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Digital access and household consumption in china through financial participation and household constraints

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ABSTRACT

Convenient internet access can reduce the effort involved in obtaining information, comparing products, and completing transactions, but its relationship with household consumption depends on financial resources and decision-making capabilities. This manuscript reorganizes the evidence reported by Wang and Tang from five repeated cross-sections of the China Social Survey covering 2015, 2017, 2019, 2021, and 2023. The estimation sample contains 26,787 observations. The principal outcome, described in the underlying study as consumption intentions, is measured by the logarithm of annual household consumption expenditure; average propensity to consume supplies an alternative outcome. Convenient access is represented by a binary response indicating whether the internet can be used at any time and place. The fully controlled baseline coefficient is positive at 0.0543 and remains positive with the alternative outcome and winsorized variables. Income comparisons concentrate the statistically significant association among lower-income households. Provincial broadband infrastructure provides an instrument in a two-stage analysis whose second-stage estimate is 0.3245, although the exclusion restriction remains an identifying assumption. Financial asset diversification, used as a financial-literacy proxy, partially mediates the relationship, with stronger evidence among households classified as having lower debt. Risk preference positively moderates the access–consumption association. These results support an account in which digital access, financial participation, and household constraints are jointly relevant. Measurement choices, repeated cross-sectional identification, unequal debt-group sizes, and inconsistencies in reported mediation statistics limit causal and behavioral interpretation. The implications concern inclusive connectivity and financially sustainable participation rather than indiscriminate expansion of household spending or borrowing.

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1. INTRODUCTION

The economic value of internet access depends partly on what households can do with it. A connection can make products easier to locate, allow prices to be compared across sellers, and reduce the time required to complete a purchase. It can also provide access to financial information and new payment arrangements. None of

these opportunities guarantees additional consumption, however. Households must still decide whether a purchase is affordable, whether an unfamiliar transaction is trustworthy, and whether present expenditure is compatible with future obligations. The relationship between digital access and consumption therefore combines changes in opportunity with differences in resources, knowledge, and willingness to accept uncertainty.

This manuscript develops that argument using the empirical investigation by Wang and Tang [1]. The underlying study combines five waves of the China Social Survey and examines convenient network access, household consumption, financial literacy, and risk preference. The present text restructures and paraphrases the published analysis while retaining its numerical evidence and attribution. It does not represent a newly collected survey or an independent replication of the original regressions. Its central finding is that convenient access is positively associated with household expenditure, with important differences across income groups, debt conditions, and risk preferences.

The Chinese setting gives the question substantial economic relevance. The original article cites the National Informatization Development Report for historical figures at the end of 2024: an internet population of 1.108 billion, penetration of 78.6 percent, 5G coverage in more than 90 percent of administrative villages, and 4.251 million operational 5G base stations [1]. It places these developments alongside real growth of 5.1 percent in per-capita consumption expenditure. These figures establish the background to the research rather than variables observed for each household in the estimation sample. They also illustrate why widespread infrastructure and continuing consumption constraints can coexist. Extensive connectivity does not eliminate unequal opportunities to use digital services effectively.

Research on digital finance and household consumption has increasingly considered the mechanisms connecting access with economic behavior. Work on consumption upgrading emphasizes the relevance of financial asset allocation [2], while studies of rural consumer convenience and elderly consumption examine populations whose participation may depend on specific barriers [3], [4]. Related research addresses digital literacy, financial-market participation, and mobile access to financial knowledge [5], [6]. These topics suggest that a connection may matter through more than the immediate availability of an online shop. It may alter information acquisition, financial participation, and the management of household resources. Establishing which mechanisms are actually measured remains essential.

The study's terminology requires particular care. Its principal outcome is called consumption intentions, but the observed variable is annual expenditure incurred over the previous year. This is a measure of realized spending, not a direct answer about willingness to buy in the future. The distinction affects both interpretation and policy. Higher expenditure can reflect greater purchasing capacity or easier transactions, but it can also reflect changes in needs, prices, household composition, or borrowing. A finding about expenditure cannot, without additional evidence, be treated as a finding about confidence, satisfaction, or a latent intention to consume. The original outcome label is retained in the tables, while the interpretation follows its operational definition.

Financial literacy presents a related distinction. The source defines the concept as the ability to understand financial information and make reasonable decisions, but measures it through the number of financial asset categories held. Asset diversification can be associated with knowledge and participation, yet it also depends on wealth, product availability, and eligibility. Consequently, the proposed mediation pathway is most directly observed as a relationship involving financial asset holding. The broader literacy interpretation is plausible but incomplete. Recognizing that distinction preserves the substantive argument without assigning the data a level of psychological measurement that they do not provide.

The analysis also treats household constraints as more than background controls. Lower-income households may receive larger incremental benefits from access because information and transaction barriers bind more strongly for them. Debt can prevent financial knowledge or participation from translating into additional expenditure, even when digital opportunities improve. Risk preferences may affect whether households use unfamiliar payment systems or purchasing channels. These mechanisms can reinforce or offset one another. Convenient access may expand the feasible set of decisions while leaving some households unable or unwilling to choose additional consumption.

Empirically, the source examines 26,787 observations from 2015, 2017, 2019, 2021, and 2023. Baseline specifications add regional and household controls progressively, followed by alternative outcome and outlier checks. Income subsamples assess distributional differences. An interaction examines risk preference, a provincial infrastructure instrument addresses possible endogeneity, and sequential regressions with Sobel and bootstrap calculations examine mediation. The resulting evidence supports a positive association, but the repeated cross-sectional design and the assumptions behind the instrument and mediator require a measured account of causal claims.

The contribution is therefore a conditional account of digital consumption rather than a universal prediction that connectivity always raises expenditure. The literature review distinguishes access, financial participation, and household decision conditions. The methods section describes the survey, operational measures, and estimation strategy. Five results tables preserve the descriptive and regression evidence, including all reported

coefficients and mediation statistics. The discussion evaluates the implications for inclusion, consumer protection, and future identification. Throughout, the objective is to retain the original findings while making explicit what the available measures and design can sustain.

