Spatial Correlation and Determinants of Information Consumption Among Urban Residents in China: An Empirical Study Based on a Dynamic Spatial Durbin Panel Model (Postprint)

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Abstract

【目的】Information consumption has emerged as a burgeoning consumption hotspot. To facilitate the advancement of information consumption levels among urban residents, this study examines its determinants.

【方法】This paper analyzes the developmental trajectory and spatial correlation of information consumption among Chinese urban residents, alongside three categories of internal and external influences on contemporaneous information consumption, constructs a corresponding theoretical framework, and subsequently conducts empirical investigation employing a dynamic spatial Durbin model.

【结果】Current-period information consumption expenditure does not engender spatial spillover effects on neighboring regions; information consumption demonstrates durable goods characteristics, while residents' information consumption patterns are subject to influence by the information consumption habits of residents in adjacent areas. Among the influencing factors, escalations in price levels and income stimulate local residents' information consumption expenditure in the short term; conversely, enhancements in education levels and information infrastructure generate significant positive spatial spillover effects on neighboring regions in the short term. In the long-term effects, only price levels and income exert influence on local residents' information consumption expenditure.

【局限】Due to data availability constraints, five factors were selected for analysis: price index, education level, information infrastructure, number of internet users, and income. Omitted factors may potentially impact the analytical results.

【结论】When investigating the determinants of household consumption, various spatial effects must be accounted for; otherwise, estimation results may be subject to bias.

Full Text

Preamble

Spatial Correlation and Influencing Factors of Information Consumption Among Urban Chinese Residents: An Empirical Study Based on Dynamic Spatial Durbin Panel Model

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Abstract

[**Objective**] Information consumption has become an increasingly important driver of economic growth. To promote information consumption among urban residents, this study investigates its key influencing factors. [**Methods**] We analyze the development trajectory and spatial correlation of information consumption among urban Chinese residents, examining three types of internal and external influences on current consumption. We construct a theoretical model and conduct empirical analysis using a dynamic spatial Durbin panel model. [**Results**] Current information consumption expenditures exhibit no spatial spillover effects on neighboring regions, while demonstrating durable goods characteristics. However, residents' information consumption is influenced by the consumption habits of residents in adjacent areas. Among the influencing factors, price and income increases stimulate local information consumption in the short term, whereas improvements in education levels and information infrastructure generate significant positive spatial spillover effects on neighboring regions. In the long term, only price and income levels affect local residents' information consumption expenditures. [**Limitations**] Due to data availability constraints, we examine only five factors: price index, education level, information infrastructure, number of internet users, and income. Unconsidered factors may influence the results. [**Conclusions**] When studying factors affecting household consumption, spatial effects must be incorporated; otherwise, estimates may be biased.

Keywords: Information Consumption; Spatial Correlation; Internal Influence; External Influence; Dynamic Spatial Durbin Panel Model
Classification Codes: F49; G35

3. Information Consumption and Its Influencing Factors

Consumption theory represents a core topic in economics. By constructing consumption functions to examine relationships between expenditures and influencing factors, researchers can provide theoretical foundations for effective consumption policies. In August 2013, the State Council published the White

Paper "Several Opinions on Promoting Information Consumption to Expand Domestic Demand," establishing information consumption as a growing hotspot with substantial potential to upgrade consumption patterns, release market potential, and stimulate effective investment. Consequently, analyzing information consumption' s influencing factors has become essential [1].

Three critical questions must be addressed: First, do provincial-level urban residents' information consumption patterns exhibit spatial spillover effects, given that ignoring cross-regional correlations yields biased conclusions? Second, does the habit formation theory commonly applied in consumption research apply to Chinese urban residents' information consumption, and does information consumption' s unique nature create internal and external habit formation effects? Third, based on these analyses, are dynamic non-spatial panel models or static spatial panel models appropriate for this research question?

This study addresses these questions by analyzing influencing factors of urban Chinese residents' information consumption. Habit formation theory comprises internal habit formation—emphasizing how consumers' past consumption affects current decisions—and external habit formation—examining how demonstrative groups' consumption behaviors influence others. Naik et al. constructed a theoretical consumption habit model based on lifecycle hypotheses through utility maximization [2]. Dynan studied how consumption habits affect current consumption using intertemporal utility maximization models [3]. Guariglia and Rossi examined how consumption habits, permanent income, and labor income risk influence current consumption [4]. Angelini investigated the effects of consumption habits, precautionary saving, wealth, and income on current consumption [5]. Alessie and Teppa analyzed habit formation and income uncertainty impacts on consumption [6].

Previous consumption research exhibits three limitations: First, most studies consider only internal or external habit formation, or alternatively, only spatial effects of current consumption, rarely integrating all three influences simultaneously. External habit formation receives limited attention or is proxied by averages. Second, few studies analyze spatial correlations when examining information consumption determinants. Third, no research has definitively established whether habit formation effects exist in residents' information consumption.

This paper analyzes spatial correlations in urban Chinese residents' information consumption and the three internal/external influences on current consumption, employing a dynamic spatial Durbin panel model to empirically examine influencing factors.

