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<https://doi.org/10.1057/s41599-023-01781-0>

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Internet use, market transformation, and individual tolerance: Evidence from China

Yunliang Zhang¹, Xueli Chen²✉ & Zhiyang Shen³

Earlier literature studies the relationship between Internet use and individual tolerance, but little research explores these links in the context of China. This article analyzes the impact of Internet use on individuals' tolerance using Chinese national social survey data from 2015 to 2021. The results find that Internet use has a significant positive effect on individual social tolerance (ST) and moral tolerance (MT), and this effect is still valid after dealing with the endogenous problem by instrumental variables and the propensity score matching method. Moreover, the division of university education, unit system, and Hukou moderate the relationship between Internet use and individual social tolerance. Last, opportunity fairness and outcome fairness play the suppressing effects, not mediating effects. This article clarifies the role of digital technology in the development of high-quality economics and proposes that the government should pay more attention to changes in social attitudes.

¹Research Institute of Social Development, Southwestern University of Finance and Economics, 611130 Chengdu, China. ²Institute of Journalism and Communication, Chinese Academy of Social Sciences, 100021 Beijing, China. ³School of Management and Economics, Beijing Institute of Technology, 100081 Beijing, China. ✉email: chenxueli05@163.com

Introduction

Since the twenty-first century, digital information platforms have become channels for the public to obtain and share information. The development of new media technologies reduces the cost of understanding and exchanging information with the public; however, it also poses new challenges to the formation of an individual's social psyche. With the development of the market economy and the popularity of diverse cultures, people's tolerance also changes. However, because of the growing news of fraud cases, individual tolerance is also affected; therefore, enhancing people's tolerance from the perspective of Internet use becomes an important issue that cannot be ignored.

The literature on public tolerance forms two research paradigms. The first paradigm focuses on the typological study of tolerance and social function analysis of different kinds of tolerance (Vogot, 1997). The second research paradigm focuses on micro and macro factors that affect an individual's tolerance. These research paradigms yield meaningful findings, but there still is room for further exploration. According to the 48th Statistical Report on the Development of Chinese Internet, China's Internet penetration rate rose from 45.80% in 2013 to 75.60% in December 2022, and the number of Internet users increased from 618 million in 2013 to 1067 million in 2022. However, there is no research on whether Internet use affects individual tolerance in the context of China, and little research examines the moderating and mediating effect between Internet use and personal tolerance change, which also needs to be further explored. Therefore, this paper raises the following question: is there a positive or negative impact of Internet use on public tolerance in China? If this effect is natural, what is its moderating mechanism?

This article applies the Chinese Social Survey data from 2015 to 2021. It matches the data of the China Statistical Yearbook to empirically examine the impact of Internet use on Chinese tolerance and its moderating effect. The innovation points of this paper are as follows. First, this paper considers China's development situation as the research context, uses national survey data, and analyzes the impact of Internet use on Chinese tolerance to enrich the field of the benefits of digital technologies resulting in changes in social mentality in different countries. Second, from the perspective of institutional transformation, this study analyzes the effect of three moderator variables on the relationship between Internet use and public tolerance, including the university education division, labor market division (*danwei* or *unit system*), and household registration division (*Hukou*), aiming to expand the studies on the moderating and suppressing effect of the influence of technology on social attitude changes.

Literature

The type of tolerance and its influence factors analysis. Different scholars provide different definitions and categories of tolerance. Gibson (1992) argues that individuals have an accepting attitude toward others who are different from them in terms of race, religious beliefs, and other issues. Depending on the object of different types of tolerance, Vogot (1994) divides tolerance into political, social, and moral tolerance. Political tolerance means accepting that others have equal rights to vote, participate in the governance of public affairs, have the freedom to give a speech to all members of society, and have other political rights; therefore, political tolerance points to an individual's actions in public spaces. Social tolerance refers to an individual's acceptance of different races, ethnicities, nationalities, language system use, other religious beliefs, and health status; therefore, the object of social tolerance is the pre-grant of members' rights and the acquisition of initial socialization. Moral tolerance refers to an individual's acceptance of private sphere rights, such as sexual

behavior, abortion, and other premarital behaviors; thus, moral tolerance is an individual's private interest in life. Since then, many scholars have studied the measures of different types of tolerance. Lu and Yu (2020) use the 2010–2014 World Values Survey data by including developed countries, such as the United States, and developing countries, such as Nigeria, and investigate the types of public tolerance. In this study, moral tolerance includes the public's acceptance of acquired immune deficiency syndrome (AIDS) groups, gay groups, and living together before marriage, and social tolerance includes the public's acceptance of different skin colors, migrant status, faiths, or different languages. The above research results provide a foundation for future research.

Scholars have discussed the factors that influence political tolerance, social tolerance, and moral tolerance. First, in terms of political tolerance, Vogt (1997) assumes that political tolerance is a fundamental tolerance, and it is the basis for individuals to win and maintain other tolerances. Prior studies show that individuals' political tolerance is not only influenced by people's age (Sotelo, 1999), educational degree (Golebiowska, 2020), cognitive ability (Rasmussen and Ludeke, 2022), and political knowledge (Hall, 2018) but also by their social support network (Ikeda and Richey, 2009), social environment (Hass and Cunningham, 2014), and other external factors. Second, to date, research has been able to convincingly show that social capital (Crowley and Walsh, 2021), institutional environment (Weldon, 2006), macroeconomic environment (Persell et al., 2001), and other factors can significantly affect an individual's social tolerance and moral tolerance. Among these factors, many scholars focus on the analysis of the function of social attitudes. Andersen and Fetner (2008) conclude that positive social attitudes can significantly enhance people's social tolerance toward gay groups. Hadler (2012) undertake a similar study and find that hate attitudes toward foreign residents or the dread of gay groups can significantly reduce an individual's tolerance.

Taken together, these studies analyze the influencing factors of different types of tolerance, such as people's demographic characteristics, socioeconomic characteristics, and external environment. As the core content of human capital, individual degrees of education receive a lot of attention. Vogt (1997) finds that education levels acquired mainly through interpersonal contact, cognitive ability development, mental health development, and multicultural acceptance affect an individual's tolerance. With the development of Internet technology and the expansion of Internet use, the academic community begins to investigate the impact of Internet use on individual tolerance (Lu and Yu, 2020).

The impact of Internet use on individual tolerance. Media is an information dissemination tool that relies on a specific material carrier. Although the media carrier is objective, the information that it carries is time-varied and pre-framed. Inglehart (1977) analyzes the World Value Survey data and finds that the value of members in different countries is undergoing a quiet, revolutionary change. Lippmann (1997) points out that any form of media always uses a specific messaging framework to transmit information to the public so that the audience can quickly form the awareness that the media expects. Specifically, the media can influence the audience's social attitudes through media information content and information exposure time. Robinson and Appel (1979) demonstrate that it is easy for an audience to form distrust; in other words, harmful information has a trigger effect on the audience's negative behavior effect. Putnam (1995) shows that exposure to harmful information can reinforce the audience's distrust of strangers. However, Li (2012) argues that the

disclosure of economic development information by the media improves the audience's trust in the government.

