Financial inclusion toward economic inclusion: empirical evidence from China's rural household

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Abstract

Purpose – Focusing on micro-level indicators, we investigate financial inclusion levels in rural China, examining its determinants and impact on household welfare. We construct a financial inclusion index of four essential financial services: savings, digital payments, credit and insurance. We identify factors influencing financial inclusion among Chinese rural households and assess the effects of financial inclusion on household welfare.

Design/methodology/approach – With the entropy method, we use data from the 2019 China Household Finance Survey to assess financial inclusion levels in rural China. Determinants and their impact on welfare are analyzed through probit and ordinary least squares models, respectively. Propensity scoring matching is applied to address potential endogeneity.

Findings – We reveal that rural households exhibit limited usage of formal financial services, with notable regional disparities. The eastern region enjoys the highest financial inclusion and the central region lags behind. Household characteristics such as family size, education level of the household head, income, employment status and financial literacy significantly influence financial inclusion. Financial inclusion positively impacts household welfare as indicated by household consumption expenditure. The use of different types of financial services is crucial with varying but significant effects on household welfare.

Originality/value – This study offers valuable insights into China's rural financial inclusion progress, highlighting potential barriers and guiding government actions.

Keywords Financial inclusion, Credit, Rural household China, Household welfare

Paper type Research paper

1. Introduction

Financial inclusion appears globally as a surging topic among governments, financial sectors and academics. It is a multifaceted concept, encompassing various indicators (Sarma, 2008). It refers to the guaranteed access, availability and use of essential, formal financial services that are safe, suitable and reasonably priced for all members of an economy, with particular emphasis on ensuring access for disadvantaged groups, including the disabled, women and unemployed (Allen *et al.*, 2016; Sarma, 2008). There is growing evidence that an inclusive economy can reduce information asymmetry, facilitate

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savings and credit activities, and alleviate poverty and income inequality (Singh and Roy, 2015; Turegano and Herrero, 2018). This is because an inclusive financial system balances inequality in capital resource allocation instead of providing services to more advanced or profitable markets. It also reduces income inequality and the gap between rich and poor (Allen *et al.*, 2016).

According to the Global Findex Database 2017, despite significant progress having been made in promoting financial inclusion worldwide, there are still 1.7 billion unbanked adults. This phenomenon is most acute among low-income groups in developing economies, including China (Demirgüç-Kunt *et al.*, 2017). Development disparity is prominent in emerging countries. The primary issue is that poor households are often constrained from the formal financial system for credit, savings and insurance services. According to the World Bank Global Findex database 2017, China has a relatively high financial inclusion in terms of account ownership, one of the major indicators of financial inclusion, compared with other economies. China's account ownership is 80%, which is higher than the world average of 69%. However, the use of formal credit is minimal. The proportion of Chinese adults formally banked and borrowed is only 23% (Demirgüç-Kunt *et al.*, 2017). There is a critical gap between Chinese urban and rural populations regarding access and use of financial services (Feng *et al.*, 2019a, b).

Academic research on financial inclusion focuses solely on the national level, rather than the aggregate level of financial services at the household level. Studies show that formal financial services' access and use have predominantly expanded in China's urban areas, while rural areas remain underdeveloped, particularly in credit utilization (Chen and Jin, 2017). Previous studies primarily focus on the general use of financial services (Fungáčová and Weill, 2015; Sarma, 2008); we take a unique approach by using four measures of financial services: the use of savings, mobile payments, credit and commercial insurance. This approach provides a more detailed analysis and contributes to a nuanced understanding of financial inclusion in Chinese rural households. The factors that influence the use of formal financial services and the reasons for being excluded from the financial system in rural China remain inconclusive. Rural households face multiple challenges, including financial illiteracy, information asymmetry and an income lack that pose obstacles to establishing an inclusive financial system (Zhu *et al.*, 2021). Financial inclusion is considered to enhance economic development through facilitating easily available various financial services to most people, but the impact of financial inclusion on household welfare and its possible transmission channels remains uncertain and lacks empirical support in prior studies (Lopez and Winkler, 2018; Yeung *et al.*, 2017).

This study contributes to the literature in several ways. First, it endeavors to bridge the research gap on China's rural areas and assesses the level of financial inclusion through different lenses by considering both traditional and modern financial products and services, and the key determinants associated at the rural household level, focusing on the demand side of financial services. Second, the study investigates the relationship between financial inclusion and household welfare and its potential transmission channels through the aggregate measure of financial inclusion in China's rural households. To the best of our knowledge, no study has examined the level of financial inclusion in rural China and its determinants and the welfare impacts of financial inclusion using aggregate measures of financial services at the household level. In 2020, China's rural population comprises 39% of the total population, with farms constituting a significant portion of rural households (World Bank Group, 2020). This study is important for providing meaningful insights for the Chinese government in a comprehensive review of China's financial inclusion progress and demonstrates potential obstacles that prevent rural Chinese households from being financially included. We find that Chinese rural households in different regions show varying levels of formal financial service usage. The eastern region has the highest level of

financial inclusion and the central region has the lowest. Factors such as family size, education level, income, employment and financial literacy influence financial inclusion. The empirical estimates suggest that financial inclusion positively impacts household welfare as evidenced by a 23% higher household consumption by financially included households compared with those that are not included. The potential channels through which financial inclusion might influence household welfare include the use of mobile payments, credit cards and commercial insurance.

The rest of the paper is organized as follows. Section 2 reviews the literature on financial inclusion and the status of financial inclusion in rural China. Section 3 discusses the data and methodology used for empirical analysis. Section 4 presents the study's results and Section 5 concludes with the key findings.

2. Literature review

2.1 The development of financial inclusion in China

Financial inclusion refers to the accessibility for both individuals and businesses to useful, affordable financial products and services (e.g. payments, savings, credit and insurance) that are provided in a sustainable, responsible manner (World Bank Group, 2022). Research in China has mainly investigated the overall level of financial inclusion rather than regional disparity. A few studies in China have focused on financial inclusion from households' perspective at the micro-level. For example, a cross-country study by Fungáčová and Weill (2015) finds that China has a high level of financial inclusion compared with other BRICS (Brazil, Russia, India, China and South Africa) countries in greater use of formal accounts and savings. Using data from the 2011 China Household Financial Studies (CHFS), Chen and Jin (2017) show that Chinese households had a low prevalence of formal credit (19.77%), with significant regional disparities and disproportional allocation among different social groups.

