



Research Article

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Research on The Statistical Measurement of Consumption Quality During the Covid-19 Pandemic

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Abstract

In 2020, the Central Committee of the Communist Party of China formally established the new development pattern of "take the domestic big circulation as the main body, the domestic and foreign double circulation" during the COVID-19 pandemic. Under the New Development Pattern angle of view, the consumption is the kinetic energy to turn "outside promotes the inside" to "inside promotes the outside". And the quality of consumption to a large extent reflects people's consumption. Consumption quality means that people's consumption is no longer limited to meet the most basic needs of life, but more attention to high-quality goods and service quality. With the improvement of consumption quality, people's physical and mental health develops more comprehensively, and social and economic development is more harmonious. In order to explore the growth of consumption quality, from the perspective of the new development pattern, we construct the consumption quality index system from four dimensions: The consumption quality of the consumer, the objective object of consumption, the external environment of the consumption society and the new development pattern, including 4 first-class indicators, 9 second-class indicators, and 15 third-class indicators. The factor comprehensive scores of consumption quality from 2001 to 2019 were obtained by principal component analysis.

Keywords: New Development Pattern, Consumption Quality, Principal Component Analysis

Introduction Introduce the Problem

In 2020, the Central Committee of the Communist Party of China formally established a new pattern of development of "Domestic circular economy" at an expert symposium on economic and social fields. The development model theory, "Double circulation of domestic and international with domestic as the main body and mutual promotion", is consistent with the new normal theory, supply-side structural reform and high-quality development theory. It is a new development of the political economy with Chinese characteristics.

Several scientists have been studying the new development model. Jinying Li explains the new development model in detail in the article "Establishing a new development model to promote high-quality development", and also explains how to promote it [1].

The quality of consumption is also called "Quality of life" by some Western scholars. Consumption quality means that people's consumption is no longer limited to meet the basic needs of life, but pay attention to the quality of high-quality goods and services.

Some scholars have studied the influencing factors of consumption quality and evaluated it. In the article "The construction and measurement of the evaluation system of the consumption quality of Chinese residents", thinks that the consumption quality consists of three aspects: the subjective consumer, the objective object and the external environment [2]. Zhang Sun mentioned that it is closely related to the level of food consumption expenditure in his article "The relationship between the quality of e-commerce consumption and the development of service industry" [3].

Most of scholars study the new development pattern and consumption quality separately, but seldom study the change of consumption quality under the new development pattern. From the perspective of new development pattern, this paper constructs the evaluation system of consumption quality, calculates the consumption quality and obtains the annual score of consumption quality during the COVID-19 pandemic.

Concept Definition New Development Pattern

"The world today is going through major changes not seen in a century," Jinping Xi said. The new development pattern is an inev-

itable choice to deal with various crises and risks in the era of major changes. It is also the product of following the General Law of the economic rise of modern powers. All economies need to make the necessary adjustment from "Promoting internal development from outside" to "from the inside to the outside". The new pattern of development refers to the double circulation of domestic and international with domestic as the main body and mutual promotion. It is in line with the historical law of the economic development of big countries.

Consumption Quality

In this paper, consumption quality is defined as people's consumption is no longer limited to meet the most basic needs of life, but pay more attention to high-quality goods and service quality. It also means people get pleasure and satisfaction from consumption. In that period that China's economy was relatively poor, people consumed mostly necessities, preferring cheap, high quality, standardized products. But as people's consumption ideas changed, under the new development pattern, in the market driven by domestic demand, the necessities of life have already been met, and people spend more on the goods or services about health, comfort and other use value, more personalized and high security. Such a transition makes people's consumption from the "Transaction quantity theory" into the "Consumption quality theory" [6]. Consumption quality is not only a single indicator of consumption, but can reflect all aspects of life indicators. It not only promotes the economy, but also plays a vital role in the all-round development of human beings and the harmonious development of society. Nowadays, the state advocates high-quality development, and encourage people to spend to expand domestic demand. In order to measure the consumption quality, this paper defines it as the proportion of consumption enjoyment, consumption development, individual consumption power, consumption structure, consumption experience and residents' satisfaction. It is composed of the consumption quality of the main body of consumption, the objective object of consumption, the external social environment of consumption and the new development pattern.

