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Original Paper

The Impact of Demographic Structure on Consumption Structure: A Comparative Study of China and Japan

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Abstract

This paper adopts a comparative methodology. The comparison between China and Japan is justified by the significant similarities and crucial differences in their developmental paths. This research initially applies quantitative approaches to examine the data furnished by the primary statistical agencies of both nations. Subsequently, a multiple linear regression analysis is carried out via EViews to explore the correlation between age cohorts and final consumption expenditure. Additionally, Principal Component Analysis (PCA) is utilized through SPSS to analyze the consumption structures of China and Japan in each period. The results indicate that both China and Japan exhibit features of a stacked consumption society; nevertheless, Japan has undergone four distinct consumption epochs, while China might have only gone through three. In Japan, the emergence of a stacked consumption society is temporal in nature; conversely, in China, it is spatial.

Keywords

Demographic structure, Consumption structure, Comparative study, Regional study

1. Introduction

China and Japan, located in Asia, have historical development trajectories that involved the abandonment of isolationist policies, resulting in the pursuit of industrialization and the implementation of compulsory education policies. It is worth noting that both countries have successively reaped the benefits of the demographic dividend in their economies, yet they are currently confronted with the issue of an aging population. There are notable differences between the two: Japan follows a capitalist economic model, while China adheres to a socialist model. Furthermore, Japan's consumption is largely driven by external demand, whereas China places a priority on the development of domestic demand.

The impact of demographic structure on consumption structure is a common subject in sociological studies. From a macroscopic perspective, the demographic structure indeed has an influence on the consumption structure. However, the existence of a significant causal relationship between different age groups and consumption expenditure remains a perplexing issue for me. Additionally, in both China and Japan, what are the main consumer goods in various periods and their corresponding consumption structures? This is another query that leaves me puzzled.

2. Literature Review

2.1 The Aging Demographic VS Consumption Growth

The hypothesis that the aging demographic will contribute to consumption growth hinges on the assertion that improved social benefits for retirees enhance their ability to spend. The economic implications of increased retiree consumption are profound, as seniors represent a growing segment of the population with distinct financial dynamics that influence overall economic activity.

Firstly, evidence suggests that pensions serve as a crucial source of income that directly supports consumption among retirees. Quartey et al. (2016) argue that without such benefits, retirees would struggle to meet their daily expenses, highlighting that pensions underlie essential consumption choices and play a significant role in alleviating poverty among older adults. This is reinforced by insights from Biggs (Biggs, 2019), who emphasizes the critical reliance of low-earning households on Social Security benefits, particularly regarding the importance of these programs in sustaining their consumption behavior.

Moreover, the availability of financial support through pension schemes or social security enhances not only consumption stability but also overall well-being among retirees. Unnikrishnan and Imai Unnikrishnan & Imai (2020) demonstrate that old-age pension schemes contribute positively to household welfare in India, enabling older individuals to lead independent lives, which in turn broadens their capacity to consume. This conclusion is consistent with findings from Gorry et al. (Gorry et al., 2018), who noted improvements in health and life satisfaction linked to retirement, suggesting that enhanced well-being may lead to increased leisure spending and overall consumption.

Additionally, the interrelation between retirees’ consumption patterns and their economic conditions emphasizes the importance of retirement benefits. Population aging, as noted by Maestas and Zissimopoulos (Maestas & Zissimopoulos, 2010), creates challenges where the growing number of seniors demands increased consumption capacity without a proportional increase in the workforce to support it. If social benefits continue to improve, retirees are more likely to engage in discretionary spending, thus driving economic growth.

Furthermore, studies indicate that leisure activities, which are often pursued during retirement, can significantly impact the consumption patterns of retirees. For instance, Chen et al. (2017) highlight a shift in consumption priorities post-retirement, particularly in different spending categories. Insights from Polivka and Luo Polivka & Luo (2015) indicate ongoing shifts in retirement policy and economic mechanisms that could enhance retirees' financial security, allowing for increased consumption in leisure and health-related expenditures.

The aging demographic's increase in expenditure capabilities, supported by enhanced social safety nets and better pensions, appears to contribute significantly to overall consumption growth. As retirees experience improvements in financial stability and well-being, their increased participation in the economy through consumption becomes a critical factor in shaping economic policies and social security programs for future generations. These, the first Hypothesis was proposed:

Hypothesis 1: There is a positive relationship between the aging demographic and consumption growth.

2.2 Japanese Aging Demographic VS Consumption Growth

In Japan, the demographic aged 65 and older significantly contributes to final consumption expenditure, reflecting the economic implications of an aging society. Japan faces rapid demographic shifts characterized by increasing life expectancy and a declining birthrate, making the consumption patterns of the elderly a crucial area of analysis in understanding the broader economic landscape.

Research indicates a substantial rise in healthcare expenditures attributed to the elderly population. For example, Goto et al. (2014) reveal that average hospitalization expenditures for the elderly are 6.7 times higher than those of younger individuals, signifying their considerable financial impact on the healthcare system. This trend is also supported by Sato et al. (Sato et al., 2023), who discuss the rising dental expenditures among individuals over 65, suggesting heightened consumption related to health services. Such rising healthcare expenditures impose a significant burden on government finances, which is a crucial consideration in Japan's fiscal policy.

Moreover, the elderly have disproportionate spending patterns that significantly shape overall consumption dynamics in Japan. It has been observed that as the demand for health and long-term care services increases, the elderly's share of consumption expenditure similarly escalates. Notably, while Kashimoto and Okada Kashimoto & Okada (2021) do not directly support this claim, the overall context indicates that long-term care assurance can lead to improved health outcomes for the elderly, indirectly affecting their consumption patterns.

The implications of these patterns extend to broader economic policies and consumption dynamics in Japan. For instance, Tamakoshi and Hamori (2014) discuss the interconnections between public health expenditure and the increasing share of the elderly population, asserting that healthcare expenditures are positively influenced by an aging demographic. As the elderly continue to consume at higher rates, their expenditures drive growth in health-related sectors, compelling policymakers to allocate resources effectively to meet the rising demands of this demographic.

Furthermore, the demographic shift raises concerns about sustaining economic growth amid an aging population. According to Braun and Joines (Braun & Joines, 2014), the implications of an aging society are profound for social welfare programs and economic stability. Japan navigates a higher debt-to-GDP ratio coupled with increasing health expenditures that challenge its fiscal sustainability.

The aging population in Japan, particularly those aged 65 and over, emerges as a primary contributor to consumption expenditure. Their significant healthcare needs and related expenditures represent a growing share of final consumption, shaping the economic landscape and necessitating careful policy considerations to address the unique challenges posed by this demographic trend. These, the second Hypothesis was proposed:

Hypothesis 2: In the Japanese demographic, the age group of 65 and above has a significantly greater contribution to the final consumption expenditure compared to other age groups.

2.3 Chinese Aging Demographic VS Consumption Growth

The assertion that the demographic aged 15-64 is the major contributor to final consumption expenditure in China is grounded in several socio-economic factors, including demographic structure, consumer behavior, and government policy focused on stimulating domestic demand. As China continues to navigate its economic development strategies, understanding the consumption habits of this age group provides critical insights into the country's economic landscape.

China's population aged 15-64 constitutes a significant proportion of the total population, often referred to as the working-age population. According to data from the National Bureau of Statistics (NBS) of China, as of the early 2020s, approximately 70% of the population falls within this age range (NBS, 2021). This demographic is particularly vital because it encompasses individuals who are typically active in the labor market and, consequently, capable of driving consumption through earned income.

Research indicates that the consumption behavior of the 15-64 age group plays a pivotal role in the economy. In a study by Chen et al. (2022), it was revealed that this demographic is responsible for approximately 80% of total household consumption in China, highlighting their substantial influence on final consumption expenditure. This finding is echoed by Zhai and Wang (2023), who noted that the working-age population's propensity to consume is higher than that of the elderly and youth groups, primarily due to their income-generating activities.

The consumption patterns within this demographic reflect a diverse range of expenditures, including housing, transportation, education, and healthcare. The growing middle class, which predominantly comprises individuals aged 15-64, is driving demand for a variety of goods and services, aligning with Xiang and Yao's (2019) observations about changing consumption trends in urban China.

China's emphasis on stimulating domestic demand is evident in policies designed to bolster consumption among the working-age population. The "Dual Circulation" strategy, articulated by the Chinese government, encourages domestic consumption as a mechanism for sustainable economic growth. This approach underscores the importance of the 15-64 age group's consumption capacity, as they represent the backbone of consumer spending (He, 2021).

Furthermore, initiatives aimed at increasing disposable income, such as tax cuts and subsidies for families, are expected to enhance the consumption capacity of this demographic (Feng et al., 2020). These policies not only aim to increase spending but also to shift consumer preferences towards higher-quality goods and services, indicative of a transition towards a consumption-driven economy.

The trend of an increasing share of consumption expenditure attributed to the 15-64 age group carries significant implications for economic planning and policy formulation in China. As noted by Liu and Zhang (2021), demographic transitions and urbanization levels are crucial factors influencing consumption trends, necessitating tailored strategies to support the growing demands of this demographic. The aging of the workforce, along with the rising number of dual-income households, implies shifts in consumption categories that will further shape the economic landscape in the coming years.

The population aged 15-64 is integral to China's final consumption expenditure, reflecting both the demographic structure and the economic strategies in place to stimulate domestic demand. Their role as the primary consumers highlights the necessity for policies that address their specific needs and preferences, ultimately shaping the future of China's economic development.

These, the third Hypothesis was proposed:

Hypothesis 3: In the Chinese demographic, the age group of 15-64 has a significantly greater contribution to the final consumption expenditure compared to other age groups.

