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Land Expropriation, Household Behaviors, and Health Outcomes: Evidence from China*

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Abstract

Using a nationally representative dataset from China, we exploit an event study approach to trace out the consequences of land expropriation on household economic behaviors and health outcomes. The expropriated rural households receive an average compensation per capita of over 6 thousand *yuan* (60 percent of pre-event income) immediately after expropriation and thus have a higher income level. Among the people in these households, the likelihood of working in the agricultural sector decreases while that of working in the non-agricultural sector increases. Meanwhile, medical consumption per capita increases substantially by 0.4 thousand *yuan* and the saving rate rises by 14 percentage points. People in these households experience a significant improvement in subjective health status, in terms of self-reported health and depression, while their health-related behaviors do not change significantly. Overall, land expropriation influences the economic and health conditions of the affected rural households by providing additional liquidity.

Keywords: Land Expropriation, Household Behaviors, Health
JEL Classification: H13, I10, O18

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1. Introduction

Along with the development of the states, land expropriation has been a common occurrence throughout much of human history and remains prevalent in today's developing countries (Besley and Ghatak 2010). According to the Land Matrix, more than 1.7 percent of the world's agricultural area was expropriated from 2000 to 2012, a phenomenon referred to as the *global land rush*. (Anseeuw et al., 2012; Lay et al., 2021).[2] Researchers have conducted studies about the economic costs associated with insecure property rights, such as undermining investment incentives and hindering long-term development (Jacoby et al., 2002; Johnson et al., 2002), as well as political consequences including lower political trust and more conflicts between officials and affected citizens (Sha, 2023; Zhao and Xie, 2022).

However, there remains a paucity of evidence on the effects of expropriation on household behaviors and health consequences. One major reason is that empirical data capturing both land expropriation experience and subsequent household behaviors is scarce. Among developed countries, expropriation happened frequently in earlier times when rich data are not available. For instance, to promote railway construction, milling, and mining, large-scale land expropriation in the US was prevalent between 1870 and 1910 when data access was limited (Besley and Ghatak, 2010). Recent incidences of land expropriation predominantly arise in developing countries, while nationally representative and reliable datasets are scarce, referred to as *data deprivation* mentioned by Serajuddin et al. (2015).

Leveraging the unique aspects of China's land expropriation context, our study aims to analyze the potential consequences of land expropriation on household behaviors and health outcomes. Answering this question is important for several reasons. First, land expropriation represents a crucial phase in state development. Governments frequently expropriate land to facilitate infrastructure construction, urbanization, or the provision of public goods, all of which are key steps in economic growth. Numerous developing countries are frequently experiencing land expropriation, paralleling the experiences of developed nations in their earlier histories (Besley and Ghatak, 2010; Lay et al., 2021). Second, land expropriation often entails compensation payments to affected parties and it is directly relevant to the well-being of them. However, the impact of this additional liquidity on household behaviors has been largely neglected in existing research. Finally, for farmers, agricultural

[2] Refer to the Land Matrix for large-scale (200 hectares or larger) land expropriation. Over 33 million hectares of land expropriation were documented in the dataset during 2000-2020. The top 10 countries with the highest expropriation size are all developing nations, including Indonesia, Ukraine, Russia, Brazil, Papua New Guinea, Argentina, Philippines, Ethiopia, Myanmar, South Sudan, and Ghana. Unfortunately, China is not included in the Land Matrix dataset because the team lacks local partners and networks in this area (Lay et al., 2021).

land is often considered a major asset, as it provides the foundation for farming activities and serves as a valuable resource for agricultural production. To date, there is limited empirical evidence regarding the direct impact of losing their most valuable capital goods on farmers' economic behaviors and health conditions.

Land expropriation in China provides a natural context for examining impacts on household behaviors and health outcomes. On the one hand, land expropriation in China is *mandatory*, with the local governments maintaining direct and major control. Individuals do not have the option to voluntarily sell their land, thus minimizing the potential selection bias inherent in voluntary land transactions (Ma and Mu, 2020). On the other hand, the China Family Panel Studies (CFPS) dataset offers a wealth of information suitable for our analysis, including data on land expropriation experiences, household behaviors, and individual health outcomes (Sha, 2023; Zhao and Xie, 2022). The expropriated households in the CFPS dataset account for more than 25 percent of the entire sample, ensuring our analysis is based on a sizable population of affected individuals.

Our empirical identification strategy is built on the different timing of land expropriation across households. Examining the determinants of the timing of expropriation, we find that the timing of expropriation has insignificant correlations with a variety of regional, household, and individual characteristics, which is consistent with the fact that land expropriation is mandatory and not affected by individual/household preferences or willingness. The different timing of such events allows us to use the event study approach to quantify the magnitude of potential effects. The findings remain robust when using staggered difference-in-differences (DD) or considering heterogeneous treatment effects (Borusyak et al., 2024; De Chaisemartin and D'Haultfœuille 2020).

We begin by investigating the related compensation and labor market outcomes of the household members. First, the households receive an average compensation per capita of 6.3 thousand *yuan* in the first year after expropriation, while the estimate becomes 1.7 thousand *yuan* afterward. Second, on average, the probability of employment in the agricultural sector drops by 5.1 percentage points (11 percent), while that of employment in the non-agricultural sector increases by 4.2 percentage points (8.1 percent). A more pronounced effect is observed when examining the latter part of the period (i.e., the second and later post-event periods), indicating an increasing trend in the effects as time progresses. Taken together, affected individuals are mainly experiencing structural changes in their labor supply, with a small and statistically insignificant decline in the overall labor force participation rate.

We then explore the possible effects on household incomes. Consistent with the magnitude of the impact on compensation, household income per capita increases by 6.8 thousand *yuan* in the first year

after expropriation, suggesting that income from other sources such as agricultural products or wages does not change substantially in the first year. In line with the results of labor market outcomes, household agricultural earnings per capita drops while household non-agricultural earnings per capita increases, with the magnitude of average changes being larger during the latter part of the post-expropriation periods.

Meanwhile, we conduct parallel analysis for household consumption and saving rates. We find that medical consumption per capita significantly rises by 0.44 thousand *yuan* (41 percent) while the impacts on the consumption of other categories are positive but small and insignificant, leaving the impact on total consumption increases by 0.96 thousand *yuan* insignificantly. In addition, the significant effects on consumption occur mainly in households with less-educated household heads or with a lower consumption level before expropriation, i.e., they are more likely to face credit or liquidity constraints. Given a much higher income but slightly increased consumption after expropriation, the household saving rate rises by 14 percentage points. The increase is persistent during three post-event survey waves. With the median saving rate of 24 percent prior to the event, such an effect is both economically and statically significant. This might be explained by the increased precautionary saving motive caused by land expropriation, as land is traditionally viewed as a major and informal insurance for rural households (Yu et al., 2010).

Moreover, we explore the consequences of land expropriation on health outcomes. The probability of reporting good health status significantly rises by 19 percent, while that of depression scores drops by 5.1 percent in the latter part of the post-expropriation period (i.e., the second and later post-event periods). The positive effects on subjective health status are concentrated on individuals in the expropriated households receiving higher compensation. However, we do not find significant impacts of expropriation on individuals' physical health such as chronic diseases, or health-related behaviors measured by obesity, smoking, and medical insurance participation. Considering the results on household income and consumption as well as labor market outcomes, we conclude that the enhanced level of health status could be potentially explained by lower farm work participation, higher usage of medical services, and especially the increase in household income that mainly comes from compensation.

We conduct a range of robustness checks to examine the validity of the identification strategy and explore the potential spillover effects. We show that expropriated individuals and households are not systematically different from those not expropriated. We also find that the results are not sensitive to data attrition or alternative model specifications, such as using staggered DD designs, the inclusion of

province fixed effects or individual/household fixed effects, or considering heterogeneous treatment effects. In addition, we find insignificant spillover effects of a certain scale of land expropriation in the local village on households that did not experience expropriation.

The above findings provide a new perspective for understanding the role of land expropriation -- it can serve as a potential solution to land market imperfections. In China, where land is publicly owned and there is no well-functioning market for land use rights, many rural households might want to move into the non-agricultural sector to start a new life but are unable to due to the shackles from the land. Land expropriation may provide them with an effective and legal way to turn the illiquid land into liquid cash (compensation). Our findings show that this additional liquidity injection has positive effects on some economic and health outcomes, such as the probability of entering the non-agricultural sector, consumption, and subjective health status. Of course, one should be cautious to interpret our findings into land expropriation being a universally good thing, as we only examine a few economic and health outcomes, and also find that it increases households' uncertainty about the future, in terms of increased saving rates. Land expropriation may negatively affect other outcomes due to its mandatory nature, particularly for those households who prefer to stay, such as reducing political trust and increasing local conflicts (Sha, 2023).

Our findings contribute to a range of literature. First, scholars have well documented the effects of land expropriation or insecure property rights on economic and political outcomes.[3] Our results contribute to the literature by examining how land expropriation impacts labor market behaviors, household income and consumption, and health outcomes with a nationally representative sample in a unified context. The outcome variables selected for this study provide direct and comprehensive insights into the living conditions of households affected by land expropriation, thereby advancing our understanding of such a critical phase in national development that many developing countries inevitably undergo. The large-scale panel data in a more recent time period enables us to provide new credible estimates.[4]

[3] Scholars find that insecure property rights may reduce investment incentives for households (Cull and Xu, 2005; Jacoby et al., 2002; Johnson et al., 2002; Leight, 2016), decrease productivity (Chen, 2017), increase individual migration (Ma and Mu, 2020; Wang et al., 2020; Zhang and Song, 2022), induces social exclusions (Hui et al., 2013), and results in political distrust and local conflicts with government officials (Sha, 2023; Zhao and Xie, 2022). Meanwhile, secure property rights have been shown to induce investment (Galiani and Schargrodsky, 2010; Goldstein and Udry, 2008; Goldstein et al., 2018), increase credit access (Deininger and Goyal, 2012), boost productivity (Banerjee et al., 2002; Gottlieb and Grobovsˇek, 2019), improve resource allocation efficiency (Beg, 2022; Chari et al., 2021; De Janvry et al., 2015; Field, 2007), spur entrepreneurship (Bu and Liao, 2022), and promote migration (Chernina et al., 2014).

[4] To the best of our knowledge, there are a couple of exceptions. Xie (2019) explored the employment effects of land expropriation using cross-sectional data collected in 2014 from Nanjing, a provincial capital city in China. Wang et al. (2019) studied the health impacts of land expropriation using cross-sectional data collected in 2011 from Chengdu, another provincial capital city in China. Zhao et al. (2022) also used descriptive methods to study the impacts of land expropriation on a series of health outcomes. Our study employs causal inference techniques to assess the impacts of expropriation on not only health outcomes but also other vital variables such as labor market outcomes and household income and consumption, which is more credible and comprehensive.

Second, our findings speak to the studies on credit and financial constraints (Agarwal et al., 2007; Evans and Moore, 2012; Thakor, 2022; Wang, 2012; etc.).[5] Given that property rights protection can provide more liquidity for fixed assets, turning "dead" property, such as land, into "live" assets that serve purposes beyond their primary functions (De Soto, 2000).[6] We add up to this literature by studying the impact of turning illiquid land assets into liquid cash on households behaviors and health outcomes, which may serve as an inspiration for the design of land expropriation in other developing countries.

Third, our work is also related to the literature on precautionary saving and the substitution among different insurances (Baiardi et al., 2020; Borghans et al., 2014; Leland, 1968; Lugilde et al., 2019; Rask and Rask, 2000). Since land serves as insurance against food shortage for rural farmers (Yu et al., 2010), the expropriation of land compels affected individuals to leave this insurance and face increased uncertainty in the future. Empirically showing the effects of land expropriation on the saving behaviors of affected households, this study complements this literature by showing the effects of additional uncertainty on precautionary saving and providing novel evidence about the substitution effects between land and self-insurance.

Fourth, our paper is related to the literature that investigates the relationship between income and health (Apouey and Clark, 2015; Cesarini et al., 2016; Deaton, 2008; Lindahl 2005; Raschke 2019; Van Kippersluis and Glama, 2014).[7] Our findings show that the compensation brought by land expropriation as a source of positive income shock to investigate its impacts on a wide range of health outcomes, including subjective health status, physical health, and health-related behaviors.

Last, our findings also connect to a growing literature on the forced migration or inheritance of land. These studies examine the labor market impact of forced migration on people who lose their original land due to wars (e.g., Bauer et al., 2013; Sarvimäki et al., 2022) or natural disasters (e.g., Nakamura et al., 2022), and the occupational choice affected by the inheritance of agricultural land (e.g., Fernando, 2022). Similarly, we find that individuals who lose their land due to a mandatory policy, i.e., land expropriation, move from the agricultural sector to non-agricultural work.[8]

[5] Research has documented how financial constraints and liquidity affect consumption (Agarwal et al., 2007; Agarwal and Qian, 2014), agricultural productivity (Thakor, 2022), entrepreneurship (Evans and Jovanovic, 1989; Hurst and Lusardi, 2004; Paulson and Townsend, 2004; Wang, 2012), and mortality (Evans and Moore, 2012).

