Forest Policy and Economics 129 (2021) 102513

Contents lists available at ScienceDirect

Forest Policy and Economics

journal homepage: www.elsevier.com/locate/forpol

# Married to rubber? Evidence from the expansion of natural rubber in Southwest China

Shi Min [a], Xiaobing Wang [b], Junfei Bai [c,*], Hermann Waibel [d]

[a] College of Economics and Management, Huazhong Agricultural University, No.1 Shizi Shan Street, Hongshan District, Wuhan 430070, China
[b] China Center for Agricultural Policy, School of Advanced Agricultural Sciences, Peking University, No. 5 Yiheyuan Road, Haidian District, Beijing 100871, China
[c] Beijing Food Safety Policy & Strategy Research Base, China Agricultural University, 17 Qinghua East Road, Haidian District, Beijing 100083, China
[d] Institute of Development and Agricultural Economics, Leibniz University Hannover, Koenigsworther Platz 1, D-30167 Hannover, Germany

ARTICLE INFO

*Keywords:*
Matrilocal residence
Labor
Resource
Rubber farming

ABSTRACT

The environmental and economic effects of rubber expansion in southeast Asia have been widely explored, while the possible social influence on local community is rarely investigated. This paper investigates the impacts of rubber cultivation by women's natal households on women's decisions about matrilocal residence after marriage in an ethnic-minority region of Southwest China from the perspectives of family labor and resource endowment. The results suggest that economic factors extend beyond Dai women's traditional customs to determine a woman's decision to live in a matrilocal residence. When labor constraints and resource heterogeneity are present, higher household labor demand and the possession of more location-specific resources such as rubber plantations may increase the likelihood of female family members living in a matrilocal residence after marriage. The findings complement the literature on both the social impacts of agroforestry expansion and the marriage migration in a community with unequally distributed, location-specific resources.

## 1. Introduction

In the past several decades, the widespread expansion of the agroforestry such as natural rubber and oil palm in Southeast Asia has led to debates on local sustainable development (Angelsen, 1995; Qiu, 2009; Wicke et al., 2011; Ziegler et al., 2009). For example, from 2003 to 2019, the planting areas of natural rubber in Thailand increased from 2.02 million ha to 3.62 million ha, while the rapid expansion of natural rubber in China has occurred too, from 0.66 million ha to 1.18 million ha (Janekunprasoot, 2020). Although rubber cultivation has significantly improved the livelihood of smallholders, the rapid expansion of smallholder rubber farming has also resulted in deforestation and environmental degradation (Qiu, 2009; Min et al., 2018).

As rubber cultivation is highly labor-intensive, the expansion of smallholder rubber farming may also exert some influence on the reallocation of family labor in the short term and on the mobility of family labor in the long term (Min et al., 2017b; Kullawong et al., 2020). A typical case is the rubber boom in Xishuangbanna Dai Autonomous Prefecture (XSBN), in the upper Mekong region, Southwest China (Min et al., 2019); in this area, rubber plantations occupy most of the available labor force (Fu et al., 2009). Furthermore, a kind of special long-term labor mobility that seems associated with rubber cultivation also occurs in XSBN. In this situation, a man marries a female who owns more rubber plantations than he does, and thus, the male migrates to the female's home. The resulting matrilocal residence is, potentially, a form of marriage migration. While this phenomenon is observable, to date, no study has been conducted to provide evidence for this type of social influence by rubber cultivation. Moreover, among the Dai minority (who are the majority in XSBN), women also show higher probabilities of matrilocal residence after marriage according to their traditional customs (Unger, 1997; Yang, 2001; Zhang, 2004a; Diana, 2013). Hence, empirically identifying the social influences of rubber cultivation on this kind of special labor mobility (matrilocal residence) can be challenging in XSBN, especially for the Dai ethnicity.

The existing qualitative studies have provided important references for understanding the influence of rubber cultivation on matrilocal residence. Divale (1974) believed that matrilocal residence was an adaptive response to the disequilibrium involving land, water, or food resource ratios between the households of the husband and wife. Thus, a man whose natal household has relatively low endowments tends to migrate to his wife's household, which has more endowments. Similarly, Ember (1974) indicated that due to its relatively high disequilibrium of

* Corresponding author.
*E-mail addresses:* min.ccap@pku.edu.cn (S. Min), xbwang.ccap@pku.edu.cn (X. Wang), jfbai@cau.edu.cn (J. Bai), waibel@ifgb.uni-hannover.de (H. Waibel).

https://doi.org/10.1016/j.forpol.2021.102513
Received 17 April 2020; Received in revised form 8 April 2021; Accepted 6 May 2021
Available online 20 May 2021

resource endowment, a migratory society normally has a greater potential for matrilocal residence. In a study regarding the indeterminacy of the period of matrilocal residence, Bossen (1988) found that the departure of the junior couple might be delayed or hastened by the labor force needs of both spouses' natal families. Therefore, a matrilocal residence can be hypothesized as a result of the disequilibrium of labor and resource endowments such as rubber plantations between wives' and husbands' natal families.

Several quantitative studies have investigated matrilocal residence in various communities. Using data from two agricultural villages in Northeast Japan from 1716 to 1870, Tsuya and Kurosu (2000) found that matrilocal marriage was negatively influenced by the number of wives' older siblings but positively affected by household landholding. Kato (2013) found a higher probability of matrilocal residence if the wife had a job or if she had the right to inherit assets from her natal family. The studies by Fan and Huang (1998) and Zhang (2004) implied that matrilocal residence might be correlated with women's education, economic endowments, parents, and family composition; however, their studies did not provide direct evidence for these correlations. Based on survey data of 1655 married persons born from 1964 to 1976 in Southeast China, Chu et al. (2011) empirically determined that the number of wives' brothers and the educational differences between couples negatively affected the likelihood of matrilocal residence. However, these studies not only lacked an appropriate theoretical framework for matrilocal residence but also failed to control for the possible factor of marital customs related to a specific ethnicity, such as the Dai minority.

Hence, the objective of this study is to improve scholarly understanding of the impact of rubber cultivation on matrilocal residence of Dai female farmers in Southwest China. To achieve this aim, first, following previous studies on marriage economics, we develop a conceptual model that includes the heterogeneities in family labor and location-specific resource endowments (rubber plantations) to illustrate the decision of female farmers to live in a matrilocal residence. Second, using unique household survey data of smallholder rubber farmers in the XSBN, Southwest China, we empirically test the impact of the Dai minority attribute on a woman's decision to live in a matrilocal residence and examine the effects of female farmers' natal family labor and rubber plantations on their decision to live in a matrilocal residence after marriage. Next, a series of additional analyses are conducted regarding the empirical results. Finally, the potential implications of this study are briefly discussed from the perspectives of different disciplines.

The results suggest that economic factors, including family labor and rubber plantations, play a more important role in Dai women's decisions to live in a matrilocal residence than traditional customs. A woman's household labor shortage may foster the incidence of matrilocal residence; however, a woman whose household possesses more rubber plantations also has a higher probability of matrilocal residence. The findings confirm that when labor constraints and resource heterogeneity are present, a household's higher labor demand and possession of more location-specific resources may increase the likelihood that a female family member will live in a matrilocal residence when she marries.

The contributions of this study include but not limited to the following aspects. First, this study provides new insights into a woman's decision to live in a matrilocal residence in XSBN, which is revealed to be significantly affected by the woman's natal family's labor force and rubber plantations. Second, this study complements empirical evidence about the impact of rubber cultivation on social aspects such the residence choice after marriage in XSBN. Most previous studies on the impacts of rubber cultivation focused on the economic and environmental aspects, while few studies investigated the social impacts of rubber cultivation.

This paper is organized as follows. In the next section, we conduct the literature review. Section 3 constructs a model and presents the empirical strategies. Section 4 presents the study area, data collection procedure, and descriptive statistics. In Section 5, we report the estimation results. Section 6 briefly discusses the potential implications of this study from the perspectives of various disciplines. The final section concludes the paper.

## 2. Marriage migration and matrilocal residence

Marriage migration has long existed as a particular type of labor migration (Watts, 1983; Davin, 2007) and is similar to other types of labor migration, such as off-farm employment and rural-urban migration; thus, marriage migration is highly responsive to the changing economic, social and political climate (Davin, 2005). Migration studies have shown that a nontrivial proportion of migration in low-income countries, particularly in rural areas, is composed of women moving for marriage (Kaur, 2004; Davin, 2007). When confronted with constraints, such as the *Hukou*[1] system (in China), rural origins, and low education and status, many women in poor areas pursue migration by marrying into more developed regions in exchange for economic opportunities and both farm and off-farm work (Fan and Huang, 1998; Zhang, 2009).

Nonetheless, marriage migration is not limited to the movement of women, and it can generally be divided into three types: patrilocal residence (couples living with the husband's parents), neolocal residence (couples living independently), and matrilocal residence (couples living with the wife's parents) (Gruijters and Ermisch, 2019; Moravec et al., 2019). Patrilocal residence has traditionally been the primary form of marriage in most Asian countries, including China and Japan (Whyte, 1979; Lavely and Ren, 1992; Kato, 2013; Khalil and Mookerjee, 2018). As both society and the economy have transformed globally over the last century, neolocal residence has become the dominant marriage form worldwide. The statistical results from Landmann et al. (2018) showed that matrilocal residence is widespread in many developing countries, although its prevalence varies. In Southeast Asian countries, such as Laos and Cambodia, the percentage of matrilocal residence reaches 15–16% (Table A1).

In China, marriage migratory forms have also been transforming. Lavely and Ren (1992) showed that patrilocal marriage was strong in China from 1955 to 1985, occurring in approximately 80% of all residential patterns. In contrast, neolocal marriage occurred only 10–20% of the time, on average, while matrilocal marriage was relatively rare, occurring 4% or less, on average, in each province. Neolocal marriage has been increasing dramatically since the 1990s and has become the dominant residence type in China after marriage; neolocal marriage accounted for 56% of residences by 1994 (Treas and Chen, 2000) and had increased to nearly 70% by 1997 (Chen, 2005). Due to rapid urbanization and the recent increase in young farmers' rural-urban migration, neolocal marriage is expected to continue increasing (Zhang, 2009). A recent study by Hu and Mu (2021) found that matrilocal residence was also increasingly common in urban China, while patrilocal residence still dominates in both rural and urban China.