2. LITERATURE REVIEW

Household consumption is an intertemporal allocation problem. A family must balance current needs against expected future income, foreseeable commitments, and the possibility of adverse events. Information and transaction costs influence that balance because they determine which products and financial arrangements can be evaluated at reasonable effort. Digital access can reduce some of these costs by improving the availability of information and the speed of exchange. Its relevance is consequently not confined to online purchases. It can affect the broader environment in which households evaluate affordability, organize payments, and compare present expenditure with saving.

The digital-finance literature supplies several perspectives on this relationship. Ma and colleagues examine consumption upgrading through financial asset allocation, connecting household spending with participation in financial markets [2]. Chen and Li address digital finance and consumer convenience among rural residents [3]. Fan and colleagues study digital financial inclusion and elderly consumption [4]. These studies concern related aspects of economic participation, but the concepts should not be treated as interchangeable. Digital financial inclusion involves the availability and use of financial services, while convenient network access is a more general condition enabling many activities. A study of access therefore cannot assume that every connected household uses financial technology or obtains credit.

The distinction between availability and use is especially relevant where basic access has become common. If most respondents report convenient internet availability, remaining differences may concern coverage quality, device capability, confidence, and the ability to navigate applications. The binary access measure in the underlying study does not reveal these dimensions separately. It nevertheless captures an economically meaningful threshold: whether respondents consider the network available whenever and wherever they need it. That threshold can affect transaction timing and search effort even where it does not describe the intensity or purpose of internet use.

A transaction-cost mechanism is a reasonable starting point. Digital channels can lower the effort needed to identify sellers, compare prices, check product descriptions, and complete payment. Access can also overcome geographic limitations where local markets offer narrow choices. These changes can improve the match between household preferences and available products. An increase in recorded expenditure is one possible consequence, but not the only one. Better comparison may allow a household to obtain the same goods more cheaply, while greater convenience may change the composition rather than the total value of purchases. Theoretical reasoning alone therefore does not determine the sign of the expenditure response.

Income opportunities provide another possible channel. Digital penetration can expose households to employment information, facilitate customer contact, or support entrepreneurial activity. Research on rural tourism entrepreneurship explicitly examines the relationship between digital penetration and entrepreneurial tendencies [7]. Such opportunities can alter purchasing capacity, but the source's regressions do not directly estimate an employment or entrepreneurial mediator. The income channel remains part of the theoretical interpretation rather than an independently observed mechanism in the displayed results. Controlling for household income also changes the question, since it holds constant a resource through which digital access might operate.

Income heterogeneity follows from the possibility that barriers bind unevenly. Households with extensive financial resources may already have several purchasing channels and reliable information. Additional convenience may make relatively little difference to their expenditure choices. Households with fewer resources may benefit more from lower search costs and broader product access, although liquidity constraints can still prevent them from purchasing. The source predicts a stronger relationship among lower-income households. This is a hypothesis about differential marginal associations, not evidence in itself that aggregate consumption inequality declines. Demonstrating a reduction in inequality would require a distributional outcome or an explicit decomposition.

The literature also connects digital access with financial-market participation and knowledge. Wang and colleagues consider digital literacy and financial participation among middle-aged and older Chinese adults [5]. Zhang and colleagues investigate mobile internet access and household financial literacy [6]. Work on the digital-finance experiences of older internet users highlights a population for which service design and practical capability may be particularly consequential [8]. These topics motivate an information-based pathway: access may facilitate learning about financial products and reduce the effort required to participate. They do not establish that every additional asset category held represents an equivalent increase in financial knowledge.

Financial literacy, understood conceptually, concerns the capacity to evaluate financial choices rather than the simple accumulation of products. A knowledgeable household may diversify where diversification is appropriate, but may also avoid products whose risks or fees outweigh their benefits. Likewise, a household with

modest knowledge can hold several asset types because of default arrangements or advice from an intermediary. Research on technology acceptance and sustainable credit-card use considers the intersection of financial knowledge and adoption decisions [9]. Zaimovic and colleagues similarly examine digital financial knowledge alongside attitudes, behavior, and inclusion [10]. These distinctions support analyzing knowledge and participation jointly without collapsing them into the same construct.

The source's asset-category count can thus be interpreted as an observable indicator of financial breadth. Deposits, fixed-income wealth-management products, equity assets, and commercial insurance expose households to different financial arrangements. Holding a broader set may reflect greater familiarity with products, but it can also reflect wealth and lifecycle circumstances. Studies of household aging, commercial insurance, and risky asset allocation demonstrate why participation is shaped by demographic and institutional conditions [11]. Work on insurance purchases in the digital-finance setting likewise connects digital services with a particular form of household financial behavior [12]. These literatures make the asset-based proxy relevant while also clarifying why it is not a direct knowledge test.

The alternative mediator, financial assets as a share of total household assets, addresses another part of the same economic environment. It indicates portfolio composition rather than the number of distinct product categories. A high share can reflect liquid holdings, limited property ownership, or other balance-sheet features. A low share may coexist with substantial financial sophistication if a household owns valuable real estate. Research on long-term care insurance and financial allocation among older households illustrates the importance of institutional arrangements for portfolios [13]. Convergence between the count and share specifications would support an allocation-related pathway, but would not independently validate their interpretation as equivalent measures of literacy.

Risk preference supplies a psychological boundary condition. Unfamiliar transactions can involve uncertainty about payment security, product quality, delivery, and recourse after a problem. Households that tolerate more uncertainty may be more willing to try digital purchasing and payment arrangements. Research on online security behavior and electronic-payment intentions directly addresses the connection between digital capabilities and participation decisions [14]. Studies of digital-currency adoption also examine intention in a setting where perceptions of novelty and risk can be important [15]. The underlying paper extends this reasoning to the interaction between convenient internet access and household expenditure.

A positive interaction does not imply that stronger risk tolerance is always beneficial. Greater willingness to accept uncertainty can facilitate useful experimentation, but can also expose households to inappropriate borrowing, fraud, or unsuitable financial products. The relevant economic question concerns the combination of expected benefit, information, and capacity to absorb losses. Risk preference can also change with experience. Successful digital transactions may make households more comfortable with unfamiliar services, while negative experiences may increase caution. A contemporaneous interaction cannot distinguish stable risk attitudes from attitudes partly shaped by digital participation itself.

