

The effect of population aging on household consumption level
in China



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ผลกระทบบของประชากรสูงอายุต่อระดับการบริโภคในครัวเรือนของ
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ยี่ฟาน มา :

ผลกระทบของประชากรสูงอายุต่อระดับการบริโภคในครัวเรือนของจีน. (The effect of population aging on household consumption level in China)

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บทความนี้เน้นที่ผลกระทบของประชากรสูงอายุต่อระดับการใช้จ่ายในครัวเรือนของจีน โดยใช้อัตราส่วนแนวโน้มการบริโภคเป็นตัวแปรตามในแบบจำลอง โดยมีมุมมองการวิจัยหลัก 3 ประการจากทั่วประเทศ เปรียบเทียบกับภูมิภาคหลัก 3 ภูมิภาค การเปรียบเทียบก่อนและหลังการระบาดของโรคระบาด . แหล่งข้อมูลหลักได้มาจาก National Bureau of Statistics of China ซึ่งมีทั้งหมด 31 จังหวัดเป็นระยะเวลาสิบปีระหว่างปี 2011 ถึง 2020

การศึกษาเชิงประจักษ์ในบทความนี้ใช้แบบจำลองกำลังสองน้อยที่สุดแบบธรรมดาเพื่อเรียกใช้ข้อมูลและรับตามข้อสรุปหลักเรื่องนโยบายอื่น ๆ ยังคงไม่เปลี่ยนแปลง ประชากรสูงอายุมีผลกระทบต่อพฤติกรรมการบริโภคของชาวจีน เนื่องจากอัตราการพึ่งพิงสูงอายุจะลดอัตราส่วนแนวโน้มการใช้จ่ายของผู้นั้น เฉพาะภาคตะวันออกเท่านั้นที่มีความสัมพันธ์เชิงลบอย่างมีนัยสำคัญระหว่างอัตราส่วนการสนับสนุนแบบเก่ากับแนวโน้มการบริโภคของประชาชน

ระดับอิทธิพลที่มีนัยสำคัญแสดงรายชื่อจากพื้นที่ในภาคตะวันออก พื้นที่กลาง และตะวันตก อัตราการระในวัยชราไม่ได้ส่งผลกระทบต่อแนวโน้มการบริโภคของผู้อยู่อาศัยในช่วงการระบาดใหญ่.

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This paper mainly focuses on the aging population's effect on Chinese household spending level by using consumption tendency ratio as a dependent variable in the model with three main researching perspectives from the whole country, comparison with three main different regions, comparison before and after outbreak of COVID-19. The main data resources are obtained from the National Bureau of Statistics of China with a total of thirty-one provinces for a ten-year period from 2011 to 2020. Empirical study in this paper uses an ordinary least squares model to analyze data and get the following main conclusions. Other conditions remain unchanged, the aging population do have impacts on the consumption behavior of Chinese residents since higher old dependency rate will lower down people's spending tendency ratio; Only the eastern region shows a significant negative relationship between the old supporting ratio and people's propensity to consume. The more significant influence level is listed from area in the eastern, middle area and western; The old age burden rate does not significantly impact on residents' consumption tendency under the pandemic period.

Field of Study:	Business and Managerial Economics	Student's Signature
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		..

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After more than two months of hard work, I finally finished writing my research paper. From the beginning of choosing the topic of the thesis to the collection of data, and then complete the article. During this period, I have learned a lot of knowledge and had a lot of feelings. From the very beginning of acquiring knowledge from the classroom, I started to study and experiment independently, checking related materials and books. The fuzzy concepts in my mind gradually clear. My individual study's (IS) framework is filled in step by step, every improvement from paper is the gain of my learning.