4.2 Analysis of Urban Residents' Information Consumption Coefficient

The information consumption coefficient reflects the proportion of information consumption in total household expenditures, representing a new dimension for characterizing information society and informatization development stages.

A larger coefficient indicates higher consumption levels and quality. Figure 2 [Figure 2: see original paper] illustrates the trend from 2002–2013, showing fluctuations but an overall upward trajectory from 0.3248 in 2002 to 0.3412 in 2013, averaging 0.48% annual growth.

4.3 Analysis of Urban Residents' Information Consumption Propensity

Information consumption propensity measures the share of income allocated to information consumption, directly reflecting consumption demand willingness and intensity. Figure 3 [Figure 3: see original paper] shows the 2002–2013 trend, revealing fluctuations but an overall decline from 0.2543 in 2002 to 0.2281 in 2013, averaging a 0.94% annual decrease.

4.4 Global Spatial Correlation Analysis of Urban Residents' Information Consumption

We initially employed k-nearest (k=4) spatial weight matrices and provincial geographic distance matrices. Results indicated spatial connections primarily occurred between regions sharing common boundaries, with spatial correlation diminishing with distance. Consequently, we adopted a first-order rook-based weight matrix (treating Guangdong and Guangxi as Hainan' s adjacent regions) [22-23].

Table 1 presents Moran' s I statistics and significance levels for urban Chinese residents' information consumption. Since 2002, Moran' s I values have been highly significant, demonstrating strong positive spatial correlation. Figure 4 [Figure 4: see original paper] illustrates the Moran' s I trend, showing an overall upward pattern despite slight fluctuations in 2010.

4.5 Local Spatial Correlation Analysis of Urban Residents' Information Consumption

Figure 5 [Figure 5: see original paper] presents the 2013 Moran' s I scatter plot for urban residents' information consumption, with a Moran' s I value of 0.341 indicating high spatial autocorrelation. The first quadrant contains six provinces (Beijing, Shanghai, Tianjin, Jiangsu, Fujian, Zhejiang) exhibiting high-high (HH) characteristics–high consumption levels with high spatial lag. The second quadrant includes six provinces (Hainan, Jiangxi, Hebei, Heilongjiang, Anhui, Guangxi) showing low-high (LH) patterns. The third quadrant comprises 14 provinces (Hunan, Shanxi, Ningxia, Shaanxi, Gansu, Guizhou, Henan, Hubei, Chongqing, Sichuan, Yunnan, Tibet, Qinghai, Xinjiang) with low-low (LL) characteristics. The fourth quadrant contains two provinces (Guangdong, Inner Mongolia) with high-low (HL) patterns. Three provinces (Jilin, Shandong, Liaoning) exhibit atypical spatial features.

Figure 6 [Figure 6: see original paper] shows the Moran' s I scatter plot for 2002–2013 average information consumption, with Moran' s I of 0.285 indicating high spatial autocorrelation. The first quadrant includes six provinces (Fujian, Jiangsu, Tianjin, Shanghai, Zhejiang, Beijing) with HH characteristics. The second quadrant contains five provinces (Hainan, Jiangxi, Hebei, Anhui, Guangxi) with LH patterns. The third quadrant includes 16 provinces (Heilongjiang, Hunan, Jilin, Guizhou, Ningxia, Shanxi, Henan, Gansu, Hubei, Tibet, Qinghai, Xinjiang, Sichuan, Yunnan, Chongqing, Shaanxi) with LL characteristics. The fourth quadrant contains Guangdong with HL characteristics. Three provinces (Liaoning, Shandong, Inner Mongolia) show atypical features.

These analyses reveal that while urban residents' information consumption expenditures grew rapidly and consumption willingness declined, spatial correlation between regions increased.

6. Empirical Results and Analysis

Based on the theoretical model (equation (2)), we introduced control variables affecting information consumption, applied logarithmic transformations, and reparameterized to obtain the dynamic spatial panel Durbin model (equation (3)). Given information consumption' s spatial correlation, spatial factors must be incorporated to avoid biased estimates. Spatial factors enable us to introduce lagged terms of information consumption and their spatial lags to reflect internal and external influences. Current information consumption experiences three effects: (1) internal influence from previous consumption; (2) external influence from spatially lagged previous consumption; and (3) external influence from spatially lagged current consumption.

The habit formation utility function is temporally non-separable: $U(C_t, H_t)$, where H_t represents habit stock with the time evolution form shown in equation (1). C_{t-1} represents internal influence from previous consumption; C'_{t-1} represents external influence from other regions' previous consumption; and C'_t represents external influence from other regions' current consumption. If parameters $\gamma_2\theta$, $\gamma_3\theta$, and $\gamma_4\theta$ exceed zero, habit formation effects exist. If these parameters are negative, consumption exhibits durability with intertemporal substitution effects [24].

Building on Naik' s lifecycle habit formation model [2] and Hang' s permanent income model [8], we introduce a utility function incorporating three internal/external influences to derive the theoretical model (equation (2)). Detailed derivations are available upon request.