In fact, Internet use has a complex impact on audience tolerance including more permissive attitudes toward sexuality, marriage, and divorce (Silverman, 1999; Zheng et al., 2019; Liu et al., 2020). Compared with Internet media, traditional media has a strong professionalism in content production. In contrast, the Internet media has evident traits that often produce a strong preference for information triggering the audience's curiosity. In addition, in the production of Internet information, any person can be either a content producer or a content consumer, which makes it difficult for a few people to monopolize the Internet platform. Unlike traditional media, information released by Internet media is highly discrete as Internet media intentionally chooses the variety of information to disclose to increase the audience's attention. In the context of China's high-quality socioeconomic development, the Internet is given the responsibility to spread positive social values. This leads to Chinese Internet media focusing on diversified information reporting rather than being overly competitive in reporting on the same information. Therefore, the growth of Internet media can provide people with more opportunities to obtain diverse information, thus enhancing their tolerance.

As an important channel for the public to understand accurate information, the healthy development of the Chinese Internet media industry benefits from the relevant national institutional arrangements. However, fake news cannot be eliminated. Previous studies have found that false or phony Internet messages can reduce individuals' social trust or government trust, and this negative effect can increase over time (Kraut et al., 1998). In addition, research on rumors has found that spreading rumors is an effective way to manipulate the public. As rumors spread rapidly, rumor makers can exhibit extreme public behavior, with devastating social consequences (Na et al., 2018). The gatekeeping theory holds that the absence of gatekeepers weakens people's trust in Internet media (Pingree et al., 2013). In response, China's media propaganda authorities have implemented multiple measures. On the one hand, leaders have made rules for the development of the Internet media industry, such as industry standards, the qualification of industry personnel, and entry thresholds for enterprises. On the other hand, leaders have adopted legal policies against phony news and rumors to ensure that Internet news is factual. Thus, accurate Internet news media can enhance individuals' tolerance of different social behaviors, attitudes, languages, and so on.

H1: Chinese are more likely to be tolerant of a higher frequency of Internet media use.

Moderate effect of market transformation. The impact of Internet use on an individual's tolerance may vary depending on the changes brought by reforming institutions. China implemented a planned economic system before 1978; its society did not have free-flowing labor, and the qualification for individuals to attend universities was the class composition of their families. Since 1978, China has undergone comprehensive reforms, the core of which was to deal with the relationship between the government and the market and establish a market economy system. In 1982, China gradually implemented a two-track development system, and the private economy began to develop. State-owned units were communities with a clear boundary of collective ownership, which people referred to as intra-institutional sectors. In the private sector, workers engaged in flexible work under the logic of the market economy, and some government officials resigned and ran the business. These two

groups constituted the vital participants of the out-of-system market. Furthermore, Chinese college entrance examinations were reinstated, which meant that individuals who completed university education could be directly assigned to system sectors (*danwei*) such as government departments. To speed up the development of the urban economy, the government has further relaxed the labor mobility policy restrictions and accelerated the reform agenda of the urban and rural household registration system (*Hukou*); therefore, agricultural *Hukou* laborers can freely enter the urban labor market. In summary, in the process of China's reform and opening up, the market transformation manifests itself in three ways: university education division, internal and external system employment division, and urban and rural *Hukou* division.

First, receiving a university education could increase individuals' cultural capital and affect their tolerance of different social behaviors. Knowledge gap theory holds that the information disseminated by Internet media increases the knowledge of both higher cultural capital groups and lower cultural capital groups. However, the latter have less access to diversified information and a higher cost of eliminating false information, and the knowledge gap increases between these two groups eventually (Tichenor et al., 1970). Bourdieu (1984) finds that cultural capital symbolizes an individual's social status or cultural assets, including physical, objective, and institutionalized cultural capital. According to status symbols such as social attitudes, consumption preferences, cultural literacy, and academic credentials, individuals classify themselves as specific social classes. The knowledge gap between different cultural capital classes extends to the digital divide problem in the Internet media technology environment. Lamout and Laueau (1988) find that university education is an important channel for individuals to strengthen their cultural capital, and the reception of university education can significantly heighten their tolerance of multiculturalism. Through university life, students enhance not only their knowledge and literacy but also their acceptance of other cultures. Therefore, compared with non-Internet users who have not completed a university education, Internet users who have completed a university education may be more tolerant.

Second, labor market segmentation leads to a gap in the possession of resources among the public and has an impact on people's tolerance. In the progress of China's market economy development, the reform of the ownership structure of production materials results in state-owned and non-state-owned identity and thus shapes two different economic sectors, namely within-system employment (*danwei*) and out-of-system employment (Nee, 1989). Compared with the system employment sector, the non-state employment sector is guided by efficiency logic and follows the principle of survival of the fittest; thus, the latter sector is more sensitive to market signals (Meng and Zhang, 2001). A person who works in the system sectors can enjoy more support from national financial resources and preferential policies, which means higher labor income, higher social welfare, and professional prestige (Zhou, 2000). Labors working in the out-of-system employment sectors not only have a free-flowing working environment and a high return rate of human capital but also face more risks brought by market uncertainty (Zang, 2002). Increased risk from uncertainty inhibits an individual's tolerance of different cultural and social behaviors. Therefore, in the face of the same Internet information, the high welfare benefits brought by the within-system employment sectors reduce the cost of individuals' exposure to multi-cultures, enhancing individuals' tolerance of different behaviors and cultures. Nevertheless, the uncertainty of out-of-system employment sectors pushes individuals to focus more on increasing their family income and

promoting their subjective well-being status, thereby reducing their tolerance.

Third, the division of urban and rural Hukou leads to opportunity inequality among the public and affects individuals' tolerance. Since the founding of the People's Republic of China, the quality between urban development and rural development has always been in a state of dual division, which comes from the Hukou system implemented by the Chinese government and the corresponding resource allocation system. In 1984, the Chinese government implemented the reform of the urban enterprise management system and improved its business environment. At the same time, high-quality medical service resources, educational resources, and other material resources were allocated to urban areas instead of rural areas, leading rural areas to face a severe shortage of such resources. In the last several years, the Chinese government has accelerated the reform process of the rural welfare system, increased its financial resources to rural areas, and reduced the uneven allocation of social resources between urban and rural areas. However, the imbalance in the allocation of public resources in urban and rural areas remains acute. Overall, the most considerable imbalance in Chinese economic development and social resource allocation is mainly between urban and rural development, which directly results in the inequality of social welfare resources for urban and rural household residents.

H2: The effect of Internet use on individual tolerance is influenced by the moderate impact of the university education division, labor market division, and urban and rural Hukou division.

