. Other covariates such as the age of the household head, the ethnic background of the family, and other measures of household assets were included in alternative models, but did not improve the fit with the data

[INSERT TABLE 2 ABOUT HERE]

Table 2 contains the descriptive statistics for all the dependent and independent variables. Looking at the two samples in Table 2, we can see that the frequency of migration is similar for the two groups, but forest households have on average more household members working outside the village. There is a notable difference in the perceived security of rights to agricultural and forest land, with around a quarter of village leaders in the agricultural sample stating that reallocation will not occur, compared with over three quarters of those asked about their forest land. Rights to rent out land are more similar, with a large majority in each group stating that land may be rented out without authorization. As far as the other explanatory variables are concerned, agricultural households have more children and fewer elderly members than forest households, and lower incidence of telephone ownership. Levels of education and distances to townships are similar. Finally, households have an average of 2.54 mu of agricultural land, relative to 24.9 mu of forest land, per adult.

## *Results*

The impacts of increased land tenure security and improved rights to rent land on migration are estimated using a Probit model for whether households have any migrants, and variants of count data models for the number of household members who migrate. All models are estimated using NLOGIT 3.0.

Table 3 presents the results of the Probit estimation of the impacts of property rights over agricultural and forest land on whether any members of the household choose to migrate.

[INSERT TABLE 3 ABOUT HERE]

In the model relating to agricultural land, neither the security of land tenure nor the rights to rent land affect whether households participate in migration or not. The variables that are important determinants of migration include the number of children, which reduces the likelihood of any migration; and the land to labor ratio, which is also negatively related to the probability of migration. Most of the county level dummy variables are also significant, indicating regional variation in the probability of migration. As Hezhang, Zhijn and Wening counties are in Guizhou Province, while the other three counties are in Ningxia Province, the results also suggest that migration is more likely among households in Ningxia than those in Guizhou.

The security of rights to *forest* land is found to have a positive and significant effect on the probability of migration by household members, although rental rights to forest land are again not significant. As with the agricultural land sample, a greater number of children in the household

reduces the probability of migration, and in this case, a higher number of elderly people also reduces the probability of migration.

We compare alternative specifications for modeling the impact of property rights on the number of household members migrating to work outside the village. Table 3 shows the results of comparing the standard Poisson model with the alternative Negative Binomial distribution, and with the ZIP and Hurdle models. In the case of the agricultural land model, the dispersion parameter in the Negative Binomial model was insignificant, suggesting the Poisson model did not suffer from overdispersion. In addition, the Vuong test for comparing the non-nested ZIP model with the Poisson model rejected the ZIP model, and the LM statistic for the Hurdle model vs. the Poisson model was also insignificant. The conclusion is therefore that the agricultural land model should be estimated using a standard Poisson model.

Comparing the alternative models for the impact of forest land rights on migration, we observe that there is evidence of overdispersion, which supports the use of the Negative Binomial rather than the Poisson distribution. The Vuong test of the Zero-Inflated model vs. the Negative Binomial model supports the use of the Zero-Inflated Negative Binomial model.

[INSERT TABLE 4 ABOUT HERE]

Table 5 contains the best-fit models for the determinants of the number of household members who choose to migrate. In the case of the agricultural households, this is the standard Poisson model, and in the case of the forest households, this is the Zero-inflated Negative Binomial model.

[INSERT TABLE 5 ABOUT HERE]

These results show that the security of property rights to both agricultural and forest land has a positive impact on the number of household members working outside the village. By contrast, whether or not land can be rented out freely does not affect the number of migrants. The other factors determining the numbers of household members migrating are broadly similar to those determining whether any migration occurs. The number of children in the household has a negative effect on the numbers of migrants, in both agricultural and forest households. The area of agricultural land is negatively related to the number of household members migrating, although the area of forest land does not have a significant effect. This is consistent with the intuition that the complementarity between land and labor is greater on agricultural than on forest land, especially since the forests in question are recently planted and do not yet require a large amount of labor for exploitation. The wealth of the household did not have a significant effect on whether migration occurred, but we find that in both the forest and agricultural models there is a positive relationship between assets and the number of household members migrating. In the model of forest household decision making, increasing distance from the main township results in fewer households participating in the migrant labor force. Finally, a number of the county level dummies significantly affect the migration decision, indicating geographical variation in the numbers migrating as well as the probability of any migration.