Debt introduces a financial constraint that may alter the proposed mediation pathway. Households facing substantial repayment commitments may use improved information to reduce borrowing or preserve liquidity rather than increase consumption. A household with limited debt may have more room to reorganize saving and spending when financial participation broadens. This reasoning supports the source's expectation of stronger mediation in the lower-debt group. It does not imply that low debt is necessarily evidence of financial health, since low borrowing can also reflect restricted access to credit. Similarly, high debt may finance housing or productive activity rather than discretionary consumption.

The wider literature on rural inclusion, financial allocation, and the risk of returning to poverty provides context for these constraints [16], [17]. Research on digital financial development gaps and rural consumption structure points to the importance of unequal institutional conditions [18]. Studies of climate adaptation and rural consumption extend the discussion to vulnerability and uncertainty [19]. These contributions support considering household resources and local conditions together. Their settings and measures differ from the source's debt split, however, so they should be used as contextual support rather than as proof that the same mechanism operates identically across populations.

Financial technology adoption also depends on place and service environment. Evidence from rural Pakistan examines adoption using structural-equation and neural-network approaches, highlighting a setting outside the Chinese survey context [20]. Research on digital inclusive finance and rural industry integration concerns the wider production environment in which households earn and spend [21]. Such work broadens the conceptual background but does not determine the magnitude of a Chinese household expenditure coefficient. Differences in regulation, financial institutions, and infrastructure can alter both the meaning of access and the choices available after access improves.

The resulting framework contains several distinct expectations. Convenient access may be positively associated with expenditure through lower transaction barriers and expanded opportunities. That association may differ across income groups. Risk preference may condition the strength of the relationship, while financial breadth

may provide part of a statistical pathway linking access with spending. Debt may constrain the translation of financial participation into consumption. Each proposition concerns a different empirical comparison. A convincing interpretation must evaluate the corresponding evidence separately rather than treating the confirmation of one relationship as confirmation of the entire framework.

3. METHODS

The underlying dataset pools five independent China Social Survey waves conducted in 2015, 2017, 2019, 2021, and 2023. The survey is administered through the Institute of Sociology of the Chinese Academy of Social Sciences and uses multistage stratified random sampling. The source describes coverage across 31 provincial-level administrative units and respondents with diverse demographic and economic circumstances. Observations missing key variables are removed, leaving 26,787 usable records. Regional indicators are obtained from national and provincial statistical yearbooks. The article does not provide a complete wave-by-wave cleaning account, survey-weight implementation, or all details needed to reproduce the harmonized sample from the raw surveys.

These data are repeated cross-sections rather than a household panel. Pooling the waves increases the scope of observed variation, but does not follow the same household as its access or financial position changes. Differences between connected and less conveniently connected respondents can therefore reflect stable or unobserved characteristics that are not removed through individual fixed effects. The displayed equations and tables do not separately document survey-year or province fixed effects. The rewritten presentation retains the reported specifications without assuming that additional absorbed effects or sampling adjustments were implemented.

The principal dependent variable, Cons_will, is the natural logarithm of total household consumption expenditure during the preceding year. Expenditure is recorded in RMB and includes food, tobacco and alcohol, housing, clothing, transport and communications, education, cultural and entertainment activities, healthcare, and daily necessities. The source uses this variable as a proxy for consumption intentions. The alternative outcome, APC, divides annual consumption expenditure by annual household income. APC describes spending relative to income and is sensitive to unusually low income, temporary income shocks, and the handling of zero or negative values. The published article does not specify every rule used to construct these ratios or transform zero-valued monetary observations.

Net_conv equals one where the respondent reports being able to access and use the internet at any time and place, and zero otherwise. The indicator combines perceived convenience and availability in a single response. It does not separately identify broadband speed, service reliability, data prices, device ownership, digital skill, or the activities performed online. Consequently, the estimated relationship concerns the observed access distinction, not a marginal change in network speed or a specified infrastructure upgrade. Measurement error is possible if respondents apply different standards when assessing what convenient access means.

Finit, the main mediator, counts the financial asset categories held by a household. The categories are deposits, fixed-income wealth-management products, stocks or funds, and commercial insurance. The count ranges from zero to four. The source interprets broader participation as an indicator of financial literacy. AAHF supplies an alternative mediator and equals financial assets divided by total household assets. Both indicators are observable financial characteristics that can reflect knowledge, resources, product access, and household preferences. They do not independently measure comprehension of interest, inflation, diversification, or credit terms. The interpretation therefore distinguishes an allocation-related statistical pathway from a demonstrated improvement in financial knowledge.

Risk is the reported risk-preference measure. The methods describe a scale from zero to five, while the descriptive table contains observations from one to five. Higher values represent greater willingness to accept risk. The exact questionnaire coding and the absence of observed zeros require clarification for replication. The interaction Net_conv multiplied by Risk tests whether the fitted access–expenditure relationship varies with that score. Because the measure is not reported as centered, the access coefficient in the interaction model represents the association at Risk equal to zero, a reference point outside the displayed observed range.

Controls capture regional development, household resources, and selected respondent characteristics. EconDev is the logarithm of provincial GDP per capita, and Traffic is the logarithm of highway length per square kilometer. FinIns indicates the reported accumulation of pension-related wealth through financial investment. Happiness uses a five-point assessment of satisfaction with family life, although the source links it conceptually to pension-related well-being. Household income, debt, and owned-property value are represented by logarithmic measures named finc, debt, and house. Health is a five-category self-reported measure. Area takes values one, two, and three for eastern, central, and western locations. The geographical code enters the displayed regressions as reported; a single ordered coefficient imposes a structure that differs from separate regional indicators.

The baseline equation relates logged expenditure to an intercept, Net_conv, and a vector of controls. Specifications add regional and household variables progressively. The moderation equation adds Risk and its product with Net_conv. The mediation sequence first regresses Finit on access and controls, then regresses

expenditure on access, Finit, and controls. A parallel sequence replaces Finit with AAHF. In symbolic terms, the proposed indirect association is the product of the access-to-mediator coefficient and the mediator-to-expenditure coefficient. Sequential regressions estimate those conditional relationships but do not by themselves establish the temporal sequence required for causal mediation.