Interestingly, in the Xishuangbanna Dai Autonomous Prefecture in Southwest China, the traditional marriage of Dai minority women tends to involve a higher probability of matrilocal residence than marriage among other ethnicities (Unger, 1997; Yang, 2001; Zhang, 2004a; Diana, 2013). This traditional custom seems similar to that of the Thai people, among whom the proportion of matrilocal residence was

[1] The Hukou system is the Chinese household registration system, which creates a spatial hierarchy of urban places, prioritizes the city over the countryside, controls population movement up and down the spatially defined status hierarchy, prevents population flow to the largest cities, enforces the permanent exile of urban residents to the countryside, binds people to the village or city of their birth, and transfers the locus of decision-making with respect to population mobility and work from the transformed household to the work unit or danwei, specifically, in the countryside, to the lowest unit of the collective (Cheng and Selden, 1994)

approximately 10% (Table A1), which is significantly higher than that in China. However, due to the lack of statistical and field survey data, there is currently no known, relatively accurate information regarding the matrilocal residence of women, including Dai women, in the XSBN. No empirical evidence is available to specify the percentage of Dai women in matrilocal residences and compare the percentage with that of other ethnicities.

According to marriage economics, the determinants of Dai women's matrilocal residence may extend beyond their traditional customs. Marriage economics as a concept was first introduced by Becker (1973, 1974) and has been developed by numerous subsequent studies, e.g., Grossbard (1978), Manser and Brown (1980), Grossbard-Shechtman (1982, 1984), Nelson (1994), Weiss (1997), and Matouschek and Rasul (2008). Generally, the economic approach to the family interprets marriage and relevant issues through the lens of utility-maximizing, forward-looking behavior (Becker, 1993). Thus, the observed decisions related to marriage, such as that regarding matrilocal residence, are likely to be an optimal result that maximizes a new couple's household utility under certain resource endowments and economic constraints. To date, while few studies have empirically examined the determinants of post-marital residence decision, previous studies stated that post-marital residence might be associated with warfare (Divale, 1974), sex-biased division of labor (Korotayev, 2003; Moravec et al., 2019), education and other individual characteristics (Landmann et al., 2018). Particularly, for matrilocal residence, it has been revealed to significantly correlate with female contribution to subsistence (Korotayev, 2003) and the number of female brothers (Gruijters and Ermisch, 2019).

## 3. Methods

### 3.1. A model of matrilocal residence

Following previous studies (Becker, 1973; Grossbard-Shechtman, 1984), we use a simple utility maximization framework to derive a conceptual model illustrating a woman's decision to live in a matrilocal residence. Assume a new couple obtains a discounted lifetime utility value of U(matrilocal) if they choose to live in a matrilocal residence and V(nonmatrilocal) if they do not. Because marriage can enable the transfer of the labor force and resource endowments between the wife's and the husband's households (Divale, 1974; Ember, 1974; Fan and Li, 2002), these two utilities are assumed to be determined by labor (L) and resource endowments (R) and a vector of other factors (Z). Thus, the two utility functions can be written as follows:

$$\mathrm{U(matrilocal)} = \mathrm{U_m}\left(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh}, \mathrm{L}^{h}, \mathrm{L}^{hh}, \mathrm{R}^{hh}, \mathrm{Z}^{hh}\right) \quad (1)$$

$$\mathrm{V(nonmatrilocal)} = \mathrm{U_n}\left(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh}, \mathrm{L}^{h}, \mathrm{L}^{hh}, \mathrm{R}^{hh}, \mathrm{Z}^{hh}\right) \quad (2)$$

where *w*, *wh*, *h* and *hh* index the wife, the wife's household, the husband, and the husband's household, respectively.

In this case, whether a new couple will choose matrilocal residence can be described as follows:

$$Max\left[\mathrm{U(matrilocal)}, \mathrm{V(nonmatrilocal)}\right] \quad (3)$$

Eq. (3) denotes that the spouses make the decision regarding matrilocal residence by comparing the utilities to be realized between matrilocal and nonmatrilocal residences. If the former is greater, the couple will choose to reside matrilocally; otherwise, they will choose to reside nonmatrilocally. Thus, a latent variable that determines the decision of a matrilocal residence can be expressed as follows:

$$\mathrm{I}^{*} = \mathrm{U(matrilocal)}–\mathrm{V(nonmatrilocal)} \quad (4)$$

The couple will choose a matrilocal residence if $\mathrm{I}^{*} > 0$; otherwise, they will not choose a matrilocal residence. Therefore, the observed decision regarding matrilocal residence can be expressed as follows:

$$\mathrm{D} = \begin{cases} 1 \; if \quad \mathrm{I}^{*} > 0 \\ 0 \; if \quad \mathrm{I}^{*} \le 0 \end{cases} \quad (5)$$

By incorporating eqs. (1) and (2) into eq. (5), we yield a conceptual model of a new couple's decision to live in a matrilocal residence:

$$\mathrm{D} = f\left(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh}, \mathrm{L}^{h}, \mathrm{L}^{hh}, \mathrm{R}^{hh}, \mathrm{Z}^{hh}\right) \quad (6)$$

In the marriage market, an appropriate marriage means that a woman must be matched with a man who is most likely to marry (Becker, 1974), while the matching itself is generally based on the characteristics of both the man and the woman (Grossbard-Shechtman, 1982). Hence, a husband's characteristics $\mathrm{X}^{h}(\mathrm{L}^{h}, \mathrm{L}^{hh}, \mathrm{R}^{hh}, \mathrm{Z}^{hh})$ should be strongly correlated with his wife's characteristics $\mathrm{X}^{w}(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh})$. This relation can be written as follows:

$$\mathbf{X}^{h}\left(\mathrm{L}^{h}, \mathrm{L}^{hh}, \mathrm{R}^{hh}, \mathrm{Z}^{hh}\right) = g\left[\mathbf{X}^{w}\left(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh}\right)\right] \quad (7)$$

If there is no information on the husband and his household, by incorporating eq. (7) into eq. (6), a woman's decision to live in a matrilocal residence (M) can be derived as a reduced form of eq. (6) as follows:

$$\mathrm{M} = f\left(\mathrm{L}^{w}, \mathrm{L}^{wh}, \mathrm{R}^{wh}, \mathrm{Z}^{wh}, \varepsilon\right) \quad (8)$$

where ε is an unobserved random error term. The coefficients to be estimated for $\mathrm{L}^{wh}$ and $\mathrm{R}^{wh}$ represent, respectively, the impacts of the labor and the resource endowments of the woman's household on her decision to live in a matrilocal residence.

According to the findings of previous studies, such as Tsuya and Kurosu (2000) and Chu et al. (2011), we expect that the impact of the labor endowments such as the number of siblings of the woman's household on her decision for matrilocal residence is significantly negative, i.e., Hypothesis 1: *a woman whose natal family has more labor endowments is less likely to live in a matrilocal residence after marriage*. This is reasonable as a woman's natal family with more labor force actually has a lower probability to need additional labor so that it is not necessary for the woman to be matrilocal residence after marriage.

Furthermore, assume that the resource endowments ($\mathrm{R}^{wh}$) of the wife's household are location-specific such as rubber plantation; thus, following Baker and Jacobsen (2007), the impact of resource endowments is anticipated to be significantly positive, i.e., Hypothesis 2: *A woman whose natal family possesses more location-specific resource endowments has a higher probability of living in a matrilocal residence after marriage*. This hypothesis is also acceptable because if the wife's family has more location-specific resources, a man has a higher probability to marry into his wife's family in exchange for the location-specific resources.

### 3.2. Empirical model

The two hypotheses proposed in above could be empirically tested by employing an econometric model. Given that a woman's decision to live in a matrilocal residence after marriage is measured as a discrete variable (1 = matrilocal residence after marriage, 0 = no), a standard binary Probit model is employed (Greene, 2012). That is, we empirically examine the probability of a woman living in a matrilocal residence, which is hypothetically determined by the woman's family labor and resource endowments.

Following the formula of a Probit model and eq. (8), the empirical model can be specified as follows:

$$M_i = \begin{cases} 1 \; if \; matrilocalresidence \\ 0 \; if \; nonmatrilocalresidence \end{cases} \quad (9)$$

$$Pr\left(M_i = 1 | L_i^{w}, L_i^{wh}, R_i^{wh}, Z_i^{wh}\right) = \Phi\left(\beta_0 + \beta_1 L_i^{w} + \beta_2 L_i^{wh} + \beta_3 R_i^{wh} + \beta_4 Z_i^{wh}\right) \quad (10)$$

where $M_i$ represents if the marriage chose to be matrilocal residence or not, which takes value of 1 if yes, and 0 otherwise; $Pr(\bullet)$ is the probability function of being matrilocal residence or not; $\Phi(\bullet)$ denotes the cumulative normal distribution function. Consistent with the variables defined in the theoretical model, we defined labor ($L$), resource endowments ($R$), and a vector of other factors ($Z$). $i$ indexes the $i^{th}$ woman, and $w$ and $wh$ index the wife and the wife's household, respectively. $\beta_0$, …, $\beta_4$ are the parameters to be estimated.

$$lnL = \sum_i \left\{ M_i ln\left[\Phi\left(\beta_0 + \beta_1 L_i^w + \beta_2 L_i^{wh} + \beta_3 R_i^{wh} + \beta_4 Z_i^{wh}\right)\right] + (1 - M_i) ln\left[1 - \Phi\left(\beta_0 + \beta_1 L_i^w + \beta_2 L_i^{wh} + \beta_3 R_i^{wh} + \beta_4 Z_i^{wh}\right)\right] \right\} \quad (11)$$

Thus, the log-likelihood equation can be written as in eq. (11), which will be estimated using the maximum likelihood estimation procedure. The significance and sign of the coefficients $\beta_2$ and $\beta_3$ indicate whether and how family labor and resource endowments affect the woman's decision about matrilocal residence.

The estimation strategy is presented as follows. First, the empirical model is estimated with different specifications or proxy strategies for resource endowment, including a) the area of rubber plantation per capita, b) the specialization in rubber farming which is the proportion of rubber planting areas in total land areas, and c) the quintiles of the specialization in rubber farming. The last proxy variable is used to detect the possible non-linear impact of the specialization of rubber farming on the probability of being a matrilocal residence. Second, as mentioned in the theoretical model, the Dai ethnicity is more likely to being a matrilocal residence; it is of interest to test whether there exist the complementary or substitute effects between Dai ethnicity and the resource endowment. To do so, we include the interacted term between the Dai ethnics and the proportion of rubber planting areas in total land areas. Third, we go beyond the existing literature on the determinants of matrilocal/patrilocal marriage by conducting the mechanism analysis through the education level, family labor demand, and rubber farming. Finally, a cohort analysis is conducted to examine the matrilocal residence decision of a woman belonging to different cohorts, while an instrumental variable is used to control for the potential endogeneity of rubber farming.

