Received 30 June 2016
Revised 15 September 2016
27 September 2016
Accepted 7 October 2016

How the new media impacts rural development in China: an empirical study

Dong Zhou
Department of Cultural Industry and Management, Shanghai Jiao Tong University, Shanghai, China, and
Benqian Li
School of Media and Design, Shanghai Jiao Tong University, Shanghai, China

Abstract

Purpose – The purpose of this paper is to study a new pathway out of poverty for rural areas through cultivating non-farm employment: the new media utilization.
Design/methodology/approach – The authors utilize two waves of nationwide micro survey data in China, China General Social Survey 2005 and 2013, to investigate the impacts of new media coverage on non-farm employment and earnings in rural China with the ordered probit model and instrument variables.
Findings – The authors find that promotion of new media coverage can significantly enhance rural non-farm employment in China by 10-20 percent and ultimately increase earnings for rural residents. The findings provide new evidence for the new media as a potential newly emerging pathway out of poverty for rural areas. The conclusions are robust regarding a variety of controls and model specifications, evaluations with alternative measures, examinations within different subsamples, and estimations with constructed pseudo panels.
Social implications – Encouragement of new media coverage in rural China not only can improve the rural non-farm employment and living standards but also can contribute toward narrowing the differences between urban and rural areas, thereby balancing regional development.
Originality/value – It contributes to the existing literature through primarily empirically investigating the economic functions of new media in rural China.

Keywords Ordered probit model, IVs, New media coverage, Non-farm employment, Frequency of internet utilization

Paper type Research paper

1. Introduction

The existing literature has continually advocated that the new media has been actively playing an important role in economic development. Litan and Rivlin (2001) stated that the new media is bound to significantly and positively influence the total factor productivity based on the American industries data. With respect to information communication, its high efficiency and low cost have contributed to making markets more transparent and more effective. A wide coverage of internet not only can greatly reduce transaction costs but can also dramatically improve management efficiency in all the industries. From the Chinese provincial panel data, it is found that increased regional internet coverage has generated a positive impact on local economic growth (Li and Jing, 2013; Xie and Gao, 2015). For individual development, Hindman (2000) found that disparities of socio-economic performances between metropolitan and non-metropolitan residents in the USA are more associated with internet utilization rather than heterogeneous regional economic characteristics. Furuholt and Kristiansen (2007) further empirically showed that the disparity of internet coverage has gradually enlarged gaps in economic performances between rural and urban residents in Tanzania (e.g. innovations, human capital

The authors are grateful to Data and Research Center of Renmin University Bejing for sharing their data and their research is sponsored by Shanghai Pujiang Program (16PJC060) and Shanghai Jiao Tong University Cross-Disciplines Research Fund (12JCY06). All mistakes are of the authors' own.

China Agricultural Economic Review
Vol. 9 No. 2, 2017
pp. 238-254

1756-137X
DOI 10.1108/CAER-06-2016-0091

accumulation, and income). These literature studies all support that unbalanced internet coverage can aggravate regional disparity. Therefore, promotion of rural network facilities construction and generalization of internet coverage are important for improving regional welfare and balancing regional development.

Meanwhile, it is widely recognized that there are obvious internet coverage disparities between rural and urban areas. For example, in the scenario of China, the rural network coverage rate is 27.5 percent in 2014 while the coverage rate is higher than 60 percent in the urban areas. Moreover, rural farmers barely adopt network for production in China, compared with agricultural institutions or developed countries (Zhao *et al.*, 2006). Considering the possibility that the increasing rural-urban income gap is partly attributable to the existing spatial disparity in internet coverage and the existing rural labor surplus (Cai and Wang, 2007; Li *et al.*, 2011), it is important to understand the impacts of internet utilization on rural labor market in China. At the same time, rural non-farm income is commonly accepted as a critical pathway out of poverty for rural residents (Adams, 2002; Berdegue *et al.*, 2001; Haggblade *et al.*, 2010; Lanjouw and Lanjouw, 2001). Consequently, examining how the network coverage affects rural non-farm employment as well as rural earnings undoubtedly is very informative for policy implication.

The existing empirical literature on rural economy focuses on different determinants as well as government's roles in promoting rural development, such as human capital buildup (Luan *et al.*, 2015), elimination of the institutional constraints (Li *et al.*, 2011), fosterage of rural enterprises, and preferential tax policies (Janvry and Sadoulet, 2000; Reardon and Berdegué, 2001; Christiaensen *et al.*, 2013). However, the studies scarcely probe into the effects on rural employment and earnings from the respect of new network technology utilization. This article contributes to the literature on rural economy and investigates relationship between the new approach, internet accessing, and increases in non-farm employment and earnings using Chinese national micro data sets. In addition, a newly emerged branch of literature in new media economics has started to emphasize the importance of new media in "the new rural construction" through effective information dissemination after 2003 in China. However, empirical studies to quantify the effects are still numbered. Hence, we also contribute to this branch of literature in the way of empirically measuring the effects of new media utilization on rural development.

We find that the average marginal effects of internet utilization on improving non-farm employment are around 10-20 percent with the China General Social Survey (CGSS) 2005 and 2013, with the use of ordered probit models as well as using instrument variables. The conclusions are robust to a variety of controls regarding family background and individual characteristics, as well as alternative measures for outcome and independent variables, examinations within different subsamples, and estimations with constructed pseudo panels. This paper is organized as follows: Section 1 is the introduction; Section 2 presents the theoretical framework and describes the rural-urban disparity in China; Section 3 proposes the empirical models and describes the data; Section 4 presents the empirical results, and also robustness checks are provided; and Section 5 offers concluding remarks.

2. Theoretical framework and background

2.1 Rural development and new media

Two stylized facts are widely documented in the literature on rural China (Cai and Wang, 2007; Li *et al.*, 2011): rural labor surplus and rural-urban income gap. The urban-rural income disparity continues to expand and keeps ranking at the top of the world (Cai and Wang, 2007). During the urbanization process, more and more rural residents move to urban areas for non-agricultural opportunities, but household registration system, hukou, keeps constraining labor mobility. There are still over 0.67 billion residents living in rural China in 2014. Considering the large population size, welfare of rural residents is an indispensable and

critical component for the long-term development of China (Le *et al.*, 2010). Most of the existing literature focuses on studying institutional reforms to encourage labor mobility but ignores inner creation of rural economic vitality. Since the capacity of cities to accommodate rural-urban migrants is limited by the current circumstances, reforms within rural areas to diverse rural employment and to enhance rural economic vitality turn to be the key determinants to better livings in rural areas.

