sustainability

MDPI

Article

Psychological Needs, Physiological Needs and Regional Comparison Effects

Xuepin Wu and Jiru Han *

Department of Economic, Hainan University, Haikou 570228, China; xuepin19@126.com
* Correspondence: hjr15838245377@163.com

Abstract: This paper innovatively constructs a panel extended linear expenditure system (ELES) model including the theory of internal and external habit formation and analyzes the time effect of consumption habits and the regional differences of the comparison effects on rural residents in a variety of consumption expenditures from a temporal and spatial perspective. This research demonstrates the following. Firstly, overall, rural residents have least internal habits in terms of subsistence spending, followed by developmental spending and the most in enjoyment spending. Secondly, China's rural residents consider the "actual use value" of commodities in "introverted" consumption expenditures; but in "export-oriented" consumption expenditures, besides the "actual use value" of the goods, they also seek to fulfill their "emotional demands". Thirdly, there is the largest comparison effect on food and housing consumption expenditures for rural residents in coastal economic developed regions, and the smallest comparison effect on clothing, transportation, cultural and educational expenditures. It is the largest comparison effect on clothing and medical care expenditures for rural residents in underdeveloped regions of the central and western, and the smallest comparison effect on food and housing consumption expenditures.

Keywords: time effect; comparison effect; panel extended linear expenditure system (ELES) model

Citation: Wu, X.; Han, J. Psychological Needs and Physiological Needs and Regional Comparison Effects. *Sustainability* **2021**, *13*, 9464. https://doi.org/10.3390/su13169464

Academic Editors: Domingo Ribeiro-Soriano and Andrea Rey-Martí

Received: 10 June 2021
Accepted: 19 August 2021
Published: 23 August 2021

1. Introduction

Do all kinds of consumption expenditures have a time effect? Are there any regional differences in the comparison effect? Physiological needs are the first needs of human beings, and also the most basic and minimal needs of human beings, such as the needs of food, clothing, shelter to meet the needs of relieving hunger, keeping out the cold and sleeping. If these needs cannot be met to a minimum, human beings cannot continue to survive and multiply. Psychological needs are the highest and most advanced needs. The Hierarchy of Needs Theory of the famous American Psychologist Maslow believes that psychological needs include safety, love and belonging, being respected and self-realization. According to consumption theory, residents seek to fulfill both physiological and psychological needs by means of various types of consumption expenditures. Physiological needs are not related to income, but psychological needs are affected by income as well as previous expenditures (i.e., habit preferences). With an increase in consumer income, the associated with consuming certain commodity changes over time and, to a certain extent, psychological and physiological needs changing over time reflects the essence of residents' demand for this type of commodity. We call this phenomenon a time effect. The comparison effect is also called the joint external positive effect, that is, the consumer's demand for a certain commodity will be affected by the demand for the same kind commodity for other people around. In addition, different regions have different nationalities, consumer groups, regional cultures and government functions because of the constraints and influences of the natural and social environment.

These factors affect local residents' consumption behavior and form different regional consumption characteristics. Furthermore, after Chinese economy has entered a new normal, the consumption situation has undergone significant changes, consumption patterns have continued to innovate, and personalized and diversified consumption has gradually become the mainstream. According to the National Bureau of Statistics, the contribution rate of final consumption to economic growth in 2019 is close to 60%. Consumption is still the main driving force for economic growth, but the current institutional obstacles which are restricting the expansion and upgrading of consumption are still prominent. Consumer markets in key areas are still unable to effectively meet the multi-level and diversified consumption needs of urban and rural residents. The consumption policies for different geographical groups still lag behind the needs of consumption improvement and capacity expansion. The consumption policy system is still unable to effectively support the improvement of residents' consumption ability and expected improvement. Therefore, the goal of this study is to: study the time effect of the physiological and psychological needs of various types of rural residents' expenditures, grasp the regional differences in the comparison effect of rural residents in various types of consumption expenditures, explore the consumption potential of rural residents, guide rural residents to rationally expand their consumption, and promote the consumption structure. It is of great practical significance to optimize, upgrade and enhance the basic role of consumption in economic development.

In the current research on residents' consumption behavior, few documents study the dynamic changes of rural residents' psychological and physiological needs in various consumption expenditures from the perspective of habitual preference; few documents have studied the regional differences and dynamic characteristics of the "comparison effect" of rural residents in various consumption expenditures. The biggest contributions of this paper are: First, embed the theory of internal habit formation into the panel ELES model and build a panel ELES model within time effects, and empirically study the dynamic changes of the physiological and psychological needs of rural residents in different regions for various consumption expenditures; the second is to embed external habits into the panel ELES model to empirically study the differences in consumption comparison effects of rural residents in different regions.

The influence of internal and external habits on consumer behavior is a complex social and psychological phenomenon that is not only affected by consumers' own needs, motivations and other psychological factors but also by the external social environment of consumers, such as the social economic culture, consumer family environment and consumer groups. Habit formation theory posits that due to the "ratchet effect" and "demonstration effect" of consumption, consumers' behavior is affected by an individual's early consumption level (i.e., internal habit formation) and the consumption behavior of surrounding groups (i.e., external habit formation). Robert A. Pollak first introduced internal and external habit formation into the extended linear expenditure system (ELES) model in 1970 and 1976 [1,2]. Based on Pollack's research [1,2], Louis Phlips [3] introduced state variables representing the impact of early behavior into the ELES model to reflect the impact of income changes and early behavior on the consumption structure.

Since then, habit formation has been introduced into various studies on resident consumption expenditures and household savings. Matthew T. Holt and Barry K. Goodwin [4] introduced the reverse almost ideal demand system to study the impact of habit formation on meat expenditures in the United States. Bob Alessie and Federica Teppa [5] discovered that habits form evidence supporting Dutch residents' saving behavior. Roman Muraviev [6] identified detailed characteristics about the optimal consumption flow for the problem of maximizing habit formation utility. Benjamin Verhelst and Dirk Van den Poel [7] used the spatial panel data model to empirically analyze the impact of internal and external habits on different levels of consumer spending. Hein de Vries et al. [8] studied the influence of habit formation and an individual's previous behavior on fruit consumption. Chetty and Szeidl's [9] research demonstrated that the

formation of consumer habits leads to oversensitive and too smooth consumption. Emmanuelle Augeraud-Veron et al. [10] improved the internal habit formation model through infinite dynamic programming. Tiong-Thye Goh et al. [11] used political participation cases to show evidence of habit formation in social media consumption. Fatya Alty Amalia et al. [12] conducted a study on halal food purchases of Indonesian millennials and showed that purchase intentions and habits can independently influence their purchase behavior. Foreign scholars have studied the impact of internal and external habits on household savings, consumption expenditures and individual consumption. Even though a few scholars have introduced the formation of internal and external habits into the ELES model, they have not applied a panel ELES model.

In recent years, habit formation theory has also been introduced into different mathematical models by domestic scholars to study its impact on resident consumption. The first category studies the impact of internal and external habits on the total consumption of urban and rural residents. The results demonstrate that habit formation is an important explanatory variable affecting residents' consumption [13]. Urban and rural residents' consumption shows significant internal habit formation. Internal and external habit formation has a significant impact on urban residents' average propensity to consume and their consumption structure [14–16]. From the perspective of consumption structure, rural residents' various consumption expenditures show significant internal habit formation and their consumption of transportation, communication, education, cultural and entertainment services is affected by the demonstration effect of urban residents' consumption [17]. The consumption behavior of urban residents has a demonstration effect on rural residents [18]. New urbanization has accelerated the improvement of residents' consumption levels through the "demonstration effect" of external habit effects [19]. The formation of habit slows down the rate of changes in urban residents' consumption and inhibits the increase in consumption propensity [20]. Since the reform and opening up, the consumption behavior of rural residents in my country has obvious habit formation effects. Both excessive sensitivity and habit formation effects are greatly different due to the different stages of farmers' income growth rate [21]. The second category studies the impact of internal and external habits on urban and rural residents' food consumption. The results demonstrate that habit formation has a significant impact on food consumption [22,23]. Habit formation will affect people's decision to consume carbonated beverages [24]. In addition to food consumption, the family can only consume household services and products [25]. Different consumers have different consumption choices for entertainment such as travel [26]. The formation of these different habits may also be reflected in the choice of domestic and foreign products [27]. Suppliers will also adopt different policies based on the heterogeneity of consumer choices [28]. Even though there are many studies examining the impact of regional differences on consumption, most suffer from shortcomings. First, the current literature focuses on the geographical factors that affect consumption in the physical environment (including the natural environment and transportation, communications, medical and other infrastructure) and the non-material environment (factors such as government functions, economic differences, income levels, social security, etc.). However, few studies have explored the impact of external habit formation in different regions on various types of consumer expenditures from the perspective of regional differences. In fact, different regions have different consumption cultures, so there are significant differences in the consumption behavior, psychology and shopping habits of local residents that influence their consumption of various commodities. There is little literature that has examined the regional differences and dynamic characteristics of the "comparison effect" on rural residents in terms of their various consumption expenditures.

Regarding the research on the impact of environmental or regional differences on consumer behavior, domestic and foreign scholars have investigated the impact of regional differences on consumer behavior in the following aspects. The first aspect is the impact of the material consumption environment on the consumption of public goods

and quasi-public goods provided by the government, such as environmental, transportation, communications, medical and other infrastructure-related commodities of a region. For example, government expenditures in different places have an impact on consumption [29–31]. There is a stable co-integration relationship between medical and health expenditures and natural conditions in different places and local rural residents' consumption. These factors have a significant impact on the growth of rural residents' consumption [32]. There are significant differences in the impact of rural circulation infrastructure environment on rural consumption structures and expenditures [33]. Factors such as "urbanization" in rural areas, the "dual structure of urban-rural circulation," "poor supporting services (after-sales)," and "expired goods" have a significant impact on the consumption gap between urban and rural residents [34]. Different regions and different types of infrastructure investment have different crowding-out effects on household consumption [35].