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1: Introduction

1.1 Background Information

In the past, the realistic demand of “raising sons to support parents in their old age” may be the key factor influencing people's willingness to have children. Young parents need to spend time and money on raising their children which can seem like a kind of savings of money and human capital. After children grow up, they will pay money and time to support their elderly parents which can be regarded as a repayment of their parents' early investments. This phenomenon is mainly due to the underdeveloped economic situation where China was in the feudal period. The lack of financial products and immature financial industry which lead people have no proper financial instruments to save their income with a serious moral hazard risks and high inflation rate of paper money in the market. In addition, inadequate health care systems with backward medical care conditions cannot provide guaranteed services to citizens which causes low newborn survival rate and high mortality rate on elderly population. These are several factors behind which cause people to have conservative concepts in their mind “the more sons, the more blessings.”

After the implementation of reform and opening-up policy, the Chinese economy has developed rapidly. The nation's GDP has progressed from eleventh economic aggregate in 1978 to the second largest economic entity in the world in 2020 based on the world bank's data (*Figure 1*). In the past, Chinese people normally had an inherent thought that raising sons to support parents when they are getting older, this also became a key variable affecting people's fertility desire. As time passes, the country's economic development, well-developed operating system on both medical care services and endowment insurance industries, one child policy's implement unconsciously reduced residents' needs on “raising children for old age.” Since the population aging is directly influenced by the nation's low fertility rate, it is generally assumed that if the total fertility rate¹ lower than 2.1, the number of newborns will not be sufficient to make

¹Total Fertility Rate (TFR): refers to the average number of children per woman in a country or region during her reproductive years.

up their parents' number. If the total fertility rate remains stable below 2.1, the country's birth rate will decrease year by year. (pic.bankofchina.com, 2022)

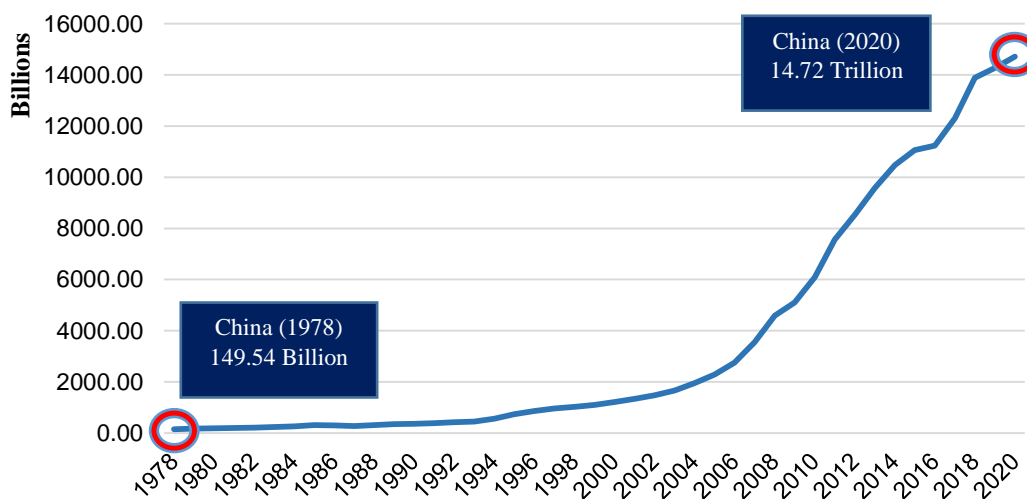


Figure 1: China's GDP (current US\$) 1978 – 2020

(Source: data.worldbank.org, 2020)

Based on the seventh national population census in 2020, the total population of China are 1,411.78 million compared with the sixth nation census data in 2010 which has 1,339.72 million. The population of China has increased 72.06 million over these ten years with an average annual growth rate 0.53%. In contrast with the previous ten years' rate 0.57% from 2000 to 2010, the recent average annual growth rate is 0.04% lower than previous rate. Furthermore, the national population of elderly people whose age above 60 is 264.02 million which accounts for 18.70% of the total population (*Figure 2*). And for elderly group of people whose age above 65 is 190.64 million which accounts for 13.50% of the total population. In an overall look, China's dependency ratio of the elderly population is 19.70%. The slower growth rate of the total population, decreased proportion of working-age people and increasing section on elderly group. These are the three characteristics of the aging trend that China is currently facing.