Typically, rural earnings involve two sources: farming and non-farm earnings. Theoretically, employment decision depends on human capital factors and family background. Human capital factors, for example, education attainment and health condition, are the most influential determinants. The higher the education level, the more probably one selects non-farm jobs as well as has a higher income (Shen and Zhou, 2004). Family-related factors are also important, for example, the impacts of parents through intergenerational transmission mechanism. If one's parents have non-farm employment experience, he or she is more likely to choose non-farm employment. Family size also can affect individual's labor market decision, in particular for females. Regional macro-characteristics are also important while individuals are making employment decisions: business cycle, development of rural enterprises, and changes in regional policies. Undoubtedly, government's supports for rural enterprises and infrastructure investment will contribute to regional employment. The aforementioned traditional determinants are largely explored in the existing literature; however, the role of new media is still in its infancy.

Positive influences of the new media on promoting rural development can be summarized as follows. First, it can effectively spread agricultural information, including knowledge on agricultural production, rural education in scientific farming and technology, agricultural market updating, and the like. Compared with other traditional methodologies, the new media has its unique superiority in effective information dissemination: unprecedentedly rich information, fast speed of dissemination beyond imagination, and infinitesimal cost (Cai Rang Zhuo Ma, 2010; Chen and Chen, 2006; Deng, 2011; Feng, 2007). Second, propagation of non-agricultural productions and updating of market information through new media can generate effects on non-agricultural employment. The new media can accelerate knowledge communications and lower cost of knowledge generalization in the rural setting. For example, educational programs and career training programs can be directly provided through the new media, which further contributes to non-farm employment and enhanced productivity.

Third, the link between agricultural and non-agricultural departments can be effectively strengthened by the internet technology, and ultimately, transition from agricultural production to non-agricultural economy can be accelerated. The traditional channel of employment information, social network, will gradually be replaced by the new media. Internet utilization can directly enhance rural communication with the outside. Combined with individual subjective initiatives and consciousness, this connection might change traditional thinking of farmers. When the rural residents start to get in touch with effective information and knowledge through the new media, rich information will shape their thinking and learning, update their knowledge, and modernize their values. Chen (2009) also states that the network transmission combined with the subjective initiative of farmers will improve the rural living standards in China. Gao (2013a, b) theoretically and empirically evaluates how new media consumption modernizes value of farmers with the data obtained from the Henan province. The changes in consciousness gradually lead to breaking the conservative thinking and traditional production mode. We illustrate the above mechanism with the following framework. In all, as stated by Zhang and Fang (2002), the new media is an important driving force for the construction of new rural areas.

2.2 Chinese network development

Since China Education and Research Network connected with American NCFnet in 1994, China officially has started the era of new media. In 2009, the World Media Summit was

held and 3G licenses were officially released in China. In 2013, 4G licenses are formally released. Digitalization and the popularity of mobile internet have become significant characteristics in Chinese society and play an important role in economic development (Yue, 2014). We can access to internet not only through traditional ways, for example, broadband connection and dial-up based connection, but also through television, mobile phones, portable devices, tablet PCs, and computers. Currently, China's new media coverage is mainly concentrated in urban areas, while the rural residents are still constrained by economic and geographical environments. As shown in Figure 1, the rural internet users grow slowly, while the national level dramatically increases. Obviously, there is an increasing spatial disparity of the internet coverage between urban and rural areas in China based on the statistics from China Internet Network Development Status Reports.

From 2003 to 2015, the number of internet users[1] in China had a logarithmic growth, especially a sharp jump after 2008. At the end of 2003, total internet users of the nation were around 68 million, with a coverage rate of 8.5 percent. The total increased to nearly 650 million people, and the coverage rate accounted for 47.9 percent in 2014. Most of them have access to internet through mobile phones (around 557 million). Average education attainment of the internet users is senior secondary schooling. The range of ages for the most frequent users is 20-39 years, accounting for 55.3 percent of the total population. Gender ratio of internet users has been maintained at 6:4 for the past ten years. Time of surfing changed from 15.9 hours per week in 2005 to 26.1 hours per week in 2014. Compared with the large rural population, there are only 0.18 billion internet users in the rural areas in 2014. Reasons for never using internet in surveys are lacking of skills and knowledge as well as equipment to access.

In rural areas, there were 19.31 million network users, simply accounting for 2.6 percent of the rural population in 2005, while there were around 91.7 million urban network users, accounting for 16.9 percent of the urban population. The number of rural users was only one-fifth of the number of urban users in 2005. Rural coverage rate was only 1/6 of the coverage rate in the urban setting. After 2007, the number of rural internet users began to steadily grow, and after 2010, the rural internet coverage rate remained at 27-28 percent. At the end of 2014, the rural network users reached 178 million, but its coverage rate stills stayed around 28 percent for a total resident rural population of 670 million. The rural network coverage rate is still far below the urban network coverage rate, and this gap is widening.

Overall, there are three observed stylized facts in rural China: rural labor surplus, rural-urban income gap and rural-urban internet coverage disparity. It is likely that the internet coverage disparity may contribute to the rural-urban income gap. Taking the positive role of new media, generalizing rural internet coverage can benefit rural

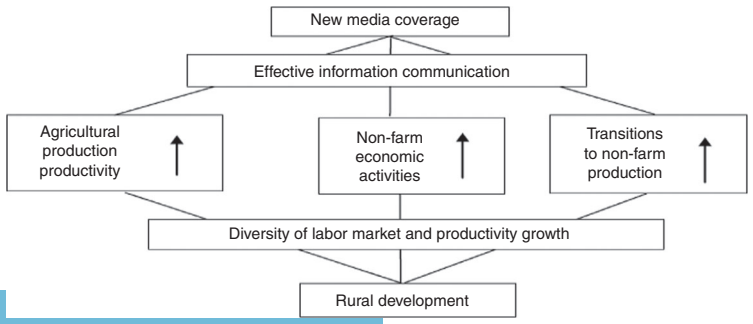


Figure 1.
The theoretical framework

employment and economic development. In this paper, we will utilize national micro-level data to measure rural internet utilization and evaluate its impacts on rural non-agricultural employment.

3. Data and empirical models

3.1 Data and statistics summary

The data sets we mainly draw are the 2005 and 2013 waves of CGSS, which are repeated cross-sectional data sets. This survey provides us with nationwide rural samples from 20801 districts (counties) among 26 provincial-level regions as well as four municipalities and further shares rich information on individual socio-economic performances. Reasons for selecting these waves are that rural internet coverage started to develop in 2005, and with the 4G licenses issued in 2013, mobile internet utilization became popular. The combination of these two waves can present us with changes over time. We can classify the rural population into two types: residents living in rural areas and urban areas separately with respect to current residence address and urban and rural hukou owners with respect to their hukou status. In the wave of 2005, the total number of rural residents was 4,270 of the total 10,343 individuals while the number of rural hukou owners is 4,560. In the wave of 2013, the total sample size is 11,354, and there are 4,651 rural residents and 6311 rural hukou owners. The difference between the number of rural residents and rural hukou owners implies the increased rural-urban migrants. Overall, from 2005 to 2013, rural population has increasingly moved to cities for non-farm jobs. Our main empirical sample for analysis is observations in labor market: rural residents from the age of 16 to 60 years. Overall, 3,287 observations were left out for the 2005 wave and 3,686 for the 2013 wave. By contrast, there are 3961 individuals with rural hukou in 2005 and 4,746 in 2013. We focus on the rural residents who are currently living in rural areas, while the sample with rural hukou is tested for robustness checks.

