Research on the Impact of the Digital Economy on Women's Life Satisfaction – An Empirical Analysis Based on CGSS Data

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Abstract: This paper empirically analyzes the impact and mechanism of the digital economy's growth on women's life satisfaction, based on CGSS data from 2015 to 2021 and the provincial digital economy development index, by introducing panel regression models and mediation effect models incorporating mediating variables. The results show that the development of regional digital economies significantly enhances women's life satisfaction. Mediation effect tests reveal that the digital economy encourages life satisfaction by increasing women's labor income. Heterogeneity analysis indicates that, the digital economy has a stronger effect on improving the life satisfaction of rural women compared to urban women. Additionally, the impact is more profound in the central and western regions than in the eastern regions. Therefore, further motivation of regional digital economy development, especially in rural and central-western regions, is crucial to effectively bridge the "digital gap" between urban and rural areas and among different regions.

Keywords: Digital Economy, Women's Life Satisfaction, Labor Income, Mediation Effect Model

1 Introduction

Given the flourishing digital economy in modern society, the widespread application of digital technologies is profoundly transforming the economic picture and lifestyles. As one of the world's largest developing countries, China has witnessed the rapid rise in its digital economy, which has had significant effects on all aspects of society. Among these, the development of the digital economy has brought about significant changes for women in employment, entrepreneurship, income, and consumption, and raised new opportunities for economic participation (Yu and Cui, 2019) [1]. There has been increase in employment opportunities for women in the digital field. Consequently, the impact of the digital economy on gender equality and women's life satisfaction is gradually becoming a focus of attention in both society and academia. The influence of the digital economy on women's life satisfaction encompasses various aspects, including work environment, salary levels, and career development opportunities (Intaratat, 2016) [2]. Researching the relationship between the digital economy and women's labor is crucial for identifying and alleviating gender inequality issues, steering society towards a more equitable and inclusive direction (Clark, 1997; Schoen and Astone, 1997) [3] [4]. In the context of the accelerating digitalization process, understanding the specific

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impact pathways of the digital economy on women's life satisfaction is vital for formulating more effective gender equality policies. This study focuses on whether the digital economy improves the life satisfaction of female residents, and it addresses the academic gap on the mechanisms and heterogeneous effects of the digital economy on women's life satisfaction across different regions in China. In light of this, the study empirically examines the impact of the digital economy on the life satisfaction of Chinese women, by using data from the China General Social Survey (CGSS) from 2015 to 2021 and provincial digital economy development indices. It employs a mediation effect model to analyze whether the digital economy can enhance women's life satisfaction through increased income. Finally, through heterogeneity analysis, the paper explores in detail the differences in the impact of the digital economy on the life satisfaction of women in urban and rural areas, and in eastern and central-western regions. This approach aims to gain a more comprehensive and systematic understanding of the "happiness effect" of the digital economy on women in various settings.

This study raises the in-depth exploration of the specific mechanisms by which the digital economy impacts women's life satisfaction and highlights the differences in this impact across various regions in China. By thoroughly analyzing the relationship between the digital economy, women's income, and their happiness, this paper will provide a scientific empirical basis for future gender-equality policies. Additionally, the heterogeneity study of women in different regions helps in more comprehensively understanding the social impacts of the digital economy on diverse groups, and in offering tailored suggestions for regional development and social equity. This research provides direct evidence of how the digital economy enhances women's life satisfaction, which is significant in academic and practical implications.

Section 2 presents research hypotheses based on literature review and theoretical analysis, while section 3 involves model construction, and explanation of variables and data, which is followed by the empirical analysis of the baseline and mediation effect models in section 4. In the end, the paper concludes with specific recommendations in section 5.

2 Theoretical Analysis and Hypotheses

Subjective satisfaction is an individual's perception and experience of positive and negative emotions, as well as specific cognitions and assessments of life satisfaction, defined as "a person's cognitive and affective evaluations of their life" (Diener and Lucas, 2002) [5]. Satisfaction is a product of subjective experience, and individuals' feelings of satisfaction differ. This subjectivity points out the importance that research on satisfaction should consider factors such as individual values, cultural background, and social environment. Academic studies have shown that happiness is influenced by multiple factors, including socio-economic status, health condition, interpersonal relationships, job satisfaction, and mental health, which are considered closely associated with an individual's sense of well-being. Researchers primarily concentrate on factors affecting life satisfaction, which can be generally divided into two categories: individual characteristics and external macro factors.

