

The Effect of Interpersonal Spending Pressure on Intention to Smoke among Low-Income People in China

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Objectives: Test the effect of capital on household human relationship expenditure and thus examine the effect on the willingness to smoke.

Methods: Threshold model and Critical theory of capital.

Results: China is a large consumer of tobacco, and tobacco account for a significant proportion of interpersonal spending in China. It is found that the percentage of social spending of low-income families is much higher than that of high-income families. In recent years, the social expenditures of extremely low-income people have far exceeded their income. At the same time, the types of urban and rural areas, traditional customs, business management, social exchange, and education level significantly impact the family's human relationship expenditure.

Conclusion: This paper shows that, unlike in Western countries, cigarettes present a huge advantage in interpersonal interactions in China, hence the phenomenon that the richer one is, the more one consumes tobacco. Social poverty has become a significant obstacle to the sustainable growth of low-income people's income. Under the effect of capital, the relationship between people is deeply reflected as the relationship between human and material, and then presents the characteristics of materialization. The reason why people accept this way of interaction lies in the domination of rational principles. To control the materialized social relations, we need the construction of timely theory and the formation of values free from capital control to alleviate the social poverty of low-income families, which should be paid attention to in future research.

Key words: Human relationship expenditure; Critical theory of capital; Intention to smoke; Threshold model
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The word "human relationship" has existed in China since ancient times, just as recorded in the

classic *Book of Rites*: "what is the human relationship? Joy, anger, sorrow, fear, love, evil, desire, these seven emotions are

known by nature.¹ In ancient China, human relationship refers to human feelings. In modern society, the connotation of the human relationship has changed. In modern society, human relationship refers to "resources that can be used to trade in interpersonal communication" and "social norms of how people get along with each other".² This phenomenon exists in China and is a moral law recognized by all cultures.³ Some researchers also pointed out that the human relationship expenditure was a kind of "conspicuous consumption" and believed that the craziness of fashionable consumption and extravagance in society originated from people's desire for social status and respect from others.⁴ This is similar to the Chinese concept of "face," which is an important principle to control and regulate Chinese social behavior.^{5,6} China's human relationship is different from those of other countries. China is a traditional relationship society.^{7,8} There are more "tender feelings" in Chinese human relationships. But under the veil of affection, there are many complicated things, "relationship," "corruption," "rent-seeking," and so on, accompanied by a lot of "reciprocity" of human relationships. Cigarettes are an important commodity and means of human interaction. According to Suha, smokers' identities include both individual and social components.⁹ A long-standing problem in Chinese academia that has plagued research on the relationship between smoking and income in China is that, unlike in other countries, the average income of smokers is higher than that of nonsmokers in China.¹⁰ Therefore, some researchers point out that human relationship is one of the core concepts to understand Chinese social behavior.⁵ At

the same time, as the monetary form of human relationship, "human relationship expenditure" is an embodiment of the social relationship between people. Consumption on smoking is an important factor linking interpersonal interactions in China. (1) It has been noted that perceived smoking social norms significantly and positively predict social smoking; (2) identity partially mediates the relationship between perceived smoking social norms and social smoking; (3) the concepts of human relationship positively moderate the relationship between perceived smoking social norms and social smoking, while they do not significantly moderate the relationship between perceived smoking social norms and identity. The perceived social norms of smoking influence the identity mechanism and cultural value regulation mechanism of social smoking.¹¹ Therefore, the in-depth study of "human relationship expenditure" is an important entry point for understanding China's social relations and carrying out in-depth poverty alleviation work.

According to the survey data of CFPS (China family panel studies) in 2010 and 2014, as shown in the figure: Taking families as the unit, from the perspective of the total expenditure change of human relationship expenditure, it increased from 2286 CNY in 2010 to 3833 CNY in 2014, with an increase of about 67%. From the perspective of the proportion of human relationship expenditure in family income, it increased from 6.87% in 2010 to 8.15% in 2014, with an increase of about 18.6%, as shown in Table 1:

Table 1 Overall changes in human relationship expenditure		
	2010	2014
Average total human relationship expenditure	2286.17	3833.59
Average total household income	33277.71	47050.96
The proportion of human relationship expenditure in income	0.0687	0.0815

This kind of change is undoubtedly huge, such as Fei Xiaotong's *"From the Soil,"* Yang Guoshu's *"Chinese psychology,"* and other works revealed that China's previous human relationship

expenditure theory is based on a solid agricultural civilization. With the deepening of reform, the status of the market economy is gradually improving, and China is more and more integrated into the globalization system. The problems in

leaping from agricultural civilization to industrial civilization also need to be solved by using the thinking of industrial civilization. Therefore, this paper uses the China family tracking survey (CFPS) survey data in 2010 and 2014 to make an empirical test to explain the differences in human relationship expenditure among different income groups. It uses the western left-wing researchers' critical theory of capital as the analytical framework and Foucault's post-modern theory as the explanatory framework to explain the reasons for the differences and the rationality of human relationship expenditure. Based on the existing theories, this paper then uses the indicator of cigarette consumption to reveal the solution to "human relationship poverty".

LITERATURE REVIEW AND THEORETICAL CONSTRUCTION

Through the Search of related literature, we find that most of the related literature about human relationship expenditure in China are news reports, and there are not many academic papers. Among the current research results, sociology is the main one, followed by economics. In the geographical space, most of them are concentrated in rural areas. Many researchers have pointed out that the human relationship expenditure in rural areas has become an economic burden for farmers.^{12,13} In terms of research methods, qualitative methods are often used to analyze the motivation and significance of human relationship expenditure: (1) human relationship expenditure can reduce transaction costs among acquaintances;¹⁴(2) The results show that human relationship expenditure has the functions of information exchange, resource sharing and risk sharing;¹⁵(3) Human relationship expenditure can effectively reduce the vulnerability of rural family economy;¹⁶(4) Families with a higher proportion of gift spending have more opportunities to get jobs in the labor market in the competitive, mature period.¹⁷ (5) For individuals who place greater importance on the role of those around them, their behavioral motivations and intentions are more likely to be coordinated with others, and their behavioral responses are more likely to be coordinated with others. The perceived social norms of smoking were more influential on the social smoking behavior of smokers who valued relationships more than those who did not.¹¹Through literature review, we can find that: (1) the existing literature mainly focuses on the

description of the phenomenon and the traditional explanation, lack of quantitative research methods and comparative research; (2) The relevant theoretical research still stays in the familiar words such as "family," "Confucian ethics," "face," "tradition," "the pattern of difference sequence" and "acquaintance society"; (3) The research on human relationship expenditure is almost policy-oriented, but the theory of human relationship expenditure lags behind. With the continuous evolution of the times, we can't always use tradition to explain the present. Reality itself should also make a sound.

In modern society, "market economy" and "globalization" are two key factors. The theoretical discussion of "human relationship expenditure" cannot be separated from this background. The relationship between the three is shown as follows: globalization is an extensive framework, and market economy is a small framework in globalization. Understanding human relationship expenditure must be placed under these two frameworks, which is a field not covered by previous relevant theories. No matter in the context of market economy or globalization, capital is undoubtedly the keyword. Similarly, the concept of "capital" has hardly been involved in analyzing human relationship expenditure in the past. It only uses the meanings of "money" and "property" to express it. However, the connotation of capital is extremely rich, and this expression is not the most essential stipulation of capital. Therefore, grasping the clue of "capital" is the key to understand today's human relationship expenditure. So, what kind of influence does capital have on people, on people's social relations, and human relationships? In short, according to the left-wing critical theory of capital and Foucault's post-modern theory, modern society is a society connected by capital and with capital as the only principle. The social relationship between people is determined by capital; that is, what a person is no longer critical. People's social relationship has the nature of the material, which leads to the materialization of people. The characteristics of capital itself define the whole process of materialization as rational, making it inevitable to get human relationship expenditure and evolve into an essential expression of human relationship. Specifically, the impact of capital on human relationships is shown as follows: Capital - the impact on people (role) - the impact on social relations (materialization) - the inevitability of human relationship expenditure

(rationalization of materialization) - the final result (separation of people).