[6] For instance, it is well documented in the literature that the land titling reform can mitigate the land owners' credit constraints (Deininger and Goyal, 2012; Zhang et al., 2020), and raise the wealth and income of the owners (Bu and Liao, 2022; Chernina et al., 2014).

[7] For example, Deaton (2008) uses Gallup World Poll to show that the fraction of people satisfied with their health is higher in higher-income countries. There are also studies using lottery wins as income shocks to explore their effects on health, such as Apouey and Clark (2015), Cesarini et al. (2016), Lindahl (2005), Raschke (2019), with varying results observed across countries. Van Kippersluis and Glama (2014) also use inheritances to test the impact of the windfall on health behaviors.

[8] We thank the reviewer for her/his constructive suggestions.

The rest of the paper is organized as follows. Section 2 describes the institutional background. Section 3 introduces the data and empirical strategy. Section 4 reports our main results of mechanical effects, labor market outcomes, household income and consumption, and health outcomes. Section 5 discusses the validity of findings and offers additional robustness checks. Section 6 concludes and discusses.

2. Institutional Background: Land Expropriation in China

In China, all land is publicly owned. The state owns the land in urban areas, while the collectives (i.e., villages) own the land in rural areas. The land is divided into three types of use: agricultural land, construction land, and unutilized land. The inhabitants in rural areas are entitled to privately use the land for agricultural purposes within a certain tenure, generally 30 years, which is stipulated in the contracts villagers sign with the village committee. The land in rural areas can be legally transferred for agricultural use in a rental market, with changes in use rights and unchanged ownership.

Moreover, any organization or individual must apply for the use rights of the land owned by the state, if they need land for construction purposes in urban areas. The *Constitution of the People's Republic of China (PRC)* says that according to the law, the state can expropriate land for the public interest and give corresponding compensation. The same clause is also mentioned in the *Land Administration Law*. In line with these, collectives or villagers themselves are not certified to sell the land to a third party for construction use. Local governments are officially entitled to expropriate land from rural households, convert it into state-owned urban land, and then sell it to a third party for construction purposes. In this sense, land expropriation can be seen as a legal and effective way for rural households to "sell" their lands and move on from being tied to the land.[9]

Local governments usually draft yearly land utilization plans in accordance with the local development plans. Given the top-down nature of land use planning, local governments are not required to consult with the collectives or villagers when making these decisions. Only after the plan is made are they obligated to publicize information regarding the location, time, and compensation arrangements for the land expropriation.

Under economically decentralized and politically centralized institutional settings in China, local governments are incentivized to expropriate land (Xu, 2011). First, the revenue from land expropriation is an important source of extra-budgetary revenues for local governments. In the context of economic decentralization, local governments' fiscal revenues are composed of two parts, budgetary

[9] We thank the reviewer for her/his constructive suggestions.

and extra-budgetary revenues. They need to share their budgetary revenues with the central government but have exclusive control rights over the extra-budgetary revenues, which mainly consist of land sales revenues. As the sole legal sellers in the urban land market, they can expropriate land at a relatively low compensation price and sell it at a much higher monopoly price to gain excess earnings for extra-budgetary revenues. Second, to gain promotion, local governments need to demonstrate their abilities by developing the local economy. Due to political centralization, the central government has control over public officials nationwide, leading to a performance-based tournament for promotion among the cadres at the same level (Li and Zhou, 2005; Yao and Zhang, 2015). Consequently, to drive local economic development, local government officials tend to expropriate land for infrastructure construction, industrialization, and urbanization.

Specifically, local governments set up the basic scheme of compensation for the expropriated land, which varies across localities. According to the *Land Administration Law*, farmers are entitled to three types of compensation: compensation for land loss, resettlement subsidies, and compensation for structures and standing crops. The calculation of the former two items is based on the average market value of the annual yield of crops cultivated on the land for the past three years, while the total compensation paid should be no more than 30 times the estimated value. For the attachments like houses and crops on the land expropriated, the standards for compensation are prescribed by the province-level government. Local governments also adopt several new measures in recent years to raise the compensation standard, taking not only the original agricultural purpose of the land but also the location, the supply and demand relationship of the land, and the local development level into consideration. According to Sha (2023), even though there exist other forms of compensation like allocating another piece of land, pension insurance, providing jobs, transferring *hukou* from rural to urban, etc., cash is the most popular form of compensation, accounting for more than 70 percent.

The impacts of land expropriation on household behaviors is controversial. For one thing, due to its mandatory/involuntary nature, some households who prefer to stay but cannot may have grievances against the local government. It was reported that violent land expropriation in some regions had led to villagers' distrust of the local government and local conflicts, and that these conflicts prompted the official authority to take measures to investigate and punish illegal and irregular forced land expropriation.[10] Recent studies on land expropriation document an adverse political consequence of land expropriation, with decreased political trust and increased local conflicts (Sha, 2023).

For another, though the compensation paid to farmers for their expropriated land is usually less

[10] See https://www.gov.cn/xinwen/2014-10/17/content_2766501.htm and http://news.cntv.cn/2013/05/14/ARTI1368522528284314.shtml (in Chinese) for more details.

than the market value of the land (Ma and Mu 2020; Sha 2023), the amount of compensation is considerable compared to the income of rural households. Our calculations in the results section using CFPS, a nationally representative survey data in China, indicate that the average income of households before expropriation is 10.3 thousand *yuan*/capita, while the compensation received immediately after expropriation is 6.3 thousand *yuan*/capita, accounting for more than half of their annual income. This certain injection of liquidity may ease their budget constraints and thus could potentially affect their economic and health outcomes, such as consumption and health. For instance, some reports show that some expropriated households had satisfying compensations and held optimistic attitudes toward their new lives.[11]

In the meantime, high medical costs have long been a major challenge for Chinese farmers. Guo et al. (2020) report significant disparities in outpatient and inpatient services both within and between urban and rural areas, with household income playing a crucial role in explaining this phenomenon. Li and Zhu (2006), Wang and Yu (2016), and Yang and Kanavos (2012) also reach a similar conclusion. Hence, it is of great significance to assess the impact of such a windfall from land expropriation on their health outcomes.

3. Data and Empirical Strategy

3.1 Data

We primarily use data from the China Family Panel Studies (CFPS), the Chinese equivalent of the US Panel Study of Income Dynamics (PSID). The CFPS is a nationally representative, biennial longitudinal survey launched in 2010 by the Institute of Social Science Survey (ISSS) of Peking University. The five major data modules collect information from communities, households, household members, adults, and children, respectively. The main sample covers 25 provinces, 162 counties, and 649 villages in mainland China. The CFPS questionnaire has a rich set of questions covering topics such as economic activities, education outcomes, family dynamics and relationships, migration, and health. To maximize the sample size for analysis, we use all six waves (2010, 2012, 2014, 2016, 2018, and 2020) of data up to now.

We use the CFPS data because households are asked about whether their land was expropriated in the past 12 months in each wave of the survey. Besides, households provide information about the

[11] See https://news.sina.com.cn/o/2013-02-16/103926272493.shtml, https://www.hainan.gov.cn/hainan/sxian/201308/75b64673558842b4bc1fe0ef88a57e53.shtml, https://www.mnr.gov.cn/dt/td/201706/t20170616_2360353.html, https://news.sina.com.cn/o/2017-06-28/doc-ifyhmtrw4261385.shtml, https://www.thepaper.cn/newsDetail_forward_3514759, and http://www.huizhou.gov.cn/wsfw/ggfw/zf/spf/content/post_4385503.html (in Chinese) for more details.

specific land expropriation year in the first wave (the 2010 wave). More importantly, the CFPS traces every household and individual in each wave, providing a good opportunity for us to assess the dynamic impact of land expropriation. Previous studies such as Sha (2023) and Zhao and Xie (2022) have used this dataset to analyze the potential impacts of land expropriation on political trust and local conflicts.

Different from the outcomes investigated by earlier studies, we focus on the labor market, income and consumption, and health outcomes, which may be more directly relevant to individual and household welfare. Specifically, we focus on 1) labor market outcomes at the individual level, such as being involved in farm work or off-farm work; 2) incomes and consumptions at the household level; and 3) health conditions at the individual level, such as self-reported health, chronic diseases, etc.

Figure 1 plots the proportion of households who ever had land expropriation experience over the calendar year since 2010. Land expropriation seems not a rare event for households in rural China. The proportion increased from 11.8 in 2010 to 27.0 percent in 2020. In other words, there is 15.2 percent of the households in the whole sample experiencing land expropriation during the years covered by the CFPS. We restrict our sample to those between the ages of 20 and 80 at the survey time.[12] In line with event study literature (Dobkin et al., 2018; Gross et al., 2020), we exclude households whose land was expropriated between 2000 and 2010, as they are considered always-treated units. In our analysis, we include households who ever had their land being expropriated between 2012 and 2020.[13] Our baseline sample comprises 1,182 households and 3,581 individuals.

Table 1 displays basic summary statistics for our primary analysis samples (columns 1-3) and the whole CFPS sample (columns 4-6). All outcomes are self-reported. We employ the Consumer Price Index (CPI) to adjust all income and consumption amounts to 2010 levels, which serves as the starting point of the sample. Individuals' labor market outcomes are presented in Panel A of Table 1. We categorize individuals' jobs into two categories: agricultural work and non-agricultural work. "Agricultural work" refers to individuals who work in the agricultural sector, such as operating their own farm or other agricultural businesses like fishery or animal husbandry. "Non-agricultural work" refers to individuals who are employed by someone else or individuals working for themselves in non-agricultural industries such as retail and entrepreneurship.

Panels B and C of Table 1 present the summary statistics of household incomes and consumption.

[12] For the individual sample, we restrict the sample to individuals who aged between 20 and 80 from 2010 to 2020. For the household sample, we restrict the sample to households with the household head aged between 20 and 80 from 2010 to 2020.
[13] Although the CFPS covers both urban and rural respondents, urban households and individuals are excluded from our analysis sample because land expropriation occurs exclusively in rural villages.

In addition to household income, we are concerned about two income categories corresponding to the above job categories, including agricultural earnings and non-agricultural earnings. Besides, household consumption is divided into four categories: medical service, other service consumption, food and dress consumption, and housing-related and daily used consumption. The medical expense is included in the service consumption category. Except for the saving rate and family size, all variables in these two Panels are expressed in per capita terms. The average household income and consumption per capita are 15.2 thousand *yuan* and 12.5 thousand *yuan*, respectively.

We report individual health-related outcomes, individual demographics, and household head demographics in Panels D, E, and F, respectively. In our sample, the gender composition is almost balanced, and the average age in 2015 of individuals is approximately 46 years. We classify the education level of the individuals into three groups: primary school or below, junior high school or above, and missing education information. Fifty-two percent of the individuals acquire a primary school or below education. Only several individuals miss their education information.

Columns 4-6 show the summary statistics for the same variables in the whole CFPS sample, which do not differ systematically from the analysis sample we use. This indicates that the sample we constructed is representative.

3.2 Empirical Strategy

In light of the roll-out of the expropriation, we employ an event study approach that utilizes the timing of land expropriation to identify the dynamic effects on individuals and households. We estimate both nonparametric and parametric event study models. To begin with, it is important to note that the CFPS only asks about land expropriation experience during the previous 12 months and it conducts surveys biennially. Consequently, there is a possibility of imprecise measurements of expropriation, as some households may have experienced land expropriation without documentation in the dataset. These measurement errors suggest that the estimates from our event study approach should be considered as a conservative lower bound.

Nonparametric Event Study. We analyze the coefficients on various indicator variables for the time relative to the event ("event time"). A key advantage of this method is that it enables us to intuitively assess the pattern of outcomes relative to the time of expropriation. The nonparametric event study model's specification takes the form:

$$y_{ict} = \theta + \sum_{r=-3}^{-2} \mu_r + \sum_{r=0}^{2} \mu_r + X_{ict}\alpha + \delta_t + \delta_c + \epsilon_{ict}, \quad (1)$$

where i refers to individual or household, c denotes county, and t denotes calendar time periods. y_{ict} corresponds to the outcome variables of interest at the individual or household level. X_{ict} signifies a vector of control variables. δ_t and δ_c are coefficients on calendar time and county fixed effects, respectively.[14] μ_rs are coefficients on indicators for the time relative to the land expropriation. The key coefficients of interest are the μ_rs, which estimate the outcome at a given r relative to the omitted category μ_{-1}.