The second aspect concerns the impact of the non-material consumption environment on consumption. For example, governmental functions in different regions have an important influence on the consumption behavior of local residents [36–39]. Consumers in different social environments have a "demonstration effect" on local residents' consumption [40]. The social consumption environment in which consumers are located has a significant impact on various consumer demands [41]. Domestically, the regional economic and income differentials between provinces are the main reasons for the increase in the inter-provincial consumption gap [42]. The consumption of various regions in rural China has been divergent since 1993 [43]. Regional per capita disposable income and regional development are the central factors affecting consumption differences between rural and urban residents [44]. The influence of income level, urbanization rate, real estate market development scale and consumption habits on residents' consumption levels features significant regional differences [45] and the effects of the borrowing level and income gap on residents' consumption shows that there are regional differences between urban and rural areas and regions [46], such as imperfect social security and regional development imbalances in terms of the nature and degree of consumption [47]. The fluctuations in housing prices in different regions significantly impacts local urban residents' consumption expenditures [48], and urban-rural and regional differences have a major impact on the slowdown in consumer growth and the welfare effects of unequal consumption [49]. China's urban household consumption inequality is closely related to regional differences, with the lowest consumption in the western region, the second-lowest in the central region and the highest in the eastern region [50].

Even though the extant literature has previously examined the impact of regional differences on consumption, there are still imperfections in this regard. First, the current research mainly focuses on the regional factors affecting consumption in the physical environment (the natural environment and transportation, communications, medical and other infrastructure) and the non-material environment (government functions, economic differences, income levels and social security). Few studies have examined the impact of external habit formation in different regions on various types of consumption expenditures from the perspective of regional differences. In fact, there are different consumer cultures in various regions and large differences exist in the consumption behavior, consumer psychology and shopping habits of the local residents, which affects the consumption of various commodities. Second, few studies have discussed the regional differences and dynamic characteristics of the "comparison effect" of rural residents in various types of consumption expenditures from different geographical perspectives and analyzed whether a comparison effect exists between the various types of consumption among the different regions.

Therefore, this article closely combines the ELES model, the utility function and the habit formation theory to build a new empirical research model to examine the "comparative effect" of consumption in different regions of China and the time effects of the physiological and psychological needs of residents' various consumption. The biggest

contribution of this article to the current literature is as follows. First, this paper embeds internal habit formation theory into a panel ELES model, constructs a panel ELES model with time effects and empirically examines the effects of dynamic changes in the physiological and psychological demands of rural residents on consumption expenditures in a variety of regions. The second is to embed external habits into the panel ELES model to empirically study the differences in the consumption comparison effect of rural residents in different regions.

2. Materials and Methods

2.1. Theoretical Model-Building

For the specific theoretical framework of the ELES model used in the empirical part of this article, please refer to the last few references.[51–58]

Corresponding to the "ratchet effect" and "demonstration effect" concepts originally proposed by James S. Dusenberry, habit formation in modern consumption theory is generally divided into "internal habit formation" and "external habit formation." The former describes the effect of consumers' past consumption experience on their utility function while the latter indicates the influence of model groups' consumption behavior on consumption decisions. Therefore, we first introduce the formation of internal and external habits into the ELES model and construct a panel ELES model that includes the formation of internal and external habits.

2.1.1. Internal Habit Formation Model

Robert A. Pollak (1970) first put the formation of internal habits into the ELES model, and believed that the formation of internal habits affects basic needs, and the form of dependence of basic demand on previous consumption can be divided into the following forms:

First, $\gamma_t^{(k)} = \psi^{(k)} q_{t-1}^{(k)}$,the basic consumption in period t ($\gamma_t^{(k)}$) is positively correlated with the demand in period t−1($q_{t-1}^{(k)}$).

Second,$\gamma_t^{(k)} = \gamma_0^{(k)} + \psi^{(k)} q_{t-1}^{(k)}$, $0 \le \psi^{(k)} < 1$,the basic consumption in period t consists of physiological needs ($\gamma_0^{(k)}$) and psychological needs ($\psi^{(k)} q_{t-1}^{(k)}$).Obviously the second case is more in line with the actual situation than the first case.

The third one is $\gamma_t^{(k)} = \psi^{(k)} y_{t-1}^{(k)}$, $y_{t-1}^{(k)} = (1-\delta)\sum_{j=0}^{\infty} \delta^j q_{t-1-j}^{(k)}$, $0 \le \psi^{(k)} < 1, 0 \le \delta < 1$, that is, the consumption in period t is a linear function of the weighted sum of all previous consumption ($y_{t-1}^{(k)}$), δ is the memory coefficient.

And these three forms can be unified into the following forms:

$$\gamma_t^{(k)} = \gamma_0^{(k)} + \psi^{(k)} y_{t-1}^{(k)}, \; y_{t-1}^{(k)} = (1-\delta)\sum_{j=0}^{\infty} \delta^j q_{t-1-j}^{(k)} \; 0 \le \psi^{(k)} < 1, \; 0 \le \delta < 1$$

where, the basic demand $\gamma_t^{(k)}$ for the *k*-th good (service) is divided into two parts: "physiological needs" $\gamma_0^{(k)}$ and "psychological needs" $\psi^{(k)} y_{t-1}^{(k)}$; physiological needs are the most basic and minimal needs of human beings, and the most basic consumption for human survival, and they have nothing to do with income, where $\psi^{(k)}$ represents the internal habit formation parameter of the *k*-th commodity and reflects the degree of influence of habit-forming stock on current consumption and $y_{t-1}^{(k)}$ is the habit-forming stock at period $t-1$ of the *k*-th consumer product, which is the weighted average of consumption during past periods. If we substitute it into a utility function containing internal habits (in this case, the utility function is not just a function of the demand for

various commodities during the current period, the internal habit stock $y_{t-1}^{(k)}$ also affects the utility level):

$$U = \sum_{k=1}^{M} \beta^{(k)} \ln(q^{(k)} - (\gamma_0^{(k)} + \psi^{(k)} y_{t-1}^{(k)}))$$

In the above formula, β is the marginal budget share, which represents the allocation ratio of an additional unit of budget to various commodities. The utility function form here is proposed by L.R. Klein and H. Rubin in 1947. Here is a reference to these two practices.

The equation that maximizes the consumer's current utility under budget constraints is:

$$\begin{cases} Max \sum_{k=1}^{M} \beta^{(k)} \ln(q_t^{(k)} - (\gamma_0^{(k)} + \psi^{(k)} y_{t-1}^{(k)})) \\ s.t. \sum_{k=1}^{M} p^{(k)} q_t^{(k)} \le I_t \end{cases}$$

Constructing the Lagrangian function at the boundary:

$$L = \sum_{k=1}^{M} \beta^{(k)} \ln(q_t^{(k)} - (\gamma_0^{(k)} \psi^{(k)} y_{t-1}^{(k)})) - \lambda_t (\sum_{k=1}^{M} p^{(k)} q_t^{(k)} - I_t)$$

The first-order condition for maximizing utility is:

$$\begin{cases} \frac{\partial L}{\partial q_t^{(k)}} = \frac{\beta^{(k)}}{q_t^{(k)} - (\gamma_0^{(k)} + \psi^{(k)} y_{t-1}^{(k)})} - \lambda_t p^{(k)} = 0 \\ \frac{\partial L}{\partial \lambda_t} = \sum_{k=1}^{M} p^{(k)} q_t^{(k)} - I_t = 0 \end{cases}$$

Given consumer income and the prices of various commodities, optimal demand can be obtained from:

$$q_t^{(k)} = \gamma_0^{(k)} - (\beta^{(k)} / p^{(k)}) \sum_{k=1}^{M} p^{(k)} \gamma_0^{(k)} + (\beta^{(k)} / p^{(k)}) I_{(t)} + \psi^{(k)} y_{t-1}^{(k)}$$
$$- (\beta^{(k)} / p^{(k)}) \sum_{k=1}^{M} p^{(k)} \psi^{(k)} y_{t-1}^{(k)}$$

The above formula is solved from the above equations (line 267 and 268) and combined with the previous formula. Due to space limitations, the finishing process is omitted.

