



Early-life experience of land reform and entrepreneurship

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ABSTRACT

We examine the long-run impact of land reform experience in childhood and adolescence on entrepreneurship later in life. To do so, we take advantage of village-level variation in the Household Responsibility System (HRS) reform in China that transformed land property rights from a communal system into an individualized tenure system. We find that early-life exposure to land reform increases the probability of becoming an entrepreneur in adulthood. This positive association is mainly driven by exposure to the HRS increasing the propensity for solo and necessity entrepreneurship. We also find considerable heterogeneity in the long-run impact of early-life HRS reform exposure across subsamples. Females, individuals from low-income families, individuals with less-educated parents and individuals in the central region are more likely to become entrepreneurs following early-life exposure to land reform. Overall, while previous research has found that land titling reform in China significantly increased business creation in rural areas, our findings imply that the positive impact of land reform on entrepreneurial ventures is likely to be understated if its long-run impact on those exposed to land reform early in life on the likelihood of their becoming entrepreneurs later in life is not considered.

1. Introduction

Entrepreneurship is critical for stimulating economic growth, driving innovation, creating jobs and alleviating poverty and inequality (King & Levine, 1993; Sutter, Bruton, & Chen, 2019). A large literature examines the factors that affect entrepreneurial activity. For example, studies have considered the role of credit constraints (Banerjee & Newman, 1993; Falkinger & Grossmann, 2013), collateral constraints (Schmalz, Sraer, & Thesmar, 2017), family wealth (Hurst & Lusardi, 2004), institutional arrangements (Field, Jayachandran, & Pande, 2010), gender (Babbitt, Brown, & Mazaheri, 2015), education (Cheng & Smyth, 2021), age (Liang, Wang, & Lazear, 2018) and risk aversion (Herranz, Krasa, & Villamil, 2015) in affecting entrepreneurship. Much of the literature has focused on the role of favorable conditions in increasing the likelihood of entrepreneurship. Studies have shown that propensity for entrepreneurship is associated with better access to financial capital (Adelino, Schoar, & Severino, 2015), higher levels of family wealth (Fairlie & Krashinsky, 2012) and higher levels of training and formal education (Estrin, Mickiewicz, & Stephan, 2016). However, more recently, the theory of underdog entrepreneurship proposed by Miller and Le Breton-Miller (2017) posits that adversity and challenges experienced in both childhood and adulthood could nurture favorable survival capabilities, including greater

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resilience, resourcefulness, self-determination and other personal qualities, that are essential ingredients for starting new business ventures.

A subset of this broader literature has examined the relationship between land property rights and entrepreneurial entry (Angulo-Guerrero, Pérez-Moreno, & Abad-Guerrero, 2017; Bylund & McCaffrey, 2017; Harper, 2013; Sarasvathy, 2004; Wang, 2012). Previous research has shown that security of property rights helps to promote innovative behaviour and risk-taking that are beneficial for entrepreneurship (Angulo-Guerrero et al., 2017; Bjørnskov & Foss, 2013; Sahasranamam & Raman, 2018). Bu and Liao (2022) find that large-scale land titling reform in China, that provides more stable and secure farmland property rights, significantly increased the number of rural enterprises. These authors find that better access to financial capital, increased land and labor availability and productivity, and improved social trust are potential mechanisms underlying the association between land property rights and rural enterprise growth.

All of these studies are concerned with the contemporary effect of property rights reform on entrepreneurship in adulthood. We lack evidence, though, on how exposure to property rights reform in childhood or adolescence might affect propensity for entrepreneurship later in life. This is an important gap in understanding given that mounting evidence suggests that early-life experiences more generally could mould one's cognitive and non-cognitive abilities that influence their subsequent suitability for employment and propensity for entrepreneurship (Cheng, Guo, Hayward, Smyth, & Wang, 2021; Doyle, Harmon, Heckman, & Tremblay, 2009; Heckman, Pinto, & Savelyev, 2013). We seek to address this gap in the literature. To do so, we use data from the China Labor-Dynamics Survey (CLDS) to examine whether, and to what extent, exposure to Household Responsibility System (HRS) reform, which assigned collective-owned farmland to a household with secure tenure, in childhood and adolescence, shapes one's propensity for entrepreneurship later in life. Specifically, we identify the long-term impact of land reform by exploiting exogenous temporal and geographical variations in the village-level rollout of the HRS reform between 1978 and 1985 in China.

We focus on the long-run effect of HRS reform experience in childhood and adolescence because these two stages are the most critical for an individual to recognise and understand the world, develop cognitive abilities and form their values, norms and personality traits (Bai & Wu, 2020; Cheng, Tani, & Torgler, 2023; Hou et al., 2020; Piaget, 2003). A large body of literature shows that a broad range of early-life shocks during childhood and adolescence, including the HRS reform exposure early in life, can interact with generic endowments and production technologies to generate long-lasting impacts into adulthood (Almond, Currie, & Duque, 2018; Xu, 2021). Thus, we expect that the HRS reform experience during childhood and adolescence is likely to have a stronger impact on an individual's involvement in entrepreneurial activity later in life.¹

We find that exposure to land reform in childhood and adolescence significantly increases the probability of becoming an entrepreneur later in life. This finding implies that the positive impact of land reform on entrepreneurial ventures is likely to be understated without considering its long-run impact on later-life entrepreneurship. We also find considerable heterogeneity in the long-run impact of early-life exposure to the HRS reform across subsamples. Females, individuals from low-income families, individuals with less-educated parents and individuals in the central region are likely to benefit more from early-life exposure to the land reform. While exposure to land reform might reduce income inequality within rural areas and between genders, its positive impact might be mitigated by the fact that disadvantaged individuals are more likely to end up in low-income entrepreneurship in the informal sector.

We contribute to the literature in four ways. First, we add to relatively small literature on the impact of early-life experience on whether one becomes an entrepreneur later in life. Drawing on the underdog framework of entrepreneurship (Miller & Le Breton-Miller, 2017), existing studies that do examine early life experience on entrepreneurship later in life, have focused solely on the effect of negative events, such as famines (Cheng et al., 2021), wars (Awaworyi Churchill, Munyanyi, Smyth, & Trinh, 2021) and political upheavals (Hayward, Cheng, & Zhe Wang, 2022) on building resilience and underdog traits. The HRS potentially has a more nuanced effect on entrepreneurship later in life, where it could also help reinforce advantages in childhood.

Second, we provide new evidence of the causal effect of early-life experience on entrepreneurship. More generally, we contribute to the recent entrepreneurship literature that employs lab or natural experiments to make causal inference about why individuals become entrepreneurs (Anderson, Wennberg, & McMullen, 2019; Williams, Wood, Mitchell, & Urbig, 2019). Estimating the causal relationship between the length of early-life exposure to the HRS reform and the likelihood of becoming an entrepreneur is complicated by the fact that the timing of the land reform implementation is endogenous to local conditions, including the level of economic development, the severity of the Great Famine and political radicalism, which may shape subsequent economic development, as well as the institutional environment and social norms that could affect entrepreneurship (Angulo-Guerrero et al., 2017; Bai & Kung, 2014). Moreover, there might be other sources of endogeneity, such as unobserved heterogeneity, that simultaneously influence an individual's early-life reform exposure and probability of starting a business, and errors in measuring the length of early-life HRS reform exposure based on the retrospective nature of the data on reform timing. To address endogeneity, we instrument for early-life exposure to the HRS using the interaction between adverse weather shocks and initial irrigation conditions prior to the land reform as the instrumental variable (IV).

Third, we contribute to the limited literature on the determinants of different types of entrepreneurship. The focus of existing entrepreneurship literature has largely been on examining opportunity and employer entrepreneurship, which is believed to be more effective at driving economic growth and job creation (Aparicio, Urbano, & Audretsch, 2016; Kuckertz, Berger, & Mpeqa, 2016).