## 4. Data and descriptive statistics

### 4.1. Survey site

In this study, we use data collected from a comprehensive household survey of smallholder rubber farmers in the XSBN of Yunnan Province in Southwest China conducted in March 2013. The XSBN is a minority autonomous region with diverse cultures and approximately 10 ethnic groups (e.g., the Dai minority, the Hani minority, and the Han majority, etc.), among which the Dai minority is the dominant group and represents more than 30% of the prefecture's total population. The XSBN is a mountainous region that has experienced rapid changes in land use with the transition from traditional agriculture and tropical rainforest to rubber farming (Zhang et al., 2015). Min et al. (2017a) demonstrated that over 58% of smallholder rubber farmers were Dai. Therefore, the Dai minority is the main stakeholder in the XSBN's rubber economy.

To achieve this study's objective, it is interesting to utilize data on small-scale rubber farmers in the XSBN for several reasons. First, the rubber plantation is an appropriate proxy variable for location-specific resource endowments. As a strict requirement of natural rubber's growing environment, a rubber plantation is recognized as an important resource endowment with a remarkable comparative advantage for smallholders in the XSBN. Additionally, rubber plantations are location-specific. Second, the special approach and time for harvesting rubber latex makes rubber farming highly labor-intensive (Min et al., 2017a). In the XSBN, all the rubber trees are planted in the mountainous region. The rubber trees must be tapped in the early morning before the sun rises, and the rubber must be collected before noon. Considering the potential risk and danger of work among the rubber trees in the mountains before the sun rises, men in the household are generally responsible for tapping rubber. Thus, rubber farming's relatively high demand for male labor may facilitate the resource endowment effect on a woman's decision to live in a matrilocal residence. Third, traditionally, Dai minority women tend to have a higher probability of matrilocal residence than women of other ethnicities after marriage (Unger, 1997; Yang, 2001; Zhang, 2004a; Diana, 2013). Thus, the possible difference in matrilocal residence between the Dai minority and other ethnicities could reflect the effects of the Dai minority's traditional customs on a woman's decision to live in a matrilocal residence. Overall, the case study of smallholder rubber farmers in the XSBN should provide a unique opportunity to examine the issues we have raised and empirically test our hypotheses.

### 4.2. Date source

To obtain a representative sample of smallholder rubber farmers in the XSBN, we applied a stratified random sampling approach in the survey by considering the distribution of rubber plantations (Min et al., 2017b). First, sample townships were selected by applying the stratified random sampling approach (stratified by rubber planting area per capita) and considering the distribution of rubber planting areas). As shown in Fig. A1 of appendix, 3 townships were selected from Jinghong and Mengla, respectively, while 2 sample townships were selected from Menghai. Secondly, applying the same sampling approach, six sample villages were selected within each sample township in Jinghong and Mengla, while only 3 sample villages were selected within each township in Menghai. Thirdly, sample households were randomly selected based on the list of smallholder rubber farmers in each village. Finally, we collected 612 household questionnaires from 42 villages of 8 townships in the XSBN's three counties. During the survey, we employed a comprehensive household questionnaire, which includes detailed information on the socioeconomic characteristics of family members, land use, rubber farming and other questions relevant to rubber.

To explore the matrilocal residences of female members of smallholder rubber farmers, we designed a module to collect information on their families and household agriculture before marriage. To narrow this study's research scope, we targeted women who satisfy the following requirements: 1) original family member in the surveyed household, including women who were original members of the household in the past but excluding women who came from other households for marriage or other reasons; 2) married, divorced, or widowed; and 3) no more than 40 years old. Smallholder rubber farming in the XSBN began in the 1980s; therefore, smallholders only began to harvest rubber in the 1990s. We consider that the effects of rubber farming on marriage

**Table 1**
Definitions and descriptive statistics for all variables.

| Variable | Definition and description | Mean | Std. dev. |
|---|---|---|---|
| Sample size | | 402 | |
| MATRI | Matrilocal residence after marriage (1 = yes; 0 = no) | 0.124 | 0.330 |
| DAI | Ethnicity (1 = Dai, 0 = other) | 0.550 | 0.498 |
| YEARS | How long has the woman been married? (years) | 8.744 | 5.202 |
| AGE | Age of marriage (years) | 20.813 | 3.621 |
| EDU | Level of education (years) | 7.381 | 3.168 |
| BRO | Num. of brothers (in the year the woman married) | 0.995 | 0.971 |
| SIST | Num. of sisters (in the year the woman married) | 1.007 | 1.222 |
| PARE | Parents' health status (in the year the woman married; 1 = unhealthy, 0 = healthy) | 0.095 | 0.293 |
| LAND | Household-operated land per capita (hectare/capita) | 0.914 | 0.888 |
| RUBBER | Area of rubber plantation (hectare/capita) | 0.486 | 0.574 |
| SPECI | Specialization in rubber farming (proportion of rubber planting areas in total land areas) | 0.519 | 0.365 |
| LOW | Altitude ≤600 MASL (1 = yes; 0 = no) | 0.187 | 0.390 |
| MIDDLE | 600 MASL < altitude ≤800 MASL (1 = yes; 0 = no) | 0.493 | 0.501 |
| HIGH | Altitude >800 MASL (1 = yes; 0 = no) | 0.321 | 0.467 |
| MH | 1 = Menghai; 0 = other | 0.154 | 0.362 |
| JH | 1 = Jinghong; 0 = other | 0.448 | 0.498 |
| ML | 1 = Mengla; 0 = other | 0.398 | 0.490 |

Data Source: Authors' survey.

migration emerged during the same period and therefore target women who are no more than 40 years old. Finally, we collected information on 402 women who met these criteria and the socioeconomic characteristics of their households.

### 4.3. Descriptive statistics of key variables

Table 1 presents the definitions and descriptive statistics of all the variables used in the model of matrilocal residence. Approximately 12.4% of the sampled women decided to live in a matrilocal residence after marriage. In light of previous studies (Morgan and Rindfuss, 1984; Lavely and Ren, 1992), a vector of variables ($Z_i^{wh}$) such as marriage year and ethnicity was included. On average, the sampled women had been married for more than 8 years, and approximately 55% of the 402 women belonged to the Dai minority.

To avoid the potential endogeneity of explanatory variables for a woman's decision to live in a matrilocal residence, all the explanatory variables were set as lagged variables, i.e., all the collected data was related to the woman's status before marriage. According to the variable setting of a woman's labor endowment ($L_i^w$ in previous marriage studies, Lavely and Ren, 1992; Fan and Huang, 1998; Zhang, 2004; Chu et al., 2011; Kato, 2013), we included the woman's age and education level before marriage. On average, the age at first marriage is 21 years old. The number of a woman's siblings and her parents' health status were employed as proxy variables for her natal family's labor endowment ($L_i^{wh}$) (Tsuya and Kurosu, 2000; Chu et al., 2011; Rajan, 2014). On average, women had one brother and one sister, and approximately 10% of the women's parents were unhealthy.

To empirically test the effects of resource endowment ($R_i^{wh}$) on matrilocal residence, the areas and specialization of the rubber plantations of the women's households were included; we also included the land area variable (Tsuya and Kurosu, 2000). The results show that, on average, household land area was 0.914 ha per capita, 51.9% (0.486 ha) of which was used to plant rubber. Considering that the XSBN is a mountainous region, we also controlled for the altitude of the household location. Approximately 19% of the women's households were located below 600 m above sea level, while nearly 50% and 30% were located in middle- and high-altitude regions, respectively. Also, 15.4% of sample women were from Menghai, while 44.8% and 39.8% were from Jinghong and Mengla, respectively.

**Table 2**
Differences between matrilocal and nonmatrilocal residences.

| Variable | MATRI = 1 | | MATRI = 0 | | Difference# | |
|---|---|---|---|---|---|---|
| | Mean | Std. dev. | Mean | Std. dev. | | |
| Sample size | 50 | | 352 | | | |
| DAI | 0.760 | 0.431 | 0.520 | 0.500 | 0.240 | *** |
| YEARS | 10.320 | 5.850 | 8.520 | 5.073 | 1.800 | ** |
| AGE | 20.120 | 3.166 | 20.912 | 3.674 | −0.792 | |
| EDU | 6.300 | 2.550 | 7.534 | 3.220 | −1.234 | *** |
| BRO | 0.660 | 0.848 | 1.043 | 0.979 | −0.383 | *** |
| SIST | 0.600 | 0.808 | 1.065 | 1.260 | −0.465 | ** |
| PARE | 0.200 | 0.404 | 0.080 | 0.271 | 0.120 | *** |
| LAND | 0.859 | 0.797 | 0.922 | 0.901 | −0.063 | |
| RUBBER | 0.640 | 0.700 | 0.464 | 0.552 | 0.176 | ** |
| SPECI | 0.687 | 0.307 | 0.495 | 0.367 | 0.192 | *** |
| LOW | 0.300 | 0.463 | 0.170 | 0.377 | 0.130 | ** |
| MIDDLE | 0.520 | 0.505 | 0.489 | 0.501 | 0.031 | |
| HIGH | 0.180 | 0.388 | 0.341 | 0.475 | −0.161 | ** |
| MH | 0.040 | 0.198 | 0.170 | 0.377 | −0.130 | ** |
| JH | 0.560 | 0.501 | 0.432 | 0.496 | 0.128 | * |
| ML | 0.400 | 0.495 | 0.398 | 0.490 | 0.002 | |

Data Source: Authors' survey and calculation.
Note: # Mean-comparison tests; *, ** and *** represent the 10%, 5%, and 1% significance levels, respectively.

Table 2 shows the differences in the mean values of all the variables between women who live in a matrilocal residence and women who live in a nonmatrilocal residence, indicating possible correlations between these variables and matrilocal residence. Dai minority women have a significantly higher proportion of matrilocal residence than other ethnicities. This result is consistent with the traditional customs of the Dai minority, but it does not control for the other variables that may affect a Dai woman's decision to live in a matrilocal residence.

On average, women living in a matrilocal residence have been married for over ten years, which is significantly longer than the time that women living in a nonmatrilocal residence have been married. This result shows a positive correlation between the length of the marriage (in years) and matrilocal residence, implying a decreasing trend of matrilocal residence over time. Additionally, matrilocal residence is correlated with female education; that is, women with higher education levels tend to live in a nonmatrilocal residence.