The instrument is Infra, the natural logarithm of the provincial number of internet broadband access ports in the corresponding year. The first-stage equation predicts convenient access using Infra and the controls; the second-stage equation relates expenditure to instrumented access. The relevance argument is that communications capacity affects the ability to obtain convenient internet service. The exclusion argument requires provincial infrastructure to affect household consumption only through the measured access variable after conditioning on the controls. The source motivates this assumption using the policy and planning origins of infrastructure. Such origins do not guarantee exclusion, since investment may also be associated with employment, business activity, local services, or other determinants of consumption.

Instrument diagnostics include an LM underidentification statistic and a Cragg–Donald Wald F statistic, compared with a reported Stock–Yogo critical value of 16.38. The source does not fully specify the variance estimator, clustering structure, or sampling-design adjustment underlying every regression. This matters because the instrument and several controls vary at the province-year level. Households within those units may share unobserved influences. The reported diagnostics and significance markings are retained, while their interpretation remains conditional on the underlying estimation assumptions and the absence of a fully documented clustering design.

Income groups are formed around the median household income, producing 13,393 higher-income and 13,394 lower-income observations. The source compares coefficients using a reported Wald Z statistic. Its introduction also refers to seemingly unrelated regression comparisons, but the numerical evidence available in the tables is the displayed Wald result. Debt groups are described as a median split and contain 8,914 higher-debt and 17,873 lower-debt observations. Since the descriptive median of debt is zero, this unequal division may reflect ties or a zero-debt classification. The exact allocation rule is not supplied, so the labels and sample sizes are retained without reconstructing a different cutoff.

Robustness checks replace the outcome with APC and winsorize continuous variables at the first and ninety-ninth percentiles. The source additionally reports Sobel–Goodman calculations and a bootstrap with 1,000 resamples for mediation. The bootstrap table includes point estimates, standard errors, z statistics, p values, and 95-percent confidence bounds. Some entries do not reconcile mechanically, so they are preserved with a qualification rather than silently recalculated. The original authors state that they do not have permission to share the data and declare no competing interests. Those statements apply to the underlying publication; no new data collection, redistribution, or independent estimation is claimed here.

4. RESULTS

The results are organized around the distinction between access, household conditions, and the proposed financial pathway. Five tables retain the original descriptive statistics, all displayed regression coefficients, their reported parenthetical statistics, sample sizes, and goodness-of-fit measures. The consolidation brings together related analyses without treating different outcomes or subsamples as interchangeable. Parentheses in the regression panels reproduce the original test statistics. Significance symbols remain as published, and no undisclosed control coefficients, alternative specifications, or additional data have been supplied.

Table 1 establishes the empirical range of the household measures and the amount of variation available in convenient access. It places the expenditure outcome beside the alternative consumption ratio and the financial variables so that their differences in scale remain visible. The reported minima and medians are particularly relevant to interpreting the logged monetary controls and the debt-group comparison. The table also makes clear that the access indicator is highly concentrated at one, which limits how broadly a comparison with the relatively small zero-access group can be generalized.

Table 1. Descriptive statistics for household outcomes digital access and financial characteristics

Variable	N	Mean	SD	Minimum	Median	Maximum
Cons_will	26787	9.4455	0.7719	7.8497	9.3546	11.7363
APC	26787	2.4382	6.3894	0.1198	0.8952	52.3220
Net_conv	26787	0.9751	0.1558	0.0000	1.0000	1.0000
Finit	26787	1.8799	1.3992	0.0000	1.0000	4.0000
AAHF	26787	0.6474	0.3054	0.0000	0.7426	1.0000
Risk	26787	2.7093	1.4522	1.0000	3.0000	5.0000
Infra	26787	17.066	0.7110	14.948	17.078	18.351

EconDev	26787	11.089	0.4404	10.259	11.058	12.156
	0		3	2	5	
FinIns	26787	0.8781	0.3271	0.0000	1.0000	1.0000
Happiness	26787	3.9066	0.9391	1.0000	4.0000	5.0000
Traffic	26787	3.2044	0.9523	0.8582	3.3961	4.7756
finc	26787	10.347	2.0664	0.0000	10.807	13.144
	5			5	8	
debt	26787	3.5189	5.0852	0.0000	0.0000	13.527
					8	
house	26787	11.304	3.7464	0.0000	12.206	15.830
	2			1	4	
health	26787	2.6811	0.9790	1.0000	3.0000	5.0000
area	26787	1.7995	0.8756	1.0000	1.0000	3.0000

The average logged expenditure outcome is 9.4455, with a standard deviation of 0.7719. APC is much more dispersed: its mean is 2.4382, its median is 0.8952, and its maximum is 52.3220. This divergence indicates that the alternative outcome is strongly influenced by observations with high consumption relative to recorded annual income. It does not show that the typical household consumes more than twice its income. Ratios can rise because of temporarily low denominators as well as high spending, and the descriptive table does not identify the balance between those possibilities.

Net_conv averages 0.9751, meaning that convenient access is reported for the overwhelming majority of observations. The financial asset-category count averages 1.8799, while the average financial asset share is 0.6474. These figures describe participation and portfolio composition, not performance on a financial-knowledge assessment. Risk averages 2.7093 and ranges from one to five in the displayed data. Logged debt has both a minimum and median of zero, alongside a standard deviation of 5.0852. These features help explain why an apparently simple debt split may produce unequal groups, but do not establish the exact treatment of ties or zero liabilities.

The descriptive information supports examination of conditional relationships but cannot establish the mechanism behind them. Households with several financial assets may have better information, more wealth, or greater access to institutions. Convenient connectivity may likewise correlate with urban services or unobserved household circumstances. Subsequent specifications introduce controls and an instrument to address parts of this problem. The descriptive table should therefore be read as the starting distribution of the observed measures rather than as direct evidence that digital access changes financial knowledge or consumption preferences.

Table 2 presents the progression from the simplest expenditure regression to the fully controlled specification, followed by the alternative outcome and winsorization exercises. Showing the estimates side by side clarifies which comparisons involve additional covariates and which alter the dependent variable or data treatment. The coefficients cannot all be interpreted on the same scale because APC is an income-normalized ratio, whereas the other four outcomes are logarithmic expenditure measures.