¹ In the empirical analysis, we extend our sample to individuals born in 1965 or later and examine the effect of HRS reform exposure between 18 and 25 years old on the likelihood of becoming an entrepreneur. The results in Table A5 show that HRS reform experience before 18 years old has a significant association with the propensity of becoming an entrepreneur, while the impact of the length of reform exposure between 18 and 25 years old is not significant. This finding provides strong evidence for the validity of focusing on the HRS reform experience in childhood and adolescence.

However, necessity and solo entrepreneurship is prevalent in transition economies like China (Cheng & Smyth, 2021; Sahasranamam & Raman, 2018). It has been well-documented that there are important differences between opportunity and necessity entrepreneurship and between solo and employer entrepreneurs in terms of motivation for starting a business, human capital endowment, survival rates, venture success and influence on socioeconomic development (Angulo-Guerrero et al., 2017). This makes it important to explore the heterogeneous long-run effects of early-life HRS reform experience on different forms of entrepreneurship. This point is particularly relevant in light of the fact that nearly two-thirds of necessity-oriented entrepreneurs turn into more opportunity-oriented over time (Williams & Round, 2009). We find evidence of heterogeneity across entrepreneurship types. Specifically, we find that longer exposure to the HRS reform in early life significantly increases the propensity for solo and necessity entrepreneurship, while its impact on the probability of becoming an employer or opportunity entrepreneur is not significant.

Finally, we extend the literature that has specifically considered the long-run consequences of land reform and titling programs on outcomes later in life (Albertus, Espinoza, & Fort, 2020; Besley, Leight, Pande, & Rao, 2016; Keswell & Carter, 2014). Emerging evidence indicates that exposure to land reform early in life leads to a significant improvement in health status and wages in adulthood, while it has a detrimental effect on educational attainment because land reform raises the opportunity cost of schooling due to the increased returns to child labor (Albertus et al., 2020; Xu, 2021). Although Xu (2021) has investigated the association between childhood exposure to the HRS reform and occupational prestige, there is a lack of evidence on how early-life land reform experience affects the propensity for entrepreneurship. We extend this strand of literature to examine the long-term effect of the HRS reform experience in childhood and adolescence on one's probability of entry into entrepreneurship in adulthood. Methodologically, existing studies have relied on the county or provincial level HRS rollout to identify the effect of HRS reform (Chen & Lan, 2020; Hu, Huang, Luo, You, & Zhang, 2019; Xu, 2021). However, the basic unit of the HRS reform was the production team, rather than a county or province.² It took one or two years for most of the production teams in a county to adopt the HRS, and even longer for those in a province (Chen & Lan, 2020). Therefore, methodologically, we provide a more precise estimate of the effect of HRS reform by exploiting the village-level variation in the timing of the HRS reform.

2. Household responsibility system reform and entrepreneurship

2.1. Overview of the household responsibility system in China

In the early 1950s, China launched a campaign of land collectivization that sought to boost agricultural productivity, with the objective of increasing output in order to fuel industrialization and help establish the People's Commune system. Farmers were compelled to join production teams consisting, on average, of 27 households, and to work collectively together (Bai & Kung, 2014). Because this made the observation of work effort difficult, each farmer's contribution to the production team was measured according to assigned tasks or time allocated, rather than their marginal product. This practice created a severe free-rider problem, contributing to a collapse in productivity and famine during the Great Leap Forward (Deininger & Jin, 2003). Overall, it is estimated that total factor productivity dropped by approximately 30% throughout the collectivisation period (Lin, 1992).

At the end of the 1970s, China initiated the HRS reform, which transformed land property rights from a communal system into an individualized tenure system, in an attempt to promote agricultural productivity. Under the HRS, production teams and collective organization of agricultural production were dismantled, and previous collective-owned land and production means were equally assigned to individual households. This system successfully separated land ownership and contract rights. Although farmers were not granted farmland ownership, they held private land use rights and residual claim rights to grain production after meeting their procurement obligations to the state, under contracts initially for up to 15 years and later extended to another 30 years. Similar to the agricultural decollectivisation that occurred in many developing countries, the HRS reform considerably enhanced farmers' work incentives and promoted agricultural productivity and outputs in subsequent years (Xu, 2021). The HRS reform was introduced in a staggered manner across regions and over time. To reduce political backlash and potential risk of failure, the reform was initially trialed in poor, remote and mountainous areas in rural China. The first step towards decollectivization was measured, with only 24% of production teams being effectively dismantled by the end of 1980. However, the reform rolled out rapidly after the central government sanctioned it for nationwide implementation in 1982. About 98% of production teams and 97% of rural households had adopted the HRS by 1983 (Bai & Kung, 2014). The staggered nature of the implementation of HRS reform offers a unique opportunity to examine its long-run impact on an individual's propensity to become an entrepreneur later in life.

2.2. How early-life experience of household responsibility system reform affects entrepreneurship in adulthood

Conceptually, there are several potential channels through which early-life HRS reform experience is associated with entrepreneurial choice. First, the relationship between early-life land reform experience and the likelihood of becoming an entrepreneur might be mediated by human capital. The effect of exposure to HRS in early life on human capital development is *ex ante* unclear. On the one hand, having more secure property rights potentially increases the productivity and income of the parents, which relaxes the credit constraint on investment in their child's education. On the other hand, land reform raises the opportunity cost of schooling due to the increased returns to child labour and decreases returns to education due to the narrowed income gap between urban and rural areas

² In 1978, each county consisted, on average, of 1826 production teams and each village contained approximately 3–10 production teams (Brandt, Rozelle, & Turner, 2004).

(Xu, 2021).

Irrespective of whether the HRS increases or reduces schooling, either outcome can potentially increase or decrease propensity for entrepreneurship. In the event that the HRS reduces schooling, as an underdog characteristic, educational poverty can foster resilience, resourcefulness and other necessary skills to successfully enter the labour market via self-employment (Miller & Le Breton-Miller, 2017). If the HRS increases schooling this can have countervailing effects on entrepreneurship as it could help develop cognitive and non-cognitive skills that are useful in both paid employment and entrepreneurship (Parker, 2008). An improvement in educational attainment generated by the HRS reform can promote one's ability to exploit entrepreneurial opportunity, such as social capital and risk tolerance (Akgüç, Liu, Tani, & Zimmermann, 2016), while it also raises the opportunity cost of pursuing entrepreneurship as better-educated individuals are more likely to obtain a secure and well-paid job as an employee (Cheng & Smyth, 2021).

Second, financial support from parents provides an important source of funding a new venture (Lindquist, Sol, & Van Praag, 2015). If the HRS provides more secure property rights that boost productivity and income, this could relax financial constraints for those exposed children to start a new venture through increasing household wealth. The inability to raise sufficient financial capital is the main barrier to entrepreneurship (Aretz, Campello, & Marchica, 2020). There is emerging evidence that a higher level of tenure security under the HRS has promoted agricultural investment and farmers' productivity (Jacoby, Li, & Rozelle, 2002) and transformed tillage technology to make it more suitable to local factor endowments and farm size (Chen & Lan, 2020), which leads to a permanent increase in agricultural output and family income (Lin, 1992). An increase in parental wealth and wealth accumulation is conducive to children's propensity to enter into entrepreneurship and business survival, especially in the presence of liquidity constraints (Hurst & Lusardi, 2004). Given that the economic incentives induced by the HRS reform gradually faded after the completion of the reform in the late 1980s (Wang, Shao, & Li, 2019), individuals exposed to the HRS reform at different early-life stages are likely to face different financial constraints for starting new businesses.

