

Digital Transformation, Information Search, and Women's High-Quality Employment

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The promotion of fuller and higher-quality employment is a prime task for China's high-quality development. Both employment security (ES) and employment quality (EQ) need to be improved for women who, as an essential part of labor force, have long been faced with high stress and employment threshold. The role of digital transformation in promoting women's employment through reducing the cost of job information search is analyzed with the Job Search Theory in this paper. By using China Household Finance Survey (CHFS) data, this research found that digital transformation of households in China contributes to women's employment significantly, raises the number and proportion of female family members in employment, and enhances women's access to medical care insurance, endowment insurance, unemployment insurance, housing fund and overtime pay. Digital transformation can improve the information accessibility of households, and the reduction in information asymmetries benefits women's employment, as indicated by the mechanism analysis. The positive impact of digital transformation is more pronounced for households in Central China, Western China and provinces with high unemployment rates, as well as those supporting the elderly and without housing. This paper will serve as a reference to fuel high-quality employment and reduce difficulties for women in the context of digital transformation.

Keywords: digital transformation, women's employment, high-quality employment, information asymmetry

1. Introduction

The percentage of women in employed population across the society of China was 43.5% in 2020. Women should be a key labor force on the way to realizing high-quality employment, whose labor force participation and EQ matter whether high-quality employment will be made possible and in the end affect social stability and harmony. For a long time, women have been under great stress for employment and

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the gender wage gap remains acute (Luo *et al.*, 2019). According to relevant data, globally, about 2.4 billion working-age women are inaccessible to equal economic opportunities; women in 86 countries face different forms of employment restrictions; and 95 countries do not guarantee men and women in the same workplace are given equal pay for equal work.¹ Since the 18th CPC National Congress, China has emphasized several times the need to grow digital economy, which has been upgraded as a state strategy. In 2021, the digital economy of 47 major countries added up to USD38.1 trillion, accounting for 45% of GDP, with nominal year-on-year growth of 15.6%.² The benefits for employment created by digital economy have gradually come to the fore. The number of jobs offered by digital industrialization reached 32.6% of the total employment and the number of hires accounted for 24.2% of the total in 2020. The progress of digital technology has given rise to new business forms and models as well as emerging opportunities and patterns of work, so the capacity to absorb employment is expanding increasingly (Wang and Dong, 2020). Digital transformation has become a strong driving force to optimize the employment structure towards high-quality economic development (Qi *et al.*, 2020).

Women are different from men, as they are often required to take care of household chores, childrearing, and care for elderly people, and these activities lead to voluntary choices in division of labor within household, which restrict women's labor force participation (Chen *et al.*, 2016; Kim and Cheuna, 2019). Digital transformation, capable of breaking spatial and temporal limitations, gives rise to new types of jobs (e.g., digital managers, AI engineers and technicians) and thus offers women more flexible job opportunities. However, the Creative Destruction effect incurred by digitalization to the labor market may also reduce the labor demand in some industries in a short period of time and put mounting stress on women's employment. AI technologies would displace employees in low-tech industries and lower labor remuneration in some industries (Acemoglu and Restrepo, 2018). The widening digital divide could also increase the employment threshold and gender wage gap for women. China's labor force participation rate for women, slightly above the world average, though, has been severely downward from 73% in 1990 to 62% in 2020, according to the World Bank.

Under the impact of COVID-19 pandemic and others, the decline in China's labor force participation rate for women in 2020 was evidently larger than that in 2010–2019. To realize high-quality employment, it is really critical to ensure women's employment and the EQ as well. Therefore, the analysis of digital transformation-generated benefits for employment and a systematic look into how digital transformation of households impacts women's high-quality employment are of high academic values and major social implications. Compared with previous studies, this paper may have innovations

¹ The World Bank: *Women, Business and the Law in 2022*, March 2022.

² CAICT: *White Paper on Global Digital Economy (2022)*, December 2022.

as follows. (1) The impact of digital transformation on women's employment is examined by using data at the micro level; (2) Attention is paid to the impact of digital transformation on women's high-quality employment; and (3) The mechanism role of information searching skills is analyzed from theoretical and empirical levels.

2. Theoretical Analysis and Research Hypotheses

As the digital economy advances in depth, there have been studies confirming the positive impact of Internet use on women's employment decision-making, but analyses based on data at the micro level have been few (Kuhn and Mansour, 2014) and theoretical analyses are even scarcer. In this paper, the impact of digital transformation of households on women's employment is first analyzed from a theoretical perspective, and the mechanism role of information searching skills is examined.