In the biennial CFPS data, event time r refers to the survey wave relative to the survey wave in which the household first reported having land expropriation ("first report expropriation wave", i.e., $r = 0$). The $r = 0$ interview occurs within a year after the expropriation occurs. We analyze up to three waves prior to and two waves after the first report expropriation wave. We combine three or more waves before the first report expropriation wave as μ_{-3}, and combine two or more waves after the first report expropriation wave as μ_2. The omitted category μ_{-1} reflects an interview conducted, on average, one year prior to the land expropriation. For the individual-level baseline specification, additional covariates of X_{ict} include fixed effects for the individual's gender, age, and education. To capture the age profile for different genders, we also incorporate the dummies for the interaction of the individual's gender and age fixed effects. For the household-level baseline specification, we use the household head's corresponding information. Considering that the sampling of the CFPS stratifies at the village level and the adoption of land expropriation programs also varies considerably across villages, we cluster robust standard errors at the village level.[15]

The nonparametric event study in Equation (1) relies on the identifying assumption that, conditional on having a land expropriation during our observation window and the included controls, the timing of the expropriation is uncorrelated with the outcome. Given that land expropriation is always subject to the development plans of local governments, and villagers themselves have minimal effects on this political action, the assumption is likely satisfied. This assumption may also be validated by the parallel pre-trend in our event-study results. In the robustness section, we further examine the correlation between the timing of expropriation and several characteristics at county, household, and individual levels.

The nonparametric event study in Equation (1) enables us to examine patterns in outcomes in the waves leading up to land expropriation. The relatively sharp timing of the event allows us to visually

[14] Considering that high-dimensional fixed effects may exacerbate measurement error bias and increase the likelihood of false positives (Jennings et al., 2023), we control for county fixed effects instead of individual/household fixed effects in the baseline analyses. We also report regressions controlling for individual/household fixed effects in our robustness section, and find consistent results with the baseline estimates.

[15] We thank the reviewer for her/his constructive suggestions.

and informally assess whether outcomes appear to change sharply around the event. Furthermore, it informs our formulation of the parametric event studies that deliver our main estimates.

Parametric Event Study. We employ the parametric event study to quantify the magnitude of estimated effects and their statistical significance. Our choice of functional form is guided by the patterns seen in the nonparametric event studies. The parametric event study takes the form:

$$y_{ict} = \theta' + \sum_{r=0}^{2} \mu'_r + X_{ict}\alpha' + \delta'_t + \delta'_c + \epsilon'_{ict}. \quad (2)$$

The key coefficients of interest, the μ'_rs, represent the change in outcome following the land expropriation relative to all the periods before the expropriation. We include the same covariates consistent with Equation (1). The identifying assumption is that, conditional on having land expropriated and the included controls, the timing of the expropriation is uncorrelated with deviations of the outcome from all the previous periods. Considering that the impact of land expropriation on economic and health outcomes may change over time, apart from reporting coefficients for each post-expropriation wave, we also calculate and compare the average effects across all post-event periods (event time 0~2) and across the later periods (event time 1~2). For example, because health status is a stock rather than a flow, the longer-run health impacts of land expropriation may exceed the one-wave estimates (Finkelstein et al., 2012). Meanwhile, some studies find that self-reported improvements in mental health outcomes can persist for longer than general health (Katz et al., 2001). In addition, as it takes time to adjust to a land expropriation shock, consumption responses and labor market effects in the later post-expropriation period may also differ from the immediate effects.

Staggered Difference-in-Differences (DD). In addition to the event study analyses, we also report the results from a staggered DD model based on Equation (3) as follows. Despite its current challenges, this approach is the most frequently used method in the DD setting with variations in treatment timing across units. The key independent variable DD_{ict} is a dummy variable, which takes 1 if the individual/household i residing in county c is during the post-expropriation period. The key estimated coefficient δ represents the summary of the effect across all post-expropriation years, which is supposed to be comparable to the average effect across all post-event periods (event time 0~2) estimated from the above parametric event study. We also report the estimates from the staggered DD model after controlling for the dummy of event time 0 in column 4 of Appendix Tables A.5-A.6, to provide an additional robustness check for the average effect across the later periods (event time 1~2) estimated from the parametric event study. The results from these staggered DD models are consistent with the event study estimates.

$$y_{ict} = \theta'' + \delta DD_{ict} + X_{ict}\alpha'' + \delta_t'' + \delta_c'' + \epsilon_{ict}''. \quad (3)$$

Notably, the identification based on Equations (1) and (2) has other possible issues related to staggered implementation such as heterogeneous treatment effects. Therefore, we provide further robustness checks to alleviate such concerns in Section 5. Specifically, we first test whether expropriated individuals and households are systematically different from those not expropriated and find no distinction between them. Then, we examine the determinants of the timing of expropriation and find that a variety of regional (county), household, and individual characteristics do not predict the timing of expropriation. Furthermore, we show that the results are robust to considering heterogeneous treatment effects and changing the level of fixed effects to the province or individual/household level. Finally, we test whether land expropriation of a certain scale would affect the outcomes among non-expropriated households/individuals and find insignificant results.

4. Empirical Results

4.1 Compliance with the Expropriation

In this section, we provide evidence for the mechanical effects by illustrating the impact of land expropriation on reported land expropriation and received cash compensation in Figure 2. For each outcome, we plot the estimated coefficients on event time (μ_rs) from the nonparametric event study regression (Equation (1)), with 90 percent confidence intervals calculated using standard errors clustered at the village level. Note that survey waves occur biennially, and, on average, land expropriation takes place one year prior to the "event time 0" interview (first report expropriation wave). All dependent variables are reported for the previous 12 months.

[Figure 2 about here]

As depicted in Panel A of Figure 2, the probability of experiencing land expropriation becomes 100% at event time 0, which is the survey wave when individuals first report land expropriation. This provides direct evidence for the validity of considering the wave when individuals first report land expropriation as the "event wave." The effect of land expropriation on receiving compensation is visually apparent "immediately" (i.e., at event time 0, approximately one year after the land expropriation) and persists in the following years (though diminishing magnitudes), as illustrated in Panel B.

In addition, we compute the implied effects at various post-expropriation periods more formally based on the parametric event study coefficients and the effects estimated from a staggered DD model. Panels A and B of Table 2 report the parametric results, the implied average effects within all survey

waves following the expropriation, and that during and after two waves following the expropriation. The results closely resemble the outcomes of the nonparametric event study approach. Households receive an average compensation per capita of 6.3 thousand *yuan* immediately after expropriation while receiving 1.5 thousand *yuan* three waves after expropriation. In other words, households receive 22.7 thousand *yuan* immediately after expropriation because on average there are 3.6 people within households. The average compensation per capita within all survey waves after expropriation is 3.2 thousand *yuan*. The fact that land expropriation continues to have a statistically significant (though substantially smaller) impact on compensation in the subsequent years indicates that the compensation is not paid in full at once, and some households may experience land expropriation multiple times (Cai et al., 2020). Panel C of Table 2 reports the results of the staggered DD model. The estimates are consistent with those using the event study approach.

[Table 2 about here]

4.2 Expropriation Effects on Labor Market Participation

Following land expropriation, rural households lose a portion or all of their land. It is reasonable to anticipate that individuals previously working on their own farms might alter their work categories after the expropriation. To examine the labor market effects of the expropriation, we regress a series of job-related outcome variables on event time dummies. We display the estimated coefficients on event time from the nonparametric event study regressions (Equation (1)) in Figure 3, and present the estimated coefficients from the parametric event study regressions (Equation (2)) and the staggered DD model (Equation (3)) in Table 3.

[Figure 3 about here]

We initially investigate the impact of land expropriation on the probability of working. As illustrated in Panel A of Figure 3, individuals significantly decrease the probability of working immediately after the land expropriation occurs (i.e., event time 0), although the negative impacts on working probability diminish and become insignificant in subsequent years. In line with the results from nonparametric regressions, the parametric findings (column 1 in Table 3) reveal that the probability of working drops by 2.9 percentage points (approximately 4.4 percent relative to the pre-event mean), and it turns insignificant at the event time 1 and event time 2. On average, the working probability changes little during three post-event survey waves. These observations suggest that individuals are compelled to leave their lands and are more likely to be out of work in the short term, but these adverse effects dissipate in the long term.

[Table 3 about here]

We further investigate the impacts of land expropriation on the probability of participating in different job categories. As shown in Panel B of Figure 3, following land expropriation, individuals have a lower probability of engaging in agricultural work, while they are more likely to engage in non-agricultural work. Turning to the parametric results (columns 2-4 of Table 3), we find that the probability of employment in the agricultural sector significantly drops by approximately 15 percent compared to the pre-event mean (coefficient: -0.069) in the third wave after expropriation (event time 2), which is over 1.6 times the impact at event wave 0. Meanwhile, relative to the pre-event mean, the probability of employment in the non-agricultural sector significantly increases by roughly 11 percent (coefficient: 0.058) at event time 2, which is over 2.0 times the impact in the survey wave immediately after the land expropriation.

On average, individuals are less likely to work on their own farms after losing their land by approximately 11 percent during three post-event survey waves relative to the pre-event mean. The estimate from the staggered DD is consistent, with a magnitude of about 9 percent. Conversely, individuals are more likely to work in the non-agricultural sector, with average impacts during three post-event survey waves of around 8.1 percent (staggered DD: about 6 percent) relative to the pre-event mean. The magnitudes of these average impacts are larger during the second and later post-event periods, with a 12 percent drop in agricultural self-employed participation and a 9.4 percent rise in the probability of being employed by others or non-agricultural self-employed.

Taken together, these results show that land expropriation can lead to structural changes in the labor market. One potential explanation is that the land loss eliminates the opportunity to work on one's own farm, causing rural individuals out of work immediately, while this disruption forces them to adjust afterward. Specifically, former farmers, no longer tied to their land, begin to seek employment and engage in non-agricultural work, leading to mitigated negative impacts on labor market participation.

4.3 Expropriation Effects on Household Income and Consumption

Panel A of Figure 4 presents the non-parametric findings concerning the impact of expropriation on household total income and the compensation they receive. Specifically, the results indicate an immediate increase in households' total income per capita following land expropriation, with this effect persisting in subsequent waves. The figure also shows that the rise in total income per capita is mainly driven by the compensation they receive. The parametric results in column 1 of Table 4 confirm that land expropriation leads to a significant increase in household income per capita, with an average rise

of 6.3 thousand *yuan* in the first year after implementation, equivalent to 62 percent of the pre-event mean. Although the effect diminishes in later waves, it remains statistically significant. Notably, households' total income per capita still increases by approximately 4.2 thousand *yuan* in the third wave after expropriation, corresponding to 41 percent of the pre-event mean. On average, during three post-event survey waves, annual household income per capita rises by 4.8 thousand *yuan* (staggered DD: 5.9 thousand *yuan*), which represents a rise in income of about 47 percent relative to the per-event mean.

[Figure 4 about here]

A more in-depth analysis of the components of total income reveals that the increase in household income following land expropriation is also driven by the rise in their non-agricultural earnings. As illustrated in Panel B of Figure 4, although agricultural earnings per capita starts to decrease from the implementation of land expropriation, non-agricultural earnings per capita experiences a significant increase after expropriation. Columns 3-4 in Table 4 provide a parametric analysis that sheds further light on the scale of the rise in different income categories. The results show that agricultural earnings per capita decreases by an average of 0.50 thousand *yuan* (staggered DD: 0.41 thousand *yuan*), equivalent to 25 percent of the pre-event mean. In comparison, non-agricultural earnings per capita increases by an average of 1.6 thousand *yuan*, representing 22 percent of the pre-event mean. The effect on non-agricultural earnings is larger in the later period (event time 1~2), with a magnitude of around 2.0 thousand *yuan*.

[Table 4 about here]

We also conduct an analysis of the impact of expropriation on household consumption. Panel A of Figure 5 shows the insignificant change in household consumption per capita following land expropriation. Further investigation into the components of consumption in Panel B and C reveals that only medical expenses per capita experience a significant increase after expropriation, while other forms of consumption, such as other items of service consumption per capita, food and dress consumption per capita, and housing-related and daily used consumption per capita, have insignificant changes. Columns 1-5 in Table 5 confirm these findings. It turns out that medical consumption per capita rises by an average of 0.44 thousand *yuan* (staggered DD: 0.41 thousand *yuan*) within all survey waves after the expropriation, corresponding to 41 percent of the pre-event mean. Combined with the result that the total income rises by 47 percent of the pre-event mean, the income elasticity for medical services is 0.9.

[Figure 5 about here]

Theoretically, households may fail to smooth consumption in response to income changes in the presence of liquidity constraints, imperfect credit markets, or behavioral factors (Hastings and Shapiro, 2018; Jappelli and Pistaferri, 2010; Jappelli and Pistaferri, 2011; Kueng, 2018; Zeldes, 1989). If liquidity or credit constraints lead to non-smoothing of household consumption, we are supposed to observe larger effects among households that are more likely to be liquidity-constrained or have difficulty in accessing a well-functioning credit market, when they are faced with an additional liquidity injection from land expropriation compensation. Therefore, we further examine whether liquidity or credit constraints play a role in the response of rural household consumption to the land expropriation shock.[16] First, we categorize households into liquidity-constrained and liquidity-unconstrained groups by total consumption per capita prior to land expropriation. Households with pre-event total consumption levels higher than the median are regarded as the liquidity-unconstrained group. As shown in columns 1-2 and 5-6 of Appendix Table A.1, households that have lower pre-expropriation consumption levels, i.e., tend to be liquidity-constrained, significantly increase their total consumption and medical consumption after experiencing land expropriation, while insignificant effects are observed among liquidity-unconstrained households. The magnitudes of the average impacts are also larger in the liquidity-constrained group than in their counterparts.