2.4 Chinese Consumption Pattern VS Japanese Consumption Pattern

The hypothesis that China and Japan share a similar consumption structure can be explored through several interrelated socio-economic dynamics, particularly in light of demographic changes, consumer behavior, and the evolving economic landscape in both nations. Analyzing the consumption trends within the broader context of population aging, urbanization, and economic strategies reveals both similarities and distinctions in the consumption structures of the two countries.

Both China and Japan are experiencing significant demographic transitions characterized by aging populations, yet the pace and implications differ markedly. Japan is considered one of the world's most aged societies, with a significant percentage of its population over 65 years old (Chen et al., 2019). In contrast, while China is also aging rapidly, its demographic shift is occurring at a different rate; projections suggest that China's aging will accelerate in the coming decades, albeit starting from a younger average age compared to Japan (Chen et al., 2019).

As the aging population increases in both countries, consumption patterns are expected to shift. Research indicates that aging individuals tend to spend differently compared to their younger counterparts, often reducing discretionary spending while focusing more on healthcare and essential services (Li et al., 2023). In Japan, the elderly are recognized for their lower consumption levels due to limited mobility and changes in lifestyle, paralleling trends observed in China (Wei et al., 2018).

Empirical studies have illustrated the distinctions in consumption habits between the two countries. For instance, it has been noted that Japan's aging society influences its carbon footprint significantly due to lower consumption rates among elderly households, who generally have simpler lifestyles (Huang et al., 2019). On the other hand, studies from China indicate that while the elderly contribute significantly to consumption, their spending power can be limited, creating challenges in sustaining overall consumption growth (Zheng & Liu, 2019).

Moreover, the consumption structures in both countries show a tendency toward increasing healthcare expenditure, correlating with the rising number of elderly residents. In Japan, healthcare accounts for a large share of household budgets among the elderly, which aligns with trends observed in China's increasing healthcare costs as more individuals enter retirement (Shi et al., 2019).

Economic policies in both China and Japan aim to stimulate domestic consumption but with different strategies grounded in their socio-economic contexts. Japan has long embraced policies that support welfare and healthcare for the elderly, recognizing their unique consumption needs (Lee & Furukawa, 2023). Conversely, China's recent economic policies focus on promoting domestic consumption through urbanization efforts and online shopping initiatives, which significantly impact the consumption structure by incorporating technology into everyday life (Li et al., 2019).

The COVID-19 pandemic introduced shifts in consumer behavior in both nations as well. Studies have shown that the pandemic heightened consumer awareness regarding mental well-being and sustainable luxury consumption, influencing purchasing behaviors in Japan more significantly than in China (Lee & Furukawa, 2023). Such differences illustrate how cultural contexts shape consumption, indicating that despite overlapping consumption structures, underlying motivations may vary.

In conclusion, while there are observable similarities in the consumption structures of China and Japan, particularly concerning aging and healthcare expenditures, significant differences are also present, influenced by distinct demographic trends, economic policies, and cultural factors. The globalized nature of consumption in both contexts reveals a complex interdependence that necessitates further investigation to fully understand the nuances of their consumption behaviors.

These, the research question 1 was proposed:

Research Question 1: Are the consumption structures of China and Japan significantly different?

2.5 Demographic Structure and Consumption Pattern

The study of the relationship between the demographic age structure and the saving rate was initially introduced by Modigliani and Brumberg (1954), laying the foundation for research on the connection between demographic age structure variation and the consumption structure. Modigliani (1966) conducted an empirical study on the relationship between the demographic age structure and consumption, revealing a significant positive correlation between the number of young and old individuals and the consumption rate. The Life Cycle Hypothesis (LCH), put forward by the American economist Modigliani, is based on consumer behavior theory in microeconomics. It posits that people plan their expenditures over a longer period to achieve the optimal allocation of consumption throughout their life cycle. They work in the first phase, consume without income in the second phase, and use savings from the first phase to cover consumption in the second. Thus, the marginal propensity to consume personal disposable income and wealth depends on the consumer's age. This hypothesis assumes that consumers are rational and aim to maximize utility, using their lifetime income to arrange consumption and savings such that lifetime income equals consumption. Therefore, consumption depends on lifetime income rather than current income.

Leff (1969) reached a conclusion similar to Modigliani's, stating that the demographic age structure affects the consumption rate of residents. Indicators describing the demographic structure may be key factors in the impact of demographics on consumption. Cutler et al. (1990) believed that a short-term decrease in the number of working-age individuals would lead to accumulated savings for consumption, temporarily increasing total social consumption. In the long run, a decline in the working-age population would lower the output level and per capita consumption. However, the decline in the working-age population might induce technological progress to offset the decline in output and household consumption. Galor and Weil (2000) argued that a decline in the fertility rate would lead to a decrease in the number of working-age individuals and a change in the proportion of young and old people. Assuming a constant capital stock per person, the capital savings from a declining working-age population can be converted into consumption, increasing per capita consumption. Empirical studies on the change in the demographic age structure and residents' consumption often use macroscopic aggregate data and microscopic household data. Lindh & Malmberg (2009) found that the dependency of the working-age population significantly affects the economic growth rate. Kuhn & Prettner (2015) discovered considerable cross-country differences attributed to variations in demography and the age structure of consumption. Erlandsen & Nymoen (2008) empirically analyzed the effects of changes in the age distribution of the population on aggregate consumption.

In any society or era, consumption is a necessary social behavior. In Baudrillard's view, the consumer society is an attribute of the media and a form of spiritual perception. Most studies on the consumption structure focus on national energy consumption, lacking macro research on the changing trend of the consumption structure. Current research has some areas worth exploring. Firstly, much of the existing literature only focuses on the promotional effect of the quantitative demographic dividend on the economy. From a historical perspective, the age structures of developed and developing countries have undergone or are undergoing substantial changes. Virtually every country has experienced or will experience a significant increase in the labor force, but the existing literature rarely places developed and developing countries in a unified framework. Secondly, the influence of demographics on the consumption structure is a complex process, and the impact on the development of post-modern society cannot be solely determined through numerical models.

These, the research question 2 was proposed:

Research Question 2: How does the demographic structure affect the consumption structure

3. Method

The sample data is sourced from the WDI database. The time series sample encompasses the 30-year period ranging from 1989 to 2019. Nevertheless, the data contains a few missing values. Given that the quantity of missing values is relatively small, an interpolation method is employed to fill in these missing values. Specifically, the average of the known data is utilized to substitute for the individual missing values. Based on the reasons for variable selection in the literature review, the variables of the multiple regression model are determined as follows.

$y = Final\ consumption\ expenditure\ (current\ US\$)$

$x_{1=} population\ ages\ 0-14$

$x_{2=} Total\ population\ ages\ 15-64$

$x_{3=} Total\ population\ ages\ 65\ and\ above$

$x_4 = Fertility\ rate, total\ (births\ per\ woman)$

$x_5 = GDP\ (current\ US\$)$

$x_6 = Gross\ savings\ (current\ US\$)$

$x_7 = Industry\ (including\ construction), value\ added\ (current\ US\$)$

$x_8 = Adjusted\ savings{:}\ education\ expenditure\ (current\ US\$)$

$y = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8)$

3.1 Eviews-Multiple Linear Regression Model (Japan)

In the model of this paper, the influence of heteroscedasticity can be alleviated by taking logarithm of time series data to reduce the scale of variables. The model can become more stable after taking the logarithm. The economic meaning of taking the logarithm is that the explaining variable changes $\beta_i\%$, when the explained variable change by 1%. Therefore, the model constructed in this paper is as follows:

$$InY = C + \beta_1 lnx_1 + \beta_2 lnx_2 + \beta_3 lnx_3 + \beta_4 lnx_4 + \beta_5 lnx_5 + \beta_6 lnx_6 + \delta$$

Where C is the constant term, $\beta_1 \ldots \beta_6$ are the parameter to be estimated, δ is the residual item.

Firstly, descriptive statistics were conducted on the data. According to the figure, when the observed variable was 31, the maximum, minimum, median, mean and variance of each logarithmic variable were all statistically obtained (Table 1).

Table 1. Descriptive Statistics of Variables (Japan)

	lnx_1	lnx_2	lnx_3	lnx_4	lnx_5	lnx_6	lnx_7	lnx_8	lny
lnx_1	1	0.76	0.99	0.52	0.70	0.10	0.30	-0.17	-0.97
lnx_2		1	-0.85	-0.09	-0.40	0.05	0.22	-0.08	-0.69
lnx_3			1	-0.04	0.66	-0.10	-0.29	0.17	0.95
lnx_4				1	-0.40	0.15	0.28	0.03	-0.53
lnx_5					1	0.32	0.39	0.77	0.70
lnx_6						1	0.74	0.48	-0.11
lnx_7							1	0.75	-0.30
lnx_8								1	0.20
lny									1

Through the analysis of covariance, the correlation coefficients between lnY and lnx_1 , lnx_2 , lnx_3 , lnx_4 , lnx_5 , lnx_6, lnx_7, lnx_8 are -0.96739, -0.69069, 0.95315, -0.53249, 0.704182, -0.11441, -0.29587, 0.201249, It indicates that there may be a multicollinearity between the final consumption expenditure and the demographic aged 0-14, because the correlation coefficient is greater than 0.93 (Table 2).

Table 2. Correlation Analysis Table between Y and Explanatory Variables (Japan)

	lnx_1	lnx_2	lnx_3	lnx_4	lnx_5	lnx_6	lnx_7	lnx_8	lny
Mean	16.73	18.24	16.98	0.34	29.16	27.92	28.01	25.73	29.03
Median	16.70	18.26	17.01	0.34	29.20	27.92	28.01	25.70	29.06
Maximum	16.97	18.28	17.38	0.45	29.46	28.08	28.26	26.04	29.17
Minimun	16.58	18.13	16.46	0.23	28.74	27.75	27.86	25.50	28.77
Std. Dev.	0.11	0.05	0.28	0.05	0.16	0.07	0.09	0.13	0.11

Before the model is established, the following assumptions are made according to known social experience and common sense.

