

Family Characteristics, Regional Differences and Information Consumption—— Based on the Research of Hierarchical Linear Model

Long ZHANG, He-Xu LI

School of Economics and Management, North Western University, Xi'an 710127, China

zhanglong_2005@sina.com

Key words: Family characteristics, Regional differences, Information consumption, Hierarchical linear model

Abstract: Based on the 2014 CFPS data and regional macro data, this paper discusses the ways and mechanisms of family characteristics and regional differences affecting information consumption by using hierarchical linear model. The results show that 8% of the differences in household information expenditure are caused by regional differences. Education level, urban and rural location and per capita income have significant positive effects on information consumption, and the influence of family size on information consumption is negative. Regional characteristics can not only directly affect the level of information consumption, but also can adjust the residents' information consumption tendency through cross level interaction effects. Therefore, in different areas, families with the same characteristics, the level of information consumption is not the same. According to this result, this article finally provides the corresponding policy suggestion for promoting the information consumption level and expanding the effective demand.

Problem Proposition

Since the Chinese economy into the new normal, investment growth down, the economic downturn, consumption-driven growth is particularly important. In the context of China's economic restructuring, the final share of consumer spending in GDP rose from 48.74% in 2010 to 51.11% in 2015. However, China's consumption rate is only about 37% in 2015, not only lower than the developed countries of the United States (68.10%) and the United Kingdom (65.07%),but also lower than the developing countries of India (59.57%) and Brazil (63.37%).Besides, far less than the world average of more than 60% level. In 2016, China's information consumption scale reached 3.9 trillion yuan, an increase of 22%, a direct contribution to GDP growth of 0.26 percentage points. In 2015, the United States, Japan per capita information consumption spending were \$ 3,400 and \$ 2,400, while China only \$ 631. Therefore, in the economic transition period, to expand consumer spending, and actively cultivate information consumption, enhance the information consumption space for the stability of economic growth, promote the upgrading of consumption structure is of great significance.

Through the research on the existing literature, foreign scholars have started earlier in the research of information research. Josephine (2000)'s research shows that the quality of information service, the quality of information and the language restriction are limited to the consumption of farmers' information service. Utkarsh (2017) used the structural equation model to examine the impact of individual differences on the service experience in information search behavior.

Domestic literature before 2013, basically on the theoretical level of information consumption research, and after 2013, there has been concerned climax of information consumption and focus on the empirical level. In the research of information consumption theory, Yinglong Zheng (1994) first proposed the concept of information consumption. In the empirical research, Huifang Zhang (2016) used the provincial panel data from 2003 to 2012 to study the relationship between the income of urban residents and the evolution of information consumption structure..

From the current research literature, the study of the influencing factors of information consumption is empirical research on macro factors or micro factors, mainly using traditional regression analysis method. In this paper, considering the external economic environment, policy

environment and family characteristics, combined with the factors affecting the macro and micro level, using the hierarchical linear model, we analyze the influence of family characteristics and regional differences on information consumption and put forward valuable policy recommendations for expanding information consumption and promoting rapid economic growth.

Many scholars at home and abroad have analyzed the factors that affect the consumption level, which can be classified into two categories, micro level factors and macro level factors.

At the micro level, the factors that influence household consumption include income level, family size, education level, urban and rural location, etc. The income is the main factor affecting the consumption decision. Family size depends on the number of households, which affects consumer demand (Shijie Yin, 2003). Information consumption is sharing and value-added, so the information consumption requirement for high quality consumers (Shijie Yin, 2003).

At the macro level in macroeconomic factors, such as product prices, industrial structure, social security system, economic development and so on, will have an impact on consumer behavior. Because consumer in a certain period, prices are important factors affecting consumption. The imbalance of industrial structure is the root of the current shortage of consumption demand (Wenxuan Pan, 2009). Social security can reduce uncertainty and promote consumption.

Based on the above analysis, this paper put forward the following hypotheses:

Hypothesis 1: information consumption expenditure is positively related to consumer price under other conditions unchanged.

Hypothesis 2: under other conditions unchanged, the higher the educational level, the higher the ability of information consumption.