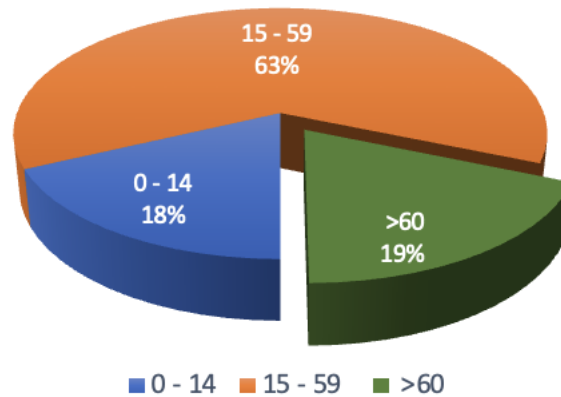


Figure 2: Age composition on the seventh national population census in 2020

(Source: data.stats.gov.cn, 2020)

1.2 Research Questions

The main problem mentioned in this literature is the effects of an aging population on residents' consumption tendency. The proportion of the elderly supported by society is increasing which drives to the main problem in this literature whether population aging has an impact on household consumption level. The percentage of working people get less and the whole society needs to support a larger portion of elder population. Younger people have a heavier social burden plus senior citizens spend less. The country's economic vitality might fluctuate which affects the general household consumption level. Maestas, Mullen, and Powell (2016) used to estimate the impact of aging on their countries' economic growth.

For the rural areas, people's income gap is getting larger while the aging population becomes more serious mainly due to the implementation of one-child policy and younger people tend to migrate to cities instead of villages. However, the previous research found that rural areas' consumption inequality is much less than their income's inequality. Instead, aging population does not significantly affect rural residents' unbalanced spending, education and family size are the main factors that influence their consumption inequality (Qu and Zhao, 2008). It also further proved in the later paper that higher old-age dependency ratio is the important factor lowering city people's consumption level but not for countryside inhabitants. For the three main divided sectors of China, the influence of population aging on its households' consumption

level from largest to smallest is east, central, and west (Mao, Sun, & Hong, 2013). By looking deeper, taking thirty-one provinces' population economic panel data from year 2001 to 2018 (Jin and Li, 2021), a larger portion of oldness does have a negative impact on consumers' spending in an overall look. The different impact level is also quite remarkable among the three areas of China.

1.3 Hypothesis

The paper used to evaluate the impact of population aging on consumption levels in China, which is important for the further improvement and development of the country's "consumption theory." As we all know there are many existing studies with related topics of demographic structural effects on residents' consumption came from foreign scholars like Keynes' absolute income hypothesis and Modigliani's life cycle hypothesis.

In Keynes' theory, he identified the relationship between people's income and consumption. When a person's income rises, his or her consumption also will continue to increase but not at the same increasing rate as income. By looking into the cross section of the population, those groups of rich people generally consume a lower proportion of their income compared with poor people. For the life cycle theory which was proposed by the economists Franco Modigliani and his student Richard Brumberg, it indicates that a rational consumer will reasonably arrange his consumption and saving during the whole life, his lifetime receiving income and consumption spending should be equal. The life cycle theory divided human life into three different periods which are youth, middle age and old age. For both young and old groups of people, their consumption usually exceeds income. However, people who are in the middle age will have more income than consumption since they have to take responsibility to take care of their families as the main group of the labor force.

Even though some points can be explained under these theories, there are still some differences based on China's national condition. A huge portion of older people have no savings or retirement income since they spend all of their money on their children in earlier days and living off their sons and daughters when they are getting older. It

does not quite fit with Modigliani's hypothesis. Based on the relevant data, an aging population has some impacts on a country's overall spending and even on its economic development. This paper aims to improve the demographic consumption theory of China, and also provide its special relationship between aging population structure and consumption tendency situation based on China's national condition to the world as data references.

The rest of this research paper presents the effect of old dependency ratio on residents' propensity to consume in China by using the ordinary least square model, with discussions of related literature and recommendations for the government. The following section talks about relevant literature reviews. Section 3 describes relevant data and methodologies used in the research process. Section 4 presents the main empirical results of researched questions with additional findings. Conclusions and limitations are in Section 5, and the further recommendations conclude in Section 6.