Third, the intergenerational transmission of entrepreneurship might be a potential mechanism that accounts for the relationship between early-life HRS reform experience and entrepreneurial behaviour. The intergenerational transfer of entrepreneurship from parents to children is well-established in the literature (Lindquist et al., 2015). The HRS increased entrepreneurship among adults, who are, or later became parents, exposed to the reforms in two ways. One is that land titling and certification reform in rural China led to a contemporary increase in business creation (Bu & Liao, 2022). The other is that the HRS released a large number of surplus workers from agricultural activities and generated an increase in rural-urban migration. The effect on migration was more pronounced in regions in which rental rights were more established (Mullan, Grosjean, & Kontoleon, 2011). Migrants, and those with migration experience, have a higher propensity to become underdog entrepreneurs (Miller & Le Breton-Miller, 2017; Wassink, 2020). Thus exposure to the HRS in childhood or adolescence could lead one to become an entrepreneur later in life channeled through the HRS increasing the likelihood of one's parents becoming entrepreneurs.

Fourth, the HRS reform plausibly has a much broader impact on infrastructure development, financial development and the institutional environment, which may exert long-run impacts on business creation. Previous research has found that the HRS reforms resulted in rapid industrialization of rural towns and villages (Gu, Hu, & Cook, 2017). Individuals who experienced the HRS reform in their childhood are more likely to obtain an urban *hukou* (Xu, 2021), and, thus, have better access to infrastructure such as transportation (Audretsch, Heger, & Veith, 2015), financing from state-owned banks (Fan, Li, Li, & Zhang, 2022) and public services delivered by local governments, such as entrepreneurship education and training programmes (Alexandria, Alicia, & Brent, 2014), that facilitate entrepreneurship. Moreover, the staggered introduction of HRS may shape the different patterns of institutional environment, including formal and informal arrangements such as legal rules, economic norms and social trust, and its evolution over time (Xu, 2011), which play an important role in economic activity, including labour market choices (Angulo-Guerrero et al., 2017).

3. Data and descriptive analysis

We use data from the 2012, 2014 and 2016 waves of the CLDS, administered by the Centre for Social Survey at Sun Yat-sen University. The CLDS is a nationally representative panel dataset covering 29 mainland provinces and municipalities (excluding Tibet and Hainan).³ The CLDS adopts a multistage cluster, stratified, and probability proportional to size sampling method. The CLDS employs six sampling frames to collect a nationally representative sample, including populous and underpopulated provinces in the east, central and west regions. In addition, another two sampling frames, the Pearl River Delta region and the non-Pearl River Delta region, were designed to increase the representativeness of Guangdong province. The baseline survey covered 16,253 individuals and 10,612 households from 174 communities/villages. The 2012 and 2016 waves surveyed 23,594 and 21,086 individuals and 14,214 and 14,226 households from 397 and 401 communities/villages, respectively. The survey collects detailed information on employment, year and place of birth, the year in which the HRS was established in a village, and a rich array of other personal and family characteristics.

Given that we focus on the long-term impact of exposure to the HRS reform in childhood and adolescence on one's propensity for entrepreneurship in adulthood, we restrict our analytical sample as follows. First, we restrict the sample to individuals who are 15–60 years old and participating in the labour market at the time CLDS was administered. Second, to rule out the potential confounding effects of other important historical events on an individual's labour market outcomes in adulthood, such as the Great Chinese Famine (1959–1961) and the Cultural Revolution (1966–1976), which can have long-lasting impacts on adult outcomes (e.g., Cheng et al.,

³ For a detailed description of the CLDS, see Wang, Zhou, and Liu (2017).

2021; Hayward et al., 2022), we further restrict our sample to individuals born in 1970 or later. Third, given that we match individual-level data with the HRS reform rollout information at the village level and that respondents are more likely to be influenced by the reform in the village in which they were born, we further exclude individuals who hold a non-local *hukou* (migrants) and whose county of birth is not identical to the county surveyed. In total, there are 884 individuals from 142 villages who experienced the HRS reform in their early life in the 2012 wave, 3767 individuals from 213 villages in the 2014 wave and 1534 individuals from 151 villages in the 2016 wave.⁴

Entrepreneurs, in general, are defined as individuals who report their primary occupation as self-employed, including solo entrepreneurs (without employees) and employer entrepreneurs (with employees). Entrepreneurs in the CLDS were also asked to indicate whether they started their own business in order to take advantage of a perceived unique market opportunity (opportunity-oriented entrepreneurs), because of involuntary job loss and lack of other job opportunities (necessity-oriented entrepreneurs) or if they had mixed start-up motivations (mixed-motivations entrepreneurs).

Our measure of early-life HRS reform experience is the number of years that respondents have been exposed to the HRS reform (1978–1985) before turning 18. Individuals born after the HRS reform are assumed to have been exposed to the reform for up to 19 years (including one year in utero during the HRS reform). Given that the construction of early-life reform experience is based on retrospective data on the village-level implementation of land reform, we validate the reliability of this retrospective information by matching it with the historic rollout of the HRS reform, following the approach in the existing literature (Wang, Cheng, Wang, & Chen, 2021). Fig. 1 plots the estimated reform adoption rates across years based on data from the CLDS and Bai and Kung (2014).⁵ We observe that the reform timing in these two datasets is generally identical. An Epps–Singleton two-sample test suggests no significant difference between these two distributions (p -value = 0.9874). It provides strong evidence that our measure of early-life reform experience is reliable and not subject to significant measurement error.

Table 1 presents summary statistics for the rate of entrepreneurship by the length of exposure to the HRS during childhood and adolescence. In our sample, respondents, on average, were exposed to the HRS reform for 13.76 years during their childhood and adolescence. Within the sample 2157 respondents had experienced the maximum 19 years of reform, accounting for 34.87%, while 474 respondents had experienced 3–6 years of reform, accounting for 7.66%. The proportion of entrepreneurs, in general, is 17.77%. Most of the entrepreneurs are solo and involved in start-up activity because of a lack of alternative employment opportunities, accounting for 15.67 and 5.48%, respectively. In general, the rate of entrepreneurship increases slightly with longer exposure to the HRS reform in early life from 12.87% among individuals with 3–6 years of reform exposure to 19.73% among those with 12–18 years of reform exposure. A Kruskal–Wallis test suggests that there are significant differences in the proportion of entrepreneurs in general, as well as solo and employer entrepreneurs among individuals experiencing different intensities of reform exposure, while differences in the proportion of opportunity, necessity and mixed motive entrepreneurs are not significant.

4. Methods

Our identification strategy exploits the variation in the timing of the HRS reforms across villages. We evaluate the effect of exposure to the HRS reforms during childhood and adolescence on the propensity for entrepreneurship by estimating the following specification:

$$Y_{ivt} = \alpha + \beta HRS_{iv} + \beta X_{it} + \gamma C_i + \delta P_i + \sigma_t + \varepsilon_{ivt} \quad (1)$$

where the subscript i denotes the individual, v denotes the village and t represents the wave. Y_{ivt} is a dichotomous outcome variable indicating whether an individual i in village v is an entrepreneur in general or one of the five types of entrepreneur (solo, employer, opportunity, necessity or mixed motivations) in wave t (yes = 1; no = 0), depending on the exact empirical specification. HRS_{iv} , which is our main variable of interest, is the length of exposure to the HRS reform in childhood and adolescence in village v for individual i . In contrast with previous studies that mainly rely on the provincial or county level HRS rollout to identify the long-term effects of the HRS reform (e.g. Hu et al., 2019; Xu, 2021), one important advantage of our model is that we rely on finer *village*-level HRS rollout, which, instead of a general cohort effect, allows us to calculate the precise years of exposure for each respondent and estimate the effect of length of exposure. X_{it} is a vector of control variables consisting of personal, household and regional characteristics. Appendix Table A1 contains the definitions and descriptive statistics for these control variables. C_i is the cohort effects to control for potential cohort-specific differences in the rate of entrepreneurship and other unobserved factors that vary uniformly across cohorts. In our baseline estimates, we control for the linear cohort trend in the estimation. In robustness checks, we control for more demanding interactions between the province and the linear cohort trend and its squared term to allow the cohort-specific effects to be non-linear and to vary across provinces. Of the remaining variables, P_i is the province fixed effects; σ_t is the wave fixed effects; and ε_{ivt} is the error term.