2.1. Theoretical Model: Impact of Digital Transformation on Women's Employment

An optimal job search model for women is constructed upon the Job Search Theory (Mortensen and Pissarides, 1999) for analyzing the impact of digital transformation on women's employment. With a reference to existing literature, women's labor productivity is assumed to be ρ . Unemployed women can find jobs with the highest salary and get job opportunities by searching in the labor market. The salary quotes distribution in the labor market is $f(w)$, and its probability density function (PDF) is $f(w)$. Every woman is informed about the market's salary quotes distribution but probably has no way of knowing the salary for a particular job because of information asymmetries. Furthermore, as the salary distribution are salary in equilibrium and individual job search does not alter this distribution, women will meet the same salary quotes distribution $f(w)$ in each search of jobs. In addition, salary quotes in the labor market tend to float within a certain range, and those either too high or too low will fade out. This paper therefore assumes the labor market's salary quotes, w , to range within $[a, b]$.

In the optimal job search model, each job search of women comes with costs, which are assumed to be C . Search costs mainly consist of the information searching cost and pre-job search expenses on transportation, food, etc., as shown in previous literature. The information searching cost is used mainly for women acquiring employment-related information. The more information they access to, the more likely they get satisfactory jobs. Pre-job search expenses are assumed as C_f and the information searching cost as C_i . C_f assumed to be fixed in each search, depends mainly on exogenous factors (e.g., the distance between workforce and the job market, demographic characteristics of workforce, and labor market characteristics). The information searching cost is variable by a woman's ability and channel to acquire

information. Digital transformation will influence their search for information as digital technology advances in-depth. The level of digital transformation of households is assumed as D ($0 \leq D \leq 1$) and the benefit factor of digital transformation on search costs as α and hence $C_i = \alpha(1-D)$, and $C = C_f + \alpha(1-D)$. Meanwhile, considering that digital transformation requires learning digital technology as well as purchasing and using related devices, the cost factor of digital transformation per unit is assumed to be p . Since women often need to go through multiple job searches, the intertemporal utility discount rate between two searches is assumed as r ($0 \leq r \leq 1$), which is exogenously determined by the market. In searching for job opportunities, women will set a minimum/reservation wage (w_i) beforehand. When the market's pay offer is equal to or higher than individual minimum/reservation wage, it is accepted and the woman enters the labor market. Otherwise, it is rejected. The woman continues searching. Here the probability of $w_i \leq w$ in each search is assumed to be P .

The objective of women is to maximize the effectiveness of their search. As assumed, the utility of the first job search is as follows:

$$U_1 = E(w | w_i \leq w)P(w_i \leq w) + \frac{U_2[1 - P(w_i \leq w)]}{1+r} - [C_f + \alpha(1-D)] - pD \quad (1)$$

where U_1 denotes the utility of the first job search and U_2 denotes the utility of the second job search. Women will have another try when they fail to get a satisfactory job through the first search.

By their objectives, the termination of search can be expressed by Equation (2):

$$U = U_t = U_{t+1} / (1+r) \quad (2)$$

Equation (2) implies that one more search can no longer bring additional benefit to women, so they will stop to make employment decisions, either to take a job or not to take a job at all. The utility of job search can be expressed as follows:

$$U = \frac{1}{P(w_i \leq w)} \left[\frac{E(w | w_i \leq w)P(w_i \leq w)}{1+r} \right] - [C_f + \alpha(1-D)] - pD \quad (3)$$

The derivation shows that the condition for maximizing the utility of job search can be expressed as follows:

$$\frac{1}{1+r} \int_{w_i^*}^b (w - w_i^*) f(w) d(w) = [C_f + \alpha(1-D)] + pD \quad (4)$$

Here, w_i^* denotes the optimal reservation wage of women. It is also clear in

Equation (4) that women set the optimal reservation wage by search costs and will adjust to close the gap between their reservation wage and the market's pay offer so as to get job opportunities. If search costs are less than the additional benefit from job search, they continue to search; and if search costs are equal to the additional benefit, they stop and the make decisions.