Most importantly, we have information on the internet utilization frequency individually and heterogeneous characteristics at levels of society, community, family, and individual. As shown in Table I, there is a significant rise in internet (including mobile internet) usage among the rural residents from 2005 to 2013. It increases from 3.17 to 30.5 percent, which is similar to that reported by the CNNIC but slightly higher: the national rural network coverage rate is 2.6 percent in 2005 which is 28.6 percent in 2013. Aside from the internet utilization frequency, we also use a dummy, internet access, indicating whether one has access to internet or not, as the key interested independent variable. Second, recent working experience is used as the main dependent variable. It includes three categories for recent working experience regardless of the current employment status: never work (0); pure agricultural employment (1), including individuals currently doing agricultural jobs and currently are unemployed but only have agricultural experience before; and non-agricultural employment (2) which refers to population with non-farm experience. It is considered that the dependent variable is an ordered variable. The second method to measure our interested dependent variable is a dummy variable representing whether one currently has a non-farm job or not. As is shown in Table I, non-farm employment has been significantly improved while there is a dramatic decline in farming population from 2005 to 2013. Considering the current employment status at the surveyed time, we observe a pretty high unemployed rate in 2013, which is consistent with an increasing rural labor surplus. The surplus was estimated at 25 percent in 2008 and numbered 468 million out of total 700 million in 2010 according to the paper of Li *et al.* (2011).

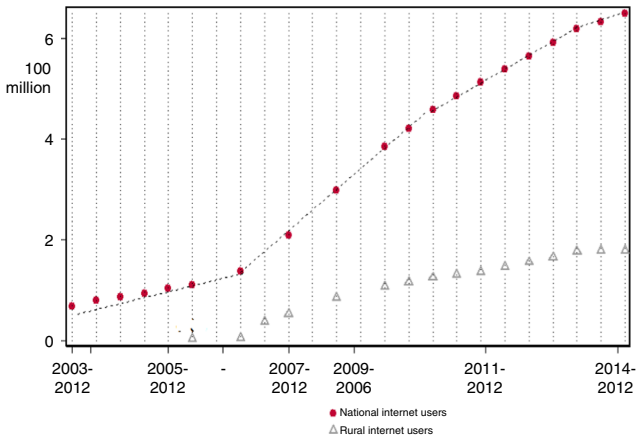
We are interested in the relation between internet utilization and non-farm employment. To visually illustrate the relation, we first graph the non-farm employment rates against different frequency of internet utilization over time in Figure 2. In all, from 2005 to 2013, the proportion of non-farm employment is positively correlated with the frequency of network usage.

Data sets	2013 CGSS			2005 CGSS		
Variables	Obs.	Mean	SD	Obs.	Mean	SD
Work experience	3,286	1.46	0.59	3,686	1.14	0.44
= 0 never work	172	5.23		138	3.74	
= 1 only with agricultural experience	1,429	43.49		2,886	78.30	
= 2 non-farm experience	1,685	51.28		662	17.96	
Internet access (yes = 1; never use = 0)	3,287	0.307	0.461	3,686	0.032	0.175
Frequency of internet utilization	3,279	1.75	1.29	3,686	1.08	0.50
= 0 never use (%)	2,279	69.50		3,569	96.83	
= 1 barely use	253	7.72		40	1.09	
= 2 sometimes use	236	7.20		18	0.49	
= 3 often use	300	9.15		18	0.49	
= 4 frequently use	211	6.43		41	1.11	
Education attainment = 0 illiterate (%)	427	12.99		535	14.51	
= 1 primary	1,048	31.88		1,437	38.99	
= 2 junior	1,272	38.7		1,302	35.32	
= 3 senior	412	12.53		376	10.20	
= 4 college and above	128	3.89		36	0.98	
Health condition (%)	3,286	3.78	1.10	2,903	3.65	1.18
= 1 very unhealthy	91	2.77		55	1.89	
= 2 relatively unhealthy	457	13.91		551	18.98	
= 3 so so	527	16.04		707	24.35	
= 4 relatively healthy	1,223	37.22		629	21.67	
= 5 very healthy	988	30.07		961	33.10	
Age	3,287	43.02	11.50	3,686	41.01	10.73
Female	3,287	0.51	0.50	3,686	0.53	0.50
Minority	3,287	0.13	0.34	3,686	0.08	0.27
Being single	3,287	0.13	0.34	3,686	0.08	0.27
Lnincome	3,018	8.05	3.22	3,490	7.78	1.46
Family size	3,286	3.50	1.47	3,686	4.42	1.69
Father with no-farm experience	3,287	0.16	0.36	3,686	0.10	0.30
Employment status						
Currently being employed	3,286	0.79	0.41	3,686	0.96	0.19
Currently with non-Farm jobs	3,286	0.28	0.45	3,686	0.18	0.38

Notes: Sample includes rural residents at ages of 16-60 in rural labor market and living in rural areas. If the interest variable, "work experience", equals to 0, it means the individual never work; if it equals to 1, it means the individual only has agricultural work experience including currently doing agricultural work as well as currently is unemployed and only has agricultural work experience; if it equals to 2, it means the individual has non-farm working experience, including currently doing non-farm job, currently doing agricultural job but having non-farm experience as well as currently being unemployed but only having non-farm work experience

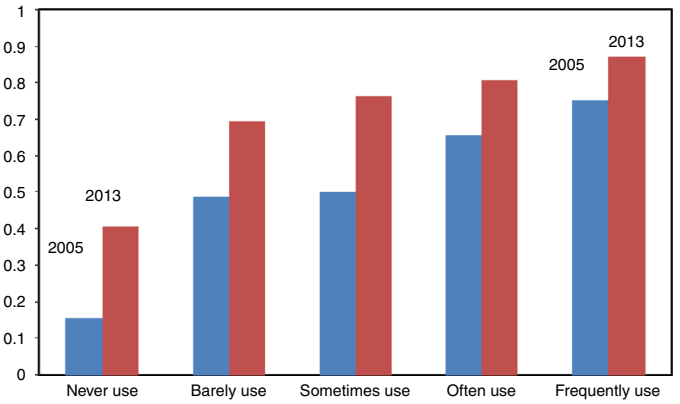
Table I.
Statistics summary

The more frequent they access the internet, the higher probability they join non-farm employment. Table I also presents statistics of individual characteristics and related family information. The variable marriage status shows that single individuals account for 13 percent in 2013, which is higher than the 2005 wave, 8 percent. The ratio of female to male is close to 1:1. The average age of the individuals is 43 years old in 2013, and the average age was 41 years old in 2005. Average education attainment has increased, as more rural residents have accomplished senior high schooling and above in 2013. However, still the proportion of farmers who only possess junior high school and primary degree attainments is large. Another important indicator for human capital, health, is also included. According to their self-evaluation, most of the residents are optimistic about their health status. The average family size has declined from 4.4 in 2005 to 3.5 in 2013. The individuals with fathers having experience of non-farm employment are more in 2013 than 2005 (Figure 3).