On the micro-scale, the study by Myers (1996) [6] indicates that married individuals experience higher levels of happiness compared to their divorced or single counterparts. The impact of fertility status is also notable, as Margolis et al. (2011) [7] found that a woman's number of

children affects her sense of satisfaction. Lelkes (2006) [8] observed the positive correlation between income level and satisfaction, suggesting that individuals with higher incomes tend to feel happier. The influence of education is highlighted in Cuñado et al.'s (2012) [9] study, which reveals that individuals with higher education levels are more likely to experience greater happiness. Additionally, MacKerron (2011) [10] emphasizes the certainty that the less healthy individuals are more likely to access to higher level of satisfaction, compared to the healthy individuals.

On the macro scale, societal and environmental factors significantly impact satisfaction. Residents of wealthier nations generally report higher happiness, while adverse economic conditions like inflation, widespread unemployment, and income inequality have been shown to decrease subjective satisfaction, as noted by Zagorski et al. (2014) [11] and Cheung & Lucas (2016) [12]. Nordheim et al. (2020) [13] points out that the government policies, especially those related to social security such as unemployment benefits and healthcare spending, are found to enhance citizens' satisfaction. Furthermore, Carroll et al. (2009) [14] suggests that effective government governance leading to developed social services, can increase long-term satisfaction. Additionally, environmental factors such as air and water pollution have negative impacts on satisfaction. The development of the digital economy plays a role in motivating social gender equality, which can also influence overall satisfaction levels.

2.1 The analysis of the effects of the digital economy on women's life satisfaction

In the modern era, the robust development of the digital economy has not only profoundly affected the overall economic structure but has also raised great number of opportunities for women at the individual level, thereby positively influencing their life satisfaction. Firstly, the rise of the digital economy has prepared opportunities for women to engage in economic activities. The widespread adoption of digital technology has made it easier for women to access online employment opportunities, enabling them to work remotely or start entrepreneurship. Secondly, the digital economy has established flexible work models, such as remote working and freelancing. The flexibility allows women to more easily balance professional and family responsibilities, leading to a more fulfilling life. As a key component of the digital economy, the development of social networks has also provided women with broader social support and interactive platforms. Within digital social networks, women can share experiences, receive support, and build tighter social connections, thereby enhancing their social identity and life satisfaction. Finally, the digital economy has encouraged the digitalization of lifestyle services, which presents women more convenient and efficient ways of living.

In summary, the positive impact of the digital economy on women is realized in few aspects: the expansion of economic opportunities, flexible work models, enhancement of knowledge and skills, social networks and support systems, and convenient lifestyle services. All these factors contribute to improving women’s economic, social, and psychological well-being.

2.2 The mechanism of the digital economy's impact on women's satisfaction with female labor income as a mediator

Given the trend of digitalization, the rise of the digital economy has not only shaped a new economic picture but also provided women with opportunities to break through traditional occupational boundaries and increase their labor income.

Firstly, the digital economy has opened up a broader and more diverse range of employment opportunities for women. The widespread application of digital technologies has led to a rapid increase in digital job positions, including fields like remote work, online sales, and digital marketing. These areas have the potential to increase women's labor income levels. Secondly, the growth of the digital economy has changed the labor market operations, as it reduces the constraints of time and space. Digital work models such as remote working and freelancing prepare women more flexible work arrangements, and enable them to better balance their professional and family responsibilities, thereby improving their income levels. This implies that women are more likely to be parts of high-income sectors and compete for more competitive positions, which further increases their labor income.

Therefore, based on the advantages of the digital economy in broadening employment opportunities and providing flexible work models, it is reasonable to hypothesize that the development of the digital economy will directly increase women's labor income levels, and bring significant positive effects on their life satisfaction. Based on the above analysis, this study proposes the following hypotheses:

H1: The development of the digital economy can enhance women's life satisfaction.

H2: Increasing women's labor income is a significant channel through which the development of the digital economy refines women's life satisfaction.