Hypothesis 3: under the same conditions, the higher the proportion of the third industry in the consumer's area, the higher the information consumption expenditure.

Hypothesis 4: the improvement of social security system can indirectly promote the consumption level of residents.

Hypothesis 5: the greater the per capita GDP of a region, the higher the level of information consumption.

Hypothesis 6: family, urban and rural location difference has obvious influence on information consumption.

Hypothesis 7: the higher the per capita income of the family, the higher the level of information consumption.

Hypothesis 8: family size will reduce the level of information consumption.

Measurement Methods

In this paper, we use the family region stratified data, and use the hierarchical linear model to analyze two levels of factors. Building the model as follows:

$$\text{Micro level: } Y_{ij} = \beta_{0j} + \sum_{i=1}^n \beta_{ij} X_{ij} + \varepsilon_{ij} \quad (1)$$

$$\text{Macro level: } \beta_{ij} = \gamma_{i0} + \sum_{j=1}^m \gamma_{ij} Z_j + \mu_{ij} \quad (2)$$

Among them, X_{ij} for family level factors, Z_j for regional factors, and Y_{ij} for information consumption levels.

Data Selection and Variable Definition

In this paper, the micro data is selected from the 2014 China Family Panel Studies (CFPS) data, the macro data from China Statistical Yearbook 2015.

According to Yin Shijie (2003) on the definition of generalized information consumption, the amount of household information consumption is the sum of the three consumption expenditure of health care expenditure, transportation and communication expenditure and entertainment education

culture expenditure. The methods of variable selection and variable handling are shown in table 1.

Table 1 Variable selection

Variable name definition	Variable	computing method
Family level variables		
Lnc	Per capita information consumption expenditure	Per capita expenditure on information is logarithmic
Lni	Per capita annual income	Per capita annual income is logarithmic
Family si	Family size	number of family members
Urban	Urban-rural location	1 for urban;0 for rural
Edu	Average educational level	"Master" is 20, "undergraduate" is 17, "junior college" is 15, "secondary school / high school / technical school" is 12, "junior high school" is 9, "primary school" is 6, others is 1.
Regional level variables		
Lngdp	Per capita GDP	Per capita GDP is logarithmic.
P3	Proportion of third industries in the region	Ratio of added value of regional third industry to gross domestic product
Exp	Per capita social security expenditure	The per capita social security expenditure is based on the logarithm.
CPI	information consumer price index	According to the weight of the resident price index calculated by the National Bureau of statistics, the three consumer price indices of entertainment, culture, transportation, communications and health care are weighted equally.

Empirical Analysis

Feasibility Analysis

The zero model can help us to analyze the feasibility of the model by examining the correlation coefficient of the household information consumption expenditure (logarithm) group. If the intra-group correlation coefficient is not significant, the traditional regression analysis method can be used. On the contrary, consider the use of hierarchical linear model. The zero model is set as follows:

$$\text{The first layer: } \ln c_{ij} = \beta_{0j} + \varepsilon_{ij} \quad (3)$$

$$\text{The second layer: } \beta_{0j} = \gamma_{00} + \mu_{0j} \quad (4)$$

$$\text{The mixed model is: } \beta_{0j} = \gamma_{00} + \varepsilon_{ij} + \mu_{0j} \quad (5)$$

Table 2 Parameter estimation and test results for zero model

	Parameter Estimation	Zero model
Fixed effect	Regional average information consumption β_0	
	Intercept items γ_{00}	7.829***
		(0.061)
Variance component	Second floor area τ_{00}	0.091***
	The first floor area σ^2	1.048
Deviance (-2LL)		28026.014

Note: ***\ *** reprints $p < 0.01$ \ $p < 0.05$ \ $p < 0.1$ Brackets are standard errors.

From the regression results (see Table 2), it can be seen that the intercept term is 7.829 and the statistical significance is significant at the 1% level, indicating that the household per capital information consumption logarithm is 7.829. The intra-group correlation coefficient (ICC) is $0.080(p = \hat{\tau}_{00}/(\hat{\tau}_{00} + \hat{\sigma}^2) = 0.091/(1.048 + 0.091) = 0.080)$, which represents 8% of the total difference. According to the suggestion of Cohen (1988), it is a moderate degree of correlation, which is a non-negligible difference between groups. So we can not only use the general regression model for analysis, must take into account the characteristics of differences between groups.