Note: The red dot represents the total number of users; the grey triangle represents the total number of rural users; and the vertical space reveals information on the total number of urban users
Source: Statistical Reports on Development of China Internet Network (2003-2015) from the Internet Network Information Center China (CNNIC)

Figure 2.
Growth of internet users in China



Source: Empirical sample of 2005 and 2013 CGSS

Figure 3.
Frequency of internet utilization and non-farm employment

3.2 Empirical models

To answer our research question, how the new media influences rural employment, in particular for non-farm employment, the first measure is a discrete variable: the dependent variable *y*. It includes three categories for recent working experience regardless of the current employment status: never work (0); pure agricultural employment (1) including individuals currently doing agricultural jobs and currently are unemployed but only have agricultural experience before; and non-agricultural employment (2) which refers to population with non-farm experience. Considering that the dependent variable is an ordered variable (working experience) and the interested explanatory variables (frequency of internet utilization) are dummy variables, we adopt ordered probit model.

The problem is that the parameters estimated by the ordered probit model lack direct economic implication. They can only tell us the significant degree of the explanatory variables and help to determine the explanatory direction of the given independent variable X. Therefore, it is important to compute the average marginal effect of X on the probability of choosing non-farm employment for rural residents.

As stated above, our interested explanatory variable is rural internet utilization which is a category variable indicating individual's utilization frequency: never use, barely use, sometimes use, often use, and frequently use. Dummies are introduced to represent corresponding category with the base group: never use. Another two alternatives are explored too: first, a continuous variable that is the z-score of frequency, which is computed in the way of taking individual percentage deviations from the regional mean of internet frequency for each waves. Advantages of the z-score index include alleviating measure error in self-reported frequency and making the results comparable. Second, we use the dummy indicating whether one has access to internet or not, which is the most intuitive and straightforward.

One concern is the potential bidirectional correlation between non-farm employment and internet utilization. Our strategy is to estimate the probability of internet access with instrument variables and then control the predicted degree into the second-stage estimation for evaluating a causal effect of the new media utilization on rural employment. Several plausible variations, which are not related with the employment status but are to some extent correlated with the network usage, are utilized. Specifically, we instrument the internet access in 2013 with provincial average mobile phone coverage rate in 2005, whether the individual prefers spending time on friends' meeting on weekend or not, and one's frequency of visiting neighbor. respectively. First, access to internet through mobiles became very popular in 2013, and 86 percent of the internet users have surfed through their mobile devices which could not be anticipated in 2005. Provincial mobile coverage rates in 2005 to some extent capture regional endowments of mobile internet access. Second, when one frequently visits his or her neighbors, his or her time allocation onto internet surfing to some extent can be affected. Visiting decision can reflect one's personality and preferred communication style, but not directly explain their employment decision or other macro-circumstances. Significantly positive estimators at the second stage can provide convincing evidence for real effects from internet coverage onto non-farm employment:

$$\Pr(\text{Internet access}_i) = \alpha + \beta \text{ instrument variable}_i + \gamma X + \varepsilon_i \quad (1)$$

$$\Pr(\text{Working experience}_i) = a + b \text{ predicted probability of internet access}_i + cX + e_i \quad (2)$$

Furthermore, we collapsed the data to age cohort level, constructed a pseudo panel which alleviate the endogenous concerns at individual level, and evaluated the impacts at the cohort "average" person. Similarly, we also collapsed the data to provincial level and constructed a pseudo panel based on provincial "average" representatives. These two alternatives, to some extent, alleviate measurement error and selection problem at the individual level and provide us with evidence to support the existence of real effects of internet access on non-farm employment. Additionally, aside from the nonlinear probability models, we also implement linear probability model and binary probit model for robustness checks. Also, we adopt other measurement for dependent variables: a dummy variable that only consider whether the individuals are currently working in non-farm positions or not (1 = yes; 0 = the others). We not only estimate the main empirical sample but also the subsample currently being employed. Consistent findings are found, and more results are available if required.

The second question is whether there exist impacts of new media on rural earnings directly and through the channel of employment. To answer it, extended Mincer models are implemented. In the estimations, dependent variable is the natural log of total annual income at individual level, while age and age square are controlled for life-cycle earning hypothesis. We control for the predicted degree of non-farm employment with internet utilization as well as the internet access to estimate the effects of the internet access directly on earnings and through employment on earnings. In all the regression models, education attainment is measured by dummies representing different level: illiterate, primary, junior secondary, senior secondary, and college and above. Similarly, health condition, as an important factor of human capital, is recorded in terms of five statuses: very unhealthy, unhealthy, so-so, relatively healthy, and very healthy. Other explanatory variables include constant, gender, ethnicity (whether is minority or not), marital status (whether is single or not), family size, and father's non-farm experience. The time effect, a survey year dummy, is controlled for. We also control for provincial fixed effects, and age cohorts fixed effect. Regional specifics and secular specifics, for example, local macro-development and time trend, are controlling for in this way.

4. Estimation results and robustness

4.1 Impacts on rural employment

We first adopt the ordered probit model and use the sample of rural residents from the repeated cross-sectional data sets: CGSS 2013 and 2005. Results are presented in Table II. Results of rural hukou owners are also provided for robustness checks (see sample 2). Two measures of internet coverage are used: in the left panel, we use dummies of utilization frequency, and in the right panel, we compute the *z*-score of frequency, which is measured by the percentage deviation of one's frequency from the mean of each region the individual lives in for each survey year. The *z*-score is a continuous distribution of internet utilization. Since there are difficulties in interpretation of the coefficients directly, we further calculate the average marginal effects of the internet utilization on non-farm employment based on our main results with sample 1. Important estimators with their robustness standard error are reported in the Table III.