There is no consensus in the literature regarding the determinants of financial inclusion and/or the individual characteristics associated with financial inclusion at the household level. Studies have identified that financial exclusion is a part of social exclusion; the level of financial inclusion is highly correlated with individuals' characteristics, including age, gender, income level, lack of documents, education level and financial literacy (Cámara and Tuesta, 2014; Demirgüç-Kunt and Klapper, 2013), and economic circumstances such as regulatory policies, remoteness, cost of documentation and trust in banking systems (Allen *et al.*, 2016; Ezzahid and Elouaourti, 2021).

For China, Yeung *et al.* (2017) report that financial services in rural China are geographically accessible, but only a minimal proportion of the rural population participate in the formal financial system. This situation calls for more studies on the determinants of financial inclusion from the demand side of financial services. As noted by Chen and Jin (2017), banks typically consider factors like a stable income, education level, employment and assets when approving formal credit applications. Access to formal credit was historically limited for households with lower financial literacy, family income and assets available for collateral (Chen and Jin, 2017; Chen and Lemieux, 2016). According to Fungáčová and Weill (2015), the use of the financial services in China is highly correlated with socioeconomic factors and individual characteristics. Higher income and education, male and older age are closely related to greater use of formal accounts and credit in China. However, the authors find that income and education are not statistically significant determinants; better education does not contribute to better access to credit in China but affects the adoption of alternative credit sources. Using county-level data from 2014 to 2019, Liu *et al.* (2017) find the determinants of digital financial inclusion vary among urban and rural groups. Secondary education supports the development of rural digital financial inclusion, but such effect is less

evident in urban regions. Zhu *et al.* (2021) reveal that social relationships have a significant negative impact on household financial exclusion (without formal financial accounts) in China.

2.2 Financial inclusion and household welfare

The benefit of an inclusive financial system to improve the living standards of the poor, low-income and other disadvantaged groups is well established in prior research. Most studies focus on macroeconomic factors, such as financial inclusion acting as a catalyst to greater economic empowerment, poverty alleviation and income inequality reduction (Bruhn and Love, 2014; Claessens, 2006; Demirgüç-Kunt *et al.*, 2017; Turegano and Herrero, 2018). This is because it ensures household access to formal saving services that allow households to save present consumption for future rewards, make investments, accumulate liquid and durable assets, and provide individuals with insurance services that can facilitate households' resilience to idiosyncratic shocks (Célerier and Matray, 2019; Iddrisu and Danquah, 2021).

However, there is little systematic research on how individuals experience the impact of financial inclusion at the micro-level and the results are mixed. For instance, Bruhn and Love (2014) conclude that increased access to finance has a sizable positive impact on the economic activity and income level of low-income individuals. The channels are through the labor market by fostering the creation of informal business operations and improving employment. DeLoach and Smith-Lin (2018) establish a relationship between access to formal banking services and the ability to absorb adult health shocks in Indonesia. With US banking deregulation from 1994 to 2005, Célerier and Matray (2019) conclude that owning a bank account leads to better consumption smoothing, access to debt, and financial security for low-income groups.

Using a composite financial inclusion index in 2011, Zhang and Posso (2019) show that financial inclusion positively impacts household income in China, especially for low-income households. Iddrisu and Danquah (2021) find that financially deprived households have lower welfare than their financially included counterparts in Ghana. Conversely, Amendola *et al.* (2016) fail to find any positive effects of financial inclusion, measured by credit access, on poverty rates or non-durable product consumption in Mauritania. Dimova and Adebowale (2018) demonstrate that financial inclusion, proxied by having a bank account, promotes per capita spending but concurrently increases inter-household inequalities. Mallick and Zhang (2019) analyzed the effect of owning a transaction account on household consumption inequality at the household level in China. They reveal an uneven impact of financial inclusion on alleviating consumption inequality. The effect of welfare improvement varied among income groups and was limited for urban households. Overall, evidence on the positive impact of financial inclusion on both individual and overall welfare is inconclusive, emphasizing the need to differentiate between types of financial service.

3. Data and methods

This study collects the 2019 number of rural bank branches and residents' data from the China Banking and Insurance Regulatory Commission and the National Bureau of Statistics of China. Household-level data are from the CHFS, conducted by the Survey and Research Center of Southwestern University of Finance and Economics (SWUFE). The CHFS is a nationwide survey with questionnaires for individuals, households and communities, carried out every two years since 2009. It collects micro-level financial information about Chinese households, including financial assets and liabilities, income and expenditure, insurance and social security, demographic characteristics. The survey provides a comprehensive, detailed description of households' economic and financial behavior throughout the country. We use

the 2019 survey, covering 34,363 households (12,336 from rural areas) from 29 provinces (excluding Xinjiang, Tibet, Hong Kong, Macao and Taiwan), 343 counties and 1,360 communities in China.

3.1 Calculation of the financial inclusion index

The process of constructing a multidimensional financial inclusion index includes four steps: (1) dimension selection; (2) normalization of variables; (3) assigning weights for each sub-index; and (4) aggregation of the sub-indices. Calculation of financial inclusion index is now provided.

3.1.1 Dimensions selection. Based on Sarma (2008, 2012) and Chakravarty and Pal (2013), financial inclusion involves three key dimensions: accessibility, availability and the use of financial services. This comprehensive measure captures multiple dimensions from both the demand and supply perspectives to measure the extent of financial inclusion. Following Sarma's (2008) proposed index, we consider two dimensions: access and use of bank services, because they are crucial components of financial inclusion. The access dimension indicates service reach, whereas the use dimension measures the permanence and depth of financial service adoption, reflecting an individual's level of participation in economic activity in the financial system.

Because of data availability, the access dimension comprises two indicators: the number of bank branches and financial service outlets per 1,000 residents in rural areas. We focus on the demographic penetration of banking services, given that commercial banks are the primary financial service providers in China. For the use dimension, many studies, such as Demirgüç-Kunt *et al.* (2017), Fungáčová and Weill (2015) and Sarma (2008), used cheque account ownership as a key indicator of financial service use. However, merely having a bank account doesn't guarantee active use if there is a dismal record of account use. To address this, we select four variables: the proportion of formal savings, credit card usage, mobile account usage and commercial insurance usage, as measures of financial inclusion at the rural household level. In contrast to traditional indicators, we include mobile payment accounts to reflect the increasing impact of digital technology. Rising mobile phone penetration in developing countries, particularly in China, indicates the importance of considering mobile payments as non-traditional financial services, aligning with the growing accessibility of financial services through smartphones (Hannig and Jansen, 2010). Table 1 presents definitions of the financial inclusion index indicators.