Method

The Method, Principal Component Analysis (PCA), is also called Principal Vector Analysis (PCA). The main idea is to reduce the dimension, and to use a few comprehensive indexes (that is, principal components) to reflect most of the information of multiple indexes. The information contained in PCA is expressed in variance. The first principal component has the largest variance, and so on. The higher number, the more information contains.

Determination of Study Area

The new development pattern is rich in connotation, involving foreign economic relations and trade, tourism, residents' life, scientific and technological innovation, and many factors. This paper aims to analyze whether the consumption quality of the whole country has been promoted obviously under the new development pattern and whether it has had a great influence on people's life. In this paper, the changes of consumption quality in 19 years and the relationship between them are calculated by choosing various data from the Statistical Yearbook of China from 2001 to 2019.

The Theoretical Basis for Constructing the Index System

The new development pattern was formally proposed in 2020, but the 11th and 12th five-year Plans promulgated in 2006 and 2011 called for "Promoting development on the basis of expanding domestic demand", the Central Committee of the Communist Party of China has put forward a series of measures to promote economic development based on domestic demand and innovation. "Unleashing the potential of domestic demand" is the key word in the 2019 government work report. Therefore, for the indicator system of the new development pattern, this paper chooses three secondary indicators: Foreign Economic and trade, the number of innovation achievements, and high-quality development. As for the quality of consumption, most scholars think that the quality of consumption is the essential characteristic about the quality of consumption, which is formed by the interaction of the subject, object and environment of consumption. It consists of three parts: subject quality, object quality and environment quality. Thinks that the change of residents' consumption quality can be reflected by the level of food consumption expenditure to a great extent [3]. Yun He thinks that the optimization and upgrading of consumption quality and consumption structure can promote each other [4].

In this paper, the consumption quality refers to people's consumption is no longer limited to meet the most basic needs, but more focus on high-quality goods and service quality. The development data of consumption expenditure, enjoyment data and non-food data are all objective objects of consumption. The objective object of consumption can reflect the situation of consumption quality. That is, in people's consumption expenditure, consumption enjoy data and development data proportion, non-food expenditure will be higher, the higher the quality of consumption. Consumption quality also refers to the sense of pleasure and satisfaction people get through consumption. This satisfaction can be directly brought about by an increase in the consumption power of the consumer, namely, an increase in per capita disposable income, an increase in per capita GDP, and an increase in per capita consumption expenditure: people are able to afford higher consumption, the consumer satisfaction can also be brought by the external environment of the consumer society, with a comfortable living environment and medical security, people are happier when they spend. Therefore, employment, cultural output, medical and health care, the living environment of the residents are guaranteed, and the quality of people's consumption will also rise. At the same time, the quality of consumption is also related to the new development pattern.

To sum up, in order to measure consumption quality, this paper defines consumption quality as the proportion of consumption enjoyment, consumption development, individual consumption power, consumption structure, consumption experience and residents' satisfaction with public life. The measurement of consumption quality selects 15 indicators from four dimensions: The consumption quality of the consumer, the objective object of consumption, the external social environment of consumption and the new development pattern.

Basic Contents of the Index System

Under the New Development Pattern Angle of view the connota-

tion of consumption quality is rich. T This article is based on a number of principles such as: The scientific, feasibility, representativeness, comparability of indicators, referring to previous experience. Finally, after many times of screening and index replacement, a set of relatively complete scientific measurement of consumption quality indicator system under the new development pattern is constructed.

Table 1: Consumption quality index system from the perspective of New Development Pattern

First-level indicator	Second-level indicator	Third-level indicator	variable name	
Quality of consumption customer	consumer spending power	per capita disposable income	x1	
		per capita consumer spending	x2	
		per capita GDP	x3	
Quality of consumption object	Proportion of consumption	share of non-food consumption	x4	
	expenditure	share of enjoyment consumption	x5	
		share of development consumption	х6	
		ratio of subsistence consumption	x7	
Quality of social environment	employment	urban registered unemploy- ment rate	x8	
	cultural output	per capita public book collection	x9	
	health care	per capita health care institu- tional beds	x10	
	living environment	per capita park green area	x11	
Quality of new development pattern	foreign economic relations and	ratio of imports	x12	
	trade	Ratio of exports	x13	
	innovative development	registration of innovative achievements	x14	
	domestic high-quality development	product quality pass rate	x15	