Multiplying $p^{(k)}$ on both sides of the above equation, $V_t^{(k)} = p^{(k)} q_t^{(k)}$ represents the consumption expenditures of the first category of goods (services), yielding:

$$V_t^{(k)} = \alpha_t^{(k)} + \mu_t^{(k)} + \beta^{(k)} I_t$$
$$\alpha_t^{(k)} = \alpha_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} \psi^{(k)} p^{(k)} y_{t-1}^{(k)}$$
$$\alpha_0^{(k)} = p^{(k)} \gamma_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} p^{(k)} \gamma_0^{(k)}$$
$$\mu_t^{(k)} = \psi^{(k)} p^{(k)} y_{t-1}^{(k)}$$

Among them, $\alpha_0^{(k)}$ represents the consumer's total physiological demand for various types of commodities and $\mu_t^{(k)}$ reflects the habitual inventory of the consumption of the *k*-th category of commodities. To simplify the model, we assume that the habitual stock depends on the demand from the previous period, that is, $\delta = 0$, thus,

$$y_{t-1} = q_{t-1}, \mu_t^{(k)} = \psi^{(k)} p^{(k)} q_{t-1}^{(k)} = \psi^{(k)} V_{t-1}$$

and the model can be simplified to:

$$V_t^{(k)} = \alpha_t^{(k)} + \psi^{(k)} V_{t-1}^{(k)} + \beta^{(k)} I_t, \alpha_t^{(k)} = \alpha_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} \psi^{(k)} V_{t-1}^{(k)}$$

Representing the above model as a panel data model yields the following equation:

$$V_{it}^{(k)} = \alpha_t^{(k)} + \psi^{(k)} V_{i,t-1}^{(k)} + \beta^{(k)} I_{it} + u_{it} \quad (1)$$

2.1.2. External Habit Formation Model

Assuming that the formation of external habits only affects basic needs and that the demonstration effect of consumption is lagging, the impact of consumer *i* on the demonstration effect of other consumers can be expressed as:

$$\gamma_{it}^{(k)} = \gamma_0^{(k)} + \sum_{j \neq i}^{N} \phi_{ji}^{(k)} q_{j,t-1}^{(k)} \qquad 0 \leq \phi_{ji}^{(k)} < 1, 0 \leq i, j \leq N, 1 \leq k \leq M$$

where *N* is the total number of consumer groups, $\phi_{ji}^{(k)}$ represents the external habit formation parameter, reflecting the degree of influence of consumer *j* on consumer *i*. Since having too many parameters to be estimated will significantly reduce the degrees of freedom of the data, it is further assumed that other consumers have the same influence on consumer *i*. This yields:

$$\gamma_{it}^{(k)} = \gamma_0^{(k)} + \phi_i^{(k)} \overline{q}_{i,t-1}^{(k)}$$

where $\phi_i^{(k)}$ reflects the average impact of other consumers on consumers and $\overline{q}_{i,t-1}^{(k)}$ s the average demand of the *k*-th category of other consumers during the previous period. Similarly, the utility function containing external habits is optimized. We can obtain optimal demand as:

$$q_{it}^{(k)} = \gamma_0^{(k)} - \frac{\beta^{(k)}}{p^{(k)}} \sum_{k=1}^{M} p^{(k)} \gamma_0^{(k)} + \frac{\beta^{(k)}}{p^{(k)}} I_{it} + \phi_i^{(k)} \overline{q}_{i,t-1}^{(k)} - \frac{\beta^{(k)}}{p^{(k)}} \sum_{k=1}^{M} p^{(k)} \phi_i^{(k)} \overline{q}_{i,t-1}^{(k)}$$

If we let $V_{it}^{(k)} = p^{(k)} q_{it}^{(k)}$ and multiply $p^{(k)}$ on both sides of the above equation, we can obtain the panel model form as:

$$V_{it}^{(k)} = \lambda_i^{(k)} + \phi_i^{(k)} \overline{V}_{i,t-1}^{(k)} + \beta^{(k)} I_{it} + v_{it} \quad (2)$$

$$\lambda_i^{(k)} = \alpha_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} \phi_i^{(k)} \overline{V}_{i,t-1}^{(k)}$$

$$\alpha_0^{(k)} = p^{(k)} \gamma_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} p^{(k)} \gamma_0^{(k)}$$

In summary, after integrating the internal and external habit formation theories into the panel ELES model, two meaningful conclusions can be drawn from the above con-

structed models, Models (1) and (2). The first point is that consumption demand can be divided into two parts: basic demand and supplementary demand. Supplementary demand is supplementary consumption after deducting basic demand from income. Basic demand is composed of "physiological demand" and "psychological demand." Parameter $\psi^{(k)}$ measures the internal habits of consumer spending, $\varphi_i^{(k)}$ is the coefficient of variation in the presence of individual differences, which measures the degree of demonstration consumption of the surrounding groups. The intercept $\alpha_t{}^{(k)}$ of Model (1) consists of two parts—physiological needs $\alpha_0^{(k)}$ and psychological needs $\beta^{(k)}\sum_{k=1}^{M}\psi^{(k)}V_{t-1}^{(k)}$ The second point is that physiological demand is not related to income level whereas psychological demand, which is related to previous consumption expenditures, is related to income level. The impact of internal habits on consumption expenditures has a time effect and the demonstration effect has an individual effect, which confirms empirical research on panel ELES models; other studies have found the results of time effects and individual effects. Third, Model (1) is a dynamic panel model. To avoid the problem of biased estimation of endogenous explanatory variables, the system generalized moment method model is used to estimate the dynamic panel model and the validity of the instrumental variables is tested using the Sargan test, which was proposed by Arellano and Bover [41] and Blundell and Bond [42]. Therefore, integrating the habit formation theory into the ELES model expands the theoretical connotations of the original model and partially explains the causes of the temporal and individual effects in the panel ELES model from the perspective of consumer behavior.

2.2. About the Data

The research data in this article were drawn from the rural consumption structure data regarding China's 31 provinces between 2002 and 2017 as compiled in the China Statistical Yearbook. We use different types of consumption expenditures to correspond urban residents in various provinces as model variables for rural residents. In this way, the panel data of the composition of the sample (N = 31 and T = 16) for this study were obtained. According to the current statistical caliber, various consumption expenditures of rural residents in China are divided into eight categories (M = 8): (1) food; (2) clothing; (3) household equipment, supplies and services; (4) medical care; (5) transportation and communication; (6) education, cultural and entertainment services; (7) housing; and (8) miscellaneous goods and services. To remove the influence of price factors during modeling, to deflate disposable income and rural residents' various consumption expenditures, the year 2002 was used as a base period to calculate rural households' consumer price index and each province's classified price index, thus establishing a panel. The ELES model can empirically disregard changes in price factors such that various expenditures can truly reflect the changes in residents' actual needs.

This paper uses Models (1) and (2) as empirical models to examine the time effects of rural residents on various consumption expenditures and the differences in the demonstration effects of rural residents on the various consumption expenditures of different provinces.

$$\begin{aligned} V_{it}^{(k)} &= \alpha_t^{(k)} + \psi^{(k)} V_{i,t-1}^{(k)} + \beta^{(k)} I_{it} + u_{it} \\ V_{it}^{(k)} &= \lambda_i^{(k)} + \phi_i^{(k)} \overline{V}_{i,t-1}^{(k)} + \beta^{(k)} I_{it} + v_{it} \\ k &= 1,2.....8; i = 1,2.....31; t = 2002,2003.....2017 \end{aligned} \tag{3}$$

where k is the type of consumption, I is the province and t is the year. V_u and I_u represent consumption expenditure and per capita disposable income of rural residents in the t-th province in year t, respectively.$V_{i,t-1}$ represents rural residents' consumption expenditures during the last period and the corresponding coefficient $\psi^{(k)}$reflects the formation of rural residents' internal habits. $\bar{V}_{i,t-1}$ represents the urban residents' consumption

expenditures during the last period of the *i*-th province and $\phi_i^{(k)}$ reflects the external habit formation of rural residents' consumption, that is, the magnitude of the comparison effect.

3. Results

3.1. The Empirical Results of Model (1)

Model (1) is a dynamic panel data model. To avoid the problem of biased estimation of endogenous explanatory variables, according to the work of Arellano and Bond (1991), the lag term before the $t-2$ period of the $V_{i,t-1}$ variable is a good Instrument variable. Therefore, in the estimation process of the eight models in this paper, $V_{i,t-3}$ is used as an instrumental variable. The Sargan test is used to assess the validity of the instrumental variables. The estimated results obtained by the system generalized moment estimation model are shown in Table 1. It can be seen from Table 1 that the *p*-values of the Sargan test are relatively large and that the null hypothesis is accepted, which indicates that the assumption regarding the validity of the instrumental variable is accepted and that the estimation method is reasonable. In the estimation process for the (1) food and (8) miscellaneous models, the model individuals adopt the difference form and the *p*-value of the residual diagnosis indicates that the original hypothesis is accepted, that is, that the model does not have sequence correlation. Orthogonal deviation is used for individuals of the other models; the sequence correlation test of residuals is invalid. Finally, according to the recommendations of Naik and Moore [43], the time effect of internal habits formed in the fixed-effects estimation Model (1) is used (see Table 1) and the dynamic panel data model with a fixed time point is used in the estimation. The estimates of all models in this paper are obtained using Eviews8.0.

Table 1. Estimated Results of Internal Habit Formation Model (1).

Project	Food	Clothing	Residence	Equipment	Medical Care	Transportation	Education	Other
ψ	0.137 ***	0.718 ***	0.570 ***	0.834 ***	0.760 ***	0.860 ***	0.865 ***	0.22 ***
β	0.008	0.017 ***	0.094 ***	0.008 ***	0.009 *	0.068 ***	0.018 ***	0.005 **
α_{2004}	35.29 ***	5.43	−40.34 **	4.160	10.23	−20.51 ***	−1.25	5.14 ***
α_{2005}	122.21 **	23.59 ***	−37.18 *	16.31 ***	32.79 ***	7.67 ***	30.74 ***	6.19 **
α_{2006}	125.79 ***	16.16 ***	−18.71	10.530 **	20.65 ***	−23.83 ***	17.82 *	4.56 **
α_{2007}	128.84 ***	21.42 ***	−37.46 *	14.545 **	9.94	−27.73 ***	19.87	5.03 **
α_{2008}	124.02 ***	16.62 **	−57.59 ***	11.93 *	30.95 ***	−26.91 ***	35.09 **	−2.96 *
α_{2009}	141.44 ***	22.87 ***	−14.36	20.94 ***	39.66 ***	1.64	62.58 ***	2.52 **
α_{2010}	159.33 ***	26.91 ***	−119.90 ***	23.28 ***	29.08 **	−38.58 ***	71.18 ***	3.69 ***
α_{2011}	200.41 ***	60.38 ***	−116.67 ***	58.14 ***	95.44 ***	8.64	64.07 **	20.31 **
α_{2012}	245.29 ***	51.47 ***	−150.71 ***	23.80 **	80.81 ***	2.98	116.22 ***	11.99 **
α_{2013}	300.44 ***	36.83 ***	−47.17	72.35 ***	116.22 ***	24.41	218.75 ***	4.57
α_{2014}	381.67 ***	66.14 ***	−78.15 *	66.66 ***	113.61 ***	−41.02	305.37 ***	22.39
α_{2015}	422.30 ***	27.26 *	−98.61 **	39.37 **	104.34 ***	0.10	225.96 ***	−8.89 ***
α_{2016}	445.33 ***	24.11	−107.44 **	47.49 ***	112.56 ***	31.14	263.99 ***	−24.68
α_{2017}	513.79 ***	27.21	−111.74 *	42.76 **	107.74 ***	−80.49 ***	266.96 ***	17.36 **
Sargan test (*p*-value)	0.50	0.59	0.37	0.55	0.20	0.32	0.12	0.60
AR(1)	0.047	----	--	--	--	--	--	0.017
AR(2)	0.62							0.23

Note: The software used is Eviews 8.0, and ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively. -- indicates that the residual correlation test is invalid.