Consistent with most of the existing literature, different family background, different ethnic groups, and different marital status can affect the rural individual's employment. Also probability of non-farm employment varies over regions and cohorts. For example, we find that a man, who is Han, and currently married is more likely to engage in non-agricultural employment. The coefficient of survey year dummy of 2013 is significantly positive. It captures the time effect and implies that people with the same socio-economic characteristics (for example, at the same age and with same family characteristics) have higher probabilities to take non-farm jobs in 2013 as the macro-economy develops. The major results and implications are interpreted as follows.

First of all, as the most important innovation of this paper, we study rural non-farm employment with respect to new media coverage: the coverage of internet as well as mobile internet. Compared with the group of never users, the other groups of network users have greater probabilities to change from unemployment to non-farm employment. All the coefficients are positive and significant, which advocate the positive effect of internet utilization in rural labor market, especially in improving non-farm employment. On the whole, the more frequently one utilizes internet, the more possible he has non-farm working experience. Given two rural individuals share the same socioeconomic performances and similar family characteristics (e.g. same gender, same age, same education level and same health status, with similar situations of family background), if one can regularly access internet and the other cannot, the former is more likely to have non-farm experience by around 10-20 percent on average. The marginal effect is slightly larger in 2013 (see Table III). *Z*-score estimates also provide consistent conclusions. One might concern subjective

Dependent variables	Work experience			
Samples	Sample 1	Sample 2	Sample 1	Sample 2
Internet utilization measure	*Frequency*		*Z-score measure of frequency*[a]	
Frequency of internet utilization	Base: never use			
Barely use	0.296*** (0.103)	0.328*** (0.082)		
Sometimes use	0.366*** (0.109)	0.498*** (0.088)		
Often use	0.369*** (0.114)	0.603*** (0.092)	0.270***	0.389***
Frequently use	0.644*** (0.137)	0.743*** (0.103)	(0.044)	(0.041)
Education attainment	Base: illiterate			
Primary	0.132*** (0.044)	0.145*** (0.040)	0.133*** (0.040)	0.146*** (0.040)
Junior	0.385*** (0.051)	0.426*** (0.046)	0.390*** (0.046)	0.433*** (0.046)
Senior	0.413*** (0.071)	0.400*** (0.064)	0.412*** (0.063)	0.403*** (0.064)
College and above	−0.249 (0.180)	−0.215 (0.134)	0.056 (0.126)	−0.203 (0.131)
Health Status	Base: very unhealthy			
Relatively unhealthy	0.336*** (0.111)	0.224** (0.096)	0.242** (0.098)	0.224** (0.096)
So-so	0.370*** (0.110)	0.240** (0.095)	0.268*** (0.097)	0.242** (0.096)
Relatively healthy	0.414*** (0.110)	0.327*** (0.095)	0.362*** (0.097)	0.329*** (0.095)
Very healthy	0.446*** (0.110)	0.299*** (0.096)	0.345*** (0.097)	0.298*** (0.096)
Time dummy of 2013	0.879*** (0.042)	0.788*** (0.037)	0.929*** (0.100)	0.976*** (0.037)
Female	−0.521*** (0.035)	−0.458*** (0.031)	−0.469*** (0.031)	−0.459*** (0.031)
Minority	−0.155** (0.060)	−0.142*** (0.052)	−0.157*** (0.052)	−0.151*** (0.052)
Being single	−0.237*** (0.070)	−0.151** (0.060)	−0.106* (0.059)	−0.155*** (0.060)
Father with non-farm experience	0.166*** (0.058)	0.120* (0.058)	0.129** (0.061)	0.133** (0.062)
Family size	−0.005 (0.011)	−0.018* (0.009)	−0.015 (0.009)	−0.018* (0.009)
Pseudo R^2	0.164	0.195	0.182	0.196
Obs.	6,179	7,577	6,179	7,588

Notes: Control variables: constant, dummies of age cohorts or birth year fixed effects and provincial fixed effects. Sample 1 refers to 16-60 years old rural labor force living in rural areas for both waves. Sample 2 is labor force group with rural hukou owners (including rural-urban migrants) for both waves; the standard errors of robustness are reported within the parentheses. Without notice, all the tables follow the same expressions. [a]Measure: [individual reported frequency – Mean frequency for each province in each survey year]/Mean frequency for each province in each survey year. *,**,***Coefficients are significant at 10, 5 and 1 percent levels, respectively

Table II.
The impact of internet utilization on rural employment

Frequency of internet utilization	2005	2013	2005 and 2013
The base group: never use			
Barely use	0.083 (0.031)***	0.101 (0.035)***	0.093 (0.033)***
Sometimes use	0.104 (0.034)***	0.125 (0.037)***	0.115 (0.036)***
Often use	0.105 (0.036)***	0.126 (0.039)***	0.116 (0.037)***
Frequently use	0.196 (0.047)***	0.216 (0.043)***	0.207 (0.045)***
Alternative measure			
Z-score of frequency	0.069 (0.0111)***	0.091 (0.014)***	0.080 (0.0129)***

Notes: The average marginal effects are computed from the regression results of sample 1, rural residents, in Table II. *,**,***Coefficients are significant at 10, 5 and 1 percent levels, respectively

Table III.
Average marginal effects on non-farm employment

measurement error in self-reported information or a potential selection bias between employment and internet utilization at individual level. So, instead of individual percentage deviations from the provincial average, we also compute the average frequency of the internet utilization at provincial level as well as at age cohort level respectively and control into

estimation directly. They are relatively independent from the individual internet coverage. Consistently, we find that the marginal effects of the internet usage on the non-farm employment are significantly positive. Evidence supports that the new media is an important determinant of the non-farm employment in rural China.

Second, employment experience can also be affected by family characteristics, for example through intergenerational transmission mechanism and the mechanism of marriage market. After controlling for gender discrepancy, ethnic discrepancy, regional variation, cohorts fixed effects, etc. if one's father has a non-farm employment experience, then he (or she) has a higher probability to take a non-farm job, as the estimated parameter of variable of father's non-farm experience is positive and significant. Individuals married and with big family also are more likely to have non-farm working experience. Age cohorts of 20-45 years are more likely to have non-farm employment experience.

Third, human capital remains the most important determinant of one's employment decision. The patterns of estimators for education attainment show that the higher the education level one obtains, the more likely he has non-farm experience. Similarly, health status and employment patterns are significantly positively correlated. The better the health condition, the higher the probability they possess non-farm experience. Enhancement of human capital, in any country, is a necessity for rural long-term development. As has been widely documented in literature, career training, education programs, and knowledge popularization are the major approaches contributing to rural human capital development. However, the positive role of new media in providing career training, education program, and knowledge popularization is generally neglected. While the new media enjoys the reputation of rapid, cheap, and efficient communication, public investment to improve rural human capital can integrate the active role of new media.