Dimension	No.	Indicator	Definition
Access	1	Number of bank branches/1,000 residents	The number of bank branches in rural areas divided by the rural population
	2	Number of financial service-outlets/1,000 residents	The number of financial service-outlets in rural areas divided by the rural population
Usage	3	Proportion of rural households using saving accounts	The number of households using saving accounts divided by total rural households
	4	Proportion of rural households using mobile payment accounts	The number of households using mobile payment accounts divided by total rural households
	5	Proportion of rural households using credit cards	The number of households using credit cards for transactions and/or business operations divided by total rural households
	6	Proportion of rural households using commercial insurance	The number of households using commercial health/life insurance divided by total rural households

Source(s): Authors' own work

Table 1. Indicators of composite financial inclusion index

3.1.2 Normalization of variables. We follow Sarma's (2008) min-max method to normalize dimensional variables. The equation is:

$$d_i = \frac{A_i - m_i}{M_i - m_i} \tag{1}$$

where A_i is the actual value of variable i; m_i is the minimum value of variable i; M_i is maximum value of variable i; and i ranges from 1 to 6. Normalization allows rescaling each variable into an equal scale with range [0, 1], where higher the value, the higher financial inclusion in dimension i.

3.1.3 Assigning weights. In contrast to conventional approaches in most composite indicators in previous studies (e.g. Chakravarty and Pal, 2013; Sarma, 2008; Park and Mercado, 2015) that often assign equal weights or employ subjective weighting schemes criticized for potential bias, we use the entropy method to assign weights to the dimensions in the financial inclusion index. The entropy method is widely used in socioeconomic studies, offering a nuanced perspective by dynamically adjusting weights based on the extensiveness or scarcity of information in each dimension (Liu *et al.*, 2021). In general, when the order degree of uncertainty is low, the entropy value is small, signifying concentration of information (Zhu *et al.*, 2019). This approach aligns with our objective to capture the statistical importance of variables and introduces a data-driven methodology that accommodates the inherent uncertainty or variation in the data. Weighting calculation by the entropy method follows.

First, we calculate the value of p_{ij}, which denotes the normalized indicator i of the j^{th} province as a percentage of the sum of the i^{th} indicator across all provinces:

$$p_{ij} = \frac{d_{ij}}{\sum_{j=1}^{n} d_{ij}} \tag{2}$$

The entropy value E_i of the i^{th} indicator is defined as:

$$E_i = -\frac{1}{Ln(n)} \times \sum_{j=1}^{n} p_{ij} Ln\left(p_{ij}\right) \tag{3}$$

where $p_{ij} Ln\left(p_{ij}\right) = 0$ is generally set when $p_{ij} = 0$ for the convenience of calculation in the actual use of entropy weight method. The total weights are then summed to 1, and the weight of the i^{th} indicator is given as:

$$w_i = \frac{1 - E_i}{\sum_{j=1}^{k} (1 - E_i)} \tag{4}$$

3.1.4 Aggregation of variables. We follow Sarma (2008) and HDI that use the arithmetic mean in calculating the financial inclusion index. This can be expressed as:

$$FII = \sum_{i=1}^{k} w_i \times d_i \tag{5}$$

3.2 Empirical model (I): the determinants of financial inclusion in rural China

We use the probit model based on Tuesta *et al.* (2015) and Lotto (2018) to analyze the determinants of financial inclusion and certain variables of interest at the micro-level in rural China. The probit model is widely used for econometric analysis, which is appropriate for this study where the dependent variable is dichotomous with the value zero or one.

$$y_i^* = x_i'\beta + \varepsilon_i \quad (6)$$

$$y_i = 1 \text{ if } y_i^* > 0;\ y_i = 0 \text{ if } y_i^* \leq 0 \quad (7)$$

where the subscript i denotes rural household i; β is a vector of parameters; and ε represents a normally distributed error term with $E(\varepsilon) = 0$ and $Var(\varepsilon) = 1$.

Financial inclusion is a multidimensional phenomenon involving not only access to bank accounts but to other financial services. Thus, we use the usage dimension of financial inclusion to better understand the determinants of financial inclusion from the demand side at the rural household level. These include the use of savings, mobile payment, credit card accounts and commercial insurance. We consider a wide range of explanatory variables available from the CHFS 2019 dataset that agree with the literature: household head's characteristics (gender, age, education level, employment status, local official status, financial literacy) and the household's demographic characteristics (family size and income).

For the financial literacy of the household head, we use factor analysis to construct a financial literacy index (*Financial literacy*) based on the CHFS 2019 survey results. Previous studies point out the importance of recognizing the difference between "incorrect answer" and "I do not know," because the incorrect responses contain useful information that indicate different levels of financial literacy (Lusardi and Mitchell, 2011; van Rooij *et al.*, 2011). Following previous studies, we consider the distinction between incorrect and "do not know" responses in our analysis. It is generally accepted that the level of financial literacy represented by an incorrect answer differs from that described by a response "does not compute" or "does not know" (Feng *et al.*, 2019a, b; Ling *et al.*, 2023). We exploit two dummy variables for each question on interest rate [1] (*fin_lit1a* and *fin_lit1b*), inflation rate [2] (*fin_lit2a* and *fin_lit2b*). The first dummy variable represents whether the answer is correct and the latter dummy variable indicates "do not know" answers. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity test the applicability of factor analysis (Bartlett, 1937; Kaiser, 1974). The KMO test indicates the strength of the partial correlation among the variables; a KMO value greater than 0.5 is considered plausible to conduct factor analysis. Bartlett's test of sphericity is used to test correlation of the indicators (Bartlett, 1937). The results of factor analysis are presented in Tables 2 and 3. The descriptive statistics of the variables are summarized in Table 4.