The finding that there is a stronger relationship between tenure security and migration for forest land than agricultural land is likely to be because the return to agricultural land falls with the reduction in available labor when household members migrate. This is supported by the negative relationship between agricultural (but not forest) land area and migration. It suggests that the opportunity cost of allocating labor to migration is higher in relation to agricultural land than forest land due to a greater

complementarity between land and labor. This reflects the countervailing effect of tenure security on migration discussed in the theoretical model. Overall, however, results indicate that the positive effect of tenure security on migration outweighs the potential negative effect, so that an increase in tenure security results in more migration.

A further reason why households with rights to forest land may be more likely to experience losses if land is expropriated due to migration relates to the relative time-horizons of agricultural and forest production. Much of China's forest land was deforested during the 1980s and 1990s, but substantial plantation efforts have been made since then (Zhang et al. 2000). As a result, the value of forest land-use rights will tend to increase over time as the timber matures. Insecure property rights are widely recognized to reduce the effectiveness of afforestation activities because they reduce the discount rates of households using the land, which in turn lowers the expected benefits from allowing timber growth (Mendelsohn 1994; Deacon 1994). However, the findings of this paper suggest another avenue through which insecure property rights may affect forest cover: if migration is reduced due to a risk of land expropriation, the pressure on forest resources, and the incentives to deforest, are likely to be higher than if rural households are engaged in, and earning income from, off-farm activities.

## **6. Conclusions**

This paper has looked at whether rural land tenure arrangements act as constraints on rural-urban migration in China. Although there has been little work elsewhere on the relationship between land tenure and migration, the unusual structure of property rights for agricultural and forest land has led others to suggest that these might affect labor mobility in China (Yang 1997; Zhao 1999).

This is an important time to consider possible constraints on migration because of the relaxation of previously very strict limitations on where people could move to find employment. The intention behind the easing of the *hukou* regulations is to reduce disparities between rural and urban areas, and

allow continued growth of the industrial sector. However, the removal of restrictions at the destination location will only increase rates of migration if households are not constrained by other factors at the original location. These constraints could include a lack of access to funds for the initial stages of the migration process, or lack of information about employment opportunities. This paper has focused specifically on whether tenure insecurity or limits on renting land act as constraints on migration.

A simple theoretical model of household labor allocation between work on the household's agricultural or forest land and wage employment outside the village predicted that secure land tenure would have an indeterminate impact on migration. This is because it both increases the incentive to migrate due to the lower risk of land expropriation, and reduces the incentive to migrate because if expropriation does not occur, the household will have more land to manage. The theoretical impact of improved land transfer rights was unambiguously positive. Testing this empirically, in relation to both forest and agricultural land for a sample of households in Guizhou and Ningxia Provinces, we found that in practice, greater tenure security tends to increase migration, while restrictions on land rentals do not have a significant impact.

The second of these findings, relating to land rentals, is somewhat surprising because not only did the labor allocation model predict a positive impact, but other studies have also made similar predictions (Yang 1997; Zhao 1999). However, it may be because property rights are already evolving rapidly that this aspect is no longer significant. A large majority of households in the sample said that they already had the right to rent out agricultural (87%) and forest (73%) land, suggesting that while this may have previously been a constraint (and may still be in other regions), it is no longer for these households.

The finding that increased land tenure security has a positive effect on migration leads to the important conclusion that where land is at risk of expropriation, rural households may not allocate labor to migration to the extent that they otherwise would. This type of constraint on household decision-making has three key implications. The first direct effect is that the welfare of rural households is reduced by restrictions on their options for utility maximization. More widely, the constraint is likely to increase rural-urban inequality, and may potentially slow rates of economic growth at the national level. The third implication relates to land conservation, particularly on forest land. Current rural conservation programs such as the Sloping Land Conversion Program and the National Forest Protection Program rely on shifting labor away from farming on vulnerable land, or harvesting timber. Given the limited alternative economic opportunities in rural areas, barriers to migration will compromise the effectiveness of these programs. These are all additional reasons, beyond the standard arguments relating to investment incentives, for strengthening the security of household rights to land.