Data Processing

According to the index system of high-quality economic development, the data from 2001 to 2019 were analyzed by Principal Component Analysis (PCA) by SPSS software. The steps are as follows: First, the missing values are linearly interpolated; second, the missing values are standardized; and third, the covariance Matrix of each year are computed separately, the fourth step is to calculate the covariance Matrix eigenvalues and sort them from large to small and find the corresponding eigenvectors. The fifth step is to calculate the contribution of variance and select the number of principal components. Step 6: Calculate the Principal Component Score, that is, the annual score.

Empirical Analysis Composite Score of Consumption Quality

After 9 iterations of Principal Component Analysis (PCA) on 15 indicators, combined with Lithograph, lithograph is a graph that shows how much variable information is covered by factors. Generally, the first factor covers the most information, and then decreases, general selection from steep to smooth corresponding to the number of the first factor 5, and then look at the factor cumulative contribution rate, found that the first 5 factors reached 92.08%, so the final selection of 5 factors.

Table 2: Cumulative Variance Contribution of Principal Component Analysis

Serial number	1	2	3	4	5
Cumulative contribution	49.82%	65.97%	77.80%	86.14%	92.08%

The cumulative contribution rate of the five principal components was 92.08%, the first principal component was 49.82%, the second principal component was 16.16%, the third principal component was 11.82%, and the fourth principal component was 8.34%, the contribution rate of the fifth principal component was 5.93%. So

choosing 5 principal components can reflect 92.08% information of 15 indexes. Using these five principal components, the annual comprehensive evaluation scores of consumption quality are as follows:

Table 3: Consumer quality composite scores from 2001 to 2019

year	Quality of consumption subject	Quality of consumption object	Quality of social environment	Quality of new development pattern	Quality of consumption	
2001	-1.4231	-0.9514	-0.8450	-0.9638	-0.9240	19
2002	-1.3214	-1.0518	-1.0717	-0.8572	-0.8405	18
2003	-1.2335	-0.8868	-1.2806	-1.0293	-0.7409	17
2004	-1.1132	-0.9892	-1.0625	-1.0755	-0.7296	16
2005	-0.9801	-0.8220	-0.9972	-0.5844	-0.6479	15
2006	-0.8305	-0.6282	-0.8279	-0.1643	-0.5402	14
2007	-0.5850	-0.5809	-0.6162	0.1939	-0.4070	13
2008	-0.3473	-0.3671	-0.6240	0.2591	-0.2906	12
2009	-0.1780	-0.4193	-0.5414	0.0767	-0.1073	11
2010	0.0711	-0.1821	-0.1505	-0.2093	-0.0043	10
2011	0.2297	0.1475	-0.0037	-0.3997	0.0601	9
2012	0.4032	0.3398	0.2254	0.0691	0.2551	8
2013	0.4609	0.8205	0.4250	0.0013	0.4234	7
2014	0.6789	1.1967	0.6065	0.4168	0.5404	6
2015	0.6940	1.1547	0.8050	1.1481	0.6218	5
2016	0.9255	1.1981	1.0335	1.1227	0.7268	4
2017	1.2057	1.2357	1.3448	0.7335	0.7870	3
2018	1.5145	1.3386	1.6034	0.5153	0.8800	2
2019	1.8287	1.2217	1.9772	0.7468	0.9378	1

According to the consumer quality index, the highest score in 2019 is 1.8287 and the lowest is-1.4231 in 2001. Consumption level refers to the sum of all kinds of expenses that consumers spend to satisfy their daily life in a certain period of time. In this paper, consumption level is represented by per capita consumption expenditure, which is standardized and then plotted with consumption quality, as shown in figure 1. According to the changing trend of consumption quality and consumption level, the consumption quality and consumption level have been rising year by year. As can be seen from the graph, the increase rate of consumption quality lags behind the consumption level, and the increase of consumption quality is relatively slow. According to statistics, the per capita consumption expenditure of urban residents increased from 3,138.8 RMB in 2001 to 21,558.9 RMB in 2019. In less than two decades, it has risen sevenfold, at a very rapid rate. The contrast