3.3 Empirical model (II): the impact of financial inclusion on household welfare

We select a consumption-based measure of household welfare, a metric widely used in prior studies (Beegle *et al.*, 2012; Koomson *et al.*, 2020; Chakrabarty and Mukherjee, 2022), to investigate the causal relationship of between financial inclusion and household welfare. Though certain scholars argue that a consumption-based measure of household welfare

	Initial eigenvalues			Extraction sums of squared loadings		
Component	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	2.390	59.739	59.739	2.390	59.739	59.739
2	0.885	22.115	81.854			
3	0.429	10.714	92.568			
4	0.297	7.432	100.000			

Note(s): [a]Extraction method: principal component analysis
Source(s): Authors' own work

Table 2.
Factor analysis results of financial literacy[a]

offers a more accurate representation of welfare than income-based measures (Meyer and Sullivan, 2012; World Bank Group, 2001), the rationale for choosing consumption over household income is rooted in the volatility of income because of seasonal patterns. This volatility can lead to either overestimated or underestimated income. In contrast, consumption is regular in terms of production cycles, especially in an agriculturally dominated economy, therefore, better represents rural households' living standard (Deaton and Zaidi, 2002). Following Iddrisu and Danquah (2021), we use ordinary least squares (OLS) technique to investigate the welfare impact of financial inclusion at household level. The empirical model can be expressed as:

$$y_i = \beta Fin_i + \gamma X_i + \alpha_i + \varepsilon_i \tag{8}$$

where y_i is the dependent variable representing total annual consumption by household i. The main independent variable, Fin_i, refers to the measure of household i's financial inclusion status. X_i is a vector of control variables that have been identified in past studies. It includes the demographic characteristics of the household such as age, gender, family size, education level, total income, marital status, employment status, ethnicity and Hukou (agricultural residence permit). These variables provide insights into how financial inclusion combined with household characteristics can facilitate household welfare at the micro-economic level. The variable, α_i, is a region-level dummy variable that controls for geographical characteristics and ε_i is the normally distributed error term. Descriptions of the model variables are summarized in Table 4.

Specifically, Fin_i is a binary variable equal to one if the household is financially included as represented by financial deprivation status. We closely follow Alkire *et al.* (2011) and Iddrisu and Danquah (2021) for computation of the Multidimensional Poverty Index to determine the level of financial deprivation, representing household financial inclusion status. To measure the level of financial inclusion at the household level, we define financial inclusion as the use of basic, affordable financial products and services that satisfy the savings, transactions and payments, credit and insurance needs of individuals (Demirgüç-Kunt and Klapper, 2013; World Bank Group, 2022). Therefore, Fin_i is based on the financial deprivation score using four equally weighted indicators representing the use of financial services and products (savings, mobile payment, credit cards, commercial insurance). Considering each component is represented by a single indicator, we follow Iddrisu and Danquah (2021) and Zhang and Posso (2019) and assign equal weights to each financial deprivation component. The score for each indicator is then summed to obtain the household deprivation score, which ranges from 0 to 1, to reflect the extent of a household's financial deprivation (see Table 5).

We follow Zhang and Posso (2019) and select a cut-off score of 0.5 as half of the four indicators to distinguish whether a household is financially included or excluded to compute a binary measure of household financial inclusion status (Fin_i). If the total deprivation score of a household is less than 0.5, Fin_i equals one and the household is said to be financially included, and vice versa. To ensure the robustness of this measure, we use two other cut-off scores, 0.25 and 0.75 as robustness checks. Beck (2016) points out that it is important to

Table 3.
KMO and Bartlett's test results of factor analysis

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.652
Bartlett's test of sphericity	Approx. Chi-square	15249.635
	df	6
	Sig	0.000

Source(s): Authors' own work

Variable	Obs	Mean	SD	Min	Max	Description
Financial inclusion variables						
Fin (Financial inclusion)	12,022	0.143	0.350	0	1	Binary: a measure of households' level of financial inclusion, and it takes a value of 1 if a household is financially included (deprivation score of financial inclusion is below 0.5), 0 otherwise
Financial deprivation score	12,022	0.842	0.204	0	1	Household financial deprivation score (0–1)
Saving account	12,022	0.119	0.323	0	1	Binary: equal to 1 if the household uses a saving account, 0 otherwise
Mobile payment account	12,022	0.339	0.473	0	1	Binary: equal to 1 if the household uses a mobile payment account, 0 otherwise
Credit card	12,022	0.062	0.240	0	1	Binary: equal to 1 if the household uses a credit card for day-to-day consumption and/or business operations, 0 otherwise
Commercial insurance	12,022	0.113	0.317	0	1	Binary: equal to 1 if the household has a commercial health/life insurance, 0 otherwise
Household head's characteristics						
Age	12,019	59.128	11.800	17	102	Continuous: household head's age
Age^2	12,019	3,635.3	1,395.4	289	10,404	Continuous: household head's age squared
Gender	12,022	0.848	0.359	0	1	Binary: equal to 1 if the household head is male, 0 otherwise
Marriage	12,018	0.863	0.344	0	1	Binary: equal to 1 if the household head is married, 0 otherwise
Ethnicity	11,159	0.893	0.310	0	1	Binary: equal to 1 if the household head is Han Chinese, 0 otherwise
Hukou	12,008	0.928	0.259	0	1	Binary: equal to 1 if the household head has an agricultural residence permit (Hukou), 0 otherwise
Farmer	12,002	0.540	0.498	0	1	Binary: equal to 1 if the household head is engaged in farming, 0 otherwise
Temporary worker	12,002	0.147	0.354	0	1	Binary: equal to 1 if the household head is employed as temporary worker, 0 otherwise
Employee	12,002	0.060	0.237	0	1	Binary: equal to 1 if the household head is employed by someone or some units, 0 otherwise

(*continued*)

Table 4.
Descriptive statistics of the variables

Variable	Obs	Mean	SD	Min	Max	Description
Self-employed	12,002	0.053	0.223	0	1	Binary: equal to 1 if the household head is self-employed, 0 otherwise
Unemployed	12,002	0.200	0.400	0	1	Binary: equal to 1 if the household head is unemployed, 0 otherwise
Basic education	12,011	0.513	0.500	0	1	Binary: equal to 1 if the household head's highest education level is primary school, 0 otherwise
Junior high education	12,011	0.363	0.481	0	1	Binary: equal to 1 if the household head's highest education level is junior high school, 0 otherwise
Secondary high education	12,011	0.109	0.312	0	1	Binary: equal to 1 if the household head's highest education level is secondary high school, 0 otherwise
Tertiary education	12,011	0.015	0.120	0	1	Binary: equal to 1 if the household head's highest education level is tertiary education, 0 otherwise
Communist Party	11,432	0.128	0.334	0	1	Binary: equal to 1 if the household head's political status is communist party, 0 otherwise
Financial literacy	11,627	−2.25e−06	1.000	−0.7	2.453	Continuous: the level of household head's financial literacy generated by factor analysis
Household demographics						
Family size	12,022	3.268	1.683	1	12	Continuous: number of family members in the household
Household total consumption (log)	12,022	10.453	0.872	7.2	14.7	Continuous: natural logarithm of household total annual consumption
Household total income (log)	11,587	10.014	1.380	0	15.878	Continuous: natural logarithm of household total annual income
Income_Q1	11,188	0.210	0.408	0	1	Binary: equal to 1 if the household belongs to the first income quintile (the poorest), 0 otherwise
Income_Q2	11,188	0.192	0.394	0	1	Binary: equal to 1 if the household belongs to the second income quintile, 0 otherwise
Income_Q3	11,188	0.215	0.411	0	1	Binary: equal to 1 if the household belongs to the third income quintile, 0 otherwise
Income_Q4	11,188	0.185	0.389	0	1	Binary: equal to 1 if the household belongs to the fourth income quintile, 0 otherwise

