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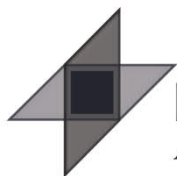
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Research Article

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Socioeconomic development and young adults' propensity of living in one-person households: Compositional and contextual effects

Adam Ka-Lok Cheung¹

Wei-Jun Jean Yeung²

Abstract

BACKGROUND

The proportion of young adults living in one-person households (OPHs) has increased remarkably worldwide. Recent literature suggests that socioeconomic development established favorable conditions for individuals to live alone. Few studies have yet examined the complex relationship between contextual-level socioeconomic development, individual-level factors, and living in OPHs.

METHODS

We drew data from a subsample of young adults (aged between 20 and 35) from China 1% Population Sample Survey 2005 ($n_i = 582,139$; $n_j = 345$). Two-level random-intercept logistic regression models were employed to examine the relationship between prefecture-level socioeconomic development and living in OPHs. Two series of models, controlling for single and migrant statuses, and other sociodemographic variables, were estimated for male and female separately.

RESULTS

First, there are positive associations between singlehood/migration and living in OPHs. Being single or a migrant are the most important individual-level correlates of living alone. Second, we found a strong positive curvilinear correlation between prefecture-level development and living alone that are well explained by the concentration of internal migrants but not the proportion of singles in the developed regions. Third, after controlling for migrant status, we only found a weak positive contextual effect of development on living alone. Yet, there are cross-level interaction effects that the associations between prefecture-level development and living alone are strong for single and migrant adults.

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CONTRIBUTION

Our findings highlight the relative importance of internal migration over singlehood in explaining the concentration of OPHs in developed areas, which has important implications on the geographical patterns of OPHs among young adults.

1. Introduction

The rise of one-person households is an important demographic feature of modern societies (Bennett and Dixon 2006; Fokkema and Liefbroer 2008; Kobrin 1976; Klinenberg 2012). According to official figures, about one-third of family households in France, Japan, the United Kingdom, and the United States are one-person households (OECD 2016). Previous studies have shown that the within-country geographical patterns of household structures are closely related to levels of socioeconomic development (Li, Fan, and Song 2020; Vitali 2010). In most societies, one-person households are much more common in the most developed areas than in the least developed areas (Hall, Ogden, and Hill 1997; Ogden and Schnoebelen 2005; Vitali 2010). However, the relationship between the levels of socioeconomic development and the geographical patterns of one-person households, and the mechanisms behind this relationship, remain unclear and require further investigation.

While earlier studies thoroughly investigated the factors of living alone among older adults (Bongaarts and Zimmer 2002; Chevan and Korson 1972; Kramarow 1995; McGarry and Schoeni 2000), recent studies have paid increasing attention to younger adults, as their tendency to live alone is particularly responsive to socioeconomic conditions (Esteve et al. 2020; Ho 2015; Jamieson and Simpson 2013; Klinenberg 2012; Raymo 2015; Stone, Berrington, and Falkingham 2011; Vitali 2010). The increase in young solo dwellers raises questions regarding how families function, and indeed regarding the very definition of the family (Esteve et al. 2020). Hence, it is important to understand the nature of young adults living alone (Stone, Berrington, and Falkingham 2011).

Three mechanisms can be identified in the literature to potentially explain the higher proportion of one-person households among young adults in more developed areas: differences in marital behavior (Ogden and Hall 2004), the concentration of migrants (Cheung and Yeung 2015), and the urban culture in metropolitan areas (Jamieson and Simpson 2013; Kislev 2019; Klinenberg 2012; Ronald 2017). These mechanisms are not competing with each other, but the relative importance of each could point to different natures of the geographical concentration of one-person households and therefore yield different policy implications. However, empirical assessments of the validity and the

relative importance of these mechanisms is lacking. Without further empirical investigation, we know little about which mechanism is more relevant in explaining the high concentration of one-person households in the most developed areas.

Furthermore, most studies on this topic have been conducted in advanced economies, where a high proportion of one-person households makes the phenomenon difficult to ignore. In contrast, the rise of one-person households in emerging economies has received little attention in the literature. In China, one-person households make up about 13% of all Chinese family households (National Bureau of Statistics of China 2016), which is a lower proportion than in the OECD. However, the share of one-person households is rising rapidly in China, and the absolute number of people living alone in China is very large (Yeung and Cheung 2015), at about 54 million in 2015 (National Bureau of Statistics of China 2016). Over the past few decades, there has been an increasing concentration of one-person households in economically developed areas in China (Cheung and Yeung 2015). Studying the relationship between socioeconomic development and living in one-person households among young adults in China may help us to understand the phenomenon in other emerging economies.

Analyzing multilevel data from the 2005 1% Population Sample Survey, this study investigated the relationship between prefecture-level socioeconomic development and the propensity of young adults to live in one-person households. We used a series of two-level random-intercept logistic regression models to examine how young adults' propensity to live in one-person households is related to prefecture-level socioeconomic development and how much this relationship is mediated by single (unmarried or divorced) status and migrant status. In addition, we examined the cross-level interaction effects between prefecture-level socioeconomic development and individual-level determinants of living alone for young adults. Because the relationship between socioeconomic development and living in one-person households may be different for men and women, we analyzed the data separately for men and women.

2. Literature and framework

2.1 Socioeconomic development and geographical patterns of one-person households

The regional heterogeneity of the proportion of one-person households in more developed countries is obvious. The rates in metropolitan areas are much higher than the national averages. For example, in 2014, the City of London had the highest percentage of one-person households (more than half of all households) in the United Kingdom (Office for National Statistics 2014). Similarly, more than half of all households in inner

Paris were one-person households (Ogden and Schnoebelen 2005). A similar pattern has also been observed in Japan, South Korea, and even in some emerging economies, such as Vietnam and India (Dommaraju 2015; Guilmoto and de Loenzien 2015; Ronald 2017). However, this clustering pattern of one-person households in the most developed areas is not necessarily universal: Mutanda and Odimegwu (2019) showed that living alone was more common in rural than urban areas in South Africa, and Podhisita and Xenos (2015) found that the percentage of one-person households was roughly equal between rural and urban areas in some less developed countries in South and Southeast Asia.

