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DRIVERS BEHIND FARMERS' WILLINGNESS TO TERMINATE ARABLE LAND USE CONTRACTS

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ABSTRACT

The shortage of land resources has become a serious problem in China's rapid urbanisation. A recognised method for solving arable land resource shortage problems is to encourage marginal farmers to terminate their arable land use contracts with the government so that they can be transferred to farmers with better prospects. This paper analyses the drivers behind farmers' willingness to terminate their arable land use contracts based on survey data from agricultural households in Guanzhong, Shaanxi Province, China, using a multivariable logistic model. Results show that households led by male householders, with large families, fewer agricultural labourers, more plots of land, including family members with non-agricultural skills training and including family members who are covered by rural residents' health insurance, are more likely to terminate their contracts.

Key words: Agricultural development, rural land use, urbanisation, farmers' willingness, arable land use contract termination, drivers

INTRODUCTION

Food security is a significant recent global issue, especially in developing countries including China (FAO 1996; UN 2010; HLPE 2011). The food security problem in China is becoming increasingly serious due to its rapid economic growth over the last 20 years (Gandhi & Zhou 2014). Because of this rapid economic development, dietary habits reflect greater affluence as consumption of animal protein, meat and vegetable oils has increased, and consumption of starchy staples has declined (Kastner *et al.* 2012). As a consequence, China's self-sufficiency is becoming increasingly

difficult to sustain (Khan *et al.* 2009; Simelton 2011). China's food self-sufficiency rate dropped to 87 per cent in 2014, and approximately 30 per cent of all agricultural products are supplied by global markets (Zhang 2014). Imports of cereals and wheat were respectively 6 and 2.6 million tonnes in 2011 (FAO 2014). Along with rapid population growth, the loss of arable land (Tilman *et al.* 2001) and inefficient use of arable land (Lin & Ho 2003) are two main causes of this phenomenon. China witnessed a 8.32 Mha arable land decrease (MLRC 2009) and a 104 million population increase from 1996 to 2008 (NBSC 2009). In fact, the per capita arable land area has

dropped from 0.106 ha to 0.092 ha in this period (Christiansen 2009; Lichtenberg & Ding 2008). As points of reference, the same ratio in the US in 2008 was 0.58 ha, in Germany 0.15 ha and in the Netherlands 0.06 ha.

The Chinese government has pursued various arable land protection policies without much success (Lin & Ho 2003). Inefficient arable land use is common in China (Long *et al.* 2007; Gao & Li 2014a). Due to the low income and the limited arable land area per farm household, farmers cannot afford to use machines or hire specialised labour to do farm work to increase their agricultural production, which leads to underutilisation and arable land resources being left idle.

Since the loss of arable land to urbanisation and other purposes is inevitable, there are good reasons to make full use of idle or vacant arable land and to improve the efficiency of the arable land in use. An important background to the problem is the hukou system (Cheng & Selden 1994; Chan & Zhang 1999; Wang 2004) which distinguishes between the urban and the rural populations. Being a member of an agricultural cooperative implies having the right to contract to use land, and provides access to rural social support (medical cover, education, a pension scheme etc.). Stopping farming implies losing these rights (and ultimately the loss of housing). Furthermore, it is almost impossible to return to agriculture at a later stage, or for the next generation to do so. Use rights can only be transferred to the cooperative as a whole, and is done without financial compensation for the transfer (Luo *et al.* 2012). There is therefore no market for land use rights. These conditions mean that farming families tend to continue farming, even after their most productive family members have left for the cities (Kung 2000; Knight & Song 2003; Huang *et al.* 2012).

A farming family's decision to give up their rural way of life also implies the termination of their rural hukou, though it is not generally possible to obtain an urban hukou in return. Farmers do not therefore take the decision to terminate lightly, even relatively poor farmers. It would thus be helpful to encourage farmers who have lost the desire to farm to transfer

vacant arable land to other, more ambitious farmers, to allow them enlarge their farms (Wang *et al.* 2012). This study aims to uncover the drivers which motivate willingness to give up farming and to terminate their arable land use contracts. The remainder of the paper is organised as follows. The following section reviews the study of arable land abandonment and targeted policies in Western countries and China. The third section describes the data in the research. The fourth section describes the research method. The fifth section presents the results. The final section provides conclusions and proposes countermeasures.