Static spatial effect test results appear in Table 2 . Likelihood ratio tests indicate that under static conditions, a two-way fixed effects model incorporating both individual and time fixed effects is appropriate. However, (robust) LM tests suggest a spatial error model.

Table 3 presents static and dynamic spatial panel Durbin model regression re-

sults. For the static model, Wald_{spatial} and LR_{spatial} tests significantly reject simplifying the spatial Durbin model to spatial lag or spatial error specifications, supporting the spatial Durbin model approach.

However, static models inadequately describe consumption inertia. The dynamic spatial Durbin model enhances explanatory power, achieving higher R^2 and LogL values. We tested whether $L.\ln CZXF$ and $W * L.\ln CZXF$ coefficients are jointly significant through an omitted variable LR test (equation (4)). The LR statistic of 38.2168 follows a χ^2 distribution with 2 degrees of freedom ($p = 0.0000$), rejecting the null hypothesis and confirming that lagged consumption factors should be included.

Calculating $\tau + \rho + \eta$ yields 0.7646. A bilateral Wald test of the null hypothesis $\tau + \rho + \eta = 1$ produces a test statistic of 7.2460, which rejects the null, indicating the dynamic spatial Durbin model satisfies stability conditions. An F-test for time effects (statistic=3.3850, df=(10,287)) supports using a two-way fixed effects model with time fixed effects.

Table 3 results show that under dynamic conditions, $W * \ln CZXF$ is insignificant, indicating current information consumption generates no spatial spillover effects on neighboring regions. In contrast, static spatial Durbin model results suggest significant spatial spillover effects, demonstrating its inability to distinguish between current and lagged effects, leading to omitted variable bias.

Table 4 presents dynamic spatial panel Durbin model results for information consumption inertia effects. The negative internal effect of previous consumption indicates information consumption' s durable characteristics—higher previous consumption reduces current consumption. This reflects durable goods properties: purchasing computers or phones reduces subsequent expenditures on these items. Additionally, information services' non-rivalrous and shareable nature allows unlimited usage and consumption, enabling "free-riding" that reduces current expenditures following high previous consumption. Conversely, previous consumption generates positive spatial spillover effects, indicating that regional consumption is influenced by neighboring regions' consumption habits —an effect undetectable through static models.

Dynamic spatial panel models decompose explanatory variable effects into short-term and long-term components, each further divisible into direct and indirect effects. Table 5 presents these decompositions based on Table 3 parameter estimates.

Short-term effects show that price and income increases raise local information consumption (effects: 0.7543 and 1.1548), while other variables' direct effects are insignificant. Education and information infrastructure improvements generate significant positive spatial spillover effects on neighboring regions (effects: 0.0389 and 1.2592), suggesting educated population mobility stimulates neighboring regions' consumption. Local information infrastructure improvements create positive spillovers despite insignificant negative local effects, indicating

that while infrastructure upgrades may reduce information consumption prices, local expenditures remain unaffected.

Long-term effects reveal that only price and income significantly affect local consumption, with no significant spatial spillover effects for any variables.

Based on 2002–2013 panel data analysis of spatial correlation and influencing factors in urban Chinese residents' information consumption, we conclude: (1) External habit formation from spatial effects plays a non-negligible role in promoting information consumption; (2) Information product and service supply capacity should be enhanced while strengthening legal and technical measures to regulate information content usage; (3) Region-specific policies should be implemented for low-level clusters, high-level clusters, and mixed high-low clusters to improve income, education, and infrastructure, thereby establishing long-term mechanisms for sustainable consumption growth.

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Supporting Data

Supporting data are self-archived by the author and available upon request at E-mail: 1980zhangsu@163.com.

[1] Zhang Su. xinxixiaofei.xlsx. Panel data on information consumption and influencing factors.

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Information Consumption of Urban Chinese Residents: An Empirical Study Based on Dynamic Spatial Durbin Panel Model

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Abstract: [Objective] This paper analyzes the factors influencing information consumption, aiming to further promote such activities among urban Chinese residents. [Methods] First, we studied the development condition, spatial correlation and three types of internal and external influencing factors. Then, we constructed the corresponding Dynamic Spatial Durbin Panel Model and conducted an empirical study. [Results] The information consumption had the

durable features but posed no spillover effects. The urban residents' consumption could also affect the adjoining region residents' behaviors. The increasing of price and income promoted the information consumption in short term. The improvement of education and information infrastructure posed spatial spillover effects to adjoining residents. In the long term, only the price and income had impacts on local residents. [Limitations] We only examined the impacts of the price, education level, information infrastructure, number of cyber citizen, and income. Other factors might also affect the results. [Conclusions] We must study the residents' information consumption behaviors based on all spatial spillovers to avoid biased results.

Keywords: Information Consumption; Spatial Correlation; Internal Influence; External Influence; Dynamic Spatial Durbin Panel Model

Note: Figure translations are in progress. See original paper for figures.