The literature provides three plausible theoretical explanations for the positive relationship between socioeconomic development and young adults' propensity to live in one-person households. The first explanation is related to the geographical pattern in marital behaviors. Previous research had already confirmed that socioeconomic development is closely related to a declining marriage rate and increasing divorce rate (Cherlin 2012). Given that the within-country levels of socioeconomic development across regions are uneven, there are regional heterogeneities in marriage and divorce rates. Young men and women remain single for much longer and are more likely to get divorced when they do marry in more developed areas than in less developed areas (Peng 2011; Ji 2015; Ji and Yeung 2014; Zhang, Wang, and Zhang 2014). Past studies in most contexts have shown that single and divorced adults have a relatively high propensity for living alone (Hall, Ogden, and Hill 1997; Ogden and Hall 2004; Ogden and Schnoebelen 2005; Park and Choi 2015; Raymo 2015; Stone, Berrington, and Falkingham 2011; Reher and Requena 2018). Hence, regional variations in the proportion of unmarried and divorced adults are a plausible mechanism for explaining the within-country geographical pattern of one-person households. This perspective does not assume the effect of single status on living in one-person households varies across developmental contexts, with the concentration of one-person households in the most developed areas in a country regarded as a simple reflection of the marital status of the local population. Hence, on this first account, the rise of one-person households in the most developed areas signals a lower propensity to marry or remain married.

The second explanation is related to the geographical pattern of internal migration. Economic development in more developed areas usually attracts a vast number of migrant workers from less developed areas, especially young adults who seek economic opportunities. Migrant workers in emerging economies are often low-skilled laborers and face high costs of living in more developed areas. Hence, migrant workers are often unable to bring their families with them. Some migrant workers may choose to live in small, low-cost apartments as a temporary arrangement. In China, for example, residents are registered with a *hukou* (household registration status), which is assigned at birth based on the *hukou* status of their parents. Entitlement to citizens' benefits is often linked with local *hukou* status. As migrant workers do not have local *hukou* at their destination,

their children have limited access to public education and health care in destination cities. Due to the scarce resources available to migrant workers, many cannot afford to bring their families with them to live in the city. Many migrants, therefore, leave their families in the provinces of their hukou origin. One survey revealed that about two-fifths of migrant workers in Beijing lived in one-person households (Zhao and Chen 2008). Hence, the flow of labor migration has driven up the proportion of one-person households in developed areas (Cheung and Yeung 2015).

Again, this perspective emphasizes the population composition and does not assume effect heterogeneity for the migrant status across developmental contexts. The concentration of one-person households in more developed areas is a natural reflection of the population composition. Therefore, the high concentration of one-person households in the most developed areas is not necessarily linked to individualism, as is often thought (Kislev 2019).

Assuming that singles and migrants have a greater tendency to live in one-person households, areas with a high concentration of singles and migrants would then have a higher prevalence of one-person households. These compositional effects explain the regional variations in one-person households through the changing composition of specific individual characteristics among the local population. Combining these first two accounts, the effect of socioeconomic development on younger adults' propensity to live in one-person households is said to be mediated by individuals' marital and migration behaviors.

The third explanation for the positive relationship between socioeconomic development and the geographical pattern of one-person households emphasizes the role of the environmental and cultural factors of socioeconomic development in making living in one-person households more attractive (Jamieson and Simpson 2013; Kislev 2019; Klinenberg 2012; Ronald 2017). This strand of the literature suggests that socioeconomic development establishes the cultural and structural conditions for the rise of one-person households (Jamieson and Simpson 2013; Klinenberg 2012). The proportion of the population who are willing and able to live alone might depend on favorable conditions for living alone or unfavorable conditions for living with family members (Yu 2017). Klinenberg (2012) suggested that urban development has established much useful infrastructure for living in one-person households, from the availability of small apartments in the housing market to the availability of eating outlets and other options for domestic outsourcing. A similar argument was made by Ronald (2017) in explaining the rise of young one-person households in Toyko and Seoul. Rapid socioeconomic development also promotes a culture of individualism, partly through the expansion of education in developed areas, which not only increases the number of highly educated persons who are more accepting of an individualistic lifestyle but also creates a culture

of individualism that affects other members of society. Living alone may be more tolerated and less stigmatized in a context with many highly educated persons.

According to this perspective, the increased proportion of one-person households is mostly explained by contextual rather than compositional effects. Although it is not explicitly discussed in the literature, the contextual effects of socioeconomic development on living in one-person households could be conditional. For instance, socioeconomic development may increase the attractiveness and feasibility of living alone for single adults. Similarly, with the availability of small apartments, socioeconomic development may encourage migrants to live in one-person households. The effect may therefore be minimal among local residents and married adults. In other words, the high concentration of one-person households in metropolitan areas is not necessarily an effect of more singles and migrants living in more developed areas; it might be an effect of singles and migrants in more developed areas being more likely to live in one-person households. The contextual effects of socioeconomic development on living in one-person households have rarely been assessed empirically, especially using quantitative data (for exceptions, see Vitali 2010; Yu 2017). It is still unknown whether and to what extent the contextual effects of socioeconomic developments, relative to the compositional effects, have contributed to the increase in one-person households.

These three explanations for the geographical patterns of one-person households are not mutually exclusive and may overlap. Nonetheless, the validity and relative importance of the three explanations could yield different theoretical implications for how we understand the nature of living in one-person households and the functioning of the family in areas with high concentrations of one-person households.

2.2 Hypotheses and the Chinese context

Based on the discussion above, we derived the following hypotheses. First, we hypothesized that young adults who live in highly developed prefectures are more likely to live in one-person households:

H1: There is a positive relationship between prefecture-level socioeconomic development and young adults' propensity for living in one-person households.

The three explanations discussed above are relevant to this positive relationship in the Chinese context. Since China's economic reform began in the late 1970s, rapid but highly uneven development has taken place across the country. The regional disparity within China has grown steadily, with coastal cities experiencing a much more dramatic pace of development than inland areas. Men and women also marry at a much later age

in the most developed areas, such as Beijing, Guangdong, and Shanghai, than in less developed areas, such as Guizhou and Qinghai (Ji and Yeung 2014). We expected a single status to be positively associated with living in one-person households, as suggested by past studies, and thereby derived our second hypothesis from the first explanation. Once the single status is controlled for, we expected that the positive relationship between prefecture-level socioeconomic development and young adults' propensity for living in one-person households would be weakened:

H₂: The positive relationship predicted in *H₁* is accounted for by the higher proportion of young single and divorced adults in the more developed prefectures.

There has also been a rapid increase in internal migration in China since the economic reform, which is partly a consequence of uneven economic development across regions (Liang and White 1997). In 2000, the majority (50.35%) of internal migrants were housed in coastal provinces and municipalities, such as Guangdong, Zhejiang, Fujian, Jiangsu, and Shanghai (Liang and Ma 2004). This geographical pattern of the migrant population has implications for the geographical patterns of one-person households among young adults. We expected that migrants without local hukou would be associated with a higher propensity to live alone in China, as suggested in previous studies (Zhao and Chen 2008), and thereby derived our third hypothesis from the second explanation. Once the migrant status is controlled for, we expected that the association between socioeconomic development and propensity to live in one-person households would be significantly weakened:

H₃: The positive relationship predicted in *H₁* could be accounted for by the higher proportion of young adult migrants without local hukou in the more developed prefectures.