THEORETICAL BACKGROUND

This abandonment of farm land and the tendency not to transfer land use rights to other, more ambitious farmers is not a uniquely Chinese phenomenon, being typical of how the abandonment of arable land and villages works in other developing countries (Robinson 2004; Mukherjee & Zhang 2007), and of how the same phenomenon occurred in Western countries during their period of rapid economic growth (Garcia & Ayuge 2007). Several Western countries have been confronted by the same difficulties in the past, although the institutional context differed considerably. Farmland abandonment often occurred in mountainous areas and other areas with difficult production circumstances in Europe (MacDonald *et al.* 2000). The abandoned farmland often had relatively low productivity, located on steep gradients and with poor soil (DLG 2005; Gellrich *et al.* 2007). In China the marginalisation of farmland is also caused by the attractive opportunities available in urban areas, and by the difficulties encountered in rationalising production in farming regions (Strijker 2005). The remaining farmers took over the farmland left by the migrating farmers in more prosperous areas, but farmland was abandoned in agriculturally poor areas (Beaufoy *et al.* 1994; Bignal & McCracken 1996).

Two models have been proposed to analyse the abandonment phenomenon in Europe (Champion 2001; Antrop 2004): the

'cyclical evolution model' and the 'vanishing evolution model' (Sun *et al.* 2011; Long & Li 2012). These two models theoretically explain the process of abandonment of villages, arable land and housing. Both models have four phases, with the only difference between them being the fourth phase. Villages revitalise in the final phase of the cyclical evolution model, while in the other model they die and vanish. The first phase in both approaches is the centralising phase. During this phase, the accessibility of facilities causes local village centres to expand at the cost of their peripheries (the areas with scattered housing), as farmers migrate to the village centres and to urban areas to find non-agricultural jobs. The migrating families leave their lands and their housing in the village peripheries. As a consequence, less labour remains in the peripheries, and those who stay have more space and more land available, resulting in an improvement in their standards of living. In the second phase, the inflow of population in the villages leads to deterioration of environmental conditions in the villages, making these villages less attractive to new comers. During this phase, the sub-hollowing phase, the development of villages slows and arable land and houses are vacated because farmers tend to move to urban areas due to industrialisation creating economic opportunities for migrants. This speeds the transition to the third phase, the hollowing-out phase, during which the village experiences a decline in overall population and a decrease of utilised arable land and housing in both the village centre and its periphery, as people from the villages also tend to move to the attractive cities. The fourth phase in the cyclical evolution model, the centralising phase, has the village regenerated by returning migrants as a result of counter-urbanisation (Long *et al.* 2012). Smaller and more remote villages often lack the qualities to attract migrants: according to the vanishing evolution model, these villages can die through depopulation and abandonment of arable land and housing.

Many developed countries have pursued public policies to encourage farmers to quit agriculture and hand over their land to other

farmers to increase the scale of agricultural production.

In 1962 the government of France established a Social Action Fund for Structural Reform to encourage older farmers to quit agriculture by means of a pension scheme. In the 1970s this was extended to farmers who planned to retire in the near future: these farmers were compensated for giving up their arable land operations. The French government also established non-profit organisations called Farm Improvement and Rural Development Agencies to purchase improve and return land to the remaining farmers (Anderson & Johnson 1970).

The UK also implemented policies in 1976 to encourage farm development. The Rent (Agriculture) Act 1976 stipulates that half the cost of the consolidation of small farms could be provided by the government. Small farm holders who wished to give up farming and transfer their land to the remaining farmers were thereby enabled to obtain compensation from the government (Rossi 1977).

The Netherlands also pursued policies to modernise agriculture through increase in the scale and efficiency of land use. Modernisation was primarily encouraged through the *Ontwikkelings en Saneringsfonds voor de Landbouw* (Development and Reconstruction Fund for Agriculture), established in 1951. The fund supplied subsidies for modernisation, and compensation and pensions for those who were willing to give up agriculture while transferring their land to modernising farmers. Large-scale, publicly financed re-allotment policies, including a comprehensive range of infrastructure works, were carried out pursuant to the Law on Re-allotment of 1954 (Van den Brink & Molema 2008).