2: Literature Review

Based on the relationship between population aging and residents' consumption level, one of the most prominent theories proposed by Modigliani in the 1950 is called life cycle theory. It divided human life into three main periods which are youth, middle age, and old age. The theory concluded that the consumption is greater than income for younger and older people. And income is greater than consumption in the middle age period. The larger percentage of young people and senior citizens accelerate residents' consumption level, oppositely, a larger portion of middle age will play an inhibitory role.

2.1 Foreign Literature Reviews

From foreign literature reviews, population structure has been considered to be one of the most important factors to determine peoples' saving rate. By doing research on seventy-four countries, high dependency ratio and birth rate are the important factors which cause a great different saving rate between developed and developing countries

(Leff, 1969). It limited the saving rate's improvement but encouraged people's consumption level. For the paper, Maestas, Mullen, and Powell (2016) found that every extra 10% increasing on the portion of older people (60 +) will correspondingly decrease 5.5% GDP per capita growth rate. Around 67% of reduction comes from the slower growth rate on workers' productivity through the age distribution, and the rest 33% sources from lower growth in the labor force.

2.2 Chinese Literature Reviews

Based on the research papers from analyzing China's national conditions, Qu and Zhao (2008) have taken three years' CHIP (Chinese Household Income Project) data in 1988, 1995 and 2002 to do analysis by using both variance and regression decomposition methods. In rural areas, there is a certain risk smoothing mechanism to reduce the external impact on income. The research of Wang (2011) indicates that the factor of population aging significantly influences consumption behavior of urban citizens, ceteris paribus, higher proportion of old people will follow by high average propensity to consume among them. By doing the empirical research findings of population aging structure's impacts on residents' consumption level, Mao, Sun, & Hong (2013) collected thirty-one provinces' panel data of China and found that the deepening aging of population has significantly lowered the per capita consumption of urban residents but not for countryside inhabitants.

2.3 Further Considerations

Most of the previous papers only analyzed the countryside and city individually, since they considered China a dual economy country. Nowadays, the nation's urban and rural integration is a new stage of its modernization and urbanization. The advanced development of network communication and transportation lead both urban, rural areas' resources complementarity and harmonious development. The 'regional' analysis results might not be that accurate based on current Chinese developing situations. Also, some empirical studies only take several years of data which might be insufficient and measurement results are difficult to be persuasive. Small database

might make the degree of freedom relatively larger, and its regression results lack of stability. Furthermore, there are not many available reports that take deep consideration about the objective factor pandemic to evaluate the effect of population's propensity to consume. In this paper, we considered cities and villages together to evaluate each provinces' situation. It takes all thirty-one provinces' data of China with ten years panel data to analyze is and consider the impact of pandemic.

3: Data and Method

3.1 Data Collection

This paper uses ten years panel data from 2011 to 2020 which include the whole nation with thirty-one provinces, autonomous regions and municipalities' main demographic data. Most data resources are collected from the government database's National Bureau of Statistics of China and the population sampling survey takes the country as a whole and provinces as its sub-units. The national interest rate data is collected from annual reports of THE PEOPLE'S BANK OF CHINA. Based on the special annotation from national statistics, the database does not include data on Hong Kong, Macau and Taiwan Province since they are the relatively independent areas with their own statistical systems and legal provisions.

For the old and children dependency ratio, the national population census was conducted in years of "0" and 1% sample survey of the national population was used in the year of "5." In the remaining years, the sample size is collected about 1% of the total population by using stratified, multi-stage, cluster probabilistic and proportional sampling methods to take samples. For households' disposable income and consumption expenditure, the National Bureau of Statistics has implemented an integrated reformation of the urban and rural household surveys from which data are collected on the country's residents. Disposable income refers to the sum of final residential consumption expenditure and their savings available which also means the income available to people for their discretionary use. The consumption expenses indicate the money that households used to satisfy all expenses for their daily

consumption needs. The consumer price index indicates the trend and degree of that both urban and rural residents purchase goods and services when price changes in a certain period of time. The National Statistics Bureau selects different economic regions and reasonably distributed areas of China, as well as representative goods and services as samples to conduct regular surveys of the market prices. The savings rate is taken from THE PEOPLE'S BANK OF CHINA with its Statistics and Analysis Department by using one-year time deposit interest rate. For the gross regional product, which is a quantity of value indicator and mainly influenced by changing prices and volumes.