A.The role of human and the materialization of social relations

David Harvey pointed out that in *Das Kapital*, from the general formula of capital G-W-G', we can see that G to G' is a process not related to the content, and it only cares whether the final capital is more than the other the beginning. This process has strong rationality: only when the amount of capital obtained at the end of the expectation is more than initially, such a change will be realized. Otherwise, it won't be very sensible. At the same time, this process also has a vital purpose: capital has become the beginning and end of this process, so capital has become the purpose. Because of the rationality and purpose of capital, the production based on the principle of G-W-G' has the highest efficiency. Capital also has a universality: capital is the product of the collective, and it can only move through the common activities of many members of the society, and in the final analysis, only through the common activities of all members of the society".¹⁸ However, this is a kind of universality of being given. This "being given" means that no matter whether people accept it from heart or not, as long as they can only act according to this principle, they accept it. In this way, this universality means that human beings exist as capital only when certain capital exists for them. The existence of capital is his/her existence and his/her life.¹⁹ The existence of capital defines the content of his/her life so that he/she cannot intervene. "In this way, human survival depends on capital. It doesn't matter what a person is. What matters is the role of "capitalist," "worker," "creditor," and "debtor." Therefore, people do not interact with others as "people," but as "roles." So, once capital is involved in these roles, how will social relations change?

People play different roles in different situations, occupations, and identities. The development of human social relations is based on roles. Capital has a power of "simplification," which connects different roles thoroughly through the bridge of "capital": different occupations can be contracted through the capital with the same form and different quantity, which is embodied as wages or remuneration; Parents and children cannot have any emotional connection, as long as there is "parenting," "alimony" and other capital connection,

they will not be punished by law. In Marx's view, capital can even directly and indirectly determine the role of people: if you have capital, you can be a creditor, landlord, entrepreneur, etc.; through capital, you can marry the most beautiful bride, even if you are ugly; through capital, you can hire the most brilliant people, even if you are stupid. Under the influence of capital, all social relations between people have undergone a complete transformation, "all feudal, patriarchal and pastoral relations have been destroyed. It mercilessly cuts off all kinds of feudal fetters that bind people to their natural superiors. It makes people have no other connection except naked interests and merciless cash transactions".¹⁹

This kind of connection with capital as the core replaces all social relations. It doesn't matter what the content of people's communication is. What matters is whether it conforms to the form of G-W-G'. Therefore, it is not only what people are, but also what roles they play. Different roles are like commodities with different pricing, which can be directly or indirectly related and determined by capital, and capital will completely open up the social relationship between people. Therefore, capital serves as an end and as an intermediary, mediating social relations so that the social relations between people get the nature of materials. Therefore, Marx believes that "capital is not a kind of material, but a social relationship between people with material as an intermediary." Then, how does the materialized social relationship mediated by capital become a social consensus?

Rationalization of social relations

As a social relationship, capital is so reasonable, efficient, and purposeful that it is generally accepted. Although such a universal social relationship is given, it is given under rational principles. This rational process is hard to stop on its own. Like a perpetual motion machine, the movement of capital can run all the time without any support from the outside world. It is self-discipline. Therefore, even if there is an economic crisis, as long as it is adjusted according to the principle of capital rationality, it can still circulate endlessly. For example, in the second volume of *Das Kapital*, there are a lot of seemingly meaningless calculations and circular arguments. Rosa Luxemburg once criticized him impatiently: "accumulation, production, realization, and

exchange are carried out step by step... This special" accumulation "can go on indefinitely as long as the ink and paper are enough for him to continue to write." It is so rational that it is impossible to find any illogicality in it, so it also means a kind of "rationalization." In Foucault's eyes, rationality lies in the historical construction, which has the characteristics of subjectivity, universality, and standardization. On the one hand, it determines a series of normative standards to isolate some people; on the other hand, it separates people into the rational world. In the context of rationality, the rationality of capital is more reasonable and exerts a force on each individual.

The concept of rationality is rarely involved in traditional Chinese culture, and previous studies on human relations have not explored rationality in depth. But in modern society, the inevitability of human relationship expenditure forces people to accept this rationality consciously. This also determines that rationality in G-W-G 'capital dominates social actions, including human relationship expenditure. Therefore, in the process of human interaction, whether it is the custom of "reciprocity" subjectively or the consideration of "expecting expected return" objectively, the logic of capital rationality is attached.

Social deconstructions and human separation

From the rural society, where people are familiar with each other, to the commodity society with high efficiency and cooperation, the traditional factors such as "human relationship," "face," and "difference pattern" play a role, more importantly, the existence of capital. In the context of modernity, everything is moving in the society with capital as the intermediary. It must conform to this kind of the norm. Capital will rationalize the tradition thoroughly. This kind of rationalization means that it washes away all the irrational contents in the tradition and only retains its form, and the tradition will become a vassal of capital. Under the effect of capital, the emotional factors in human relationship expenditure are more attached to the rational logic, making society completely deconstructed. The key to deconstruction is that the materialization of society makes people separate. As Foucault pointed out, the power of norms runs through discipline, which plays a role in a system of formal equality, and norms lead to the emergence of individual differences.²⁰ That is to say, the ability of

individuals to fulfill the norms is not the same. If practiced according to individual conditions, they will not meet the norms. However, such differences caused by non-compliance with norms cannot be recognized because norms are the overall social identity, and personality has become something that must be abandoned. People without personalities, like broken atoms, exist alone. They are separated from each other but related (only mediated by capital). Human nature cannot be reflected as an isolated person because human nature is not an abstract thing inherent in a single person. However, the essence of reality reflected by all social relations is mediated by capital and thus has the characteristics of things. The universality of commodity forms fills the whole society. Just as in rural areas in recent years, human relationships are often transformed into "money transactions" based on the principle of rationality, which leads to the strange phenomenon that "the gifts are getting thicker and thicker, and the feelings are getting thinner and thinner" between people.

Empirical test

Once the capital is laid out in the whole society, it will inevitably lead to the materialization of all social relations, which will also lead to the materialization of human beings. This materialization means that the world is broken, people are separated like isolated atoms, and can only communicate through the capital. With the integration of globalization and the implementation of a market economy, China has undoubtedly been influenced by capital. In particular, when new year's money becomes the most effective means of communication between the elderly and the young when money becomes the most crucial measure of family and friendship, and the human relationship expenditure becomes the most direct manifestation of materialized social relations. Therefore, the empirical test of materialization in this paper will focus on human relationship expenditure. The rationalization tradition mentioned above is naturally the influencing factor that should be investigated, and other indicators reflecting globalization and market economy should also be included. In addition, we should also focus on the difference of materialization degree caused by different income levels, especially those low-income people, to reveal the enormous dilemma brought by human relationship expenditure.

BASIC INFORMATION OF DATA AND VARIABLES

CFPS data description

China family panel studies (CFPS) is a large-scale social survey designed and implemented by the China Social Science Survey Center of Peking University. At present, the central part of the published data is composed of baseline survey data in 2010 and follow-up survey data in 2012 and 2014. In the aspect of sample selection, the respondents of CFPS covered 25 provinces/cities/autonomous regions, representing about 95% of the population in China. The main target of the survey was family households, the most basic social structure unit. The initial sample size was 16000 households. Based on this, the questionnaire was composed of five parts: Community questionnaire, family member questionnaire, family questionnaire, adult questionnaire, and children questionnaire. This is a large-scale comprehensive database organically unified at the three levels of individuals, families, and communities. Due to the limitation of the questionnaire design, we cannot get the data of cash gifts in 2012, so the data used in this paper is the cross-sectional data of 2010 and 2014 in CFPS.