In Germany the government enacted the Farmers' Relief Act in 1957, which stipulated that all farmers gained the right to participate in a state-financed pension scheme to guarantee them an income after retirement from agriculture. Farmers desiring access to this pension were expected to transfer their farm through inheritance or sale. This kind of pension insurance not only offers farmers a secure income after retirement, but also improves the utilisation efficiency of arable

land and provides more opportunities for younger farmers to develop agricultural production (Hua 2007). A negative aspect of this policy is that farmers, even when they leave their farms to work in urban areas, tend to formally maintain their farming enterprise, to remain eligible for the existing attractive pension scheme (Lobley *et al.* 2010). This bears some resemblance to the current situation in China.

After the European Economic Communities, later the European Union, came into being, national policies were replaced by the Common Agricultural Policy (CAP). The structural part therefore also contained measures for the winding up of farms: Council Directive 72/160/EEC of 17 April 1972 on the encouragement of the cessation of farming and the re-allocation of utilised agricultural area for the purposes of structural improvements. This measure has survived all changes to the CAP, and is now included as Article 19c Regulation 1305/2013.

Because farmers in China do not own the arable land they use, they cannot sell their land but can only transfer their use rights to other farmers, in a manner similar to renting. In practice, farmers have no incentive to do so because they do not get any compensation for this arable land transfer. Although the government has implemented policies to encourage farmers to transfer underutilised land, this policy has so far not achieved its goals because of the lack of land supply and demand information, owing to the undeveloped land market and the high transfer cost of arable land. Therefore, it is desirable to develop a policy to encourage farmers who no longer intend to farm to hand over their land voluntarily.

From the 1980s to the mid-1990s, farmers' incomes increased due to economic reforms (Khan & Riskin 1998; Ravallion & Chen 1999; Yao 1999; Yang 2004). Many farmers living in the open fields were attracted to the villages, leading to abandonment of land and houses in the peripheries. Meanwhile, population growth required more houses, which led to building activities on arable land near villages (the centralising phase of the cyclical evolution model). The decade after the mid-1990s saw rapid urbanisation and the flight

of large numbers of rural labourers to the cities (Zhao 1999; Zhang & Song 2003). This was initially mainly temporary and seasonal migration. In this sub-hollowing phase, the arable land and houses were often seasonally idle. Due to the rapid economic growth, urbanisation increased further and more farmers were employed as long-term workers in the cities (Knight *et al.* 1999). Although such migration was often almost permanent, the arable land and houses in rural areas could not be sold due to the land property system and due to the social security system, implying that the arable land and houses in rural areas remained idle for the long term (Long *et al.* 2009). During this hollowing-out phase, abandonment in the villages increased (Li *et al.* 2010; Liu *et al.* 2010; Long & Li 2012). Since 2005, the Chinese government has paid closer attention to solving these rural issues and has endeavoured to protect arable land in rural areas. Policies were implemented to renovate the hollowed-out villages and to solve the arable land abandonment issues (Liu *et al.* 2010, 2013; Long *et al.* 2010). Along with urban and rural development, counter-urbanisation will probably emerge in the future to solve the problem of land under-utilisation, or in the case of less attractive villages, they will vanish forever.

As things stand now, although rapid urbanisation (Jiang 2002; Jian & Huang 2010) has created conditions for arable land use contract termination, the absence of a social security mechanism for farmers leaving agriculture is the main obstacle to farmers' willingness to quit the land (Fan 2001; Zhang 2011). This contrasts with farmers in Western countries in the 1960s and 1970s, who could obtain compensation from their governments following retirement, and who could expect a return for the sale of the land they owned as well. The current arable land termination policies in China lack effective methods for solving the lack of compensation problem. The government does not offer attractive options for farmers willing to terminate their farming contracts, as the current compensation standards are generally low, and as a consequence it is quite common in rural

China for many 'absent farmers' to occupy large areas of unused arable land.