Because the length of early-life reform exposure is time-invariant, we employ a random effects (RE) panel regression model to

⁴ Given the information on village-level rollout of the HRS reform is only available in the 2014 and 2016 waves, we match the date of the HRS reform with individual-level data of respondents in the 2012 wave who were tracked and resurveyed in the following waves. Therefore, the sample size in the baseline survey is relatively smaller than that in the 2014 and 2016 waves. As a robustness check, we drop the 2012 wave from our analysis and re-examine the association between HRS reform exposure in childhood and adolescence and the likelihood of becoming an entrepreneur. The results in Table A3 show that the length of early-life exposure to the HRS reform continues to have a significant effect on the propensity of becoming an entrepreneur. The results are consistent with our main findings in Table 2.

⁵ The reform adoption rate is defined as the proportion of villages having adopted the HRS in each year based on the CLDS data, while it is defined as the share of production teams having adopted the HRS in each year based on the data from Bai and Kung (2014).

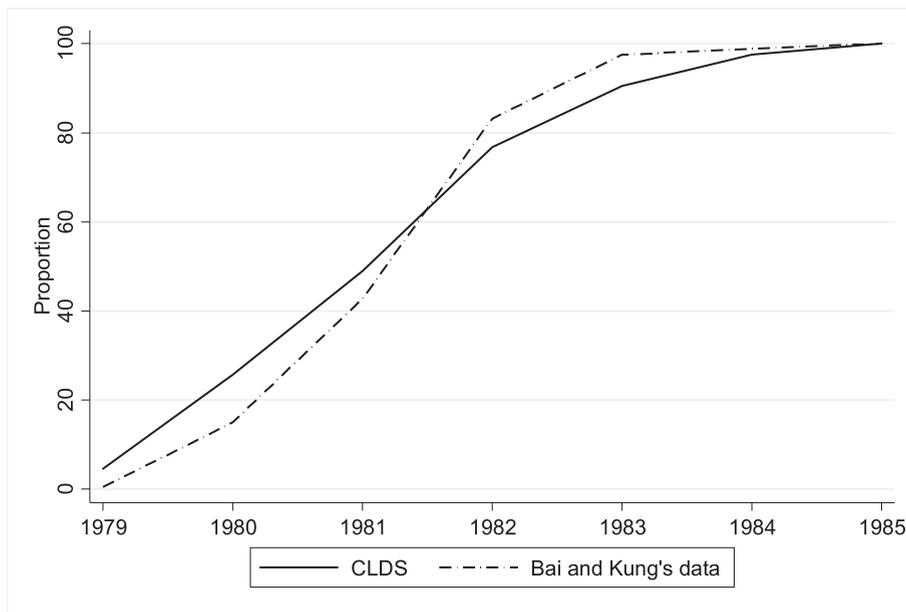


Fig. 1. The HRS adoption rate across years based on a comparison of data from the CLDS and Bai and Kung (2014).

Table 1

Summary statistics of entrepreneurship by level of HRS reform exposure.

	Length of reform exposure				Kruskal-Wallis test	
	3–6 years	7–11 years	12–18 years	19 years	Chi-squared value	p-value
Entrepreneur in general	12.87	17.61	19.73	17.43	12.487	0.0059
Employer entrepreneur	1.20	3.37	3.92	2.20	13.834	0.0031
Solo entrepreneur	11.94	15.17	17.01	15.87	7.585	0.0554
Opportunity entrepreneur	2.59	3.92	4.92	4.04	4.654	0.3257
Necessity entrepreneur	4.84	5.82	5.71	5.17	2.200	0.6991
Mixed-motive entrepreneur	1.90	2.19	2.49	2.09	1.155	0.8854
Sample size (%)	474 (7.66)	1846 (29.85)	1708 (27.62)	2157 (34.87)		

estimate the impact of exposure to the HRS reforms during childhood and adolescence on the probability of becoming an entrepreneur. However, one threat to our identification is that the implementation of the HRS reform across regions might not be random. The pace and timing of land reform may have been endogenous to local economic conditions, and stage of development, especially during the first stage of reform before 1981 (Chen & Lan, 2020). For example, the HRS reform was trialled in poor and remote rural areas to mitigate the political backlash and potential risk of failure. Villages or production teams that had experienced greater famine severity and accumulated more agricultural public goods were more likely to adopt the HRS earlier (Bai & Kung, 2014). Thus, there may be some unobserved regional heterogeneity, such as the institutional environment, which is correlated with both the rollout of the land reform and associated length of reform exposure and labour market outcomes. In addition, unobserved household heterogeneity may affect both early-life reform exposure and the propensity for entrepreneurship. Finally, a potential concern about our estimation strategy is that the RE estimates may be biased downward by measurement error in early-life HRS reform experience, if respondents do not perfectly recall and report the timing of the land reform in their villages.

To address potential endogeneity, we instrument for the length of exposure to the HRS reforms in early life with the interaction between provincial level adverse weather shocks and the initial irrigation condition before the first wave of land reform in 1978. Following Bai and Kung (2014), adverse weather shocks are defined as the average proportion of total arable land in each province affected by climatic disasters between 1975 and 1977. The initial irrigation condition, as a proxy for public goods provision, is measured by the proportion of irrigated land at the provincial level between 1975 and 1977.⁶

Weather changes have been widely used as an instrument to study the causal effect of early life shocks on human capital development and labour market outcomes (Meng & Yamauchi, 2017). The validity of our IV rests on the intuition that provinces with better

⁶ The weather data is from the *Report of the Damage Caused by Disasters in China 1949–1995* compiled by the Ministry of Civil Affairs of the People's Republic of China and the proportion of irrigated land data is from the *China Compendium of Statistics 1949–2008* compiled by the Department of Comprehensive Statistics of the National Bureau of Statistics.

public goods provision are more likely to adopt the HRS when struck by negative weather shocks, and, thus, individuals from these provinces will be exposed to the HRS for longer in their childhood and adolescence. In our sample, individuals from provinces that had better initial irrigation condition and experienced more severe weather shocks were exposed to the HRS reform for 14.06 years, while those from provinces with a lower proportion of irrigated land and a lower proportion of land affected by climatic disasters had experienced 13.53 years of reform.

5. Main results

We first examine the long-run impact of exposure to the HRS reforms in childhood and adolescence on the likelihood of becoming an entrepreneur in general for the full sample. [Table 2](#) presents the ordinary least squares (OLS), random effects (RE) and random effects two-stage least squares (RE-IV) estimates. In all estimations, we cluster the standard errors at the village level.

The OLS and RE results in columns (1) and (2) suggest that individuals with longer exposure in their childhood and adolescence are more likely to be entrepreneurs in adulthood. The RE estimates suggest that a one standard deviation increase in the length of HRS reform exposure (4.90 years or 35.61 percentage points increase in the mean length of exposure) is associated with a 3.48 percentage points increase in the probability of becoming an entrepreneur. Full exposure to the land reform, that is for 19 years, increases an individual's probability of becoming an entrepreneur by 13.49 percentage points.

The IV estimates from the RE-IV model reported in column (3) are consistent with the OLS and RE estimates in terms of the level of significance and direction of coefficients. The first stage results show that weather shocks significantly increase the length of time to which an individual was exposed to the HRS reform in childhood and adolescence in provinces with a higher level of public goods, which is consistent with the findings in [Bai and Kung \(2014\)](#). The Kleibergen-Paap rk Wald F statistic suggests that the instrument is not weak. Our IV estimates show that an additional year of exposure to land reform in early life is associated with a 3.93 percentage points higher probability of becoming an entrepreneur. This implies that the OLS and RE estimates underestimate the effect of early-life exposure to the HRS reform on promoting entrepreneurial activity. That the IV estimates are larger is consistent with previous studies that also find a higher IV-to-OLS estimate ratio in examining the long-run effects of childhood experience, especially when employing weather shocks as an instrument ([Meng & Yamauchi, 2017](#); [Wang et al., 2021](#)).