Mediator effect of fairness. In general, people judge the equity of a society's resource allocation from results and opportunities (Yankovic, 1981). Fair results are reflected in the degree of income inequality, and opportunity equity is shown in the openness of class mobility. In terms of result fairness, it is evidence that an excessive income gap can decrease the public's tolerance. In a social structure with a disparity between the rich and the poor, the upper classes are worried that wealth will be taken over by the lower classes; conversely, the lower classes are dissatisfied with the excessive gap held by the higher classes. This economic isolation leads to a more severe tolerance crisis (Hetherington, 2005). In terms of equity of opportunity, the opportunity for upward mobility is significantly reduced when the rate of class mobility slows down, which gives the lower class a pessimistic view of its future and ultimately reduces its tolerance to other behaviors or multi-cultures. In the context of rising Internet information, the rural Hukou residents learn that the urban Hukou residents enjoy a wealth of educational resources, medical resources, and higher income, which enhances their sense of relative deprivation and may decrease their tolerance. However, urban residents can learn about the lag of rural development through the Internet, thus enhancing their empathy for urban residents and improving their tolerance of different social behaviors or cultures.

Since China's market-oriented reform in 1978, the material living standards of the public have been greatly improved, which enables the Chinese to obtain more work choices and development opportunities and also promotes the social class of a large number of the public. However, in the process of social development, there are always unequal opportunities and unequal distribution based on differences in human capital and regional economic development. When inequality is considered to be derived from personal ability, people's judgment of fairness is relatively strong. However, when inequality is considered as an external opportunity difference, the public's judgment of fairness

is reduced. Therefore, the conclusion of whether society is fair or not is the result of individual judgment based on certain information, thus, the information itself and the media that disseminates information affect people's sense of fairness. With the increasing popularity of the Internet in China, new media represented by the Internet tends to spread more negative information, which leads to long-term exposure to Internet information will make the audience believe that the information transmitted by the media is true, and weaken the public's sense of fairness, and ultimately affect their tolerance for other groups or other behaviors.

H3: The effect of Internet use on individual tolerance is influenced by the mediator's impact on fairness.

Research design

Data. The data used in this study consists of two parts. First, this study uses Chinese Social Survey data (CSS). The CSS survey is a nationwide, bi-annual, and comprehensive survey conducted by the Institute of Sociology of the Chinese Academy of Social Sciences and covers 31 provinces in mainland China. The CSS was first initiated in 2005 and has been performed in several rounds, with the latest released data being the 2019 survey data; each survey visits the members of 7000–10,000 persons aged 18–69 years. The CSS survey began to ask respondents about their Internet usage and tolerance attitudes in 2015; thus, this study selects the data from 2015 to 2021. After deleting the outliers and missing values, a valid observation for this research is a record of 33,547. Second, this article uses data from the China Statistical Yearbook from 2015 to 2021, which records Internet penetration and the scale of Internet user access at the provincial level as a macro context. Finally, to obtain the analytical data for this study, we match the CSS survey data with statistical yearbook data.

Measures

Dependent variable. The dependent variable is the respondents' sense of tolerance. The related question in CSS is the following: "In terms of your personal beliefs, can you accommodate the following groups, including (1) premarital cohabitants, (2) LGBTQ+ (Lesbian, Gay, Bisexual, Transgender, Queer, +) groups, (3) people begging for food/money, (4) persons released from prison, and (5) persons with different religious beliefs." The possible answers are very unacceptable, less acceptable, more acceptable, and very acceptable.

We first conduct a factor analysis of the respondents' options; this results in two factors, which we name moral tolerance (MT) (KMO: 0.572; Bartlett's test: $p < 0.000$) and social tolerance (ST) (KMO: 0.696; Bartlett's test: $p < 0.000$). MT includes respondents' tolerance for premarital cohabitation and LGBTQ+ groups. We add respondents' options for these two groups and then average them to obtain MT scores. ST includes the respondents' tolerance for those begging for food/money, those released from prison, and people's faiths. We add a total score of the respondents' choices about these three groups and take the mean to obtain the respondent's ST score. Second, this article standardizes and normalizes the two tolerance scores to make them range from 0 to 100; the higher the tolerance score, the higher the respondent's tolerance.

Independent variable. The CSS interviewed individuals about Internet use behavior through two items: (1) do you use the Internet? (yes = 1, no = 0); (2) how often do you use the Internet to browse current political news and participate in online discussions? (never = 1, several times a year = 2, at least once a month = 3, at least once a week = 4, many times a week = 5,

Table 1 Descriptive statistics (N = 33,547).

Variable	Description	Mean	sd	Min	Max
MT	The value of moral tolerance	51.930	20.157	1	100
ST	The value of social tolerance	31.645	23.718	1	100
use_d	No Internet use = 0, Internet use = 1	0.491	0.500	0	1
use_c	6 being the highest Internet use frequency	2.527	2.612	0	6
edu_d	Below college education degree = 0, Complete college education or above = 1	0.182	0.386	0	1
gender	Male = 0, female = 1	0.451	0.498	0	1
age	Individual's age	45.691	13.982	17	70
CPC	1 being a member of the Communist Party of China	0.105	0.307	0	1
hukou	Agricultural hukou=0, Non-agricultural hukou=1	0.337	0.472	0	1
hukou_loc	Residents' hukou registered in local = 1, registered in other place = 0	0.758	0.428	0	1
rural	Living in rural = 0, living in urban = 1	0.563	0.496	0	1
system	1 is the status of work in government-affiliated institutions, army, state-owned or collective enterprises	0.107	0.309	0	1
Log_asset	The logarithm of an individual's family asset	10.659	1.433	0	13.722

The survey province and year are multi-categorical variables, and not reported.

almost every day = 6). In the benchmark regression section, we set 0 points for the “non-Internet-use group” and 1–6 points for the “Internet-use group”. In the robustness test, we combine the two items to form a variable with a score from 0 to 6; the higher the score, the more frequently respondents used the Internet.

Moderator variables. Based on the theoretical analysis, we select the three-division results of China's market transformation as the moderator variable. The operational variable of the university education division is whether the respondent has completed university education (completed = 1, not completed = 0). The operational variable of the labor market division is whether the respondent is employed in system sectors such as government departments, military departments, collective enterprises, and state-owned enterprises. If the respondent is employed within these sectors, they are “in the system” and assigned a score of 1; if not, they are assigned a score of 0. The operationalization of the Hukou division is household registration: if the respondent's Hukou is rural, they are assigned a 0; if it is urban, they are assigned a 1.

Mediator variables. We select the social fairness value as the moderator variable. Social fairness is an individual's subjective evaluation of the fairness of resource allocation in the whole society. CSS measures residents' sense of social fairness in 8 items, including the college entrance examination, political rights, law enforcement, public health, work or employment opportunities, wealth and income distribution, pension and other social security benefits, and rights between urban and rural areas. The answer options: very unfair = 1, unfair = 2, hard to say = 3, fairer = 4, and very fair = 5.

In addition, we classify the eight items into “opportunity fairness” (OpF) and “outcome fairness” (OcF). According to Whyte (2010), we argue that opportunity fairness is reflected in the college entrance examination, political rights, law enforcement, and work or employment opportunities. And outcome fairness is reflected in public health care, wealth and income distribution, social security benefits such as pensions, and rights between urban and rural areas. Finally, we add the indicators belonging to the same category and took the mean to generate OpF and OcF.

Control variables. To control for the interference caused by individual or regional characteristic differences, we also consider the respondents' gender, age, political affiliation, family economic income, Hukou characteristics, survey year, and survey districts. Table 1 presents the descriptive statistics and definitions of the variables.