Abandonment of arable land and withdrawal from agriculture has occurred and has been researched worldwide (MacDonald *et al.* 2000; Strijker 2005; Gellrich & Zimmermann 2007; Corbelle-Rico & Crecente-Maseda 2014; Gao & Li 2014b, Milenov *et al.* 2014; Terres *et al.* 2015). The research has included the drivers behind (Baumann *et al.* 2011; Müller *et al.* 2013), consequences of (Yoshikawa *et al.* 1998; Green *et al.* 2005) and policy responses to (MacDonald *et al.* 2000; Scozzafava & De Sanctis 2006; Van Meijl *et al.* 2006; Keenleyside *et al.* 2010; Renwick *et al.* 2013) this phenomenon. The drivers which influence farmers' willingness to terminate their arable land use contracts will be investigated further in the context of our research. According to the literature, the drivers which influence farmers' willingness to terminate their arable land use contracts are varied. Yan *et al.* (2012) suggest that the gender and age of the head of household, the amount of non-farm labour available and the non-agricultural income have a significant effect on farmers' willingness to terminate. Wang, Z.L. *et al.* (2012) consider that the compensation for termination and compensation policy are two important drivers, and that the characteristics of the farmers and their families, of the arable land utilisation and the social security system also play a role. Gao and Li (2014a) proposed that the drivers which impact on farmers' willingness to terminate have a covariant relationship with each other and with the farmers' property cognition, behaviour cognition, welfare cognition and skill cognition, and household per capita income, arable land area and available labour amount are also affected. Luo *et al.* (2004) emphasises that the security function of arable land and economic compensation are the two key factors. Based on these findings, we selected the farmers' personal and family characteristics, economic factors and resources as the main drivers for further analysis.

DATA

The data in this paper are sourced from a household survey conducted in Guanzhong

district, Shaanxi Province, from June to September 2013. To ensure a representative and even distribution of survey data, a stratified random sample choice method was applied when choosing sample farmers. Sample farmers were directly interviewed in the survey. All farmer interviews were voluntary. Six hundred and fifty copies of the questionnaire were distributed and, after excluding questionnaires returned with missing or contradictory answers, 619 sets of household data were obtained. The effective questionnaire ratio was 95.23 per cent. The household data mainly reflect the family characteristics, agricultural production status and the farmers' willingness to terminate their arable land use contracts.

We told the farmers during the survey that they would receive compensation if they chose to terminate their contracts and that the compensation standard would be higher than the current one, but the specific amount of compensation was not revealed. Respondents could choose between three degrees of willingness in the survey questionnaire: being unwilling, neutral or willing to terminate. Table 1 describes the farmers' willingness to quit farming.

It was found from the survey that, 393 farmers expressed unwillingness to terminate their arable land use contracts, 64 per cent of the total. Of the 619 farmers we interviewed, only 145 (23%) were willing to terminate their arable land use contracts. This shows that the majority of the farmers were unwilling to terminate their arable land use contracts. This desire in farmers to continue holding their contracts but to abandon their land leads to waste and underutilisation of precious arable land resources.

To analyse the drivers behind the farmers' willingness to give up their arable land, we classified all the indicators into three categories, namely the householders' personal and family characteristics, economic factors and resources. The householders' personal and family characteristics include six indicators: the gender, age, education level and marital status of the head of the household, the family size and the amount of agricultural labour available. The economic factors relevant to the households numbered five indicators:

Table 1. *Statistical results of farmers' willingness to terminate their arable land use contracts (numbers and %)*

Willingness to terminate	Frequency	Proportion (%)
1 = unwilling	393	64
2 = neutral	81	13
3 = willing	145	23
Total	619	100

total income, agricultural income, whether any family member had received non-agricultural skills training, whether any family members were covered by rural residents' health insurance and part-time job status. The household resources include four indicators: arable land area, number of land plots, house area and the distance to the nearest town. The variable descriptors, values, means and standard deviations for each indicator are presented in Table 2.

Table 2 shows us that the head of a household is usually male and relatively old. The farmers also usually have a relatively low level of education. All the features are consistent with the actual conditions reported for rural areas in China overall (De Brauw *et al.* 2002; Zhang *et al.* 2002; Knight & Song 2003).