Based on the above theoretical analysis, available references, and data, the variables used in the empirical research are as follows (Table 2):

1). Human relationship expenditure. The explanatory variable of this paper is the expenditure of human family relationships, which is commonly known as the gift of human relationships, and money as a wedding gift. In the questionnaire, the expenditure of relatives and friends' families due to marriage, further education, the birth of children, funeral, housewarming, and celebrating the Chinese New Year (including visiting relatives, passing out red packet) is widely included. Among them, all gifts in kind will be converted into cash. The total amount index is used in the annual human relationship expenditure because the demand for cash gifts on almost all occasions is based on the family rather than each person. Using the per capita index will seriously underestimate the actual amount of human relationship expenditure.

2). Family income. The threshold variable is the per capita net income of the family, and the explanatory variable with the threshold effect is the total net income of the family. Net income refers to

the total income of a family minus all kinds of expenses incurred to obtain the income. In addition, according to the existing data in the questionnaire, this income index in CFPS will convert the agricultural products produced and sold by farmers into the adjustment item of family income according to the market price, to alleviate the problem of underestimating the income of families in areas with insufficient marketization in general surveys. Every family will choose the corresponding human relationship expenditure according to their total income. The choice behavior of families with different degrees of wealth is likely to be different. There is a certain threshold effect; however, the whole family net income is not a good indicator of wealth due to the different numbers of families. This paper takes the per capita family net income as a proxy variable to reflect the wealth and takes it as the threshold variable behind the regression model. Unlike the expenditure of family human relations, family income is often earned by some family members and used for the living consumption of each family member. Therefore, the per capita index can more genuinely reflect the family living standard than the overall index.

3). Classification of urban and rural areas. The urban and rural variables based on the National Bureau of Statistics data are used to reflect the differences in human relationship expenditure under different production and lifestyles.

4). Family size. With the increase of the number of family members, the social network is also more open, so the family size reflects the rise of human relationship expenditure caused by expanding the social circle.

5). Traditional customs. Contemporary tradition is a tradition rationalized by capital, but many human relationship expenditures are often regarded as traditional customs. Therefore, factors such as the weight of the family clan concept and the sublation of the funeral ceremony may lead to differences in human relationship expenditure. In this paper, whether or not to worship ancestors in the past year is regarded as a proxy variable to reflect the difference from one side.

6). Business operation. The enterprise is the most crucial market subject in the market economy under the condition of globalization. The process of preparing for the enterprise is also the process of profoundly participating in the materialization of capital. In this process, a factor closely related to the

expenditure of human relations is the social relationship. Generally speaking, the managers of private enterprises, whether large or small, need to deal with many customers, suppliers, and government personnel and have relatively complex social relations. Therefore, different answers to whether a family runs a company or a business may mean different spending on human relations.

7). Social communication. In such a developed media era, the materialization brought about by globalization and the market economy has penetrated every corner of social contact. Daily contact and communication or wedding and funeral news notice cannot be separated from specific media. More importantly, the frequency of social communication is closely related to the materialization process. Therefore, this paper introduces the monthly family communication expenditure (including fixed-line, mobile phone, Internet, mail, etc.) as a proxy variable of the frequency of communication media used by

families to communicate with the outside world. This expenditure may affect the amount of human relationship expenditure.

8). Education. The process of receiving an education is also accompanied by the reshaping of outlook on life and values and social circle change. This process takes capital as the core and materialization as the essence. Therefore, people with different educational backgrounds may have different materialization levels and behavior styles. Because of the difference in the number of people in different families, this paper uses the average education years of adults in the family to reflect the family's education level to control the impact of academic qualifications on human relationship expenditure.

9). Provinces. There are considerable differences in economic level, social customs, and residents' temperament in different regions, so we need to control the possible impact of this level of factors.

Table 2
Descriptive statistics of cross-sectional data

Variable code	Variable meaning	Year	Mean	SD	Min	Max	Samples
Gift	Annual expenditure of family relationship	2010	7.14	1.17	3.91	9.62	11709
		2014	7.65	1.15	4.61	10.31	10043
Indinc	Net income per capita of logarithmic families	2010	8.69	1.04	5.52	11.1	11709
		2014	9.04	1.22	4.79	11.24	10043
Faminc	Total net income of logarithmic family	2010	9.96	1.03	6.4	12.23	11709
		2014	10.25	1.22	5.99	12.28	10043
Country	Whether he/she is a registered rural resident (1 - yes)	2010	0.53	0.5	0	1	11709
		2014	0.52	0.5	0	1	10043
Scale	Family size (number of people)	2010	3.88	1.64	1	10	11709
		2014	3.79	1.76	1	10	10043
Worship	Tomb sweeping / ancestor worship (1 - yes)	2010	0.71	0.45	0	1	11709
		2014	0.65	0.48	0	1	10043
Manage	Whether to run a business (1 - yes)	2010	0.08	0.27	0	1	11709
		2014	0.09	0.29	0	1	10043
Com	Logarithmic monthly communication expenditure	2010	4.07	1.4	0	6.4	11709
		2014	4.62	1.25	0	6.69	10043

Edu	Family education years per capita	2010	7.05	4.04	0	22	11709
		2014	6.97	3.89	0	20.5	10043

BRIEF DESCRIPTION OF THE THRESHOLD MODEL

The threshold model is mainly used to study the inflection point or structure mutation point between the explained variable and some explanatory variables, which can better describe the change of marginal effect than the general linear model; At the same time, the model uses the existing data to estimate the specific threshold by constructing an estimator, so as to effectively avoid the confusion and possible errors caused by different researchers' subjective boundaries.

The method of dividing threshold according to the characteristics of data itself can be traced back to the Threshold Auto-regression Model (TAR)

proposed by Tong. H. (1978). Although this model is mainly an improvement of the AR model in time series at first, many researchers gradually use this method to study cross-sectional data and panel data. Finally, Hansen (1999) solved the problem of related test methods in his panel threshold model.

The setting of the threshold model

Because the models composed of different threshold numbers are not very different, for the sake of brevity, the description of the model and related tests, taking the single threshold model as an example, the mathematical expression can be written in the following form:

$$Gift_i = \alpha + \beta_1 Faminc_i I(Indinc_i \leq q) + \beta_2 Faminc_i I(Indinc_i > q) + z_i' \gamma + \mu_i \quad (1)$$

Its model structure is similar to the multiple linear regression model, in which "is" the explanatory variable family favor expenditure), "is" the threshold variable family net income per capita, and "is" the threshold variable explanatory variable family net income, which is the indicator function, That is: when the conditions in parentheses are proper, the value of the function is 1. Otherwise, the value is 0, where "is" a certain threshold cut-off point, and "sum" respectively represents the estimated coefficients of the explanatory variable under different conditions. "Is" a vector composed of a series of other explanatory variables without threshold effects mentioned above and represents its coefficient vector. "Sum" is a constant term and a random interference term, respectively.

Estimation of the threshold model

If known, then formula (1) can be carried out by the simple OLS method, but in practical analysis, the specific value of the cut-off point cannot be clearly known, so it needs to be estimated. The formula (1) can be written as the following matrix form:

$$Gift = X \hat{\beta}(q) + \hat{\mu}(q) \quad (2)$$

Where "is" the explained variable vector, "is" the explained variable matrix, represents the coefficient matrix estimated according to a specific value and is the corresponding residual vector. The sum of squares of the residuals can be expressed as

$$S^2(q) = \hat{\mu}'(q) \hat{\mu}(q) \quad (3)$$

According to the suggestion of Chan (1993) and Hansen (1999), the simplest way to get the specific estimation of the threshold cut-off point is to minimize the sum of the squares of the residuals, that is to say, there is a:

$$\hat{q} = \arg \min_q S^2(q) \quad (4)$$

Finally, according to the threshold value, the model coefficient estimated by OLS is the final model estimation result.