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## Appendix - Impact of land tenure on migration decisions

Consider a rural household that maximizes its total labor income by allocating its fixed labor resource  $L \in [0,1]$  between farm and off farm activities  $l$ . Let us assume for simplification that off farm activities are only available through migration to urban areas and wage employment. To access migration, households have to pay a fixed cost  $F$ . The wage rate  $w$  is discounted by the variable costs of migration and by the probability of being unemployed in urban areas (Harris and Todaro 1970). The migration participation constraint is therefore:  $wl - F \geq 0$ . It is further assumed that there is no local labor market for on-farm labor. Indeed, local on farm labor in rural China is almost inexistent or very thin (Bowlus and Sicular 2003) and in our sample, there is no evidence that households exchange any on-farm labor.

The farm production technology is given by:  $f(L-l, n)$ , where  $l$  is the amount of household labor allocated to migration,  $L-l$  is the resulting farm labor and  $n$  is the land input. Capital is ignored as an input in this simple model. It is assumed that  $f(.,.)$  is increasing in both its arguments at a decreasing rate and that farm labor and land are complementary factors of production so that the cross derivative is positive.

Denote the household land endowment. In the baseline model, land is considered to be fixed and non transferable. Land is thus treated as an exogenous and free factor so that:  $n = N$ . This assumption is later relaxed in the model to take the possibility of land rentals into account.

This model is a partial equilibrium model. It is assumed that households do not internalize the potential negative externality of their migration decision on land rights.

### (a) Expropriation risk and migration:

Because of egalitarian land distribution, efficiency and, possibly, interest protection motivations by village leaders, the reduction in household size resulting from migration entails an expropriation risk

(Rozelle and Li, 1998). To see how this might affect migration, let us consider a two period decision making framework. In the first period, the household decides how much labor to allocate to migration. In the second period, the household size having been reduced by the amount of migrant labor, the household faces a risk of expropriation, which is assumed to increase linearly with the amount of labor allocated to migration. Let us also assume that the risk of expropriation depends on the development of land rights in the village, which we denote by  $R$ . A higher value of  $R$  means property rights more similar to those of a market economy, so that the risk of expropriation  $h(R) \in [0,1]$  is decreasing in  $R$ . The probability of expropriation when the household supplies  $l$  to migration is:  $lh(R)$ . This probability is comprised between 0 and 1 since:  $l, h(R) \in [0,1]^2$ .

We still consider that there is no possibility of land exchange, while we do not consider discount rates. The household decision problem is therefore:

$$\max_{l,n} wl + pf(L - l, n) \quad (1)$$

$$\text{s.t.} \quad n \leq N[1 - lh(R)] \quad (2)$$

$$wl - F \geq 0 \quad (3)$$

Because of the absence of a land exchange market, the household uses all land available and constraint (2) holds with equality. Let us first consider the case where the migration participation constraint (3) is slack at equilibrium so that the household supplies a positive amount of labor to migration. The first order condition with respect to migrant labor is then:

$$w - pf_1(L - l^*, N[1 - l^*h(R)]) - pf_2(L - l^*, N[1 - l^*h(R)])Nh(R) = 0 \quad (4)$$

The third term of this expression shows how the expropriation risk represents a tax on migration.

How does migration vary with the development of land rights? Differentiation of (4) gives:

$$\frac{dl^*}{dR} = - \frac{NH(R)[pf_{12}(\cdot,\cdot)l - pf_2(\cdot,\cdot) + pf_{22}(\cdot,\cdot)NH(R)]}{pf_{11}(\cdot,\cdot) + NH(R)[pf_{22}(\cdot,\cdot)NH(R) + pf_{12}(\cdot,\cdot) + pf_{22}(\cdot,\cdot)]} \quad (5)$$

Here, the development of land rights has two countervailing effects on migration<sup>11</sup>. A decrease in the probability of expropriation is akin to a reduction of the tax on migration, which boosts migration incentives. However, this positive effect is counterbalanced by a negative effect due to the complementarity between land and farm labor. A decrease in the probability of expropriation means that the household will keep more land, which necessitates farm labor and decreases migration incentives. This finding is intimately linked to the assumption of absence of local market for on-farm work. Regarding the impact of land rights on the decision to supply a positive amount of labor to migration, the participation constraint (3) is either relaxed or tightened depending on whether land tenure security  $R$  impacts  $l$  positively or negatively respectively.