Table 4. (*continued*)

Variable	Obs	Mean	SD	Min	Max	Description
Income_Q5	11,188	0.197	0.398	0	1	Binary: equal to 1 if the household belongs to the fifth income quintile (the richest), 0 otherwise
Region	11,685	1.981	0.815	1	3	Categorical: equal to 1 if the household locates in eastern provinces, 2 = central provinces, 3 = western provinces

Source(s): Authors' own work

Table 4.

Indicator	Weight	Deprived if
Saving account	¼	Household does not use a term deposit
Mobile payment account	¼	Household does not use a mobile payment account
Credit card	¼	Household does not use a credit card
Commercial insurance	¼	Household does not use any commercial insurance

Source(s): Authors' own work

Table 5.
Calculation of financial deprivation score

understand that the positive impact of financial inclusion on individual and overall welfare does not merely come from account ownership but from active use of it. Therefore, we investigate the importance of each of the four indicators as a single measure of financial inclusion in improving households' welfare. This is to answer the question: Which channel(s) of financial inclusion is(are) most important in explaining improvement in households' living standard.

Given equation (8) might suffer from endogeneity, we adopt propensity score matching (PSM) (Rosenbaum and Rubin, 1983) to account for it and selectivity bias. Endogeneity may arise because household welfare can be influenced by the level of financial inclusion and, simultaneously, the decision to be financially included can be influenced by the level of economic welfare. To address this issue, we leverage our main independent variable Fin_i, which is a binary variable that allows us to use PSM for its estimation. We first include a set of household demographics (age, gender, family size, marital status, employment status, ethnicity, Hukou (agricultural residence permit), education level and income level) as covariates to estimate the propensity scores. Subsequently, various matching methods are used to match treated and untreated households based on the propensity score. Caliendo and Kopeinig (2008) argue that there are pros and cons in selecting different matching algorithms when calculating the propensity score. We therefore adopt multiple matching algorithms (nearest-neighbor, kernel, radius and local linear regression) to ensure the reliability of our PSM results.

4. Empirical results

4.1 Level of financial inclusion in rural China

Table 6 displays the weighted normalized values of two financial inclusion dimensions and composite financial inclusion index at the rural level for 29 provinces in China. The results indicate that different provinces in China are at different levels of financial inclusion, ranging from a minimum of 0.11380 (Guizhou) to a maximum of 0.78512 (Shanghai). This reflects

Province	Access	Usage	Financial inclusion index	Ranking
Shandong	0.09686	0.22012	0.31698	11
Beijing	0.54216	0.20869	0.75085	3
Tianjin	0.50013	0.28101	0.78114	2
Shanghai	0.58717	0.19795	0.78512	1
Hebei	0.05749	0.24626	0.30374	12
Liaoning	0.19848	0.14000	0.33847	10
Jiangsu	0.21482	0.27551	0.49033	5
Zhejiang	0.33736	0.21589	0.55325	4
Fujian	0.17639	0.21900	0.39539	7
Guangdong	0.13782	0.21712	0.35493	9
Hainan	0.10038	0.09521	0.19558	21
Eastern Region	*0.26809*	*0.21061*	*0.47871*	
Shanxi	0.08487	0.14522	0.23009	16
Jilin	0.09596	0.10176	0.19772	20
Heilongjiang	0.05304	0.12845	0.18150	22
Anhui	0.02419	0.14601	0.17021	23
Jiangxi	0.06764	0.14426	0.21191	18
Henan	0.01959	0.13397	0.15356	25
Hubei	0.06349	0.16886	0.23235	15
Hunan	0.02904	0.17890	0.20794	19
Central Region	*0.05473*	*0.14343*	*0.19816*	
Inner Mongolia	0.15735	0.14040	0.29775	13
Guangxi	0.01629	0.12595	0.14225	28
Chongqing	0.13072	0.13634	0.26707	14
Sichuan	0.05446	0.16828	0.22274	17
Guizhou	0.01007	0.10373	0.11380	29
Yunnan	0.00286	0.14438	0.14725	27
Shaanxi	0.09913	0.26843	0.36756	8
Gansu	0.03003	0.11794	0.14797	26
Qinghai	0.06176	0.10426	0.16602	24
Ningxia	0.13287	0.31850	0.45137	6
Western Region	*0.06955*	*0.16282*	*0.23238*	

Source(s): Authors' own work

Table 6. Financial inclusion index level by Chinese region in 2019

Turvey and Xiong (2017) who say that there is substantial variability across provinces, including rural areas. Regionally, rural households in the east have the highest level of financial inclusion for single measures (i.e. access and usage) of financial inclusion and the composite financial inclusion index. Those in the central region report a dismal performance with the lowest financial inclusion index.

4.2 The determinants of financial inclusion in rural China

Since the coefficients of the probit estimates have no direct interpretation, Table 7 shows the probit estimates of the marginal effects (Greene, 2003). The marginal effects capture the change in probability of financial service usage with the value change in the corresponding independent variable, holding all other variables constant. Multiple measures of the goodness-of-fit test are conducted for each model in our study: the likelihood ratio test (LRT), pseudo R^2 and proportion of correct prediction (see Table 7).