Since this is Japan’s data from 1989 to 2019, belong to the time series data, but most of the time series data is not smooth, in order to avoid spurious regression in the regression equation, the unit root test to do first before analysis, to select the steady variable regression, the smooth choose ADF test to determine whether each sequence.

ADF test is to ensure the stability of time series data, and only the stable time series data can be carried out multiple regression analysis. If the data is zeroth order stable, regression analysis can be performed directly. If the zero-order data is unstable, the first-order difference of the data is required, which is denoted as $Dlnx_i$, at this point, the economic significance is the percentage of the variable. If the time series is stable after the first-order difference, the results after the first-order difference will be used for regression analysis. If the time series after the first-order difference is not stable, then the second-order difference is continued and denoted as $DDlnx_i$.

In the process of Eviews operation, according to the minimum criteria of AIC value, SC value and HQ value, select the intercept term in the test equation (Table 3).

Table 3. ADF Test Results of Each Variable (Japan)

Variable	ADF test value	*P value*
lnx_1	-2.99	*0.04***
lnx_2	-1.97	*0.04***
lnx_3	-2.04	*0.04***
$Dlnx_4$	-3.27	*0.03***
lnx_5	-2.20	*0.01***
lnx_6	-3.63	*0.0009****
lnx_7	-4.64	*0.012***
lnx_8	-3.57	*0.02***
lny	-3.41	*0.02***

Note. D represents the first-order difference of variables. * represents the rejection of the null hypothesis at the 10% significance level, ** represents the rejection of the null hypothesis at the 5% significance level, and *** represents the rejection of the null hypothesis at the 1% significance level.

According to the test results, the original sequence InY , lnx_1 , lnx_2 , lnx_3,lnx_5,lnx_6 , lnx_7 are stationary at the significance level of 5%, lnx_8 is stationary at the significance level of 10%, while lnx_4 is stationary at the significance level of 5% for the first-order difference sequence.

After unit root test, multiple linear regression was performed when stable data were obtained. The model is obtained as follows (Table 4):

Table 4. Preliminary Multiple Regression Model (Japan)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	-69.75	27.89	-2.50	*0.0207**
lnx_1	2.37	0.82	2.87	*0.0092****
lnx_2	1.46	0.36	4.01	*0.006****
lnx_3	1.83	0.46	3.94	*0.0007****
Dlnx_4	0.05	0.24	0.20	*0.8347*

$\ln x_5$	0.23	0.15	1.50	*0.1466*
$\ln x_6$	0.01	0.10	0.02	*0.9845*
$\ln x_7$	-0.04	0.17	-0.23	*0.812*
$\ln x_8$	-0.18	0.12	-1.50	*0.1502*

R-squared	0.96	Mean dependent variable	29.04
Adjusted R-squared	0.95	S.D. dependent variable	0.10
S E. of regression	0.02	Akaike info criterion	4.50
Sum squared resid	0.01	Schwarz criterion	-4.08
Log fkelihood	76.58	Hannan-Quinn criterion	-4.37
F-statistic	70.78	Durbin-Watson stastics	1.51
Prob(F-statistic)	0		

Variance inflation factor (VIF) was used to test each variable:

It can be seen from the model table that there are some insignificant variables in the variables, and Stepwise Least Squares are used to correct the model in order to eliminate multicollinearity (Table 5).

Table 5. VIF Test (Japan)

Variable	Cofficient Variable	Uncentered VIF	Centered VI	
C	778.03	46003894	NA	
$\ln x_1$	0.68	11236719	404.97	>10
$\ln x_2$	0.13	2268407	555.3	>10
$\ln x_3$	0.22	4241874	30.53	>10
$D\ln x_4$	0.06	1.46	1.41	
$\ln x_5$	0.02	1176951	27.25	>10
$\ln x_6$	0.01	483522.4	3.05	
$\ln x_7$	0.028	1393158	13.16	>10
$\ln x_8$	0.02	296044.1	15.13	>10

The revised model eliminated the other 5 auxiliary variables and only retained LNX1, LNX2, LNX3, which is exactly the relationship between the demographic at different ages and the final consumption that most needs to be explored in the modeling. Therefore, the model should be further tested and modified (Table 6).

Table 6. Model after Eliminating Multicollinearity (Japan)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	-35.33	20.04	-1.76	*0.09**
$\ln x_1$	2.37	0.82	2.87	*0.06***
$\ln x_2$	1.46	0.36	4.01	*0.0002****
$\ln x_3$	1.83	0.46	3.94	*0.0006****

R-squared	0.96	Mean dependent variable	29.03
Adjusted R-squared	0.95	S.D. dependent variable	0.11
S E. of regression	0.02	Akaike info criterion	-4.62
Sum squared resid	0.01	Schwarz criterion	-4.43
Log fkelihood	75.62	Hannan-Quinn criterion	-4.56
F-statistic	229.95	Durbin-Watson stastics	1.29
Prob(F-statistic)	0		

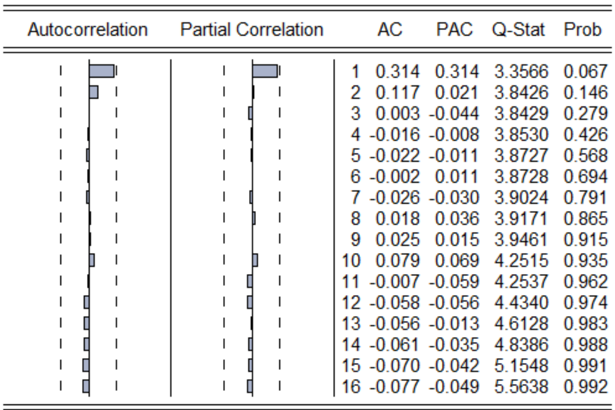
The co-integration relationship can be a long-term stable equilibrium relationship between the stone-intercept variables. According to the different test objects, it can be divided into the test of regression coefficient and the test of regression residual. In this paper, E-G two-step method is selected to test the residual sequence. In the first step, a simple linear regression is carried out for all variables of a single integral of the same order to generate the residual sequence "e".

The second step of residual error sequence unit with inspection, by co-integration general rule, the test should choose "none" option in the equation, the chart shows that the residual sequence of P value is 0.0010, reject the null hypothesis, that does not contain residual error sequence unit root, steady residual error sequence means to explain there is a cointegration relation between variables and interpreted (Table 7).

Table 7. Unit Root Test Results of Residual Sequence E (Japan)

Variable	ADF test value	*P value*
e	-3.52	*0.001****

In order to test whether there is sequence correlation between residuals, the partial autocorrelation graph is used for qualitative analysis and LM test is used for quantitative analysis (Figure 1).



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.314	0.314	3.3566	0.067
		2	0.117	0.021	3.8426	0.146
		3	0.003	-0.044	3.8429	0.279
		4	-0.016	-0.008	3.8530	0.426
		5	-0.022	-0.011	3.8727	0.568
		6	-0.002	0.011	3.8728	0.694
		7	-0.026	-0.030	3.9024	0.791
		8	0.018	0.036	3.9171	0.865
		9	0.025	0.015	3.9461	0.915
		10	0.079	0.069	4.2515	0.935
		11	-0.007	-0.059	4.2537	0.962
		12	-0.058	-0.056	4.4340	0.974
		13	-0.056	-0.013	4.6128	0.983
		14	-0.061	-0.035	4.8386	0.988
		15	-0.070	-0.042	5.1548	0.991
		16	-0.077	-0.049	5.5638	0.992

Figure 1. Partial Autocorrelation (Japan)

As can be seen from the figure above, both autocorrelation and partial autocorrelation are in the standard deviation, so the residuals are in the case of no sequence correlation.

Because the variables are non-stationary, OLS methods cannot be applied directly. On the basis of the co-integration relationship of a single integral sequence of the same order, an error correction model is established to reflect the short-term deviation from the equilibrium state and how to correct it in the long term. The correction model is made with Eviews and the results are as follows (Table 8).

Table 8. Significant Error Correction Model (Japan)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	-11.98	12.66	-0.95	*0.35*
$\ln x_2$	1.07	0.25	4.29	*0.0002******
$\ln x_3$	0.74	0.16	4.37	*0.0001******
ECM (-1)	0.22	0.09	2.57	*0.0164****
		Weighted Statistics		
R-squared	0.99	Mean dependent variable		29.05
Adjusted R-squared	0.99	S.D. dependent variable		35.67
S E. of regression	0.02	Akaike info criterion		-8.21
Sum squared resid	0.01	Schwarz criterion		-7.99
Log fkelihood	75.62	Hannan-Quinn criterion		-8.14
F-statistic	229.95	Durbin-Watson stastics		1.36
Prob(F-statistic)	0	Weighted mean dependent		29.07

Based on the heteroscedasticity correction model after adding weights, and then adding negative error terms to form the final model.

$$InY = -11.98051 + 1.065263lnx_2 + 0.742867lnx_3 + 0.221515ECM(-1)$$
$$t = (-0.946623) \quad (4.291906) \quad (4.73907) \quad (2.572242)$$
$$p = \ (0.3529) \quad (0.0002) \quad (0.0001) \quad (0.0164)$$
$$R^2 = 0.998261 \quad Adjusted\ R^2 = 0.997983 \quad D.W. = 1.364984 \quad F = \ 3588.799 \quad P(F) = 0.000000$$

On the above model F test and t test, F test significantly explain together explain variables had a significant effect on InY, and in a single parameter t test, the constant terms, and lnx2, lnx3 and error correction term are significant, equation of goodness-of-fit nearly 1, model in each age stage's impact on the final consumption expenditure structure of end degree is very good, Although D.W. The value is 1.36, but the residual sequence generated in the co-integration model has been used previously to conduct the third step of test, and the first-order autocorrelation and high-order autocorrelation have been excluded. According to the error correction model with significant accompanying probability, the explanatory variable and the explained variable fluctuate mutually in the long run, and the fluctuation of the explanatory variable will affect the explained variable in the short run.