*(b) Land exchange rights and migration*

We now ignore the expropriation risk and consider instead the possibility of land rentals. Land rentals are allowed with a probability  $s(R)$  which is increasing in  $R$ , and the rental rate is normalized to 1. The quantity of land that the household rents out is denoted by  $n^o$ , and the quantity of land that it rents in by  $n^i$ . Net land rentals are:  $e = n^o - n^i$ .

The household revenue maximization problem becomes:

$$\max_{l,n,e} wl + pf(L-l,n) + s(R)e \quad (7)$$

$$\text{s.t. } n + e = N \quad (8)$$

$$wl - F \geq 0 \quad (9)$$

Which can be rewritten as:

$$\max_{l,n} wl + pf(L - l, n) + s(R)(N - n) \quad (9)$$

$$\text{s.t. } wl - F \geq 0 \quad (10)$$

Considering first that the migration participation constraint is slack at equilibrium, the first order conditions with respect to migrant labor and cultivated land are, respectively:

$$w - pf_1(L - l^{**}, n) = 0 \quad (11)$$

$$pf_2(L - l^{**}, n) - s(R) = 0 \quad (12)$$

The marginal productivity of labor is equalized to the real off farm wage, while the marginal productivity of land is equalized to the land rental rate. Now, how does migration vary with a development of land rental rights ?

Differentiation of equation (12) gives:

$$\frac{dn}{dR} = \frac{s'(R)}{pf_{22}(\cdot, \cdot)} \quad (13)$$

which is negative given the concavity of the production function. Hence, the amount of land under cultivation decreases with an increase in  $R$ . As a result, more labor is freed from farming and migration increases. Indeed, differentiation of (11) gives:

$$\frac{dl^{**}}{dn} = \frac{pf_{12}(\cdot, \cdot)}{pf_{11}(\cdot, \cdot)} \quad (14)$$

The last equation is negative which implies that a development of land rental rights increases migration incentives. Going back to the migration participation constraint, since the amount of labor

allocated to migration increases, the participation constraint is relaxed by the development of rental rights.

Table 1 : Characteristics of sampled households and villages

	Agricultural households	Forest-based households
Average number of people in household	5.03	5.16
Average number of adults	3.36	3.88
Average number of children	1.64	1.21
Area of agricultural land (mu)	16.2	4.72
Area of forest land (mu)	1.76	37.8
Number of adults per household with more than primary education	2.38	1.99
% of households with at least one member working outside the village	50.7	59.0
Mean income per capita (in cash and in kind, ¥ per year)	1700	2593
Most common ethnic group	Han (72%)	Dong (51%)
Average number of households per village	407	292
Mean distance from village to nearest road (km)	2.08	0.42
Most common form of transport	Bus	Bus
% of villages with a school	82.5%	87.5%

Table 2: Descriptive statistics of regression variables

Variable	Description	Mean (S.D.)	
		Agricultural land survey	Forest land survey
migdum	Dummy: 1= migration	0.507 (0.501)	0.593 (0.492)
migrants	Number of household members working outside village	0.787 (0.925)	1.23 (1.29)
secure	Dummy: 1=reallocation not expected to occur again	0.262 (0.441)	0.789 (0.408)
rental	Dummy: 1=allowed to rent land without authorization	0.871 (0.336)	0.737 (0.441)
children	Number of children in household	1.64 (1.15)	1.21 (0.932)
elderly	Number of HH members over 65 years	0.241 (0.518)	0.407 (0.663)
education	Dummy: 1=HH head has more than primary education	0.538 (0.499)	0.418 (0.494)
landarea	Ratio of area of agricultural/forest land (mu) to number of adults in HH	2.54 (2.83)	24.9 (73.0)
assets	Dummy: 1=HH has fixed or mobile telephone	0.427 (0.495)	0.705 (0.457)
distance	Distance to township (km)	6.00 (4.49)	5.39 (4.47)

Table 3. Probit estimates of migration participation decision

Variable	Agricultural land model		Forest land model	
	Coefficient	S.E.	Coefficient	S.E.
secure	0.294	0.212	0.390	0.193**
rental	-0.183	0.265	-0.093	0.166
children	-0.167	0.071**	-0.142	0.085*
elderly	0.139	0.153	-0.265	0.117**
education	0.117	0.165	0.232	0.162
landarea	-0.078	0.037**	-0.005	0.006
assets	0.225	0.174	0.251	0.179
distance	-0.001	0.019	-0.001	0.018
county2	-0.550	0.269**		
county3	-0.285	0.542		
county4	1.021	0.366***		
county5	0.878	0.331***		
county6	0.890	0.244***		
county2f			0.149	0.184
county3f			0.164	0.227
constant	0.002	0.356	-0.068	0.288
% correct prediction	66.1		60.7	
Obs	286		285	

Note: \*, \*\*, \*\*\* denotes respectively 1, 5 and 10 % significance level.