The decision to live in a matrilocal residence appears to be positively correlated with household labor demand. Women who have more siblings have a lower likelihood of living in a matrilocal residence, while women whose parents are unhealthy have a higher likelihood of living in a matrilocal residence. This result, to some extent, supports our first

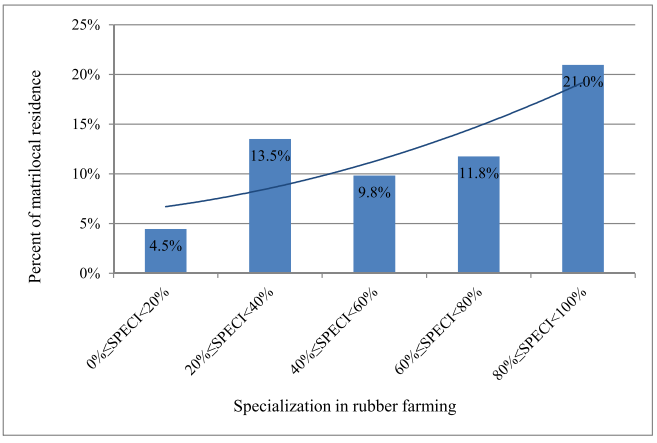


**Fig. 1.** Relation between matrilocal residence and specialization in rubber farming.

**Table 3**
Differences between the Dai minority and other ethnicities.

| Variable | Dai minority | | Other ethnicities | | Difference# | |
|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. | | |
| Sample size | 221 | | 181 | | | |
| MATRI | 0.172 | 0.378 | 0.066 | 0.249 | 0.106 | *** |
| YEARS | 8.661 | 5.177 | 8.845 | 5.245 | −0.185 | |
| AGE | 20.643 | 3.549 | 21.022 | 3.706 | −0.380 | |
| EDU | 7.674 | 2.843 | 7.022 | 3.499 | 0.652 | ** |
| BRO | 0.652 | 0.647 | 1.414 | 1.125 | −0.763 | *** |
| SIST | 0.679 | 0.793 | 1.409 | 1.505 | −0.730 | *** |
| PARE | 0.090 | 0.288 | 0.099 | 0.300 | −0.009 | |
| ln(LAND) | −1.050 | 2.912 | −1.429 | 3.846 | 0.379 | |
| ln(RUBBER) | −3.548 | 6.709 | −5.867 | 8.653 | 2.319 | *** |
| SPECI | 0.576 | 0.346 | 0.449 | 0.376 | 0.128 | *** |
| LOW | 0.253 | 0.436 | 0.105 | 0.307 | 0.148 | *** |
| MIDDLE | 0.548 | 0.499 | 0.425 | 0.496 | 0.122 | ** |
| HIGH | 0.199 | 0.400 | 0.470 | 0.500 | −0.271 | *** |
| MH | 0.149 | 0.357 | 0.160 | 0.368 | −0.011 | |
| JH | 0.462 | 0.450 | 0.431 | 0.497 | 0.031 | |
| ML | 0.389 | 0.489 | 0.409 | 0.493 | −0.020 | |

hypothesis.

Furthermore, although the land area of a woman's household is not correlated with her matrilocal residence decision, the area of land used for rubber farming is positively correlated with matrilocal residence. Rubber farming is location-specific and is typically male labor-intensive. When more rubber plantations are owned than can be regularly managed by family labor, the migration of external labor to households, including those in situations of matrilocal residence, becomes particularly important. Similarly, as shown in Fig. 1, women whose households are more specialized in rubber farming (i.e., women whose households allocate higher proportions of land for rubber plantations) may have a significantly higher proportion of matrilocal residence. These results are consistent with our second hypothesis, namely, that higher resource endowments, such as households' rubber plantations, facilitate female members' matrilocal residence.

Moreover, the extent of matrilocal residence varies in terms of the altitude of the household location, indicating a heterogeneity of matrilocal residence in altitude distribution. Women whose households are located at low (high) altitudes have a higher (lower) proportion of matrilocal residence. Finally, the extent of matrilocal residence also differs in counties. In Jinghong, there are more proportions of women living in a matrilocal residence after marriage.

Table 3 shows the differences in the variables between the Dai minority and other ethnicities including the Hani minority, the Bulang minority, the Han majority and so on. All the variables differed significantly between the Dai minority and other ethnicities, except for years of marriage, marriage age, parents' health status and area of the rubber plantation. For instance, compared with the women of other ethnicities, the women of the Dai minority have fewer brothers and/or sisters at the time of marriage, their families averagely have a higher specialization level in rubber farming, while there is also a higher proportion of them living in a matrilocal residence after marriage. These significantly different variables between the Dai minority and other ethnicities may aid in understanding the possible impact mechanisms of the Dai minority on a woman's decision to live in a matrilocal residence.

## 5. Results

Table 4 shows the estimation results for matrilocal residence, including all the explanatory variables. The empirical model is estimated three times by considering the different settings of the resource endowment variables. In model (a), the logarithm of the rubber planting area is applied directly. In model (b), we control for total household land area; therefore, we use the variable of specialization in rubber farming to avoid a possible correlation between land area and rubber planting area. In model (c), the extent of specialization in rubber farming is further divided into five groups, which allows us to test the significance of the difference in the probability of matrilocal residence among groups.

**Table 4**
Estimation results for matrilocal residence.

| Variable | Result (a) | Result (b) | Result (c) |
|---|---|---|---|
| ln(RUBBER) | 0.0288* | | |
| | (0.0166) | | |
| SPECI | | 0.878*** | |
| | | (0.326) | |
| 20% ≤ SPECI<40% | | | 0.734* |
| | | | (0.414) |
| 40% ≤ SPECI<60% | | | 0.678* |
| | | | (0.395) |
| 60% ≤ SPECI<80% | | | 0.782** |
| | | | (0.366) |
| 80% ≤ SPECI<100% | | | 0.931*** |
| | | | (0.355) |
| ln(LAND) | | −0.0279 | −0.0400 |
| | | (0.0275) | (0.0306) |
| DAI | 0.207 | 0.231 | 0.223 |
| | (0.205) | (0.210) | (0.207) |
| YEARS | 0.0427** | 0.0533*** | 0.0510** |
| | (0.0194) | (0.0204) | (0.0200) |
| AGE | 0.0173 | 0.0178 | 0.0186 |
| | (0.0307) | (0.0305) | (0.0305) |
| EDU | −0.0998*** | −0.0969*** | −0.100*** |
| | (0.0313) | (0.0313) | (0.0318) |
| BRO | −0.308** | −0.306** | −0.287** |
| | (0.134) | (0.138) | (0.139) |
| SIST | −0.254** | −0.233** | −0.253** |
| | (0.116) | (0.112) | (0.111) |
| PARE | 0.609** | 0.613** | 0.618** |
| | (0.275) | (0.276) | (0.276) |
| MIDDLE | 0.0512 | 0.102 | 0.0880 |
| | (0.223) | (0.224) | (0.225) |
| HIGH | −0.446* | −0.229 | −0.268 |
| | (0.258) | (0.269) | (0.262) |
| JH | 0.878** | 0.770* | 0.759** |
| | (0.389) | (0.396) | (0.380) |
| MH | 0.557 | 0.622* | 0.613* |
| | (0.367) | (0.368) | (0.361) |
| Constant | −1.416** | −2.275*** | −2.375*** |
| | (0.699) | (0.824) | (0.849) |
| *N* | 402 | 402 | 402 |
| Pseudo $R^2$ | 0.190 | 0.202 | 0.207 |
| Log lik. | −122.3 | −120.4 | −119.8 |
| Wald $Chi^2$ | 47.81*** | 49.40*** | 49.01*** |
| AIC | 270.513 | 268.821 | 273.536 |
| BIC | 322.467 | 324.772 | 341.475 |

Notes: Robust standard errors in parentheses; *$p < 0.10$, **$p < 0.05$, and **$p < 0.01$.

Regardless of the model specifications, the dummy variable for Dai ethnicity is always statistically insignificant. This result reveals that a Dai ethnic background alone cannot predict the high rate of matrilocal marriage in the area, although it has been commonly recognized as a traditional custom. The observed high rate of matrilocal marriage among Dai women may be attributable to the significant heterogeneity between the Dai minority and other ethnicities (Table 3).

### 5.1. Impacts of labor and resource endowments on matrilocal residence

As shown in Table 4, when other explanatory variables are controlled, the three variables regarding the labor endowments of a

woman's household always exert significant impacts on her matrilocal status. The number of a woman's brothers or sisters has negative effect on the likelihood of her matrilocal residence, which is similar to the study by Chu et al. (2011) in which they found both the numbers of women's elder brothers and younger brothers had negative effects on their matrilocal residence in China, despite there was no explanations rooted in economics. As the stated by Landmann et al. (2018), family structure, especially the labor, is likely to have the marriage consequences into matrilocal/patrilocal residence or nuclear family. The results in Table 4 also show that if either of a woman's parents is unhealthy, she has a significantly higher probability of matrilocal residence after marriage. This is reasonable as unhealthy parents need to be taken care of by additional labor. Like the explanation of Gruijters and Ermisch (2019), matrilocal residence is often driven by practical concerns, such as the need for male labor or support in old age. Hence, a woman's natal family with fewer number of siblings and the existence of unhealthy parents probably have a higher labor demand, thereby increasing the probability of matrilocal residence after her marriage. Thus, these results jointly confirm the first hypothesis, that a woman whose natal family has more labor endowments is less likely to live in a matrilocal residence after marriage.

Among the three columns of the results in Table 4, rubber (the proxy variable of resource endowment) always significantly affects the decision for matrilocal residence, regardless of the type of setting. Result (a) suggests that women whose households own more rubber plantations have a higher probability of matrilocal residence than women whose households own fewer rubber plantations. When we control for household land area in result (b), the specialization in rubber, i.e., the share of rubber plantations in the total land area, continues to have a significant and positive impact on matrilocal residence. Result (c) further shows the significant differences in matrilocal residence among the groups by specialization in rubber farming. These results are consistent with the findings of previous studies. For instance, Tsuya and Kurosu (2000) showed a positive effect of household landholding on female matrilocal residence in Japan, while the study conducted by Kato (2013) found that any provision of home ownership and intergenerational transfer from wife's side would increase the probabilities of female matrilocal marriages. These findings imply that the forming of female matrilocal residence depended heavily on the economic resources of female natal family. Hence, the second hypothesis of this study—i.e., that a woman whose natal family possesses more location-specific resource endowments has a higher probability of matrilocal residence after marriage—is also testified.