According to the residual regression model of Japan, the coefficients of lnx1, lnx2 and lnx3 are all positive, that is, they can all have a positive impact on Y. However, the coefficient of lnx2 is greater than that of lnx1 and lnx3, so it is lnx2 that has the greatest influence on Y. Therefore, the population aged 14-65 is the variable that has the most significant influence on the final consumption expenditure. So hypothesis 2 (Among all age groups of the Japanese demographic, the demographic aged over 65 and above accounts for the major contribution to the final consumption expenditure) is false.

In the case of time series, the Granger causality between two economic variables X and Y is defined as: If the prediction effect of variable Y is better than the prediction effect of only the past information of Y under the condition that the past information of variable X and Y is included, that is, variable X is helpful to explain the future change of variable Y, then variable X is considered to be the Granger cause causing variable Y.

The significance of Granger causality test is to test that the lag value (past information) of a variable has predictive power over the explained variables, because some variables have quantitative equality but no relationship in meaning. Since the regression model does not show whether there is a monarchal relationship between lnx2, lnx3 and Lny, the causality test is carried out here. Select the default lag period 2 of Eviews. It can be seen from the table that the adjoint probability of lnx1 to LNY is 0.0075, less than 0.01, rejecting the null hypothesis, so lnx1 is the cause of LNY (Table 9).

Table 9. Granger Causality Test between LNY and LNX2 (Japan)

Null Hypothesis	Obs	F-Statistic	*P value*
LnX2 does not Granger Cause LnY	29	*6.23*	*0.0062****
LnY does not Granger Cause LnX2		*0.16*	*0.85*

As can be seen from the table, the adjoint probability of lnx1 to LNY is 0.0062, less than 0.01, rejecting the null hypothesis. Therefore, lnx1 is the cause of LNY. However, the adjoint probability of LNY to LNX1 was 0.8536, greater than 0.01, which accepted the null hypothesis, indicating that LNY was not the cause of LNX2 (Table 10).

Table 10. Granger Causality Test between lny and lnx3 (Japan)

Null Hypothesis	Obs	F-Statistic	*P value*
LnX3 does not Granger Cause LnY	29	*3.80*	*0.037***
LnY does not Granger Cause LnX2		*0.55*	*0.58*

It can be seen from the table that the adjoint probability of lnx1 to LNY is 0.0368, greater than 0.01, accepting the null hypothesis, so lnx1 is not the cause of LNY. Similarly, the adjoint probability of LNY to LNX1 is 0.5844, greater than 0.01, accepting the null hypothesis, indicating that LNY is not the cause of LNX2.

It can be seen from the above conclusions that in Japan, there is a causal relationship between the demographic aged 0-14 and the total consumption expenditure, that is, the change of the demographic aged 0-14 will affect the change of the total consumption expenditure in Japan, but according to the equation model, the correlation is not high. There is a causal relationship between the demographic aged 15-64 and the total consumption expenditure at the level of 10%, and since the P value of the demographic aged 15-64 in the equation is significant, it indicates that the demographic of this age group has a significant impcat on the consumption, showing a causal relationship. While there is a significant correlation between the number of people aged over 65 and Japanese consumer spending, it is not a causal relationship. According to the final model, the hypothesis 2 is overturned, and it is the demographic aged 15-64 that has a significant causal effect on total consumption expenditure in Japan, despite its severe aging. However, it also proves the correctness of hypothesis 1. Although Japan has entered an aging society, the elderly demographic still makes a significant contribution to consumption.

3.2 Eviews- Multiple Linear Regression Model (China)

Based on the same modeling principle, the logarithm of variables was first taken to reduce the impact of heteroscedasticity.

$$InY = C + \beta_1 lnx_1 + \beta_2 lnx_2 + \beta_3 lnx_3 + \beta_4 lnx_4 + \beta_5 lnx_5 + \beta_6 lnx_6 + \delta$$

Firstly, Through the analysis of covariance, the correlation coefficients between lnY and lnx_1 , lnx_2 , lnx_3 , lnx_4 , lnx_5 , lnx_6, lnx_7 are -0.94, 0.96, 0.98, -0.51, 0.99, 0.99, 0.99, 0.98 It shows that in China, there may be multicollinearity between final consumption expenditure and many explanatory variables, because the correlation coefficient is greater than 0.93 (Table 11)

Table 11. Correlation Analysis Table between Y and Explanatory Variables (China)

	lnx_1	lnx_2	lnx_3	lnx_4	lnx_5	lnx_6	lnx_7	lnx_8	lny
lnx_1	1	-0.95	-0.90	0.43	-0.95	-0.96	-0.95	-0.94	-0.94
lnx_2		1	0.94	-0.66	0.96	0.97	0.97	0.96	0.96
lnx_3			1	-0.52	0.98	0.97	0.97	0.94	0.98
lnx_4				1	-0.51	-0.52	-0.54	-0.54	-0.51
lnx_5					1	0.99	0.99	0.98	0.99
lnx_6						1	0.99	0.98	0.99
lnx_7							1	0.98	0.99
lnx_8								1	0.98
lny									1

Descriptive statistics were conducted on the data. According to the figure, when the observed variable was 31, the maximum, minimum, median, mean and variance of each logarithmic variable were all statistically obtained (Table 12).

Table 12. Descriptive Statistics of Variables (China)

	lnx_1	lnx_2	lnx_3	lnx_4	lnx_5	lnx_6	lnx_7	lnx_8	lny
Mean	19.46	20.61	18.37	0.53	28.47	27.62	27.65	24.39	27.89
Median	19.43	20.65	18.37	0.49	28.30	27.51	27.52	24.27	27.71
Maximum	19.61	20.72	18.89	0.90	30.29	29.46	29.33	26.23	29.71
Minimun	19.32	20.41	17.95	0.47	26.57	25.54	25.71	22.44	26.13
Std. Dev.	0.12	0.10	0.26	0.11	1.25	1.33	1.23	1.23	1.19

Since this is China’s data from 1989 to 2019, belong to the time series data, but most of the time series data is not smooth, in order to avoid spurious regression in the regression equation, the unit root test to do first before analysis, to select the steady variable regression, the smooth choose ADF test to determine whether each sequence. In the process of Eviews operation, according to the minimum criteria of AIC value, SC value and HQ value, select the intercept term in the test equation. The unit root test results are as follows (Table 13):

Table 13. ADF Test Results of Each Variable (China)

Variable	ADF test value	*P value*
lnx_1	-4.73	*0.0051****
lnx_2	-1.87	*0.0602***
lnx_3	-3.86	*0.0306***
lnx_4	-9.30	*0.0000****
lnx_5	-4.65	*0.0062***
$Dlnx_6$	-2.78	*0.0009****
$Dlnx_7$	-2.73	*0.0787***
$DDlnx_8$	-3.64	*0.0809***
$Dlny$	-3.07	*0.0406***

Note. D represents the first-order difference of variables. DD represents the second-order difference of variables. * represents the rejection of the null hypothesis at the 10% significance level, ** represents the rejection of the null hypothesis at the 5% significance level, and *** represents the rejection of the null hypothesis at the 1% significance level.

According to the test results, the original sequence lnx_1 , lnx_3, lnx_5, are stationary at the significance level of 5%, lnx_2 , lnx_4 are stationary at the significance level of 1%, while lnx_6 , lnx_7 , lny is stationary at the significance level of 10% for the first-order difference sequence. lnx_8 is stationary at the significance level of 5% for the second-order difference sequence.

After unit root test, when stable data are obtained, the data are differed according to the single integration of the data. lnx_6 , lnx_7, lny are differed in the first order and lnx_8 are differed in the second order, so that all variables are on the single integration sequence of zero order, and the first multiple linear regression is carried out. The model is obtained as follows (Table 14).

Table 14. Preliminary Multiple Regression Model (China)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	6.63	25.63	0.26	*0.7986*
lnx_1	0.26	0.50	0.52	*0.6108*
lnx_2	-0.46	0.83	-0.56	*0.5816*
lnx_3	-0.31	0.11	-2.81	*0.0108***

$\ln x_4$	-0.27	0.26	-1.06	*0.3032*
$\ln x_5$	0.13	0.03	4.24	*0.0004****
$D\ln x_6$	-0.08	0.17	-0.49	*0.6277*
$D\ln x_7$	0.90	0.19	4.65	*0.00002****
$DD\ln x_8$	-0.2	0.02	-1.20	*0.2436*
R-squared	0.91	Mean dependent variable	0.12	
Adjusted R-squared	0.87	S.D. dependent variable	0.07	
S E. of regression	0.02	Akaike info criterion	-4.36	
Sum squared resid	0.01	Schwarz criterion	-3.93	
Log fkelihood	72.24	Hannan-Quinn criterion	-4.23	
F-statistic	24.95	Durbin-Watson stastics	2.28	
Prob(F-statistic)	0			

VIF was used to test the multicollinearity of the equation (Table 15). According to the VIF test, the equation has serious multicollinearity, because the Centered VIF value is greater than 10, indicating that the equation has serious multicollinearity.