Model (1) estimates the time effect ($\alpha_t^{(k)}$) of the internal habit formation parameters of the eight types of consumption items of rural residents in China. According to the meaning of $\alpha_t^{(k)} = \alpha_0^{(k)} - \beta^{(k)} \sum_{k=1}^{M} \psi^{(k)} V_{t-1}^{(k)}$, it consists of two parts: physical needs ($\alpha_0^{(k)}$)

and psychological needs $\beta^{(k)}\sum_{k=1}^{M}\psi^{(k)}V_{t-1}^{(k)}$. Since $V_{t-1}^{(k)}$ in psychological needs has nothing to do with the individual provinces, when we calculate psychological needs, this paper uses the average value of provincial rural residents' consumption expenditures in the year t−1 combined with the internal habit formation parameters $\psi^{(k)}$ and residents' marginal consumption propensity $\beta^{(k)}$ of different consumption types estimated in Table 1 to calculate the psychological demand effect for each year. Then, in Table 1 ($\alpha_t^{(k)}$), two items are added to obtain the physiological effect for each year ($\alpha_0^{(k)}$) and the physiological and psychological demand effects of the eight types of consumer expenditures of rural residents in China from 2004 to 2017 (see Figures 1–8).

It can be seen in Table 1 that the internal habit formation coefficients of various consumption expenditures of rural residents in China are positive and significant, that is, that there are significant internal habit formations in various consumption expenditures of rural residents in China, which indicates that rural residents in China experience a ratchet effect in expenditures. Among the eight items of consumption expenditures, the largest internal habit coefficient is for culture, education and transportation, and the smallest is for food, housing and miscellaneous items. In general, the internal habits of rural residents in China are relatively small in terms of survival consumption expenditures, followed by developmental consumption expenditures and the largest for enjoyment consumption expenditures. This demonstrates that, in recent years, as the income of rural residents in China increased, the proportion of rural residents' expenditures on food and housing gradually decreased, but expenditures on education, cultural entertainment and transportation significantly increased. In fact, with the recent emphasis on rural children's education, public education in rural areas of China no longer meets the educational needs of rural residents. Many rural residents can only meet their educational needs through means other than compulsory education. In addition, the consumption of cars by rural residents has increased significantly over recent years. These factors are the main reasons for the increase in rural residents' expenditures on education and transportation.

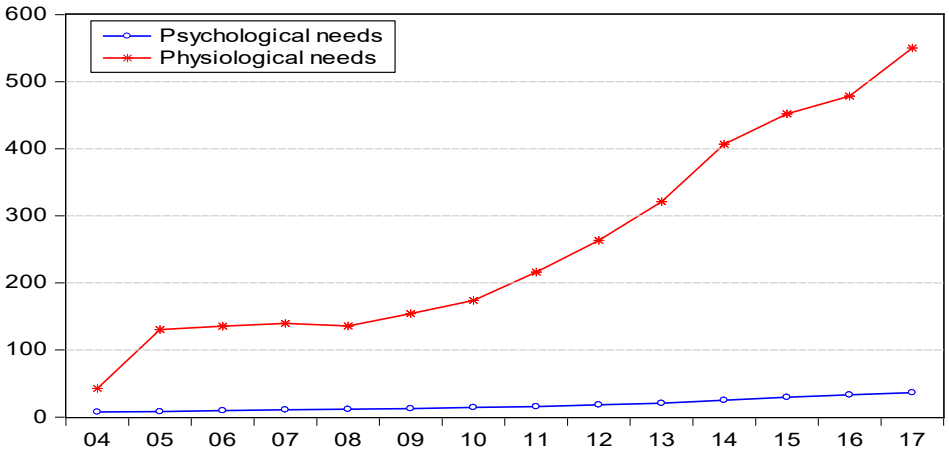

Figure 1. Rural Residents' Psychological and Physiological Needs for Food Consumption.

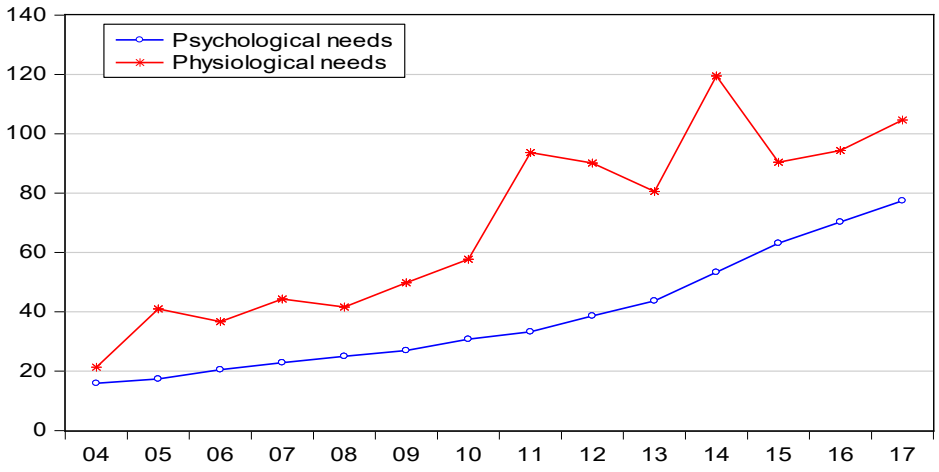

Figure 2. Rural Residents' Psychological and Physical Demand Effects on Clothing Consumption.

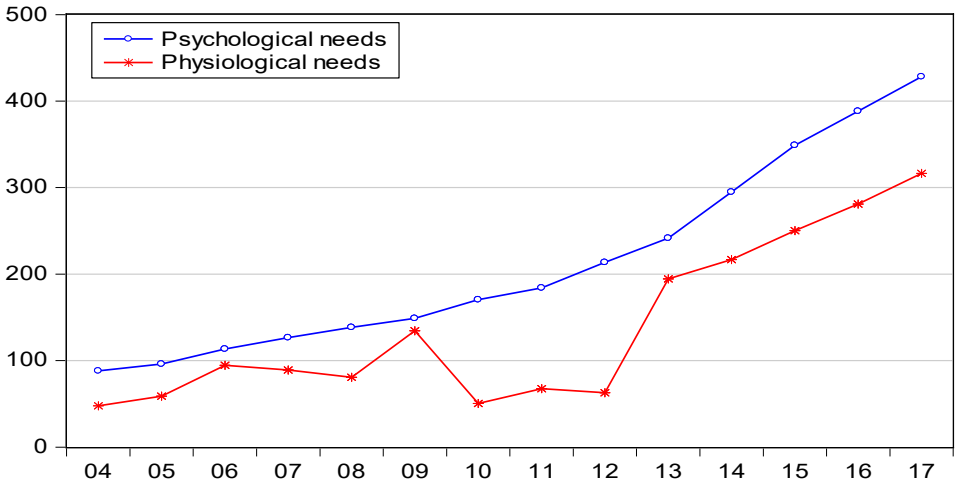

Figure 3. Rural Residents' Psychological and Physiological Demand Effects on Residential Consumption.

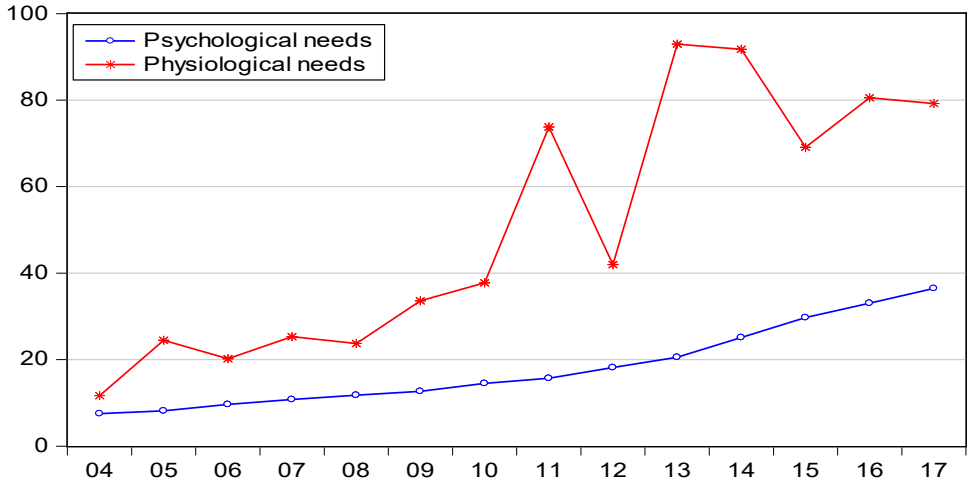

Figure 4. Rural Residents' Psychological and Physiological Demand Effects on Equipment Consumption.