Table 2. Baseline expenditure estimates and alternative outcome checks

Variable	Expenditure basic	Regional controls	Full controls	APC outcome		Winsorized
Net_conv	0.0866***	0.0752**	0.0543**	0.8920***		0.0458**
	(2.5941)	(2.3308)	(2.1174)	(3.4517)	(2.0831)	
EconDev	—	−0.0155	−0.0138	0.1919		−0.0114
		(-1.0051)	(-0.8903)	(1.4966)	(-0.7828)	
FinIns	—	0.0151	0.0133	0.0886		0.0100
		(1.0271)	(0.8944)	(0.7213)	(0.7464)	
Happiness	—	0.0081	0.0042	−0.0309		0.0030
		(1.5381)	(0.4864)	(-0.4351)	(0.3797)	
Traffic	—	−0.0095	0.0195**	0.1422**		0.0154**
		(-1.3496)	(2.4052)	(2.1187)	(2.0395)	
finc	—	—	0.0018	0.0059		0.0033
			(0.7260)	(0.2932)	(0.8726)	
debt	—	—	−0.0022**	−0.0004		−0.0021**
			(-2.2825)	(-0.0492)	(-2.3923)	
house	—	—	0.0020	0.0069		0.0018
			(0.9744)	(0.4140)	(0.9730)	
health	—	—	0.0039	0.0224		0.0039
			(0.7793)	(0.5473)	(0.8652)	
area	—	—	−0.0470***	−0.0501		−0.0407***
			(-6.8957)	(-0.8860)	(-6.5861)	
Constant	9.4276***	9.5879***	9.5369***	−5.3050***		9.5003***
	(315.4290)	(51.6998)	(51.0982)	(-3.4304)	(53.8092)	
N	26,787	26,787	26,787	26,787		26,787
R-squared	0.0157	0.2052	0.2923	0.4853		0.3122

The access coefficient falls from 0.0866 in the basic model to 0.0752 after the first controls and 0.0543 in the full specification. Its reported test statistic in the latter is 2.1174, with significance marked at five percent. The decline indicates that observed regional and household characteristics account for part of the initial

association. The remaining positive coefficient is consistent with convenient access being associated with greater annual expenditure conditional on the included variables. It is not a coefficient for a continuous increase in network quality, since Net_conv records a binary distinction.

In the APC model, the access estimate is 0.8920 with a reported statistic of 3.4517. This result supports a positive relationship with spending relative to income as well as with the expenditure level. The unusually dispersed APC distribution nevertheless matters when interpreting its economic magnitude. A ratio outcome does not isolate willingness to spend independently of income measurement, borrowing, asset drawdown, or temporary resource changes. The winsorized expenditure model gives an estimate of 0.0458 and a statistic of 2.0831, retaining the positive sign after restricting extreme continuous observations at the stated percentiles.

The control estimates supply additional context. In the fully controlled baseline, debt is negatively associated with expenditure at −0.0022, while Traffic is positive at 0.0195. The ordered regional variable is negative at −0.0470. Household income, owned-property value, self-reported health, and the other displayed controls are not individually significant in that column. These estimates should not be elevated into independent causal conclusions. Their role is to describe the conditional model used for the access comparison, and their interpretation depends on transformations, coding, and the regional structure imposed by the specification.

Table 3 combines income heterogeneity with the risk-preference models. The first two columns compare higher- and lower-income groups, while the final two distinguish a model with separate access and risk terms from one containing their interaction. Bringing these comparisons together preserves two different boundary conditions: financial resources can influence the opportunities that access creates, while risk preferences can influence the willingness to use those opportunities. Dashes indicate regressors not reported in the corresponding specification.

Table 3. Income differences and moderation by risk preference

Variable	High income	Low income	Risk main effects	Risk interaction
Net_conv	0.0123	0.0985**	0.0452**	0.0397*
	(0.4821)	(2.3159)	(2.0888)	(1.6701)
Risk	—	—	−0.0068*	0.0085
			(-1.7840)	(0.9576)
Net_conv×Risk	—	—	—	0.0158**
				(2.4444)
EconDev	−0.0426*	0.0106	−0.0313*	−0.0313*
	(-1.8805)	(0.4986)	(-1.7085)	(-1.7060)
FinIns	0.0029	0.0175	0.0094	0.0094
	(0.1202)	(0.9397)	(0.6271)	(0.6291)
Happiness	0.0034	−0.0002	0.0036	0.0036
	(0.2601)	(-0.0141)	(0.4210)	(0.4238)
Traffic	0.0022	0.0366***	0.0131	0.0131
	(0.1967)	(3.0292)	(1.4821)	(1.4836)
finc	—	—	0.0019	0.0019
			(0.7648)	(0.7650)
debt	−0.0009	−0.0035**	−0.0022**	−0.0022**
	(-0.7338)	(-2.5266)	(-2.3737)	(-2.3751)
house	−0.0003	0.0044	0.0021	0.0021
	(-0.0857)	(1.6170)	(1.0543)	(1.0492)
health	0.0098	0.0003	0.0039	0.0039
	(1.3399)	(0.0378)	(0.7900)	(0.7906)
area	−0.0377***	−0.0550***	−0.0465***	−0.0465***
	(-3.6786)	(-5.9885)	(-6.8118)	(-6.8156)
Constant	9.8714***	9.2645***	9.7745***	9.7491***
	(35.3008)	(36.3108)	(42.6319)	(41.2579)
N	13,393	13,394	26,787	26,787
R-squared	0.3016	0.2837	0.2724	0.3061
Wald Z and p	2.8456 / 0.0044	—	—	—

The higher-income access estimate is 0.0123 and is not significant, whereas the lower-income estimate is 0.0985 with a statistic of 2.3159. The reported cross-group Wald result is Z equal to 2.8456 and p equal to 0.0044. This supplies evidence of a difference beyond the simple observation that one subgroup coefficient is significant and the other is not. The result supports the source's conclusion that the positive expenditure association is concentrated among lower-income households. It does not directly demonstrate that digital access reduces a consumption-inequality index, since no such index is estimated in the displayed analysis.