Figure 1 shows the changes in Chinese MT and ST from 2015 to 2021. As can be seen, MT and ST show different trends, namely, the ST keeps upward and the MT shows a trend of first decreasing and then increasing, but the MT is higher than ST in the same year. From the descriptive statistics shown in Table 1, the mean value of the Chinese public's MT is 51.93, while the mean value of ST is only 31.645, which indicates that the public's tolerance for people begging for food/money, persons released from prison, and people of different faiths is lower than that for premarital cohabitants or LGBTQ+ groups. In addition, while 49.1% of the respondents are Internet users, 18.2% of respondents have completed university education, 10.5% of the respondents are CPC members, 33.7% are rural Hukou, and 10.7% are employed in the system sector (*danwei*).

Method of analysis. This study's empirical regression model consists of two parts.

First, considering that an individual's MT and ST are continuous variables, this study uses ordinary least squares (OLS) as the benchmark regression analysis. However, as the two individual tolerances are influenced by common factors such as gender, education level, family income, and unobservable factors at the same time, a statistical link may exist between the disturbances. For this reason, this study further use seemingly unrelated regression (SUR).

$$\text{OLS model : tolerance}_i = \alpha_0 + \beta_0 \text{use}_i + \gamma_i X_i + \mu_i \quad (1)$$

$$\text{SUR model : } \begin{pmatrix} y_{\text{social_tolerance}} \\ y_{\text{moral_tolerance}} \end{pmatrix} = \begin{pmatrix} \text{use}_1 & 0 \\ 0 & \text{use}_2 \end{pmatrix} \times \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} = \alpha_0 + \text{internet_use} \times \beta + \varepsilon \quad (2)$$

In Eq. (1), tolerance_i is the score of individuals' MT and ST; use_i is the individual's Internet use frequency; X_i is the individual's gender, age, and other control variables; μ_i is a random disturbance item, and ε stands for control variables and random perturbations in Eq. (2).

Second, to test the moderating effect of market transformation division, this study choose the interaction variables, namely university education division, labor market division, and Hukou division, multiplied by Internet use. The estimated model is as follows:

$$\text{tolerance}_i = \alpha_3 + \beta_3 \text{use}_i + \gamma_3 \text{div}_i + \beta'_3 \text{use}_i \text{div}_i + \delta_i X_i + \mu_i \quad (3)$$

Equation (3) is the estimated function of the moderate effect, and the coefficient div_i stands for the respondents' market transformation division variables, while the coefficient β'_3 indicates a moderate effect.

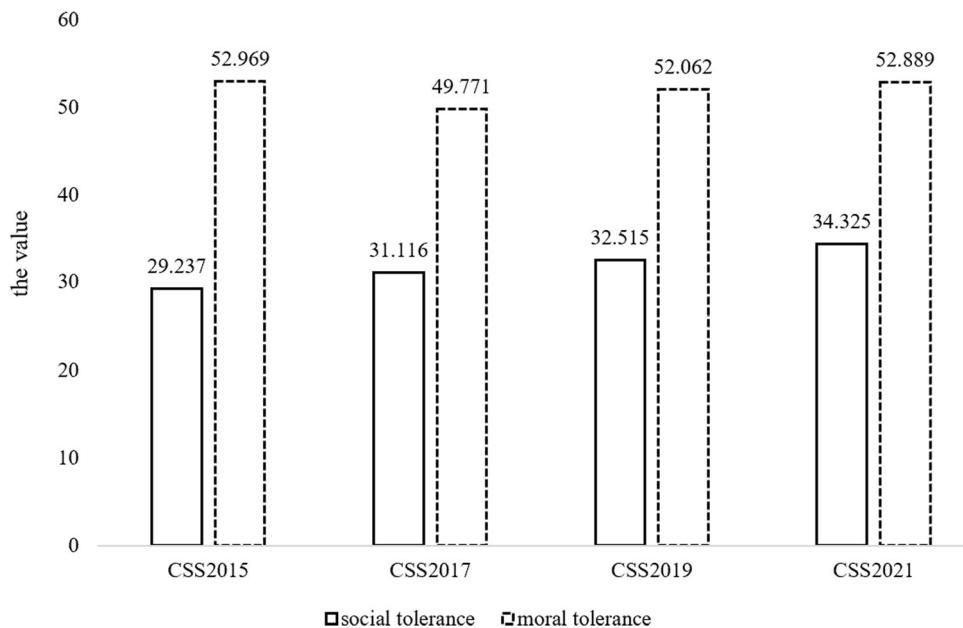


Fig. 1 The changes in social tolerance and moral tolerance in China.

Table 2 The result of the mean test.

Sample	No college education		College education or above		Mean T-test
	Variables	obs	Mean	obs	Mean
MT	27,430	50.50	6117	58.34	7.836***
ST	27,430	28.55	6117	45.52	16.973***
Sample	Outside the system				
MT	29,968	51.50	3579	55.56	4.063**
ST	29,968	31.08	3579	36.40	5.325***
Sample	Agricultural hukou				
MT	22,302	51.07	11245	53.64	2.575**
ST	22,302	30.25	11245	34.41	4.161***

, *Represent significance at the 5% and 1% levels, respectively.

Third, to assess whether the mediating mechanism effect holds, we choose a three-step analysis method.

$$\text{Fairness}_i = \alpha_4 + \beta_4 \text{use}_i + \delta_i X_i + \varepsilon_i \quad (4)$$

$$\text{tolerance}_i = \alpha_5 + \beta_5 \text{use}_i + \gamma_5 \text{Fairness}_i + \delta_i X_i + \mu_i \quad (5)$$

In Eqs. (4) and (5), Fairness_i stands for the mediator variables such as respondents' OpF and OcF. In Eq. (5), the coefficient γ_5 denotes the effects of the mechanism variables on the individuals' MT and ST. β_5 denotes the direct effect of Internet use on the individuals' MT and ST.

Results

Benchmark analysis. This study first examines whether there are statistically significant differences in ST and MT among different types of respondents. As can be seen from Table 2, the ST and MT of respondents who have completed college education are significantly higher than those of respondents without a university education. Second, respondents who engage in the system employment sector are more socially and morally tolerant than those who work outside the system, at a statistical level of 1%. Third, the mean value of non-agricultural Hukou residents' ST and MT is higher than that of the agricultural Hukou population.

Table 3 reports the impact of Internet use on individuals' two forms of tolerance. Models 1–4 are estimated results that applied the OLS model, and Models 5 and 6 use the SUR model for the robustness tests. Among them, Models 1, 2, and 5 utilize the dependent variable of MT, and Models 3, 4, and 6 utilize the dependent variable of ST.

From the findings of Models 1 and 3, compared with the non-Internet-use group, the Internet-use group has a higher MT ($\beta = 2.115, p < 0.01$) and ST ($\beta = 0.871, p < 0.01$); Models 2 and 4 show that the higher the frequency of Internet use, the higher the mT ($\beta = 0.403, p < 0.01$) and ST ($\beta = 0.145, p < 0.05$). In short, with the help of Internet media, individuals' MT and ST have significantly improved.