The literature suggests that individuals are better able to afford to live in one-person households when contextual-level socioeconomic development has established an urban infrastructure (e.g., small, low-cost apartments and options for domestic outsourcing) and cultural environment (e.g., a less stigmatized environment for young adults leaving the parental home) favorable for the rise of one-person households (Klinenberg 2012; Ronald 2017). One example in China is the development of urban villages in cities where many migrant workers stay. Without the urban villages, which contain low-cost housing, living in one-person households would be much more costly and difficult for young adults. This is a contextual effect and is considered independently of the composition effects brought by socioeconomic development:

H_{4a}: There is a significant and positive contextual effect of prefecture-level development on living in one-person households, even when controlling for individual-level factors.

We also expected the positive contextual effects to be conditional, and stronger among certain groups of young adults. Specifically, we expected that young single and migrant adults would be more responsive to the level of socioeconomic development in living in one-person households than married and local residents:

H_{4b}: The positive effect of prefecture-level development on living in one-person households is stronger for single adults than for married adults.

H_{4c}: The positive effect of prefecture-level development on living in one-person households is stronger for migrants than for local residents.

To test the above hypotheses, we needed to control for other demographic factors associated with socioeconomic development and the propensity to live in one-person households among young adults in China. From previous studies, we expected that age, college education, employment status, and ethnicity are all associated with the propensity to live in one-person households (Dommaraju 2015; Guilmoto and de Loenzien 2015; Raymo 2015; Park and Choi 2015; Podhisita and Xenos 2015). The literature suggests that college education and employment are positively associated with independent living arrangements (Sandstrom and Karlsson 2019; Stone, Berrington, and Falkingham 2011; Vitali 2010) due to a higher level of acceptance of individualism and access to the resources needed to live independently. We controlled for ethnicity on the basis that people with Han ethnicity (comprising the ethnic majority in China) may be more likely to live alone than those from ethnic minorities. Due to the one-child policy and other sociocultural factors, family sizes among the Han ethnicity in China are often smaller (Cai 2010; Peng 2011), with Han Chinese, therefore, having a higher likelihood of living alone.

3. Data and methods

3.1 Sample

A random subsample of the China 1% Population Sample Survey in 2005 was taken to examine the prevalence rate of living in one-person households among young adults aged between 20 and 35 in the noninstitutional population. Those who lived in collective

households (i.e., dormitories, retirement housing, communal living, prisons, hospitals, and other institutional settings), comprising approximately 3% of the total population, were excluded from the analysis. We chose to define young adults as those aged between 20 and 35 because the propensity of living in one-person households for adults in this age group was the most responsive to contextual-level socioeconomic development. This is discussed in more detail in the results section. The additional analysis confirmed that our findings remained robust to wider and narrower age ranges.

The analytic sample had a two-level data structure: Level 1 units referred to the younger adults ($n_i = 582,139$), who were nested within Level 2 prefecture-level units ($n_j = 345$). Excluding the two Special Administrative Regions of Hong Kong and Macau, there are 31 provinces and municipalities (provincial-level units) in China, with each provincial-level unit divided into prefecture-level units (prefecture-level cities, prefectures, or leagues). We chose to use prefectures as the Level 2 units because the prefecture-level contexts have a more direct influence on individuals' choice of living arrangement than the provincial-level contexts. We used geographic identifiers to match individual cases with the characteristics of the prefecture-level units in which they resided at the time of the interview. The dataset did not provide contextual-level information, such as indicators of local economic development, so we collected the relevant information for each prefecture-level unit either by aggregating the individual-level information or by merging with external sources, such as government reports and publications.

3.2 Variables

Living in one-person households. The dependent variable in this study was a dichotomous variable, with 1 indicating that the Level 1 unit (i.e., an individual) lived in a one-person household, and 0 otherwise.

Individual-level variables. We used six individual-level variables in our analysis. The individual-level variables were age (in years), educational level (less than college = 0, college or above = 1), employment status (not employed = 0, employed = 1), ethnicity (Han ethnicity = 0, other ethnicity = 1), single status (married = 0, not married = 1), and migrant status (with a local hukou = 0, without a local hukou = 1).

Prefecture-level variable. As our aim was to compare the probability of living alone for young adults in prefectures at different levels of socioeconomic development we constructed an index variable measuring the following indicators of socioeconomic development at the prefecture-level: average housing conditions in the prefectures (0–6, indicating the availability of tap water, flushable toilet, shower facilities, toilet, gas stove/electric cooktop, etc.), the prefecture-level percentage of college graduates,

prefecture-level percentage of nonagricultural employment, prefecture-level percentage of residents without a local hukou, prefecture-level urbanization rate, and logged local GDP per capita. Except for the prefecture-level GDP per capita information, which was obtained from the China Statistical Yearbook, the other indicators were derived by aggregating the individual-level information. The prefecture-level variables were highly correlated with each other. In view of the potential for multicollinearity, a principal component analysis (PCA) was conducted to reduce the number of factors. With reference to the eigenvalue-one criterion and scree-plot test, the results of the PCA indicated that the above prefecture-level variables could be loaded onto a single dimension explaining about 73% of the variance (Cronbach's $\alpha = 0.92$). Starting from the second factor, the contribution of each additional factor to the explained variance is low. Thus, we chose only the first factor to indicate the socioeconomic development level for the prefectures. We constructed a prefecture-level socioeconomic development index (SED index) based on the PCA results and rescaled the variable to a scale of 0 to 10 for easier interpretation. The factor loadings and correlation matrix of the variables in the socioeconomic development index are reported in Appendices 1 and 2.

3.3 Analytical strategy

The literature suggests that one-person households are mostly clustered in the most highly developed areas (e.g., Cheung and Yeung 2015). Unfortunately, the analyses performed by most past studies were either at the aggregate level or the individual level (for an exception, see Vitali 2010). Empirically, the effects of development can be decomposed into two parts: compositional effects (SED affects the propensity for living in one-person households by changing the individual-level characteristics) and contextual effects (SED directly affects the propensity of living in one-person households). In this study, we conducted multilevel analyses to distinguish the two effects of development on young adults' propensity to live in one-person households.