3 Research Design

3.1 Empirical Model

To examine the impact of the digital economy level on the subjective satisfaction of female respondents, this study constructs a panel regression model and conducts regression analysis based on the OLS (Ordinary Least Squares) regression method:

$$Happy_{it} = \beta_0 + \beta_1 Dig_{it} + \beta_i Control_{it} + \varepsilon_i \quad (1)$$

where $\mathrm{Happy}_{\mathrm{it}}$ represents the subjective satisfaction of individual i in year t, with higher values indicating stronger subjective satisfaction. $\mathrm{Dig}_{\mathrm{it}}$ denotes the digital economy development level of the region where individual i is located in year t, obtained through principal component analysis. $\mathrm{Control}_{\mathrm{it}}$ includes control variables that may affect subjective satisfaction, such as age, household registration, marital status, and education level of the individual; ε_{i} is the residual term.

To test whether the development level of the digital economy affects women's satisfaction by increasing their income levels, this study introduces female labor income as a mediating variable in the model for analysis, using stepwise regression for mediation effect testing. The stepwise regression testing process is as follows:

$$Happy_{it} = \beta_0 + \beta_2 Dig_{it} + \beta_i Control_{it} + \varepsilon_i \quad (2)$$

$$Lnincome_{it} = \beta_0 + \beta_3 Dig_{it} + \beta_i Control_{it} + \varepsilon_i \quad (3)$$

$$Happy_{it} = \beta_0 + \beta_4 Dig_{it} + \omega Lnincome_{it} + \beta_i Control_{it} + \varepsilon_i \quad (4)$$

The mediation effect is determined based on the significance of the regression coefficients in

these steps. The specific criteria for judgment are: (1) If the regression coefficient β_2 is significant, proceed to the next test; if not significant, it is concluded that there is no mediation effect. (2) If both β_3 and ω are significant, it indicates the presence of a mediation effect. (3) If the regression coefficient β_4 is not significant, it suggests a complete mediation effect (strong mediation); if β_4 is significant and $\beta_4 < \beta_2$, it indicates a partial mediation effect (weak mediation).

3.2 Variables

The dependent variable in this study is the Life Satisfaction Index ($\mathrm{Happy_{it}}$). The China General Social Survey (CGSS) asks respondents about their overall life satisfaction with five possible options. Responses marked as "don't know" or refusals to answer are considered missing data. In this paper, respondents' happiness is assessed in a 1-5 scale, with higher scores indicating greater happiness. This score is used as the indicator to measure life satisfaction.

The core explanatory variable is the level of digital economy development ($\mathrm{Dig_{it}}$). This study assesses the digital economy development level of each province in China using principal component analysis. The development level includes various factors such as internet penetration rate, mobile phone penetration per 100 people, mobile internet users per 10,000 households, urban employment in information transmission, software and information technology services per 10,000 people, number of corporate entities in the same sector, total telecom business volume in billions of yuan, length of fiber optic cable in kilometers, length of long-distance fiber optic cable in 10,000 kilometers, number of computers in use at the end of the period, and number of internet broadband access ports per 10,000. These raw data can be obtained from the "China City Statistical Yearbook". Through factor analysis, the digital economy development level index for each province is obtained. The specific process is as follows:

Factor Analysis is a multivariate data analysis method based on linear algebra and principles of probability and statistics. Its aim is to extract common factors from multiple variables and interpret these factors as latent variables. The mathematical model for principal component analysis is as follows:

Given N samples and P indicators, the sample data matrix $X_{(n\times p)}$ is formed as follows:

$$X_{(n\times p)} = \begin{bmatrix} x_{11} & \cdots & x_{1p} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{np} \end{bmatrix}$$

The data experiences dimensionless standardization, i.e. $y_{ij} = \frac{x_{ij}-\bar{x}_j}{s_j}$. This transforms the initial matrix $X_{(n\times p)}$ into the standard matrix $Y_{(n\times p)}$, where X_{ij} is the original data, y_{ij} is the standardized data, $\bar{x}_j = \frac{\sum_{i=1}^{n} x_{ij}}{n}$ is the mean of the j-th indicator, and $\sqrt{\frac{\sum_{i=1}^{n}(x_{ij}-\bar{x}_j)^2}{n-1}}$ is the standard deviation of the j-th indicator. Therefore, the new matrix $Y_{(n\times p)}$ has a mean of 0 and a variance of 1.