Then the function of the optimal reservation wage is as follows:

$$\Phi = \int_{w_i^*}^b (w - w_i^*) f(w) d(w) - (1+r) [C_f + \alpha + (p - \alpha)D] \quad (5)$$

$$C = C_f + \alpha + (p - \alpha)D \quad (6)$$

By taking the first order derivative, we have:

$$\partial \Phi / \partial C = -(1+r) \quad (7)$$

$$\frac{\partial \Phi}{\partial w_i^*} = - \int_{w_i^*}^b (w - w_i^*) f(w) d(w) \quad (8)$$

Combined with Equation (5) and Equation (8), it is shown that:

$$\frac{\partial w_i^*}{\partial C} = - \frac{\partial \Phi}{\partial C} / \frac{\partial \Phi}{\partial w_i^*} < 0 \quad (9)$$

As a result, the larger the search costs C is, the less the additional benefit that women gain from their search. Combined with Equation (6), there is:

$$\frac{\partial w_i^*}{\partial \alpha} = \frac{\partial \Phi}{\partial \alpha} / \frac{\partial \Phi}{\partial w_i^*} > 0 \quad (10)$$

As indicated by Equation (10), the larger the benefit factor of digital transformation is and the higher the optimal reservation wage of women is set, the more likely they are to gain greater additional benefit from job search. At the same time, the impact of digital transformation on women's optimal reservation wage is associated with the benefit factor and cost factor of digital transformation. When the benefit factor is larger than the cost factor, digital transformation helps to reduce search costs, affecting women's employment in a positive way, and vice versa. Accordingly, the first research hypothesis is proposed as follows:

H1a: When the cost of digital transformation is less than the benefit, ceteris paribus,

digital transformation will promote women's employment.

H1b: When the cost of digital transformation is larger than the benefit, *ceteris paribus*, digital transformation will not promote women's employment.

2.2. Mechanism Analysis of Digital Transformation's Effect on Women's Employment

High search costs and unreasonable reservation wages mainly result from information asymmetries, according to the Job Search Theory. In this paper, the focus is placed on the impact of digital transformation on job information search. Studies based on business digital transformation have revealed that the growth of digital economy helps to reduce information asymmetries, lessen the irrationality of managers' decision-making actions, and improve the corporate governance effectively (Qi *et al.*, 2020). Digital transformation delivers business managers more cost-effective ways of information search. Digital technology, including the Internet, big data, and AI, can broaden and deepen information accessibility so effectively that consumers and target markets will be analyzed precisely. Similarly, the digital economy also has an impact on individual information search. Studies have presented that Internet use can largely increase the channels through which workforce acquires information, so education is better matched with employment, which leads to higher EQ (Ding and Liu, 2022). Internet job search shows an evident effect of wage premiums, which can reduce information asymmetries in the market and raise workforce's income. In summary, the second research hypothesis is set as follows:

H2: *Ceteris paribus*, digital transformation can promote women's employment by improving the information accessibility of households.

The above two hypotheses are to be empirically analyzed and tested with the CHFS data.

3. Data, Variables and Model

3.1. Data

The CHFS data is adopted for this research. CHFS samples covering 29 provinces except for Xizang, Xinjiang, Hong Kong SAR, Macao SAR, and Taiwan regions, which are representative of the nation and reveal the status and financial behavior of Chinese households in detail (Gan *et al.*, 2013). At the individual level, CHFS collects information on employment and income and thus it is effective in measuring individual employment and EQ. Given the in-depth advancement of digital economy, the CHFS in 2017 and 2019 inquired households' use of digital technology (e.g., smartphones, computers, and the Internet) and collected data on their digital finance (including the use of mobile payments, and practices of online wealth management),

which provides data support for measuring digital transformation of households in this paper.

3.2. Variables

3.2.1. Independent Variables

Digital transformation is set as the independent variables here. Unlike that of industries or businesses, digital transformation of households is more micro and demand-driven, reflected in such behaviors as the use of digital technology as well as practices of online wealth management (e.g., mobile payments and Internet finance). It has shown that mobile payments were used three times per capita a day in 2020.¹ Mobile payments could influence household consumption and income and lower household poverty vulnerability (Li *et al.*, 2020). Digital finance could advance household entrepreneurship to affect the asset allocation, consumption and income of households (Yin *et al.*, 2019). The World Bank represents the digitization of households with the use of ICT devices, Internet, digital services, and digital finance in the Digital Economy Household Survey (DEHS). In short, in order to measure digital transformation of households comprehensively, a digital transformation index is constructed through factor analysis of indicators that represent the use of digital technology and practices of digital finance of households on the micro level, drawing on previous literature (Yin *et al.*, 2021) and based on CHFS data. Specifically, the factors involve whether a household has a smartphone or computer, uses mobile payments, engages in online wealth management, or shops online, among which smartphones and computers reflect the household's use of digital technology, while mobile payments, online wealth management, and online shopping reveal its practices in the digital finance market.