Consistent with descriptive statistics, several independent variables also have significant impacts on the decision for matrilocal residence in vary extent. While the results among models (1), (2), and (3) are quite similar, we would like to choose the most correct one to explain the estimation results of other independent variables. We calculate the Akaike's information criterion (AIC) and Bayesian information criterion (BIC) to identify the model that better fits the data. The BIC is more useful in selecting a correct model, while the AIC is more appropriate in finding the best model for predicting future observations (Chakrabarti and Ghosh, 2011). Hence, according to the results of AIC and BIC in the bottom of Table 4, model (a) was selected to interpret the impacts of other independent variables on the decision for matrilocal residence. As shown in the result (a), the length of the marriage (in years) positively affects the decision for matrilocal residence, confirming the decreasing trend of matrilocal residence over time in southwest China. This finding is similar to the trend found in Japan (Kato, 2013). Also, consistent with previous studies that indicated the important role of education in marriage decisions (Fan and Huang, 1998; Zhang, 2004; Chu et al., 2011; Landmann et al., 2018), women with higher education levels are less likely to be matrilocal residence (Table 4). This may be because that education increases a woman social status and earning ability, and reduces attachment to traditional norms and customs (Gruijters and Ermisch, 2019).

The results also suggest significant heterogeneities of the extent of matrilocal residence in different regions. First, as shown in results (a), (b) and (c) in Table 4, the coefficient of the high-altitude variable (HIGH) changes from significantly negative to insignificance. It indicates that women who live in high altitudes are less likely to be matrilocal residence in relative to those who live in low altitude areas. The possible explanation is that the planting area of natural rubber is relatively few in high altitudes; therefore, the coefficient of the high-altitude variable (HIGH) turns insignificant when the variable of land area is further controlled (Results (b) and (c)). Second, women living in Jinghong have a higher probability of matrilocal residence after marriage. A possible reason is that Jinghong has more Dai people than Mengla county, and, therefore, has stronger traditional customs of the Dai female matrilocal marriages as a peer effect.

### 5.2. Additional analysis

In this section, we first investigate the potential interaction effect of ethnicity and rubber plantation on a woman's decision to live in a matrilocal residence as well as heterogeneities in the determinants of matrilocal residence between the Dai minority and other ethnicities. Second, we further detect the possible mechanisms of Dai minority effects on matrilocal residence. In doing so, we employ the stepwise regression approach to re-estimate the empirical model explained in eqs. (9)–(11). Then, a cohort analysis for matrilocal residence is conducted to verify the robustness of the empirical results. Finally, we employ an instrumental variable and a probit model with continuous endogenous regressors to test for the potential endogeneity of rubber farming in explaining the decision on matrilocal residence.

### 5.3. Interaction effects with ethnicity

As shown in column 2 of Table 5, the coefficient of the variable regarding rubber cultivation is nonsignificant compared to result (b) in Table 4, while the coefficient of the interaction terms of rubber cultivation and ethnicity is statistically significant. This result indicates that the effect of the Dai minority attribute on matrilocal residence is accompanied by location-specific resource endowments, confirming that the cause of matrilocal residence extends beyond the influence of the Dai minority's traditional customs. We go beyond earlier work by investigating effect channels of our hypothesis two. In Southwest China, the consequence of marriage choice exists the complementary effects between the norm and land endowment.

Columns 3 and 4 in Table 5 report the estimation results of matrilocal residence for the Dai minority group and the other ethnicities group, respectively. The differences in the significant independent variables between the results (Dai and other) can indicate heterogeneities in the

**Table 5**
Estimation results for matrilocal residence demonstrating the interaction effects between the Dai minority and other ethnicities.

| Variable | All sample | Dai | Other |
|---|---|---|---|
| Dai | 0.577** | | |
| | (0.242) | | |
| Dai# ln(RUBBER) | 0.146*** | | |
| | (0.0351) | | |
| ln(RUBBER) | −0.0150 | 0.144*** | −0.0184 |
| | (0.0196) | (0.0377) | (0.0312) |
| Other variables | Yes | Yes | Yes |
| Constant | −2.035*** | −1.301 | −0.253 |
| | (0.765) | (0.909) | (1.592) |
| *N* | 402 | 221 | 152 |
| pseudo $R^2$ | 0.226 | 0.201 | 0.364 |
| Log lik. | −116.9 | −81.05 | −26.71 |
| Chi-squared | 58.61*** | 47.87*** | 43.09*** |

Notes: Robust standard errors in parentheses; *$p < 0.10$, **$p < 0.05$, and **$p < 0.01$; the full results would be provided upon request.

**Table 6**
Stepwise regression results for matrilocal residence.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| DAI | 0.557*** | 0.658*** | 0.265 | 0.497*** | 0.459*** | 0.483*** | 0.564*** |
| | (0.175) | (0.182) | (0.201) | (0.169) | (0.174) | (0.184) | (0.175) |
| | [0.106] | [0.116] | [0.045] | [0.092] | [0.083] | [0.089] | [0.101] |
| YEARS | | 0.0245 | | | | | |
| | | (0.018) | | | | | |
| AGE | | 0.002 | | | | | |
| | | (0.026) | | | | | |
| EDU | | −0.074*** | | | | | |
| | | (0.026) | | | | | |
| BRO | | | −0.333** | | | | |
| | | | (0.139) | | | | |
| SIST | | | −0.243** | | | | |
| | | | (0.105) | | | | |
| PARE | | | 0.790*** | | | | |
| | | | (0.256) | | | | |
| ln(RUBBER) | | | | 0.025* | | | |
| | | | | (0.015) | | | |
| ln(LAND) | | | | | −0.013 | | |
| | | | | | (0.029) | | |
| SPECI | | | | | 0.771*** | | |
| | | | | | (0.257) | | |
| MIDDLE | | | | | | −0.255 | |
| | | | | | | (0.207) | |
| HIGH | | | | | | −0.491* | |
| | | | | | | (0.257) | |
| JH | | | | | | | 0.854** |
| | | | | | | | (0.333) |
| ML | | | | | | | 0.752** |
| | | | | | | | (0.337) |
| Constant | −1.504*** | −1.314** | −0.947*** | −1.374*** | −1.903*** | −1.199*** | −2.236*** |
| | (0.144) | (0.614) | (0.250) | (0.140) | (0.236) | (0.244) | (0.326) |
| *N* | 402 | 402 | 402 | 402 | 402 | 402 | 402 |
| pseudo $R^2$ | 0.036 | 0.076 | 0.096 | 0.048 | 0.066 | 0.049 | 0.062 |
| Log lik. | −145.6 | −139.5 | −136.5 | −143.7 | −141.0 | −143.5 | −141.6 |
| Chi-squared | 10.15*** | 24.67*** | 22.21*** | 9.858*** | 14.34*** | 17.28 | 17.88*** |

Note: Robust standard errors in parentheses; Marginal effects in brackets; * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

determinants of matrilocal residence between the Dai minority and other ethnicities. Notably, the hypothesis regarding the positive impact of resource endowment on matrilocal residence appears to be valid for only the Dai minority group. This result implies that the impact of resource endowment on matrilocal residence may be somewhat associated with a specific ethnicity.

### 5.4. Mechanism analysis

Following the mechanism test approach presented in previous studies Li and Zhu, 2006; Sekabira and Qaim, 2017), the test in this study gradually controls for other socioeconomic variables, which are significantly different between the Dai minority and other ethnicities (Table 3), in matrilocal residence regressions to determine whether these controlling factors attenuate the effect of the Dai minority dummy variable. The results are shown in Table 6. All the models shown feature a woman's decision regarding matrilocal residence as the dependent variable.

In column (1), we include Dai ethnicity as a dummy variable, and the result shows that Dai women have a significantly (10.6%) higher probability of living in a matrilocal residence than do other ethnicities. The model in column (2) includes Dai ethnicity together with the women's marriage year, age at marriage, and educational level. The estimated results show that the ethnicity variable remains significant, and its marginal effect on the likelihood of living in a matrilocal residence increases slightly. This result is because the relatively high educational level of the Dai ethnicity (Table 3) significantly reduces the likelihood of matrilocal residence; a higher educational level is associated with a greater preference for independent living (Logan and Bian, 1999).

In column (3), we include the Dai ethnicity dummy variable together with the number of siblings and parents' health to test the existence of a possible mechanism involving labor demand. The results show that the Dai ethnicity dummy variable becomes insignificant, whereas the numbers of brother or sisters are significantly negative, and the variable of unhealthy parents is significantly positive. These results indicate that the matrilocal residence effect of the Dai women is primarily channelled through the pathways of a family's labor shortage.

In columns (4), (5), (6) and (7), the planting area of rubber, the specialization in rubber, and the household location slightly reduce the marginal effects of the Dai ethnicity dummy variable to varying degrees. The results reveal the possible mechanisms of the Dai ethnicity effects on matrilocal residence through the variables of rubber planting area, specialization in rubber and the household location. However, the Dai ethnicity dummy variable remains significant in columns (4), (5), (6) and (7), suggesting that other pathways also play a role.

Finally, when the model includes all the other socioeconomic variables (Table 5), the Dai ethnicity dummy variable is insignificant. By comparing the results found in Tables 5 and 6, the consistent significant variables include marriage year, education, number of siblings, parents' health, the rubber planting area, and specialization in rubber. These results suggest that the mechanism of the Dai minority effect on

**Table 7**
Estimation results for matrilocal residence among various cohort combinations.

| Variable | (1) | (2) | (3) | (1)(2) | (2)(3) | (3)(4) | (1)(2)(3) | (2)(3)(4) |
|---|---|---|---|---|---|---|---|---|
| SPECI | 1.187** | 1.201** | 1.947* | 1.027*** | 0.938** | 1.207* | 0.972*** | 0.772* |
| | (0.539) | (0.601) | (1.141) | (0.363) | (0.445) | (0.708) | (0.335) | (0.426) |
| BRO | −0.558** | −0.369 | −0.343 | −0.359** | −0.293* | −0.347 | −0.333** | −0.247 |
| | (0.269) | (0.282) | (0.287) | (0.180) | (0.173) | (0.283) | (0.139) | (0.173) |
| SIST | −0.264 | −0.504* | 0.146 | −0.350** | −0.213 | −0.0330 | −0.231** | −0.209 |
| | (0.216) | (0.286) | (0.297) | (0.139) | (0.160) | (0.263) | (0.115) | (0.154) |
| PARE | 1.187** | 1.201** | 1.947* | 1.027*** | 0.938** | 1.207 | 0.972*** | 0.772* |
| | (0.539) | (0.601) | (1.141) | (0.363) | (0.445) | (0.768) | (0.335) | (0.426) |
| Other variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | −4.191** | −2.413 | −1.312 | −2.574** | −2.648** | −1.606 | −2.742*** | −2.062** |
| | (2.047) | (1.864) | (1.929) | (1.123) | (1.145) | (1.413) | (0.876) | (1.037) |
| *N* | 95 | 99 | 130 | 208 | 229 | 194 | 338 | 293 |
| Pseudo $R^2$ | 0.425 | 0.254 | 0.304 | 0.231 | 0.172 | 0.240 | 0.204 | 0.182 |
| Log lik. | −25.65 | −31.41 | −30.93 | −68.70 | −72.08 | −45.53 | −107.0 | −84.39 |
| Wald $Chi^2$ | 36.68*** | 22.00*** | 33.18*** | 36.46*** | 23.96*** | 34.84*** | 42.52*** | 34.17*** |

Notes: Robust standard errors in parentheses; *$p < 0.10$, **$p < 0.05$, and **$p < 0.01$; the full results would be provided upon request.

matrilocal residence is channelled through heterogeneities in women's educational level, family labor demand, and rubber farming.