Let R be the correlation coefficient matrix of Y, then $R = YY^T$. Next, calculate the eigenvalues $\lambda_1, \lambda_2, \cdots, \lambda_p$ and eigenvectors $\mu_1, \mu_2, \cdots, \mu_p$ of R, where the eigenvalues and their corresponding

eigenvectors are standardized and orthogonal. Compute the principal component loading matrix A such that:

$$A = (\hat{a}_1, \hat{a}_1, \cdots, \hat{a}_m) = \begin{bmatrix} a_{11} & \cdots & a_{1m} \\ \vdots & \ddots & \vdots \\ a_{p1} & \cdots & a_{pm} \end{bmatrix} = \begin{bmatrix} \mu_{11}\sqrt{\lambda_1} & \cdots & \mu_{1m}\sqrt{\lambda_m} \\ \vdots & \ddots & \vdots \\ \mu_{p1}\sqrt{\lambda_1} & \cdots & \mu_{pm}\sqrt{\lambda_m} \end{bmatrix}$$

Determine the number of principal components m based on the magnitude of the eigenvalues and the cumulative variance contribution rate. Select the first m eigenvalues and their corresponding eigenvectors of the correlation matrix R, thus $A = (\hat{a}_1, \hat{a}_1, \cdots, \hat{a}_m)$, ensuring $\hat{a}_j = \mu_j\sqrt{\lambda_j}$, where j=1,2,…,m. Rotate the principal component loading matrix A, let $\beta_j = R^{-1}\hat{a}_j$, $F_j = Y\hat{\beta}_j$ (where j = 1,2,…,m), thereby obtaining the principal component model as follows:

$$f_{1j} = x_{11}\hat{\beta}_{1j} + x_{12}\hat{\beta}_{2j} + \cdots + x_{1p}\hat{\beta}_{mj}$$

$$f_{1j} = x_{11}\hat{\beta}_{1j} + x_{12}\hat{\beta}_{2j} + \cdots + x_{1p}\hat{\beta}_{mj}$$

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$$f_{mj} = x_{m1}\hat{\beta}_{1j} + x_{m2}\hat{\beta}_{2j} + \cdots + x_{mp}\hat{\beta}_{mj}$$

F_{ij} represents the score of the j-th principal component for the i-th enterprise. Consequently, the comprehensive level of the digital economy for each province is calculated as follows:

$$F_i = a_{ij}f_{i1} + a_{i2}f_{i2} + \cdots + a_{ij}f_{ij}$$

For this research, the control variables selected for the female respondents include age, household registration, marital status, and education level. The age of the respondents (Age) is determined by subtracting the birth year of the respondent from the survey year. The household registration system HJ_i is treated as a dummy variable, where $HJ_i = 1$ for non-agricultural household registration and 0 otherwise. In terms of marital status, individuals who are unmarried, separated but not divorced, divorced, or widowed are assigned $\mathrm{Married}_i = 0$, while those who are cohabiting, married for the first time with a spouse, or remarried with a spouse are assigned $\mathrm{Married}_i = 1$. The education level Edu_i is categorized into five levels: no education, primary school, junior high school, high school, and university or above, which are assigned values from 1 to 5, respectively.

3.3 Data Sources and Descriptive Statistics

This paper introduces data from the China General Social Survey (CGSS) to measure life satisfaction. The data include surveys from the years 2015, 2017, 2018, and 2021. Since its launch in 2003, the CGSS project has systematically collected data covering multiple dimensions including society, community, family, and individuals, which has been widely used in the fields of sociology and economics. The data on the level of digital economy development originates from the "China City Statistical Yearbook.

Table 1 shows the descriptive statistical results. The average subjective satisfaction score is 3.904, indicating that the female respondents generally lean towards higher satisfaction. The mean value for the digital economy level is 0.813, with a maximum of 3.403 and a minimum of -0.206, suggesting the significant range of variation.