3.2.2. Dependent Variable

The dependent variable is women's employment. In this paper, the working age is defined as 16–70 years old according to existing literature as a way to fully reflect the employment of female family members of working age. Women's employment decision-making is not just about individuals, but considers more of their households and macro factors. In order to picture women's employment at the household level comprehensively, three variables—whether there are female family members in employment, the number of female family members in employment, and the proportion of female family members in employment—are defined. The working age

¹ China UnionPay: 2020 Mobile Payment Security Survey Report, February 2021.

for robustness testing is defined as 16–59 years old by National Bureau of Statistics (NBS) rule to test if the results are robust.

3.2.3. Mechanism Variable

Information searching skills is the mechanism variable. For a long time, due to data limitations and the complexity of variable connotations, few literatures have been able to measure information searching skills comprehensively. Some studies have used cellphone signal coverage and whether a household owns a telephone as proxy variables measuring information accessibility (Xu *et al.*, 2013). Zhang *et al.* (2021) measured Internet information channels by whether individuals view the Internet as the primary source of information. However, these variables are too subjective and homogeneous to highlight the convenience of information access benefiting from digital transformation. In light of the issues of research, this paper measures information searching skills at the household level with nine indicators selected on the basis of 2017 CHFS data, including financial information search, information access through Internet, access to information on employment policies, access to information on social security policies, access to information on state policies, access to information on district and county government debts, access to information on district and county government revenues, access to information on district and county government expenditures, and access to information on government's work to increase people's incomes. First, the indicators for information searching skills of households are constructed with the entropy weight method (EWM). Besides, since there could be biases associated with any difference in the distribution of indicators when the EWM is used, factor analysis and cumulative scoring are employed to calculate the indicators. The factor analysis uses the nine factors, which are the same as those used in the EWM. The cumulative scoring calculates scores according to whether the interviewed households answer questions correctly, scoring 1 point for knowing the information and 0 points for not. All three methods cover information on state-disclosed policies and information on finance and economics that is closely related to employment, and measure the information searching skills of households by how much the respondents are informed of these policies. A household has poor information searching skills if it does not pay attention to or know about such disclosed information that is closely related to life and employment; and it has strong information searching skills if it has a good command of such information.

3.2.4. Control Variables

With reference to previous literatures (Kim and Cheung, 2019), this paper selects some factors that may affect women's employment and EQ, including demographic

characteristics, household characteristics, job market characteristics, and economic characteristics. The number of female family members of working age may be more than one, and women's employment decision-making is not just about individuals, but considers more of their household factors. The head of household (HOH) is the major source of income and the primary decision maker, whose educational attainment, marital status and health conditions can affect women's employment and the proportion of women in employment. Therefore, the educational attainment and marital status of the HOH are controlled. In addition, control variables that represent the educational attainment and marital status of female family members in employment are added in the robustness testing to see if the results are robust. Data on demographic and household characteristics are from the CHFS and data on provincial job market and economic characteristics from the NBS. The log values of total household income, total household assets, provincial GDP per capita, and provincial average salary of urban employment are used in the empirical analysis.¹

Based on 2017 and 2019 CHFS data, a balanced panel is constructed and the two-way fixed-effects (FE) model is used for empirical analysis. The digital transformation index is a continuous variable within [0, 1], and the larger the index, the higher the level of digital transformation of households. A total of 29,398 samples of two-period balanced panel were finally obtained after data cleaning. The proportion of female family members in employment fell from 68.18% in 2017 to 53.27% in 2019, according to the results of descriptive statistics. The downward trend was just as that reflected by the data from the World Bank and the NBS. The mean of the digital transformation index in 2017 and 2019 is 0.44 and 0.57, respectively, indicating that the digital transformation of households in China has continued to rise. It remains to be seen whether the deepening digital transformation can empower women's employment.

3.3. Empirical Model

To examine the impact of digital transformation of households on women's employment and test the first hypothesis, this paper constructs a balanced panel of households with 2017 and 2019 CHFS data and employs the fixed-effects model for empirical analysis. The regression model is shown as Equation (11):

$$Employment_{it} = \beta_0 + \beta_1 digital_{it} + \beta_x X_{it} + c_i + \lambda_t + \varepsilon_{it} \quad (11)$$

where $Employment_{it}$ denotes the employment of working-age women in household i in t year, and it represents the dummy variable for whether there are female family

¹ Due to limited length of the paper, the way in which all the variables are defined and descriptive statistics for all variables are not reported and kept for reference.

members in employment and the continuous variable for the number and proportion of female family members in employment, respectively, in the baseline regression. $digital_{it}$ denotes the digital transformation index of household i in t year. β_i is the coefficient of interest in this equation and measures the impact of digital transformation on women's employment and X_{it} denotes the control variable. ε_{it} is the error term; c_i is the household fixed effect and λ_t is the time fixed effect.