Analysis of influencing factors of information consumption

A complete model can help us analyze the impact of family level factors and regional factors on the level of information consumption. The first layer of the whole model is the whole model, and the second layer model is also the complete model. Model settings are as follows:

The first layer:

$$lnc_{ij} = \beta_{0j} + \beta_1 * familysi + \beta_2 * urban + \beta_3 * lni + \beta_4 * edu + \varepsilon_{ij} \tag{6}$$

The second layer:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * P_3 + \gamma_{02} * lngdp + \gamma_{03} * lnExp + \gamma_{04} * CPI + \mu_{0j} \tag{7}$$

$$\beta_1 = \gamma_{10} + \gamma_{11} * P_3 + \gamma_{12} * lnExp + \mu_1 \tag{8}$$

$$\beta_2 = \gamma_{20} + \gamma_{21} * CPI + \mu_2 \tag{9}$$

$$\beta_3 = \gamma_{30} + \gamma_{31} * lngdp + \gamma_{32} * CPI + \mu_3 \tag{10}$$

$$\beta_4 = \gamma_{40} + \gamma_{41} * P_3 + \mu_4 \tag{11}$$

The mixed model is:

$$lnc_{ij} = \gamma_{00} + \gamma_{01} * P_3 + \gamma_{02} * lngdp + \gamma_{03} * lnExp + \gamma_{04} * CPI + \gamma_{10} * familysi + \gamma_{11} * familys * P_3 + \gamma_{12} * lnExp * familys + \gamma_{20} * urban + \gamma_{21} * CPI * urban + \gamma_{30} * lni + \gamma_{31} * lngdp * lni + \gamma_{32} * CPI * lni + \gamma_{40} * edu + \gamma_{41} * P_3 * edu + \mu_0 + \mu_1 * familysi + \mu_2 * urban + \mu_3 * religion + \mu_4 * edu + \mu_5 * lni + \varepsilon_{ij} \tag{12}$$

In the above equation, i represents the family, j represents the region, $\beta_1 \dots \beta_4$ represents the partial regression coefficient of the family level independent variable to the model respectively; $\gamma_{00} \dots \gamma_{40}$ respectively expresses the fixed effect of each equation.

In the data processing process, each observation is subtracted from the average of the group of observations, and the "centering" process is performed, so that the value of the variable becomes smaller and the collinearity between the variables becomes smaller ; The second will reduce a degree of freedom, in the future estimates of the error term variance, there will be biased

characteristics. Using HLM software for analysis, the results reported in Table 3.

From the regression results, the proportion of the tertiary industry, the per capita GDP, the per capita area of social security and the consumer information consumption price index of the situational effect is significant, and positive. In addition, they have obvious cross-level interaction. Indicating that they can explain the regional differences in information consumption levels and are positively correlated with the level of household information consumption.

The impact of family factors and regional factors on information consumption will be discussed separately below.

Average Consumption of Information between Regions

From the regression results, for the average information consumption items, to enhance the proportion of the third industry can promote the improvement of the level of information consumption (confirmed hypothesis three), but the impact is relatively small. In areas with better economic development, the level of information consumption is also higher (hypothesis five). Social security expenditure has a significant effect on information consumption. The higher the per capita social security expenditure, the higher the level of information consumption in the region (confirmed hypothesis four). The coefficient of the consumer information consumer price index is positive (confirming hypothesis one), which indicates that the rise in the price of information consumer goods has increased the level of regional information consumption. It should be noted that this refers to the impact of price levels on the overall level of consumption, rather than on the impact of individual goods or certain commodity consumption.