### 5.5. Cohort analysis

The results in Tables 4 and 5 show the significant differences in matrilocal residence among the groups by years of marriage. Similarly, in the study by Kato (2013) on the 20th-century family system in Japan, the incidence of matrilocal residence differed over various periods. Thus, the robustness of the determinants of matrilocal residence among different periods is worthy of study. Accordingly, in this section, we perform simple cohort analysis to further test the validity of the proposed matrilocal residence model. First, we split the households in the sample into four cohorts. Table A2 of appendix presents the mean values of all the variables among the four cohorts. The results of the mean-comparison test demonstrate that the average values of the variables in the last three cohorts are, to varying degrees, different from those in the first cohort. Therefore, some heterogeneities exist in these variables among the four cohorts. Second, we take two steps to test the solidity of the matrilocal residence model and the robustness of its determinants: a) the empirical model of matrilocal residence is estimated in each cohort, and b) the four cohorts are randomly combined into five cohort combinations. Then, the empirical model is estimated in each cohort combination.

Table 7 presents the estimation results for the matrilocal residence model among various cohort combinations. The results of Wald $Chi^2$ tests indicate that almost all the estimation results of the matrilocal residence model among different cohort combinations are statistically valid. One exception is the model in cohort (4), which cannot be successfully estimated due to the small sample size and low incidence of matrilocal residence; therefore, it was omitted.

**Table 8**
Results of the ivprobit model for matrilocal residence and the falsification test.

| Variable | SPECI | Matrilocal residence | Matrilocal residence |
|---|---|---|---|
| SPECI | | 2.597*** | 0.824 |
| | | (0.645) | (0.334) |
| IV(state farm) | 0.228*** | | 0.241 |
| | (0.037) | | (0.350) |
| Other variables | Yes | Yes | Yes |
| Constant | 0.810*** | −3.291*** | −2.273*** |
| | (0.111) | (0.832) | (0.820) |
| *N* | | 402 | 402 |
| Log lik. | | −174.616 | −120.181 |
| Wald $Chi^2$ | | 89.32*** | 51.41*** |
| Wald test ($Chi^2$) | | 3.76* | |

Notes: Robust standard errors in parentheses; *$p < 0.10$, **$p < 0.05$, and **$p < 0.01$.

Specifically, the validity of our first and second hypotheses persists across all the cohort combinations. These results further emphasize the important role of family labor and resource endowments on a woman's decision to live in a matrilocal residence even across different periods. Furthermore, the heterogeneities in the independent variables among these cohorts result in some differences in the significance of their coefficients among the models of various cohort combinations. Overall, the cohort analysis confirms that the specification of our proposed matrilocal residence model is valid and that its determinant results are robust.

### 5.6. Potential endogeneity

Considering that the variable of rubber farming in explaining the decision on matrilocal residence may suffer from an endogeneity problem, we further employ a probit model with continuous endogenous regressors (ivprobit model) and the instrumental variable (IV) approach to test for endogeneity. A variable "Is there any state rubber farm within 50 km of the township? (1=yes;0=otherwise)" is proposed as an instrumental variable. Intuitively, the proposed IV can affect the rubber farming of surrounding farmers due to technology diffusion but does not directly affect surrounding farmers' decisions regarding matrilocal residence. A falsification test in Table 8 indicate that the IV significantly affect the specialization of rubber farming of smallholders (column 1), while the IV does not have a significant and direct impact on matrilocal residence (column 3). This result confirms the validity of the proposed IV, empirically. Moreover, the results in Table 8 also imply that the IV may have an indirect impact on matrilocal residence by the channel of the specialization of rubber farming.

Columns 1–2 in Table 8 report the estimate results of the ivprobit model. First, the result of the Wald test ($Chi^2$) further confirms that the proposed IV is valid. Thus, there indeed exists an endogeneity problem for the variable of rubber farming in explaining the decision of matrilocal residence. Nevertheless, the estimate results also show a positive effect of rubber specialization on the probability of matrilocal residence, consistent with our results above. Hence, while an endogeneity problem exists, the main findings of this study are still valid.

## 6. Discussion

One major finding of this study, namely, that a woman whose natal household possesses more rubber plantations has a higher probability of matrilocal residence, implies that matrilocal residence may be associated with a woman's land use rights. In rural China, women and men have an equal right to obtain allocated land from the village collective. However, women who marry outside of the village generally lose the right to land tenure in their natal villages, while women living in their natal villages after marriage are allowed not only to hold their land

tenure but also to inherit land upon the death of their husband and parents, provided that their own land tenures have not expired. Kudo (2015) found that in rural Tanzania, allowing women living in a village to inherit land upon their husband's deaths increases the probability of married men choosing to live in the village. Our results reveal that rubber plantations, instead of other land use types, are a significant factor that attracts men's marriage migration. The reason for this result may be that rubber plantations offer more potential benefits than other land use types in rural XSBN.

A good understanding of matrilocal residence has broad implications for economic, societal, human, and biological issues (Pulliam, 1982; Feinman, 1992; Hamilton et al., 2005; Peters, 2010; Jones, 2011). For example, matrilocal residence can prevent traditional conflicts between a mother-in-law and daughter-in-law within a family, while the strong emotional bond between a wife and parents can facilitate cross-generational financial and caretaking assistance (Tsui, 1989). In matrilocal households, women can enjoy the assistance and protection of their families and clans, the security of economic independence, the maintenance of land rights, and the authority that comes with bargaining and decision-making power (Warner et al., 1986; Judd, 2007; Grogan, 2013). Thus, matrilocal residence can also offer women the best protection against domestic violence (Rajan, 2014).

According to the findings in this study, a woman's decision regarding matrilocal residence extends beyond the traditions of the Dai minority and primarily depends on her natal family's economic conditions, including labor and location-specific resource endowments. This phenomenon implies that by shifting marriage migration, the possession of resource endowments appears to strengthen a woman's rights and power within a marital relationship, thereby reducing gender inequality.

However, matrilocal residence may also raise potential risks regarding family conflicts. Matrilocal residence driven by resource endowments might not be an ideal residence type if social stigma is attached to a husband who lives with his wife's parents after marriage, in that "*a man who abandons his parents and leaves his ancestors is unfilial and abominable; a man who lives with his wife's parents is a loser and his life and work have to rely on the wife's household*" (Morgan and Rindfuss, 1984). Under such a condition, a husband must withstand the social pressure of surrounding public opinion. In addition, matrilocal residence may adversely affect a son-in-law's productivity, that is, men are more productive in a patrilocal residence than in a matrilocal household (Guha, 2010). This phenomenon indicates that a male member who has newly joined a matrilocal residence may not efficiently complement the labor shortage in his wife's family, as we expected. These situations would negatively affect the marital relationship, increasing the risk of family conflicts.

Moreover, matrilocal residence, as one type of residence pattern and human social organization, is correlated with both genetic diversity and variation (Oota et al., 2001; Jordan et al., 2009). Therefore, the disequilibrium of labor and resources contributes (to an extent) to genetic diversity and human genetic variation by causing various residence patterns, and the existence of matrilocal residence has biological implications.

Finally, the findings regarding the positive impacts of resource endowments, such as rubber plantations, on a woman's decision to live in a matrilocal residence also have reference implications for counterfactuals in terms of unmarried men in rural China. Zhou et al. (2011) indicated that high levels of rural-urban migration from inland villages depleted these villages of young people, especially women. Accordingly, a strong gradient across the age range in the ratio of unmarried men to women resulted in all the villages, from a ratio of 1.9 in the group aged 20–24 to a ratio of 75.0 in the group aged 35–39. The high gender imbalance resulted in many older rural Chinese men being unmarried, which severely threatened social stability and security in rural China. According to our findings, economic factors play an important role in this type of social problem. To resolve this issue, one feasible option would be to promote poverty alleviation by helping provide farmers with more agricultural capacities, employment opportunities, and productive resource endowments.

## 7. Conclusion

Although matrilocal residence has existed for many years, few studies have examined its economic impacts. Based on the theoretical framework of marriage economics in previous studies, we constructed a simple model of matrilocal residence with heterogeneities in the family labor and resource endowments of wives' households, thereby proposing two hypotheses regarding the determinants of matrilocal residence. Based on a case study of female household members of smallholder rubber farmers in the XSBN in Southwest China, this study empirically examines the factors that may influence a woman's decision regarding matrilocal residence and verifies the robustness of the established model and the results.

The results indicate that traditional customs of the Dai minority women are not the true reason for their higher probability of matrilocal residence. Instead, the two proposed hypotheses are confirmed; that is, fewer family labor endowments and more resource endowments, such as rubber plantations, of the wives' households encourage the incidence of matrilocal residence. Although the trend of matrilocal residence has decreased over time, the labor and resource endowments of the wives' households play important roles in women's decisions to live in a matrilocal residence regardless of the time period.

This study provides new insights into a woman's decision to live in a matrilocal residence, particularly in a community with unequally distributed resources. Marriage migration can be interpreted as a mechanism for equalizing the spatial distribution of marriageable young men and women (Watts, 1983), while matrilocal residence appears to help balance the distribution of labor and location-specific resources between a couple's natal families. Although it is difficult to accept that a marital relationship involving matrilocal residence is not only attributable to love but also correlated with labor and resource endowments, we must accept that this reality is in line with the law of economic development. Furthermore, the positive and negative effects of matrilocal residence discussed in this study are worthy of study.

The findings of this study also have several policy implications. First, the significant impact of rubber cultivation on women's matrilocal residence implies the importance of concerning of the social impacts of rubber cultivation during the policy-design related to the sustainability of rubber cultivation in addition to economic and environmental impacts. Second, some traditional customs of ethnic minorities are impacted by modern agriculture and economic development. For some valuable ethnic traditions, it is needed to be paid more attention. Third, it is worth noting that the so-called traditional customs such the Dai women's matrilocal residence in XSBN are jointly affected by education level, labor endowment, rubber cultivation and household location; thus, it is necessary to distinguish economic consequences and traditional customs clearly in practice.