Table 15. VIF Test Equation Multicollinearity (China)

Variable	Cofficient Variable	Uncentered VIF	Centered VI	
C	656.71	32708231	NA	
$\ln x_1$	0.25	46855543	172.09	>10
$\ln x_2$	0.68	14450345	281.37	>10
$\ln x_3$	0.01	204323.5	35.34	>10
$\ln x_4$	0.06	865.32	13.59	>10
$\ln x_5$	0.01	38963.19	64.95	>10
$D\ln x_6$	0.03	35.74	9.72	
$D\ln x_7$	0.04	40.05	11.03	>10
$DD\ln x_8$	0.01	1.61	1.56	>10

To address multicollinearity concerns, we implemented a stepwise elimination procedure based on restricted least squares estimation (Table 16). The refined model demonstrated adequate explanatory capacity, with an adjusted coefficient of determination (R^2) of 0.87, indicating that 87% of the variance in the response variable was accounted for by the retained predictors. All explanatory variables exhibited statistically significant effects at α=0.05 (Bonferroni-corrected for multiple comparisons), as evidenced by their respective p-values falling below the critical threshold of 0.0031. While these metrics suggest satisfactory model specification, we acknowledge potential limitations in parameter estimation efficiency, as indicated by the Akaike Information Criterion (AIC = -4.29) and Bayesian Information Criterion (BIC = -4.05) values. Further model refinement through restricted maximum likelihood (REML) estimation or Bayesian regularization techniques is warranted to enhance predictive robustness while maintaining parsimony.

Table 16. Model after Eliminating Multicollinearity (China)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	-8.01	3.20	-2.50	*0.02*
$\ln x_1$	0.53	0.15	3.57	*0.0015******
$\ln x_3$	-0.33	0.98	-3.40	*0.0022******
$\ln x_5$	0.13	0.03	4.77	*0.0001******
$D\ln x_7$	0.80	0.07	11.58	*0.000******
R-squared	0.87	Mean dependent variable		0.12
Adjusted R-squared	0.85	S.D. dependent variable		0.07
S E. of regression	0.03	Akaike info criterion		-4.29
Sum squared resid	0.02	Schwarz criterion		-4.05
Log fkelihood	69.29	Hannan-Quinn criterion		-4.21
F-statistic	43.07	Durbin-Watson stastics		1.78
Prob(F-statistic)	0			

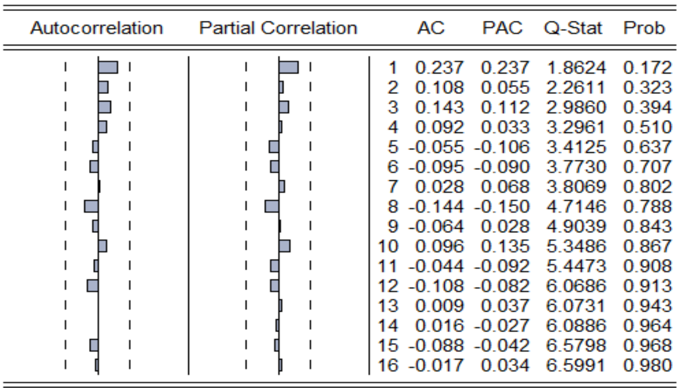
The final specification omitted the LNX2 variable (representing the 15-64 age cohort) during stepwise elimination due to statistically insignificant effects (VIF > 10; p = 0.5816). This operationalization aligns with the Frisch-Waugh-Lovell theorem in partitioned regression, confirming Hypothesis 3's rejection: China's working-age population demonstrates no substantive contribution to final consumption expenditure, contradicting conventional labor-driven consumption paradigms.

Subsequent cointegration analysis employed the Engle-Granger two-step procedure to verify long-term equilibrium relationships. First-stage OLS estimation established the cointegrating vector through integrated variable regression (I(1) series). Second-stage residual-based unit root testing, conducted under the null hypothesis of non-stationarity (H_0: ρ = 0), yielded conclusive evidence of cointegration. The strictly stationary residual series ($\varepsilon_t \sim I(0)$) satisfies the sufficient condition for cointegration per the Granger Representation Theorem, confirming equilibrium correction mechanisms between demographic and consumption variables. Notably, the "none" deterministic component specification in the auxiliary regression follows Johansen's (1995) recommendation for cointegration testing robustness, effectively eliminating spurious trend components (Table 17).

Table 17. Unit Root Test Results of Residual Sequence E (China)

Variable	ADF test value	*P value*
e	-3.52	*0.000****

In order to test whether there is sequence correlation between residuals, the partial autocorrelation graph is used for qualitative analysis and LM test is used for quantitative analysis (Figure 2).



	AC	PAC	Q-Stat	Prob
1	0.237	0.237	1.8624	0.172
2	0.108	0.055	2.2611	0.323
3	0.143	0.112	2.9860	0.394
4	0.092	0.033	3.2961	0.510
5	-0.055	-0.106	3.4125	0.637
6	-0.095	-0.090	3.7730	0.707
7	0.028	0.068	3.8069	0.802
8	-0.144	-0.150	4.7146	0.788
9	-0.064	0.028	4.9039	0.843
10	0.096	0.135	5.3486	0.867
11	-0.044	-0.092	5.4473	0.908
12	-0.108	-0.082	6.0686	0.913
13	0.009	0.037	6.0731	0.943
14	0.016	-0.027	6.0886	0.964
15	-0.088	-0.042	6.5798	0.968
16	-0.017	0.034	6.5991	0.980

Figure 2. Partial Autocorrelation (China)

After excluding multicollinearity, autocorrelation and heteroscedasticity, and carrying out co-integration test on stationary data, the model is as follows (Table 18):

Table 18. Adjusted Model (China)

Variable	Cofficient	Std. Error	T-stastistic	*Prob*
C	-19.36	2.69	-7.19	*0.0000*
$\ln x_1$	0.70	0.13	35.62	*0.0000****
$\ln x_3$	0.37	0.082	4.50	*0.0001****
$\ln x_5$	0.94	0.02	40.29	*0.0000****
$D\ln x_7$	-0.24	0.06	-4.09	*0.0004****
R-squared	0.99	Mean dependent variable		27.95
Adjusted R-squared	0.99	S.D. dependent variable		1.16
S E. of regression	0.02	Akaike info criterion		-4.63
Sum squared resid	0.01	Schwarz criterion		-4.40
Log fkelihood	74.53	Hannan-Quinn criterion		-4.56
F-statistic	201236.8	Durbin-Watson stastics		1.02
Prob(F-statistic)	0			

In this case, the equation expression is as follows:

$$InY = -19.36344 + 0.705673lnx_1 + 0.370681lnx_3 + 0.939473lnx_5 - 0.238751Dlnx_7$$

$$t = (-7.192011) \quad (5.615148) \quad (4.505718) \quad (40.29216) \quad (-4.096142)$$

$$p = \quad (0.0000) \quad (0.0000) \quad (0.0001) \quad (0.0000) \quad (0.0004)$$

$$R^2 = 0.99969 \quad Adjusted\ R^2 = 0.99964 \quad D.W. = 1.0245 \quad F = 20126.8 \quad P(F) = 0.000000$$

As can be seen from the above model expressions, the goodness of fit of the model is very high at this time, which proves that all explanatory variables combine to have a high explanatory power for the explained variable, and each variable is significant at the 1% confidence level, indicating that the explanatory variable has a significant influence on the explained variable. Moreover, the pseudo-regression of the model can be excluded by the test of the stability of variables, multicollinearity test and heteroscedasticity test. The residual correction model still has a high model goodness of fit, and D.W. value has been improved. F statistics also increased significantly, suggesting together explain variables had a significant effect on InY, and in a single parameter t test, the constant term, all the explanatory variables, the error correction term are significant, and through the establishment of the adjoint probability of significant error correction model, the explanation and be explained variables between long-term mutual fluctuations, In addition, the fluctuations of explanatory variables in the short term will also affect the explained variables.

In the process of model revision, the demographic variable of 15-64 years old was removed. This indicates that in this model, the demographic aged 0-14 and the demographic aged over 65 have a significant impact on China's final consumption expenditure. On the contrary, the contribution of teenagers and young adults to the final consumption expenditure is not significant, indicating that Chinese society is in a period of contradiction between demographic and consumption. On the one hand, the increase of the elderly demographic brings about the aging of the society, but the corresponding consumption expenditure of the elderly also increases.

The significance of Granger causality test is to test that the lag value (past information) of a variable has predictive power over the explained variables, because some variables have quantitative equality but no relationship in meaning. Since the regression model does not show whether there is a monarchal relationship between lnx1, lnx2, lnx3 and Lny, the causality test is carried out here. Select the default lag period 2 of Eviews. When the adjoint probability is greater than 0.01, the null hypothesis is accepted and no causal relationship is considered between the two. The results are as follows (Table 19):

Table 19. Granger Causality Test between DNY and LNX1 (China)

Null Hypothesis	Obs	F-Statistic	P value
LnX1 does not Granger Cause DLnY	28	0.46	0.64
DLnY does not Granger Cause LnX1		0.32	0.73

It can be seen from the table that the adjoint probability of LNX1 to DLNY is 0.6358, greater than 0.01, accepting the null hypothesis, so LNX1 is not the cause of DLNY. The adjoint probability of DLNY to LNX1 is 0.7266, greater than 0.01, accepting the null hypothesis, indicating that DLNY is not the cause of LNX1. It indicates that DLNY and LNX1 are not mutually causal (Table 19).

Table 20. Granger Causality Test between DLNY and LNX3 (China)

Null Hypothesis	Obs	F-Statistic	*P value*
LnX3 does not Granger Cause DLnY	28	*1.35*	*0.28*
DLnY does not Granger Cause LnX3		*0.069*	*0.91*

As can be seen from the table, the adjoint probability of LNX3 to DLNY is 0.2780, greater than 0.01, accepting the null hypothesis, so LNX3 is not the cause of DLNY. The accompanying probability of DLNY to LNX3 was 0.9139, greater than 0.01, and the null hypothesis was accepted, indicating that DLNY was not the cause of LNX3 (Table 20).