To get an indicator of the economic significance of these magnitudes, we can compare them with findings from previous studies for other major events in Chinese history. The effect size of early-life exposure to the HRS reform is slightly higher than that of being a child or adolescent in the Great Famine and the Sent-Down Youth Program in China. [Cheng et al. \(2021\)](#) find that a one standard deviation increase in the severity of the Great Famine experienced in utero and childhood increased the probability of becoming an entrepreneur by 1.3–1.5 percentage points. [Hayward et al. \(2022\)](#) suggest that a 10% increase in exposure to the Sent-Down Youth Program is associated with approximately 0.7 percentage points higher probability of involvement in entrepreneurial activity in later life. However, the magnitude of the effect of early-life land reform experience on entrepreneurship observed in this study is lower than the size of the effect of other fetal or early-life shocks on labour market outcomes. For instance, a 10% increase in exposure to maternal absence in early childhood leads to a 1.8–2.9 percentage points increase in the probability of working and a 2.6–6.8 percentage points decrease in wages ([Wang et al., 2021](#)). A 10% increase in alcohol exposure during pregnancy is associated with 2.4% lower earnings later in life ([Nilsson, 2017](#)). Individuals who participated in a deworming programme in their childhood could earn over 20% more than nonparticipants ([Baird, Hicks, Kremer, & Miguel, 2016](#)).

[Bu and Liao \(2022\)](#) found that land titling reform in China significantly increased business creation in rural areas. Our findings imply that the positive impact of land reform on entrepreneurial ventures is likely to be understated if its long-run impact on those exposed to land reform early in life on the likelihood of their becoming entrepreneurs later in life is not considered.

Next, we examine the impacts of early-life reform exposure on different forms of entrepreneurship. The IV estimates in columns (1) and (2) in [Table 3](#) suggest that the length of early-life exposure to the HRS reform has a stronger effect on the propensity of becoming a solo entrepreneur than on becoming an employer entrepreneur. A one standard deviation increase in the length of exposure to land reform causes an increase of 14.60 and 9.11 percentage points in the probability of becoming a solo entrepreneur and an employer entrepreneur, respectively. In columns (3) to (5), we find that the positive association between early-life exposure to the HRS reform and the probability of becoming an entrepreneur is mainly driven by necessity entrepreneurship. An additional year of land reform exposure is associated with a 3.11 percentage points increase in the probability of becoming a necessity entrepreneur.

One potential explanation for our findings is that early-life exposure to the HRS reform is in fact detrimental to human capital accumulation, especially at critical school ages, due to the increased opportunity cost of schooling induced by the reform ([Xu, 2021](#)). We also examine the long-run impact of exposure to the HRS reforms in childhood and adolescence on educational attainment based on the CLDS. The results in [Table A2](#) suggest that there is a U-shaped relationship between the length of early-life reform exposure and educational attainment, with individuals who experienced approximately 11 years of the HRS reform in their childhood and adolescence having the lowest level of education. A lower level of education is negatively associated with entry into employer entrepreneurship and transitioning from being a solo entrepreneur or employee to an employer entrepreneur ([Coad, Nielsen, & Timmermans, 2017](#)). A lower level of human capital will also make it more difficult to secure, or retain, salaried employment, increasing the likelihood that individuals will become entrepreneurs out of necessity ([Unger, Rauch, Frese, & Rosenbusch, 2011](#)).

One plausible explanation for the significant impact on necessity entrepreneurship is that anecdotal evidence from Japan, South Korea and Taiwan suggests that major land reform either paved the way for, or occurred simultaneously with, significant reforms and institutional changes ([Galor, Moav, & Vollrath, 2009](#)), which are more crucial in influencing necessity entrepreneurship in China ([Sahasranamam & Raman, 2018](#)). For instance, the existing literature suggests that the successful HRS reform has laid the foundation for market-oriented property rights regime, affected social advance and justice, reduced land-related disputes and increased

Table 2
Early-life HRS reform exposure and entrepreneurship.

	(1) OLS	(2) RE	(3) RE-IV
Length of exposure	0.0081*** (2.82)	0.0071** (2.36)	0.0393** (2.23)
Control variables	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
N	6185	6185	6185
adj. R ²	0.0681	0.0726	0.0554
Kleibergen-Paap robust Wald F statistic			103.78 (0.0000)
<i>First stage results</i>			
Interaction between weather adversity and initial irrigation condition			3.5202*** (10.19)

Notes: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01. All specifications include the full set of controls listed in Table A1; full results are available from the authors.

Table 3
Early-life HRS reform exposure and different types of entrepreneurship (RE-IV results).

	(1) Solo entrepreneur	(2) Employer entrepreneur	(3) Opportunity entrepreneur	(4) Necessity entrepreneur	(5) Mixed motivations entrepreneur
Length of exposure	0.0298* (1.86)	0.0186** (2.04)	0.0163 (1.64)	0.0311*** (2.58)	0.0078 (1.14)
Control variables	Yes	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes	Yes	Yes
N	6031	5240	4593	4669	4489
adj. R ²	0.0521	0.0325	0.0567	0.0169	0.0231
Kleibergen-Paap robust Wald F statistic	107.67	95.38	90.07	89.95	85.32
p-value	0.0000	0.0000	0.0000	0.0000	0.0000
<i>First stage results</i>					
Interaction between weather adversity and initial irrigation condition	3.6251*** (10.38)	3.6394*** (9.77)	3.7628*** (9.49)	3.7247*** (9.49)	3.7841*** (9.24)

Notes: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01. All specifications include the full set of controls listed in Table A1; full results are available from the authors.

individuals' social trust and risk-taking behaviour, which could exert long-term impact on the propensity for entrepreneurial activities (Bu & Liao, 2022; Ding, 2007; Xu, 2011).

6. Heterogeneity

In this section, we examine the heterogeneous effects of early-life exposure to the HRS reform on the propensity for entrepreneurship across subsamples. Table 4 presents the heterogeneous effects by gender, family income level, parental education and region. Panel A shows that the length of early-life reform exposure is significantly and positively associated with the probability of becoming an entrepreneur among females, while the association among males is not significant. These results align with previous findings that females tend to benefit more from the land reform in terms of human capital development, especially those at higher education stage, and they are less likely than males to be used as child labour (Albertus et al., 2020).

However, the increasing incidence of entrepreneurship among females does not necessarily imply an improvement in their socioeconomic status, as they are more likely to engage in necessity-based entrepreneurship rather than opportunity-based entrepreneurship in the informal sectors where average wages are lower (Hernandez, Nunn, & Warnecke, 2012). In our sample, 48.96% of females start their business ventures due to a lack of alternative employment opportunities, more than three percentage points higher than that of males. In panel B in Table A6, we find that an additional year of land reform exposure is associated with a 3.01 percentage points increase in the probability of a female becoming a necessity entrepreneur and a 2.12 percentage points increase in the probability of becoming an opportunity entrepreneur. One plausible explanation for our findings is that females are more likely to experience gender discrimination in China's labour market (Wang & Cheng, 2021). They face high levels of gender inequality in social networks and entrepreneurial financing and, thus, are disproportionately represented in the informal sector in which necessity entrepreneurship is most prevalent (Sequeira, Wang, & Peyrefitte, 2016). The results provide strong evidence in support of our argument that the increase in the entrepreneurship rate among females induced by the HRS reform may not improve their socioeconomic status. Thus, gender earnings inequality is likely to persist in the foreseeable future and might even be worse.

Table 4
Heterogeneity (RE-IV results).