We select multiple levels of financial inclusion indicators as the dependent variables to reflect the inclusiveness of rural households regarding the adoption of various financial services. These are binary variables indicating whether households use formal savings (*Savings account*), mobile payment account (*Mobile account*), credit card (*Credit card*) and

Independent variable	(1) Saving account usage	(2) Mobile account usage	(3) Credit card usage	(4) Commercial insurance usage
Age	0.003 (0.002)	−0.003 (0.004)	−0.002 (0.002)	0.008*** (0.002)
Age^2	0.000 (0.000)	−0.000** (0.000)	0.000 (0.000)	−0.000*** (0.000)
Gender	0.015 (0.010)	0.007 (0.012)	−0.003 (0.007)	−0.001 (0.009)
Family size	−0.012*** (0.002)	0.031*** (0.002)	0.006*** (0.001)	0.008*** (0.002)
Farmer	0.030*** (0.009)	−0.030*** (0.011)	−0.012* (0.007)	0.000 (0.009)
Temporary worker	0.043*** (0.012)	−0.002 (0.014)	−0.016* (0.009)	−0.005 (0.011)
Employee	0.050*** (0.015)	0.041** (0.018)	0.012 (0.010)	−0.004 (0.014)
Self-employed	0.054*** (0.016)	0.131*** (0.020)	0.022** (0.010)	0.030** (0.014)
Junior high education	0.044*** (0.007)	0.041*** (0.008)	0.007 (0.005)	0.041*** (0.007)
Senior high education	0.025*** (0.011)	0.075*** (0.012)	0.020*** (0.007)	0.044*** (0.010)
Tertiary education	−0.013 (0.027)	0.155*** (0.036)	0.029** (0.014)	0.061*** (0.022)
Income_Q1	−0.144*** (0.012)	−0.272*** (0.013)	−0.059*** (0.009)	−0.110*** (0.011)
Income_Q2	−0.099*** (0.011)	−0.223*** (0.012)	−0.062*** (0.008)	−0.104*** (0.010)
Income_Q3	−0.063*** (0.010)	−0.155*** (0.011)	−0.050*** (0.007)	−0.060*** (0.009)
Income_Q4	−0.019** (0.009)	−0.089*** (0.011)	−0.040*** (0.006)	−0.043*** (0.008)
Financial literacy	0.031*** (0.003)	0.045*** (0.004)	0.017*** (0.002)	0.018*** (0.003)
Communist party	0.003 (0.009)	0.016 (0.012)	0.010 (0.007)	−0.010 (0.009)
Observations	10,304	10,304	10,304	10,304
LRT	496.46***	2867.42***	586.86***	597.55***
Pseudo R^2	0.066	0.312	0.132	0.098
Log likelihood	−3619.754	−4552.238	−2073.015	−3247.184
Percent correct predictions	0.875	0.783	0.938	0.889
Mean predicted probability	0.125	0.217	0.062	0.111

Note(s): Each column represents the probit estimate of the determinants of the four financial inclusion indicators in China. We report the estimated marginal effects. Standard errors are in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively
Source(s): Authors' own work

Table 7.
The determinants of financial inclusion in rural China

commercial insurance (*Commercial insurance*). According to columns (1) to (4), Table 7, most variables have a significant impact on the four financial inclusion indicators. However, several exceptions exist compared with the literature for age, gender and communist party membership. There are no differences by household head age, gender, and being a communist party member in choosing to be financially included. Specifically, age and age squared are insignificant for the first three financial inclusion indicators. This contradicts Fungáčová and Weill (2015) who assert a significant impact of age on financial services usage. The only exception is the use of commercial insurance. The results show significant positive effect for age and a significantly negative effect for age^2, indicating that there is a non-linear relationship between age and commercial insurance usage. Household heads of an older age are more likely to be financially included for commercial insurance usage but only up to a certain age.

For family size, our results show that a larger family negatively affects the use of formal savings. Households with larger families increase by 1.2% the likelihood of not using formal savings, which agrees with Soumaré *et al.* (2016) for West Africa. Conversely, family size

favorably influences the use of digital accounts, credit cards and insurance by 3.1%, 0.6% and 0.8%, respectively. A possible reason is that as family size increases, there is an increasing demand for payment transactions, borrowing and insurance services to protect family members against external shocks (Kaur and Kapuria, 2020). Employment type significantly impacts financial service usage, aligning with Soumaré *et al.*'s (2016) findings. Of the four employment types, self-employed household heads appear to be more likely to be financially included in all four services by 5.4%, 13.1%, 2.2% and 3%, respectively. Notably, farming household heads have a negative correlation with mobile account and credit card usage, possibly because of limited digital access and a preference for informal borrowing from friends, relatives and pawnshops (Zhu *et al.*, 2021).

Most education levels are significant and positively related to the use of the four types of financial service, especially household heads with senior high education. These findings support previous studies such as Chen and Jin (2017), Mohammed *et al.* (2017) and Zhu *et al.* (2021), suggesting that education level plays a critical role in improving financial inclusion. Income level is statistically, significantly negative for the financial inclusion indicators. As expected, the likelihood of financial inclusion falls in the lower income quantiles. This is consistent with Demirgüç-Kunt *et al.* (2017), who conclude that income is positively related to financial inclusion level. The impact of financial literacy is identical for all four financial inclusion indicators. Financial literacy level is significantly, positively correlated with financial inclusion, indicating that higher financial literacy means a higher likelihood of participating in the financial market. This corroborates the results of Grohmann *et al.* (2018), Lusardi and Mitchell (2011) and Sanderson *et al.* (2018). This is because better financial knowledge means better ability to participate in formal financial markets, which facilitates the uptake of formal savings, digital accounts, credit and insurance services.

4.3 Financial Inclusion's impact on household welfare

4.3.1 Baseline results. Table 8 presents the baseline OLS results of equation (8) investigating the impact of financial inclusion proxied by the financial deprivation score on rural household welfare. The dependent variable is (log) annual total consumption expenditure per household as a measure of household welfare. In all estimates, we use robust standard error at the household level to control for potential heteroskedasticity; regional effects are also controlled in the estimates.

The OLS estimates in Table 8 suggest that financial inclusion (Fin_i) is negatively correlated with household welfare at the 1% significance level. This means that being financially included suggests a better outcome in improving household consumption expenditure than counterparts. The large coefficient estimate of Fin_i indicates that the total household consumption of financially included households is approximately 23% higher than financially excluded households, implying that financially deprived households have a relatively lower welfare level than financially included counterparts. The result confirms our expectations and agrees the conclusions of prior studies such as Iddrisu and Danquah (2021), Mwangi and Atieno (2018) and Zhang and Posso (2019). For the control variables, we observe that larger households, male-headed households, self-employed households, higher levels of education, higher income levels and married head households are significant predictors of household welfare.

4.3.2 The effect of various channels of financial inclusion on household welfare. To understand the potential channels through which financial inclusion influences household welfare, we explore the relative importance of each of our four indicators of financial inclusion for household welfare. Table 9, Columns (1) to (4), reveal that financial inclusion using various banking services (mobile payment, credit cards, commercial insurance) has a significant impact on explaining household welfare at the 1% level, but with varying magnitudes.