3.4. Endogeneity Analysis

The endogeneity problem may result from omitted variables and reverse causality when model (11) is used to study the impact of digital transformation on women's employment. Women's labor force participation is affected by complexities (Chen *et al.*, 2016), and besides controlled variables in this research, there are many unobservable or inaccurately measurable factors (e.g., regional culture and personalities) affecting women's employment. These factors affect women's participation in the labor market but cannot be accurately measured yet. These unobservable variables that do not change over time cannot be identified in cross-sectional data and will not be handled well even with instrumental variables (IVs). For this reason, a balanced panel is constructed with 2017 and 2019 CHFS data, with household and time fixed effects controlled. The two-way fixed-effects model is effective in solving the endogeneity problem resulting from unobservable variables that do not change over time.

What's more, women continue to learn new technology and knowledge in the course of employment, improve their personal information and use of digital technology, and contribute to the digital transformation of households. Therefore, reverse causality may also cause bias, and to handle it, an instrumental variable is constructed for FE-IV estimates. Drawing on previous research (Zhang *et al.*, 2020), the "distance between location and Hangzhou $\times$ distance between location and provincial capital" is taken as an instrumental variable. For fulfilling the differential requirement of FE, the IV is multiplied by the year variable in the empirical analysis. Hangzhou is the birthplace and center of digital economy and digital technology, and the closer a location is to Hangzhou, the higher-level its digital level is. Provincial capitals, as economic and political centers, generally enjoy the highest-level digital economy in each province, and the closer a location is to them, the more strongly its development is driven by. This IV meets the requirement for correlation as it is closely related to digital transformation of households. Geographic distance as an exogenous variable is unlikely to affect women's employment in households through other channels except for digital transformation, so the requirement for exogeneity is also met.

Beyond the above IV, since the distance to Hangzhou and the distance to a provincial capital are both too macro to represent the heterogeneity of households among

different communities, with a reference to previous literatures (Lusardi and Mitchell, 2011), the mean of digital transformation index of all households in the community other than this household is calculated, and another IV is constructed. A household's digital transformation is not only its subjective choice, but also influenced by others and the surrounding environment. Communities with better digital infrastructure tend to see higher-level digital transformation of households. Moreover, whether female family members of working age are employed is not necessarily related to the digital transformation of other households in the community. In short, the mean of digital transformation index of all households in the community other than this household is a proper IV. To enhance the exogeneity, the "mean of digital transformation index of all households in the community other than this household $\times$ distance to provincial capital" is set as an IV in the empirical analysis and its log value is taken.¹

4. Empirical Analysis

4.1. Baseline Regression: Impact of Digital Transformation on Women's Employment

Based on 2017 and 2019 CHFS data, a balanced panel is constructed to empirically test the impact of digital transformation on women's employment. Columns (1) to (3) of Table 1 report the FE estimates for the impact of digital transformation on whether there are female family members in employment, the number of female family members in employment, and the proportion of female family members in employment, respectively. The results show that digital transformation improves women's employment significantly, and higher-level digital transformation raises the number and proportion of female family members in employment significantly. In terms of economic significance, for every one unit rise in the digital transformation index, the probability of female family members in employment increases by 0.06 units, and this effect is significant at the 1% level. Furthermore, digital transformation can enlarge the number and proportion of female family members in employment significantly. For every one unit rise in the digital transformation index, the number of female family members in employment will increase by 0.11 units and the proportion by 0.08 units, and both positive impacts are significant at the 1% level. H1a is confirmed by the results of two-way FE estimates. Seen from the control variables, women's labor force participation is complex decision-making, as individual characteristics, household characteristics, and job market characteristics (e.g., the proportion of minors or seniors, economic status, etc.) affect their employment to varying degrees.

¹ Due to space limitation, the FE estimation results of instrumental variable analysis are not reported and kept for reference.

Table 1. Impact of Digital Transformation on Women's Employment: FE

	(1)	(2)	(3)
	Whether there are female family members in employment	Number of female family members in employment	Proportion of female family members in employment
Digital transformation	0.0643*** (0.0150)	0.1125*** (0.0226)	0.0781*** (0.0146)
Control variables			
Time and household fixed effects		Controlled	
Constant term			
R ²	0.1036	0.1604	0.1087
N	29398	29398	29398

Note: *, ** and *** represent the significance at 10%, 5% and 1% levels respectively. In parentheses are heteroskedasticity-robust standard errors. R² is within R². The same below. Due to space limitation, the results for control variables are not reported.