Search for threshold estimation

In the above analysis, a "test" method is used to select the specific threshold value. In the case of continuous threshold variables, there are countless selection methods. On the one hand, too many alternative values will enhance the accuracy of the results, but the change of the results is generally subtle, which greatly reduces the estimation efficiency of the model; On the other hand, too few

alternative values can easily describe the general situation of the threshold effect in the data, but some important structural change points may be ignored, which makes the estimation of the threshold model biased.

In this regard, Hansen (1999) thinks that the fixed distance quantile of the threshold variable should be used as the clue to search for the threshold value. Therefore, when dealing with cross-sectional data in this paper, firstly, the threshold variable Q is sorted from small to large. Then, the quantiles (0.25%, 0.50%, ..., 99.50%, 99.75%) were used as the alternative threshold cut-off points for "test". Finally, to avoid the estimation bias caused by too few samples in the group and the adverse effect of tail reduction in data processing, the quantiles contained in the minimum and maximum 500 sample values are excluded, which will not be used as the possible cut-off point.

Correlation test of the threshold model

After the estimation of the threshold model is obtained, the selection of threshold model and threshold multiplicity needs to refer to relevant tests, that is, to test the existence of threshold effect and the credibility of threshold estimation.

First of all, we need to test whether the coefficient differences caused by structural changes described in (1) are significant in the data:

$$H_0: \beta_1 = \beta_2 \quad H_1: \beta_1 \neq \beta_2$$

When the original hypothesis is true, there is no significant difference in the coefficients, (1) will be simplified as a general multiple linear regression equation:

$$Gift_i = \alpha + \beta Faminc_i + z_i' \gamma + \mu_i \quad (5)$$

Construction statistics:

$$F = \frac{S_0^2 - S_1^2(\hat{q})}{\hat{\sigma}^2} \quad (6)$$

It represents the sum of squared residuals estimated directly by the ordinary least squares method without threshold effect and represents the sum of squared residuals estimated by ordinary least squares method after introducing the threshold effect under specific estimation value, which is the sample variance in the sample this case. That is:

$$\hat{\sigma}^2 = \frac{1}{n-1} S_1^2(\hat{q}) \quad (7)$$

Although this statistic is similar to the general F-test in form, it does not obey the standard F-distribution. According to Hansen's (1999) theory, the critical value of the distribution subject to this statistic can be obtained through the bootstrap method.

Then, after determining the existence of the threshold effect, Chan (1993) and Hansen (1999) proved that the threshold estimates obtained are consistent, but their asymptotic distribution is exceptionally irregular. In order to evaluate the credibility of the threshold estimates obtained by formula (4), which is the actual threshold value in the population, it is necessary to test whether other possible threshold values in the sample are equal to the actual threshold value. There is a hypothesis test:

$$H_0: q = q^* \quad H_1: q \neq q^*$$

Since the threshold estimate converges to the actual value of the threshold in large samples, the test can be converted to the confidence interval of the actual value. The usual method is to use the LR value to construct the non-rejection region:

$$LR(q) = \frac{S_1^2(q) - S_1^2(\hat{q})}{\hat{\sigma}^2} \quad (8)$$

Among them, it represents the sum of residual squares of the threshold model formed by the estimated threshold value and represents the sum of residual squares of the threshold model developed by other possible threshold values. Similarly, the distribution of this statistic is different from the standard distribution used in the general LR test. Under a series of assumptions and the original assumptions, Hansen (1999) gave the formula for calculating the critical value of confidence interval according to the asymptotic distribution:

$$c(\alpha) = -2 \ln(1 - \sqrt{1 - \alpha}) \quad (9)$$

It is easy to get: critical value at the significance level. The significance level set in this paper is 5%. Suppose the confidence interval obtained is too broad, which means that the threshold estimation is not significantly different from most other possible threshold values. In that case, the credibility that the threshold value obtained under this estimation method is equal to the actual value of the threshold will be reduced.

ESTIMATED RESULTS OF EMPIRICAL ANALYSIS**Estimated results of sectional data byyear**

The threshold estimates and related tests for the annual cross-sectional data are given in table 3 and table 4.

Table 3
Threshold estimates and confidence intervals for cross-sectional data

Year	Type	Threshold estimate	CI
2010	Single threshold model	6.941	[6.841,7.020]
	Double threshold model	6.941	[6.841,9.405]
		8.311	[8.117,9.632]
		6.941	[6.841,9.405]
	Triple threshold model	8.311	[8.117,9.632]
		9.405	[9.011,9.632]
2014	Single threshold model	7.262	[7.078,9.824]
	Double threshold model	7.262	[6.630,7.262]
		7.262	[6.630,7.262]
		9.817	[9.770,10.252]
	Triple threshold model	10.82	[7.800,11.238]

Table 4
F-test of threshold model for sectional data

Year	Threshold type	F statistic	P-value	BS times	Critical value		
					1%	5%	10%
2010	single	48.583**	0	500	6.758	4.486	2.957
	double	8.345**	0.004	500	6.08	4.31	2.762
	triple	11.213**	0	500	6.166	4.219	3.325
2014	single	77.794**	0	500	6.438	3.976	2.81

double	31.233* **	0	500	9.168	4.735	3.377
triple	8.548** *	0.006	500	7.948	4.735	3.197

We can draw the following conclusions from the above results: first, the threshold effect exists significantly. No matter what model is at the 1% significance level, it rejects the original hypothesis that there is no structural change, but with the increase of the threshold multiplicity, the F statistic presents a significant downward trend; Second, the estimation of single threshold model is more robust, because the re-estimated threshold of double threshold model is still the same as that of the former; Thirdly, for the cross-sectional data in 2010, although the F-test under the triple threshold model is significant, the non-rejection region (confidence interval) constructed by LR value becomes too broad from the double threshold, so that the

confidence intervals of different thresholds overlap, and the credibility of threshold value approaching the real value is low, so it is relatively better to adopt the single threshold model. Similarly, for the cross-sectional data of 2014, it is better to choose the double threshold model. Figure 1 shows the LR function diagram of the single threshold model in 2010, and Figure 2 and Figure 3 show the LR function diagram of the first and second round search under the double threshold model in 2014. The dotted line in the figure represents the critical value of 7.35 given by Hansen (1999) at the 5% significance level, which offers the 95% confidence interval of the threshold estimation from a graphical point of view.