4.2 IV estimates

For endogenous concerns, we resort to the instrument approach. One observed fact is the total number of internet users is nearly 650 million people in 2014 and around 557 million have access to internet through mobile phones. The popularity of mobile internet in 2013 was unanticipated in 2005. We use this information of provincial mobile phone coverage rate in 2005, which to some extent reveals the regional endowment in mobile surfing, to instrument internet access in 2013. The second instrument is to use the information about whether the individuals prefer spending time with friends on weekend or not. The third instrument is one's frequency of visiting neighbors to predict the probability of internet access. Variations of internet access explained by these characteristics are not directly correlated with one's employment experience. Using the instruments, we estimate the impacts of new media onto non-farm employment with the predicted probability of internet coverage in the second-stage regression. As presented in Table IV, the second-stage estimators are all significantly positive supporting causal impacts of internet utilization on non-farm employment in rural areas.

4.3 Robustness checks

We first use the alternative outcome variable which is also used in the second stages in Table IV: non-farm employment (1 = currently non-farm employment; 0 = the other). We implement linear regression models and probit probability models for rural residents separately. As shown in the upper panel of Table V, when rural individuals access to internet and mobile internet more frequently, they are more likely to engage in non-farm employment. We also examine the subsamples of employed population as well as smaller subsamples of birth cohorts 1965-1985[2] to evaluate how the internet coverage influences the non-farm employment. Consistently, we obtain similar results as the main results of Table II. Second, we resort to alternative independent variable of interest: an internet access

The first stage	Dependent variable: internet access in 2013		
	Probit probability model estimation		
Instrument one	Provincial mobile phone coverage rate in 2005		
Coef.	0.976***	Obs.	3,191
Robust SE	(0.376)	Wald-χ^2	995.50
The second stage	2013 CGSS		
Dependent variable	Currently having non-farm jobs		Working experience
	OLS Est.	Probit Est.	Ordered probit
Internet access	0.769***	1.931***	2.678***
(Predicted probability)	(0.114)	(0.488)	(0.393)
Obs.	3,190	3,190	3,190
Pseudo R^2 or R^2	0.247	0.225	0.185
The first stage	Dependent variable: internet access in 2013		
	Probit probability model estimation		
Instrument two	Whether prefer spending time with friends in casual time		
Coef.	0.119**	Obs.	3253
Robust SE	(0.070)	Wald-χ^2	1036.24
The second stage			
Dependent variable	Currently having non-farm jobs		Working experience
	OLS Est.	Probit Est.	Ordered probit
Internet access	0.662***	1.729***	2.062***
(Predicted probability)	(0.099)	(0.415)	(0.343)
Obs.	3,252	3,252	3,252
Pseudo R^2 or R^2	0.395	0.224	0.186
The first stage	Dependent variable: internet access in 2013		
	Linear probability Est.		Probit probability Est.
Instrument three	Individual frequency of visiting neighbors (base group = monthly visit)		
Barely visit	−0.019 (0.020)	Barely visit	−0.091 (0.105)
Weekly	−0.018 (0.020)	Weekly	−0.090 (0.108)
Yearly visit	−0.002 (0.017)	Yearly visit	−0.030 (0.082)
Daily visit	−0.037 (0.018)**	Daily visit	−0.190 (0.090)**
F-statistics	98.76	Wald-χ^2	1049.00
Obs.	3,283	Obs.	3,283
The second stage			
Dependent variable	Currently having non-farm jobs		Working experience
	OLS Est.	Probit Est.	Ordered probit
Internet access	1.027**	3.730***	0.757
(Predicted value based on OLS estimation first stage)	(0.465)	(1.806)	(0.455)
Internet access	0.683***	1.825***	1.937***
(Predicted value based on probit estimation first stage)	(0.097)	(0.406)	(0.334)

Notes: Main sample includes individuals who are rural residents in the ages of 16-60 years old in labor force from 2013 CGSS; when we use the first instrument, mobile phone usage rate in 2005, we predict the probability of individuals to access internet in 2013 with probit model controlling for same controls without provincial dummies in the first stage; for all instruments, the first stages were also implemented with OLS regressions, and consistent conclusions are found. The *F*-statistics of OLS estimations at the first stage are around 90 to 110; limited by survey information, we only apply the instrument approach to 2013 CGSS. Other Control variables include constant, gender, minority, marital status, education attainment, health status, non-farm experience of father, family size, dummies of age cohorts, age fixed effects and provincial fixed effects. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table IV.
The existence of causal effects

dummy (1 = use internet; 0 = never use internet). On average, the average marginal effect of internet utilization on non-farm employment is 12 percent as shown in the middle panel of Table V. Third, we collapse the data to provincial level in different survey years, and construct a two-period pseudo panel with "provincial average representatives". In other words, we track different provincial level "individuals" over time to investigate the effect of

Dependent variable	Currently having non-farm jobs			
Model	Probit probability model		Linear probability model	
Rural resident data sets	2013	2005 and 2013	2013	2005 and 2013
Internet utilization	Base: never use		Base: never use	
Barely use	0.364 (0.099)***	0.389 (0.090)***	0.119 (0.032)***	0.133 (0.029)***
Sometimes use	0.304 (0.107)***	0.201 (0.098)**	0.110 (0.034)***	0.087 (0.031)***
Often use	0.436 (0.111)***	0.310 (0.098)***	0.154 (0.036)***	0.129 (0.032)***
Frequently use	0.547 (0.127)***	0.472 (0.109)***	0.189 (0.040)***	0.187 (0.035)***
Obs.	3,276	6,179	3,276	6,179
Pseudo R^2 or R^2	0.224	0.220	0.243	0.219
Dependent variable	Working experience			
	Ordered probit probability model			
Rural resident data sets	2013	Marginal effect	2005 and 2013	Marginal effect
Internet access	0.362 (0.073)***	0.116 (0.023)***	0.392 (0.064)***	0.117 (0.019)***
Obs.	3,284		6,187	
Pseudo R^2	0.182		0.181	
Pseudo panel construction				
Dependent variable	Working experience			
Samples	Rural Residents 2005 and 2013		Rural Hukou Owners 2005 and 2013	
Specification[a]	(1)	(2)	(1)	(2)
Internet utilization	0.322 (0.104)***	0.135 (0.043)***	0.233 (0.089)***	0.134 (0.041)***
Number of group	27	44	27	44
Group base	Province	Age cohorts	Province	Age cohorts

Notes: Sample includes rural residents who are 16-60 years old in labor force. Other Controls variables include constant, gender, minority, marital status, education attainment, health status, non-farm experience of father, family size, dummies of age cohorts, age fixed effects, and provincial fixed effects, or regional fixed effects. [a]In the specification (1), we first collapse the data by provincial level in different survey years, treat a province as an "individual" and track different provincial level "average individuals" over time, in the specification (2), we first collapse the data by age cohort level in different survey years, treat one age cohort as an "individual" and track average "individuals" at age cohort level over time. In other words, the first panel is a panel of provincial average representatives, and the second panel is a panel of average person representing one specific age cohort, "a cohort panel". *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table V.
Robustness checks – impacts of internet coverage on non-farm employment

the internet utilization. Similarly, we construct a pseudo panel with birth cohort averages as bases, treating a specific age cohort as an "individual" and tracking the "individuals" over time. In these ways, we alleviate potential concerns of selection or measurement error at individual level. As shown in the lower panel of Table V, estimators with the pseudo panels are consistently and significantly positive. In all, consistent conclusions are found: the more often one can access the internet, the more likely one has non-farm employment.