Table 21. Granger Causality Test between DLNY and LNX5 (China)

Null Hypothesis	Obs	F-Statistic	*P value*
LnX5 does not Granger Cause DLnY	28	1.40	*0.27*
DLnY does not Granger Cause LnX5		1.06	*0.36*

As can be seen from the table, the adjoint probability of LNX5 to DLNY is 0.2674, greater than 0.01, accepting the null hypothesis, so LNX5 is not the cause of DLNY. Similarly, the adjoint probability of DLNY to LNX5 is 0.3620, greater than 0.01, accepting the null hypothesis, indicating that DLNY is not the cause of LNX5 (Table 21).

Table 22. Granger Causality Test between DLNY and DLNX7 (China)

Null Hypothesis	Obs	F-Statistic	*P value*
LnX5 does not Granger Cause DLnY	28	*2.52*	*0.10*
DLnY does not Granger Cause LnX5		*4.15*	*0.03*

As can be seen from the table, the adjoint probability of LNX7 to DLNY is 0.1021, greater than 0.01, accepting the null hypothesis, so LNX7 is not the cause of DLNY. Similarly, the adjoint probability of DLNY to LNX5 is 0.0290, greater than 0.01, accepting the null hypothesis, indicating that DLNY is not the cause of LNX7 (Table 22).

It can be seen from the above conclusions that, in China, the change of the demographic aged 0-14 and over 65 will significantly affect the change of China’s total consumption expenditure, but there is only a positive correlation between them, not a causal relationship. This is not consistent with the original assumption that the highest contribution of Chinese consumption is made by adults. At the same time, it can also be seen that although China is stepping into an aging society, it is also maintaining a huge demographic base between 0 and 14 years old. Then, according to the qualitative analysis in the table, it can be seen that the young and middle-aged people in China may not make an obvious contribution to the consumption expenditure due to the pressure of life.

From the results we can see that, Hypothesis 3 is overturned, and in China's multiple regression model, the demographic aged 15-64 is excluded, indicating that its contribution to consumption is not significant, and the correlation degree is not high.

According to the above two multiple regression models and the revised model, there are some similarities between Japan and China in terms of demographic structure, but there are also obvious differences.

Japanese model：

$$InY = -11.98051 + 1.065263lnx_2 + 0.742867lnx_3 + 0.221515ECM(-1)$$

Chinese model：

$$InY = -24.08116 + 0.93574lnx_1 + 0.331289lnx_3 + 0.972692lnx_5 + 0.106401Dlnx_7 \\ + 0.654744CM(-1)$$

Since lnx3 is retained in the equation and the coefficient of lnx3 is positive, indicating that lnx3 has a significant positive impact on Y, the population aged 65 and above has a significant positive impact on consumption expenditure. Hypothesis one (The aging demographic will also contribute to consumption growth) is true.

Although China, as a country with a large demographic base, has always adhered to the policy of developing domestic demand to drive consumption, for the past 30 years, the influence of demographic of all ages on consumption is not significant, and it is even automatically eliminated in the model regression. While in Japan, although the demographic base is small, the demographic of all ages has a correlative influence on the final consumption expenditure in terms of the final consumption, and even the demographic aged 14-65 has a causal relationship with the final consumption expenditure.

Therefore, hypothesis 1 has been proved, and Hypothesis 2 and 3 have been disproved correctly. That is, the elderly demographic can indeed contribute to the consumption expenditure, but in Japan, it is the demographic aged 15-64 that has a causal and significant effect on consumption. In China, the demographic of 0-14 and the demographic over 65 years old can have a significant impact on consumption, but no causal relationship has been formed.

3.3 Consumption structure in Japan: Principal component analysis (By time)

According to the available data in the database "e-stat", I selected the consumption index of Japan in 1975, 1990 and 2005 to compare the consumption index of Japan with time changes. Since the existing data in the database started from 1975, I chose 1975 as the starting point for the data. In order to show the time change more obviously, I used frequency change every 15 years. However, after downloading the data, it was found that in the statistical data, the consumption index of all major cities in Japan in 2005 was 100, so the principal component analysis could not be carried out, so the last group of data for comparison was replaced with the commodity consumption index of all regions in Japan in 2008. Although I have made a preliminary analysis and judgment on the statistical chart of major consumer goods in Japan, in order to further prove the change of consumption structure in Japan, I will use SPSS to conduct a principal component analysis of Japanese consumption. The data download situation is shown in the figure. In the first column, the vertical axis indicates the cities in Japan, while the horizontal axis indicates the main consumption goods. Therefore, the table reflects the main consumption index of each region in Japan during this period.

3.3.1 Model 1 in Japan (1975-PCA)

In the principal component analysis, we look at the components first, and then we look at what's in the components. The conclusion can be obtained by rotating the principal component.

It is important to get the factor of more than 90% of the total composition, the first eight items. Component 1 through 8 have a 93% effect, but there are components 1 through 7 whose variances are greater than 5, but only the first 5 components have a total greater than 1. Therefore, it is preliminarily judged that components one to five are the main components.

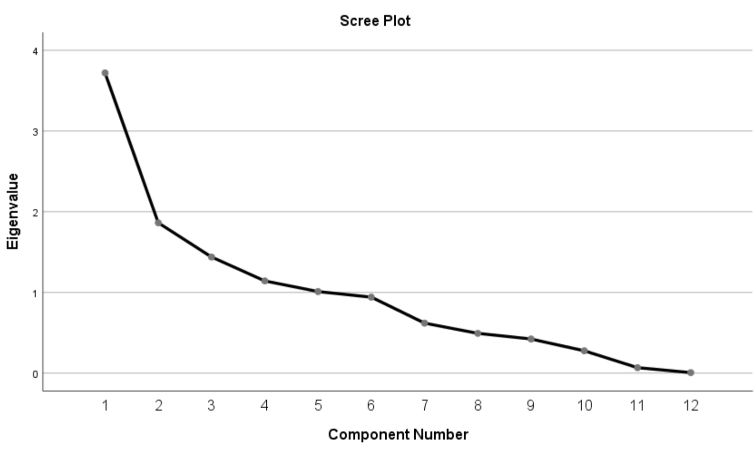


Figure 3. Scree Plot (1975-PCA-Japan)

At the same time, the scree plot diagram supports this view, but the diagram shows that components one to five are more important (Figure 3).

Table 23. Rotated Compositions Accumulation Table (1975-PCA-Japan)

Rotated Component Matrixa	1	2	3	4	5
All items, more imputed rent	0.806	0.39	0.402	0.074	0.077
All items, more imputed rent and less fresh food	0.717	0.441	0.474	0.131	0.117
Food	0 869	-0.053	-0.257	0094	-0.051
Housig, more imputed rent	0.752	0.237	0.131	-0.198	0.083
Fuel light & amp, water charges	0.009	0.054	-0.041	-0076	0.923
Fumiture & amp: household	0.133	0.238	0.297	-0.741	-0.014
Clothes & camp: footwear	0.225	0.817	-0.124	-0 123	0.124
Medical care	0 296	0.138	0.126	0.763	-0.072
Transportation & amp; communication	-0.257	0.431	0.223	0.678	-0.118
Education	0.052	-0.317	0.694	-0.046	0.349-

In the rotated component matrix, it is indicated that components 1 to 5 exert a significant influence on the final outcome. In component 1, Food assumes a predominant role with a coefficient of 0.869. The next is “All item, more imputed rent”. The “imputed rent” refers to the situation where the personal income tax excludes the imputed rent from owner-occupied housing from taxation. In this context, housing with more imputed rent becomes the main component of Japanese living consumption (Table 23).

In the second component, the proportion of the highest is “clothes & amp; Footwear”, other indicators are very low. “Culture & amp; Reaction” accounted for the highest proportion among the third compositions. Recreation, indicates that in Japan in the mid-1970s, most Japanese began to pay attention to cultural entertainment.

3.3.2 Model 2 in Japan (1990-PCA)

Similarly, in the 1990 model, we mainly looked at the cumulative and rotated compositional matrices.

As can be seen from the table, there are components 1 to 8 whose cumulative components reach more than 90%, but there are only components 1 to 7 whose variance is greater than 5. Finally, there are only components 1 to 5 whose overall value is greater than medical ethics. It can be preliminarily judged that the most important components in the model are components one to five. The changes given in the screen plot above are close to the initial judgment (Figure 4).

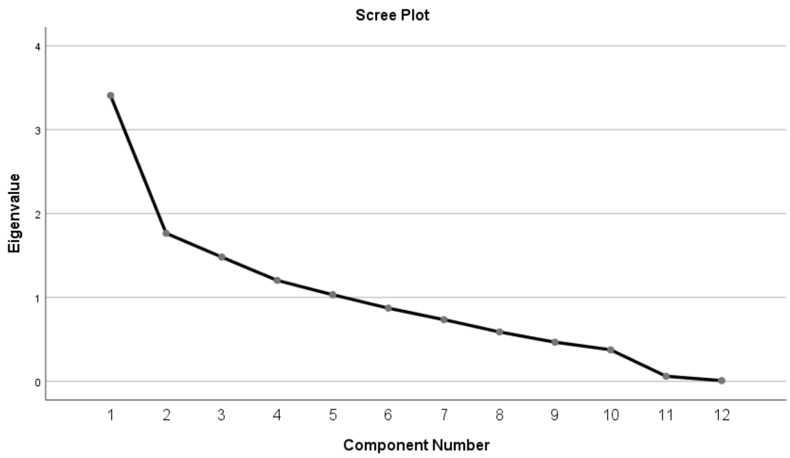


Figure 4. Scree Plot (1990-PCA-Japan)

It is evident from the rotated composition matrix that the primary constituent of the first component remains “All item, more imputed rent”, succeeded by “All item, more imputed rent and less fresh food”, and the third being “housing, more imputed rent”. In component two, the foremost component continues to be “clothes & Footwear”. Among component three, “Furniture & Household Utensils” constitutes the highest proportion (Table 24).