consumption quality increased from-0.9240 to 0.9378. Although it also increased year by year, the increase was slow to the consumption level and the growth rate was low. At the same time take two years of adjacent consumption quality, consumption level increases instantaneous change rate. It is obvious that consumption level increase is bigger than consumption quality. Therefore, the acceleration of consumption quality is smaller than that of consumption level, and it is accelerating fast. Because as long as people's income rises, per capita consumption expenditure will rise obviously, and the more per capita consumption expenditure, the higher the consumption level, the two are in direct proportion. But the consumption quality is different. Its acceleration is small. Because it does not be improved immediately, it requires an improvement in the quality of consumption in every household, and the whole society is a relatively stable state. So, the improvement of

consumption quality is a slow and tortuous process.

Through the consumption quality image stage analysis, the consumption quality was negative from 2001 to 2009. At first, people live a hard life, and income is not high. Labor force is little. Consumption level is low. Family population is on the high side, so consumption expenditure is spent on clothes, food, shelter and transportation. Even poor families, there may not be enough to eat, wear not warm, so the quality of consumption as low as negative-0.9240. With the social and economic development, the state's various poverty-alleviation policies, people's per capita income increased. The consumption level rose. Gradually every family has

been satisfied with food and clothing, then consumption quality has increased significantly. People no longer need to worry about food, even have a surplus. But due to the impact of consumption concept, most people will choose to save money rather than shopping. And that contributed to consumption quality increase relatively slow in2010 to 2011. Later, in 2012-2019, with the deepening of the new development pattern and the improvement of product quality, people began to pursue high-quality goods and service quality, and began to actively consume, consumption of more developmental and hedonic data, coupled with continued growth in consumption levels, has led to an improvement in the quality of consumption, reaching 0.9378 by 2019.

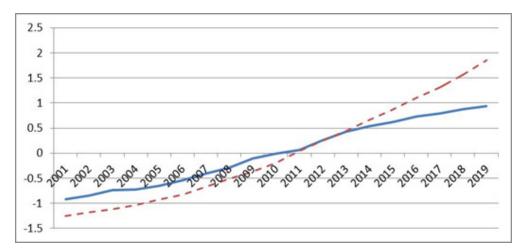


Figure 3.1: Trend Chart of Consumption Quality and Consumption Level

Quality of Consumption Subject

In order to measure the consumption quality of the consumer, this paper selects three indicators, namely per capita consumption, per capita consumption expenditure and per capita GDP.

From 2001 to 2019, it shows an upward trend, from-1.42 to 1.83. In 2001-2013, the growth rate gradually slowed down. And it presented a straight-line increase in 2013-2014. Followed by a near-zero growth rate in 2014-2015, it remained basically flat for

two years, and finally, the growth rate increased significantly in 2015-2019. The internal reason is that with the progress of the times and the development of the society, people are more capable and can obtain more income, thus they can afford more consumption expenditure. And the whole economy of the residents rises steadily, so that the consumption of the main consumption, consumption level increased significantly. To a great extent, the improvement of the quality of consumption subject will directly promote the improvement of consumption quality.

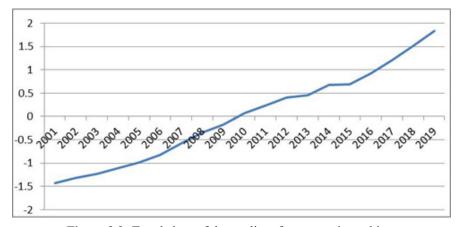


Figure 3.2: Trend chart of the quality of consumption subject

Quality of Consumption Objective Object

In terms of the quality of the objective object of consumption, this paper selects four three-level indicators: The ratio of non-food consumption to consumption expenditure, the ratio of enjoying data consumption to consumption expenditure, the ratio of development data consumption to consumption expenditure, and the ratio of subsistence consumption to consumption expenditure, respectively reflects the consumption of urban residents in the eight categories of various types of data accounted for the situation.