Figure 1
Single threshold in 2010

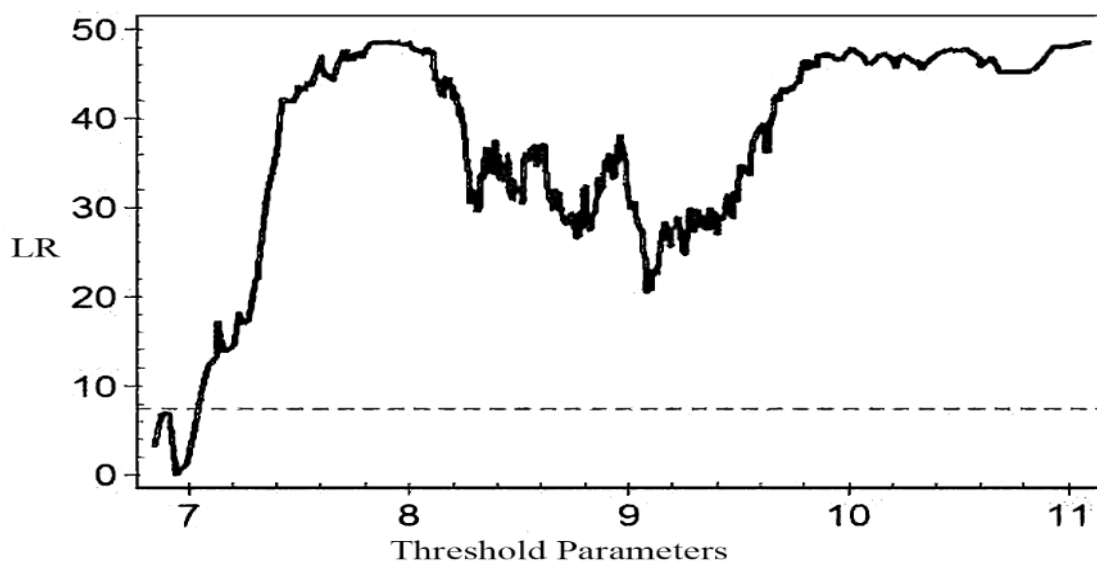


Figure 2
The first round of double threshold in 2014

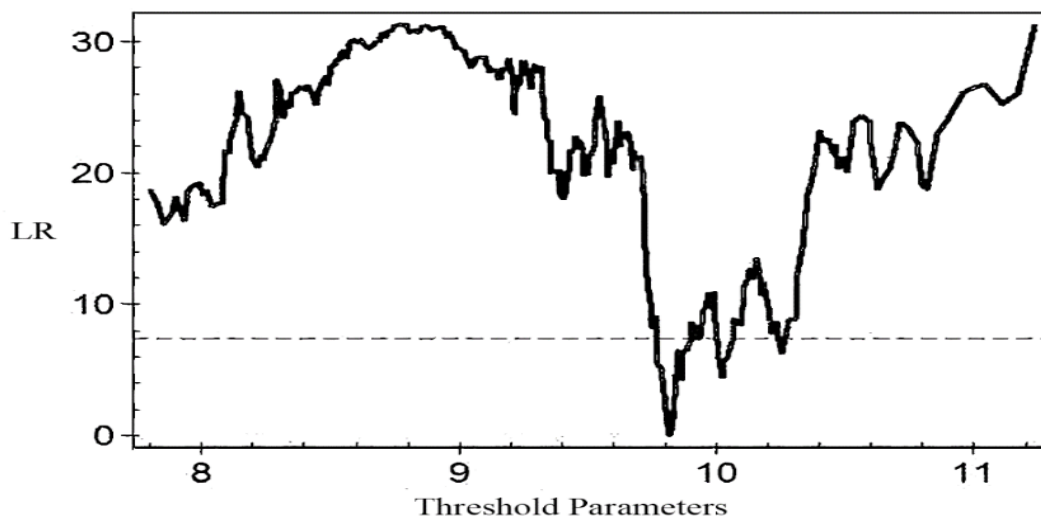
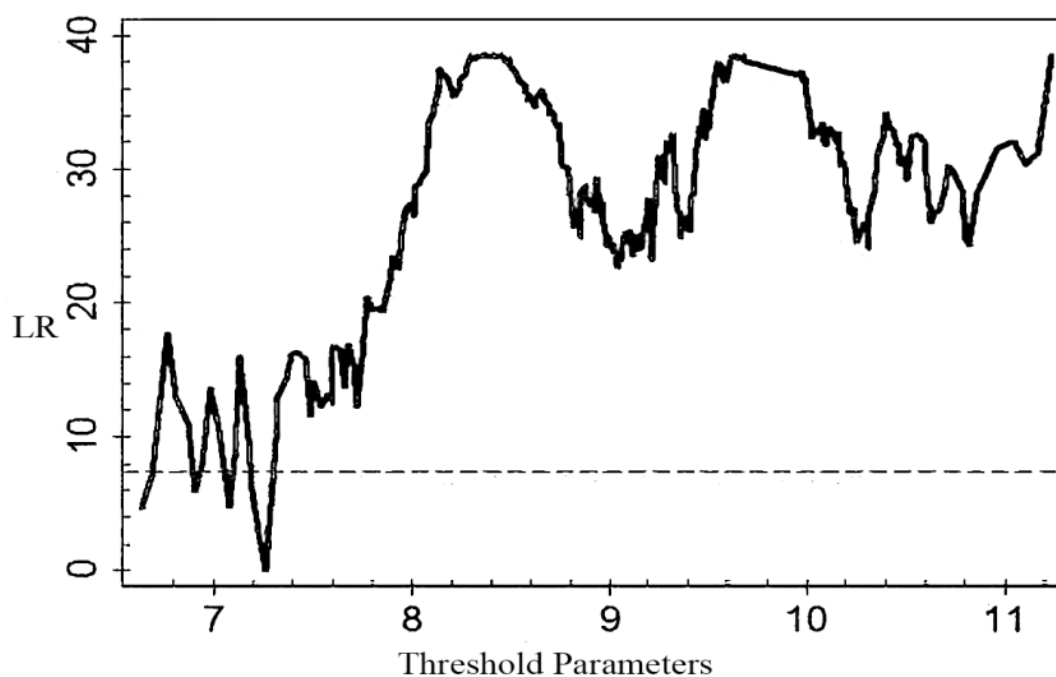


Figure 3
The second round of double threshold in 2014



According to the threshold number and estimated value of the threshold model in the above analysis, the multiple linear regression model with structural change can be calculated. It should be noted that although the data in 2010 support the single

threshold model, to better compare with other data, the estimation results of the double threshold model in this year are also given. The results are summarized in the first three columns of the table below.

Table 5
Estimation results of the Threshold model

	2010 section		2014 section	Mixing section	
	Single threshold	Double threshold		OLS	WHITE
Faminc*I(Indinc≤)	0.0420***	0.0381***	0.0418***	0.0426***	0.0426***
	-0.00614	-0.0063	-0.00701	-0.00504	-0.00537
Faminc	0.276***	0.237***	0.142***	0.215***	0.215***
	-0.013	-0.019	-0.016	-0.0127	-0.0133
Faminc*I(Indinc>)		0.00884***	0.0161***	0.0112***	0.0112***
		-0.00315	-0.00293	-0.0021	-0.00206
Country	0.0524**	0.0527**	0.0516**	0.0502***	0.0502***
	-0.0212	-0.0212	-0.023	-0.0157	-0.0155
Scale	-0.0039	0.00432	0.0264***	0.0142***	0.0142***
	-0.00639	-0.00703	-0.00749	-0.00512	-0.00527
Worship	0.0922***	0.0918***	0.197***	0.137***	0.137***
	-0.0201	-0.0201	-0.0219	-0.0148	-0.0149
Manage	0.216***	0.218***	0.328***	0.277***	0.277***
	-0.0334	-0.0334	-0.0359	-0.0244	-0.0237
Com	0.166***	0.166***	0.189***	0.243***	0.243***
	-0.00779	-0.00778	-0.00927	-0.00792	-0.00889
Edu	0.0188***	0.0192***	0.0154***	0.0171***	0.0171***
	-0.0028	-0.0028	-0.00312	-0.00209	-0.00211
Year2014				0.522***	0.522***
				-0.0135	-0.0136
	3.529***	3.836***	4.756***	3.611***	3.611***
Constant term	-0.168	-0.201	-0.187	-0.139	-0.142
Province dummy variable	control	control	control	control	control
Number of samples	11709	11709	10043	21752	21752
Adjust the square sum of explanation	0.331	0.331	0.243	0.316	0.316
F statistic	182	176.8	90.42	272.8	—

Note:

(1) The value in brackets is the standard deviation.

(2) *** $P < 0.01$, ** $P < 0.05$, * $P < 0.1$.

(3) Indicating function representatives: when the condition in brackets is true, the function value is 1. Otherwise, it is 0.

(4) The values of each column are 6.941, 6.941, 7.262, and 7.287, respectively, and the values of the last three columns are 8.311, 9.817, and 9.643, respectively. This will lead to the singularity of the OPG variance matrix and the loss of F-statistics when dealing with heteroscedasticity.