Judging from the household economic factors results, there are considerable differences in farmer income levels. Of the 619 households surveyed, 446 families had a total income less of than RMB 30,000 (EUR 1 ~ RMB 7.4), 62 families had between RMB 30,000 and 50,000, and 70 families had between RMB 50,000 and 100,000. Only 41 families' total income exceeds RMB 100,000. In 2013 the average total income of rural households across all of China was RMB 36,600 (CHFS 2014). The agricultural income of the sample households follows a similar trend. Agricultural income accounted for less than RMB 5,000 for 442 families, between RMB 5,000 and 10,000 for 82

Table 2. *Variable names and statistical description (mean and standard deviation)*

Variable	Symbol	Value	Mean	S.D.
Personal and family characteristics				
Head of household's gender	X ₁	1 = male (599); 0 = female (20)	–	–
Householder's age	X ₂	units: year	50.89	10.40
Householder's education level	X ₃	years of education, units: year	5.71	3.82
Householder's marital status	X ₄	1 = married (589); 2 = divorced (5); 3 = widowed (19); 4 = single (6)	–	–
Family size	X ₅	units: people	4.04	1.55
Amount of agricultural labour	X ₆	units: people	2.31	1.32
Economic factors				
Total income	X ₇	units: RMB ten thousand	3.11	5.86
Agricultural income	X ₈	units: RMB ten thousand	0.45	0.64
Whether any family members had received non-agricultural skills training	X ₉	1 = yes (290); 0 = no (329)	–	–
Whether any family members were covered by rural resident health insurance	X ₁₀	1 = yes (233); 0 = no (386)	–	–
Part-time job status	X ₁₁	1 = yes (498); 0 = no (121)	–	–
Resources				
Arable land area	X ₁₂	units: mu (1 ha = 15 mu)	12.26	11.38
Number of plots	X ₁₃	units: plot	3.73	2.28
House area	X ₁₄	units: m ²	116.91	68.80
Distance to the nearest town	X ₁₅	units: km	36.01	24.97

Note. Frequency is included in parenthesis.

families, and only 95 families made more than RMB 10,000 of agricultural income. The average proportion of agricultural income against total income in the sample group was 14.5 per cent, while the average proportion across all of China was 21.7 per cent in 2013 (CHFS 2014). We can also observe that only a minority of respondents had received non-agricultural skills training, and only a minority were covered by rural residents' health insurance. The vast majority of families are not exclusively engaged in agricultural production, having part-time jobs as well.

The household resources data show that the average arable land area is about 3 mu per capita (1 ha = 15 mu), which is more than the national average of 1.52 mu (MLRC 2013). However, this indicator has a high standard deviation: some families had much larger areas of arable land than others. Most families lived in large houses, almost 40 km away from a town. The average number of plots of arable land under cultivation is 3.7, implying an average plot size of a little less than 4 mu. This indicates that these farmers' arable land is highly fragmented, leaving limited options for mechanised and modernised agricultural production.

METHOD

Because the dependent variables are discrete variables and the constraints of general linear regression could not be satisfied, multi-linear regression could not be used. The logistic model is a discrete-choice model, in which the logical distribution is seen as the probability distribution of random error (Peng 2013). The logistic model is suitable for the analysis of choice behaviour according to the principle of utility maximisation. As this paper intends to determine what drives farmers in their desire to terminate their arable land use contracts the most, we approached the analysis from the perspective of the farmers' utility maximisation. It is therefore reasonable to perform an empirical analysis using a multi-logistic model, and the maximum likelihood method was used to estimate the model. In fact, because all the indicators have interaction relationships with

each other, the multi-logistic model could be used to study the combined effects among all the indicators (Kurth *et al.* 2006; Localio *et al.* 2007).

The three degrees of willingness used as explanatory variables in this paper (unwilling, neutral and willing to terminate) were assigned the values 1, 2 and 3 respectively. For $n = 1, 2, \dots, N$, the multivariable logistic model can be expressed as follows:

$$\text{Ln} \left[\frac{P(y=n|x)}{P(y=N|x)} \right] = \partial_n + \sum_{k=1}^k \beta_{nk} x_k, \quad (1)$$

where $P(Y_i=n)$ is the probability of the farmers having n degree of willingness, x_k is the k explanatory variable and β_{nk} is a coefficient vector. With N as the reference degree of willingness, the ratio of the probability of a farmer having N degree of willingness and the probability of a farmer having the other degrees is $P(y=n|x)/P(y=N|x)$, which is known as the odds.