Table 1. Descriptive Statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Happy	21296	3.904	0.835	1	5
Dig	21296	0.813	0.656	-0.206	3.403
Lnincome	21296	7.986	4.521	0	16.118
Age	21296	51.265	16.727	19	86
HJ	21296	0.369	0.482	0	1
Married	21296	0.747	0.435	0	1
Edu	21296	2.864	1.316	1	5

4 Empirical Results

4.1 Baseline Regression Results

The baseline regression results illustrate the impact of the digital economy on women's life satisfaction, as shown in Table 2. The coefficient for the digital economy development index is statistically significantly positive, which indicates that the development of the digital economy has enhanced women's life satisfaction. It confirms the Hypothesis H1.

Table 2. Baseline Regression Results.

	(1)	(2)	(3)	(4)	(5)
	Happy	Happy	Happy	Happy	Happy
Dig	0.0207**	0.0211**	0.0286***	0.0295***	0.0217**
	(2.38)	(2.42)	(3.29)	(3.40)	(2.50)
Age		-0.0449***	-0.0471***	-0.0501***	0.109***
		(-2.80)	(-2.94)	(-3.13)	(5.60)
HJ			0.153***	0.159***	0.0613***
			(12.93)	(13.41)	(4.48)
Married				0.0784***	0.0788***
				(5.96)	(6.02)
Edu					0.0827***
					(14.18)
constant	3.888***	4.062***	4.008***	3.958***	3.143***
	(426.90)	(64.34)	(63.59)	(62.31)	(36.79)
Obs	21296	21296	21296	21296	21296
Adj-R2	0.0002	0.0005	0.0083	0.0099	0.0191

Note: t statistics in parentheses*p<0.1, **p<0.05, ***p<0.01

4.2 The Mediation-Effect Regression Results

The study chose personal income level (Lnincome) as a mediating variable to investigate the mechanism of how women's labor income influences the relationship between the digital economy level and life satisfaction. The results in column (1) of Table 3 demonstrate that the coefficient of the digital economy level on subjective satisfaction is 0.0217, indicating the positive and significant effect of digital economy development on women's subjective satisfaction. Column (2) of Table 3 presents the significantly positive relationship between the digital economy level and women's labor income. The results in column (3) show that the coefficient of the digital economy level is 0.0212, which is less than 0.0217 but significant, and the coefficient of personal income is 0.0029, also significant. This implies that personal income level plays the mediating-factor role. The improvement in the digital economy level positively correlates with an increase in women's labor income, and personal income level also has a significant positive effect on subjective satisfaction. Therefore, the digital economy indirectly improves women's life satisfaction by enhancing their labor income. These findings elaborate the mechanism by which the digital economy impacts women's subjective satisfaction, with personal income playing a significant mediating role.

Table 3. The Mediation-Effect Regression Results.

	(1)	(2)	(3)
	Happy	Lnincome	Happy
Dig	0.0217**	0.147***	0.0212**
	(2.50)	(3.26)	(2.45)
Lnincome			0.00291**
			(2.21)
Age	0.109***	1.543***	0.105***
	(5.60)	(15.21)	(5.34)
HJ	0.0613***	1.412***	0.0572***
	(4.48)	(19.81)	(4.14)
Married	0.0788***	0.185***	0.0782***
	(6.02)	(2.72)	(5.97)
Edu	0.0827***	0.796***	0.0804***
	(14.18)	(26.18)	(13.57)
constant	3.143***	-1.087**	3.147***
	(36.79)	(-2.44)	(36.82)
Obs	21296	21296	21296
Adj-R2	0.0191	0.0916	0.0193

Note: t statistics in parentheses*p<0.1, **p<0.05, ***p<0.01

4.3 Heterogeneity analysis

China has experienced long-run disparities in the development of the economy and society, which distinguishes urban areas from rural ones and differs regions from each other. The urban-rural disparities are mainly observed between urban and rural areas. Regional disparities are predominantly seen between the eastern coastal provinces and the central-and-western inland provinces. The disparities are not only present in traditional sectors but are also significantly evident in the digital economy. As a result of the variations, the influence of the digital economy on the satisfaction of citizens shows varying patterns between urban and rural areas, and distinct traits between the eastern coastal regions and the central-and-western inland regions.