Second, as people with higher education levels have easier access to credit markets to smooth income fluctuations (Jappelli and Pistaferri, 2011), we next categorize households into difficult-access-to-credit and easy-access-to-credit groups by household head's education level and then do a parallel heterogeneity analysis. As shown in columns 3-4 and 7-8 of Table A.1, we only observe significant effects among households whose household heads have relatively low education (primary school and below), i.e., harder to access credit markets. Collectively, the above results show that the impact of land expropriation on household consumption is not evenly distributed, with larger and more significant effects falling into households with tighter liquidity or credit constraints.

Combining the income and expenditure results, we observe that the saving rate of households rises after the expropriation and persists in later waves in Panel D of Figure 5. This could be attributed to the fact that households may need to allocate a greater portion of their income to savings as a buffer to cope with potential financial risks arising from the loss of self-owned land. The parametric analysis in column 6 of Table 5 shows that the saving rate rises by 14 percentage points (staggered DD: 15 percentage points) after expropriation, which is 58 percent of the pre-event median value.

[Table 5 about here]

[16] We thank the reviewer for her/his constructive suggestions.

4.4 Expropriation Effects on Health Outcomes

We finally investigate the impacts of land expropriation on health outcomes, such as self-reported health, depression, physical health, and health-related behaviors. Self-reported health (SRH) is a commonly used indicator of subjective health status and well-being. Although it is not objective, it integrates multiple aspects of an individual, such as biological, social, functional, and mental aspects, and can reflect information recognized by the individual but unknown to others (Jylhä, 2009). In this sense, SRH can be seen as a more comprehensive health indicator. We use whether individuals report being in good health status to measure SRH.

[Figure 6 about here]

As shown in Panel A of Figure 6, individuals are more likely to report good health following land expropriation, with larger positive effects observed in later survey waves. Parametric results in column 1 of Table 6 indicate that the probability of reporting good health status significantly increases by about 7.9 percent compared to the pre-event mean (coefficient: 0.027) immediately following the expropriation. Subsequently, the probability further increases by approximately 20 percent (coefficient: 0.070) in the later wave. Compared to the pre-event mean, the average impact on the probability of self-reported good health is roughly 15 percent (staggered DD: 10 percent) during three post-event survey waves and approximately 19 percent (staggered DD after controlling for event time 0: 18 percent)[17] during the second and later post-event periods.

[Table 6 about here]

Besides self-reported health, we use depression scores as another measure of subjective health. Considering that the CFPS uses different depression measurement scales in different waves, we construct the depression score for each survey wave by computing the mean of the scores of each question, standardizing the mean, and dividing it into ten quantiles. Higher scores indicate a more severe depression status. As shown in Panel B of Figure 5 and column 2 in Table 6, after the land is expropriated, a declining trend emerges in depression scores, with insignificant effects at event time 0-1 and significant effects in the later post-event survey waves (e.g., event time 2). On average, depression scores drop by about 5.1 percent (coefficient: -0.266) during the second and later post-event periods relative to the pre-event mean.

One possible hypothesis is that the positive effects on subjective health effects are due to the

[17] We report the results of the staggered DD model after controlling for the event time 0 dummy in column 4 of Appendix Tables A.5-A.6.

compensation converted from the illiquid land expropriation.[18] If this were the case, we are supposed to observe that the effects are concentrated among those who receive higher compensation for land expropriation. To examine this, we divide individuals into different subgroups according to the amount of land expropriation compensation relative to the average household income per capita at the village level, and report the results of this heterogeneity test in Appendix Table A.2. Consistent with the hypothesis, we find larger and more significant effects on subjective health status among the individuals whose households receive higher compensation, especially for depression. This suggests that the additional liquidity provided by sufficient compensation plays an important role in improving subjective health status.

Unlike subjective health, we do not find significant impacts of land expropriation on physical health. As shown in Panel C of Figure 6 and column 3 in Table 6, after implementing land expropriation, the change in the probability of being diagnosed with chronic diseases is both statistically and economically insignificant.

We further analyze whether land expropriation can change individual health-related behaviors, with nonparametric event study results being plotted in Panel C, and both parametric event study results and staggered DD results being shown in columns 4-6 of Table 6. One potential mechanism for the improvement in self-reported health is that individuals eat healthier or reduce risky lifestyles after land expropriation, leading to better-perceived health. We do not find strong evidence for this mechanism: the impact of land expropriation on the probability of being obese (column 4) and on the probability of smoking (column 5) are insignificant. We also examine whether land expropriation affects individuals' medical insurance participation and discover insignificant changes in medical insurance participation following land expropriation (column 6).

Taken together, our findings indicate that rural individuals experience improved subjective health status following the expropriation, while their physical health status does not exhibit significant change. The enhancement in subjective health may be primarily attributed to the rise in household income especially in the case of higher compensation, the increased medical consumption, and a lower likelihood of engaging in strenuous agricultural work, rather than changes in health-related behaviors.

5. Robustness Checks

5.1 Testing for Identifying Assumptions

As mentioned before, if we want to interpret the coefficients on the indicators for the time after

[18] We thank the reviewer for her/his constructive suggestions.

land expropriation from the nonparametric event study coefficients as the causal effect of the expropriation, this would require that, conditional on having land expropriated during our observation period and the included controls, the timing of the expropriation is uncorrelated with the outcome. This assumption necessitates the absence of any trend in outcomes leading up to the land expropriation, which is supported by the insignificant pre-event estimates in Figures 2-6. We present three alternative pieces of evidence that lend support to the validity of this identifying assumption.

[Table 7 about here]

First, we examine if households expropriated are different from those who are never expropriated during our research window. We first restrict samples to households residing in villages that have experienced expropriation at some point during the observation period. For each village, we designate the year of the first land expropriation as the cutoff date and remove all samples equal to or later than the cutoff date to focus on pre-event characteristics. We then regress individual (columns 1-3 of Table 7) and household characteristics (columns 4-6 of Table 7) on whether they experienced land expropriation sometime between 2012 and 2018. To compare characteristics within villages and within the same wave, we control for village fixed effects and survey wave fixed effects. We cluster standard errors at the village level to account for the serial correlation in the outcome within villages. We do not find evidence that individuals or households with land expropriation significantly differ from those without land expropriation.

Second, we examine the correlation between the timing of land expropriation and regional characteristics. Specifically, we regress the year of land expropriation on a series of county-level characteristics during the expropriation year, such as GDP per capita, fiscal income per capita, the price of commercial housing, and the prices of land for different uses. As shown in Table 8, we do not find any evidence that later land-expropriated counties are significantly different from their earlier counterparts. We also report the F-statistics and p-values from a test of the joint significance of the county-level characteristics and reject that they are jointly significant. In the same vein, we report the results of the relation between the timing of land expropriation and individual/household characteristics in Appendix Table A.3 and again find no significant relationships. Thus, the timing of treatment across different units does not appear to be driven by the underlying characteristics of counties, households, or individuals.

[Table 8 about here]

Attrition, either from migration or nonresponse to the survey, poses another potential threat to our identifying assumption if it is correlated with the post-expropriation outcomes. The inclusion of

individual fixed effects serves as a natural approach to address potential bias arising from attrition. We further discuss this method in Section 5.3. Additionally, we present the results of a simple regression-based test in Appendix Table A.4, demonstrating that exposure to land expropriation is not significantly associated with moving out of the sample.

5.2 Considering Heterogeneous Treatment Effects

Several recent studies show that in the presence of heterogeneous treatment effects, the coefficients on the leads and lags of the treatment variable in an event study might place negative weights on the average treatment effects for certain groups and periods (Borusyak et al., 2024; De Chaisemartin and D'Haultfœuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021). To address this concern, we use an alternative estimator that addresses this issue by imputing non-treated potential outcomes following Borusyak et al. (2024). The results are presented in Appendix Figure A.1. These results indicate that the coefficients do not change much regarding their scales and significance. Our estimates are robust to considering heterogeneous treatment effects.

5.3 Controlling for Province Fixed Effects or Individual/Household Fixed Effects

We control for county fixed effects in the baseline regressions, which are identified solely based on the varying timing of expropriation for different households within the same county. This control is quite rigorous as it eliminates a portion of the pertinent expropriation variation, given that land expropriation can occur simultaneously for all affected households within a county. Consequently, this leads to relatively limited variation, which could potentially amplify measurement errors and introduce attenuation bias. Thus, we alleviate this issue by controlling for province fixed effects instead of county fixed effects. We show the relevant results in column 2 of Appendix Tables A.5-A.6. The results are largely robust after controlling for province fixed effects. The point estimates are larger than baseline results, which could be explained by the fact that more relevant variation is accounted for in this specification.

The identifying assumption would be violated if there is an individual/household-specific component of the error term that is correlated with the timing of expropriation, conditional on the included controls. Besides, there might be potential bias due to attrition. Hence, we replace county fixed effects with individual/household fixed effects in column 3 of Appendix Tables A.5-A.6. The impact of expropriation is now estimated entirely off of within-individual/household changes and therefore should not be contaminated by any differential attrition or individual/household-specific component correlated with the level of the outcomes. We find that the results remain largely consistent

with our baseline results.

5.4 Examining Potential Spillover effects

Individuals whose land was expropriated might have spillover effects on those whose land was not expropriated. The direction of the spillover effects is unclear. On the one hand, if the expropriated land is used for infrastructure development like highways or railways, unaffected individuals might have better access to job opportunities in urban areas, leading to higher income. On the other hand, it might be difficult for unaffected individuals to engage in agricultural production if construction occurs around the village, leading to lower income.

To investigate the potential spillover effects of land expropriation on unaffected individuals, we can further measure the impact of large-scale expropriation on individuals who are not directly affected by land expropriation but reside in the same village. This analysis can help identify the magnitude and direction of spillover effects, and shed light on the broader implications of land expropriation policies on rural communities.

We first calculate the percentage of households expropriated within the village. Then, we define an event as more than 5 percent of households experiencing land expropriation. Employing the nonparametric and parametric methods in baseline regressions, we test whether a certain scale of land expropriation impacts those whose land is not expropriated. The parametric results are reported in Table 9.

Based on the results, we can infer that there are almost no spillover effects of land expropriation. We find insignificant changes in individuals' work status, health status, household income, consumption, and saving rates. The above results indicate that, in the context of our study, land expropriation has limited impacts on the outcomes of individuals and households that are not directly affected by the expropriation, and our main results are not driven by these spillover effects.

[Table 9 about here]

6. Conclusions and Discussions

Land expropriation is a common way for the government to obtain land for economic development, especially in developing countries currently. Past studies focus on assessing land expropriation costs, both economically and politically (Jacoby et al., 2002; Johnson et al., 2002; Sha, 2023; Zhao and Xie, 2022). However, the comprehensive evaluation of expropriation on household behaviors and health outcomes is left understudied. Using large-scale and nationally representative

panel data in China, we fill this gap by exploring how land expropriation affects individual labor market participation, health-related outcomes, and household income and consumption.

We show that land-expropriated individuals are more likely to work in the agricultural sector and less likely to work in the non-agricultural sector, leading to insignificant changes in the overall working probability over a longer period. Households with land expropriation have a higher total income after expropriation, and the compensation for expropriation is the main driver. Consequently, these households increase medical consumption and their saving rates. Finally, individuals in these households have better health outcomes in terms of elevated self-reported health and decreased depression scores. Meanwhile, individuals' physical health and health-related behaviors have little change after land expropriation. All the results are insensitive to alternative specifications, heterogeneous treatment effects, or considering spillover effects. Collectively, our findings suggest that after being released from the land, individuals are motivated to have structural changes in their labor supply, and this change combined with compensation from expropriation leads to an increase in household income and medical consumption, eventually resulting in better subjective health status.

Our results complement the previous studies by extending the understanding of the consequences of land expropriation. We find that land expropriation can have positive effects on income, consumption, non-agricultural work participation, and subjective health status by providing additional liquidity. One potential policy implication is that creating more scope for the voluntary exchange of land use rights would be likely beneficial for some dimensions of economic and health outcomes among households that have ever been shackled to the land. Our results also speak to the literature on financial constraints, precautionary saving and substitution among different insurances, and the impacts of income change on health.

However, it is important to note that our findings should not be interpreted directly as implying that land expropriation is universally beneficial for household welfare, as we only provide evidence for certain aspects, such as income, consumption, labor market, and health outcomes. The negative effects on political trust and social stability found in recent work suggest some losses may occur in other outcomes (Sha, 2023). The combination of the involuntary/mandatory nature of land expropriation and the lack of functioning land markets in China makes it difficult to make a convincing judgment about the overall welfare effects. Nevertheless, given the current prevalence of land expropriation in developing countries, our results can have important implications for them. Specifically, land expropriation may produce positive influences on some economic and health outcomes of the affected households by providing additional liquidity, especially when the

compensation is sufficient.

Meanwhile, the estimated income elasticity of the demand for healthcare in this paper should be interpreted cautiously. We regard the compensation from the land expropriation as a windfall when calculating the elasticity, and it may not be comparable to those of other studies (Acemoglu et al., 2013).