Two-level random-intercept logistic regression models were estimated to examine how young adults' propensity to live in one-person households were affected by individual-level and contextual-level factors. In the two-level random-intercept logistic regression models, Level 1 units were persons, and Level 2 units were prefectural cities and districts. Past studies have shown that the factors behind living alone might vary for men and women (Demey et al. 2013; Torabi, Abbasi-Shavazi, and Askari-Nodoushan 2015). Hence, we estimated two separate blocks of models for male and female subsamples to examine if the association patterns differed by gender. For each subsample, we estimated a series of five nested models. In Model 1, only the respondents' age, ethnicity, education, and employment status and the prefecture-level SED index were

included. The purpose of Model 1 was to determine whether the positive relationship between the SED index and the propensity of living in one-person households remained when controlling for the individual-level demographic characteristics except for single status and hukou status. In Model 2, respondents' single status was added. In Model 3, respondents' hukou status was added but not single status. In Model 4, we added respondents' hukou status and single status alongside the other variables. The purpose of estimating Models 2 to 4 was to determine how much the positive relationship between development and living in one-person households could be accounted for by single status and hukou status. Model 4 also allowed us to examine the contextual effect of development on living in one-person households when controlling for the population composition. In Model 5, we added the interaction terms between the prefecture-level SED index and all of the individual-level variables. The purpose of this model was to determine if the positive contextual effects were conditional to specific subgroups, especially for single and migrant adults.

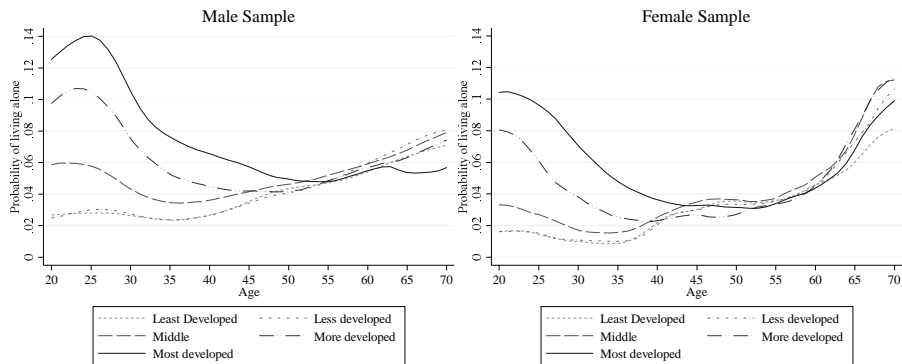
Given the large sample size for Level 1 units (individuals), the coefficients of individual-level factors were likely to be statistically significant. Therefore, we also used the Akaike information criterion (AIC) and Bayesian information criterion (BIC) for model selection. Yet, the sample size for Level 2 units (prefectures) was only 345. Hence, we still take significance tests on the prefecture-level SED index for reference. In addition to the logit coefficients presented in the tables, we also present the average marginal effects (AMEs) derived for each model, which can be interpreted as the average change in the probability of living in a one-person household per unit increase in the independent variables.

4. Results

Before examining the patterns and determinants of living in one-person households among young adults, we compared the age curves of living alone for adults living in prefectures at different levels of development. We stratified the sample into five subsamples based on belonging to prefectures at different levels of SED index: least developed prefectures ($SED < 2$), less developed prefectures ($SED \geq 2$ and < 4), mid-developed prefectures ($SED \geq 4$ and < 6), more developed prefectures ($SED \geq 6$ and < 8), and most developed prefectures ($SED \geq 8$). Figure 1 shows the age curve of living alone for male and female adults in these different socioeconomic development contexts. Figure 1 clearly shows that for older adults (aged > 55), the propensity for living alone varied little across developmental contexts within China. In contrast, the propensity for living alone was extremely responsive to developmental contexts for young adults, both male and female. For young adults, the propensity for living alone was much higher in

the most developed prefectures than in the least developed prefectures. This gap in the propensity for living alone across developmental contexts diminished gradually with increasing age, becoming much smaller after the age of 35. We, therefore, limited our analytic sample to those aged between 20 and 35 for the analyses presented in the next section.

Figure 1: Age curve (smoothed) of living alone in different socioeconomic development contexts



Source: 2005 1% Population Sample Survey

4.1 Descriptive patterns: Socioeconomic development, sociodemographic factors, and living alone

Table 1 presents the distributions of individual-level characteristics in different socioeconomic development contexts. For young adults, both male and female, the percentage of residents living alone was much higher in the most developed prefectures than the less developed prefectures (around four and six times as high for male and female samples respectively). One may therefore expect people remaining single to have been more prevalent in the most developed prefectures, but the results show that the percentage of the single population was only slightly higher in the most developed areas (39.05%) than the least developed areas (32.38%) for young male adults. For young female adults, however, the percentage of the single population in the most developed prefectures (29.63%) was almost twice that in the least developed prefectures (15.71%). Turning to migrant status, there was a high concentration of migrants without local hukou in the more developed and most developed prefectures for both males (33.86% and 52.92%) and females (34.45% and 56.30%), while the percentage of migrants without local hukou

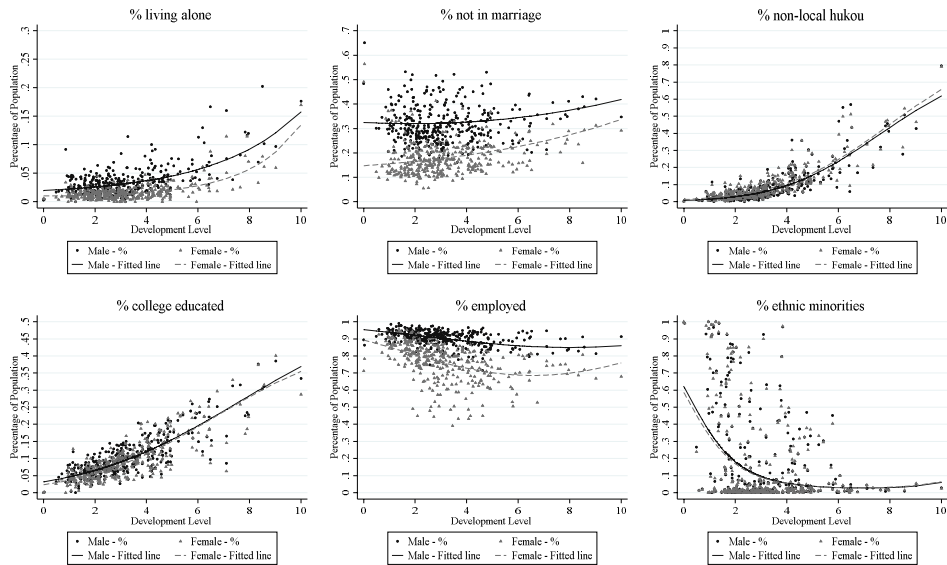
in the less developed and least developed prefectures was much lower (4.51% and 2.22% for males; 5.79% and 3.03% for females). Members of ethnic minorities were clustered mainly in the least developed prefectures (30.66% and 28.66% for males and females). In contrast, the more developed prefectures housed a much lower proportion of members of ethnic minorities (2.44% and 2.48% for males and females). For males, the employment level was high in the more (95.45%) and least developed prefectures (93.38%) but lower in the most developed prefectures (85.13%). For females, the employment level was higher in the least developed prefectures (85.17%) but relatively low in the most developed prefectures (69.75%). The lower employment level for young adults in the most developed prefectures may reflect a higher proportion of young adults still in university.