From table 5, on the whole, the net income of families has a positive elasticity to the human relationship expenditure. Comparing the regression results of the first column and the third column, we can find two characteristics of this positive influence in different years. First, the influence trend is roughly the same. After controlling for other influencing factors, in 2010, a 1% increase in total net income of low-income families (approximately 1033.80 CNY per capita annual income, 5.48% in the sample) would increase the family's renunciation expenditure by 0.318%. Still, the increase in other families was only 0.276%. In 2014, a 1% increase in the total net income of middle-income families ($7.262 < \text{index} < 9.817$) will increase the family's human relationship expenditure by 0.142%. On this basis, the increase in the proportion of low-income families (about 1425.10 CNY per capita, below the 8.38% quantile in the sample) will obviously rise to 0.184%. In contrast, the increase rate of wealthier households ($\text{Indinc} > 9.817$, approximately RMB18,342.94 per capita net income, above the quantile of 73.78% in the sample) increased slightly to 0.158%. Second, there are differences in the degree of influence. The coefficient of the total net income of households on human relationship expenditure in 2010 is much larger than that in 2014, which reflects that the influence of income factors on human relationship expenditure is shrinking, or that the "gap between the rich and the poor" on human relationship expenditure caused by income difference is becoming less obvious. However, the impact of other explanatory variables on the family's human relationship expenditure is more consistent in the two years. Specifically, under other conditions unchanged, rural families have to pay higher human relationship fees than urban families on average;

The cross-sectional data in 2014 reveals that the increase in the number of family members will significantly increase the family's human relationship expenditure, but the cross-sectional data in 2010 does not give a clear conclusion; For families with grave sweeping or ancestor worshipping behaviors and those running businesses, their human resources expenditure will be significantly higher than those who do not carry out these activities, and this positive impact will be strengthened from 2010 to 2014; Families with high communication expenditure or frequent contact with the outside world also tend to have higher human relationship expenditure; Different from "on the one hand, the custom of cash gift is caused by low cultural quality and heavy traditional ideas", the rise of average family education level will significantly increase the family's human relationship expenditure, which may be related to human relationship management. That is to say, people with a too high level of education will pay more attention to the interpersonal relationship with the people around them to make profits. Finally, the fact that the regression result in 2014 is less than that in 2010 reflects that the influencing factors of family relationship expenditure in 2014 are more complex.

Estimation results of mixed cross-sectional data

The threshold effect given by the above cross-sectional regression is different in different years. Still, it does not mean that there is no long-term rule to follow in net income impact on human relationship expenditure. According to figure 1, after controlling a single threshold, there is still a minimum LR value at the position where the net income per capita is about 9.1. It can be seen from table 3 and table 5, although the multiplicity estimates of the double threshold model given in 2010 and 2014 are different, the

threshold effect of the two years has a very similar structure, that is, a smaller threshold and a larger threshold. These phenomena mean that mixing the data of the two years may lead to more comprehensive conclusions. However, in the cross-sectional data, the variables of expenditure and income type are affected by economic growth and price index changes, which lead to a certain degree of incompatibility. Therefore, in the synthesis of mixed data, this paper standardized these variables by year according to the original

data, and then mixed them, and obtained a variable Gift with a mean value of 7 and a standard deviation of 1, a variable Indinc with a mean value of 9 and a standard deviation of 1, a variable Faminc with a mean value of 10 and a standard deviation of 1, and a variable Com with a mean value of 4 and standard deviation of 1. After standardization, these values no longer represent the specific income or expenditure but the relative wealth between samples. The descriptive statistics of variables are shown in Table 6 after the pool data is synthesized.

Table 6
Descriptive statistics of mixed data

Variable name	Average value	standard deviation	minimum value	maximum value	Number of samples
Gift	7	1	4.25	9.31	21752
Indinc	9	1	5.53	11.31	21752
Faminc	10	1	6.52	12.2	21752
Country	0.53	0.5	0	1	21752
Scale	3.84	1.69	1	10	21752
Worship	0.68	0.47	0	1	21752
Manage	0.09	0.28	0	1	21752
Com	4	1	0.31	5.66	21752
Edu	7.01	3.97	0	22	21752
Year 2014 (1-2014, 0-2010)	0.46	0.5	0	1	21752

Table 7 and Table 8 show the estimated thresholds, confidence intervals, and related tests using mixed cross-sectional data. The F statistic of the threshold effect test still supports multiple to triple threshold

models. Still, there is an overlapping confidence interval under the triple threshold, so it is reasonable to choose a double threshold model under a comprehensive consideration.

Table 7
Threshold estimates and confidence intervals for mixed data

Type	Threshold Estimate	95% confidence interval
Single threshold model	7.287	[7.134,7.403]
Double threshold model	7.287	[7.134,7.403]
	9.643	[9.600,9.816]
	7.287	[7.134,7.403]
Triple threshold model	8.811	[8.566,10.487]
	9.643	[9.600,9.816]

Table 8: F test of mixed data threshold model

Threshold type	F statistic	P value	BS times	1% Critical	5% Critical	10% Critical
Double	29.014***	0	750	6.683	3.757	2.763
Triple	10.453***	0	750	6.571	3.525	2.74

Figure 4 and figure 5 show the LR function diagram under the first and second round search of the double threshold model.