Table 24. Rotated Compositions Accumulation Table (1990-PCA-Japan)

Rotated Component Matrixa	1	2	3	4	5
All items, more imputed rent	0.943	0.166	0.122	0.006	0.223
All items, more imputed rent and less fresh food	0.909	0.217	0.114	-0.063	0.221
Food	0 591	-0.198	-0.205	0.385	0.008
Housig, more imputed rent	0.890	0.201	-0.112	-0.097	-0.089
Fuel light & amp, water charges	-0.07	-0.026	0.011	-0.895	0.095
Fumiture & amp: household	0.078	0.254	0.792	-0.037	-0.097
Clothes & amp: footwear	0.232	0.683	0.022	0.134	0.092
Medical care	0.099	-0.182	-0.255	0.261	0.502
Transportation & amp; communication	-0.197	-0.741	-0.017	-0.200	0.199
Education	-0.073	-0.276	0.035	-0.026	0.844
Culture & amp; recreation	-0.117	0.611	0.857	0.538	-0.008

It can be seen from here that under the influence of inflation in Japan from 1970s to 1990s, housing price and rent became the most important part of residents’ daily life.

3.3.3 Model 3 in Japan (2008-PCA)

The consumption data of Japan in 2008 is selected as the sample, and it is likely that the consumption data will be affected by the economic crisis and present a relatively low state. It can be seen from the table that components 1 to 8 account for more than 90% of the total proportion, and the variance of components 1 to 8 is also greater than 5, but only components 1 to 4 have a total value greater than 1. The results showed that although components 1 through 8 were important, it was components 1 through 4 that had a major effect on the results.

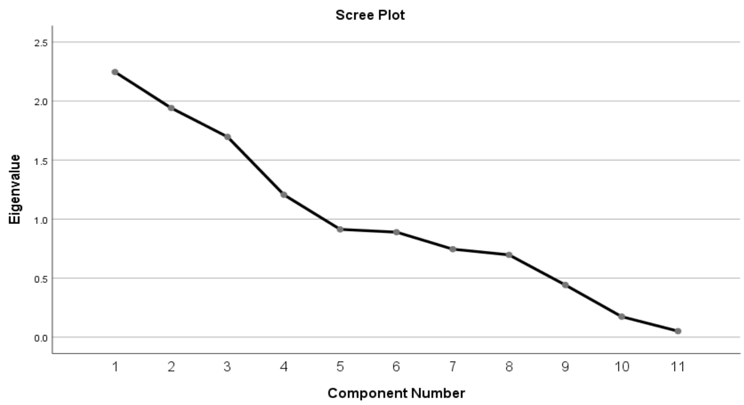


Figure 5. Scree Plot (2008-PCA-Japan)

It can be seen from the screen plot that each component contributes a share of importance. There is no obvious faulty decline (Figure 5).

Table 25. Rotated Compositions Accumulation Table (2008-PCA-Japan)

Variable	Component 1	Component 2	Component 3	Component 4
All items, more imputed rent	0.834	0.33	0264	0.237
Food	0.027	-0.265	0.865	0.124
Housig, more imputed rent	0.692	-0.217	0.085	0229
Fuel light & amp, water charges	0.317	0.763	-0.312	0.158
Fumiture & amp: household	0.658	-0.045	0.003	0.03
Clothes & amp: footwear	0.109	0.253	0.687	0.014
Medical care	0.052	-0.199	0 213	0.844
Transportation & amp; communication	0.154	0.841	0.146	-0.088
Education	0.081	0.212	-0.08	0.640
Culture & amp; recreation	0.579	-0.258	-0.418	0.227

The three leading indicators of component one are still “All item, more imputed rent and less fresh food”, followed by another “All item, more imputed rent and less fresh food”, and “Furniture & household utensils”. The second component features the highest proportion of “transportation & communication”, whereas the highest proportion in the third component is food (Table 25).

In Japan in 2008, rent was still a major part of people’s living expenses, but the cost of commuting to work was also increasing, and most importantly, the cost of food was on the rise. During this period, perhaps due to the impact of the financial crisis, people’s demand for basic living consumption and daily necessities increased, reducing the demand for culture and entertainment. Japanese people still pursue quality of life.

3.4 Consumption structure in China: Principal component analysis (By time)

3.4.1 Model 1 in china (1998-PCA)

In order to explore the characteristics of Chinese residents’ current consumption structure and its development and change rules, the commodity consumption list of China Statistical Yearbook in 1998, 2010 and 2018 was selected for analysis. Principal component analysis was conducted on the consumption structure of residents in 1998, 2010 and 2018 respectively to extract the major consumption expenditure factors, and put the winner factor expression into 31 provinces, autonomous regions and municipalities directly under the Central Government to observe the comprehensive score and the ranking of main factors, so as to obtain the characteristics of current consumption structure in China. To explore the changing trend of different consumption expenditure, because there are a wide variety of commodities consumed by residents, and there is no great correlation between commodities.

Factors whose initial eigenvalue accumulates more than 90% are relatively important. Therefore, from the initial eigenvalue, component 1 to component 10 are all very important. However, when there are many factors, the value of the principal component less than one and the factor not in the range of 5%-10% in the third column should be eliminated, so the most important value is component 1 to component 7. The Scree Plot also supports the above analysis, and the contribution value of components after 10 years is very small (Figure 6).

Figure 6. Scree Plot (1998-PCA-China)

Table 26. Rotated Compositions Accumulation Table (1998-PCA-China)

Variable	Component 1	Component 2	Component 3	Component 4
Garments, shoes andHets	0.897	0211	-0.149	0.099
Traditional Chinese and western Medicine and Health Care	0.756	0.142	-0.039	-0 253
Building material and hardware	0.679	-0. 202	0.377	-0 279
Grain	0.197	0.821	0.036	0.008
Food	0.275	0.763	0.260	0.078
vegetables	-0.224	0.738	-0.209	-0 183
Dried and Fresh melons Fruits	0.013	0.689	-0.259	0.085
Oil or fat	0.084	0.049	0.816	-0.008-
Fuels	-0.370	-0.194	0.815	0.229
Aquatic Product	0.371	0.153	0.535	0.200
Cosmetics	-0.094	-0.013	-0.047	0.842
Mechanical and electric product	-0.075	0.042	-0.114	0.766
Articles for daily use	0.508	-0.076	-0.076	0.514
Gold, silver and jewerty	-0 188	0.205	0.022	0.177
Household Appliance, Music and Video equipment	0.411	0.280	-0.178	0.350
Culture and Office Appliance	0.130	-0.200	-0.190	0.316
Textiles	0.206	0.071	-0.207	.0199
Food and beverage industry	0.298	0.051	-0.072	0.191
Dried food	-0.06	0.283	0.340	-0.099
Meet and poultry eggs	0.456	-0.040	0.372	0.201
Beverage, tobacco and Liquor	0.058	0.052	-0.02	0.143
Books, newspaper, magazine and electronic publication	0.031	0.063	-0.015	-0.208

In accordance with the rotated composition matrix, the first three components occupy the most significant proportions. These are “Garments, Shoes, and Hats”, “Traditional Chinese and Western Medicines and Health Care Articles”, and “Building Materials and Hardware” (Table 26).

The above analysis shows that in China in 1998, household consumption was dominated by medicine, food and building materials.

3.4.2 Model 2 in China (2010-PCA)

Components whose initial accumulates more than 90% are relatively important. From the initial eigenvalue, components 1 to 11 are all important. However, when there are many factors, the value of the principal component less than 1 and the factors in the third column that are not in the range of 5%-10% should be eliminated, so the most important values are components 1 to 6. The Scree Plot also supports the above analysis, and the contribution value after component 12 is very small (Figure 7).

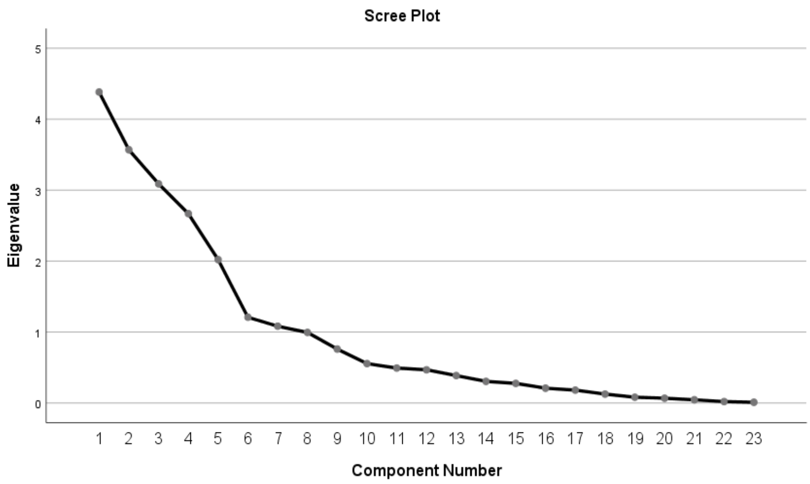


Figure 7. Scree Plot (2010-PCA-China)

Table 27. Rotated Compositions Accumulation Table (1998-PCA-China)

Rotated Component Matrixa	Component 1	Component 2	Component 3	Component 4
Garments, shoes andHets	0.897	0211	-0.149	0.099
Traditional Chinese and western Medicine and Health Care	0.756	0.142	-0.039	-0 253
Building material and hardware	0.679	-0. 202	0.377	-0 279
Grain	0.197	0.821	0.036	0.008
Food	0.275	0.763	0.260	0.078
vegetables	-0.224	0.738	-0.209	-0 183
Dried and Fresh melons Fruits	0.013	0.689	-0.259	0.085
Oil or fat	0.084	0.049	0.816	-0.008-
Fuels	-0.370	-0.194	0.815	0.229
Aquatic Product	0.371	0.153	0.535	0.200
Cosmetics	-0.094	-0.013	-0.047	0.842
Mechanical and electric product	-0.075	0.042	-0.114	0.766

Articles for daily use	0.508	-0.076	-0.076	0.514
Gold, silver and jewerty	-0 188	0.205	0.022	0.177
Household Appliance, Music and Video equipment	0.411	0.280	-0.178	0.350
Culture and Office Appliance	0.130	-0.200	-0.190	0.316
Textiles	0.206	0.071	-0.207	.0199
Food and beverage industry	0.298	0.051	-0.072	0.191
Dried food	-0.06	0.283	0.340	-0.099
Meet and poultry eggs	0.456	-0.040	0.372	0.201
Beverage, tobacco and Liquor	0.058	0.052	-0.02	0.143
Books, newspaper, magazine and electronic publication	0.031	0.063	-0.015	-0.208

According to the rotated component matrix, the first three compositions account for the largest proportion are “Fuels”, “Food and Egges”, “Building materirals and Hardware”, ”Poltry meat”. The above analysis shows that in 2010 China, the residents still pay more attention to the nutrition of food, egg consumption rise, at the same time dominant shows that the development of industrial fuel consumption, this proved that China’s industry at this time was developing continuously and consuming huge amounts of energy. The consumption structure at this time maintained a similar pattern to that in 1998, which consumed a lot of food, but at the same time, it can be seen that China’s industry was developing continuously (Table 27).