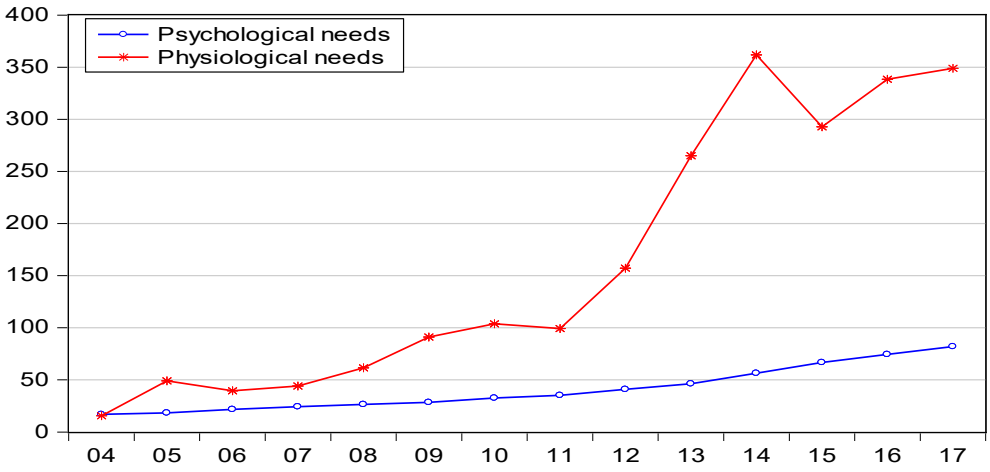

Figure 5. Rural Residents' Psychological Demand and Cultural Demand Effect on Cultural and Educational Consumption.

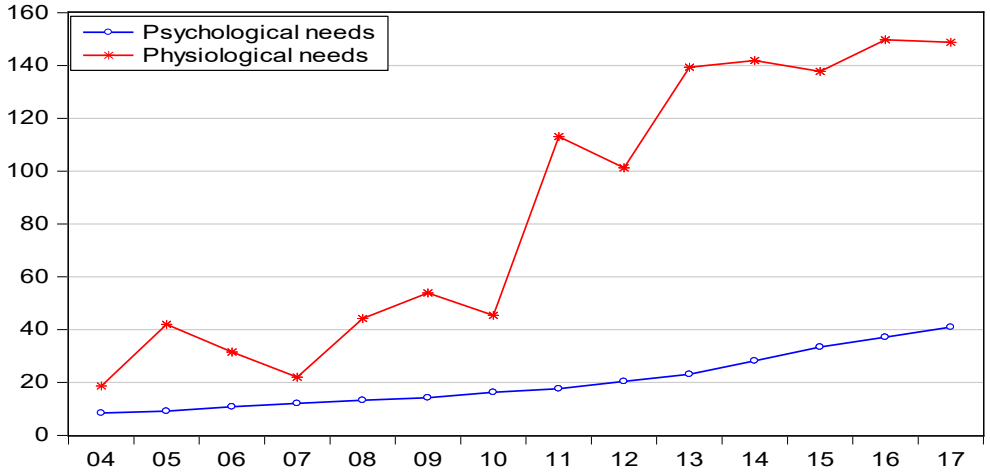

Figure 6. The Effect of Rural Residents' Psychological and Physiological Demands on Medical Consumption.

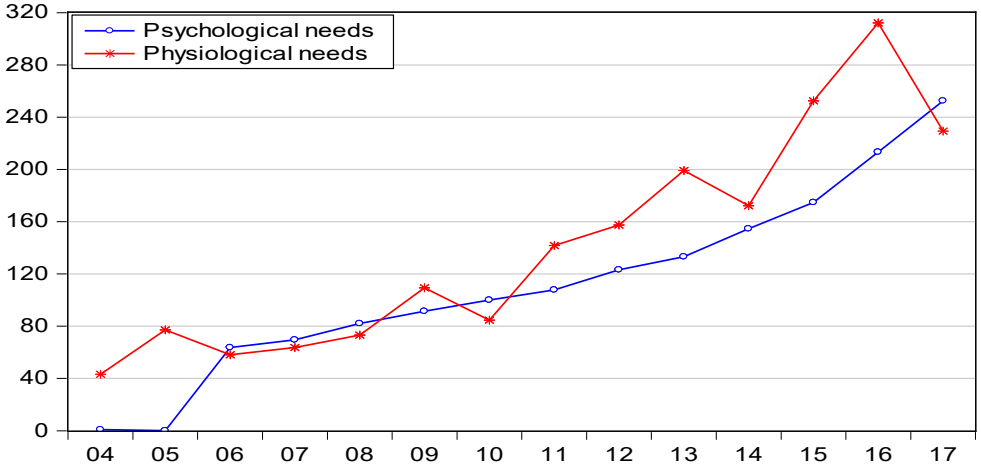

Figure 7. Rural Residents' Psychological Demand and Physiological Demand Effect on Transportation Consumption.

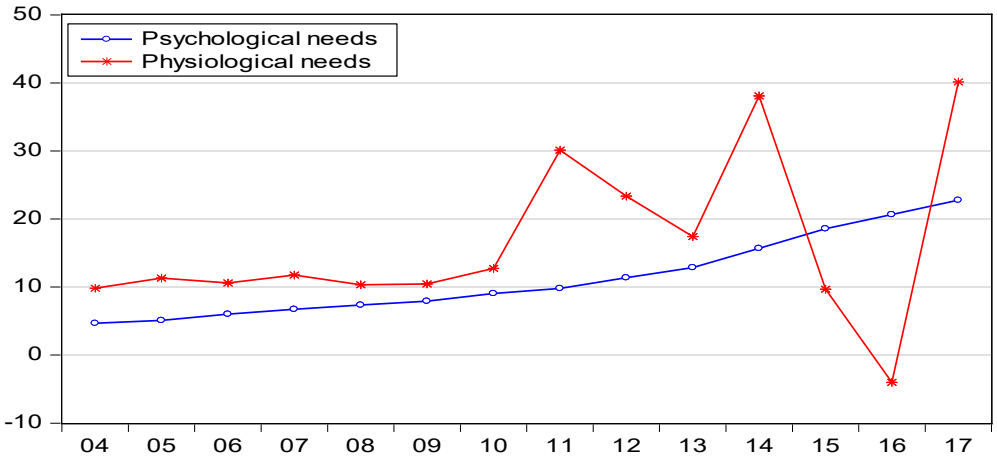

Figure 8. Rural Residents' Psychological and Physiological Demands for Miscellaneous Consumption.

It can be seen in Table 1 that, in most years, the time effect of consumption habit formation among the eight types of consumption expenditures of rural residents in China is significant, and that the physiological and psychological effects of all types of consumption expenditures are generally increasing. Figures 1–8 illustrate the following conclusions.

First, among the eight types of consumption expenditures, the psychological demand curve for residential consumption grew very rapidly. Over the past 10 years, the psychological demand of rural residents for residential consumption is higher than the physiological demand, which indicates that, regarding residential consumption, for rural residents in China the psychological sensory effects are more important than their physiological needs. In fact, this is consistent with reality. As the largest and most important consumption expenditure of rural residents in China, "living in a new house" in their lifetime is a goal of most rural residents. Rebuilding or expanding one's own house, even if one must save money and live frugally, is a true portrayal of many rural residents. Owning a house is also an important precondition for rural marriages. Therefore, the utility function of rural houses far exceeded the essence of living and endowed more psychological effects on rural residents.

Second, for the four types of consumption expenditures—food, household equipment, education and cultural services and medical care—the physical demands of rural residents in China are all greater than the psychological demand. The physiological demand curve for these four types of consumption expenditure is steep and grows rapidly, and the psychological demand curve is relatively flat and the growth is slow. Over time, the distance between the physiological demand curve and the psychological demand curve becomes larger and larger. This indicates that rural residents in China are more "pragmatic" in these four types of consumption expenditures, focusing on the "use value" of commodities, which means that they pay more attention to the lowest level of commodities fulfilling their "physiological needs" and "security needs." These two demands feature the lowest level of commodity demand in terms of Maslow's theory.

Third, in terms of clothing, transportation, miscellaneous consumption and the other four types of expenditures, the psychological demand curve of rural residents in China has the following characteristics: it is relatively steep, the growth rate is rapid and over time, its distance from the physiological demand curve becomes smaller and smaller, perhaps even intersecting. Combined with the previous analysis of residential consumption expenditures, this demonstrates that, in terms of clothing, housing, transportation and miscellaneous consumption, rural residents in China not only pay attention to the "use value" of commodities but also the psychological value of commodities. That is,

there is a higher level of demand for commodities that fulfill their "emotional needs", "respect needs" and "self-realization needs".

In fact, their consumption of clothing, living and transportation are all "extroverted" consumption expenditures; that is, the pros and cons of consumption is quickly known to others, which demonstrates that rural residents in China are more willing to be recognized by society through "extroverted" consumption.