According to the changing trend of the quality of the objective objects of consumption, on the whole, it in 2001-2019 has increased significantly, from-0.9514 to 1.22169. In 2001-2011, it is obvious that it is relatively slow to increase. During this period, people spend most of their consumption on food, clothing and other means of survival. Then in 2011-2013, people's basic living needs have been met, and people's income has been increasing, which means people have more money to spend on consumption. At this point people will choose some high-quality, comfortable, cost-effective goods, and are starting to consume more developmental and hedonic information. As can be seen from the data, in 2011-2013, people's consumption expenditure on development and enjoyment increased from 7,222.41 RMB to 8,066.6 RMB; the proportion of

people's development-oriented information and enjoyment-oriented consumption expenditure increased significantly from 0.52 to 0.61. This also causes it increase from 0.1475 to 0.8205 sharply. Finally, in 2014-2019, people's consumption patterns are basically formed. For survival, development, enjoyment, the three major data expenditure ratio is basically stable. So, it has certain fluctuation, but the range is very small, relatively stable, maintains about 1.2. So, it can promote the improvement of the quality of consumption.

It is further revealed that the consumption structure of the residents has been upgraded. The judgment of consumption structure can be obtained by observing whether the proportion of survival consumption decreases and the share of development consumption and enjoyment consumption increases in the total consumption expenditure of people. Throughout 2001-2019, at the beginning, people's survival materials accounted for the largest proportion of consumption expenditure. But the development or enjoyment of materials is very low. With the passage of time, the needs of people's live have been fulfilled. In the meantime, the share of development, enjoyment of materials increased significantly. Thus, people's consumption structure is optimized.

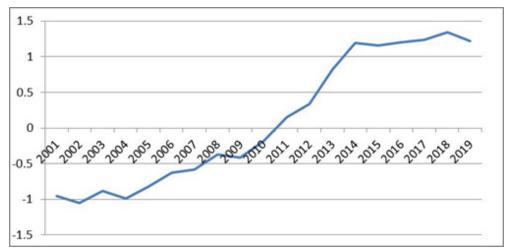


Figure 3.3: Trend chart of objective object quality of consumption

Quality of Social Environment

This paper, in terms of the external social environment of consumption, selects four secondary indicators: employment, cultural output, medical and health care, and the living environment of residents, reflecting respectively the employment situation, the cultural consumption situation, the medical security situation and the green living situation of the residents, to judge whether the residents can obtain the satisfaction of consumption under this environment.

From 2001 to 2003, the quality index dropped from-0.84497 to-1.28056. During that time, the domestic market was stagnant. Counterfeit and substandard products appeared in endless layers, and smog weather, waste water discharge and so on. The state subsequently ordered a major overhaul of the ecological and social

environment, advocated the concept of sustainable development, and reduced environmental pollution and waste of resources, to provide people with a better living environment. Through improving the medical security system, increasing the book collection, per capita green area, public services and people's lives have been greatly improved. This has led to a significant increase in people's life happiness. At the same time, the government strengthened the investigation and punishment of fake and shoddy good, and rectified the order of the market economy, to make sure the environment of the consumer market fair and clean. This also led to the 2004-2019 consumer external environmental quality index continued to increase sharply, from-1.06 to 1.98. Having a good external environment for consumption will make people happier and more pleasure when they consume. So, it will promote the improvement of consumption quality.

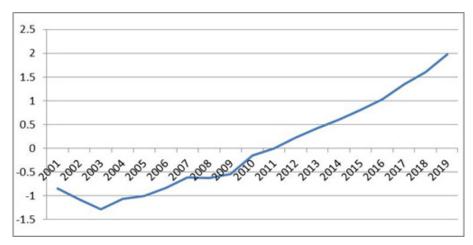


Figure 3.4: Trends in the quality of the external social environment of consumption

Quality of New Development Pattern

As for the new development pattern, this paper selects three secondary indicators: Foreign Economic and trade, innovative development and domestic high-quality development. Foreign Economic and trade reflects the relationship between domestic and foreign demand. The innovation development reflects the innovation ability of our country, and the domestic high-quality development reflects the domestic product quality.

According to the changing trend of the quality of the new development pattern, we can see that it fluctuates, up and down. In 2002-2004, 2008-2011, 2012-2013, it decreased slightly; and in 2004-2008, it increased from-1.029 to 0.1939, and from-0.43 to 1.1481 in 2013-2015, showing a clear growth trend. Finally, it's basically holding steady at 0.6 in 2017-2019.