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Figures

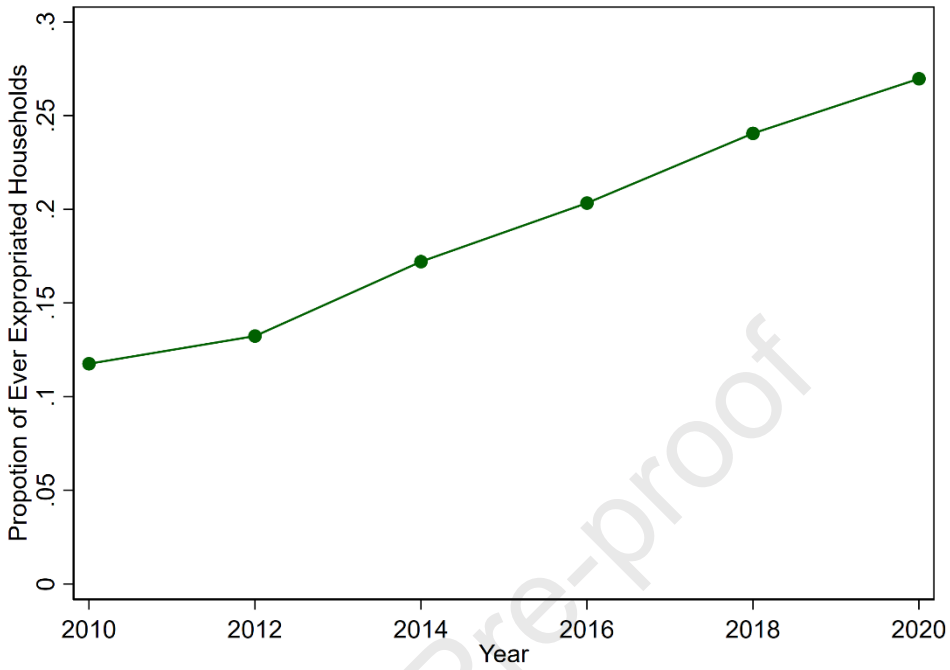
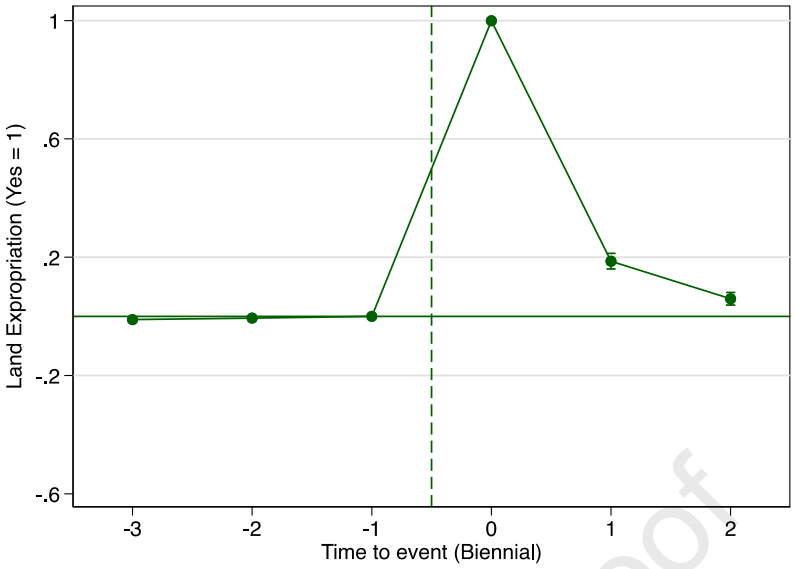
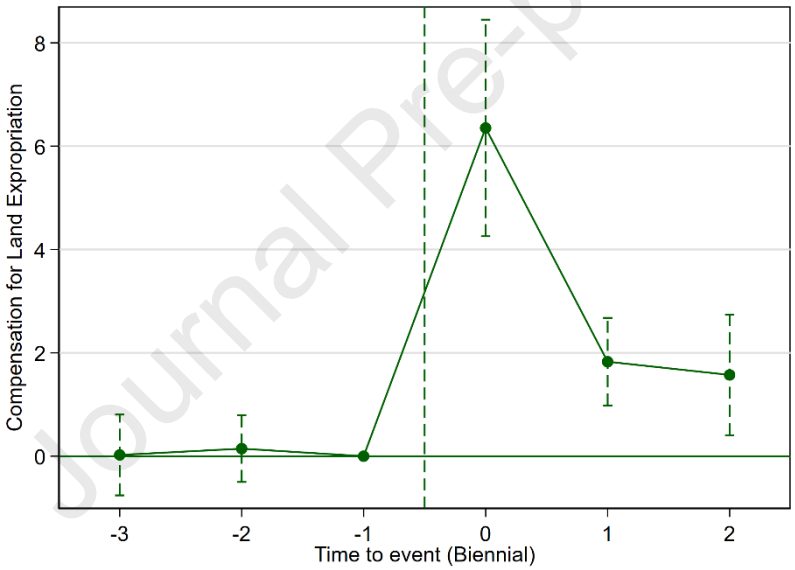


Figure 1 The Proportion of Households Who Ever Had Their Land Expropriated

Notes: The green circles indicate the proportion of households who ever had their land expropriated in survey years: 2010, 2012, 2014, 2016, 2018, and 2020. The sample includes all households interviewed in each survey wave.



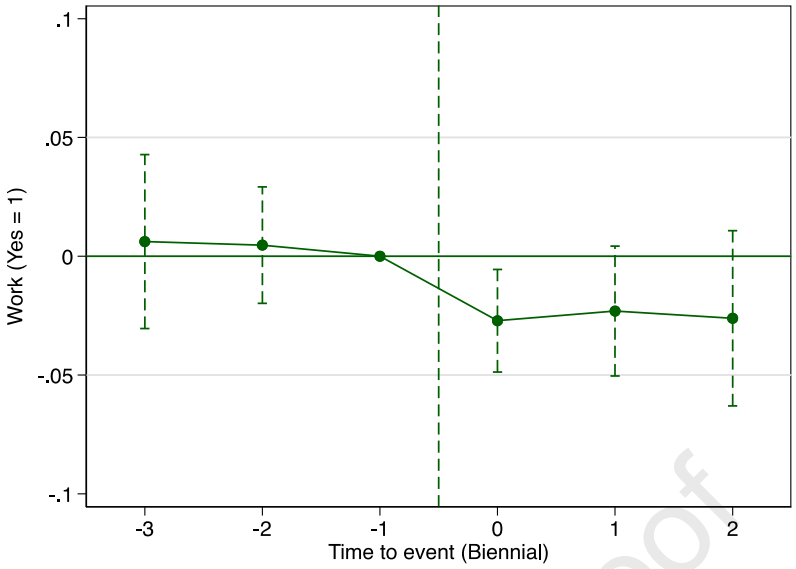
Panel (A) Land Expropriation (Yes = 1)



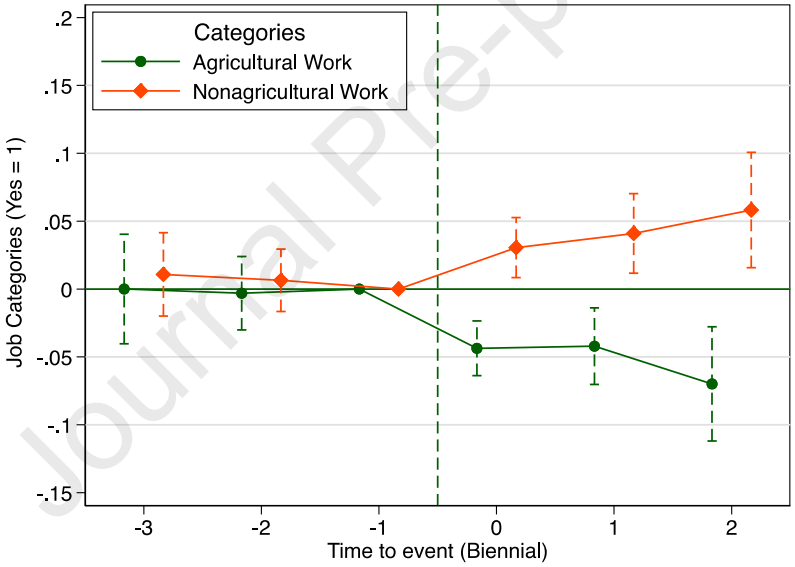
Panel (B) Compensation for Land Expropriation

Figure 2 Compliance with the Expropriation

Notes: In Panel (A), the outcome variable is whether the individual reports having land expropriation in every survey wave. The unit of observation is the individual-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. In Panel (B), the outcome variable is the compensation households received for having their land expropriated. The unit of observation is household-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. In all panels, circle markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. The compensation is measured in thousands of *yuan*. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).



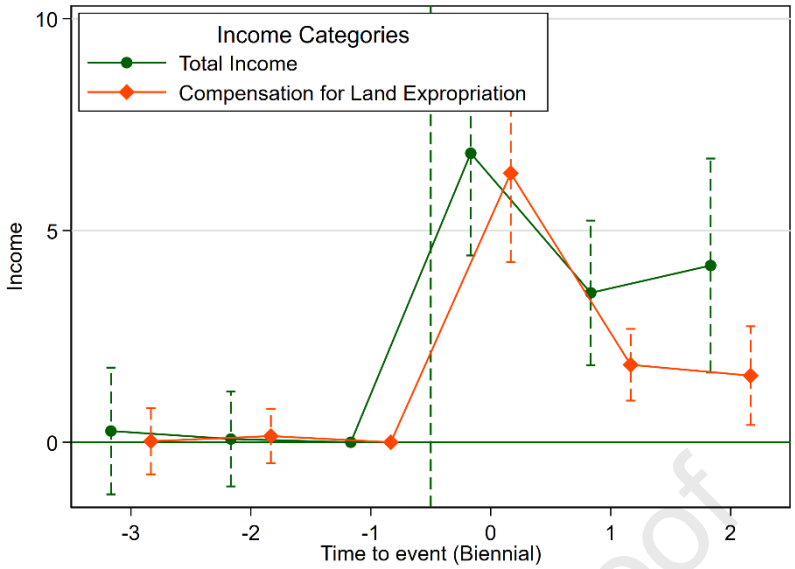
Panel (A) Whether Working When Interviewed



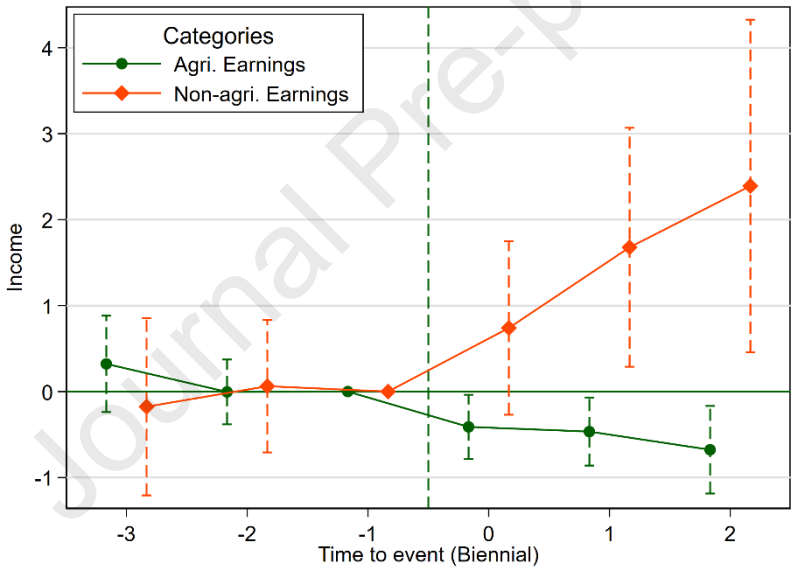
Panel (B) Participating in Different Job Categories

Figure 3 The Impacts of Land Expropriation on Labor Market Outcomes

Notes: Panel (A) shows the effects of land expropriation on the likelihood of working, and Panel (B) shows the effects of land expropriation on the probability of participating in different kinds of jobs. The unit of observation is the individual-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Solid markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).