3.2. The Empirical Results of Model (2)

Model (2) is a panel data model consisting of 31 individuals. We first determine whether the model is a variable intercept model or a variable parameter model and then estimate the parameters. Table 2 shows the results of the identification test for the existence of panel data model effects for eight categories of consumer expenditures. A, B and C represent, respectively, the sum of the squared residuals of the variable parameter model, the variable intercept model and the invariant parameter model. $F_2$is the corresponding F-value of the test hypothesis as a constant parameter model (mixed model) and F1is the corresponding F-value of the test hypothesis as a variable intercept model (in the case of refusing the mixed model). If we take the significance level as 0.05, the critical values of the F-statistics $F_1$and $F_2$are: $F_{0.05}(60,433) = 1.32$, $F_{0.05}(30,433) = 1.46$. Combined with Table 2, for the eight types of consumption models, $F_1$and $F_2$are both significant, that is, Model (2) is a variable parameter model, which indicates that the external habits of rural residents in China have individual effects. Table 3 shows the estimated results of the panel model of the eight types of consumption expenditure models, Model (2). The intercept items of the three models for housing, household equipment and miscellaneous items are significant and the intercept items of the other models are not significant. The corresponding value of each province in Table 3 is the estimated value of parameter $\phi_i^{(k)}$ in model (2), which represents the magnitude of the comparison effect of each province in various consumption expenditures. It can be seen in Table 3 that the fit R^2 of the eight types of consumption expenditures is very high. The overall value of the equation obtained from the *p*-value of the F-test is very significant and there is no second-order autocorrelation in each equation.

Table 2. Model Category Identification Test for Model (2).

	S1	S2	S3	F_1	F_2	Model Category Category
Food	5,221,790	7,042,973	13,433,034	11.34	5.03	Variable parameters
Clothing	883,600.7	1,638,850	3,473,254	21.15	12.34	Variable parameters
Housing	4,464,384	10,180,635	14,665,547	16.49	18.48	Variable parameters
Equipment	826,566.2	1,693,352	2,395,605	13.70	15.14	Variable parameters
Medical treatment	1,260,242	2,332,220	4,024,643	15.83	12.28	Variable parameters
Traffic	9,203,781	16,587,324	23,729,691	11.38	11.58	Variable parameters
Education	5,046,602	8,772,458	13,273,147	11.76	10.66	Variable parameters
Other	800,788.1	888,263.3	1,087,017	2.58	1.57	Variable parameters

It can be seen in Table 3 that, overall, rural residents in most provinces of China have significant differences between the external habit formation coefficients for various types of consumption expenditures; that is, the comparison effect of rural residents in various types of consumption expenditures in most provinces exhibit regional differences. Among the eight types of consumption expenditures, rural residents in China have the largest comparison effect on cultural, educational, residential and transportation consumption expenditures. The comparison effect of household equipment and miscellaneous consumption expenditures is not significant in most provinces. Rural residents in economically developed coastal areas are most affected by the comparison effect on food and residential consumption expenditures, while consumption expenditures on clothing,

transportation, culture and education expenditures is least affected by the comparison effect. The effect has the greatest impact and consumer spending on food and housing is least affected by the comparison effect. Consumption expenditures on culture and education in the three northeastern provinces is most affected by the comparison effect. The provinces with the largest and smallest effects on household equipment and medical consumption expenditures are concentrated in the western and central provinces.

Table 3. The Estimated Results of the External Habit Formation Model (2).

Project	Food	Clothing	Housing	Equipment	Medical care	Transportation	Education	Other
c	438.97 ***	−47.06 ***	−94.56 ***	−116.05 ***	−148.44 ***	−360.95 ***	−176.33 ***	−32.19 **
p	0.070 ***	0.052 **	0.109 ***	0.065 ***	0.076 ***	0.132 ***	0.023 ***	0.015 ***
Beijing	0.178 ***	0.130 ***	0.218 ***	0.259 **	0.091 ***	0.112 ***	0.288 ***	0.457 ***
Tianjin	0.119 ***	0.171 ***	0.298 ***	0.167 **	0.207 **	0.216 ***	0.247 ***	-
Hebei	0.049	0.087 ****	0.120 ***	0.143 ***	-	0.193 ***	0.397 ***	-
Liaoning	0.068 ***	0.123 ***	0.123 ***	-	0.226 ***	0.178 ***	0.492 ***	0.135 ***
Shanghai	0.245 ***	0.002 ***	0.17 ***	-	-	0.090 ***	0.229 ***	0.268 **
Jiangsu	0.176 ***	0.014 ***	0.202 ***	-	0.213 ***	0.220 ***	0.392 ***	-
Zhejiang	0.221 ***	0.0100 ***	0.127 ***	-	-	0.205 ***	0.364 ***	0.167 ***
Fujian	0.171 ***	0.056 ***	0.313 ***	-	-	0.079 **	0.270 ***	-
Shandong	0.078 ***	0.054 ***	-	-	0.173 ***	0.175 ***	0.393 ***	-
Guangdong	0.243 ***	0.015 **	0.219 ***	-	-	0.053 **	0.253 ***	0.134 ***
Hainan	0.115 ***	-	0.101 ***	-	-	-	0.377 ***	0.226 ***
Shanxi	0.039 *	0.07 ***	0.137 ***	0.055 ***	0.234 ***	0.132 ***	0.388 ***	0.086 **
Jilin	0.072 **	0.068 ***	0.170 ***	-	0.152 ***	0.158 ***	0.478 ***	0.291 ***
Heilongjiang	0.043	0.081 ***	-	-	0.349 ***	0.157 ***	0.522 ***	0.281 ***
Anhui	0.119 ***	0.046 **	0.268 ***	-	0.185 ***	0.130 ***	0.341 ***	-
Jiangxi	0.150 ***	-	0.198 ***	-	-	-	0.376 ***	-
Henan	0.002	0.077 ***	0.081 ***	0.051 **	0.055 *	0.102 **	0.358 ***	-
Hubei	0.091 ***	-	0.183 ***	-	0.335 ***	-	0.384 ***	-
Hunan	0.171 ***	0.012	0.274 ***	0.088 ***	0.371 ***	0.090 ***	0.378 ***	-
Neimenggu	0.143 ***	0.091 ***	0.239 ***	0.040 *	0.211 ***	0.246 ***	0.436 ***	0.147 ***
Guangxi	0.099 ***	0.042 **	0.138 ***	-	0.139 **	0.145 ***	0.379 ***	0.186 ***
Chongqing	0.136 ***	0.093 ***	0.213 ***	0.204 ***	0.121 ***	0.124 ***	0.355 ***	0.104 **
Sichuan	0.151 ***	0.057 ***	0.213 ***	0.233 ***	0.210 ***	0.094 ***	0.345 ***	-
Guizhou	0.058 ***	0.042 ***	0.227 ***	0.107 ***	-	0.149 ***	0.313 ***	0.102 **
Yunnan	0.083 ***	0.037 ***	-	-	-	0.182 ***	0.358 ***	-
Tibet	0.113 ***	0.122 ***	-	-	-	0.081 **	0.276 ***	-
Shanxi	0.039 *	0.070 ***	0.138 ***	0.055 ***	0.234 ***	0.132 ***	0.388 ***	0.085 **
Gnnsu	0.094 ***	0.043 ***	0.115 ***	0.062 **	0.118 **	0.190 ***	0.379 ***	-
Qinghai	0.101 ***	0.215 ***	-	-	0.329 ***	0.249 ***	0.302 ***	-
Ningxia	0.036 **	0.128 ***	0.081 **	0.214 ***	0.333 ***	0.181 ***	0.334 ***	-
Xinjiang	0.037 **	0.089 ***	-	-	-	0.150 ***	0.265 ***	-
AR(1)	0.747 ***	0.773 ***	0.401 ***	0.501 ***	0.304 ***	-	-	0.627 ***
r2	0.978	0.985	0.986	0.985	0.982	0.932	0.93	0.948
P(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
D-W value	1.86	1.97	2.02	2.02	2.03	1.86	1.92	1.91

Note**:** The software used is Eviews 8.0, and ***, ** and * represent the significance levels of 1%, 5% and 10%, respectively. "-" indicates that the estimated value is not significant. The variable intercept of the food model is not significant, the intercept is weighted by the cross-section and the coefficient variance method is White; the variable intercept of the clothing model and the cultural and educational model is not significant, the intercept is weighted by the cross-section and the coefficient variance method is White diagonal; The intercept of the residence model and equipment model is significant, the intercept is weighted by cross section, the coefficient variance method is White diagonal; the intercept of the traffic model and the medical model is not significant, the intercept is not weighted, the coefficient variance method is White diagonal; miscellaneous The intercept of the model is significant, the intercept is weighted by cross section and the coefficient variance method uses White diagonal.

For the eight specific consumption categories, first, the provinces with the largest comparison effect on food consumption expenditures are Beijing, Shanghai, Jiangsu, Zhejiang, Fujian and Guangdong; the provinces with the smallest comparison effects are Ningxia, Xinjiang, Shanxi, Jilin and Shanxi. Second, for consumption expenditures on clothing, the provinces with the largest comparison effect are Qinghai, Ningxia Tibet, Liaoning Beijing and Tianjin; the provinces with the smallest effects are Shanghai, Jiangsu, Zhejiang and Guangdong. Third, the provinces with the largest comparison effect on residential consumption expenditure are Beijing, Tianjin, Jiangsu, Fujian, Guangdong, Anhui, Hunan, Sichuan, Guizhou, Inner Mongolia and Ningxia; the provinces with the smallest are Henan, Guangxi, Shaanxi, Gansu and Ningxia. Fourth, with regard to household equipment consumption expenditures, 18 provinces have no significant effect on household equipment consumption expenditures. Among the remaining provinces, the provinces with the largest comparison effects are Beijing, Chongqing, Sichuan and Ningxia; the provinces with the smallest are Inner Mongolia, Gansu, Henan and Shanxi. Fifth, for medical consumption expenditures, the provinces with the largest comparison effects are Heilongjiang, Hubei, Hunan, Ningxia and Qinghai, and the provinces with the smallest are Henan, Guangxi, Chongqing and Gansu. Sixth, for transportation consumption expenditures, the provinces with the largest comparison effects are Tianjin, Hebei, Liaoning, Zhejiang, Jiangsu, Inner Mongolia, Gansu, Qinghai and Ningxia; the provinces with the smallest are Shanghai, Fujian, Guangdong and Tibet. Seventh, the provinces with the largest comparison effect on consumption expenditures on culture and education are Jilin, Heilongjiang, Liaoning and Inner Mongolia; the provinces with the smallest are Shanghai and Guangdong. The provinces with the most and least comparison effects in terms of each consumption type are listed in Table 4 below.