Figure 4
Mixed data double threshold first round

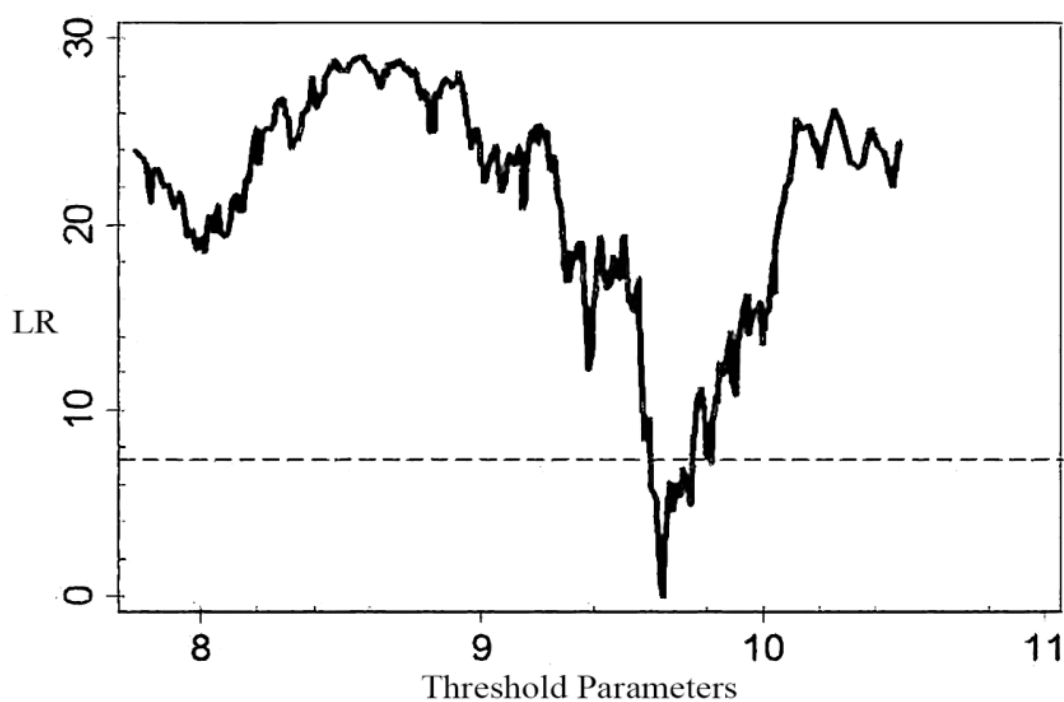
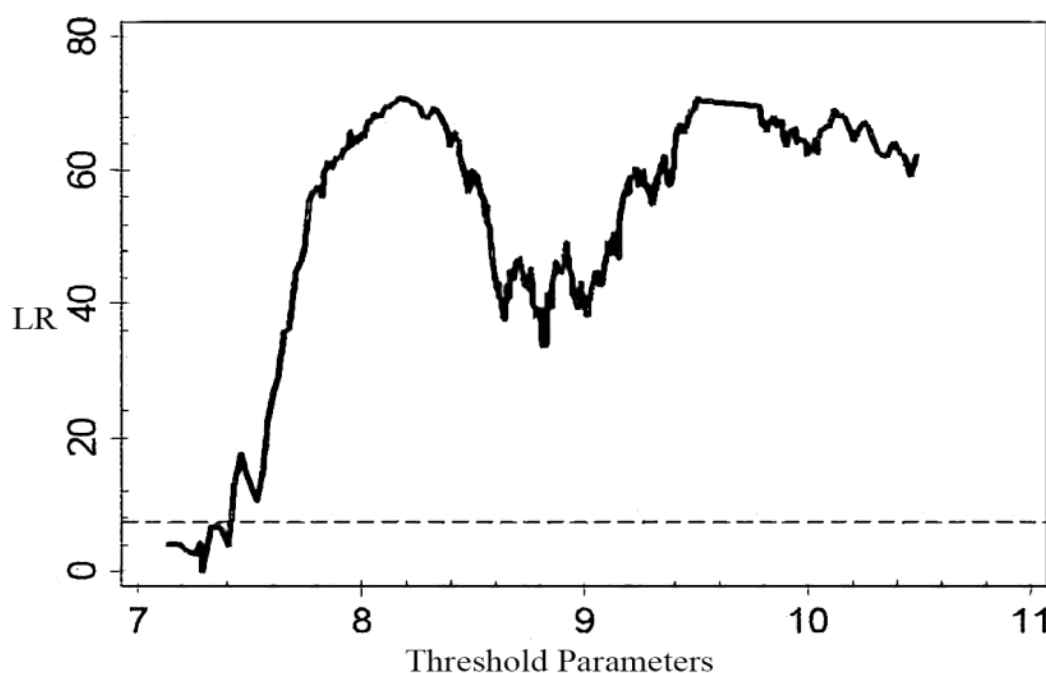
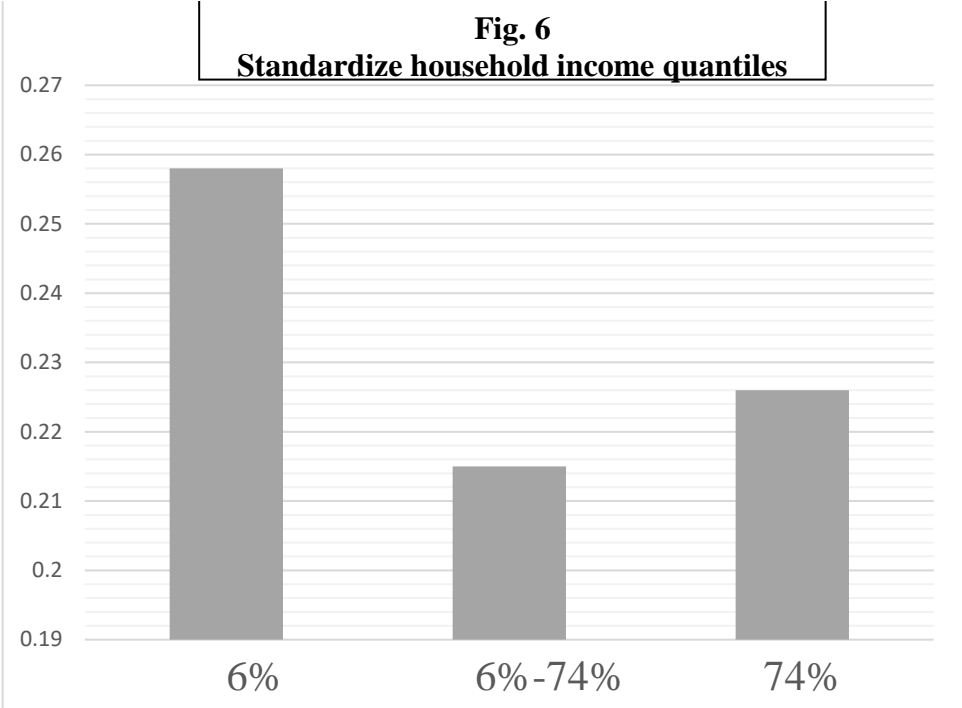


Figure 5
Mixed data double threshold second round



The last two columns in Table 5 are the final estimation results of the double threshold model. It can be seen that the estimation under the standardized mixed cross-section data basically gives the same conclusion as the estimation under the annual cross-section data and also has significant characteristics in two aspects. Taking the ordinary least squares method as an example, first of all, the elasticity of family total net income to human relationship expenditure shows a trend of high ($\text{indinc} < 7.287$, below 6% of the income quantile), low ($7.287 \leq \text{indinc} < 9.643$, between 6% of the income quantile and 74% of the income quantile), and high ($\text{indinc} \geq 9.643$, above 74% of the income quantile), as shown in Figure 6. In

general, the per capita net income is increasing year by year, so from the perspective of elasticity, it can be considered that the burden of a cash gift is different for families with varying levels of income. That is, low-income families are the heaviest, middle- and high-income families are the second, and low- and middle-income families are the lightest. Secondly, after controlling all the other set explanatory variables except year, even if the explanatory variables have been standardized, the sample in 2014 will still pay more for human relationships than the sample in 2010, which further reflects the complexity of human relationship expenditure in 2014.



6: Quantile range and elasticity of per capita net income

To sum up, as far as the original intention of human relationship expenditure is concerned, it is generally only a means of expressing blessings, which has nothing to do with the specific quantity. However, when capital materializes the whole society, human relations are increasingly expressed in the form of commodities. Like the goods consumed, family human relationship expenditure is highly positively correlated with family income. The more interpersonal relationships were valued by smokers, the greater the predictive power of perceived social norms of smoking on social smoking behavior. Similar results have been found in empirical studies[21]. And people begin to price all social relations. Among them, the low-income group is more thoroughly materialized, and their price of social relations is more distorted. At the same time, in such a materialized society, traditional ideas, enterprise management, social communication and education are all washed away by capital, which can only intensify the

materialization of the whole society intentionally or unconsciously.

FURTHER ANALYSIS OF EMPIRICAL RESULTS

The empirical analysis results of both annual cross-sections and mixed cross-sections basically confirm the theoretical analysis hypothesizes made in this paper. Compared with the general multiple linear regression model, the threshold model does get more detailed conclusions on the decision-making of human relationship expenditure of families with different income levels. It is worth pondering the difference in human relationship expenditure, especially in the low-income stage. According to the first threshold cut-off point obtained from the empirical results, we can further get the proportion of the total family human relationship expenditure in the whole family net income in different quantile ranges of family per capita net income, as shown in Table 9.