3.2 Summary statistics

In this paper, the 310 samples are collected and used in statistical research. Residents' consumption tendency ratio (CT) is the dependent variable which is calculated with consumption expenses divided by disposable income in each corresponding periods' places. The tendency ratio is more accurate for measuring people's consumption tendency without disruptions by external factors. The main explanatory variable in this research is the old dependency ratio (Old) also known as the dependency ratio of the elderly population. The National Statistics Bureau has explained in detail the ratio of the number of older people who are over 65 years old to the number of working age people who are between 15 to 64 years old. There are also five other independent variables: children dependency ratio, nationwide per capita disposable income, consumer price index, interest rate and indices of gross regional products. The children dependency ratio (Child) emphasizes the number of children whose age is below 14 to the number of working-age people (15-64). Per capita disposable income nationwide (DI) with its units RMB includes four categories of residents' income which are wage, net operating, net property, and net transfer income. Consumer price index (CPI) is based on the previous year as standard price index 100 which observes the impact of retail prices' changing on consumer goods and services on actual living expenses of the country's residents. The nation's interest rate (IR) for a one-year fixed period refers to the percentage. And the indices of gross regional product (GRP) as an indicator based on the previous year to be calculated at constant prices.

The summary statistics of variables as shown in Table 1. Total number of observations is 310 with thirty-one provinces for ten years. The mean of consumption tendency ratio is 72.36% which means people's daily consumption expenses have taken the majority of their disposable income. The highest old dependency ratio among the ten years is 25.5%. Its mean value indicates people whose age above sixty-five are taking 14.34% on average of the country's labor force among the age fifteen to sixty-four. For the variable disposable income, it has a wider range since there is a big difference from minimum to maximum with a big standard deviation value result. The development of different regions of China has brought a great difference in the disposable income of people. Consumer price index has been sustainably steady growth year over year based on the previous year's measurement index. The minimum value 94.6 as shown in the summary statistics of the last variable indicates that there is one province turned into a negative gross regional product.

Table 1: Summary Statistics for variables

Variables	Obs	Mean	St.dev	Min	Max
CT	310	72.36	5.46	56.03	90.55
Old	310	14.34	3.81	6.70	25.50
Child	310	23.18	6.46	9.90	38.40
DI	310	23,191	11,169	7,510	72,232
CPI	310	102.50	1.17	100.60	106.30
IR	310	2.13	0.79	1.50	3.50
GRP	310	107.50	2.56	94.60	113.60

Source: Author's calculations from Gretl's summary statistics

3.3 Method

From an empirical perspective, this paper took ten years' time series data from 2011 to 2020 as its data resources which used to further analyze the impact of population aging on the consumption level of Chinese residents by adopting an ordinary least square model to conduct an empirical study. It used to answer three main questions as follows. Firstly, what is the effect of the deepening population aging on people's consumption

tendency level either positive or negative? Second, do regional differences also have various impacts of population aging on residents' consumption? Lastly, whether the outbreak of pandemic aggravates old dependency ratio's effect on residents' spending tendency rate. The paper used OLS model with panel data and the model shown as follows:

$$CT_{i,t} = \beta_0 + \beta_1 Old_{i,t} + \beta_2 Child_{i,t} + \beta_3 DI_{i,t} + \beta_4 CPI_{i,t} + \beta_5 IR_{i,t} + \beta_6 GRP_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where CT denotes the average propensity to consume, Old and Child are the old and youth dependency ratios respectively, DI denotes real disposable income, CPI is the consumer price index, IR means Interest rate in China and GRP is the gross regional product index, ε denotes the residual term for the model and subscripts i and t denote region and time respectively, β_n is the coefficient of the model.