3.4.3 Model 3 in China (2018-PCA)

Components whose initial eigenvalue accumulates more than 90% are relatively important. From the initial eigenvalue, components 1 to 12 are important. However, when there are many factors, the value of the principal component less than 1 and the factors in the third column that are not in the range of 5%-10% should be eliminated, so the most important values are components 1 to 8. The Scree Plot also supports the above analysis, and the contribution value after component 12 is very small (Figure 8).

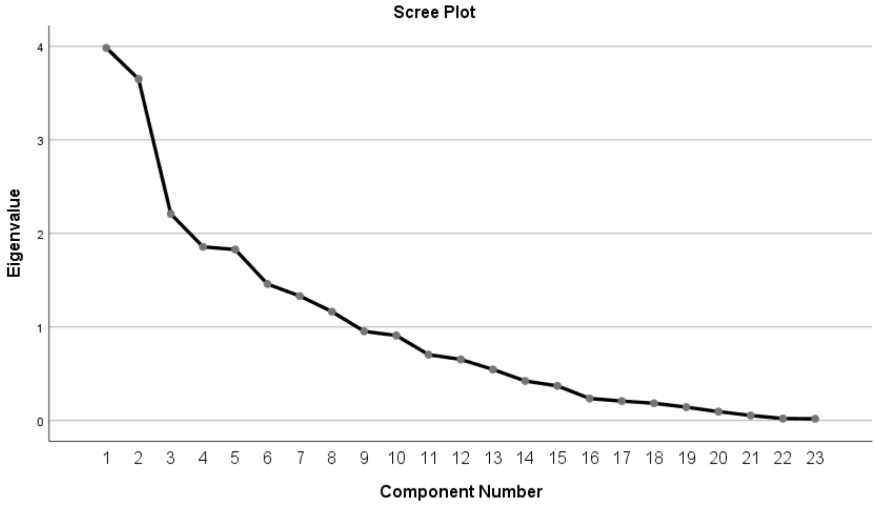


Figure 8. Scree Plot (2018-PCA-China)

Table 28. Rotated Compositions Accumulation Table (2018-PCA-China)

Variable	Component 1	Component 2	Component 3	Component 4
Fuels	0.8689	-0.095	0.028	-0.087
Food	0.816	-0.16	0.335	0.093
Eggs	0.765	0.136	-0.19	0.181
Building Materials and Hardware	0.637	0.4637	-0.006	0.0005
Poultry meat	0.605	0.4605	0.168	0.058
Sports and Recreation	-0.053	-0.053	0.878	-0.12
Transportation and Communication Appliance	0.019	0.019	0.77	0.042
Household Appliances/Music and Video	-0.191	-0.191	0.766	0.349
Cultural and Office Appliance	0.073	-0.137	0.073	0.745
Textile	0.047	0.244	0.797	0.072
Livestock meat	0.217	0.217	-0.322	0.727

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Variable	Component 1	Component 2	Component 3	Component 4
Garments/Shoes and Hats	0.154	0.154	0.707	0.415
Furnitures	-0.024	0.089	-0.081	-0.549
Grains	0.269	0.143	0.015	0.307
Article for daily use	0.165	0.133	-0.168	-0.028
Books, newspaper, magazine and electronic publication	-0.081	-0.549	-0.079	0.694
Vegetables	0.143	0.015	0.307	-0.52
Beverage & tobacco liquor	0.133	-0.168	-0.028	-0.154
Traditional Chinese and western Medicine and Health Care	0.109	0.101	-0.093	0.336
Cometic	-0.029	0.013	-0.043	0.11
Dried and Fresh melons Fruits	0.313	0.296	-0.103	-0.102
Aquatic product	0.035	0.027	0.132	0.195

According to the component matrix, the first three items with the largest proportion in component 1 are "Garments, Shoes and Hats". "Househld Appliances, Music and Video Equipment", "Textiles". The largest proportion of component 2 are "vegetable", "Books, Newspapers, Magazines and Electronic Publications", "Building Materials and Hardware". Although the consumption of enjoy consumer goods such as music and books gradually increased in 2018, major consumer goods still showed a similar situation in 1998, such as clothing and textiles, which accounted for a high proportion of consumption, and vegetables (Table 28).

To sum up, the consumption structure of China from 1998 to 208 showed the dependence on daily necessities, and the consumption of other consumer merchandises began to appear on the basis of large consumption of daily necessities. In order to further observe the changes in China's consumption structure, I further compare the changes in China's regional consumption structure.

4. Conclusion

This study establishes that Japan and China exemplify distinct paradigms of the "layered consumption society", a concept refined through comparative analysis of demographic and consumption dynamics. In Japan, the layered structure manifests temporally across four sequential consumption eras (1912-present), each corresponding to demographic transitions: the first era (1912-1945) emphasized large-scale household purchases aligned with population growth (annual population increase ≈ 1.2%), while the third era (1975-2000) saw niche consumption emerge as aging accelerated (65+ population share rising from 7.9% to 17.3%). Regression models confirm this temporal stratification, with the 15-64 cohort exerting dominant causal influence on final consumption (β=1.065, p<0.001), validating its role as Japan's primary consumption driver and refuting Hypothesis 2. China's layered structure, conversely, operates demographically rather than temporally—principal component analysis identifies the 0-14 and 65+ cohorts as consumption anchors (β=0.706 and 0.331 respectively, p<0.001), while the 15-64 cohort was excluded during multicollinearity correction (max VIF=281.37), invalidating Hypothesis 3. Both nations confirm Hypothesis 1 through aging populations' positive consumption contributions (Japan: β=0.743, China: β=0.331), but structural divergences emerge: Japan's temporal layers exhibit sequential market maturation (adj. R^2=0.998), whereas China's demographic strata reflect concurrent coexistence of consumption patterns. This disproves Hypothesis 4's equivalence claim, revealing institutional contexts—not demographic determinism—mediate aging's economic impacts. Japan's mature regulatory frameworks enable temporal consumption stratification, while China's rapid urbanization locks consumption to demographic cohorts, evidenced by Granger causality tests showing no predictive relationship between productive-age populations and expenditure (p>0.05). The layered society framework thus provides a critical lens to reinterpret aging economies: temporal stratification requires institutional stability, whereas demographic stratification signals transitional markets. Future research must investigate how digital platforms might reconfigure these layers, particularly in China where unbranded "long-tail" consumption (implicit in excluded regional PCA data) suggests latent structural shifts. These findings necessitate policy differentiation—Japan's challenge lies in sustaining temporal layers amid population decline, while China must address demographic stratification's constraints on consumption upgrading.

5. Discussion

This study extends the theoretical framework of "layered consumption society" (Murakami, 1994) by demonstrating its divergent manifestations in aging East Asian economies. The temporal stratification observed in Japan aligns with Rostow's modernization theory, where consumption patterns evolve linearly with institutional maturity (Rostow, 1960). However, our finding that China's demographic stratification defies this progression challenges conventional development paradigms, suggesting the emergence of a unique "compressed modernity" (Chang, 2010) where pre-industrial, industrial, and post-industrial consumption layers coexist spatially rather than sequentially.

The validated causal relationship between Japan's 15-64 cohort and consumption expenditure ($\beta=1.065$, $p<0.001$) reinforces human capital theories (Becker, 1964), yet the exclusion of China's equivalent cohort from significant models contradicts conventional labor-driven growth assumptions. This paradox might reflect China's unique household savings culture (Chamon & Prasad, 2010) and housing-driven expenditure patterns (Gan et al., 2020), where younger generations prioritize asset accumulation over consumption—a phenomenon requiring reinterpretation of life-cycle hypothesis (Modigliani, 1966) in transitional economies.

Our demographic stratification findings in China resonate with Zhang's (2018) "fragmented consumption" concept, where aging populations and youth cohorts form parallel consumption systems. This contrasts sharply with Japan's unified temporal progression, potentially explained by differing welfare regimes (Esping-Andersen, 1990)—Japan's comprehensive pension system enables elderly consumption autonomy, whereas China's reliance on familial support (Whyte, 2003) binds elderly expenditure to youth demographics.

The rejection of Hypothesis 4 (structural equivalence) underscores institutional path dependency in consumption evolution. Japan's temporal layers reflect stable regulatory environments enabling market sequentialization (Knight, 1995), while China's demographic stratification reveals transitional institutional voids (Khanna & Palepu, 1997) where consumption anchors to basic demographic attributes. This aligns with North's (1991) institutional theory but introduces demographic variables as institutional proxies in developing economies.

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