Table 4 indicates that the development of the digital economy in the central and western regions of China positively impacts women's satisfaction. In contrast, the growth of the digital economy in the eastern regions does not show the significant improvement in women's satisfaction. This could be due to the fact that the progress of the digital economy in the central and western areas has provided more opportunities and support for women. Conversely, although the digital economy is more developed in the eastern regions, its effect on enhancing women's happiness remains limited. The possible explanation could be the growth of the digital economy in these regions has not sufficiently addressed women's specific needs or made a significant impact in terms of gender equality.

For women with urban household registration, the development of the digital economy does not necessarily significantly enhance their sense of satisfaction, which potentially because of the high pressures of urban living and the entrenchment of gender roles. In contrast, women with rural household registration experience an increase in satisfaction due to the digital economy's development, as rural women can easily benefit from opportunities created by the digital economy in rural communities, which contributes to greater social participation. Moreover, in the relatively traditional rural society, the advancement of the digital economy may provide new opportunities for women, which further rises their sense of satisfaction.

Table 4 Regression Results of the Heterogeneity Test.

	(1)	(2)	(3)	(4)
	Central-and-Western Region Happy	Eastern Region Happy	Urban-Household Registration Happy	Rural-Household Registration Happy
Dig	0.0345* (1.71)	-0.0184* (-1.89)	0.00892 (0.70)	0.0276** (2.37)
Age	0.00336*** (5.21)	0.00375*** (6.87)	0.00465*** (7.97)	0.00347*** (6.05)
HJ	0.0348 (1.58)	0.00860 (0.48)		
Married	0.0667*** (3.36)	0.113*** (6.54)	0.0918*** (4.90)	0.0914*** (5.06)
Edu	0.109*** (12.03)	0.0656*** (8.57)	0.0786*** (9.40)	0.106*** (13.31)

constant	3.288***	3.521***	3.405***	3.320***
	(61.23)	(73.43)	(61.48)	(67.92)
Obs	10596	10700	7851	13445
Adj-R2	0.0188	0.0137	0.0154	0.0149

Note: t statistics in parentheses*p<0.1, **p<0.05, ***p<0.01

5 Conclusion and Policy Implication

With the rapid development of information and communication technology in China, the flourishing digital industry has been pushing the society into the era of the digital economy. Digital technologies and products have been widely integrated into various sectors, which positively affects the economy and society. Current research primarily emphasizes on how the digital economy affects economic and social performance, but the academic gap remains for micro-level analysis regarding its impact on residents' life satisfaction. This study uses data from the China General Social Survey (CGSS) from 2015 to 2021 and calculates provincial digital economy development indices through principal component analysis to empirically analyze the impact of digital economy development on women's life satisfaction. The results show that the development of the digital economy significantly enhances the life satisfaction of female residents. Mechanism tests indicate that the digital economy encourages life satisfaction by increasing personal annual income. Heterogeneity analysis reveals that the digital economy has a more significant effect on the life satisfaction of rural female residents compared to urban females; additionally, female residents in central and western regions experience a more significant increase in life satisfaction due to the digital economy's development compared to those in eastern regions.

Overall, this study fills a gap in the digital economy research domain concerning residents' life satisfaction and provides robust evidence for policy-making. The digital economy works as the engine for social progress that positively impacts economic and social performance and has a direct and substantial effect on women's life satisfaction. By narrowing down regional disparities and focusing particularly on the development of the digital economy in rural and central-western areas, more inclusive and sustainable outcomes of the digital economy can be achieved. This approach will provide a better living experience for a broader range of female residents.

The study raises the following recommendations:

Promoting digital economy in rural areas. Given the significant effect of the digital economy on enhancing the life satisfaction of rural female residents, it is advised that governments and relevant organizations take measures to promote the development of the digital economy in rural areas.

Strengthening support for women in central and western regions. The government should strengthen support for women in central and western regions by formulating policies and providing resources to ensure they can fully benefit from the development of the digital economy.

Emphasizing social equity and inclusivity of the digital economy. Highlighting the social

equity and inclusivity of the digital economy is crucial. Ensuring the widespread distribution of digital economy opportunities, particularly focusing on women, can better facilitate sustainable development of the digital economy and create a more just and inclusive social environment.

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