Table 4. Comparison of alternative count models

	H <sub>0</sub> Model	Comparison Model	Test used	Test statistic	Significant at 5%?	Preferred model
Agricultural land model	Poisson	Negative Binomial	LR test for overdispersion	$\alpha = 0.0001$	No	Poisson
	Poisson	ZIP	Vuong test	$V = 1.195$	No	Poisson
	Poisson	Hurdle	LM test	$LM = 1.67$	No	Poisson
Forest land model	Poisson	Negative Binomial	LR test for overdispersion	$\alpha = 0.252$	Yes	Negative Binomial
	Negative Binomial	ZINB	Vuong test	$V = 2.82$	Yes	ZINB
	Negative Binomial	NB Hurdle	Model did not converge			

Table 5. Best-fit migration equations for the number of migrants decision

Variable	Agricultural Households		Forest Households – ZINB model			
	Poisson model		NB regression model		Zero-inflation model	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
secure	0.310	0.184*	0.471	0.148***	9.942	3325
rental	-0.117	0.236	-0.096	0.133	-0.921	0.704
children	-0.197	0.061***	-0.139	0.069**	-0.116	0.396
elderly	0.050	0.122	-0.119	0.092	0.245	0.448
education	0.114	0.139	-0.194	0.134	-10.387	1476
landarea	-0.106	0.038***	-0.002	0.004	0.003	0.027
assets	0.278	0.147*	0.504	0.167***	1.617	1.012
distance	0.009	0.018	0.016	0.015	0.186	0.087**
county2	-0.519	0.285*				
county3	0.022	0.536				
county4	0.758	0.265***				
county5	0.686	0.300**				
county6	0.747	0.212***				
county2f			-0.174	0.170	-2.767	1.046***
county3f			0.134	0.172	-1.232	0.990
constant	-0.320	0.321	-0.077	0.256	-11.359	3325
Log L	-310.90		-405.29			
Obs	286		285			

Note: \*, \*\*, \*\*\* denotes respectively 1, 5 and 10 % significance level

<sup>1</sup> Estimates reported by the National Bureau of Statistics amount to 132 million rural workers in cities in 2006 (National Bureau of Statistics, 2007, in Demurger et al., 2008)

<sup>2</sup> The Gini coefficient is predicted to fall from 0.46 to 0.37.

<sup>3</sup> There were chiefly two types of reform related to the *hukou* system. The formal award of permanent residency rights was made easier and non-*hukou* migrants were enabled to access many public services from which they were previously excluded.

<sup>4</sup> With notable exceptions, such as Zhao (1999), Yang (1997), who also focus on land tenure; and Uchida et al (2009) and Groom et al (2009), who examine how the Sloping Land Conversion Programme may alleviate market and institutional constraints on migration.

<sup>5</sup> Another link between migration and property rights is through credit markets as the ability to pledge or mortgage land improves access to finance which in turn facilitates financing of migration. However, under Chinese law, it is not possible to mortgage land. This link is not pursued in this paper as it was not the focus of our empirical study.

<sup>6</sup> All values in 2004 Chinese Yuan (¥). On average, in 2004: 1 Yuan = 0.121 USD.

<sup>7</sup> This has fallen from around ¥1000 in 1997, as a result of the timber harvesting ban under the Natural Forest Protection Program, and an overall decline in forest quality.

<sup>8</sup> 1 mu = 1/15 ha

<sup>9</sup> A larger proportion of households renting-in land than renting-out land is common in household surveys for this reason (Deininger and Jin 2007).

<sup>10</sup> See Tables 1 and 2.

<sup>11</sup> The first term of the numerator and the last two terms of the denominator are positive, indicating that an increase in  $\tau$  decreases migration incentives, while the other terms are negative, indicating a positive impact of  $\tau$  on migration incentives.