4.4 Impacts on rural earnings

We have found that the new media coverage can stimulate non-farm employment in rural areas. To further evaluate whether it is possible that the coverage of the internet can further increase earnings directly and through increasing the probability of non-farm employment indirectly, we use extended Mincer income regression models. Three regressions are applied: the first regression includes the interested estimates without controlling for employment types; the second is controlling for employment status; and the third is instead of employment types, we use the internet utilization to predict the variable of work experience for each individual, and then evaluate whether the predicted probability of non-farm employment contributes to their earnings. Specifically, we estimate without controlling for employment status (regression ①) and controlling for the working experience (regression ②), respectively, in Table VI. Instead of original working

Dependent variable	Log (annual income)											
Samples	2013			2005			2005 and 2013			2005 and 2013		
	①	②	③	①	②	③	①	②	③	①	②	③
Working experience	Base group = (0) never work											
= 1 agricultural experience	4.654 (0.401)***			1.272 (0.320)***			2.965 (0.289)***			2.966 (0.289)***		
= 2 non-farm experience	5.025 (0.398)***			2.121 (0.327)***			3.643 (0.291)***			3.648 (0.290)***		
Internet access										0.244**	0.144	0.261**
										(0.122)	(0.119)	(0.121)
			1.592			4.010***			7.745***			7.668***
			(1.095)			(1.511)			(0.939)			(0.944)
Frequency of internet utilization	Base group: never use											
Barely use	0.232	0.279	0.248	0.701***	0.509***	0.748***	0.150	0.085	0.164			
	(0.216)	(0.203)	(0.217)	(0.218)	(0.170)	(0.218)	(0.196)	(0.183)	(0.194)			
Sometimes use	0.544**	0.464**	0.564**	0.235	0.170	0.216	0.200	0.115	0.207			
	(0.241)	(0.235)	(0.241)	(0.579)	(0.561)	(0.576)	(0.218)	(0.216)	(0.217)			
Often use	0.838***	0.739***	0.860***	−1.066	−1.278	−1.032	0.281	0.187	0.290			
	(0.245)	(0.236)	(0.246)	(1.278)	(1.353)	(1.272)	(0.220)	(0.212)	(0.218)			
Frequently use	0.868***	0.670**	0.902***	−0.070	−0.236	0.013	0.412*	0.231	0.464*			
	(0.306)	(0.278)	(0.307)	(0.567)	(0.512)	(0.555)	(0.248)	(0.228)	(0.246)			
Obs.	3,009	3,008	3,009	2,747	2,747	2,747	5,756	5,755	5,756	5,764	5,763	5,764
R^2	0.243	0.312	0.243	0.180	0.248	0.182	0.175	0.237	0.187	0.175	0.237	0.187

Notes: Empirical sample includes rural residents in labor market living in rural areas in the ages of 16 to 60 years. The dependent variable is natural log of annual income for each individual. If the variable of income is 0, the natural log income keeps as 0, while the missing keeps missing. Other control variables include constant, age and age square, gender, minority, marital status, education attainment, health status, non-farm experience of father, family size, birth year fixed effects, and provincial fixed effects. *,**,***Significant at 10, 5 and 1 percent levels, respectively

Table VI.
The impact of internet coverage on rural earnings

experience, the predicted degree of non-farm experience with internet utilization are controlled for in regression ③.

On the whole, non-agricultural employment brings more earnings than the other groups, which is consistent with the existing literature. As results of the improvement of productivity and nature of agricultural production, transition into non-agricultural employment reflects an improvement of the life of rural population. Second, greater probability of exposure to new media is positively associated with higher income. It is probable that the new media changes the nature of rural isolation and further leads to acceptance of changes, technology, and knowledge. We can compare the interested estimators of internet utilization before and after controlling for work experience or the predicted degree of non-farm employment. We find that they still keep partly significant when we estimate 2013 and 2005 waves separately, although they are not significant when we combine both waves of data. This change implies that transition to non-farm employment should be an important channel through which the new media can influence the rural living standards. The partly left significant and positive coefficients of internet usage hint that the new media can directly play a positive role in increasing rural earnings, but the significance is weak. In all, consistent positively significant estimates support the positive effect of accessing to new media on increasing rural earnings through its role in improving employment experience.

5. Conclusion and policy implication

Motivated by the literature on rural economics and recent generalization of internet and mobile internet, this study sets out with the goal of examining whether accessing to new media can affect rural development. We look into different frequencies of internet utilization on rural residents' employment experience as well as earnings in China. With the national survey micro-data of 2005 and 2013 CGSS, we find that the new media has significantly impacted rural labor market directly and indirectly: motivating non-agricultural employment and improving earnings. Moreover, these positive effects are magnified as the coverage of internet is intensified. Since the existences of senior rural labor surplus, spatial disparity of internet coverage, and rural-urban earnings gap in China, government should generalize the internet and mobile internet coverage in the rural areas. Encouragement of new media coverage in rural China not only can improve the rural non-farm employment and living standards but also can contribute to narrowing the differences between urban and rural areas, thereby balancing regional development.

Therefore, combining empirical evidence as well as the existing literature with the reality, we advocate the following specific policy recommendations: First, it is reported that the main reason for not using the network is lacking internet facilities and knowledge. Therefore, we should invest in internet infrastructure and facilities to increase the rural coverage of new media, lowering costs to access new media. Also complementary training of internet utilization is needed, such as a simple video tutorial visualizing the process. Second, considering the potential confusion in the information explosion era, regulations are needed and information disseminated needs to filter out the chaff. Focus should be put on popularization of effective information, production technologies, and positive values. Third, to facilitate the change from agricultural employment to non-farm employment, we should emphasize updating market information and motivating individual initiatives through internet resources. Specifically, it is to encourage changes in the ways of thinking and then increase willing to accept new things and new ideas through new media education and information dissemination. Fourth, for the demand side of labor (e.g. non-agricultural township enterprises and agricultural enterprises), public policy should take advantages of low-cost and efficiency nature of the new media coverage to enhance the development of township enterprises, increase productivity, and then create more non-farm jobs.