Table 9
Proportion of human relationship expenditure in different intervals

Quantile range of per capita net income	2010		2014	
	Less than 5.48%	More than 5.48%	Less than 8.38%	More than 8.38%
The average proportion of human relationship expenditure to total income	0.468	0.067	1.253	0.075

Through comparison, we can find that: in 2010, the first threshold quantile of per-capita disposable income was 5.48%, and the proportion of family human relationship expenditure under this quantile in the total net income of the family reached 46.80%, which was significantly higher than that of 6.70% above the 5.48% income quantile. In 2014, the first threshold of per-capita disposable income increased from 5.48% in 2010 to 8.38%; at the same time, the proportion of family affection expenditure in the total net income of the family has also increased in an all-round way, especially in the low-income range, which has nearly tripled to 125.30%. In contrast, the change in the non-low-income range is less noticeable. The high proportion of low-income families in the human relationship expenditure is really worthy of attention. Taking the data of 2014 as an example, 45.6% of families have the situation that the human relationship expenditure exceeds the net family income, while the ratio of 125.30% means that, on average, families in this income stage should not only exhaust all their income, but also pay more attention to the social relationship expenditure, and also need to use savings or debt to meet the needs of human relationship expenditure. Also, with regard to the effect of smoking on income, much of the literature finds that smoking reduces income levels. In the United States, data studies have found that smoking lowers wages by 4-8%;²²In Canada, smokers were found to earn 8% less than nonsmokers;²³In Germany, smokers earned 2%-8% less than nonsmokers;²⁴In the Netherlands, smokers earned 10% less than nonsmokers;²⁵In developing countries like Albania and even up to 24%.²⁶ The increase in the ratio of human relationship expenditure to total income means that the social relationship between people has become more and more material. The so-called human relationship is reduced to an investment or commodity, and this materialization has a more significant impact on

the poor. People regard human relationships as an investment product to gain certain benefits in the future. Low-income families and rural families have narrow and fixed characteristics in the social communication scope due to barriers such as physical capital and registered residence. Therefore, the risk of investing in human relationships is small. Under the guidance of the so-called rational principle, these families produce more human relationship expenditure. People will also regard the human relationship as a kind of commodity to meet their own utility. From the empirical results, we can know that for families in the low-income range, human relationship commodity has a higher income elasticity of demand, so it is closer to luxury goods. Smoking imposes many negative costs on society, with significant negative effects on health, work, training, etc.²⁷ According to the famous Engel's law, the total income of low-income families should be more used to buy goods to meet their material needs, that is, food, clothing, and housing. However, from the data analysis of this paper, the low-income families in China spend 125.30% of their income on a luxury called human relationships. This kind of goods cannot directly meet their own material needs, thus falling into a sort of contradiction and madness (or irrationality). Unlike other countries, however, the average income of smokers in China is higher than that of nonsmokers.¹⁰ The response here is that smoking affects income by means of social interaction. Thus, low-income people are more likely to spend more money on social spending in order to increase their income, as evidenced by the correlation between cigarette consumption and income in China. In the above, through empirical analysis to verify the materialization of capital and its rationality, we use Foucault's post-modern theory to analyze further the (very contradictory) results of human relationship expenditure.

Left-wing researchers generally believe that

capital has rationality, which is measurable, while irrationality is not. In Foucault's eyes, on the surface, the opposition between rationality and irrationality is the opposition between civilization and madness. That is, rationality is the expression of civilization, and irrationality is the language of madness. However, the blind worship of rationality makes people fall into the dilemma of rationality, that is, madness: "out of this madness, people, confine their neighbors with an action dominated by supreme rationality, communicate and recognize each other in a cold language that is not insane".¹⁸ Foucault's madness is the madness brought by the rationality constructed by norms and civilization in modern society, which is the standard of demarcation and the symbol of identity. This state, Nietzsche also called it "frenzy": that is to say, the exceptional action (materialized social relations) is mistaken for his own essence. Therefore, when the principle of rationality enters into the situation of human interaction, capital becomes the "common language" between people. The family income, social status, and the relationship between capital and society imply rational and normative social recognition. In contrast, the human relationship expenditure depends on the "etiquette" formed by capital elements, which are high or low. This means that capital itself has become morality. As Max Weber pointed out in his book *Protestant Ethics and the spirit of capitalism*, "as long as making money is legal, it can be regarded as the result of abiding by virtue of vocation and the performance of the function of vocation",²⁸ this is the ethics of capital. Under the principle of rationality in the name of standardization, civilization, and efficiency, the values based on the principle of capital naturally replace the traditional values and achieve a new kind of ethics. Therefore, it is even difficult for us to criticize it morally effectively.

Under the joint action of capital and rationality, the expenditure of human relations is increasingly characterized by various types and high consumption, thus becoming a measure to express the intimacy of social relations. The low-income families' overload of human relationship expenditure seems to be an irrational behavior, but it is in line with the rational principles of modern society. That is to say, the seemingly irrational behavior is actually coerced by modern rationality. Just as in China, cigarette consumption and income

growth show a perverse positive correlation. The rationality explained by Foucault is an everyday norm and unified standard constructed by "modern civilization and spiritual progress." The principle of rationality lies in that the norms and standards are universal and mandatory and have a binding force on every individual in the society, whether rich or poor. It means that low-income families are endowed with a similar demand for human relationship expenditure as high-income families. Because of the lack of capital, they bear the pressure of more human relationship expenditure. "All of us are destined to live in choice, but not everyone has a way to be a choice".²⁹ Face this kind of life, and the poor can only take an intuitive attitude towards it. For the bottom poor without assets, they will only be materialized more thoroughly, which is a kind of post-modern slavery.

CONCLUSIONS AND SUGGESTIONS

This paper emphasizes that under the background of market economy and globalization, the analysis of human relationship expenditure should include the factor of capital. This paper takes the general formula of capital as the starting point to explain the influence of capital on human and social relations and then act on human relationship expenditure. This paper reveals that the increasing human relationship expenditure is manifested as materialized social relations through empirical analysis to test the theoretical framework. That is to say, everyone is connected by capital. The principle of rationality endows the social connection mediated by capital with rationality, which leads to the further materialization of social relations. Other scholars' arguments that increased consumption spending on cigarettes in China can lead to higher incomes corroborate the paper's view. From 2010 to 2014, the percentage of low-income families' human relationship expenditure increased from 46.80% to 125.30%. The percentage of low-income families' human relationship expenditure was much higher than that of high-income families. In addition to the income factor, the types of urban and rural areas, traditional customs, business management, social exchange, and education level significantly impact the family's human relationship expenditure. And for a developed country like the United States, tobacco prevention should target vulnerable youth, such as those who are non-white, young, and have

parents with low levels of education. This certainly shows a very counter-intuitive manifestation.³⁰ Combining the theory and analyzing the empirical data shows that the traditional customs, education, and other factors in people's concept cannot resist the materialization of social relations and people. Still, they are also materialized by capital, which makes them strengthen the materialization in turn. The principle of rationality endows this materialized social relationship with strong rationality and universality. It means that every individual must deal with the expense of human relations brought by materialization. Therefore, the low-income people who lack material wealth, because they do not master the object of capital, undoubtedly do not qualify to make rules, which makes them in a materialized situation.

When everything becomes so rational when people no longer need emotional communication, life experience can go directly through the intermediary of capital to achieve the highest principle. There is no difference between man and machine. As scholar Shadel points out, cost considerations unaccompanied teenagers and homeless low-income earners from choosing e-cigarettes even when they are addicted, simply because of cost considerations.³¹ The power of the intermediary for capital does not stop there. Although some brands of cigarettes can become expensive, consumers are more likely to use several different types of tobacco products rather than just smoke a single brand of cigarette.³² Therefore, how to restrict the capital, break this rationality, and make the social relations return to normal is a topic that cannot be bypassed in the development. On the one hand, this paper attempts to give more academic attention and theoretical interpretation to the materialized social relations and the impact of capital on people. Under the guidance of theoretical understanding, combined with the practical situation, we should also pay attention to the "human poverty" that may be brought about by human relationship expenditure and actively promoting the support and implementation of equity policies. In this regard, we should guide and curb human interaction mediated by capital and relieve the pressure of low-income families due to human relationship expenditure. We can also increase the power of sustainable income growth and make low-income families fully use

their resources to do business and create a better life.

Conflict of Interest Disclosure Statement

The authors have no conflicts of interest, financial or otherwise.

Author Declaration

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