Table 4. Rural Areas with Greater and Smaller Comparison Effects between the Various Types of Consumer Expenditures.

	Food	**Clothing**	**Residence**	**Equipment**	**Medical**	**Transportation**	**Education**	**Others**
Provinces with larger comparison effects	Beijing Shanghai Jiangsu Zhejiang Fujian Guangdong	Qinghai Ningxia Tibet Liaoning Beijing Tianjin	Beijing Tianjin Jiangsu Fujian Guangdong Anhui Hunan Sichuan Guizhou Neimenggu Ningxia	Beijing Chongqing Sichuan Ningxia	Heilongjiang Hubei Hunan Ningxia Qinghai	Tianjin Hebei Liaoning Zhejiang Jiangsu Neimenggu Gansu Qinghai Ningxia	Jilin Heilongjiang Liaoning Neimenggu Shanghai Guangdong	Hainan Jilin Heilongjiang Shanghai Beijing
Provinces with little comparison effects	Ningxia Xinjiang Shanxi Jinlin Shanxi	Shanghai Jiangsu Zhejiang Guangdong	Henan Guangxi Shanxi Gansu Ningxia	Neimenggu Gansu Henan Shanxi	Henan Guangxi Chongqing Gansu	Shanghai Fujian Guangdong Tibet	Shanghai Guangdong	Shanxi Chongqing Guizhou Shanxi

4.Discussion

From the perspective of economic development and ecological resource protection, there is an important relationship between residential consumption and sustainable development. Consumption is an economic behavior that humans use to satisfy their own desires through consumer goods, consumption is divided into production consumption and personal consumption. As the economy develops and consumption increases, the earth's resources are decreasing. Many developing countries develop their economies in traditional models, that is, the economy of one-way material flow composed of "re-

sources-products-pollution discharge". In the process of production, processing and consumption, pollution and waste are discharged into the environment in large quantities. The use of resources is often extensive and one-off, so economic development, consumption growth and environmental protection are interdependent. To properly handle the relationship between consumption and sustainable development, for developing countries, solving environmental problems caused by consumption and economic development depends on development in the final analysis. However, economic development cannot be at the expense of the environment and cannot take the road of pollution first and then treatment. We must take the road of sustainable development and develop a circular economy. We should reduce and eliminate the production methods and consumption methods that cannot sustain development, so that the economy, society and environment can develop in harmony. Therefore, the conclusions of this paper are applicable to most developing countries.

By constructing a mathematical model, this paper effectively tests the time effects of Chinese rural residents' physiological needs and physiological needs in various consumer expenditure centers and examines the comparison effect of Chinese rural residents in various consumer expenditures in different regions. This shows that for the analysis of rural consumer behavior, the panel ELES model constructed in this paper within the formation of internal and external habits is practical and reliable. Since the model in this paper is a panel ELES model based on internal and external habit formation theory, utility function, basic demand theory and other theories, this model can be applied to the research of related residents' consumption behavior. For example, the model can be extended to study the comparison effect of consumption between different classes of society, as well as the changes in the psychological and physiological needs of various types of consumption expenditures between different classes. The future research direction of this paper is mainly to study the changes in the psychological and physiological needs of urban and rural residents of different income groups in various consumption expenditures, analyze whether different groups have a demonstration effect in various consumption expenditures, and analyze the differences in the demonstration effects of various types of consumption among different income groups.

The disadvantage of this article is that this paper fails to deduce the various consumption characteristics of rural residents in different regions in various consumption expenditures under the effect of habit formation, such as income elasticity, self-price elasticity, mutual price elasticity and the internal custom series and external custom series in different regions.

5. Conclusions

In this paper, by applying the internal and external habit formation theory, utility function, basic demand theory and a panel ELES model, we innovatively construct a panel ELES model containing internal and external habit formation theory that provides a way to examine the internal and external habit formation of the consumption structures of rural residents in China. Using new research concepts and methods, the derived panel ELES model redefines the meaning of "basic needs" and analyzes the mutual relationship between the "mental needs" and "physiological needs" of various types of consumption expenditures of rural residents in China during different time periods. From the spatial dimension, this paper analyzes the existence and dynamic evolution characteristics of the "comparison effect" between the various types of consumption expenditures of rural residents in different provinces of China. From the empirical results, this paper concludes the following.

First, there is a significant internal habit formation in various consumption expenditures of rural residents in China. Among the eight types of consumption expenditures, the one with the largest internal habit coefficient is culture, education and transportation, and the smallest is food, housing and miscellaneous. Generally speaking, the internal habits of rural residents in China are relatively small in terms of their subsistence

consumption expenditures, followed by their developmental consumption expenditures and the internal parameters of their enjoyment consumption expenditures are the largest.

Second, for the four types of "inward-oriented" consumption expenditure types—namely, food, household equipment, education and culture, and medical care—rural residents in China consider the "use value" of commodities, that is, the lowest level of commodities, that fulfills their" physiological needs" and "security needs". However, in the "extroverted" consumption of clothing, housing and transportation, in addition to the "use value" of the commodities, rural residents also hope to fulfill their "emotional needs", "respect needs" and "self-realization needs", that is, to obtain social recognition, through their expenditures.

Third, rural residents in most provinces of China have significant differences in the external habit formation coefficients for various types of expenditures. That is, in most provinces, the comparison effect on the various expenditures of rural residents exhibits regional differences. In general, rural residents in China are most affected by the comparison effect on cultural, educational, residential and transportation consumption expenditures. The comparison effect of household equipment and miscellaneous consumption expenditures is not significant in most provinces.

Fourth, rural residents in economically developed coastal areas are most affected by the comparison effect in terms of their food and housing consumption expenditures, while clothing, transportation and education and culture expenditures are the least affected by the comparison effect. Consumption expenditures on culture and education in the three northeastern provinces are most affected by the comparison effect. The western and central provinces exhibit the largest and the smallest comparison effects on household equipment and medical consumption expenditures, respectively.

In summary, the time effects of physiological and psychological needs among the eight types of consumption expenditures of rural residents in China are very obvious and the comparison effects of various regions are significantly different. The reason for this is that we believe that with the development of Chinese rural economy and the increase in income levels, changes in the items and structure of rural residents' consumption expenditures have caused changes in rural residents' consumer psychology, which has led to the existence of rural residents in various commodity expenditures. This is the main reason for the time effect. In addition, from the perspective of economics, the "comparison effect" is a fashion-conscious mind, and it is no exception for rural residents in China. As the basic needs of rural residents are satisfied, the differences among income levels, customs and regional consumption habits of rural residents in different regions, differences in family background and other aspects have made the "vanity" and "comparable with each other" more obvious, which is another main reason for the differences in regional comparison effects.

The most prominent contribution of this paper is that by constructing a panel ELES model that includes the formation of internal and external habits, the time effect of the psychological and physiological needs of Chinese rural residents in various commodity consumption expenditures is decomposed, and the various types of rural residents in different regions of China Regional differences in the comparison effect in commodity expenditures. The above contributions are of great significance to decision makers. First, through the time effects of the psychological and physiological needs of various commodities, we can formulate more detailed consumption policies for different commodities in rural China; second, through the regional differences of the comparison effect, we can formulate more personalized regional consumption policy. This has important practical significance for tapping the consumption potential of rural residents, improving consumption levels in rural areas, promoting consumption growth in rural areas and enhancing the fundamental role of consumption in economic development.

This article also has shortcomings. This article fails to deduce the various consumption characteristics of rural residents in different regions in various consumption ex-

penditures, such as income elasticity, self-price elasticity, mutual price elasticity and different regional internal custom series and external custom series.

The future research direction is about the research of the changes in the psychological and physiological needs of urban and rural residents of different income groups in various consumption expenditures, analysis about whether different groups have a demonstration effect in various consumption expenditures, and the analysis about the differences in demonstration effects of various types of consumption of different income groups.

Author Contributions: Conceptualization, X.W. and J.H.; methodology, X.W.; software, X.W.; validation, X.W. and J.H.; formal analysis, X.W.; investigation, X.W.; resources, X.W.; data curation, X.W.; writing—original draft preparation, X.W.; writing—review and editing, J.H.; visualization, J.H.; supervision, J.H.; project administration, J.H.; funding acquisition, X.W. All authors have read and agreed to the published version of the manuscript.

Funding: This article is sponsored by the National Social Science Foundation project "Research on the consumption structure of urban and rural residents based on the perspective of the embedded panel ELES model of habit formation" (grant number: 19BJL047).