Table 1: Distributions of percent living alone and sociodemographic factors in different contexts (adults aged between 20 and 35), by gender

	Socioeconomic Development Index				
	Least developed (0 to < 2)	Less developed (2 to < 4)	Middle (4 to < 6)	More developed (6 to < 8)	Most developed (8–10)
<i>Examples of prefecture-level units</i>	Yanan, Zunyi, Zhangjiajie	Nanning, Tangshan, Dandong	Jinan, Chengdu, Dalian	Nanjing, Tianjin, Xiamen	Beijing, Shanghai, Shenzhen
	Male				
<i>Living alone</i> Living in OPH	2.62%	2.68%	4.51%	8.15%	11.33%
<i>Education level</i> College	5.45%	8.59%	14.53%	22.97%	33.77%
<i>Employment</i> Employed	93.38%	90.36%	87.93%	95.45%	85.13%
<i>Ethnicity</i> Non-Han (Minorities)	30.66%	8.59%	7.46%	2.44%	2.92%
<i>Singlehood status</i> Not in marriage	32.38%	32.20%	32.66%	36.13%	39.05%
<i>Hukou status</i> Nonlocal hukou	2.22%	4.51%	14.85%	33.86%	52.92%
	Female				
<i>Living alone</i> Living in OPH	1.17%	1.24%	2.09%	4.67%	8.07%
<i>Education level</i> College	4.48%	7.69%	13.86%	22.67%	33.52%
<i>Employment</i> Employed	85.17%	75.56%	71.16%	73.43%	69.75%
<i>Ethnicity</i> Non-Han (Minorities)	28.66%	7.98%	7.38%	2.48%	3.48%
<i>Singlehood status</i> Not in marriage	15.71%	17.81%	19.64%	25.67%	29.63%
<i>Hukou status</i> Nonlocal hukou	3.03%	5.79%	16.05%	34.45%	56.30%

Figure 2 is a scatterplot with fitted lines that visualizes the bivariate relationships between prefecture-level development (SED index) and the prefecture-level percentages of living alone, single status, migrants without local hukou, residents with a college education, employed population, and ethnic minorities. The relationship between prefecture-level SED index and prefecture-level percentage of living alone was positive and curvilinear. The relationship between SED index and percentage of single status was positive, and stronger among the female subsample than the male subsample. There were also positive relationships between the SED index and the percentage of residents without local hukou and the percentage of residents with a college education. On the other hand, the relationship between the SED index and the percentage of ethnic minorities was negative and curvilinear, and the relationship between the SED index and employment was negative and weak.

Figure 2: Prefecture-level relationships between living alone, sociodemographic factors, and socioeconomic development contexts



4.2 Multilevel analysis: Individual and contextual determinants of living alone

To examine the association between living alone and individual-level and prefecture-level factors, we conducted two series of two-level random-intercept logistic regression models. The results of random-intercept logistics regression are reported in Table 2a and Table 2b for the male and female subsamples, respectively. In this section, we discuss the general patterns of association between prefecture-level SED index, individual-level factors, and living alone. Because logit coefficients are not directly comparable across models, we discuss the average marginal effects and adjusted probabilities for the subgroups in the next section.

Table 2a: Results from random-intercepts logistic regression (young male adults aged between 20 and 35)

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Prefecture-level factors</i>					
SED index	0.010 (0.061)	0.040 (0.062)	-0.034 (0.058)	-0.010 (0.056)	0.021 (0.066)
SED index (Squared)	0.022 (0.007)**	0.019 (0.007)**	0.013 (0.007)*	0.009 (0.006)	0.013 (0.006)*
<i>Individual-level factors</i>					
Age	-0.044 (0.002)***	0.078 (0.003)***	-0.045 (0.002)***	0.089 (0.003)***	0.108 (0.005)***
College education (=1)	0.750 (0.024)***	0.618 (0.025)***	0.894 (0.024)***	0.753 (0.026)***	1.670 (0.054)***
Employed (=1)	0.505 (0.036)***	0.844 (0.036)***	0.329 (0.036)***	0.690 (0.036)***	0.568 (0.077)***
Ethnic minorities (=1)	-0.198 (0.042)***	-0.218 (0.043)***	-0.160 (0.041)***	-0.189 (0.042)***	-0.277 (0.075)***
Not in marriage (=1)		2.088 (0.025)***		2.323 (0.026)***	2.131 (0.053)***
Nonlocal hukou (=1)			1.499 (0.025)***	1.814 (0.026)***	1.552 (0.065)***
<i>Cross-level interactions</i>					
SED index X age					-0.004 (0.001)***
SED index X college education					-0.172 (0.009)***
SED index X employed					0.027 (0.014)*
SED index X ethnic minorities					0.031 (0.018)
SED index X not in marriage					0.048 (0.010)***
SED index X nonlocal hukou					0.041 (0.011)***
Intercept μ	-3.091 (0.135)***	-7.888 (0.146)***	-2.872 (0.127)***	-8.191 (0.139)***	-8.514 (0.209)
σ_{μ}	0.495 (0.025)	0.483 (0.024)	0.446 (0.024)	0.425 (0.023)	0.426 (0.023)
Intra-class correlation	0.069	0.066	0.057	0.052	0.052
Level 1 units (Individuals)	276,691	276,691	276,691	276,691	276,691
Level 2 units (Prefectures)	345	345	345	345	345
AIC	88125.43	81074.93	84639.80	76415.49	75997.72
BIC	88209.67	81169.71	84734.58	76520.80	76166.21

Notes: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Table 2b: Results from random-intercepts logistic regression (young female adults aged between 20 and 35)