4.3. Impact of Digital Transformation on Women's Employment Quality (EQ)

Social security and protection of rights and interests are indicators for high-quality employment, according to the 14th Five-Year Plan. The impact of digital transformation on women's access to medical care insurance, endowment insurance, unemployment insurance, housing fund and overtime pay is examined empirically in this paper. As shown by the estimate results in columns (1) and (2) of Table 2, digital transformation helps working-age women to access to medical care insurance, endowment insurance, unemployment insurance, and housing fund. For every one unit rise in the digital transformation index, the number of employed women with access to

Table 2. Impact of Digital Transformation on Women's Employment Quality (EQ): FE

	(1)	(2)	(3)	(4)
	Number of employed women with access to medical care insurance, endowment insurance, unemployment insurance, and housing fund	Proportion of employed women with access to medical care insurance, endowment insurance, unemployment insurance, and housing fund	Number of employed women with overtime pay	Proportion of employed women with overtime pay
Digital transformation	0.0528*** (0.0073)	0.0171*** (0.0030)	0.0235*** (0.0084)	0.0165*** (0.0060)
Control variable				
Time and household fixed effects		Controlled		
Constant term				
R ²	0.0548	0.0447	0.0065	0.0043
N	29398	29398	29398	29398

medical care insurance, endowment insurance, unemployment insurance, and housing fund increases by 0.05 units and the proportion increase by 0.02 units, and the results are significant at the 1% level. After endogeneity is handled, the FE-IV estimates still support the conclusions of this paper. Digital transformation is beneficial to women's access to medical care insurance, endowment insurance, unemployment insurance, and housing fund.

Overtime pay is a provision of the *Labor Law of the People's Republic of China* and a right that calls for protection. Therefore, the impact of digital transformation on women's overtime pay is empirically tested in this paper. The estimate results in columns (3) and (4) of Table 2 indicate that digital transformation can raise the number and proportion of employed women with overtime pay significantly. The estimate results after IVs are introduced also reveal the same finding. Digital transformation has lowered the threshold for women's employment and offered them more secure job opportunities, a fairer employment environment and more harmonious labor relations.

4.4. Robustness Tests

Several robustness tests are performed, including changing digital transformation measurement, controlling for educational attainment and marital status of women, 1% winsorization, and using NBS rules to define working age. The conclusions are robust in all kinds of tests.¹

5. Further Analysis

5.1. Digital Transformation, Information Search and Women's Employment

Baseline regression and robustness testing have shown that digital transformation can promote women's employment significantly and raise the number and proportion of female family members in employment. Further, the mechanism and channel through which digital transformation affects women's employment will be probed into. Digital transformation of households involves the use of digital technology and practices of digital finance, etc., which affect the employment of female family members through different channels. Previous studies have confirmed that the advancement of digital finance expands the financial availability of individuals and households and relaxes financing constraints in entrepreneurship to stimulate individual entrepreneurship (Xie *et al.*, 2018). Digital life and digital transformation fuels employment by increasing individual-level social capital and human capital (Qi and Chu, 2021). Nonetheless,

¹ Due to limited length of the paper, the FE estimate results of full robustness analysis are not reported and kept for reference.

these studies only explain part of the channels through which digital finance or digital technology affects employment. For households and individuals, another major impact of digital transformation lies in information search. There are market frictions and incomplete information in the labor market, as suggested by the labor market search theory. Both employers and workforces need to spend time and resources searching for information to match supply and demand. Digital technology (e.g., big data, and mobile Internet) will change the ways and means of information dissemination to make it faster. Individuals are able to access various information more conveniently and at a low threshold through digital technology and digital media (Kuhn and Mansour, 2014). By 2017 CHFS data, among the 46.59% of respondents who use the Internet, 72.36% used the Internet to learn about information and 7.66% to search and apply for jobs. With the theoretical analysis and a literature review, this paper holds that another mechanism through which digital transformation affects women's employment is to improve the information searching skills of households and women, besides the mechanisms verified by previous studies. The 2017 and 2019 CHFS data are used in the baseline regression, but questions on measuring the variable of information searching skills are involved only in the 2017 questionnaires. As a result of data limitations, this paper uses 2017 CHFS data for empirical analysis. A total of 33,822 samples were obtained after data cleaning.¹

In order to measure the information searching skills of households and women effectively, this paper selects questions closely related to employment on the basis of CHFS questionnaires, and synthesizes them into a proxy variable for information searching skills of households after using the EWM, factor analysis and cumulative scoring for dimensionality reduction. The larger the indicator value is, the stronger a household's information searching skills are represented. On this basis, we explore the contribution of digital transformation to women's employment through reducing information asymmetries and improving the information searching skills of households. The main estimate results are reported in Table 3. Columns (1) to (3) suggest that digital transformation can improve the information searching skills of households significantly, which remains robust to the use of different indicator for information searching skills. The estimate results in columns (4) and (5) reveal that the stronger the information searching skills are, the higher the probability and proportion of female family members in employment will be. The information asymmetry is an important factor affecting women's employment. With the improvement in digital transformation of households, women are able to access wider and more diverse information through the Internet, and the threshold and cost for doing so are reduced. Meanwhile, they are able to get job opportunities with more comprehensive and accurate information found on the Internet.