	Coefficient	
Panel A: Gender		
Male	0.0298	(1.10)
Female	0.0478**	(2.05)
Panel B: Parental education		
≤6 years	0.0439**	(2.50)
>6 years	0.0351	(0.67)
Panel C: Family income level		
Low	0.0398*	(1.74)
Medium	0.0312	(1.39)
High	0.0571	(1.08)
Panel D: Region		
East	0.0285	(0.35)
Central	0.1207***	(3.51)
West	0.0041	(0.24)

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

In panel B in Table 4, we find that the positive impact of early-life exposure to the HRS reform on the probability of involvement in entrepreneurial activity is mainly driven by individuals with less-educated parents. An explanation is that parents with lower educational attainment are less likely to perceive the economic returns to education to be higher and believe that early investments matter relatively more than late investments (Biroli, Boneva, Raja, & Rauh, 2022; Boneva & Rauh, 2018). They also face higher financial constraints on investing in their children's human capital. Therefore, individuals with less-educated parents, who usually start from a lower baseline, are inclined to benefit more in human capital development when family credit constraints are considerably relaxed by the HRS reform (Wang & Cheng, 2022).

In Panel C of Table 4, we find that the impact of early-life HRS reform experience on the propensity for entrepreneurship is particularly pronounced for individuals from low-income families. We interpret this finding as possibly the result of a higher impact of the HRS reform on the relaxation of credit constraints on children's human capital investment among low-income families. There is emerging evidence that educational investment among relatively disadvantaged families is more susceptible to the influence of a relative increase in income (Song & Zhou, 2019). Another possible reason is that the HRS reform could substantially relax the liquidity constraints faced by individuals from low-income families when they start a new venture. Given that less-educated parents are likely to earn a lower income, the results are consistent with our findings of different treatment effects across parental education levels.

Taken together, the results in Panels B and C imply that the land reform might mitigate income inequality and other associated types of social inequalities in rural China in the long run, due to its significant impact on labour market outcomes of individuals from disadvantaged families.

In Panel D in Table 4, we find that the length of early-life exposure to the HRS reform has a significant association with the probability of entrepreneurship for individuals in the central region, while its impact on the probability of entrepreneurship for individuals in the eastern and western regions are not significant. The reason for this result may be related to relatively early implementation of the HRS reform in the central region. For instance, by the end of 1981, 90% of production teams in Jiangxi province, 69% in Anhui province and 58% in Shanxi province had adopted the HRS, which were much higher than most of provinces in the eastern and western regions. Therefore, individuals who were born in the central region are more likely to have a longer exposure to the HRS reform in their childhood and adolescence, and, thus, benefit more in terms of entrepreneurial activity.

Table 5
Robustness check – controlling for village/county-wave interactive fixed effects and lagged entrepreneurship.

	(1)	(2)	(3)
Length of exposure	0.0080*** (2.70)	0.0059** (1.81)	0.0665** (2.44)
Lagged entrepreneurship			0.4103*** (12.26)
Control variables	Yes	Yes	Yes
Province fixed effects	No	No	Yes
Wave fixed effects	No	No	Yes
Village × wave fixed effects	Yes	No	No
County × wave fixed effects	No	Yes	No
N	6185	6163	2325
adj. R ²	0.2412	0.1915	0.2531

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

7. Robustness checks

We undertake a range of checks to verify the reliability of our main findings. In the first series of robustness checks we examine if our results are sensitive to omitted variables bias. In a first robustness check, to address potential concern about unobserved village/county-year-specific heterogeneity, we control for village/county-wave interactive fixed effects, instead of province and wave fixed effects. The RE results in columns (1) and (2) in Table 5 show that the magnitudes and significance of the length of early-life exposure to the HRS reform are almost identical to those reported in columns (1) and (2) in Table 2, suggesting that potential bias due to village/county-year-specific omitted variables is not a major issue in this study.

The lagged dependent variable has been suggested as an excellent proxy for many omitted variables in the existing literature (Nair-Reichert & Weinhold, 2001). In column (3) in Table 5 we include lagged entrepreneurship as an additional explanatory variable. The IV results show that whether an individual is an entrepreneur is highly correlated with whether that individual was an entrepreneur in the previous period. While the inclusion of past entrepreneurial experience increases the magnitude of the estimated effect of early-life exposure to the HRS reform, it continues to be positively and significantly associated with the probability of becoming an entrepreneur.

Third, we account for a demanding set of cohort trends to capture shared trends in entrepreneurial activity and check whether our main estimates are biased by unobserved province-cohort-specific heterogeneity. Specifically, we further control for the quadratic cohort trend and interaction terms between provincial dummies and the linear and quadratic cohort trends. The results in Table 6 show that this more flexible specification does not qualitatively change our main findings. The estimated effects of early-life land reform experience are very close to those reported in column (3) in Table 2, suggesting that our main estimates are not driven by unobserved heterogeneity specific to cohorts and provinces.

Fourth, we employ the bounding approach proposed in Oster (2019) to check whether our OLS estimates are robust to factors not included in the specifications. Columns (1) to (3) in Table 7 present the estimated effects of exposure to the HRS reform in childhood and adolescence with no controls, the full set of controls listed in Table A1, and both the full set of controls and unobserved heterogeneity, respectively. The bias-adjusted effects of exposure to the land reforms in childhood and adolescence in column (3) are positive and significant at the 10% level. The magnitude of the bias-adjusted treatment effects is very close to that of the IV estimates reported in column (3) in Table 2, suggesting that the OLS estimates are likely to underestimate the true effect of early-life HRS reform experience. Our results meet the robustness standards suggested in Oster (2019), as the bounds of the set $[\tilde{\beta}, \beta^*(R_{max}, 1)]$ do not include zero and fall within ± 2.8 standard errors of the controlled estimates. The value of δ is greater than one, suggesting that our main findings are robust to omitted variable bias.

Fifth, given that the rollout of the HRS reform is non-random and correlated with a set of local conditions (Chen & Lan, 2020), we check whether our estimates of the effect of early-life HRS reform experience are confounded by some predetermined characteristics. Following the approach in the previous literature (e.g. Cui, Liu, & Zhao, 2019), we further control for interactions between the length of early-life reform exposure and potential confounding factors that may be associated with the timing of land reform in our main specification. The predetermined provincial characteristics include the severity of the Great Chinese Famine and the Cultural Revolution, the proportion of urban population, the proportion of irrigated land and the proportion of agricultural output in GDP. The severity of the Great Chinese Famine is measured by the difference between the death rate in 1960 and the average death rate in the three years preceding the Famine (1956–1958), which follows the method employed in Chen and Zhou (2007). The intensity of the Cultural Revolution is measured by the total number of deaths which can be attributed to political persecution between 1966 and 1971 in each province. This measure is taken from Walder (2014). The provincial level proportions of the urban population, irrigated land and agricultural output are measured as their corresponding mean values from 1975 to 1977.⁷

The RE estimates in Table 8 show that the inclusion of these potential confounding factors does not qualitatively change our baseline findings. The effects of exposure to the HRS reform in childhood and adolescence are consistent in both sign and magnitude with our main findings reported in column (2) in Table 2. All interactions between the length of early-life reform experience and these confounders are insignificant, suggesting that our estimates of the effects of early-life reform experience are unlikely to be picking up the impacts of predetermined province characteristics. Moreover, the insignificant effect of the interaction between early-life reform experience and the proportion of irrigated land provides additional evidence for the exogeneity of our instrument.

Sixth, we perform a placebo test and assume that the HRS reform was firstly implemented in 1970, eight years earlier than the actual reform year. The placebo length of early-life HRS reform exposure is constructed in the same manner as our main treatment measure. The results in Table 9 show that the placebo length of early-life reform exposure has no significant association with the probability of becoming an entrepreneur. This test lends further credence to our identification strategy.