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Prefecture-level factors</i>					
SED index	-0.007 (0.069)	-0.033 (0.073)	-0.076 (0.064)	-0.120 (0.067)	-0.290 (0.077)***
SED index (Squared)	0.028 (0.008)***	0.028 (0.008)***	0.021 (0.007)**	0.022 (0.007)**	0.024 (0.008)***
<i>Individual-level factors</i>					
Age	-0.073 (0.003)***	0.055 (0.003)***	-0.069 (0.003)***	0.066 (0.003)***	0.046 (0.007)***
College education (=1)	0.665 (0.031)***	0.287 (0.032)***	0.912 (0.031)***	0.514 (0.033)***	1.662 (0.070)***
Employed (=1)	0.637 (0.034)***	0.587 (0.035)***	0.669 (0.034)***	0.579 (0.035)***	0.717 (0.080)***
Ethnic minorities (=1)	-0.217 (0.056)***	-0.203 (0.057)***	-0.224 (0.055)***	-0.223 (0.056)***	-0.512 (0.100)***
Not in marriage (=1)		2.176 (0.034)***		2.362 (0.034)***	1.717 (0.072)***
Nonlocal hukou (=1)			1.531 (0.031)***	1.796 (0.032)***	1.394 (0.081)***
<i>Crosslevel interactions</i>					
SED index X age					0.004 (0.001)**
SED index X college education					-0.202 (0.012)***
SED index X employed					-0.025 (0.013)*
SED index X ethnic minorities					0.078 (0.021)***
SED index X not in marriage					0.130 (0.012)***
SED index X nonlocal hukou					0.067 (0.014)***
Intercept μ	-3.156 (0.155)***	-7.307 (0.174)***	-3.269 (0.147)***	-7.656 (0.167)***	-6.907 (0.260)***
σ_u	0.508 (0.029)	0.545 (0.030)	0.451 (0.028)	0.485 (0.029)	0.477 (0.029)
Intraclass correlation (ρ)	0.073	0.083	0.058	0.067	0.065
Level 1 units (Individuals)	305,448	305,448	305,448	305,448	305,448
Level 2 units (Prefectures)	345	345	345	345	345
AIC	57370.48	53056.45	55039.23	50034.33	49629.06
BIC	57455.52	53152.11	55134.89	50140.62	49799.13

Notes: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Model 1 shows the results of random-intercepts logistic regression on living alone with the SED index, its squared term, and individual background characteristics (age, college education, employment status, and ethnicity). Both college education and employment were positively associated with living alone, while age and membership of an ethnic minority were negatively associated with living alone. Controlling for these individual-level characteristics, the SED index was positively correlated with living alone in a curvilinear manner. Single status, added in Model 2, was positively and strongly related to living alone. Controlling for single status, age was positively associated with living alone. This indicates that younger adults were less likely to live in one-person households as they grew older, mainly because of marriage. Except for age, the correlations between the other variables and living alone in Model 2 were similar to those of Model 1. In Model 3, we controlled for nonlocal hukou status instead of single status. Migrants without local hukou were more likely to live alone, controlling for the

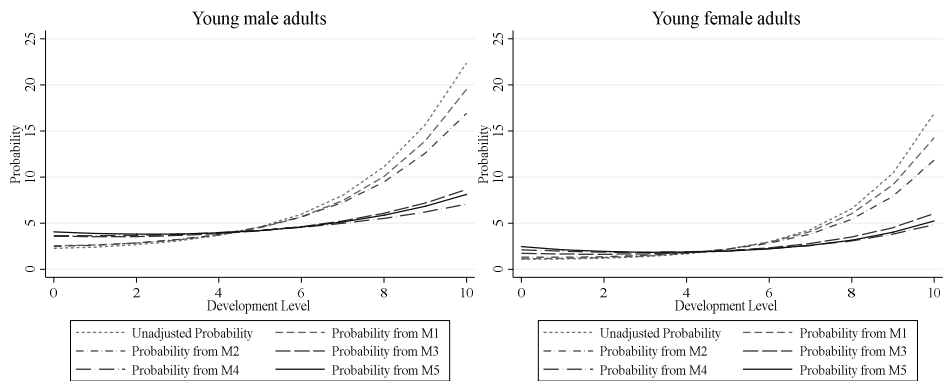
background sociodemographic variables. Again, the correlations between the other variables and living alone were similar to that of Model 1. Model 4 is the full main effect model, in which we included the prefecture-level SED index and all individual-level factors, including single status and migrant status. Both single status and migrant status were positively associated with living alone for young male and female adults. The size of the coefficient of single status was significantly larger than that of migrant status, implying that the difference in probability of living alone between being single and being married was larger than that between migrants without local hukou and local residents. Model 5 is an interaction effect model, in which we included the cross-level interaction terms for prefecture-level SED index and each individual-level factor in the analysis. The lower AIC and BIC value for the interaction effect models indicate that they are more informative than the main effect models for both male and female subsamples. We found that not only were single status and migrant status positively associated with living alone, but their positive associations positively interacted with prefecture-level SED index. In other words, the difference between a single internal migrant and a married local resident in the propensity for living alone was significantly larger in more developed prefectures than in less developed prefectures. In both the main effect and interaction effect models, the association patterns between other factors and living alone were similar to that of previous models, except that the association between prefecture-level SED and living alone for the male subsample was no longer significant in the main effect model.

In general, we found that the correlational patterns of living alone were very similar for male and female subsamples, suggesting that living alone is driven by a similar set of factors for young male and young female adults. The intraclass correlations in the final models were 0.052 and 0.065 for the male and female subsamples, respectively. Controlling for all the factors in this study, the level of prefecture-level clustering in the probability of living alone is quite low.

Figure 3 visualizes the unadjusted and average adjusted probabilities of living alone in different developmental contexts for young male and female adults, derived from Model 1 to Model 5 reported in Table 2a and Table 2b. It reveals that there was a positive curvilinear relationship between living alone and prefecture-level SED when no individual characteristic was controlled for (unadjusted probability). The probability of living alone was low (less than 5% and 3% for young male and female adults) for most prefectures with SED lower than 5. Only in the most developed prefectures were young adults much more likely to live alone (approx. 16% and 12% for male and female adults, respectively). Turning to the average adjusted probability derived from Model 1, in which age, college education, employment status, and ethnicity were controlled for, the adjusted probability curves for male and female adults appear only slightly lowered and flattened. This implies that the distribution of these individual characteristics was unable to explain much of the increased propensity for living alone in the most developed prefectures. Even