Finally, although this study complements the empirical evidence regarding the determinants of matrilocal residence, we would like to point out three limitations due to data constraint. First, this study cannot identify the difference in matrilocal residence between rubber farmers and other farmers. Future studies should collect information regarding other farmers and treat them as a reference group. Second, an empirical

model of matrilocal residence that could control for more independent variables and characteristic variables for husbands may yield more interesting findings. Third, based on a wider sample, a multiple-choice model analysis of marital residence that includes patrilocal, neolocal and matrilocal residence could provide more novel insights into marriage economics.

## Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

## Declaration of Competing Interest

None.

## Acknowledgements

We acknowledge the funding support from National Natural Sciences Foundation of China (71761137002; 71673008) and the Huazhong Agricultural University Scientific & Technological Self-innovation Foundation. This study was also conducted in the framework of the Sino-German "SURUMER Project", funded by the Bundesministerium für Wissenschaft, Technologie und Forschung (BMBF), FKZ: 01LL0919.

## Appendix A. Appendix

**Table A1**
Average percentages of matrilocal, patrilocal and neolocal residences in selected Asian countries (2000–2016).

| ISO Code | Country | % Matrilocal Residence | % Patrilocal Residence | % Neolocal Residence |
|---|---|---|---|---|
| CHN | China | 1.22 | 17.60 | 81.18 |
| NPL | Nepal | 1.98 | 30.73 | 67.29 |
| IND | India | 2.12 | 31.45 | 66.43 |
| VNM | Vietnam | 3.83 | 18.95 | 77.22 |
| BGD | Bangladesh | 3.97 | 26.98 | 69.05 |
| COL | Colombia | 7.08 | 4.87 | 88.05 |
| PHL | Philippines | 7.49 | 7.08 | 85.43 |
| THA | Thailand | 9.79 | 7.31 | 82.90 |
| IDN | Indonesia | 10.70 | 8.55 | 80.75 |
| KHM | Cambodia | 15.05 | 5.36 | 79.59 |
| LAO | Laos PDR | 16.40 | 13.30 | 70.30 |

Source: Landmann et al. (2018) and Global Data Lab (https://globaldatalab.org/areadata/patrilocal/).

**Table A2**
Differences among various cohorts.

| Variable | (1) | | (2) | | | (3) | | | (4) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Before 2000 # | | 2001–2004 | | | 2005–2008 | | | 2009–2012 | | |
| | Mean | Std. dev. | Mean | Std. dev. | | Mean | Std. dev. | | Mean | Std. dev. | |
| Sample size | 109 | | 99 | | | 130 | | | 64 | | |
| MATRI | 0.156 | 0.364 | 0.152 | 0.360 | | 0.108 | 0.311 | | 0.063 | 0.244 | * |
| DAI | 0.550 | 0.450 | 0.525 | 0.502 | | 0.569 | 0.497 | | 0.547 | 0.502 | |
| YEARS | 15.780 | 2.979 | 9.404 | 1.133 | *** | 5.646 | 1.048 | *** | 2.031 | 0.925 | *** |
| AGE | 19.101 | 3.012 | 20.687 | 3.556 | *** | 21.423 | 3.664 | *** | 22.688 | 3.361 | *** |
| EDU | 6.165 | 3.164 | 6.970 | 3.122 | * | 7.908 | 2.945 | *** | 9.016 | 2.775 | *** |
| BRO | 1.193 | 1.076 | 1.061 | 0.956 | | 0.885 | 0.978 | ** | 0.781 | 0.701 | *** |
| SIST | 1.009 | 1.190 | 1.253 | 1.417 | | 0.923 | 1.118 | | 0.797 | 1.115 | |
| PARE | 0.101 | 0.303 | 0.131 | 0.339 | | 0.069 | 0.255 | | 0.078 | 0.270 | |
| LAND | 0.916 | 0.868 | 0.791 | 0.887 | | 0.982 | 0.966 | | 0.965 | 0.745 | |
| RUBBER | 0.320 | 0.454 | 0.330 | 0.497 | | 0.623 | 0.624 | *** | 0.730 | 0.616 | *** |
| SPECI | 0.351 | 0.358 | 0.413 | 0.340 | | 0.632 | 0.331 | *** | 0.740 | 0.287 | *** |
| LOW | 0.220 | 0.416 | 0.182 | 0.388 | | 0.185 | 0.389 | | 0.141 | 0.350 | |
| MIDDLE | 0.459 | 0.501 | 0.475 | 0.502 | | 0.508 | 0.502 | | 0.547 | 0.502 | |
| HIGH | 0.321 | 0.469 | 0.343 | 0.477 | | 0.308 | 0.463 | | 0.313 | 0.467 | |
| MH | 0.128 | 0.336 | 0.202 | 0.404 | | 0.146 | 0.355 | | 0.141 | 0.350 | |
| JH | 0.413 | 0.495 | 0.485 | 0.502 | | 0.438 | 0.498 | | 0.469 | 0.503 | |
| ML | 0.459 | 0.501 | 0.313 | 0.466 | ** | 0.415 | 0.495 | | 0.390 | 0.492 | |

Data Source: Authors' survey and calculation.
Note: # Mean-comparison tests with the group (1), *, ** and *** represent the 10%, 5%, and 1% significance levels, respectively.

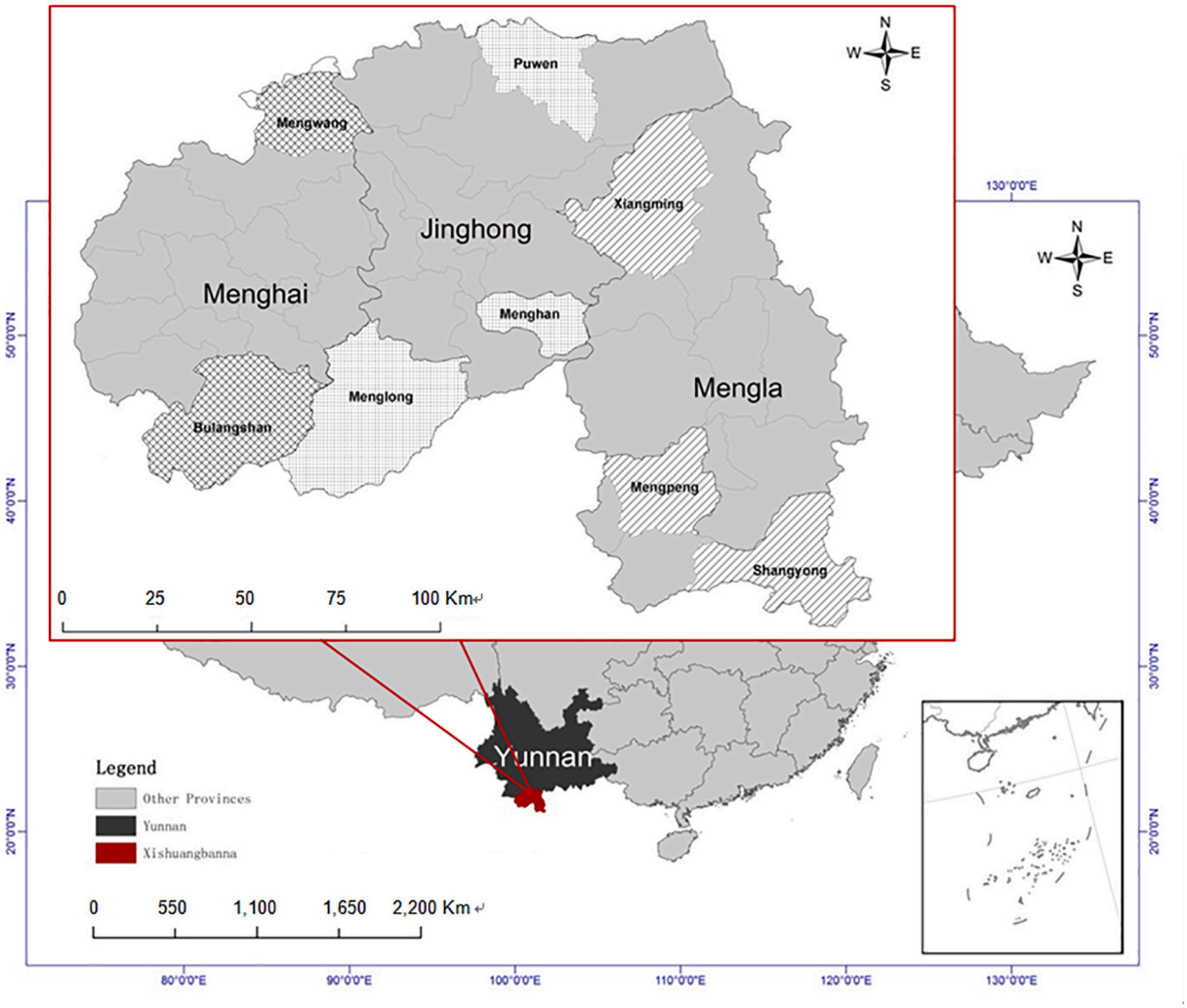


**Fig. A1.** Map of the study area and sample distribution. Source: Min et al. (2017a)

## References


Angelsen, A., 1995. Shifting cultivation and "deforestation": a study from Indonesia. World Dev. 23 (10), 1713–1729.

Baker, M.J., Jacobsen, J.P., 2007. A human capital-based theory of postmarital residence rules. J. Law Econ. Org. 23 (1), 208–241.

Becker, G.S., 1973. A theory of marriage: part I. J. Polit. Econ. 81 (4), 813–846.

Becker, G.S., 1974. A theory of marriage. In: Schultz, W. (Ed.), Economics of the Family: Marriage, Children, and Human Capital. University of Chicago Press, Chicago, Illinois, United States, pp. 299–351.

Becker, G.S., 1993. Nobel lecture: the economic way of looking at behavior. J. Polit. Econ. 101 (3), 385–409.

Bossen, L., 1988. Toward a theory of marriage: the economic anthropology of marriage transactions. Ethnology 27 (2), 127–144.

Chakrabarti, A., Ghosh, J.K., 2011. Aic, bic and recent advances in model selection. Philos. Stat. 583–605.

Chen, F., 2005. Residential patterns of parents and their married children in contemporary China: a life course approach. Popul. Res. Policy Rev. 24 (2), 125–148.

Cheng, T., Selden, M., 1994. The origins and social consequences of China's hukou system. China Q. 139, 644–668. https://doi.org/10.1017/S0305741000043083.

Chu, C.Y.C., Xie, Y., Yu, R.R., 2011. Coresidence with elderly parents: a comparative study of Southeast China and Taiwan. J. Marriage Fam. 73 (1), 120–135.

Davin, D., 2005. Marriage migration in China the enlargement of marriage markets in the era of market reforms. Indian J. Gend. Stud. 12 (2–3), 173–188.