Table 3 Complete model

Fixed effect		Coefficient	Standard Error	T-ratio	P-value
Average per capita information consumption	β_0				
Intercept items	γ_{00}	7.830	0.031	250.547	0.000
The proportion of the tertiary industry	γ_{01}	0.006	0.003	1.900	0.071
Per capita GDP	γ_{02}	0.369	0.077	4.745	0.000
Employment, social security expenditure	γ_{03}	0.350	0.083	4.231	0.000
Resident Information Consumption Price Index	γ_{04}	0.229	0.115	1.983	0.061
Family size slope	β_1				
Intercept items	γ_{10}	-0.088	0.008	-10.796	0.000
The proportion of the tertiary industry	γ_{11}	-0.002	0.000	-2.203	0.038
Per capita regional social security expenditure	γ_{12}	0.053	0.018	2.972	0.008
Urban and rural location slope	β_2				
Intercept items	γ_{20}	0.161	0.027	5.838	0.000
Resident Information Consumption Price Index	γ_{30}	0.182	0.054	3.391	0.003
Per income slope	β_3				
Intercept items	γ_{30}	0.188	0.015	12.925	0.000
Per capita GDP	γ_{31}	0.098	0.020	4.936	0.000
Resident Information Consumption Price Index	γ_{32}	0.062	0.029	2.171	0.041
Average educational slope	β_4				
Intercept items	γ_{40}	0.065	0.004	17.325	0.000
The proportion of the tertiary	γ_{41}	0.0014	0.000	4.629	0.000

industry					
Random effect		Variance Compent	df	Chi-squa re	P-valu e
Average per capita information consumption	τ_{00}	0.026	20	235.051	0.000
Family size slope	τ_{10}	0.000	22	35.159	0.037
Urban and rural location slope	τ_{20}	0.008	23	30.849	0.126
Household per capita income slope	τ_{30}	0.000	22	39.991	0.011
Educational slope	τ_{40}	0.000	23	26.188	0.292
Level-1	σ^2	0.900			
Deviance (-2LL)	26634.118				

The impact of individual family characteristics on information consumption

The regression coefficients of the intercept term on the first layer of independent variables represent the effect of individual characteristics on information consumption. The results show that the intercept items of each independent variable are statistically significant, indicating household income, family population, urban and rural education and education level have a significant effect on information consumption. Specifically, from the regression results of the complete model, we can see that the income has a significant influence on household consumption, and the regression coefficient of the intercept item is 0.188. This shows that the increase of 1% of the income makes the consumption increase by about 0.188%. The higher the income, the higher the level of information consumption (confirmed hypothesis seven). The regression coefficient of urban and rural location reached a significant level of 1%, indicating that there was a significant difference in the level of household information consumption between urban and rural areas (confirmed hypothesis two). The regression coefficient of education level is 0.065, which is 1% of the significance level, indicating that education has a significant effect on the improvement of information consumption level, the higher the education level of residents, the higher the level of information consumption (confirmed hypothesis six). The slope of the family size is negative (-0.088), indicating that the higher the population of the family, the lower the level of information consumption, indicating that in a family, the population growth will inhibit high-level consumption, the results **consistent** with the theoretical part (Confirm hypothesis eight).

Regional Characteristics Adjust Information Consumption Effects of Individual Characteristics

The hierarchical linear model can describe the effects of cross level interaction on information consumption, which is shown by the regression coefficients of the second independent variables nested in the first layer of the independent variable.

In the first layer under the family size, the proportion of the third industry and the second layer of social security expenditure on family size on information consumption regression coefficient has significant effects, the proportion of the third industry a rise of one percentage point, by family size makes the influence of information consumption is reduced by 0.002, social security expenditure by family size makes the information consumption elasticity 0.053. This shows that in the third industry accounted for a relatively high area, with the increase in the number of units of household population, information consumption level will decline; and in the social security expenditure in higher areas, with the increase in the number of units of household population, information consumption level will increase.

In the first layer of urban and rural locations under the regression coefficient of residents information consumption price index is positive, the residents information consumption price index higher areas, urban and rural locations for the influence of information consumption is more obvious, the gap between urban and rural consumption information is also bigger.

In the first layer of the income level under the more developed economy, the information

consumer price index higher areas, family information consumption is greater, which is reflected in the per capita GDP for information consumption income elasticity coefficient is 0.093, the consumer price index information to income information consumption regression coefficient was 0.062, and in statistics significant.