Seventh, we examine whether our estimates are sensitive to any villages. We drop one village at a time and replicate the IV estimation in column (3) in Table 2 with a reduced sample. Fig. 2 plots the distributions of the estimated effects of early-life HRS experience on the probability of becoming an entrepreneur and their corresponding t values. We observe that all estimated coefficients obtained from the reduced samples are significant and its distribution centres around the IV estimates obtained in the full sample. The upper and lower bounds of the distribution share the same sign as the baseline estimates. The results suggest that our main findings are not driven by individuals from one village. Moreover, this test provides strong evidence for the reliability of our measure of length of early-life reform exposure, suggesting that it is less likely to be subject to measurement error (Wang, Cheng, & Smyth, 2022).

⁷ The data is from the *China Compendium of Statistics 1949–2008* compiled by Department of Comprehensive Statistics of National Bureau of Statistics.

Table 6
Robustness check – controlling for province-specific trends (RE-IV results).

	(1)	(2)	(3)
Length of exposure	0.0461** (2.16)	0.0384** (2.18)	0.0473** (2.23)
Cohort trend	Yes	Yes	Yes
Cohort trend ²	Yes	No	Yes
Province fixed effects	Yes	Yes	Yes
Province fixed effects*cohort trend	No	Yes	Yes
Province fixed effects*cohort trend ²	No	No	Yes
Wave fixed effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
N	6185	6185	6185
adj. R ²	0.0588	0.0679	0.0764

Notes: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01. All specifications include the full set of controls listed in Table A1; full results are available from the authors.

Table 7
Robustness check – the Oster (2019) test.

	(1) Baseline effect $\hat{\beta}$ (t) [R ²]	(2) Controlled effect $\tilde{\beta}$ (t) [R ²]	(3) Bias-adjusted $\hat{\beta}^*$ R _{max} = 1.3R (t)	(4) δ for $\beta = 0$ given R _{max}
Length of exposure	0.0015 (1.08) [0.0002]	0.0081 (2.82) [0.0681]	0.0323 (1.90)	18.13

Table 8
Robustness check – controlling for potential confounders (RE results).

	(1)	(2)	(3)	(4)	(5)
Length of exposure	0.0055* (1.91)	0.0186** (2.42)	0.0093** (2.45)	0.0074** (2.30)	0.0122** (2.57)
Length of exposure * Cultural Revolution intensity	0.0001 (1.55)				
Length of exposure * Famine severity		-0.0014 (-1.60)			
Length of exposure * Proportion of urban population			-0.0048 (-0.40)		
Length of exposure * Proportion of irrigated land				-0.0003 (-0.05)	
Length of exposure * Proportion of agriculture output					-0.0139 (-1.28)
N	6185	6120	4732	6131	6185
adj. R ²	0.0734	0.0730	0.0738	0.0722	0.0727

Notes: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

Table 9
Robustness check-placebo test (RE results).

	Hypothetical reform year 1970–1977
Falsified length of exposure	0.0085 (1.42)
Control variables	Yes
Wave fixed effects	Yes
Province fixed effects	Yes
N	6185
adj. R ²	0.0735

Notes: t statistics in parentheses; * p < 0.10, ** p < 0.05, *** p < 0.01. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

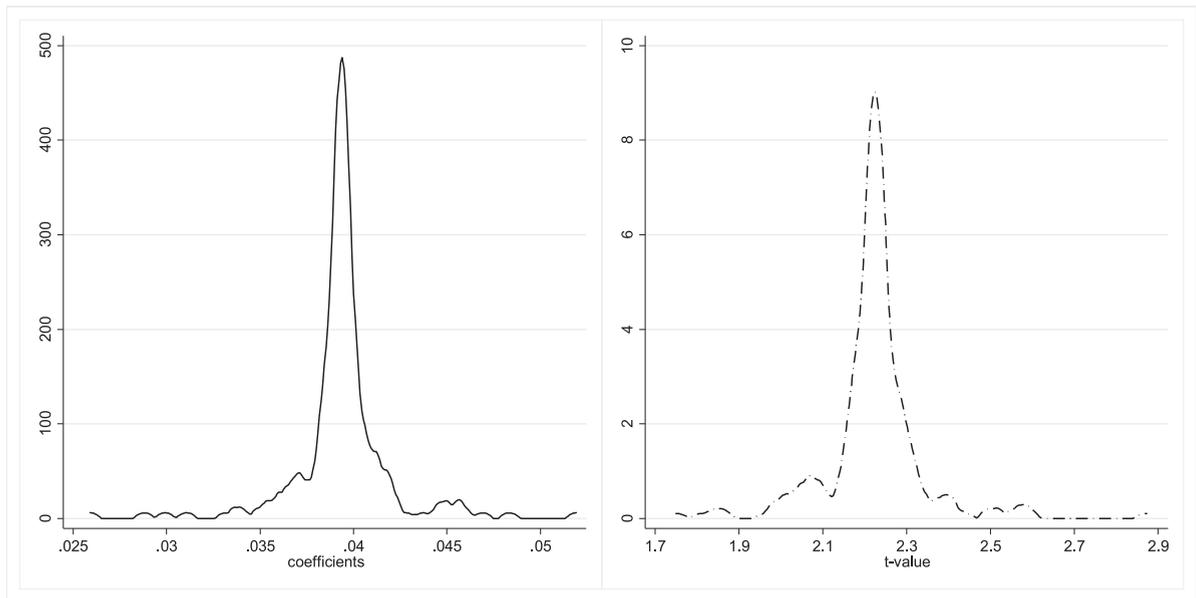


Fig. 2. Robustness check- drop one village at a time.

Eighth, one potential concern is that double counting may occur when we pool the three waves of the CLDS together in our main analysis and employ the RE model to estimate the effect of early-life exposure to the HRS reform on the propensity for entrepreneurship. In our sample, approximately 40, 45 and 15% of respondents were surveyed once, twice and three times, respectively. The double-counting of some individuals may generate an upward or downward bias in estimates when the relationship between early-life land reform exposure and the likelihood of becoming an entrepreneur is more pronounced or not significant among them, respectively. To address this concern, we keep the latest observation for each individual and re-estimate the association between early-life HRS reform experience and the probability of becoming an entrepreneur. The OLS and IV estimates in Table A4 are almost identical to those reported in columns (1) and (3) in Table 2, suggesting that our results are not driven by double-counting issue.

Finally, we employ another dataset to re-examine the effect of exposure to the HRS reform in childhood and adolescence on the probability of becoming an entrepreneur. Specifically, we use the 2010, 2012, 2014, 2016 and 2018 waves of China Family Panel Studies (CFPS). The CFPS, administered by the Institute of Social Science Survey at Peking University, is a nationally representative longitudinal survey that employs an implicit stratified, multistage, multilevel and probability proportional to the size sampling method.⁸ The 2010–2018 waves cover 33,600, 35,719, 37,147, 36,892 and 37,354 individuals and 14,960, 13,315, 13,946, 14,019 and 14,218 households from 635 communities/villages across 25 mainland provinces (excluding Inner Mongolia, Xinjiang, Tibet, Hainan, Ningxia, and Qinghai), respectively. The survey also collects information on an individual's employment, year and place of birth, the timing of the HRS reform in a village, and a wide range of personal and family characteristics.

Consistent with our approach when using CLDS, we restrict our sample to individuals who are aged between 15 and 60 years, born in 1970 or later, hold a local *hukou* and whose county of birth is the same as the county surveyed. Our final CFPS sample consists of 2769 individuals from one of the 215 villages who was exposed to the HRS reform in early life in the 2010 wave, 2558 individuals in the 2012 wave, 3376 individuals in the 2014 wave, 4037 individuals in the 2016 wave and 3412 individuals in the 2018 wave. On average, individuals surveyed in CFPS have experienced 14.16 years of the HRS reform below 18 years old and among them, 14.16% are solo or employer entrepreneurs, which are very close to the findings based on the CLDS. Table 10 presents the OLS, RE and RE-IV estimates of the effect of early-life HRS reform experience on the propensity for entrepreneurship. We find that the length of early-life exposure to the HRS reform is significantly and positively associated with an individual's probability of becoming an entrepreneur. The IV results in column (3) suggest that an additional year of early-life HRS reform exposure leads to a 1.13 percentage points increase in the probability of becoming an entrepreneur. The results based on the CFPS are consistent with our main findings in Table 2.