Davin, D., 2007. Marriage migration in China and East Asia. J. Contemp. China 16 (50), 83–95.

Diana, A., 2013. The experimental governing of mobility and trade on the China-Laos frontier: the tai Lue case. Singap. J. Trop. Geogr. 34 (1), 25–39.

Divale, W.T., 1974. Migration, external warfare, and matrilocal residence. Cross-Cult. Res. 9 (2), 75–133.

Ember, C.R., 1974. An evaluation of alternative theories of matrilocal versus patrilocal residence. Cross-Cult. Res. 9 (2), 135–149.

Fan, C.C., Huang, Y., 1998. Waves of rural brides: female marriage migration in China. Ann. Assoc. Am. Geogr. 88 (2), 227–251.

Fan, C.C., Li, L., 2002. Marriage and migration in transitional China: a field study of Gaozhou, western Guangdong. Environ. Plann A 34 (4), 619–638.

Feinman, C., 1992. Women battering on the navajo reservation. Int. Rev. Victimol. 2 (2), 137–146.

Fu, Y., Brookfield, H., Guo, H., Chen, J., Chen, A., Cui, J., 2009. Smallholder rubber plantation expansion and its impact on local livelihoods, land use and agrobiodiversity, a case study from Daka, Xishuangbanna, southwestern China. Int. J. Sust. Develop. World Ecol. 16 (1), 22–29.

Greene, W.H., 2012. Econometric Analysis, 7th ed. Prentice Hall, Upper Saddle River, NJ.

Grogan, L., 2013. Household formation rules, fertility and female labour supply: evidence from post-communist countries. J. Comp. Econ. 41 (4), 1167–1183.

Grossbard, A., 1978. Towards a marriage between economics and anthropology and a general theory of marriage. Am. Econ. Rev. 68 (2), 33–37.

Grossbard-Shechtman, A., 1982. A theory of marriage formality: the case of Guatemala. Econ. Dev. Cult. Chang. 30 (4), 813–830.

Grossbard-Shechtman, A., 1984. A theory of allocation of time in markets for labour and marriage. Econ. J. 94 (376), 863–882.

Gruijters, R.J., Ermisch, J., 2019. Patrilocal, matrilocal, or neolocal? Intergenerational proximity of married couples in china. J. Marriage Fam. 81 (3), 1–18.

Guha, B., 2010. Patrilocal Exogamy as a Monitoring Mechanism: How Inheritance and Residence Patterns Co-evolve. Singapore Management University, School of Economics, Working Papers No.09–2010. Available at: http://ink.library.smu.edu.sg/soe_research/1252.

Hamilton, G., Stoneking, M., Excoffier, L., 2005. Molecular analysis reveals tighter social regulation of immigration in patrilocal populations than in matrilocal populations. Proc. Natl. Acad. Sci. U. S. A. 102 (21), 7476–7480.
Hu, S., Mu, Z., 2021. Extended gender inequality? Intergenerational coresidence and division of household labor. Soc. Sci. Res. 93, 1–15.
Janekunprasoot, T., 2020. Research on the Countermeasures of the Development of Thai Natural Rubber Industry under the Background of Economic Globalization. Jimei University, China, Master thesis.
Jones, D., 2011. The matrilocal tribe. Hum. Nat. 22 (1–2), 177–200.
Jordan, F.M., Gray, R.D., Greenhill, S.J., Mace, R., 2009. Matrilocal residence is ancestral in Austronesian societies. Proc. R. Soc. B Biol. Sci. 276 (1664), 1957–1964.
Judd, E.R., 2007. No change for thirty years: the renewed question of women's land rights in rural China. Dev. Chang. 38 (4), 689–710.
Kato, A., 2013. *The Japanese Family System: Change, Continuity, and Regionality Over the Twentieth Century*, Working Paper No. 2013–004. MPIDR, Rostock, Germany.
Kaur, R., 2004. Across-region marriages: poverty, female migration and the sex ratio. Econ. Polit. Wkly. 39 (25), 2595–2603.
Khalil, U., Mookerjee, S., 2018. Patrilocal residence and women's social status: evidence from South Asia. Econ. Dev. Cult. Chang. https://doi.org/10.1086/697584.
Korotayev, A., 2003. Form of marriage, sexual division of labor, and postmarital residence n cross-cultural perspective: a reconsideration. J. Anthropol. Res. 59, 69–89.
Kudo, Y., 2015. Female migration for marriage: implications from the land reform in rural Tanzania. World Dev. 65 (c), 41–61.
Kullawong, S., Aditto, S., Chambon, B., Promkhambut, A., 2020. Farmer fertilization practices of mature rubber plantations in Northeast Thailand during a period of low rubber prices. Forest Soc. 4 (1), 162–180.
Landmann, A., Seitz, H., Steiner, S., 2018. Patrilocal residence and female labor supply: evidence from Kyrgyzstan. Demography. https://doi.org/10.1007/s13524-018-0724-1.
Lavely, W., Ren, X., 1992. Patrilocality and early marital co-residence in rural China, 1955–85′. China Q. 130, 378–391.
Li, H., Zhu, Y., 2006. Income, income inequality, and health: Evidence from China. J. Comp. Econ. 34 (4), 668–693.
Logan, J.R., Bian, F., 1999. Family values and coresidence with married children in urban China. Social Forces 77 (4), 1253–1282.
Manser, M., Brown, M., 1980. Marriage and household decision-making: a bargaining analysis. Int. Econ. Rev. 21 (1), 31–44.
Matouschek, N., Rasul, I., 2008. The economics of the marriage contract: theories and evidence. J. Law Econ. 51 (1), 59–110.
Min, S., Waibel, H., Cadisch, G., Langenberger, G., Bai, J., Huang, J., 2017a. The economics of smallholder rubber farming in a mountainous region of Southwest China: elevation, ethnicity, and risk. Mt. Res. Dev. 37 (3), 281–293.
Min, S., Huang, J., Waibel, H., 2017b. Rubber specialization vs crop diversification: the roles of perceived risks. China Agricult. Econ. Rev. 9 (2), 188–210.
Min, S., Bai, J., Huang, J., Waibel, H., 2018. Willingness of smallholder rubber farmers to participate in ecosystem protection: effects of household wealth and environmental awareness. Forest Policy Econ. 87, 70–84.
Min, S., Huang, J., Waibel, H., Yang, X., Cadisch, G., 2019. Rubber boom, land use change and the implications for carbon balances in Xishuangbanna, Southwest China. Ecol. Econ. 156, 57–67.
Moravec, J., Marsland, S., Cox, P.M., 2019. Warfare induces post-marital residence change. J. Theor. Biol. 474, 52–62.
Morgan, S.P., Rindfuss, R.R., 1984. Household structure and the tempo of family formation in comparative perspective. Popul. Stud. 38 (1), 129–139.
Nelson, J.A., 1994. I, thou, and them: capabilities, altruism, and norms in the economics of marriage. Am. Econ. Rev. 84 (2), 126–131.
Oota, H., Settheetham-Ishida, W., Tiwawech, D., Ishida, T., Stoneking, M., 2001. Human mtDNA and Y-chromosome variation is correlated with matrilocal versus patrilocal residence. Nat. Genet. 29 (1), 20–21.
Peters, P.E., 2010. Our daughters inherit our land, but our sons use their wives' fields: matrilineal-matrilocal land tenure and the new land policy in Malawi. J. East. Afr. Stud. 4 (1), 179–199.
Pulliam, H.R., 1982. A social learning model of conflict and cooperation in human societies. Hum. Ecol. 10 (3), 353–363.
Qiu, J., 2009. Where the rubber meets the garden. Nature 457, 246–247.
Rajan, H., 2014. The impact of household form and marital residence on the economic dimensions of women's vulnerability to domestic violence. The case of Tibetan communities. Genus 70 (2–3), 139–162.
Sekabira, H., Qaim, M., 2017. Can mobile phones improve gender equality and nutrition? Panel data evidence from farm households in Uganda. Food Policy 73, 95–103.
Treas, J., Chen, J., 2000. Living arrangements, income pooling, and the life course in urban Chinese families. Research on Aging 22 (3), 238–261.
Tsui, M., 1989. Changes in Chinese urban family structure. J. Marriage Fam. 51 (3), 737–747.
Tsuya, N.O., Kurosu, S., 2000. Economic and Household Factors of First Marriage in Early Modern Japan: Evidence from Two Northeastern Villages, 1716–1870. Oslo, International Congress of Historical Sciences.
Unger, J., 1997. Not quite Han: the ethnic minorities of China's southwest. Crit. Asian Stud. 29 (3), 67–78.
Warner, R.L., Lee, G.R., Lee, J., 1986. Social organization, spousal resources, and marital power: a cross-cultural study. J. Marriage Fam. 48 (1), 121–128.
Watts, S.J., 1983. Marriage migration, a neglected form of long-term mobility: a case study from Ilorin, Nigeria. Int. Migrat. Rev. 17 (4), 682–698.
Weiss, Y., 1997. The formation and dissolution of families: why marry? Who marries whom? And what happens upon divorce. In: Handbook of Population and Family Economics, 1, pp. 81–123.
Whyte, M.K., 1979. Revolutionary social change and patrilocal residence in China. Ethnology 18 (3), 211–227.
Wicke, B., Sikkema, R., Dornburg, V., Faaij, A., 2011. Exploring land use changes and the role of palm oil production in Indonesia and Malaysia. Land Use Policy 28 (1), 193–206.
Yang, F., 2001. The fireplace: gender and culture among Yunnan nationalities. Gend. Technol. Dev. 5 (3), 365–381.
Zhang, Q.F., 2004. Economic transition and new patterns of parent-adult child coresidence in urban China. J. Marriage Fam. 66 (5), 1231–1245.
Zhang, L., 2004a. Matrilocal marriage is not the remainder of matriarchy-restudy on matrilocal marriage in Xishuangbanna. Thinking (5), 21–26.
Zhang, H., 2009. Labor migration, gender, and the rise of neo-local marriages in the economic boomtown of Dongguan, South China. J. Contemp. China 18 (61), 639–656.
Zhang, L., Kono, Y., Kobayashi, S., Hu, H., Zhou, R., Qin, Y., 2015. The expansion of smallholder rubber farming in Xishuangbanna, China: a case study of two Dai villages. Land Use Policy 42, 628–634.
Zhou, X.D., Wang, X.L., Li, L., Hesketh, T., 2011. The very high sex ratio in rural China: impact on the psychosocial wellbeing of unmarried men. Soc. Sci. Med. 73 (9), 1422–1427.
Ziegler, A.D., Fox, J.M., Xu, J., 2009. The rubber juggernaut. Science 324, 1024–1025.