The risk-interaction estimate is 0.0158, with a reported statistic of 2.4444 and a five-percent significance marking. The access coefficient in that model is 0.0397 and the separate risk coefficient is 0.0085. The fitted access association therefore increases as the observed risk score rises. Because Risk is not reported as centered, the separate access coefficient refers to a zero-risk reference point outside the descriptive range. The interaction is more informative than interpreting that coefficient alone as the effect for a typical respondent. The evidence is consistent with risk tolerance conditioning the relationship, but it does not directly observe online experimentation or the adoption of particular payment tools.

Table 4 reports the infrastructure first stage and the instrumented expenditure equation. It preserves the instrument diagnostics alongside the coefficients because a positive second-stage estimate is not sufficient for evaluating an instrumental-variable design. Relevance can be assessed using the first-stage relationship and reported identification statistics. Exclusion, by contrast, concerns whether infrastructure has other connections with expenditure that remain after conditioning on the controls and cannot be settled by those diagnostics alone.

Table 4. Infrastructure instrument and two stage estimates

Variable	First stage access	Second stage expenditure
Infra	0.0158***	—
	(8.2504)	
Net_conv	—	0.3245***
		(3.8757)
EconDev	0.0140***	−0.3302
	(4.2493)	(-1.1130)
FinIns	−0.0039	0.1101
	(-1.3258)	(0.9538)
Happiness	0.0107***	−0.2633
	(6.2505)	(-1.0717)
Traffic	0.0126***	−0.2838
	(7.5894)	(-1.0236)
finc	0.0034***	−0.0836
	(7.0594)	(-1.0697)
debt	0.0015***	−0.0385
	(7.7021)	(-1.1595)
house	0.0009**	−0.0207
	(2.2923)	(-0.9049)
health	−0.0059***	0.1507
	(-5.9936)	(1.1154)
area	−0.0050***	0.0668
	(-3.5342)	(0.6152)
Constant	0.7439***	−8.5985
	(18.9434)	(-0.5236)
LM value	68.1273	—
Cragg-Donald Wald F	68.0647	—
N	26,787	26,787
R-squared	0.3179	0.5407

Infra has a first-stage estimate of 0.0158 and a reported statistic of 8.2504. The LM value is 68.1273 and the Cragg–Donald Wald F statistic is 68.0647, exceeding the source's comparison value of 16.38. These results support relevance and provide reassurance against weak identification under the stated diagnostic framework. They do not show that provincial infrastructure is independent of all unobserved determinants of household spending. The relationship between infrastructure investment and regional economic opportunities remains a substantive consideration for the exclusion restriction.

The second-stage access estimate is 0.3245, with a reported statistic of 3.8757, compared with 0.0543 in the fully controlled baseline. The source interprets the larger estimate as evidence that the baseline may be biased downward through measurement error or reverse causality. That explanation is possible, but differences in identifying variation and the assumptions governing the instrument can also contribute. The estimate should not be converted into a universal population effect without those assumptions. Its principal evidential contribution is that the positive access relationship remains present when the reported provincial instrument supplies the identifying variation.

The instrumented control coefficients differ appreciably from their baseline counterparts, and none of the displayed second-stage controls receives a significance marking. This pattern reinforces the need to treat the second stage as a distinct specification rather than as the baseline with a corrected access coefficient alone. The source reports R-squared values of 0.3179 and 0.5407 for the two stages, but goodness of fit does not validate exclusion. The available documentation also leaves uncertainty about adjustment for common province-year influences, which can affect inference when many household observations share the same infrastructure measure.

Table 5 assembles the main mediation sequence, the household-debt comparisons, and the bootstrap results. The first panel distinguishes the asset-category count from the financial asset share; the second retains the two debt groups and their different sample sizes; the final panel reports the resampling evidence in its original numerical form. The organization makes it possible to assess the strength of each link rather than relying only on the label of partial mediation.

Table 5. Financial asset mediation bootstrap inference and household debt differences

Variable	Model 1	Model 2	Model 3	Model 4
Net_conv	0.3852***	0.0521**	0.0625***	0.0528**
	(5.2113)	(2.1584)	(6.8254)	(2.2139)
Finit	—	0.0058**	—	—
		(2.0317)		

	AAHF	—	—	—	0.0241*** (2.5900)
	EconDev	−0.1110*** (-4.2019)	−0.0139 (-0.8959)	0.0123*** (2.8789)	−0.0131 (-0.8447)
	FinIns	0.0934*** (3.6928)	0.0133 (0.8993)	−0.0020 (-0.4838)	0.0131 (0.8868)
	Happiness	0.2642*** (18.0715)	0.0044 (0.5085)	−0.0707*** (-29.7936)	0.0001 (0.0146)
	Traffic	−0.0877*** (-6.3417)	0.0194** (2.3946)	−0.0423*** (-18.8566)	0.0171** (2.0932)
	finc	0.0414*** (9.9769)	0.0018 (0.7385)	−0.0014** (-2.1023)	0.0017 (0.6927)
	debt	−0.0246*** (-15.2324)	−0.0022** (-2.2938)	−0.0034*** (-13.1103)	−0.0024** (-2.4823)
	house	0.0468*** (13.6996)	0.0020 (0.9901)	0.0691*** (124.5773)	0.0059** (2.3443)
	health	−0.0416*** (-4.9308)	0.0038 (0.7720)	0.0172*** (12.5640)	0.0048 (0.9753)
	area	−0.0347*** (-2.9764)	−0.0470*** (-6.8986)	0.0035* (1.8579)	−0.0468*** (-6.8666)
	Constant	1.5050*** (4.7223)	9.5381*** (51.0826)	0.1658*** (3.2070)	9.5464*** (51.1446)
	N	26,787	26,787	26,787	26,787
	R-squared	0.2147	0.2823	0.5110	0.3525
	Sobel-Goodman Z value	2.1886	—	2.3424	—
	P value	0.0375	—	0.0192	—
	B Debt groups. Outcomes in order: high debt asset count, high debt expenditure, low debt asset count, low debt expenditure.				
	Net_conv	0.1562 (1.3578)	0.0825 (1.4249)	0.4258*** (5.2852)	0.0385 (1.0841)
	Finit	—	−0.0051 (-0.9078)	—	0.0082*** (3.1510)
	EconDev	−0.0973** (-2.2364)	−0.0118 (-0.4437)	−0.1186*** (-3.5732)	−0.0157 (-0.8234)
	FinIns	0.1198*** (3.1416)	0.0026 (0.1113)	0.0813** (2.4373)	0.0195 (1.0212)
	Happiness	0.1782*** (7.6011)	0.0091 (0.6103)	0.2986*** (16.0319)	0.0002 (0.0224)
	Traffic	−0.0866*** (-3.6575)	0.0194 (1.3377)	−0.0894*** (-5.2122)	0.0213** (2.1646)
	finc	0.0345*** (6.0275)	0.0011 (0.3000)	0.0464*** (7.9215)	0.0028 (0.8251)
	house	0.0620*** (10.3196)	0.0007 (0.1784)	0.0399*** (9.5047)	0.0027 (1.1117)
	health	−0.0408*** (-3.0036)	0.0030 (0.3567)	−0.0435*** (-4.0433)	0.0040 (0.6543)
	area	−0.0658*** (-3.5140)	−0.0203* (-1.7645)	−0.0171 (-1.1550)	−0.0624*** (-7.3486)
	Constant	1.5085*** (2.8809)	9.4213*** (29.2577)	1.4488*** (3.6097)	9.5799*** (41.6077)
	N	8914	8914	17,873	17,873
	R-squared	0.1002	0.2618	0.2116	0.3036
	C Bootstrap results with 1000 replications. Columns give coefficient, standard error, z statistic, and p value.				
	Indirect effect	0.0022	0.0011	2.2010	0.0450
	Indirect 95% interval	0.0001	0.0044	—	—
	Direct effect	0.0521	0.0299	2.1544	0.0320
	Direct 95% interval	0.0046	0.0996	—	—