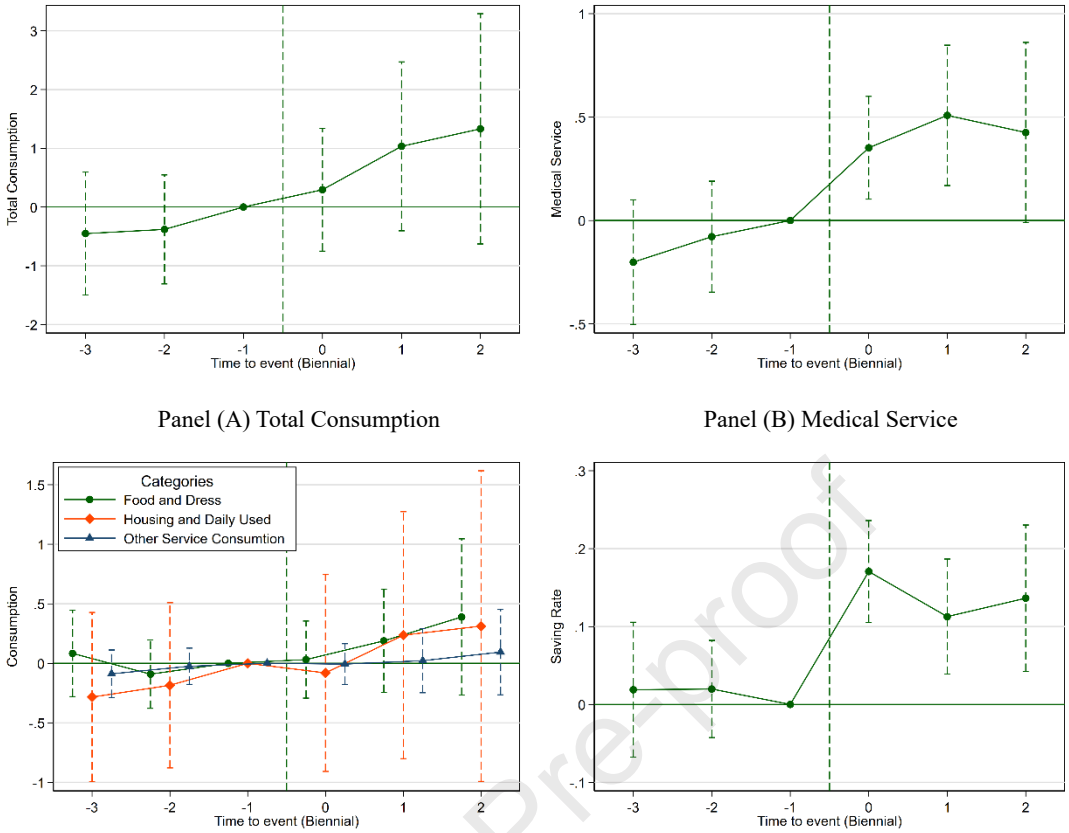
Panel (A) Total Income and Compensation



Panel (B) Different Categories of Income

Figure 4 The Impacts of Land Expropriation on Household Income

Notes: Panels (A) to (B) show the effects of land expropriation on different kinds of household income. The unit of observation is the household-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Solid markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. All income variables are measured in thousands of *yuan*. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).



Panel (A) Total Consumption

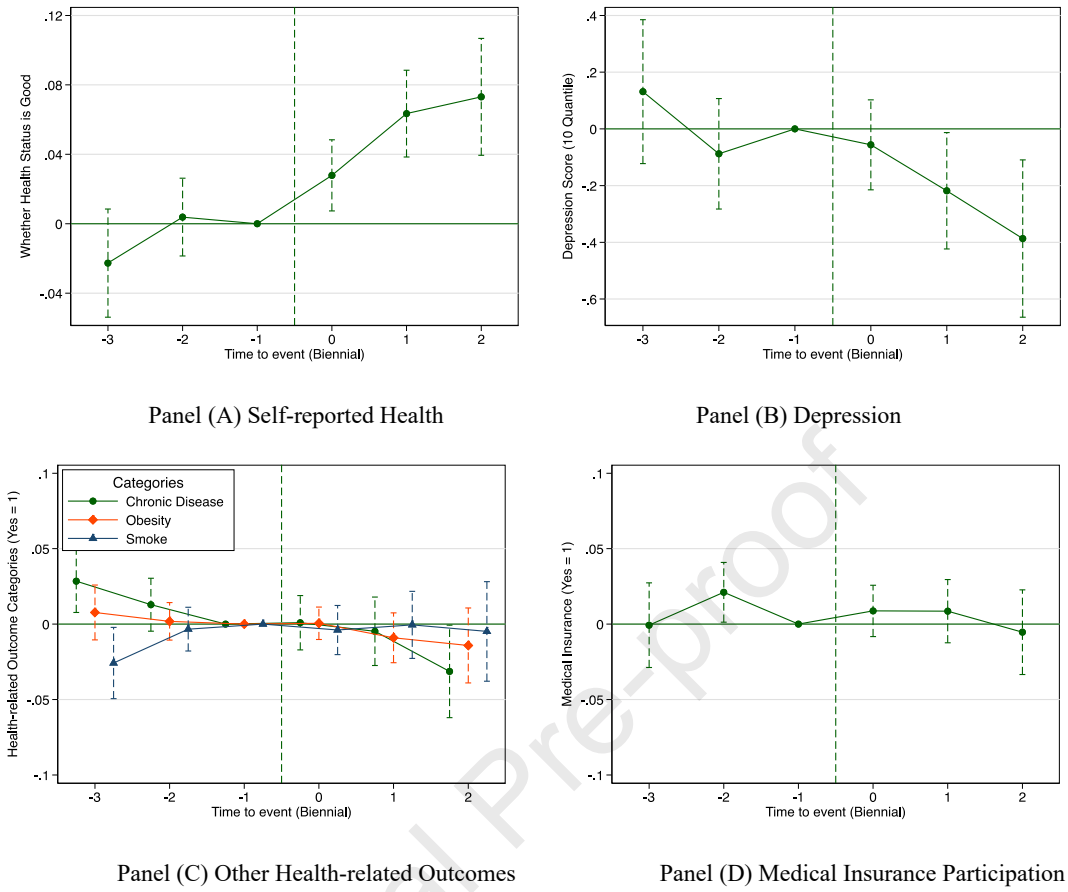
Panel (B) Medical Service

Panel (C) Other Consumption

Panel (D) Saving Rate

Figure 5 The Impacts of Land Expropriation on Household Consumption

Notes: Panels (A) to (D) show the effects of land expropriation on different kinds of household consumption and their saving rates. The unit of observation is the household-year. The sample is a five-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Solid markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. All consumption variables are measured in thousands of *yuan*. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).



Panel (A) Self-reported Health

Panel (B) Depression

Panel (C) Other Health-related Outcomes

Panel (D) Medical Insurance Participation

Figure 6. The Impacts of Land Expropriation on Health Outcomes

Notes: This figure shows the effects of land expropriation on individuals' self-reported health, depression, other health-related outcomes, and medical insurance participation. The unit of observation is the individual-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Circle markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. Event time dummies that are more than 3 waves before or 2 waves after the first reported expropriation wave are grouped to regain some statistical power; event time -1 is omitted. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).

Tables

Table 1 Summary Statistics for Individual and Household Samples

	(1)	(2)	(3)	(4)	(5)	(6)
	Analysis Sample			Whole Sample		
	N	mean	sd	N	mean	sd
Panel A. Labor market outcomes						
Work (Yes = 1)	15,777	0.707	0.455	202,255	0.624	0.484
Agricultural Work (Yes = 1)	15,777	0.434	0.496	202,255	0.309	0.462
Non-agricultural Work (Yes = 1)	15,777	0.452	0.498	202,255	0.458	0.498
Panel B. Household Income						
Compensation for Land Expropriation	7,269	1.323	14.55	81,915	0.214	4.885
Total Income	7,269	15.21	24.69	81,915	16.14	31.71
Agricultural Earnings	7,269	1.433	5.106	81,915	1.154	4.938
Non-agricultural Earnings	7,269	10.60	17.73	81,915	11.50	28.91
Panel C. Household Consumption						
Total Consumption	7,269	12.47	17.70	81,915	13.52	20.90
Medical Service	7,269	1.380	4.162	81,915	1.430	5.212
Other Service Consumption	7,269	2.064	3.291	81,915	2.417	4.422
Food and Dress	7,269	4.649	5.648	81,915	5.321	6.389
Housing related and Daily Used	7,269	4.065	12.11	81,915	3.996	14.08
Saving Rate	6,577	-0.006	0.802	73,874	0.002	0.767
Family Size	7,269	3.627	1.470	81,915	3.696	1.850
Panel D. Health outcomes						
Self-reported Good Health (Yes = 1)	15,777	0.319	0.466	202,255	0.345	0.475
Depression Scores (10 Quantiles)	12,704	5.240	3.033	159,609	5.035	3.046

Chronic Disease (Yes = 1)	15,777	0.145	0.352	202,255	0.137	0.344
Obesity (Yes = 1)	15,777	0.075	0.263	202,255	0.092	0.290
Smoke (Yes = 1)	15,777	0.293	0.455	202,255	0.258	0.438
Medical Insurance Coverage (Yes = 1)	15,777	0.872	0.334	202,255	0.827	0.378
Panel E. Individual characteristics						
Age in 2015	3,581	45.78	16.88	54,780	44.01	18.93
Male (Yes = 1)	3,581	0.501	0.500	54,780	0.499	0.500
Primary School and below (Yes = 1)	3,581	0.521	0.500	54,780	0.429	0.495
Junior Middle School and above (Yes = 1)	3,581	0.477	0.500	54,780	0.558	0.497
Missing Education Information (Yes = 1)	3,581	0.002	0.044	54,780	0.013	0.113
Panel F. Household head characteristics						
Age in 2015	1,182	54.03	11.18	14,492	55.06	12.85
Male (Yes = 1)	1,182	0.812	0.391	14,492	0.745	0.436
Primary School and below (Yes = 1)	1,182	0.599	0.490	14,492	0.516	0.500
Junior Middle School and above (Yes = 1)	1,182	0.399	0.490	14,492	0.482	0.500
Missing Education Information (Yes = 1)	1,182	0.002	0.041	14,492	0.002	0.046

Notes: The table reports descriptive statistics for key explained variables. The sample covered in columns 1-3 is used for later analysis, while columns 4-6 is for the whole sample. Panel A and D use a six-year individual-year panel (2010, 2012, 2014, 2016, 2018, and 2020). Panel B and C use a six-year household-year panel (2010, 2012, 2014, 2016, 2018, and 2020). Panel E uses cross-sectional individual-level data to present individual characteristics. Panel F uses cross-sectional household-level data to present the household head's characteristics. All income and consumption variables are measured in thousands of *yuan*.

Table 2 The Impacts of Land Expropriation on First Stage Outcomes

Dep. Var	(1) Land expropriation (Yes = 1)	(2) Expropriation compensation
Panel A: Impacts by years (Pre-event survey years as reference)		
0	1.001***	6.308***
	(0.004)	(1.216)
1	0.187***	1.793***
	(0.016)	(0.538)
2	0.060***	1.538**
	(0.013)	(0.697)
Panel B: Average Impact		
Ave. Impact (0~2)	0.416***	3.213***
	(0.009)	(0.698)
Ave. Impact (1~2)	0.124***	1.665***
	(0.012)	(0.586)
Panel C: Staggered DD		
DD	0.803***	5.203***
	(0.014)	(0.970)
Mean in pre-event years	0	0
Observations	15,777	7,269

Notes: This table displays the parametric estimates of the effects of land expropriation on individual-reported land expropriation and household-reported compensation for expropriation based on Equation (2), and staggered DD estimates based on Equation (3), using individual-year and household-year panel data, respectively. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. Panel A reports estimates for each post-event survey year; 2, 3, and 4 are restricted to have the same estimate. Panel B reports average effects for event time 0-2 and for event time 1-2. Compensation is measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3 The Impacts of Land Expropriation on Labor Market Outcomes

	(1)	(2)	(3)
	Labor market outcomes		
Dep. Var	Work (Yes = 1)	Agricultural Work (Yes = 1)	Non-agricultural Work (Yes = 1)
Panel A: Impacts by years (Pre-event survey years as reference)			
0	-0.029**	-0.043***	0.028**
	(0.012)	(0.012)	(0.014)
1	-0.024	-0.041**	0.040**
	(0.016)	(0.017)	(0.018)
2	-0.027	-0.069***	0.058**
	(0.022)	(0.025)	(0.026)
Panel B: Average Impact			
Ave. Impact (0~2)	-0.026*	-0.051***	0.042**
	(0.015)	(0.017)	(0.017)
Ave. Impact (1~2)	-0.025	-0.055***	0.049**
	(0.018)	(0.020)	(0.021)
Panel C: Staggered DD			
DD	-0.027**	-0.042***	0.031**
	(0.012)	(0.012)	(0.014)
Mean in pre-event years	0.660	0.456	0.519
Observations	15,777	15,777	15,777

Notes: This table displays the parametric estimates of the effects of land expropriation on individuals' labor market outcomes based on Equation (2), and staggered DD estimates based on Equation (3), using individual-year panel data. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. Panel A reports estimates for each post-event survey year; 2, 3, and 4 are restricted to have the same estimate. Panel B reports average effects for event time 0-2 and for event time 1-2. Panel C reports the estimates from the staggered DD. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4 The Impacts of Land Expropriation on Household Income