4: Empirical Results

4.1 The overall areas' analysis

The results of the relationship between population aging and population's consumption tendency of China from year 2011 to 2020 are shown in Table 2 under the model 1 and 2. Model 1 took both urban and rural areas to do evaluation. Model 2 is based on model 1 which take out the variable GRP since its p-value (0.9511) is greater than 5% and not significant. From the first two models, we can see that:

- (1) The significance and direction of the coefficients of the main independent variable remain consistent with what we expected in this paper. The old dependency rate has a negative impact on residents' consumption tendency ratio, every 1% increase on the old people's proportion will lead to around 22.6% decreasing on inhabitants' spending tendency, ceteris paribus, and significant at 5%, 1% respectively from model 1, 2. Therefore, we could conclude that the increasing aging of the population significantly reduces residents' per capita consumption.

- (2) The child dependency ratio also plays a negative effect on people's spending tendency. From the test results, every 1% increase on child dependency ratio will lower down consumption ratio by approximately 28.7% with the significance test 1% level, *ceteris paribus*.
- (3) The other two control variables are people's disposable income and the bank's interest rate shows a negative relationship with the dependent variable with coefficients -0.0002 and -1.2579 separately. However only the average disposable income has 1% significant level influences on the dependent variable.
- (4) The rest variables indices of consumer price and gross regional product show positive coefficient results with the population consumption tendency ratio. Only CPI passes the significance test at 5% level.

4.2 The Regional comparative analysis

The economic development and people's lifestyles are very disparate among different regions in China which also may lead to different impact results on the consumption tendency ratio. The three main separated regions east, middle and west are a policy division, neither the administrative division nor geographical concept as shown in *Figure 3*. The eastern region refers to the earliest provinces and cities with the coastal opening policy with a quite high level of economic development. The middle areas refer to the secondly developed regions, while the west standards to the economy underdeveloped areas. Its relevant model estimated results as shown in model 3, 4 and 5 respectively as shown in Table 2 and we can realize that:

- (1) In the eastern region, the effect of old dependency ratio on people's consumption is negative at 1% significance level. Every 1% increase on this main control variables, people who come from the east area will be lower down 70.7% on their spending tendency rate, other conditions remain unchanged. However, the effect of the old dependency ratio on consumption is insignificant in the midland and western regions. We can conclude that the bigger impact of the old age burden rate on residents' consumption tendency is from the eastern, middle area and western.

- (2) The child support ratio has a negative impact on the model's dependent variable in all three districts with a significant 1% level. Their coefficients for the three models are -0.3732, -0.3143 and -0.4295 respectively which indicates that influences of child dependency ratio on public spending propensity is more serious from western, eastern, and middle area.
- (3) Disposable income per capita has significant negative influences on both eastern and western but not middle area; Consumer price index has a positive impact on dependent variable in the east region, but there is not significant relationship in the middle and west places since both p-value are greater than 0.05; Increasing on bank's interest rate will lead to lower consumption tendency ratio in the eastern region at 1% significance level, however it does not obviously effect on middle and western places due to their p-value greater 0.05; The indices of gross regional product only has significant negative influences on the western area as shown in model 5 with its p-value 0.0043.