¹ Data cleaning includes removing household samples with working age for women, with an annual income less than 0, and with key variables omitted.

Table 3. Digital Transformation, Information Search and Women's Employment

	(1)	(2)	(3)	(4)	(5)
	Information searching skills (EWM)	Information searching skills (factor analysis)	Information searching skills (cumulative scoring)	Whether there are female family members in employment	Proportion of female family members in employment
Digital transformation	0.0948*** (0.0058)	4.0016*** (0.8464)	1.2518*** (0.0715)		
Information searching skills (EWM)				0.0423*** (0.0111)	0.0602*** (0.0110)
Information searching skills (factor analysis)				0.0003*** (0.0001)	0.0003*** (0.0001)
Information searching skills (cumulative scoring)				0.0017*** (0.0009)	0.0034* (0.0009)
Control variables	Controlled				
District and County fixed effects					
Constant term					
R ²	0.1764	0.0482	0.2555	—	—
N	33822	33822	33822	33822	33822

Note: Control variables include: educational attainment of HOH, married HOH, age of HOH, age squared of HOH, male HOH, proportion of older persons, proportion of minors, proportion of unhealthy persons, total household income, total household assets, household liabilities, home ownership, and whether the household is located in rural areas. Empirical analysis controls for district and county fixed effects. *, ** and *** represent the significance at 10%, 5% and 1% levels respectively. In parentheses are heteroskedasticity-robust standard errors. R² is within R². There are several R² results in columns (4) and (5) and cannot report all of them and are therefore not shown.

To verify if the mechanistic role of information searching skills is robust, a dummy variable for high information searching skills is defined according to the indicator median of information searching skills and an interaction term is brought in for analysis. From the coefficient of the interaction term, it is clear that digital transformation can fuel women's employment through improving information searching skills.¹ The estimate results of the interaction term further validate the conclusion in Table 3 that digital transformation can reduce information asymmetries through improving the information searching skills of households, thereby promoting the employment of working-age women.

In view of the endogeneity problem that may result from unobservable omitted variables when cross-sectional data is used, this paper attempts to construct a balanced panel and uses the two-way fixed-effects model for analysis. Among the nine indicators

¹ Due to limited length of the paper, the estimate results of the interaction term are not reported and kept for reference.

above, “financial information search” is the variable covered by both 2017 and 2019 CHFS data, so it is used to measure household attention to economic and financial information and then to analyze its impact on women’s employment. The FE results show that digital transformation can lift the proportion of female family members in employment effectively through significant raising household attention to economic and financial information. This positive effect remains significant after the replacement of the standard for working age.¹

5.2. Digital Transformation, Internet Information Search and Women’s Employment

Based on the previous mechanism analysis, the indicators for information searching skills are further refined to empirically test the impact of digital transformation on different types of information search. Columns (1) and (2) of Table 4 report the impact of digital transformation on households’ use of the Internet to search for information and hence promote women’s employment. The results show that digital transformation promotes women’s employment through facilitating households’ access to information through the Internet, raising the proportion of female family members of working age in employment significantly. Digital transformation helps households’ information search on smartphones and the Internet, reducing the information asymmetries faced by women to benefit their employment.

Table 4. Digital Transformation, Internet Information Search and Women’s Employment

	(1)	(2)	(3)	(4)	(5)	(6)
	Whether there are female family members in employment	Proportion of female family members in employment	Whether there are female family members in employment	Proportion of female family members in employment	Whether there are female family members in employment	Proportion of female family members in employment
Digital transformation	0.2250*** (0.0155)	0.1532*** (0.0154)	0.2196*** (0.0140)	0.1690*** (0.0138)	0.1747*** (0.0181)	0.1171*** (0.0179)
Digital transformation× Internet information search	0.0686*** (0.0229)	0.1080*** (0.0225)				
Internet information search	−0.0482*** (0.0123)	−0.0511*** (0.0120)				
Digital transformation× Financial information search			0.0932*** (0.0230)	0.0988*** (0.0227)		
Financial information search			−0.0341*** (0.0121)	−0.0259** (0.0118)		

¹ Due to limited length of the paper, the FE estimate results are not all reported and kept for reference.