Dep. Var	(1)	(2)	(3)	(4)
	HH income			
	Total Income	Compensation for Expropriation	Agricultural Earnings	Non-agricultural Earnings
Panel A: Impacts by years (Pre-event survey years as reference)				
0	6.801***	6.308***	-0.409*	0.721
	(1.423)	(1.216)	(0.215)	(0.613)
1	3.525***	1.793***	-0.443*	1.651*
	(1.043)	(0.538)	(0.242)	(0.850)
2	4.186***	1.538**	-0.636**	2.355**
	(1.525)	(0.697)	(0.301)	(1.172)
Panel B: Average Impact				
Ave. Impact (0~2)	4.837***	3.213***	-0.496**	1.575**
	(1.126)	(0.698)	(0.233)	(0.764)
Ave. Impact (1~2)	3.856***	1.665***	-0.539**	2.003**
	(1.205)	(0.586)	(0.255)	(0.938)
Panel C: Staggered DD				
DD	5.963***	5.203***	-0.409*	0.921
	(1.205)	(0.970)	(0.211)	(0.594)
Mean in pre-event years	10.25	0	1.984	7.096
Observations	7,269	7,269	7,269	7,269

Notes: This table displays the parametric estimates of the effects of land expropriation on households' different kinds of income per capita based on Equation (2), and staggered DD estimates based on Equation (3), using household-year panel data. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. Panel A reports estimates for each post-event survey year; 2, 3, and 4 are restricted to have the same estimate. Panel B reports average effects for event time 0-2 and for event time 1-2. Panel C reports the estimates from the staggered DD. All income variables are measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 The Impacts of Land Expropriation on Household Consumption

Dep. Var	(1)	(2)	(3)	(4)	(5)	(6)
	HH consumption					
	Total Consumption	Medical Consumption	Other Service Consumption	Food and Dress	Housing and Daily	Saving Rate
Panel A: Impacts by years (Pre-event survey years as reference)						
0	0.408	0.375**	0.001	0.058	-0.026	0.165***
	(0.606)	(0.154)	(0.103)	(0.187)	(0.475)	(0.039)
1	1.102	0.515**	0.022	0.217	0.265	0.109**
	(0.864)	(0.208)	(0.164)	(0.261)	(0.623)	(0.044)
2	1.375	0.421	0.090	0.423	0.325	0.133**
	(1.181)	(0.265)	(0.217)	(0.397)	(0.786)	(0.057)
Panel B: Average Impact						
Ave. Impact (0~2)	0.961	0.437**	0.038	0.233	0.188	0.136***
	(0.737)	(0.171)	(0.138)	(0.244)	(0.517)	(0.042)
Ave. Impact (1~2)	1.238	0.468**	0.056	0.320	0.295	0.121**
	(0.928)	(0.202)	(0.172)	(0.305)	(0.633)	(0.047)
Panel C: Staggered DD						
DD	0.568	0.413***	0.003	0.089	0.043	0.150***
	(0.574)	(0.151)	(0.105)	(0.182)	(0.437)	(0.037)
Mean in pre-event years	8.709	1.065	1.501	3.502	2.363	0.241
Observations	7,269	7,269	7,269	7,269	7,269	6,573

Notes: This table displays the parametric estimates of the effects of land expropriation on households' different kinds of consumption per capita and their saving rates based on Equation (2), and staggered DD estimates based on Equation (3), using household-year panel data. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. Panel A reports the estimates for each post-event survey year; 2, 3, and 4 are restricted to having the same estimate. Panel B reports average effects for event time 0-2 and for event time 1-2. Panel C reports the estimates from the staggered DD. All consumption variables are measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. Specifically, we report the pre-event median value of the saving rate instead of the pre-event mean. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6 The Impacts of Land Expropriation on Health Outcomes

Dep. Var	(1) Self-reported Good Health (Yes = 1)	(2) Depression (10 Quantiles)	(3) Chronic Disease (Yes = 1)	(4) Obesity (Yes = 1)	(5) Smoke (Yes = 1)	(6) Medical Insurance (Yes = 1)
Panel A: Impacts by years (Pre-event survey years as reference)						
0	0.027**	-0.030	-0.003	-0.000	-0.003	0.002
	(0.012)	(0.098)	(0.011)	(0.007)	(0.010)	(0.010)
1	0.061***	-0.184	-0.007	-0.009	-0.001	0.003
	(0.015)	(0.123)	(0.014)	(0.010)	(0.014)	(0.013)
2	0.070***	-0.348**	-0.032*	-0.014	-0.007	-0.011
	(0.020)	(0.166)	(0.019)	(0.015)	(0.020)	(0.017)
Panel B: Average Impact						
Ave. Impact (0~2)	0.053***	-0.187*	-0.014	-0.008	-0.003	-0.002
	(0.014)	(0.111)	(0.013)	(0.010)	(0.014)	(0.012)
Ave. Impact (1~2)	0.065***	-0.266**	-0.019	-0.011	-0.004	-0.004
	(0.017)	(0.131)	(0.015)	(0.012)	(0.016)	(0.014)
Panel C: Staggered DD						
DD	0.035***	-0.067	-0.004	-0.002	-0.002	0.003
	(0.012)	(0.095)	(0.011)	(0.007)	(0.011)	(0.010)
Mean in pre-event years	0.342	5.224	0.136	0.069	0.304	0.889
Observations	15,777	12,673	15,777	15,777	15,777	15,777

Notes: This table displays the parametric estimates of the effects of land expropriation on individuals' health outcomes based on Equation (2), and staggered DD estimates based on Equation (3), using individual-year panel data. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. Panel A reports estimates for each post-event survey year; 2, 3, and 4 are restricted to have the same estimate. Panel B reposts average effects for event time 0-2 and for event time 1-2. Panel C reports the estimates from the staggered DD. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7 The Association between Household and Individual Characteristics and whether having Land Expropriation

Dep. Var.	(1) Age in 2015	(2) Male (Yes = 1)	(3) Primary school and below (Yes = 1)	(4) Total Income	(5) Total Consumption	(6) Saving Rate
Land expropriation (Yes = 1)	0.506	-0.006	-0.014	-0.257	-0.303	-0.015
	(0.340)	(0.006)	(0.010)	(0.314)	(0.229)	(0.018)
Observations	46,820	46,820	46,820	17,362	17,362	15,652
R-squared	0.071	0.006	0.117	0.169	0.141	0.073

Notes: This table aims to show that households ever had land expropriated are not systematically different from those never expropriated within the time window we observe. We first restrict samples to households residing in villages that have experienced expropriation at some point during the observation period. For each village, we designate the year of the first land expropriation as the cutoff date and remove all samples equal to or later than the cutoff date. We then regress individual (columns 1-3) and household characteristics (columns 4-6) on whether they experience land expropriation sometime during 2012-2018. All regressions control for village and survey wave fixed effects. The income and consumption variables are measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8 The Association between the Timing of Land Expropriation and Regional Characteristics

Dep. Var.	Year of land expropriation
Log (GDP per capita)	1.62
	(2.048)
Log (Fiscal Income per capita)	0.50
	(1.013)
Log (Fiscal Expenditure per capita)	-1.15
	(1.345)
Log (Added Value of the Second Industry per capita)	-1.49
	(0.921)
Log (Price of Commercial Housing)	-0.56
	(0.892)
Log (Price of Land for Commercial and Business Facility)	0.41
	(0.510)
Log (Price of Industrial Land)	0.39
	(1.186)
Log (Price of Residential Land)	-0.07
	(0.612)
Log (per capita Loan Balance of Financial Institutions at Year-end)	-0.78
	(0.960)
F-statistics	1.250
p-value	0.309
R-squared	0.311

Notes: This table is to show the correlation between the timing of land expropriation and county-level characteristics. We regress the year of land expropriation (the year when the land expropriation happens) on a series of county-level characteristics. F-statistic and p-value of a joint test of significance of all characteristics are provided. Standard errors are reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9 Spillover Effects of Land Expropriation

Dep. Var	(1) Labor Market Outcomes	(2) Health Outcome	(3) Household Income	(4) Household Income	(5) Household Consumption	(6) Household Consumption	(7)
	Work (Yes = 1)	Self-reported Good Health (Yes = 1)	Total Income	Transfer Income	Total Consumption	Medical Service	Saving Rate
Panel A: Impacts by years (Pre-event survey years as reference)							
0	0.007	-0.011	-0.619	-0.125	0.182	0.043	-0.011
	(0.011)	(0.010)	(0.441)	(0.081)	(0.407)	(0.109)	(0.025)
1	0.014	-0.004	-1.092	-0.063	0.677	-0.015	-0.002
	(0.014)	(0.013)	(0.744)	(0.126)	(0.562)	(0.144)	(0.030)
2	0.003	0.001	0.305	0.016	0.526	0.124	0.018
	(0.020)	(0.018)	(0.978)	(0.208)	(0.796)	(0.214)	(0.037)
Panel B: Average Impact							
Ave. Impact (0~2)	0.008	-0.005	-0.469	-0.058	0.462	0.051	0.002
	(0.014)	(0.012)	(0.581)	(0.127)	(0.528)	(0.138)	(0.027)
Ave. Impact (1~2)	0.009	-0.002	-0.394	-0.024	0.602	0.055	0.008
	(0.017)	(0.014)	(0.735)	(0.160)	(0.634)	(0.167)	(0.032)
Mean in pre-event years	0.622	0.383	10.12	0.827	8.018	1.000	0.0184
Observations	42,180	42,180	18,159	18,159	18,159	18,159	16,266

Notes: This table shows the spillover effects of land expropriation on individuals and households without land expropriation. The event time 0 is defined as the survey wave when 5% or more of households in the village report land expropriation. Panel A reports estimates for each post-event survey year; 2, 3, and 4 are restricted to have the same estimate. Panel B reports average effects for event time 0-2 and for event time 1-2. All income and consumption variables are measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Appendix Figures

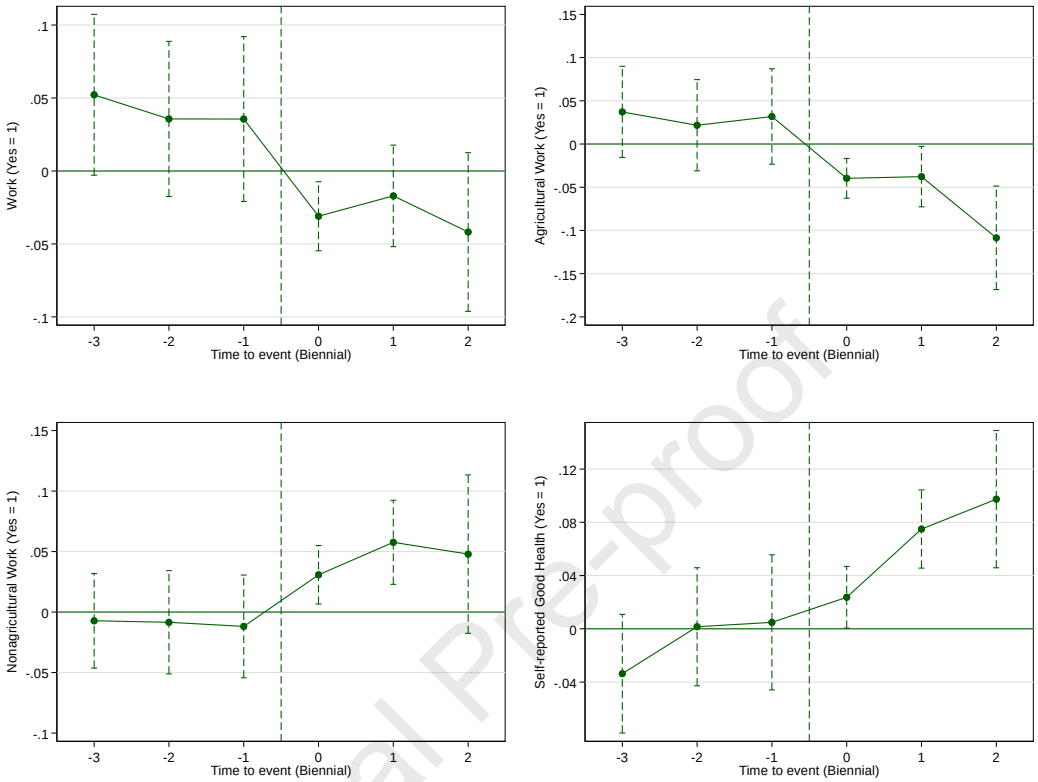


Figure A.1 The Impacts of Expropriation on Individual/Household Outcomes (Considering Heterogeneous Treatment Effects)

Notes: This figure shows the estimated coefficients from implementing the Borusyak et al. (2024) estimator. The unit of observation is the individual-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Circle markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).