In the first layer under the education level, the higher the proportion of the third industry area, the level of education for the promotion of information consumption effect is greater, but the effect of the proportion of the third industry are very small, because the regression coefficient is almost equal to zero, from the point of view, in the same conditions, each of the 10 percent increase in the proportion of the third industry, then each additional year of education level, information consumption level will be increased by 0.067 ($\exp(0.065+0.00014) - 1$)%.

Random Effect

In the random effect, we can see that in joining the regional characteristics of the variables, intercept, income and family size random effects are still significant, which shows that we also need to explain their variation to find other variables, and for the urban and rural location and level of education, they are well explained in the variation at the regional level, there is no need to search for other explanatory factors.

Concluding Comments

To sum up, the level of information consumption between regions has obvious differences, and regional characteristics can influence the consumption of information through two ways:

First, regional characteristics directly lead to regional differences in information consumption; second, regional characteristics also lead to differences in individual characteristics, information consumption elasticity. Individual characteristics for information consumption expenditure has a significant impact, at the same time, due to the regional characteristics can influence consumer information through interaction, so individual characteristics at the same level of information consumption in different regions is not the same. Specific conclusions are as follows:

First of all, regional heterogeneity leads to the difference of information consumption level. From the analysis results, the difference in information consumption between the regions accounts for 8% of the total household information consumption, and this difference cannot be ignored.

Secondly, according to the characteristics of complete model regression results shows, including the proportion of the third industry, per capita GDP and employment, social security spending increase of area average consumption of information has a significant role in promoting.

Finally, from the point of view of the whole model, the individual characteristics are decisive to the decision of information consumption. More importantly, constraints and adjustment determine individual characteristics for information consumption tend to be affected by the regional characteristics, and the direction of the adjustment direction and the influence of the individual characteristics of information consumption may not agree.

The above research and analysis have the following meanings: The first is to expand domestic demand, improve information consumption level, the most fundamental way is to increase the income of residents. Secondly, urbanization can absorb the surplus rural labor force, co-ordinate urban and rural development, speed up the pace of urbanization, pay attention to the quality of urbanization, will greatly enhance the level of rural household information consumption. The third is to increase the investment of human capital, extend the education years, improve the education level of residents, can effectively improve the residents' information consumption propensity. The government should especially increase investment in rural basic education, and the educational public resources should be tilted to the rural areas to make up for the lack of long-term investment in rural education. The fourth is on the supply side, the country should actively promote regional industrial structure upgrading, so as to expand the high level consumption of residents, promote the region's rapid economic growth.

Acknowledgments

This paper is one of the achievements of the National Social Science Foundation Project "hierarchical linear model applied to the study of income and consumption of Chinese residents and its relationship" (13BTJ012).

References:

- [1] Josephine L Dorsch. Information needs of health professionals: a review of the literature, *J. Bull Med Library Association*, 2000, 88(4):346-354.
- [2] Utkarsh. Individual Differences in Consumer Information Search for Services: A Multiple Mediation Study, *J. Journal of Retailing and Consumer Services*, (2017)323--351.
- [3] Pan Wenxuan. Reasons and Countermeasure for China's Inadequate Consumption Demand: From the perspective of Imbalanced Industrial structure, *J. Journal of Hebei University of Economics and Trade*, 2009, (06):28-33.
- [4] Zhang Huifang, Ai Tianxia. Income growth of urban residents and evolution of information consumption structure: An Empirical Study Based on Provincial Panel Data, *J. Inquiry into Economic Issues*, 2016, (12):82-89.
- [5] Yin Shijie. Consumer demand and economic growth, *J. Consumer Economics*, 2004, (05):3-7.
- [6] Zhang Long, Ge Jing. Human Capital Characteristics, Industry Characteristics and the Industry Income Gap----Based on the Research of Chinese Family Panel Survey Data, *J. Journal of Shanxi University of Finance and Economics*, 2015, (11):65-76.
- [7] Zheng Yinglong, Wang Yong. Research on Growth of Structure Difference of Information Consumption in China, *J. Business Management Journal*, 2009, (01):152-159.