	(1)	(2)	(3)	(4)	(5)	(6)
	Whether there are female family members in employment	Proportion of female family members in employment	Whether there are female family members in employment	Proportion of female family members in employment	Whether there are female family members in employment	Proportion of female family members in employment
Digital transformation×					0.1268*** (0.0225)	0.1423*** (0.0222)
Information on state policies					-0.0616*** (0.0112)	-0.0636*** (0.0110)
Information on state policies						
Control variables				Controlled		
District and county fixed effects						
Constant term						
R ²	0.1798	0.1656	0.1795	0.1660	0.1802	0.1661
N	33822	33822	33822	33822	33822	33822

Economic and financial information is one of the most important information for women's employment. Changes and developments in economics and finance have profoundly shaped the job market and the threshold for women's labor force participation. Therefore, the interaction term between digital transformation and financial information search is introduced to empirically test the impact of digital transformation on households' access to financial information. The major estimate results are reported in columns (3) and (4) of Table 4. The results indicate that digital transformation facilitates households' access to economic and financial information, which is effective in enlarging the probability and the proportion of women in employment significantly.

CHFS inquired respondents not only about their knowledge of disclosed policies (e.g., the supply-side structural reform; the policy for Chinese students receiving compulsory education that waives tuition and miscellaneous fees, and for boarders from financially disadvantaged families receiving living allowances; the integration of urban and rural residents' medical insurance; the two-child policy; and the disclosure of government expenditures on vehicle purchasing and maintenance), but also whether they were informed of employment policies, social security policies, district and county government financial policies, and government policies to raise revenue. Such disclosed information and policies measure the information searching skills of household members effectively and influence the job market. Attention to such information can help women keep updated with changes in the job market to make better choices in career and employment. Then the mechanism of paying attention to information on state policies is examined. The estimate results in columns (5) and (6) of Table 4 suggest that digital transformation can promote women's employment and raise the proportion

of female family members in employment through growing the attention to state policies.

6. Analysis of Heterogeneity

The digital transformation and employment decision-making of households are under the influence of complexities. China's regional development is uneven, and the heterogeneity among different households and populations is obvious. Therefore, in this paper, the heterogeneity is analyzed from geography, job market environment and household stress.¹ Results show that the contribution of digital transformation to women's employment is more prominent in regions under developed and with high unemployment rates, and for households that need to provide for elderly people and do not own a house.

7. Conclusions and Recommendations

Digital transformation is an inevitable trend that is profoundly shaping the way of human production and life. This paper probes into the impact of digital transformation on women's employment from a micro perspective as a reference towards realizing high quality employment for them. As shown by the Job Search Theory-based model, if digital transformation's benefit factor is greater than the cost factor, it will promote women's employment through reducing the cost of job information search. The empirical analysis reveals that digital transformation raises the probability of female family members in employment significantly, resulting in larger number and proportion of female family members in employment. For every one unit rise in the digital transformation index, the probability of female family members in employment will increase by 0.06 units. The positive impact of digital transformation remains robust after the elimination of the endogeneity problem, change of the digital transformation measurement, control for the educational attainment and marital status of women, exclusion of the effect of income extremes, and use of the NBS rule for working age, respectively. What's more, women's EQ is improved as digital transformation facilitates their access to medical care insurance, endowment insurance, unemployment insurance, housing fund and overtime pay. The mechanism analysis shows that digital transformation can drive women's high-quality employment through enhancing the information searching skills of households. The impact of digital transformation on women's employment is heterogeneous in terms of geography, job market environment and household stress, as revealed by the heterogeneity analysis.

¹ Due to limited length of the paper, the FE estimate results of heterogeneity analysis are not reported and kept for reference.

The contribution of digital transformation to women's employment for households in provinces with high unemployment rates in Central China and Western China is more significant when compared with households in provinces with low unemployment rates and in Eastern China. The impact of digital transformation on women's employment is more pronounced for households supporting for the elderly people and those without housing.

All in all, this paper holds that the digital transformation-generated benefits for employment need to be further utilized for promoting women's high quality employment. First, digital technology can be combined with employment counseling to increase the penetration rate of digital technology among women. Second, digital employment information platforms may be established to help more women access to employment information and opportunities in a cost-effective way. Third, a labor security system must be put into place in the era of digital economy as a way to raise the employment security for women.

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