Notes

1. Internet users are defined as the internet or mobile internet users at the ages of six years and above with internet usage during the past six months. Rural internet users refer to internet users living in rural areas, while urban Internet users are users living in urban areas. Official coverage rate is computed as the ratio of the number of internet users to the related total population. No separated information on rural internet coverage has been released before 2005 because of technological obstacles as well as rudimentary network construction in rural areas.
2. The estimation results are available if required.

References

Adams, R.H. Jr (2002), "Non-farm income, inequality and land in rural Egypt", *Economic Development and Cultural Change*, Vol. 50 No. 2, pp. 339-363.

Berdegue, J., Ramirez, E., Reardon, T. and German, E. (2001), "Rural non-farm employment and incomes in Chile", *World Development*, Vol. 29 No. 3, pp. 411-425.

Cai Rang Zhuo Ma (2010), "Review of the new media and traditional media development in 2009", *Modern audio-visual (Chinese)*, No. 1, pp. 12-16.

Cai, F. and Wang, M.Y. (2007), "The study of rural labor surplus and its relevant facts", *Chinese Rural Economy (Chinese)*, No. 10, pp. 4-12.

Chen, L. (2009), "Analysis of the characteristics of agricultural information transmission in the age of internet", *The Rural Economy and Scientific Technology (Chinese)*, No. 8, pp. 99-100.

Chen, L.D. and Chen, J.N. (2006), "The role of the media in the construction of new rural areas", *Contemporary Communication (Chinese)*, No. 3, pp. 4-7.

Christiaensen, L., De Weerdt, J. and Todo, Y. (2013), "Urbanization and poverty reduction: the role of rural diversification and secondary towns", *Agricultural Economics*, Vol. 44 Nos 4-5, pp. 435-447.

Deng, X.L. (2011), "Information dissemination of new media environment", *Journal Editors (Chinese)*, No. 2, pp. 27-29.

Fang, X.H. (2002), "Investigation on the communication of economic information in rural areas of South Jiangsu", *Journalism and Communication (Chinese)*, No. 4, pp. 47-55.

Feng, C.F. (2007), "The role of media information service on increasing rural earnings", *Theory and Thinking (Chinese)*, No. 6, pp. 10-11.

Furuholt, B. and Kristiansen, S. (2007), "A rural-urban digital divide? Regional aspects of internet use in Tanzania", *The Electronic Journal on Information Systems in Developing Countries*, Vol. 31 No. 6, pp. 1-15.

Gao, H.B. (2013a), "An empirical study of the impact of new media demand on rural modernization: a case study of Gongyi County", *Journalism and Communication (Chinese)*, No. 7, pp. 80-99.

Gao, H.B. (2013b), "The function and value of the new media to the promotion of rural modernization", *Journalism and Communication (Chinese)*, No. 7, pp. 43-48.

Haggblade, S., Hazell, P. and Reardon, T. (2010), "The rural non-farm economy: prospects for growth and poverty reduction", *World Development*, Vol. 28 No. 10, pp. 1429-1441.

Hindman, B.D. (2000), "The rural-urban digital divide", *Journalism and Mass Communication*, Vol. 77 No. 3, pp. 549-560.

Janvry, D.A. and Sadoulet, E. (2000), "Rural poverty in Latin America determinants and exit paths", *Food Policy*, No. 25, pp. 389-409.

Lanjouw, J.O. and Lanjouw, P. (2001), "The rural non-farm sector: issues and evidence from developing countries", *Agricultural Economics*, Vol. 26 No. 1, pp. 1-23.

Le, Z., Yu, C.Y. and Xu, H.S. (2010), "Study on rural employment", *Population and Economy (Chinese)*, No. 3, pp. 34-40.

Li, L.W. and Jing, F. (2013), "Research on the relationship between the internet and economic growth – empirical test based on the panel data of 31 provinces in China", *Journal of Beijing Technology and Business University (Social Science Edition in Chinese)*, No. 5, pp. 120-126.

Li, S., Deng, Q.H. and Knight, J. (2011), "China's rural-Urban migrants shortage and labor surplus in rural", *Management World (Chinese)*, No. 11, pp. 12-28.

Litan, E.R. and Rivlin, M.A. (2001), "Projecting the economic impact of the internet", *The American Economic Review Papers and Proceedings*, Vol. 91 No. 2, pp. 313-317.

Luan, J., Chen, J.C., He, Z.W., Li, Q. and Qiu, H.G. (2015), "The education treatment effect on the non-farm income of Chinese western rural labors", *China Agricultural Economic Review*, Vol. 7 No. 1, pp. 122-142.

Reardon, T. and Berdegué, J. (2001), "Rural nonfarm employment and incomes in Latin America: overview and policy implications", *World Development*, Vol. 29 No. 3, pp. 395-409.

Shen, M.H. and Zhou, L.G. (2004), "An empirical study on the employment of farmers", *The Financial Research (Chinese)*, Vol. 202, pp. 53-57.

Yue, L. (2014), "Mobile internet era and agricultural information dissemination strategy based on the new media", *Journalism World (Chinese)*, No. 23, pp. 48-54.

Zhang, N. and Fang, X.H. (2002), "Rural development under increasing rural communication services: review of conference on rural economic and media communication", *Journalist (Chinese)*, No. 12, p. 67.

Zhao, J.Q., Hao, X.M. and Indrajit, B. (2006), "The diffusion of the internet and rural development convergence", *The International Journal of Research into New Media Technologies*, Vol. 12 No. 3, pp. 293-305.

Further reading

Cai, F. and Wang, D.W. (2005), "The change of economic growth and the source of farmers' income", *Management World (Chinese)*, No. 5, pp. 77-83.

Chi, F.L. (2008), "The promotion effect of agricultural science and technology information dissemination on agricultural development and its developing trend", *Agricultural Outlook (Chinese)*, No. 6, pp. 41-43.

Rogers, M.E. (1969), *Modernization Among Peasants: The Impact of Communication*, Rinehart and Winston, Inc., Holt, MI, pp. 54-56.

Zhang, S.C. (2010), "The advantage of mobile phone message utilization on Lanzhou agricultural science and technology information dissemination", *Chinese Agricultural Information (Chinese)*, No. 12, pp. 41-42.

Zheng, M.Y. (2000), "The agricultural science and technology information resources on the internet and its utilization", *Journal of Fujian Agricultural University (Social Science Edition in Chinese)*, No. 4, pp. 62-64.

Corresponding author
Benqian Li can be contacted at: benqianli@163.com