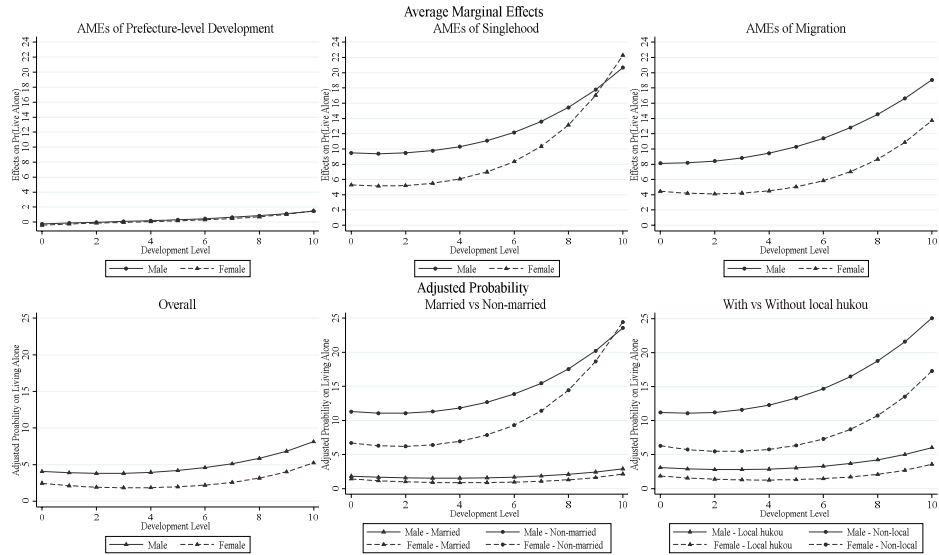
when controlling for single status in Model 2, the adjusted probability curves for male and female adults still appear only slightly lowered and flattened, similar to Model 1. This implies that the compositional difference of marital status between prefectures alone was unable to explain much of the high probability of living alone in most developed prefectures. However, the average adjusted probability curves appear considerably lowered and flattened when the migrant status was additionally controlled for in Model 3. This implies that the concentration of internal migrants in developed prefectures can explain a large part of the high propensity for living alone in these areas. The adjusted probability curves from Model 4 and Model 5 are similar to that of Model 3. In Model 4, the adjusted probability of living alone, controlling for all individual-level factors, still has a slightly positive curvilinear slope. The probability of living alone in the most developed prefectures remained around twice that in the least developed prefectures for both young male and female adults. This suggests that there was a significant contextual effect of prefecture-level SED when controlling for single status, migrant status, and other basic sociodemographic characteristics.

Figure 3: Adjusted probability of living alone across different levels of socioeconomic development



The top panel of Figure 4 visualizes the average marginal effects (AMEs) of prefecture-level SED, single status, and migrant status for young adults in different developmental contexts. The bottom panel of the figure visualizes the adjusted probabilities of living alone for the entire sample of young adults and for subgroups with different characteristics in different developmental contexts, derived from the full interaction models reported in Table 2a and Table 2b.

Figure 4: Average marginal effects and adjusted probabilities of living alone: prefecture-level development, singlehood, and hukou



Notes: AMEs and probabilities derived from Model 5 in Table 2. For AMEs of single and migrant status, married and local residents are the reference groups.

As shown in the top panel, the AME of single status on living alone for both male and female young adults was positive but significantly larger for males than females. They were also much larger in magnitude in the most developed prefectures. Single male and female adults living in prefectures with a SED index lower than 5 were more likely to live alone than their married counterparts by around 10 and 6 percentage points, respectively. In the most developed prefectures ($SED \geq 8$), single male and female adults were more likely to live alone than their married counterparts by around 18 percentage points. The positive interaction effect between single status and prefecture-level SED was stronger among females than males.

The AME of internal migration on living alone for both male and female young adults was also positive, with larger values in more developed prefectures. In prefectures with a SED index lower than 4, male and female migrants without a local hukou registration were more likely to live alone than those with a local hukou, by around 8 and 4 percentage points, respectively. In the most developed prefectures, with a SED index higher than 8, male and female migrants were more likely than locally registered residents

to live alone by around 16 and 11 percentage points. Regardless of the developmental context, the AME of migration for male adults was larger than that for female adults.

The contextual effect of prefecture-level development was conditional on individual characteristics. Examining the average adjusted probabilities of living alone for different subgroups, it is clear that single adults in highly developed prefectures are more likely to live alone than single adults in less developed prefectures. This is not the case for married adults. In addition, we found that there was no gender gap in living alone for young single adults in the most developed prefectures (with probabilities of around 20% in the most developed prefectures for both genders). In comparison, the gender gap for single adults in the less developed prefectures was noticeable (around 11% for males and 7% for females). Similarly, migrants without local hukou in the highly developed prefectures are more likely to live alone than in less developed prefectures (around 11% of male adults and 6% for female adults in less developed prefectures and around 22% and 14% for male and female adults in the most developed prefectures). In contrast, the association between contextual development and living alone was much smaller for local hukou residents (around 3% for single adults in less developed prefectures and 5% and 4% for male and female adults in the most developed prefectures).

5. Discussion and conclusions

The geographical patterns of one-person households have been well documented in China and elsewhere (Cheung and Yeung 2015; Ogden and Schnoebelen 2005; Dommaraju 2015; Guilmoto and de Loenzien 2015; Vitali 2010). However, past studies have failed to disentangle the effects of socioeconomic development into compositional and contextual effects, and therefore hamper a more comprehensive understanding of why there is a high concentration of one-person households in the most developed areas. To fill this research gap, we examined the relationship between socioeconomic development and living alone among young adults, and the mechanisms behind the relationship.

Consistent with the patterns found in many other contexts, we found a positive curvilinear relationship between prefecture-level development and living in one-person households in China. Regardless of gender, young adults were much more likely to live in one-person households in the most developed areas. However, the higher propensity of living alone in the most developed areas was not mainly due to the differences in their marital behaviors. Our analysis showed that single status was one of the most influential factors in determining living alone status, but most young adults were still choosing to marry in China in 2005, even in the most developed prefectures. The norm of universal marriage is still strong in China (Sun and Wang 2010). Although there was a difference in marital behaviors across prefectures with different levels of development, it was not

significant enough to mediate the relationship between the level of development and rates of one-person households. Our analysis thus suggests that marriage rates do not explain much of the geographical patterns of one-person households in China in 2005 when the data were collected.

Consistent with Hypothesis 3, we found that the geographical pattern of one-person households was closely related to migration patterns. The ample employment opportunities in the most developed areas in China have attracted vast numbers of migrant workers (Liang and Ma 2004; Liang, Li, and Ma 2014), and young migrants without a local hukou are more likely to live separately from their families (Zhao and Chen 2008). Our results show that the relationship between prefecture-level SED and living alone in 2005 could be well accounted for by the compositional effect of internal migration. In contrast to the findings of Klinenberg (2012) and other recent studies, our findings suggest that living alone in highly developed areas in China is largely a temporary, transitory arrangement for working-class migrants in that period. Despite its temporary nature, this living arrangement may have adverse long-term effects on migrants' family relations and individual well-being (Mu and Yeung 2020; Tong, Chen, and Shu 2019).

Turning to the contextual effect of prefecture-level socioeconomic development, our findings are partially consistent with the literature on solo living that has emphasized the positive contextual effects of urbanization and development. The results suggest that the contextual effect of development on living alone was present but weak when controlling for individual characteristics. We found highly significant cross-level interaction effects between prefecture-level SED and single status and migrant status in shaping the propensity to live in one-person households. Single and migrant adults were more likely to live alone in highly developed areas than their counterparts in less developed areas. This might be explained by the cultural and structural conditions in highly developed areas being more favorable to living alone and thus making this arrangement more attractive and feasible for single migrants only. With most young adults in China being married and having local hukou in 2005, the average contextual effect over the whole population is therefore weak at that time. In advanced economies, where single status is common for young adults, the average contextual effect of development might be stronger. In emerging economies and cultural contexts where the influence of traditional familism is still strong, the average contextual effects are likely to be weaker as there will be fewer single adults.