Data Availability Statement: All the data used in this article can be found in the China Statistical Yearbook.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Pollak, R.A. Habit Formation and Dynamic Demand Functions. *J. Political Econ.* **1970**, *78*, 745–763.
2. Pollak, R.A. Interdependent Preferences. *Am. Econ. Rev.* **1976**, *66*, 309–320.
3. Philips, L. *Applied Consumption Analysis*; North-Holland: Amsterdam, The Netherlands, 1973.
4. Holt, M.T.; Barry, K.G. Generalized Habit Formation in an Inverse Almost Ideal Demand System: An Application to Meat Expenditures in the U.S. *Empir. Econ.* **1997**, *22*, 393–320.
5. Alessie, R.; Teppa, F. Saving and habit formation: Evidence from Dutch panel data. *Empir. Econ.* **2010**, *38*, 385–407.
6. Muraviev, R. Additive habit formation: Consumption in incomplete markets with random endowments. *Math. Financ. Econ.* **2011**, *5*, 67–99.
7. Verhelst, B.; Van den Poel, D. Deep habits in consumption: A spatial panel analysis using scanner data. *Empir. Econ.* **2014**, *47*, 959–976.
8. de Vries, H.; Eggers, S.M.; van Osch, L.; van Stralen, M.M. Predicting fruit consumption: The role of habits, previous behavior and mediation effects. *BMC Public Health* **2014**, *14*, 1–11.
9. Chetty, R.; Szeidl, A. Consumption commitments and habit formation. *Econometrica* **2016**, *84*, 855–890.
10. Gozzi, F.; Bambi, M.; Lecturer, S.; Augeraud-Veron, E.; de Conference, M. Solving Internal Habit Formation Models Through Dynamic Programming in Infinite Dimension. *J. Optim. Theory Appl.* **2017**, *173*, 584–611.
11. Goh, T.-T.; Xin, Z.; Jin, D. Habit formation in social media consumption: A case of political engagement. *Behav. Inf. Technol.* **2019**, *38*, 273–288.
12. Amalia, F.A.; Sosianika, A.; Suhartanto, D. Indonesian Millennials' Halal food purchasing: Merely a habit? *Br. Food J.* **2020**, *122*, 1185–1198.
13. Anquan, Z.; Chen, L. Research on Preventive Savings of Chinese Urban and Rural Residents under the Formation of Habits. *Stat. Res.* **2015**, *32*, 23–30.
14. Chen, H.; Song, M. Research on the impact of habit formation on the consumption structure of urban residents in my country. *J. Shandong Univ.* **2019**, *1*, 25–33.
15. Hang, B.; Yan, X. Residents' consumption behavior during the period of rapid economic growth: An empirical analysis based on the formation of habits. *Q. J. Econ.* **2013**, *12*, 1191–1208.
16. Huang, Y.; Zong, Q. The effect of the formation of consumption habits of Chinese urban residents. *Econ. Res. J.* **2014**, *1*,17–28.
17. Hang, B.; Yan, X. The formation of internal and external habits and the consumption structure of residents. *Stat. Res.* **2010,** *27*, 32–40.
18. Cui, H.; Fan, J. Formation of internal and external habits and consumption behavior of Chinese rural residents. *Chin. Rural. Econ.* **2011,** *7*, 54–62.
19. Tianchang, Z.; Bingchuan, H. Research on the evolution of the effect of rural residents on food consumption habits. *Chin. Rural. Econ.* **2017**, *33*, 61–74.
20. Zang, X.; Chen, H.; Song, M. Research on the Dynamic Influence Mechanism of Habit Formation on Consumption of Urban Residents in my country. *South. Econ.* **2020**, *6*,60–75.

21. Wang, X.; Wen, T.; Han, S. Habit formation and changes in Chinese farmers' consumption behavior: Experience verification since reform and opening up. *China Rural Econ.* **2020**, *1*,17–35.
22. Jia, N.; Zhang, L.; Gan, L. The "habit formation" test of rural household food consumption under uncertainty. *Econ. Q.* **2011**, *10*, 327–348.
23. Li, G. Government expenditure and household consumption: Substitution or complementation. *World Econ.* **2005**, *5*, 38–45.
24. Wang, X.; Liu, Y. Explaining Consumer Heterogeneity in Structural State-Dependence. *Sustainability* **2020**, *12*, 2597.
25. Gu, W.; Bao, P.; Kim, J. Empirical Examination of Intention to Continue to Use Smart Home Services. *Sustainability* **2019**, *11*, 5213.
26. Tomić, S.; Leković, K.; Tadić, J. Consumer behaviour: The influence of age and family structure on the choice of activities in a tourist destination. *Econ. Res. Ekon. Istraz.* **2019**, *32*, 755–771.
27. Vranešević, T.; Perić, N. Comparative analysis of consumer attitudes in Croatia and Serbia according to domestic and foreign brands. *Econ. Res. Ekon. Istraz.* **2019**, *33*, 68–86.
28. Nicolas-Sans, R.; Ibáñez, D.G. Customer basket heterogeneity: How to measure it and some possible business applications. *Econ. Res. Ekon. Istraz.* **2012**, *34*, 2872–2592.
29. Zhang, Z. The Paradox of Enterprise Technology Innovation and Management and the Construction of the Relationship of "Balance and Symbiosis". *Chin. Soc. Manag.* **2008**.
30. Chong, C. The Dynamic Evolution of the Influence of Government Public Expenditure on Residents' Consumption Demand. *Stat. Res.* **2011**, *5*, 13–20.
31. Geng, Y. An empirical analysis of the impact of consumption environment on the consumption of rural residents in my country. *Stat. Res.* **2012**, *11*, 36–40.
32. Wu, X. Marketization, circulation facility environment and rural consumption structure-an empirical analysis based on the provincial panel data model. *Econ. Issues* **2014**, *10*, 75–80.
33. Wu, X. Evaluation of the dual structure of circulation and its dynamic impact on rural consumption. *Stat. Decis.* **2015**, *9*, 125–128.
34. Yang, Q.; Yin, H. An Empirical Study on the Impact of Infrastructure Investment and Structure, Regional Differences on Rural Residents' Consumption. *Consum. Econ.* **2017**, *33*, 26–33.
35. Karras, G. Government spending and private consumption: Some international evidence. *J. Money Credit. Bank.* **1994**, *26*, 9–22.
36. Shclarek, A. Consumption and Keynesian Fiscal Policy. 2004. Available online: https://xueshu.baidu.com/usercenter/paper/show?paperid=cec82719b875222ffb561429f5b4372c&site=xueshu_se&hitarticle=1(accessed on 20 August 2021).
37. Wang, Y.-S. The Challenges and Strategies of Food Security under Rapid Urbanization in China. *Sustainability* **2019**, *11*, 542.
38. Radulescu, M.; Serbanescu, L.; Sinisi, C.I. Consumption vs. Investments for stimulating economic growth and employment in the CEE Countries—a panel analysis. *Econ. Res. Ekon. Istraz.* **2019**, *32*, 2329–2352.
39. Xu, C.; Gong, W. Medical condition, population density, and residents' savings in China's contiguous destitute Areas. *Econ. Res. Ekon. Istraz.* **2020**, *33*, 652–671.
40. Duesenberry, J.S. *Income, Saving and the Theory of Consumer Behavior*; Harvard University Press: Cambridge, MA, USA, 1949.
41. Veenhoven, R. Happy Life-Expectancy: A comprehensive Measure of Quality-of-Life in Nations. *Soc. Indic. Res.* **1996**, *39*, 1–58.
42. Zhao, W.; Yuan, J. An Analysis of the Causes of Differences in Provincial Consumption Growth in China. *Stat. Res.* **2013**, *8*,77–83.
43. Wang, J. Research on China's Local Government Regulation and Its Impact on Industrial Efficiency. *Dr. Shandong Univ.* **2013,** *3*, 11–25.
44. Wang, K.; Liu, J. The application of multi-order model in the study of regional consumption differences. *Stat. Res.* **2011**, *1*, 84–90.
45. Ding, R.; Zhu, B. Regional differences in influencing factors of residents' consumption—An empirical analysis based on panel data of the eastern, central and western regions of my country. *Consum. Econ.* **2013**, *4*, 9–12.
46. Han, L.; Du, C. Regional and urban-rural differences in income gaps, borrowing levels and residents' consumption. *Econ. Res. J.* **2012,** *47*, 15–27.
47. Han, L.; Du, C. Study on the Regional Difference of Urban Household Consumption Financial Effect. *Econ. Res. J.* **2011,** *46*, 30–42.
48. Li, C.. On the Current Situation of Rural Financial Management and Improvement Strategies. *Times Financ.* **2014,** *10*, 34–41.
49. Ding, Z.; Kong, Q. Research on the Impact of Urban and Rural Residents' Income Nature on Urban-rural Consumption Gap. *Stat. Inf. Forum*. **2019,** *34*, 90–97.
50. Zhou, L.; Zhang, J. Evolving trends and regional differences in urban household consumption inequality in China. *Financ. Trade Econ.* **2019**, *5*, 143–160.
51. Arellano and Bover,Another look at the instrumental variable estimation of error-components models. *J. Econom.* **1995**, *68*, 29–51.
52. Blundell, M.; Bond, O. Initial conditions and moment restrictions in dynamic panel data models. *J. Econom.* **1998**, *87*, 115–143.
53. Naik, N.Y.; Moore, M.J. Habit formation and intertemporal substitution in individual food consumption. *Rev. Econ. Stat.* **1996**, *78*, 321-328,.

54. Stone, R. Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand. *Econ. J.* **1954**, *64*, 511–527.
55. Liuch, C.; Williams, R. Consumer Demand Systems and Aggregate Consumption in the U.S.A.: An Application of the Extended Linear Expenditure System. *Can. J. Econ.* **1974**, *8*, 49–66.
56. Alessie, R.; Lusardi, A. Saving and income smoothing: Evidence from panel data. *Eur. Econ. Rev.* **1997**, *41*, 1251-1279.
57. Korniotis, G.M. Estimating Panel Models tableWith Internal and External Habit Formation. *J. Bus. Econ. Stat.* **2010**, *28*, 145-158.
58. Ai, C.; Wang, W. Excessive Sensitivity of Chinese Residents' Consumption under Habit Preference: Analysis Based on Interprovincial Dynamic Panel Data from 1995 to 2005. *Quant. Econ. Technol. Econ. Res.* **2008**, *1*, 98–114.