However, as common factors affect individuals' MT and ST, that is, the disturbances in the OLS estimation model may have a statistical correlation. Models 5 and 6 are estimates that use the SUR model. From the results in the table, compared with the non-Internet-use groups, the Internet-use group has a higher MT ($\beta = 2.115, p < 0.01$) and ST ($\beta = 0.871, p < 0.01$). Additionally, this study finds the correlation coefficient of the two perturbation items obtained by the SUR equation to be 0.265 (p -value = 0.000); thus, Models 5 and 6 reject the assumption that the two-equation perturbations are independent of each other at a significance level of 1%. By testing the mean coefficient of the *use_d* variable in

Table 3 Estimation of the effect of Internet use on people's different tolerance.

Model	OLS				SUR			
	Model 1		Model 2		Model 3	Model 4	Model 5	Model 6
Variables	MT	MT	MT	MT	ST	ST	MT	ST
use_d	2.115*** (0.300)				0.871*** (0.325)		2.115*** (0.291)	0.871*** (0.327)
use_c		0.403*** (0.057)				0.145** (0.061)		
edu_dum	4.199*** (0.313)	4.167*** (0.314)	11.562*** (0.397)	11.561*** (0.397)	4.199*** (0.348)	11.562*** (0.391)		
gender	2.063*** (0.219)	2.021*** (0.219)	-0.119 (0.246)	-0.132 (0.246)	2.063*** (0.219)	-0.119 (0.247)		
age	-0.157*** (0.010)	-0.161*** (0.009)	-0.358*** (0.011)	-0.361*** (0.011)	-0.157*** (0.010)	-0.358*** (0.011)		
CPC	-0.425 (0.364)	-0.461 (0.364)	-3.028*** (0.412)	-3.032*** (0.412)	-0.425 (0.379)	-3.028*** (0.427)		
hukou	0.896*** (0.268)	0.878*** (0.269)	1.015*** (0.305)	1.019*** (0.306)	0.896*** (0.276)	1.015*** (0.310)		
hukou_loc	-0.625** (0.258)	-0.626** (0.258)	-1.148*** (0.298)	-1.151*** (0.298)	-0.625** (0.270)	-1.148*** (0.304)		
system	0.133 (0.357)	0.100 (0.357)	-2.052*** (0.431)	-2.057*** (0.432)	0.133 (0.386)	-2.052*** (0.434)		
rural	-0.260 (0.263)	-0.262 (0.263)	0.277 (0.289)	0.281 (0.289)	-0.260 (0.261)	0.277 (0.293)		
log_asset	0.188** (0.085)	0.187** (0.085)	0.244*** (0.091)	0.247*** (0.091)	0.188*** (0.081)	0.244*** (0.091)		
<i>Survey district</i>								
Middle area	0.551** (0.250)	0.563** (0.250)	-1.723*** (0.282)	-1.718*** (0.282)	0.551** (0.253)	-1.723*** (0.285)		
West area	-1.051*** (0.276)	-1.037*** (0.276)	-1.556*** (0.310)	-1.553*** (0.310)	-1.051*** (0.272)	-1.556*** (0.306)		
<i>Survey year</i>								
2017	-3.867*** (0.296)	-3.877*** (0.296)	0.995*** (0.333)	1.010*** (0.333)	-3.867*** (0.298)	0.995*** (0.336)		
2019	-2.437*** (0.331)	-2.445*** (0.331)	1.577*** (0.371)	1.625*** (0.371)	-2.437*** (0.329)	1.577*** (0.370)		
2021	-1.895*** (0.335)	-1.880*** (0.333)	2.964*** (0.377)	3.023*** (0.375)	-1.895*** (0.336)	2.964*** (0.378)		
N	33,547	33,547	33,547	33,547	33,547	33,547		
R ²	0.047	0.047	0.129	0.129	0.047	0.047		

, *Represent significance at the 5% and 1% levels, respectively, with *t*-values in parentheses.

Models 5 and 6, it is found that $\chi^2 = 10.95$, and p -value < 0.00 ; the assumption that the two coefficients are equal at the 1% significance level is thus rejected. In other words, the influence of Internet use on individuals' MT and ST is not statistically equal. Therefore, it is necessary to use SUR estimates, and the results of the SUR model are reasonable.

This study uses the estimates of Models 5 and 6 to illustrate the effects of the control variables. Having completed a university education significantly improves an individual's MT ($\beta = 4.199$, $p < 0.01$) and ST ($\beta = 11.562$, $p < 0.01$). Men have a higher MT than women ($\beta = 2.063$, $p < 0.01$), but no significant difference is found between them regarding ST. It is also found that aging weakens an individual's MT ($\beta = -0.157$, $p < 0.01$) and ST ($\beta = -0.358$, $p < 0.01$). Compared with the non-CPC members, the ST of CPC members is lower ($\beta = -3.028$, $p < 0.01$); however, there is no significant difference in MT between them. The non-agricultural Hukou residents' MT ($\beta = 0.896$, $p < 0.01$) and their ST ($\beta = 1.015$, $p < 0.01$) are higher than those of the agricultural Hukou population. Furthermore, respondents who work in the system sector had lower ST than those who work outside the system ($\beta = -2.052$, $p < 0.01$); however, we detect no significant differences in the impact of MT. In addition, an increase in family income significantly enhances an individual's MT ($\beta = 0.188$, $p < 0.05$) and ST ($\beta = 0.244$, $p < 0.05$). In contrast to individuals living in the eastern areas, residents living in western areas have lower MT ($\beta = -1.051$, $p < 0.01$) and ST ($\beta = -1.556$, $p < 0.01$). Respondents' MT experiences the most significant decline in 2017 ($\beta = -3.867$, $p < 0.01$), and then an upward trend in 2021, which is consistent with the results of Fig. 1. However, the ST keeps an upward trend from 2015 to 2021. Overall, Internet use greatly enhances the MT and ST of the Chinese.

Endogenous problems. The above regression results show that the use of the Internet has a significant positive impact on individual MT and ST. However, many people are excluded from having access to the Internet and become non-Internet users due to the digital divide or the lack of Internet devices. Furthermore, due to this research using multi-period cross-sectional survey