These findings have important implications. Many studies have attributed the rise of one-person households in advanced economies to the increasing attractiveness of remaining single, especially among young adults (Kislev 2019). Living alone and remaining single are often discussed together as if they are two sides of the same coin. However, people may live in one-person households for a variety of reasons. Those who choose to remain single and live alone may not face many negative consequences of

living alone (Ho 2015; Raymo 2015), and the rise of solo living for them could be seen as reflecting an increased individualism. In contrast, migrants who leave their families behind to work and live alone in cities may be more negatively affected (Gu, Feng, and Yeung 2018; Tong, Chen, and Shu 2019). Results in this study underscore the importance of internal migration flows in shaping the high concentration of one-person households in the most developed areas in China. This concentration should not be seen as signaling the breakdown of family institutions in the most developed areas.

In recent years, there has been a rise in family migration as more young migrants have increased (Lu and Zhou 2013) as the hukou policy that facilitated some migrant workers to bring their family members to cities has relaxed. If this trend continues, the concentration of one-person households due to internal migration may be substantially reduced. In addition, if the regional economic disparities are reduced by the rapid economic development of inland areas, we can also expect a lower proportion of solo dwellers because the migrant workers may choose to return to their places of origin. As in the first few months of 2020, when migrant workers moved back to their homes and did not return to cities due to COVID-19 and lack of job opportunities in cities, we can expect a significant drop in the population living alone. On the other hand, the urbanization process in China is set to speed up, targeted to increase to 70% in 2030 and even higher beyond that (Gao and Wei 2013), which may lead to a higher proportion of people living alone.

The context that shaped the rise of one-person households in China in 2005 differs from the experience of some advanced economies, such as the United States and countries in Western European countries, studies of which place a greater emphasis on the culture of individualism, the social welfare system, and urban infrastructure (Klinenberg 2012; Jamieson and Simpson 2013). This study shows that the rise of one-person households is not primarily linked to the demographic transition process in an emerging economy. Our findings shed light on the patterns of living alone in other emerging economies, where unskilled migrant workers are attracted to move to the metropolitan areas for economic opportunities. Even without a significant rise of individualism and breakdown of family institutions, one-person households could be more common in economically developed areas due to the rise of internal migrations.

This study has some limitations. First, the cross-sectional nature of the data prohibits us from making causal inferences from the associations among the variables presented in this study. Although the term “effect” is used throughout the paper, the correlation patterns presented are not direct evidence of the presence of causal effects. In particular, the average contextual effects of development on living alone (when controlling for some individual characteristics) could still be driven or suppressed by unknown omitted variables. However, there was a limited choice of variables in the dataset for inclusion, and further studies controlling for additional individual-level factors are needed.

Second, with cross-sectional data, we were also unable to examine the duration of living alone arrangements. Living alone could be a short-term response at the destination, which may be followed by return migration of the solo dwellers or follow-on migration of other family members. With our data, we were unable to differentiate those who were living alone temporarily from those who were living alone for a more extended period, which could have different implications for the consequences of living alone (Qu and de Vaus 2011; Richards, White, and Tsui 1987; Yi 2016). For those who live alone temporarily, we do not know for how long they live alone as well as how many solo dwellers end the practice by return migration and follow-on migration. Future research with panel or retrospective data is needed to examine these issues further.

Third, the validity and relative importance of the three explanations identified in this study is highly context-dependent. The 2005 1% National Population Sample Survey data used in this study has its limitations in helping us to understand the patterns of one-person households in China nowadays. For example, the rates of divorce and late marriage have risen significantly since 2005 (Yeung and Hu 2016). We expect marital behaviors to have played a more important role in recent years and in the following decades. With divorce and late marriage becoming more common in China since 2005, we also expect a stronger average contextual effect of development on living alone in recent years. On the other hand, the increase in cohabitation may slow down the rise of one-person households in China (Yeung and Hu 2016; Yu and Xie 2015). To verify these speculations, more recent data such as the 2015 1% National Population Sample Survey is needed. However, the microdata of the 2015 survey is only available to the researchers of a few authorized institutions within China (at <http://microdata.stats.gov.cn/>). As researchers currently working outside Mainland China, we could not access the data despite our best effort. We invite researchers with access to the 2015 data to replicate our study and compare the patterns of one-person households in 2015 with the patterns found in this study.

Despite its limitations, the use of the 2005 data has its relevance and significance to the literature as it documented the patterns of one-person households in China during the period of the most rapid economic development. The patterns of one-person households in China during this period are relevant to other emerging economies. Just after a few years of entering the World Trade Organization, the GDP per capita of China in 2005 was \$1,753, which was still comparable to other emerging economies in Asia (World Bank 2020). In 2015, the GDP per capita of China (US\$8,067 in 2015) had already far exceeded the same figure of other emerging economies in the same region, such as Indonesia (US\$3,332), Vietnam (US\$2,085), and India (US\$1,606). We believe our findings based on the 2005 data are important for family demographers in understanding the living alone phenomenon in the emerging economies with rapid economic development. This study highlights that the composition of the marital population is not primarily responsible for the geographical concentration of one-person households in

China during the early 2000s, which contrast the widespread belief held in the advanced economies that the rising prevalence of one-person households is closely related to the decline in marriage and an increase in individualism. In emerging economies such as China in 2005, migration played a much larger role in shaping the geographical patterns of one-person households. Further research on this topic for more recent years in China or other emerging economies is warranted.

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Appendix

Table A-1: Loadings of variables in constructing the socioeconomic development index

	Loadings
Prefecture-level % of college graduates	0.399
Prefecture-level % of nonagricultural jobs	0.422
Average housing conditions in the prefecture	0.407
Prefecture-level % of nonlocal hukou	0.368
Prefecture-level GDP per capita	0.417
Prefecture-level urbanization rate	0.433

Table A-2: Correlation between different indicators of prefecture-level socioeconomic development

	1	2	3	4	5	6
Prefecture-level % of college graduates	1					
Prefecture-level % of nonagricultural jobs	0.78	1				
Average housing conditions in the prefecture	0.57	0.68	1			
Prefecture-level % of nonlocal hukou	0.53	0.57	0.61	1		
Prefecture-level GDP per capita	0.63	0.65	0.73	0.66	1	
Prefecture-level urbanization rate	0.72	0.78	0.73	0.59	0.75	1