8. Conclusion

We have examined the causal effect of exposure to the HRS reform in childhood and adolescence on the probability of becoming an entrepreneur later in life. We identify the long-run impact of land reform by exploiting exogenous temporal and geographical variations in the village-level rollout of the HRS reform between 1978 and 1985 that transformed China's land property rights from a communal system into an individualized tenure system. We instrument for the length of exposure to the land reforms in early life with

⁸ For a detailed description of the CFPS, see Xie and Hu (2014) and the CFPS website www.iss.pku.edu.cn/cfps/en/index.htm.

Table 10

Robustness check – results based on data from the 2010–2018 CFPS.

	OLS	RE	RE-IV
Length of exposure	0.0029** (2.04)	0.0046** (2.31)	0.0113** (2.17)
Control variables	Yes	Yes	Yes
County fixed effects	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
N	16,152	16,152	16,151
adj. R ²	0.0910	0.1075	0.1134
Kleibergen-Paap robust Wald F statistic			1118.25 (0.0000)
<i>First stage results</i>			
Interaction between weather adversity and initial irrigation condition			3.1770*** (6.17)

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include a full set of controls for personal and family characteristics as well as province and wave fixed effects; full results are available from the authors.

the interaction between provincial level adverse weather shocks and the initial irrigation condition before the first wave of land reform in 1978. We find that early-life land reform exposure significantly increases an individual's probability of involvement in entrepreneurial activity in adulthood. This finding is robust to a number of sensitivity checks and the use of CFPS as an alternative dataset. In terms of the economic significance of our results, the magnitude of the treatment effect is higher than that of childhood experience of the Great Famine and the Sent-Down Youth Program in China on propensity for entrepreneurship documented in the existing literature. Our findings imply that the positive impact of land reform on entrepreneurial ventures would be understated without considering its long-run impact on entrepreneurship later in life for those exposed to the reforms in childhood and adolescence.

We find that the positive association between early-life exposure to the HRS reform and the probability of becoming an entrepreneur is mainly driven by solo and necessity entrepreneurship. There is considerable heterogeneity in the long-run impact of early-life exposure to the HRS reform across subsamples. Females, individuals from low-income families, individuals with less-educated parents and individuals in the central region who are exposed to the land reform in childhood and adolescence are more likely to become entrepreneurs. The heterogeneity results imply that while the land reform has the potential to reduce income inequality within rural areas and between genders, its impact might be limited by the fact that individuals from disadvantaged households and females are more likely to engage in necessity-based entrepreneurship in the low-wage informal sector.

Our findings carry some important practical implications for fostering entrepreneurship in both China and other Asian countries in which land reform has been widely advocated as a means to fuel economic growth and reduce inequality. Our findings suggest that a way to foster entrepreneurship for the Chinese government is to undertake further market-oriented land reform by granting more property rights to individual households and building an effective pricing system in rural areas to facilitate farmland transfer. This particularly applies to the new round of land tilting and certification reform initiated by the central government in 2014. Moreover, our study reveals that disadvantaged individuals are highly skewed in the informal sectors and are more likely to end up in low-income entrepreneurship, which might impair the impact of land reform on reduction of income inequality. To circumvent this problem, some form of government intervention is needed to assist individuals from disadvantaged families and females in creating new business, investing in human capital and promoting their labour market status, such as pairing land reform with conditional financial support, entrepreneurial training, rural education initiatives and labour market reforms that seek to reduce gender discrimination (Morris & Tucker, 2021).

Declaration of Competing Interest

None.

Data availability

The authors do not have permission to share data.

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Appendix A. Appendix

Table A1

Summary statistics for control variables.

Variable	Definition	Mean	Std. Dev.
Male	Male =1, female = 0	0.50	0.50
Marital status			
Single	Reference group	0.14	0.34
Married		0.85	0.36
Other		0.01	0.12
Education	Years	8.37	3.36
Hukou status	Agricultural hukou = 1, non-agricultural hukou = 0	0.96	0.20
Health status	Scale: very healthy = 1; very unhealthy = 5	3.87	0.91
CCP member	Member of the Chinese Communist Party (yes = 1; no = 0)	0.04	0.20
Medical insurance	Has medical insurance: yes = 1; no = 0	0.90	0.30
Superannuation	Has superannuation: yes = 1; no = 0	0.50	0.50
Family size	Number of family members	4.12	1.59
Parental education	The highest level of education among parents (years)	6.03	3.90
Family income	Annual family income, in logarithm	8.98	1.38
Cohort trend	A birth year linear trend equals to the birth year-1969	10.32	7.39
Urban area	Urban area = 1, rural area = 0	0.01	0.09

Table A2

Early-life HRS reform exposure and educational attainment.

	RE
Length of exposure ²	0.0082*** (3.07)
Length of exposure	-0.1791*** (-2.73)
Control variables	Yes
Province fixed effects	Yes
Wave fixed effects	Yes
N	6185
adj. R ²	0.3836

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1; full results are available from the authors.

Table A3

Robustness check-dropping the 2012 wave.

	(1) OLS	(2) RE	(3) RE-IV
Length of exposure	0.0074** (2.33)	0.0067** (2.02)	0.0436** (2.43)
Control variables	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes
Wave fixed effects	Yes	Yes	Yes
N	5301	5301	5301
adj. R ²	0.0663	0.0725	0.0512
Kleibergen-Paap robust Wald F statistic			92.08 (0.0000)
<i>First stage results</i>			
Interaction between weather adversity and initial irrigation condition			3.5684*** (9.60)

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1; full results are available from the authors.

Table A4

Robustness check-keeping the latest observation for each individual.

	OLS	IV
Length of exposure	0.0072** (2.33)	0.0415** (2.13)

(continued on next page)

Table A4 (continued)

	OLS	IV
Control variables	Yes	Yes
Province fixed effects	Yes	Yes
Wave fixed effects	Yes	Yes
<i>N</i>	4172	4172
adj. <i>R</i> ²	0.0600	0.0288
Kleibergen-Paap robust Wald F statistic		70.55 (0.0000)
<i>First stage results</i>		
Interaction between weather adversity and initial irrigation condition		3.4465*** (8.40)

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

Table A5

HRS reform exposure at different life stages and entrepreneurship.

	RE
Length of exposure before 18 years old	0.0082*** (3.31)
Length of exposure between 18 and 25 years old	-0.0607 (-0.95)
Control variables	Yes
Province fixed effects	Yes
Wave fixed effects	Yes
<i>N</i>	8925
adj. <i>R</i> ²	0.0772

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

Table A6

Heterogeneity in effects of early-life HRS reform experience on different types of entrepreneurship by gender (RE-IV results).

	(1) Opportunity entrepreneur	(2) Necessity entrepreneur	(3) Mixed motivations entrepreneur
Panel A: Male			
Length of exposure	0.0118 (0.77)	0.0302 (1.59)	-0.0007 (-0.07)
<i>N</i>	2212	2250	2145
adj. <i>R</i> ²	0.0816	0.0236	0.0436
Panel B: Female			
Length of exposure	0.0212* (1.73)	0.0301** (1.99)	0.0171 (1.62)
<i>N</i>	2381	2419	2344
adj. <i>R</i> ²	0.0462	0.0172	0.0079

Notes: t statistics in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All specifications include the full set of controls listed in Table A1 and province and wave fixed effects; full results are available from the authors.

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