Two kinds of contract termination drivers will be tested: (1) being willing to terminate against being unwilling to terminate, and (2) being neutral against being unwilling to terminate. The logistic models are the following:

$$\text{Ln} \left[\frac{p_3}{p_1} \right] = \partial_3 + \sum_{k=1}^k \beta_{3k} x_k, \quad (2)$$

$$\text{Ln} \left[\frac{p_2}{p_1} \right] = \partial_2 + \sum_{k=1}^k \beta_{2k} x_k, \quad (3)$$

where P_1 , P_2 and P_3 represent the probabilities of the farmers' respective choices.

RESULTS AND DISCUSSION

The multicollinearity test needed to be done before we used the multivariable logistic model, so we used SPSS 21 to perform the multicollinearity test. The test results are shown in Table 3. The variance inflation factor (VIF) for all the variables were less than 10 and the Tolerance scores for all the variables were over 0.1. The variables could thus be considered as not correlated with each other.

Table 3. Results of multicollinearity test

Variables	Tolerance	VIF	Variables	Tolerance	VIF	Variables	Tolerance	VIF
X ₁	0.956	1.046	X ₆	0.350	2.861	X ₁₁	0.630	1.587
X ₂	0.949	1.053	X ₇	0.711	1.407	X ₁₂	0.790	1.266
X ₃	0.960	1.041	X ₈	0.742	1.348	X ₁₃	0.779	1.284
X ₄	0.948	1.054	X ₉	0.327	3.055	X ₁₄	0.961	1.041
X ₅	0.349	2.864	X ₁₀	0.329	3.036	X ₁₅	0.946	1.057

The reference choice type in the model is being ‘unwilling to terminate the arable land use contract’. Models A and B are intended to analyse the influence of the independent variables on the following two conditions: the probability of being willing to terminate the arable land against being unwilling to terminate, which is represented as P3/P1, and the probability of being neutral against being unwilling to terminate, which is represented as P2/P1. The regression results show that the $-2\log$ likelihood is 1006.087, the chi-

square is 101.339, the Nagelkerke R² is 0.181 and the significance is 0.000, which indicate that the model is a good fit. The regression results are summarised in Table 4.

The impact of personal and family characteristics on the farmers’ willingness to terminate – The results indicate that when other conditions remain unchanged, male householders are more likely to terminate their arable land use contracts than farmers (male or female) who are unwilling to

Table 4. Regression results of the multivariable logistic model

Explanatory variables	Model A (P3/P1)		Model B (P2/P1)	
	Coefficient	S.E.	Coefficient	S.E.
Personal and family characteristics				
Householder’s gender	1.490***	0.510	2.146*	1.075
Householder’s age	-0.016	0.010	-0.017	0.014
Householder’s education level	0.035	0.027	0.038	0.038
Householder’s marital status	-0.312	0.225	0.143	0.256
Family size	0.242**	0.117	0.074	0.163
Amount of available agricultural labour	-0.242*	0.137	-0.226	0.193
Economic factors				
Total income	0.002	0.020	-0.003	0.035
Agricultural income	0.200	0.197	-0.659**	0.319
Whether any family member had received non-agricultural skills training	1.177***	0.349	-0.710	0.447
Whether any family members were covered by rural resident health insurance	0.958***	0.350	-0.179	0.497
Part-time job status	0.125	0.343	-0.463	0.429
Resources				
Arable land area	-0.033**	0.015	-0.050***	0.016
Number of plots	0.130**	0.059	-0.083	0.088
House area	0.000	0.001	0.001	0.002
Distance to the nearest town	0.002	0.004	-0.004	0.006
Constant	-0.493	0.950	-1.022	1.501

Note: *, **, *** denote the significant value at 1%, 5% and 10% significance levels, respectively.

terminate. There could be various reasons for this. Men generally have better income opportunities in urban environments. Men are typically expected to work hard to improve living conditions for their families. They would therefore have greater expectations of achieving better living conditions for their families through quitting farming and making more money in urban areas.

Family size has a significant positive impact on the farmers' termination willingness. The results show that the larger a family is, the more likely the householder will be to quit farming. It is obvious that the living and economic burden on a family increases as family size increases. Based on our data, the ratio of the average family size to the average amount of available agricultural labour is 1.7, which means that each agricultural labourer will care for roughly two other family members. Accordingly, in addition to using their family members for agricultural labour, larger families tend to use their additional family members to earn more money, for instance, by having those not involved in the agricultural family labour force move to non-agricultural sectors. However, due to the low level of income agricultural work yields, rather than send part of the family to a city, these families tend to transfer all their labour to the cities to work in urban jobs (Meert *et al.* 2005). Bigger families are thus more likely to abandon arable land than smaller ones.