Convenient access is associated with the asset-category count at 0.3852, with a reported statistic of 5.2113. When the count enters the expenditure equation, its coefficient is 0.0058 and the access estimate is 0.0521. The source reports a Sobel–Goodman statistic of 2.1886 and a p value of 0.0375. The alternative financial-share sequence gives an access-to-share estimate of 0.0625, a share-to-expenditure estimate of 0.0241, and a remaining access coefficient of 0.0528. Its reported Sobel statistic and p value are 2.3424 and 0.0192. These sequences are consistent with a small positive indirect statistical pathway alongside a remaining direct association.

The bootstrap panel reports an indirect estimate of 0.0022 and a direct estimate of 0.0521. The displayed 95-percent bounds are 0.0001 to 0.0044 and 0.0046 to 0.0996, respectively. Both intervals exclude zero as printed. However, the reported coefficients, standard errors, test statistics, and p values do not all reproduce one another

under a conventional normal-reference calculation. The values are retained without adjustment. This discrepancy limits exact verification of the inference and should be resolved against the original estimation output before using the reported precision for further calculation.

Debt-group estimates concentrate the mediation evidence in the lower-debt sample. There, access predicts the asset count at 0.4258, and the count predicts expenditure at 0.0082; both are marked significant at one percent. In the higher-debt group, the corresponding estimates are 0.1562 and −0.0051, neither significant. The remaining access estimates in the debt-specific expenditure models, 0.0825 and 0.0385, are also not significant. These findings support the source's interpretation of a stronger financial pathway among lower-debt households, while leaving the precise cross-group difference in indirect effects unquantified. No separate debt-group bootstrap contrast is reported.

5. DISCUSSION

The evidence suggests that convenient digital access is associated with greater household expenditure, but that relationship is embedded in financial and behavioral conditions. Access can reduce the effort involved in search and exchange, while household income, debt commitments, portfolio participation, and risk preferences shape the decisions made within that expanded opportunity set. This integrated interpretation is more faithful to the results than a simple technology-adoption narrative. The study identifies a positive average conditional association and several boundaries around it, rather than showing that access produces the same consumption response for every household.

The outcome distinction is central to that interpretation. Realized expenditure is economically meaningful, but it cannot directly identify willingness, confidence, or an intention to make future purchases. A household may increase spending because convenient access reveals useful products, because it has greater income, or because unavoidable costs rise. It may also substitute online spending for existing offline expenditure without changing total consumption substantially. The positive baseline estimate remains relevant to household economic behavior, yet the mechanism described as stronger consumption intentions is broader than the variable directly observed. Future work should measure intentions and realized expenditure separately if the objective is to explain how preferences become purchases.

The financial mediator similarly invites a narrower empirical reading than its conceptual label suggests. The asset-count measure records the breadth of participation across four categories. Its positive relationships with access and expenditure are consistent with financial capability playing a role, but wealth, lifecycle needs, and product availability can generate similar patterns. A household can understand financial products well while choosing a concentrated portfolio, or hold several products without understanding their risks. Treating diversification as evidence relevant to literacy is reasonable; treating it as a direct knowledge score is not. The alternative asset-share specification strengthens an allocation-based interpretation while leaving the knowledge interpretation partly unresolved.

This distinction changes the practical meaning of the mediation finding. The relevant policy objective would not be to encourage households to accumulate more categories of financial assets simply because a count is positively associated with expenditure. Financial education should help households evaluate suitability, fees, liquidity, insurance needs, and repayment obligations. In some circumstances, better decisions will involve greater participation. In others, they will involve avoiding an unsuitable product or retaining more liquid savings. The study supports considering financial capability alongside connectivity, but does not establish that higher product counts are universally desirable or that they provide a sufficient measure of successful education.

The lower-income result is one of the more consequential distributional findings. Its positive coefficient and reported cross-group test are consistent with digital convenience relaxing barriers that matter more when household resources are limited. Lower search costs and broader access to sellers may have greater practical value where local choices are constrained. Still, lower income does not imply identical needs or digital skills, and the source does not estimate whether access closes a measured expenditure gap. The finding is best understood as evidence of differential associations across income groups, with an inclusive interpretation that remains plausible rather than a demonstrated distributional outcome.