Variable	Dependent variable: (log) household annual consumption Coefficient	Robust SE
Fin_i (Financial inclusion)	0.233***	(0.020)
Age	−0.013***	(0.001)
Gender	−0.032	(0.020)
Family size	0.157***	(0.005)
Farmer	−0.120***	(0.019)
Temporary worker	−0.123***	(0.026)
Employee	0.001	(0.035)
Self-employed	0.204***	(0.036)
Junior high education	0.061***	(0.015)
Senior high education	0.139***	(0.022)
Tertiary education	0.265***	(0.056)
Income	0.143***	(0.007)
Marriage	0.202***	(0.022)
Ethnicity	0.029	(0.023)
Hukou	−0.150***	(0.027)
Constant	9.266***	(0.095)
Region controls	Yes	
Observations	10,434	
R-squared	0.397	
F-statistic	398.50	

Note(s): Robust standard errors in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively
Source(s): Authors' own work

Table 8.
Financial inclusion and household welfare

Specifically, the welfare effect of the use of mobile payment accounts has the greatest impact on household welfare, approximately 30%. The coefficient estimates for mobile account usage reflect that financially included households, measured by mobile payment account usage, have 30% more annual consumption expenditure than those without a digital payment account. The use of formal savings has a positive but insignificant effect on total household consumption, which contradicts Iddrisu and Danquah's (2021) results. This may be explained by different measures of household welfare in the studies; households with term deposit accounts tend to spend less to save for the future. Based on the coefficients in each column of Table 8, households that use credit cards and commercial insurance enhance their household welfare by 24% and 16%, respectively.

4.3.3 Robustness check I: alternative measures of financial inclusion. To ensure the robustness of our empirical results, we use alternative cut-off points to measure household financial inclusion status. We first use a cut-off of 25%, which classifies a household as financially included if the household is deprived of only one of the four components of financial deprivation, and a cut-off of 75%, which indicates a household is financially included if the household is not financially deprived from any one of the four components of financial deprivation. Table 10 presents the results of the impact of financial inclusion on household welfare using 25% and 75% cut off points, respectively. In both estimates, being financially included has a significant, positive effect on total household consumption as a measure of household welfare. The results further reinforce the robustness of our measure of financial inclusion.

4.3.4 Robustness check II: Propensity Score Matching. In this section, following Caliendo and Kopeinig (2008), we use propensity score matching (PSM) to account for potential endogeneity and selectivity bias issues. Multiple matching methods, including nearest-neighbor, radius,

Variable	Dependent variable: (log) household annual consumption (1)	(2)	(3)	(4)
Savings	0.022			
	(0.019)			
Credit card		0.243***		
		(0.031)		
Mobile account			0.299***	
			(0.017)	
Commercial insurance				0.159***
				(0.021)
Age	−0.014***	−0.013***	−0.009***	−0.013***
	(0.001)	(0.001)	(0.001)	(0.001)
Gender	−0.032	−0.032	−0.037*	−0.031
	(0.020)	(0.020)	(0.020)	(0.020)
Family size	0.160***	0.158***	0.148***	0.158***
	(0.005)	(0.005)	(0.005)	(0.005)
Farmer	−0.126***	−0.121***	−0.110***	−0.124***
	(0.019)	(0.019)	(0.019)	(0.019)
Temporary worker	−0.125***	−0.120***	−0.123***	−0.120***
	(0.026)	(0.026)	(0.026)	(0.026)
Employee	0.019	0.009	−0.007	0.018
	(0.035)	(0.035)	(0.035)	(0.035)
Self-employed	0.232***	0.217***	0.177***	0.226***
	(0.037)	(0.036)	(0.036)	(0.036)
Junior high education	0.073***	0.071***	0.050***	0.067***
	(0.016)	(0.015)	(0.015)	(0.015)
Senior high education	0.160***	0.149***	0.122***	0.152***
	(0.022)	(0.022)	(0.022)	(0.022)
Tertiary education	0.305***	0.270***	0.241***	0.287***
	(0.057)	(0.056)	(0.056)	(0.057)
Income	0.151***	0.149***	0.138***	0.147***
	(0.007)	(0.007)	(0.007)	(0.007)
Marriage	0.198***	0.201***	0.212***	0.199***
	(0.022)	(0.022)	(0.022)	(0.022)
Ethnicity	0.044*	0.045*	0.030	0.039*
	(0.024)	(0.023)	(0.023)	(0.024)
Hukou	−0.155***	−0.152***	−0.147***	−0.156***
	(0.027)	(0.027)	(0.027)	(0.027)
Constant	9.268***	9.246***	9.083***	9.283***
	(0.097)	(0.096)	(0.095)	(0.097)
Region controls	Yes	Yes	Yes	Yes
Observations	10,434	10,434	10,434	10,434
R-squared	0.390	0.394	0.407	0.393
F-statistic	378.64	384.74	416.96	386.96

Note(s): Robust standard errors in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively

Table 9.
Effect of various channels of financial inclusion on household welfare

kernel and local linear regression are used (see Table 11). It is important to test the balance of covariates in PSM. Based on the approach suggested by Staffa and Zurakowski (2018), we assess the quality of matching based on the mean standard bias instead of the *p*-value since it is highly driven by the sample size. An absolute standardized mean bias greater than 10% represents meaningful imbalance. Table 12 shows the sensitivity test results to diagnose the reliability of the match. They reveal that all variables in our PSM have a good balance in the standard bias.

Variable	Cut-offs used to construct Fin_i	
	(1)	(2)
Dependent variable: (log) household annual consumption	25%	75%
Fin_i (Financial inclusion)	0.274***	0.220***
	(0.038)	(0.015)
Age	−0.013***	−0.011***
	(0.001)	(0.001)
Gender	−0.029	−0.037*
	(0.020)	(0.020)
Family size	0.158***	0.154***
	(0.005)	(0.005)
Farmer	−0.122***	−0.122***
	(0.019)	(0.019)
Temporary worker	−0.121***	−0.123***
	(0.026)	(0.026)
Employee	0.015	0.002
	(0.035)	(0.035)
Self-employed	0.221***	0.195***
	(0.036)	(0.036)
Junior high education	0.069***	0.050***
	(0.015)	(0.015)
Senior high education	0.148***	0.134***
	(0.022)	(0.022)
Tertiary education	0.272***	0.267***
	(0.056)	(0.057)
Income	0.148***	0.137***
	(0.007)	(0.007)
Marriage	0.199***	0.198***
	(0.022)	(0.022)
Ethnicity	0.038	0.034
	(0.024)	(0.023)
Hukou	−0.155***	−0.147***
	(0.027)	(0.027)
Constant	9.271***	9.202***
	(0.096)	(0.094)
Region controls	Yes	Yes
Observations	10,434	10,434
R-squared	0.393	0.402
F-statistic	384.89	403.96