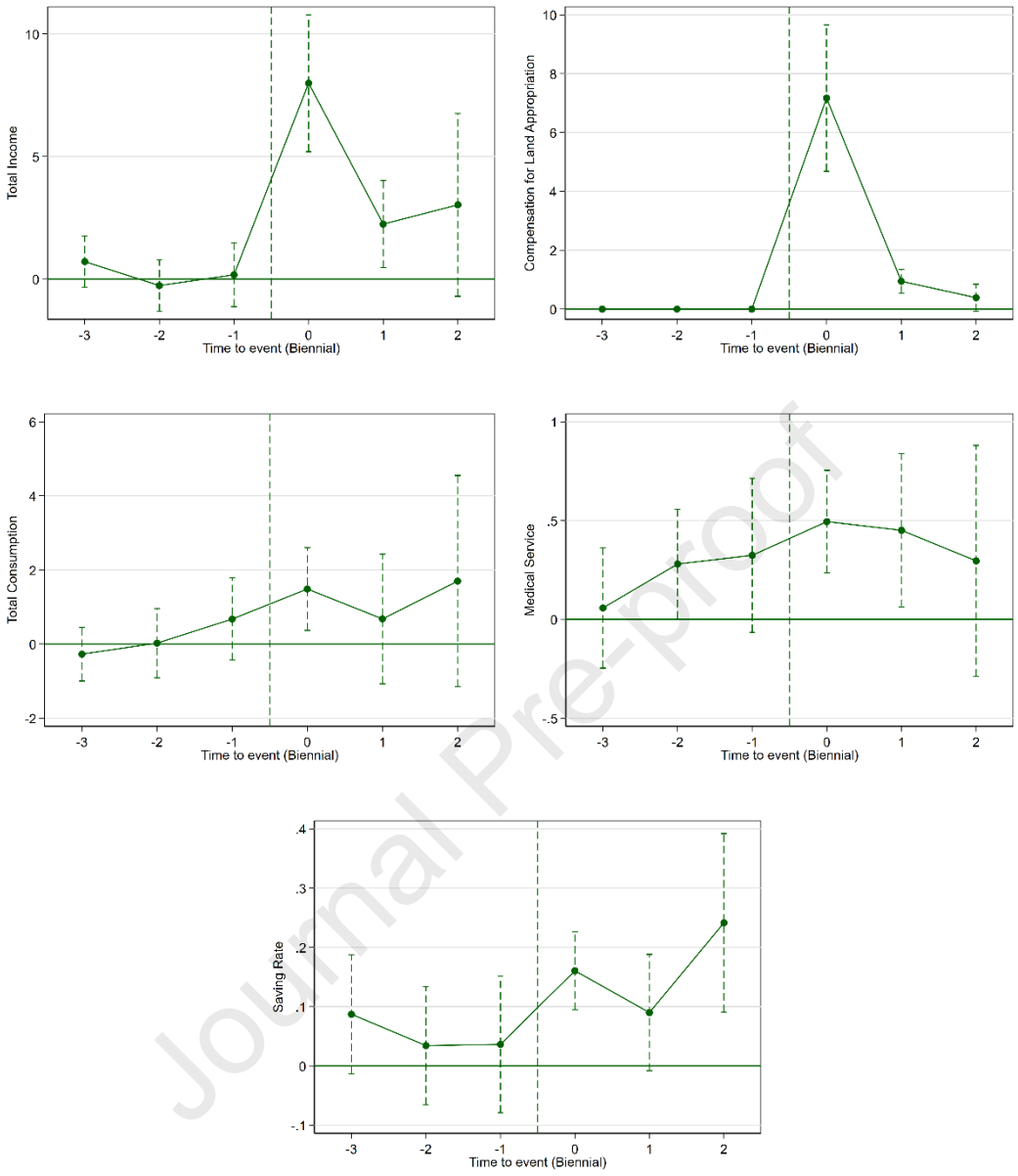


Figure A.1 The Impacts of Expropriation on Individual/Household Outcomes (Considering Heterogeneous Treatment Effects, Continued)

Notes: This figure shows the estimated coefficients from implementing the Borusyak et al. (2024) estimator. The unit of observation is the household-year. The sample is a six-year panel (2010, 2012, 2014, 2016, 2018, and 2020) and excludes households who had their land expropriated between 2000 and 2010. Circle markers in the figure plot the estimated effects of event time (i.e., the μ_rs from the non-parametric event study in Equation (1)), with the survey wave first reporting the land expropriation normalized to event time 0. The dashed lines present the 90 percent confidence interval. All income and consumption variables are measured in thousands of *yuan*. All standard errors are clustered at the village level. The CFPS is conducted every two years, so the gap between two consecutive waves is two years (the horizontal axis).

Appendix Tables

Table A.1 Heterogeneity Analysis: The Impacts of Land Expropriation on Household Consumption

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total Consumption				Medical Consumption			
	Previous Consumption Level		Household Head's Education		Previous Consumption Level		Household Head's Education	
Subsample	Low	High	Primary School and Below	Junior Middle School and Above	Low	High	Primary School and Below	Junior Middle School and Above
Ave. Impact (0~2)	4.417***	-0.783	1.600*	-0.699	0.727***	0.270	0.470**	0.313
	(0.575)	(1.723)	(0.898)	(1.207)	(0.198)	(0.323)	(0.219)	(0.299)
Ave. Impact (1~2)	4.691***	-0.163	1.475	-0.066	0.757***	0.346	0.448*	0.401
	(0.716)	(2.242)	(1.077)	(1.575)	(0.250)	(0.366)	(0.248)	(0.370)
Mean in pre-event years	4.298	13.11	7.440	10.34	0.513	1.626	1.101	1.007
R-squared	0.270	0.235	0.214	0.283	0.075	0.092	0.071	0.102
Observations	3,852	3,277	4,189	3,036	3,852	3,277	4,189	3,036

Notes: This table displays the parametric estimates of the average effects of land expropriation on household consumption based on Equation (2), using different household subsamples. Unit is the household-year. To be specific, columns 1-2 and 5-6 report the estimates for the sample divided into subgroups based on whether the household has a total consumption per capita before expropriation is higher than the median, while columns 3-4 and 7-8 report that for the sample divided into subgroups based on whether the household head is higher-educated (junior middle school and above). The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. All dependent variables are measured in thousands of *yuan*. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A.2 Heterogeneity Analysis: The Impacts of Land Expropriation on Subjective Health Status

Dep. Var.	(1)	(2)	(3)	(4)
	Self-reported Health is Good (Yes = 1)		Depression (10 Quantiles)	
Subsample	Compensation/Average Household Per Capita Income at the Village Level			
	High	Low	High	Low
Ave. Impact (0~2)	0.063***	0.054**	-0.357**	-0.152
	(0.021)	(0.022)	(0.152)	(0.180)
Ave. Impact (1~2)	0.079***	0.064**	-0.442**	-0.279
	(0.025)	(0.026)	(0.183)	(0.213)
Mean in pre-event years	0.343	0.325	5.151	5.309
R-squared	0.166	0.154	0.163	0.166
Observations	6,837	6,915	5,555	5,562

Notes: This table displays the parametric estimates of the average effects of land expropriation on subjective health status based on Equation (2), using different individual subsamples. Unit is the individual-year. To be specific, the sample is divided into subgroups based on whether the individual in the household receiving land expropriation compensation (relative to the average household per capita income at the village level) is higher than the median. The reference group is the previous years before the event, and the survey wave first reporting the land expropriation is normalized to event time 0. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. Pre-event means are calculated using the survey wave preceding the first expropriation. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A.3 The Association between the Timing of Land Expropriation and Household and Individual Characteristics

Dep. Var.	Year of land expropriation
Panel A. Household characteristics	
Log (Total Income)	2.20
	(6.176)
Log (Total Consumption)	13.00
	(13.371)
Saving Rate	0.11
	(0.100)
F-statistics	0.900
p-value	0.443
R-squared	0.543
Panel B. Individual characteristics	
Male	-0.018
	(0.029)
Age in 2015	-0.000
	(0.002)
(Omitted group: Primary school and below)	
Junior middle school and above	0.006
	(0.069)
F-statistics	0.230
p-value	0.923
R-squared	0.669

Notes: This table is to show the correlation between the timing of land expropriation and household, and individual characteristics. We regress the year of land expropriation on a series of household and individual characteristics. All regressions control for village fixed effects. F-statistic and p-value of a joint test of significance of all characteristics are provided. All standard errors are clustered at the village level and reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A.4 Effect of Land Expropriation on Attrition

	(1)	(2)	(3)	(4)
	2012-2014 Panel	2014-2016 Panel	2016-2018 Panel	2018-2020 Panel
Dep. Var	Attrition	Attrition	Attrition	Attrition
Land Expropriation	0.00	0.02	0.02	0.02
	(0.019)	(0.011)	(0.011)	(0.018)
Observations	12,613	11,898	10,994	10,450
R-squared	0.130	0.159	0.148	0.148

Notes: The unit of observation is the household. The panel data degenerates to cross-section data. Attrition is a dummy indicating whether the household attrits from the sample during the time window of each small panel. Land expropriation is a dummy that is 1 if the household is expropriated in the beginning year of the small panel. All standard errors are robust and reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A.5 Robustness Checks for Individual Outcomes

Specification	[Baseline]	Province FEs	Individual FEs	Staggered DD when Controlling the Event Time 0
	(1)	(2)	(3)	(4)
Panel A. Work (Yes = 1)				
Ave. Impact (0~2)	-0.026*	-0.026*	-0.035	
	(0.015)	(0.016)	(0.028)	
Ave. Impact (1~2)	-0.025	-0.025	-0.037	-0.025
	(0.018)	(0.018)	(0.033)	(0.017)
Observation	15,777	15,776	15,639	15,777
Panel B. Agricultural Work (Yes = 1)				
Ave. Impact (0~2)	-0.051***	-0.063***	-0.044*	
	(0.017)	(0.021)	(0.025)	
Ave. Impact (1~2)	-0.055***	-0.071***	-0.054*	-0.047***
	(0.020)	(0.025)	(0.030)	(0.018)
Observation	15,777	15,776	15,639	15,777
Panel C. Nonagricultural Work (Yes = 1)				
Ave. Impact (0~2)	0.042**	0.041**	0.034	
	(0.017)	(0.018)	(0.025)	
Ave. Impact (1~2)	0.049**	0.049**	0.039	0.044**
	(0.021)	(0.021)	(0.031)	(0.019)
Observation	15,777	15,776	15,639	15,777
Panel D. Self-reported Good Health (Yes = 1)				
Ave. Impact (0~2)	0.053***	0.044***	0.052**	
	(0.014)	(0.014)	(0.021)	
Ave. Impact (1~2)	0.065***	0.055***	0.064**	0.063***
	(0.017)	(0.017)	(0.025)	(0.015)
Observation	15,777	15,776	15,639	15,777

Notes: This table reports robustness check results for individual outcomes, using individual-year panel data. Column 1 is the baseline results. Column 2 re-estimates the baseline parametric event study specification controlling province fixed effects instead of county fixed effects in the baseline specification. Column 3 re-estimates the baseline parametric event study specification controlling individual fixed effects instead of individual characteristics in the baseline specification. Column 4 re-estimates the staggered DD after controlling for a dummy of the event time 0. Standard errors clustered at the village level are reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table A.6 Robustness Checks for Household Outcomes

Specification	[Baseline]	Province FEs	Household FEs	Staggered DD when Controlling the Event Time 0
	(1)	(2)	(3)	(4)
Panel A. Total Income				
Ave. Impact (0~2)	4.837***	5.724***	3.935***	
	(1.126)	(1.263)	(1.331)	
Ave. Impact (1~2)	3.856***	4.946***	2.811**	3.652***
	(1.205)	(1.394)	(1.385)	(1.079)
Observation	7,269	7,269	7,265	7,269
Panel B. Compensation for Expropriation				
Ave. Impact (0~2)	3.213***	3.381***	3.388***	
	(0.698)	(0.790)	(0.818)	
Ave. Impact (1~2)	1.665***	1.932***	1.976***	1.744***
	(0.586)	(0.669)	(0.622)	(0.548)
Observation	7,269	7,269	7,265	7,269
Panel C. Total Consumption				
Ave. Impact (0~2)	0.961	1.555*	0.061	
	(0.737)	(0.801)	(0.935)	
Ave. Impact (1~2)	1.238	1.897*	0.096	1.154
	(0.928)	(1.015)	(1.145)	(0.860)
Observation	7,269	7,269	7,265	7,269
Panel D. Medical Service				
Ave. Impact (0~2)	0.437**	0.486***	0.132	
	(0.171)	(0.154)	(0.235)	
Ave. Impact (1~2)	0.468**	0.532***	0.103	0.497**
	(0.202)	(0.186)	(0.283)	(0.197)
Observation	7,269	7,269	7,265	7,269
Panel E. Saving Rate				
Ave. Impact (0~2)	0.136***	0.143***	0.104*	
	(0.042)	(0.038)	(0.058)	
Ave. Impact (1~2)	0.121**	0.127***	0.083	0.114**
	(0.047)	(0.042)	(0.068)	(0.045)
Observation	6,573	6,577	6,561	6,573

Notes: This table reports robustness check results for household outcomes, using household-year panel data. Column 1 is the baseline results. Column 2 re-estimates the baseline parametric event study specification controlling province fixed effects instead of county fixed effects in the baseline specification. Column 3 re-estimates the baseline parametric event study specification controlling household fixed effects instead of the household head's characteristics in the baseline specification. Column 4 re-estimates the staggered DD after controlling for a dummy of the event time 0. All income and consumption variables are measured in thousands of *yuan*. Standard errors clustered at the village level are reported in parentheses under the coefficient estimates. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Highlights

- ✧ Land expropriation increases household income through significant compensation.
- ✧ Shift from agricultural to non-agricultural employment among affected individuals.
- ✧ Medical consumption rises, and household saving rates increase post-expropriation.
- ✧ Improvement in subjective health, no significant change in physical health.