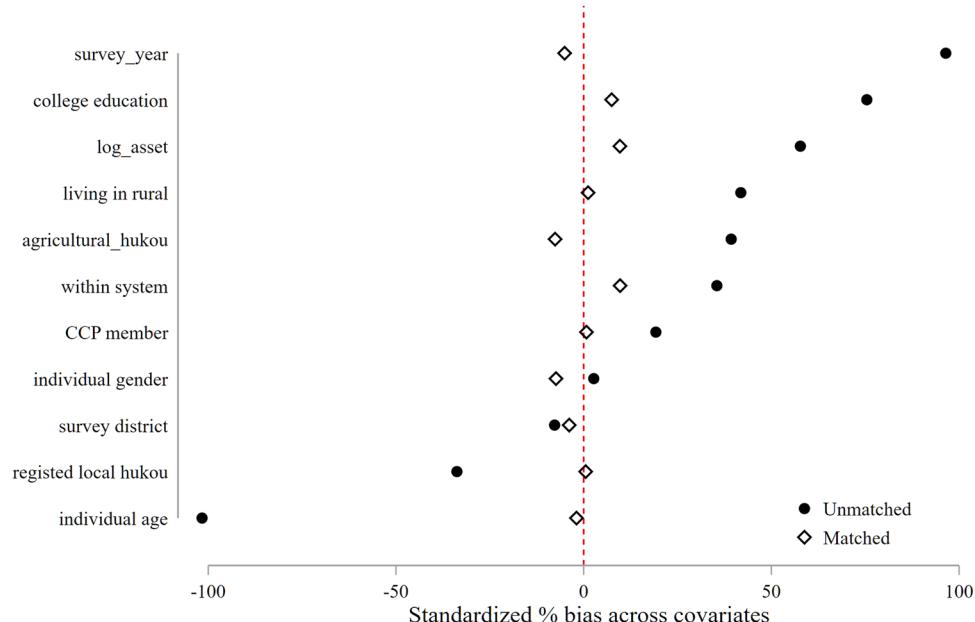
data, there are endogenous problems in the process of causal inference. The causes of endogenous problems include missing variables, two-way causal relationships, variable measurement errors, etc. Specifically, in this paper, on the one hand, Internet technology progress will directly enhance the possibility of using the Internet, but the improvement of tolerance will not directly enhance the possibility of using the Internet. Therefore, there is no reverse causality between the independent and dependent variables. On the other hand, if the benchmark model omits one or more control variables, and these control variables will simultaneously affect the individual use Internet and tolerance value, this will also lead to endogenous problems. Based on the information from the survey data, we use the instrumental variable method (IV) and the propensity score matching method (PSM) to address this problem.

First, we choose the IVs: provincial Internet coverage (Int_cov), the mean ratio of Internet users in the community of respondents living in (M_c_users), and regional inclusive financial index (Fin_index). From an exogenous perspective, the three IVs do not directly affect the dependent variable. In addition, the tolerance will not affect the popularity of the Internet, nor will it affect the regional inclusive financial development. Therefore, the IVs meet the exogenous principle. From the perspective of relevance, the Internet penetration rate, the Internet usage rate of the respondents' living areas, and the level of regional inclusive financial development all reflect the development level of an area's Internet infrastructure, which has a direct impact on the respondents' Internet use habit, therefore, the IVs meet the relevance principle. As the government does not report the Internet coverage of each province in 2019 and 2021, we only analyze the survey samples in 2015 and 2017. First, the Hausman test shows that the Chi2 = 64.93, $p < 0.01$, indicating that the OLS estimation model does have endogenous problems, and it is necessary to use the IV method to estimate. Table 4 shows the estimated results of IV regression. Models 1 and 2 are one-stage estimation results of MT and ST, and Models 3 and 4 are two-stage estimation results of MT and ST.

Table 4 The estimation result of instrumental variables.

First stage regression			Second stage regression	
	Model 1	Model 2		
	MT	ST	MT	ST
Int_cov	-0.003* (0.002)	-0.004* (0.002)	use_c	2.202* (1.178)
M_c_users	0.220*** (0.029)	0.221*** (0.029)	Sargan Underidentification test	86.94***
Fin_Index	0.005*** (0.001)	0.005*** (0.001)	Weak-instrument Wald F test	30.94***
Control variables	Yes	Yes	Hansen J Overidentification test	28.95***
			R^2	0.146
			Control variables	0.083
			Yes	Yes

*, **, ***Represent significance at the 10%, 5%, and 1% levels, respectively, with *t*-values in parentheses.

**Fig. 2** The distribution of standardized deviation of variables.

From the results of the first stage, the ratio of Internet users in the community and regional inclusive finance significantly improves the individual MT and ST. However, the provincial Internet coverage has a negative effect. In addition, the Hansen *J* statistics are 28.95 and 22.68, respectively, which indicates that the IVs meet the exogenous assumption. The Wald *F* value are 30.94 and 29.76, respectively, $p = 0.000$, indicating that the model does not have a weak IV problem. The Sargan value is 86.94 and 89.36, respectively, $p = 0.000$, indicating that there is no problem with insufficient identification of IVs. From the results in Models 3 and 4, compared with non-Internet users, Internet use significantly enhances the MT ($\beta = 2.202$, $p < 0.1$) and ST ($\beta = 3.166$, $p < 0.05$) of Internet users. Hypothesis 1 is supported.

Second, we test the covariate deviation distribution between the Internet-use group (experimental group) and the non-Internet-use groups (control group). As shown in Fig. 2, the covariate distribution of the experimental and control groups is more extensive before the sample matches. The deviation is greatly reduced between the groups after matching, which meets the propensity score matching balance requirement.

Three methods are selected to ensure the robustness of the PSM estimated effects: 1:1 matching, radius matching, and kernel matching. The estimation results are shown in Table 5. The study finds that the gap in MT between the experimental and control groups is 5.133 before the matching, and the gap in ST is 9.694.

T-test results show that the difference between the two samples is significant at the 1% level. From the matching results, the value gap between the MT and ST of the samples in the experimental and control groups both decreases, and the *t*-test value decreases dramatically. These results support the idea that Internet use can significantly enhance the public's MT and ST. Overall, Hypothesis 1 is supported.

Moderate effect analysis. The empirical analysis proves the positive effects of Internet use on the Chinese public's MT and ST. However, divisions such as the college education division, labor market division, and Hukou division may moderate the association between Internet use and an individual's MT and ST. Therefore, the following two methods are used to examine the moderating effect.

First, we use interaction testing methods, the results of which are shown in Table 6. Models 1–3 are the estimated results of the public's MT; however, education and system interaction variables are not statistically significant. This shows that compared with the non-Internet-use group, Internet users' MT does not change depending on whether they have received a college education or work in the system sectors. Models 4–6 provide solid evidence that the interaction variables have a significant positive effect on individuals' ST at the 1% level. First, Internet users who complete a college education have a higher ST than non-Internet-use

Table 5 The estimation result of propensity score matching.

MT	Method	Treated	Controls	Difference	SE	T-value
Unmatched		54.54	49.41	5.133	0.218	23.51***
Matched	1:1 PSM	54.50	52.33	2.170	0.840	2.58**
	Radius PSM	54.50	51.86	2.638	0.652	4.05***
	Kernel PSM	54.50	51.51	2.991	0.526	5.69***
ST						
Unmatched		36.58	26.89	9.694	0.254	38.23***
Matched	1:1 PSM	36.40	33.55	2.856	0.896	3.19***
	Radius PSM	36.340	33.56	2.849	0.706	4.04***
	Kernel PSM	36.40	32.71	3.691	0.572	6.45***

, *Represent significance at the 5% and 1% levels, respectively, with t-values in parentheses.

Table 6 The estimation result of moderation effect.

Variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	MT	ST	MT	ST	MT	ST	MT	ST	MT	ST	MT	ST
use_d	2.006*** (0.313)		2.140*** (0.310)		2.489*** (0.345)		0.131 (0.334)		0.654* (0.335)		0.548 (0.369)	
edu_dum	3.296*** (0.703)		4.209*** (0.313)		4.311*** (0.315)		5.389*** (0.853)		11.481*** (0.398)		11.139*** (0.399)	
system	0.142 (0.357)		0.326 (0.697)		0.174 (0.357)		-1.987*** (0.430)		-3.723*** (0.763)		-2.206*** (0.431)	
hukou	0.907*** (0.269)		0.893*** (0.269)		1.522*** (0.389)		1.090*** (0.305)		1.038*** (0.306)		-1.355*** (0.422)	
use_d×edu_dum	1.073 (0.724)						7.331*** (0.900)					
use_d×system			-0.269 (0.771)							2.328*** (0.885)		
use_d×hukou					-1.135** (0.464)						4.297*** (0.527)	
Control variables	Yes		Yes		Yes		Yes		Yes		Yes	
N	33,547		33,547		33,547		33,547		33,547		33,547	
R ²	0.047		0.047		0.047		0.131		0.129		0.131	

*, **, ***Represent significance at the 10%, 5%, and 1% levels, respectively, with t-values in parentheses.

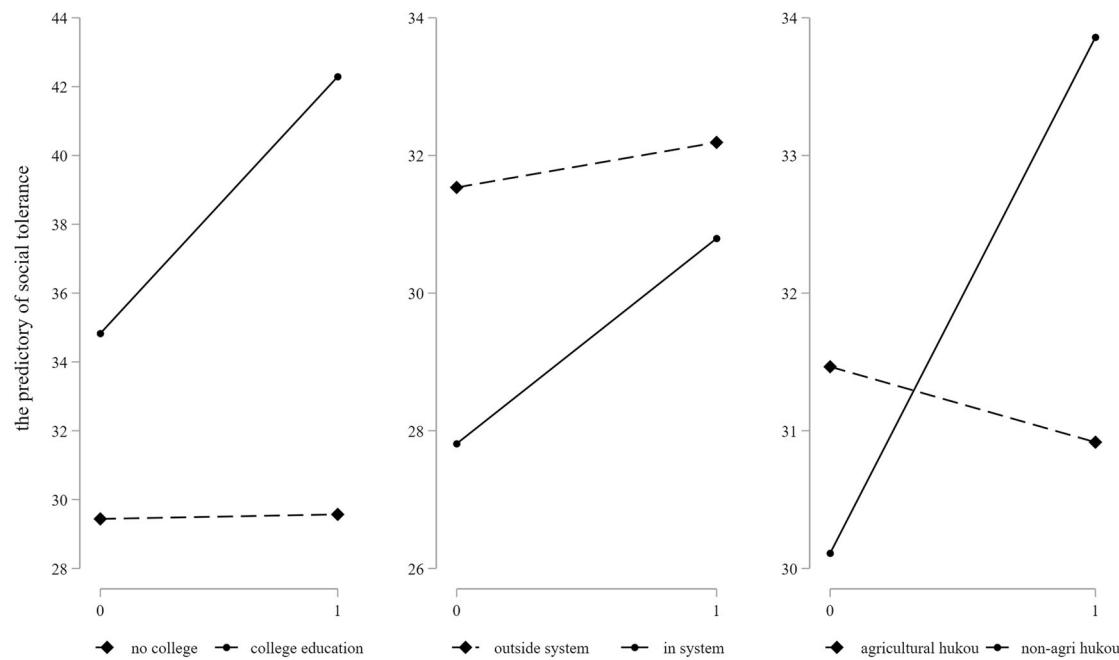
groups who do not complete a college education; second, Internet users who work in system sectors have a higher ST than non-Internet-use groups who do not work in such sectors; third, the urban Internet users' ST is higher than that of rural's non-Internet-use groups. Overall, the division of college education, labor market, and Hukou moderates the relationship between Internet use and individuals' ST, though it does not fully negotiate the link between Internet use and individuals' MT.

Second, based on the interaction effect regression results, this study uses margin plots to confirm the moderating effect. As shown in Fig. 3, without using the Internet, the ST of persons who complete a college education is higher than that of individuals who have no bachelor's degrees; conversely, with the use of the Internet, the ST value gap between the two groups increases. This trend shows that a college education division strengthens the impact of Internet use on individuals' ST. In addition, from the division of the labor market, in the absence of Internet use, the ST of individuals employed outside the system sectors is significantly higher than that of individuals working in the system. However, in the case of Internet use, the ST value gap between them narrowed considerably, which indicates its use provides an information channel for the person working in the system to understand the development of social pluralism and enhance their tolerance. Hence, we stress that the division of the labor market plays a moderating role in the link between Internet use and public ST. Finally, under the condition of non-Internet use, the ST of urban Hukou groups is significantly lower than that of the rural Hukou populations. With Internet use, the ST of agricultural Hukou populations increases significantly, however, the ST of non-agricultural hukou decreases.

Mediating effect analysis. The information transmitted by the Internet is highly mixed, which contains a lot of information

about inequality, thus strengthening the individual perception of inequality, and once exposed to information about social exclusion or social discrimination events, it ultimately affects tolerance. This paper chooses the opportunity and outcome fairness. The analysis is divided into three stages: the first step is regressing the different types of tolerance to Internet use; the second step is regressing two fairness on Internet use. If the coefficient is statistically significant, it shows that fairness will be affected by Internet use. The third step is regressing the tolerance to Internet use and two fairness. Last, compare the coefficient of the Internet use variable obtained in the third step with that in the first step. If the coefficient is not significant or the value decreases, it can be proved that the mediating effect of fairness is established. If the coefficient becomes larger, it indicates that the suppressing effect is supported.

Table 7 reports the results of the mechanical test. From Models 2 and 3, it can be seen that Internet use will significantly reduce the public's sense of opportunity and outcome fairness. Meanwhile, in Models 4 and 5, which include both independent variables and mediating variables, the OpF and the OcF variables are significantly positive, indicating that the higher the public's sense of fairness, the stronger the MT and ST. More importantly, compared with Model 1, the coefficients of Internet use variables are significantly larger in Models 4 and 6, and both are significant at the 1% level. According to the criteria for mediating effects, it can be preliminarily determined that the Internet enhances the public's sense of MT and ST by reducing the public's sense of fairness. In other words, opportunity and outcome fairness are important mechanisms for Internet use to enhance individuals' different tolerance. Overall, the mediating effect is not supported, and the opportunities and outcome fairness play a suppressing effect between Internet use and individuals' tolerance.



Data Sources: the Chinese Social Survey (2015-2021)

Fig. 3 The moderate effect plot of market transformation division.

Table 7 The result of mediating effect.

Moral tolerance Variables	Model 1 MT	Model 2 OpF	Model 3 OcF	Model 4 MT	Model 5 MT
use_c	0.403*** (0.054)	-0.021*** (0.002)	-0.032*** (0.003)	0.448*** (0.055)	0.461*** (0.055)
OpF				1.577*** (0.140)	
OcF					1.386*** (0.125)
Social tolerance Variables	ST	OpF	OcF	ST	ST
use_c	0.145** (0.061)	-0.021*** (0.002)	-0.032*** (0.003)	0.145** (0.062)	0.177*** (0.062)
OpF				0.849*** (0.158)	
OcF					1.312*** (0.141)
N	33,547	32,399	32,868	32,399	32,868
Control variables	Yes	Yes	Yes	Yes	Yes

, *Represent significance at the 5% and 1% levels, respectively, with t-values in parentheses.