Note(s): Robust standard errors in parentheses. ***, ** and * denote significance at the 1%, 5% and 10% level, respectively
Source(s): Authors' own work

Table 10. Financial inclusion with different cut-offs and household welfare

The PSM results are summarized in Table 11. The results show that household welfare is higher for households that are financially included after accounting for potential endogeneity of financial inclusion in our baseline model. All coefficients of the average treatment effect on the treated (ATT) are consistent and near the baseline results, ranging from 0.223 to 0.244, all significant at 1%. For instance, ATT of the nearest-neighbor matching algorithm is 0.224, suggesting that household annual consumption expenditure is approximately 22% higher for a household that is financially included compared with financially deprived counterparts. The local linear regression matching algorithm gives the largest ATT of 0.244, indicating that household consumption expenditure of financially included households is 24% lower than for financially deprived counterparts. Overall, all coefficients are similar to our baseline results signifying that financial inclusion has a considerable impact on household consumption

Variable	Unmatched Matched	Mean Treated	Control	% Bias	% Reduction |bias|
Age	U	51.798	60.826	−85.2	
	M	51.850	51.511	3.2	96.2
Gender	U	0.898	0.840	17.1	
	M	0.897	0.904	−1.8	89.3
Family size	U	3.916	3.032	56.5	
	M	3.910	4.001	−5.8	89.8
Farmer	U	0.401	0.567	−33.8	
	M	0.402	0.411	−1.8	94.7
Temporary worker	U	0.221	0.133	23.1	
	M	0.222	0.218	1.1	95.3
Employee	U	0.146	0.045	34.7	
	M	0.146	0.142	1.4	93.9
Self-employed	U	0.130	0.039	33.1	
	M	0.128	0.120	2.7	91.7
Junior high education	U	0.513	0.338	36.1	
	M	0.514	0.527	−2.7	92.6
Senior high education	U	0.192	0.098	27.0	
	M	0.191	0.189	0.4	98.5
Tertiary education	U	0.045	0.009	22.2	
	M	0.044	0.030	8.9	59.9
Income	U	10.900	9.831	83.0	
	M	10.892	10.817	5.8	93.1
Marriage	U	0.939	0.856	27.7	
	M	0.939	0.936	0.9	96.7
Ethnicity	U	0.926	0.888	13.2	
	M	0.926	0.942	−5.9	55.1
Hukou	U	0.894	0.934	−14.3	
	M	0.894	0.872	7.8	45.2

Source(s): Authors' own work

Table 11. Test of covariate balance (PSM)

PSM estimates with different matching methods	ATT (average treatment effect on the treated) Observed coefficient	Standard error
1-Nearest-neighbour (one-to-one)	0.224***	0.0364
4-Nearest-neighbour	0.231***	0.0299
Radius	0.223***	0.0232
Kernel	0.243***	0.0220
Local linear regression	0.244***	0.0222
Baseline result		
OLS	0.233***	0.0200

Note(s): Bootstrap standard errors with 100 replications. *** represents significance at the 1 percent level
Source(s): Authors' own work

Table 12. Propensity score matching results with different matching methods

expenditure. We can conclude that our findings on the effect of financial inclusion on household welfare are valid and robust to potential endogeneity and self-selectivity bias issues.

5. Conclusion

Using nationally representative CHFS 2019 household data, we examine the level of financial inclusion in rural China, exploring its determinants, welfare effects and potential

transmission channels at the household level. Several noteworthy findings and policy implications emerge. Despite China's notable progress in enhancing financial inclusion, the composite index highlights limited banking service usage among rural households. Substantial regional disparities exist, with the eastern region having the highest financial inclusion levels, with the central region lagging. Therefore, government efforts to promote financial inclusion should focus on less developed areas, particularly the central region, characterized by both implementation challenges and higher poverty rate. The government can facilitate financial inclusion through a favorable regulatory framework and expanded banking channels to reach underserved areas. This can be achieved through leveraging mobile banking and financial innovations to enhance overall banking accessibility.

The choice of using financial services can be significantly influenced by different household socioeconomic circumstances, such as household size, education level, financial literacy, income level and employment status. Government policies should align with household characteristics to effectively enhance financial inclusion. Initiatives such as improving financial literacy through education campaigns and dismantling barriers related to education and income are crucial in promoting financial inclusion from the demand perspective.

This study establishes the nexus between financial inclusion and welfare at the micro-level. Participating in the formal financial system has an unambiguous effect on household welfare proxied by household consumption expenditure, which means bringing the underprivileged sections under the scope of banking services can help them improve their living standard. For the transmission channels through which financial inclusion might impact household welfare, we observe that the use of mobile payment accounts, credit cards and commercial insurance influences household welfare with varying magnitude. Hence, it is essential to implement efficient measures to ensure easy access to and use of various banking services, to genuinely enhance the quality of people's lives and household welfare. It is important to acknowledge that, despite the utilization of PSM to address endogeneity concerns, this issue may not be completely eliminated. Since this study uses data from CHFS 2019, which is the first wave providing cross-sectional data on mobile payments, future research should consider using panel data to enable a more in-depth exploration of the long-term relationship between financial inclusion and household welfare, and enriching our understanding of possible transmission channels of financial inclusion on household welfare.

Notes

1. The question or fin_lit1 from the CHFS survey is "Assuming the annual bank interest rate is 5%, if you deposit 100 yuan for 1 year, what is the principal and interest earned after 1 year?; 1. Less than 105 yuan; 2. Equal to 105 yuan; 3. More than 105 yuan; 4. Do not know". Fin_lit1A equals 1 when the household gives an answer of 1, 2, or 3; 0 otherwise. Fin_lit1B equals 1 when the household gives an answer of 2, 0 otherwise.
2. The question for fin_lit2 from the CHFS survey is "Assuming the annual bank interest rate is 5%, the inflation rate is 8% a year, if you put 100 yuan in the bank for a year and things you can buy will be: 1. More than one year ago; 2. Same as one year ago; 3. Less than one year ago; 4. Do not know". Fin_lit2A equals 1 when the household gives an answer of 1, 2, or 3; otherwise 0. Fin_lit2B equals 1 when the household gives an answer of 3; otherwise 0.

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