The debt comparison adds a complementary constraint. Lower-debt households show positive links along both parts of the proposed financial pathway, whereas the higher-debt group does not. Repayment commitments may reduce the room available to translate financial participation into expenditure. Improved knowledge can also lead indebted households to moderate spending, which would be a prudent response rather than a failure of digital inclusion. The lack of significant mediation in the higher-debt group therefore need not mean that knowledge is unhelpful. It may mean that its consequences differ when balance-sheet pressure changes the household's immediate priorities.

The debt-group construction limits how precisely this argument can be assessed. The article describes a median split, but the median reported debt measure is zero and the subgroup sizes are unequal. Ties at zero can produce an imbalance, yet the allocation rule is not documented. Differences between households with and without

debt are not the same as differences between equally sized low- and high-leverage groups. Debt totals also omit repayment schedules, interest burdens, collateral, and the purposes for which borrowing occurred. A more informative analysis would distinguish those features before assigning the contrast to repayment pressure alone.

Risk preference supplies a further boundary without resolving this identification problem. The positive interaction suggests that the access–expenditure association is stronger at higher observed risk scores. That is compatible with greater willingness to try unfamiliar purchasing and payment arrangements. Research connecting digital finance, consumption decisions, and risk preference provides a closely related setting for this argument [22]. Yet the interaction does not establish that risk tolerance itself should be increased. Appropriate consumer protection may reduce avoidable uncertainty and allow cautious households to participate safely, while preserving their legitimate preferences about financial exposure.

A protective interpretation is especially relevant because convenience can lower the friction of borrowing as well as the friction of purchasing. Faster payment and credit processes can support useful consumption smoothing, but can also reduce the time available to consider costs. The source's negative debt coefficients and debt-specific mediation pattern argue against equating consumption expansion with welfare improvement. The study does not observe indebtedness caused by digital access, nor does it evaluate defaults or financial distress. Nevertheless, its framework points toward evaluating the sustainability of additional expenditure rather than treating its volume as the sole measure of success.

The instrumental-variable results strengthen the empirical case in one respect and leave an important assumption open in another. Provincial broadband ports predict convenient access, and the reported diagnostic statistics are substantial relative to the stated weak-instrument comparison. This addresses relevance. Exclusion remains harder: infrastructure can affect local businesses, employment, public services, and the availability of products. Those connections can influence expenditure even where a respondent's binary access status does not change. A provincial economic control may capture part of the environment, but cannot guarantee that all such pathways are removed.

The larger second-stage coefficient should therefore be interpreted cautiously. Measurement error and reverse causality can generate differences between ordinary and instrumented estimates, as the original article suggests. So can variation in the population whose access is responsive to infrastructure and differences between conditional associations and instrument-specific identifying variation. The available evidence does not distinguish these explanations. Reporting the larger coefficient as a more accurate universal effect would exceed the design. Its useful contribution is to show that the positive relationship is not confined to the same variation used in the baseline regression, conditional on the instrument's validity.

Survey structure introduces an additional limitation. Repeated cross-sections cannot remove unobserved household characteristics through within-household comparisons. The analysis also spans years with substantial changes in digital services and household economic conditions, while the displayed specifications do not clearly document wave effects. Regional regressors and the infrastructure instrument are shared across many observations, making the treatment of common shocks relevant to inference. Without full information on survey weights, clustering, and wave harmonization, the large household sample should not be treated as a complete answer to dependence or representativeness concerns.

Mediation precision deserves separate scrutiny. The indirect coefficient is small relative to the remaining access association, which is consistent with partial rather than dominant mediation. The bootstrap intervals are supportive as printed, but internal discrepancies between some coefficients, standard errors, and test statistics prevent exact numerical reconciliation. The Sobel result also contains a statistic–p-value combination requiring verification. Preserving those entries is necessary for fidelity to the published evidence, while identifying the discrepancy is necessary for a transparent interpretation. Additional arithmetic based on the printed table should await clarification from the original output.

Several policy implications remain reasonable despite these limits. Improving reliable, affordable connectivity in rural and remote areas can expand access to information and transactions. The income heterogeneity suggests that distributional targeting deserves attention, although the regressions do not evaluate any specific infrastructure program. Financial education can complement access by helping households assess repayment capacity and product suitability. For indebted households, advisory services and careful lending assessments may matter more than additional encouragement to consume. These recommendations follow the study's conditional framework, but their relative effectiveness would require separate evaluation.

Future research could improve both measurement and identification. Direct questions about planned purchases could be linked to later spending, while knowledge tests could distinguish financial comprehension from participation. More detailed debt measures could separate borrowing access from repayment stress. Household panels or plausibly exogenous changes in connectivity could clarify causal ordering, and richer network measures could distinguish reliability, affordability, and use. Reporting design-based inference and harmonization procedures would make the survey evidence easier to assess. Such extensions would preserve the study's main

insight—that access interacts with household capabilities and constraints—while testing the mechanism more directly.

6. CONCLUSION

The underlying study associates convenient digital network access with higher household consumption expenditure in five repeated China Social Survey cross-sections covering 2015–2023. Its 26,787 observations support a positive baseline relationship that remains present when the outcome is expressed relative to income and when continuous variables are winsorized. The infrastructure-instrument specification also yields a positive coefficient, although its causal interpretation depends on an exclusion restriction that cannot be established by first-stage diagnostics alone.

The results place household conditions at the center of the explanation. The positive access association is significant among lower-income households, risk preference strengthens the fitted relationship, and financial asset participation supplies a partial statistical mediation pathway. That pathway is more evident in the lower-debt group. These findings are consistent with digital access expanding opportunities whose use depends on resources, uncertainty, and financial commitments. They do not show that greater spending or broader product ownership necessarily improves household welfare.

Interpretation must remain tied to the observed measures. Annual expenditure is a proxy for, rather than a direct measure of, consumption intentions, and financial asset breadth does not directly test financial knowledge. Repeated cross-sections, uncertainty about debt-group construction, and inconsistencies in reported mediation inference further limit strong causal conclusions. The practical lesson is to develop connectivity together with useful financial capabilities and sustainable debt management. Digital inclusion is most valuable when households can use expanded opportunities to make informed, affordable choices aligned with their circumstances.

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