Discussion

Based on data from the Chinese Social Survey performed from 2015 to 2021, this study divides public tolerance into two dimensions, namely social tolerance and moral tolerance, and explores the influence of Internet use on different types of tolerance. Consistent with the previous literature (e.g. Zhang et al., 2020; Liu et al., 2020), this study proposes that Internet use has a positive influence on the rise of the Chinese public's MT such as homo-sexuality tolerance. Zhang et al. (2020) and Liu et al. (2020) point out that Internet use has a significant positive impact on Chinese people's homosexuality tolerance and sexually permissive attitudes by analyzing the Chinese General Social Survey data before 2015, respectively. Even though ST grows in 2015–2021, it is still lower than MT in the same year. This finding differs from that of Lu and Yu (2020), who find that the ST in India, America, and other countries is significantly higher than MT. This study suggests that differentiation is due to the measurement indicators of the two articles. In Lu and Yu's research, ST includes an individual's tolerance for different races, migrants, and people with different religious beliefs or language uses, while MT

includes the public's tolerance for AIDS groups, LGBTQ+ groups, and premarital cohabitants. Social and moral tolerance are dummy variables. In this paper, ST is the tolerant attitude toward different religious beliefs, people begging for food/money, and people who are released from prison, while MT is the kind attitude toward premarital cohabitants and LGBTQ+ groups. Finally, in this study, social and moral tolerance are continuous variables.

Findings on the influence of Internet use on tolerance are also inconsistent. Previous studies (Hadler, 2012; Henshaw, 2014; Lu and Yu, 2020) based on World Values Survey data have found that the impact is negative; however, this study analyzes the data from China and concludes that the effect is positive. We believe that the reason for this is the context development of the Internet between countries. China's reform and opening up led to tremendous advances in Internet technology. This paper holds that the rapid penetration of telecommunication infrastructure and devices changes the pattern of social relations in China. More importantly, with the increasing Internet penetration rate, public access to the Internet is becoming more convenient, fast, and low-

cost. Using the Internet is no longer limited to developed regions, families from the political or economic elites, and high cultural capital groups. The increase in Internet penetration rate dramatically narrows the class gap and cultural level gap between different social groups in terms of information access and information sharing. In other words, the rapid popularization of the Internet in China enhances the public's attitudes toward life, thus enhancing their tolerance for different groups and diverse social behaviors.

In recent years, different countries and regions have advocated the concept of high-quality development. However, high-quality development not only refers to high-quality development at the material level, but it also includes economic and social systems, ecosystems, and other fields. Theoretically, a positive social attitude is a critical aspect of high-quality development. Low tolerance values symbolize low-quality development, which may threaten social security and social development; therefore, how to use the Internet to promote high-quality economic and social development is an important program for governments to develop.

This study further finds that the impact of Internet use on the Chinese public's ST is moderated by the division features brought by market transformation, although this effect does not exist in the path of Internet use affecting the public's MT. First, from the perspective of the college education division, unequal access to college education is a systemic structural reason that needs to be considered. From 1950 to 2020, education expansion provided educational opportunities for different social classes; however, the growth of education has not reduced educational inequalities at all stages of schooling (Wu, 2017). Accompanied by the popularization of compulsory schooling, unequal educational opportunities are primarily reflected in college education opportunities (Wu, 2019). This paper finds that before and after Internet use, the public's ST gap between those who have not received a college education and those who have received it widens. This means that the growth of human capital caused by college education increases the gap in ST.

Second, regarding the labor market division, the ST of those working in the system sector dramatically increases due to Internet use, and the ST gap with the person working outside the system is narrowed. In the context of China, jobs in the system sectors play a protective role, that is, they can provide a stable source for workers to accumulate human capital, social capital, and economic capital and prevent unemployment or income reduction risk. Indeed, an individual's social welfare levels can vary greatly depending on whether they work within the system. Specifically, people who work outside the system are engaged primarily in self-pay social insurance, while those who work in the system are those whose social insurance is paid by the government. By providing diversified information, the Internet platform reduces the information gap created by the labor market division and increases opportunities for different labor groups to understand each other's life experiences, thus enhancing their ST.

Finally, from the perspective of the urban-rural Hukou division, compared with rural Hukou residents, urban Hukou residents' social tolerance increases greatly after Internet use, thus forming a "high-urban-low-rural" ST pattern. The main reason for this is the difference between urban and rural societies, that is, Chinese cities are stranger societies, and rural areas are acquaintance societies. By contrast, the cost of information communication in a stranger society is relatively higher than that in an acquaintance society. Therefore, urban residents' ST for people who beg for food/money, criminals, and other groups is lower. The second reason is the difference in resource aggregation. In the process of China's market-oriented reform and development, urban areas have gathered a variety of development

resources so that urban Hukou residents use the Internet at a lower cost and have faster access to information. Therefore, the impact of Internet use on ST is substantial.

Conclusions

This study uses Chinese Social Survey data to examine the impact of Internet use on individuals' moral and social tolerance as well as its moderating effect. The research finds that (1) overall, the social tolerance of the Chinese increased from 2015 to 2021, but the MT shows a trend of first decreasing and then increasing, and the MT is always higher than ST in each survey; (2) Internet use has a significant positive effect on individuals' MT and ST, and the positive impact is still valid after dealing with endogenous problems by using the instrumental variables method and propensity score matching method; (3) three divisions caused by market transformation moderate the link between Internet use and individuals' ST. Specifically, Internet use reduces the impact of labor market division on individuals' ST, particularly by increasing the ST of employment groups within the system sectors. Fortunately, Internet use widens the ST gap between residents with different educational levels and between urban and rural Hukou residents. However, these moderate effects do not fully affect the relationship between Internet use and a person's MT; (4) the mediating effect is not supported, and the opportunities and outcome fairness play a suppressing effect between Internet use and individuals' tolerance.

Data availability

The authors confirm that the data supporting the findings of this study are available within the supplementary materials.

Received: 8 September 2022; Accepted: 19 May 2023;

Published online: 30 May 2023

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Acknowledgements

This work is funded by the National Social Science Foundation of China (grant#: 20CWX011), the National Natural Science Foundation of China (grant#:72104028), the Guanghua Talent Project, and the Fundamental Research Funds for the Central Universities of Southwestern University of Finance and Economics (grant#: JBK2304140), and the Beijing Institute of Technology Research Fund Program for Young Scholars.

Author contributions

Conceptualization: YZ and XC; Methodology: YZ and ZS; Data curation: YZ; Writing the original draft: YZ and XC; Formal analysis: YZ, XC, and ZS; Reviewing and editing: YZ, XC, and ZS; Resource and supervision, ZS.

Competing interests

The authors declare no competing interests.

Ethical approval

This study does not contain any studies with human participants by any authors. Ethics approval was not required for this study.

Informed consent

This study does not contain any studies with human participants by any authors. Ethics approval was not required for this study.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-023-01781-0>.

Correspondence and requests for materials should be addressed to Xueli Chen.

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