The development of new development pattern and the promotion of consumption quality promote each other. The "Eleventh five-year Plan" and "Twelfth five-year Plan" promulgated in 2006 and 2011. They call for accelerating scientific and technological innovation and high-quality development of industrialization. Under the guidance of the policy, China's innovation ability has been

continuously strengthened, from 28448 to 68562, and in foreign economic relations and trade, China's innovation ability has been increased from 28448 to 68562. We have increased the volume of imported goods and increased domestic consumption of consumer goods and services. In terms of domestic high-quality development, more attention has been paid to the qualification rate of products, and more high-quality products have been produced, making people more receptive to the development and enjoyment of goods and services. By the joint effect of them, the quality of domestic consumption has been significantly increased. In turn, the quality of people's consumption increased, the quality of the demand for goods is also increasingly high, thus promoting high-quality domestic development, stimulating innovation. Only by increasing innovation can we produce better goods to meet people's needs, increase consumption power and expand domestic demand. Therefore, the new development pattern advocates high-quality development, encourages consumption and improves the quality of consumption, which in turn promotes consumption, expands domestic demand and accelerates the deepening of the new development pattern. The two promote each other, forming a virtuous circle.

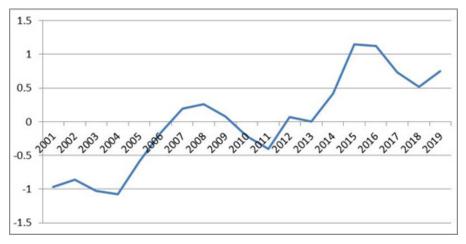


Figure 3.5: A trend chart of the quality of the new development pattern

Main contents and conclusions

In order to measure the consumption quality under the new development pattern, this paper constructs a statistical index system consisting of 15 indexes from four dimensions: The consumption quality of subject, the objective object of consumption, the external social environment of consumption and the new development pattern. Empirical analysis, draw the following conclusions:

- (1) In 2001-2019 consumption quality is rising year by year, in 2019 consumption quality the highest score reached 0.94, the lowest was in 2001 score-0.92.
- 2. (2) The consumption quality and the consumption level both increase year by year, but the growth rate of the consumption quality lags behind the consumption level. It is slow and tortuous, therefore must enhance the consumption quality.
- 3. (3) The improvement of the consumption quality of subject promotes the improvement of the consumption quality. Customer has more income, increases the consumption expenditure, the consumption power promotion, drive the main body of consumption quality promotion, causing the entire society's economy to obtain the development.
- 4. (4) The improvement of the quality of the objective object of consumption accelerates the improvement of the quality of consumption. People's basic living needs have long been guaranteed, and they can pursue better quality of life commodities. The consumption expenditure has increased the consumption enjoyment data and the development data, and the consumption structure has been upgraded, the increase in the enjoyment of development materials will also promote the all-round development of human beings.
- 5. (5) The improvement of the external environment quality of the consumption society promotes the improvement of the consumption quality. In a clean and fair environment of consumption, people will be more satisfied. People are more comfortable when they consume, and the quality of consumption is naturally improved.
- 6. (6) The development of the new development pattern and the promotion of the quality of consumption are mutually reinforcing. The new development pattern advocates high-quality development and adheres to an innovation-driven approach. By expanding the domestic consumption market, the consumption quality of the people across the country has been improved; and the improvement in the consumption quality, in turn, has promoted consumption and expanded domestic demand, accelerated the development of the new development pattern. Therefore, the development of the new development pattern and the promotion of consumption quality promote each other, forming a virtuous circle.
- 7. (7) In 2019, the consumption quality of subject ranked first, the quality of the objective consumers ranked third, the consumption external environment quality ranked first and the development of the new development pattern ranked third. Finally, the overall consumption quality score ranked first. It indicated that to improve the quality of consumption, the four aspects of development should be carried out simultaneously. Only under the new development pattern, increasing consumption power, guaranteeing the quality of consumer goods, providing a fair consumption environment, improving people's medical and health security, and creating a friendly living environment, can the quality of consumption rise sub-

stantially, and can be more conducive to the harmonious development of society [5, 7-20].

Conflict of Interest

We have no conflict of interests to disclose and the manuscript has been read and approved by all named authors.

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