As mentioned above, households with less agricultural labour are more likely to terminate arable land use contracts than to continue farming. Because of the low prices agricultural products fetch, most food products – such as corn, wheat and rice – are consumed by the families themselves. However, because the ratio between family size and agricultural labour is high, families tend to direct their limited labour resources towards industries where they are likely to earn the most. Households with less available labour are therefore more willing to terminate arable land use contracts.

The impact of economic factors on the farmers' willingness to terminate – Total agricultural income negatively affects the farmers' willingness to terminate significantly: that is, households which earn less agricultural income have a higher probability of terminating their arable land use contracts. Because

agricultural income would thus represent a diminishing proportion of the overall family income, the agricultural output of arable land becomes less important and unable to satisfy the farmers' requirements.

Farming households with family members who have received non-agricultural skills training are more likely to cease arable farming. Logically, this is because skilled farmers have better employment opportunities.

Households with family members covered by rural residents' health insurance are more likely to choose to terminate their contracts. This also demonstrates that health insurance for rural residents has been accepted and recognised by farmers. Many provinces have implemented policies to encourage farmers to settle in cities, and these policies clearly state that farmers who do so can continue to enjoy their rural resident's health insurance or change their insurance into urban system by voluntary. Farmers thus value their health insurance, not the land, as a reliable guarantee for their future livelihood. They are therefore more willing to terminate their contracts.

The impact of resources features on farmers' willingness to terminate – The amount of arable land a household has access to has a significant negative impact on the farmers' willingness to cease arable farming. The arable land area indicator passed both models at the corresponding test levels and all the coefficients were negative. It indicates that the less arable land area farmers have in use, the more the farmers are willing to terminate their land use contracts.

The number of plots in use affects the farmers' willingness to terminate significantly negatively. This means that farmers who have many plots are more willing to consider leaving farming. More plots means greater fragmentation of the available land, which means more work and fewer opportunities to modernise and achieve scale economics.

CONCLUSIONS

We used survey data from 619 households from Guanzhong, in Shaanxi Province, to analyse the drivers behind farmers' willingness to terminate

their arable land use contracts, and we applied a multivariable logistic model. The econometric regression results indicate that households with male householders, larger families with less available agricultural labour, less agricultural income, smaller arable land area divided into more plots, with family members who have received non-agricultural skills training and who are covered by rural residents' health insurance, are more likely to terminate their arable land use contracts. Accordingly, farmers who meet these characteristics should be the first to be encouraged to terminate their arable land use contracts. This group of farmers emerged as the main group to accept the offer of compensation. However, because we did not specify the level of the compensation offered, some farmers remained neutral. If the subsidy were set high enough to meet these farmers' expectations, the proportion of farmers willing to terminate their arable land use contracts would probably increase.

Due to the current food security situation in China, the accelerating rate of arable land loss and the inefficient use of the arable land resources available, maintaining and improving agricultural production efficiency is the key to feeding the huge population in China. As the loss of arable land is difficult to control, making full use of the existing arable land is of great importance. However, arable land abandonment is quite common in China, preventing the remaining farmers from enlarging their farms. It is necessary to find new approaches to transferring the abandoned arable land resources.

Against a background of rapid urbanisation, encouraging farmers to terminate their arable land use contracts and hand their arable land back to the government when deciding to move to urban areas has become a better method to solve the issues concerning agriculture, countryside and farmers. According to the results and analysis, firstly, offering further education to farmers should be vigorously pursued to improve farmers' education levels. Employable skills should also be cultivated to enhance farmers' competitiveness once they settle in cities. Second, low-income farmers should be encouraged to obtain non-agricultural skills training, to prepare them to settle and work in cities and to help them

maintain their living standards after resettlement. Finally, medical insurance for rural residents should be improved further to assuage farmers' concerns about giving up their arable land, and policies to ensure the living standards in cities for post-termination farmers should also be established.

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