Table 2: Consumption tendency to old dependency rate by different regions

Dependent Variable: Consumption tendency ratio

	Model 1 (All)	Model 2 (Exclude GRP)	Model 3 (East)	Model 4 (Middle)	Model 5 (West)
Const	20.4951 (0.5712)	21.5002 (0.4848)	45.2751 (0.2330)	55.9383 (0.2421)	136.440* (0.0601)
Old	-0.2264** (0.0108)	-0.2261*** (0.0055)	-0.7065*** (0.0000)	0.2831 (0.1267)	0.1732 (0.3204)
Child	-0.2878*** (0.0000)	-0.2866*** (0.0000)	-0.3732*** (0.0000)	-0.3143*** (0.000)	-0.4295*** (0.0014)
DI	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0002*** (0.0000)	-0.0001 (0.3559)	-0.0007*** (0.0010)
CPI	0.6852** (0.0282)	0.6830** (0.0288)	0.7172** (0.0297)	0.2527 (0.5698)	0.6763 (0.2826)
IR	-1.2579* (0.0521)	-1.2398** (0.0297)	-2.0211*** (0.0065)	1.3191 (0.2287)	-0.4648 (0.7518)
GRP	0.008 (0.9511)		-0.1852 (0.2326)	-0.0691 (0.6910)	-0.9864*** (0.0043)
R2	0.2924	0.2924	0.5943	0.3149	0.2945
Adjusted R2	0.2784	0.2808	0.5728	0.2654	0.2490
Observations	310	310	120	90	100

Notes: *,** and *** indicate significance at 10%, 5% and 1%, respectively.

Source: Author's summarization from Gretl's model analyzation



Figure 3: Three main regions of China

(Source: journals.plos.org, 2009)

4.3 Analysis before and after the epidemic

The COVID-19 outbreak has brought an irreversible impact on Chinese people's consumption patterns. The effect is widespread into different classes' people rich, poor etc. The instability of the epidemic has also changed consumers' psychology to a certain extent. Model 6 and 7 (Table 3) show two different periods that effects of old dependency rate on people's consumption tendency before and after the epidemic and we can find that:

- (1) The old dependency ratio has relatively slight influences on resident's consumption tendency during the COVID-19 period compared with before. However, the main control variable does not show significant influences on the dependent variable on either model.
- (2) The child dependency ratio has a significantly negative coefficient relationship on consumers' spending tendency level before the COVID-19 period. Every 1% increase on this independent variable, the consumption tendency ratio will decrease by 24.75%, other conditions remain unchanged. After the period of epidemic outbreak, there is no significant relationship between the two.
- (3) The control variable disposable income per capita has 1% significant level influences on the dependent variable from both models. Either before the

pandemic outbreak or during the period, the control variable's coefficients in these two models are approximately the same which is -0.0002; Consumer price index does not show any significant causal effect with the induced variable; The index of gross regional product has 1% significant level negative influences on people's spending tendency ratio during the pandemic period from model 7.

Table 3: Consumption tendency to old dependency rate before & after the outbreak

Dependent Variable: Consumption tendency ratio		
	Model 6 (Before)	Model 7 (After)
Const	51.6006* (0.0660)	106.970 (0.4200)
Old	-0.1385 (0.1984)	-0.0493 (0.7564)
Child	-0.2475*** (0.0000)	-0.0595 (0.5364)
DI	-0.0002*** (0.0000)	-0.0002*** (0.0000)
CPI	0.1355 (0.6396)	0.3748 (0.7557)
GRP	0.1837 0.3393	-0.6309*** (0.0010)
R2	0.1765	0.4624
Adjusted R2	0.1595	0.4144
Observations	248	62

Notes: *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Source: Author's summarization from Gretl's model analyzation

4.4 Findings

By looking at the overall models, we figure out that the first main result via models is that the main explanatory variables in this paper old dependency ratio (Old) does have significant negative influences on people's propensity to consume in the nationwide perspective and eastern region. The eastern area was significantly more influenced than the country as a whole by looking at the two coefficient values: -0.7065, -0.2264. One reason might be taken into consideration about these big differences is the size of the sampling area. The sampling data from eastern area is relatively narrow, while the national data covers all places' data resources with a wider range which might neutralize the results. Secondly, the child dependency ratio also has the same impact as aged people's. Larger proportion of children as counted into the workforce; the average human spending propensity will tend to decrease. Thirdly, the effects of the old support ratio on consumption propensity cannot be figured out obviously under the epidemic period. People demonstrate different consumption attitudes while facing the outbreak of pandemic and this might lead to unclear statistical results under the volatile social condition with other uncertain variable factors.

The main results found from this paper are not fully like what has been discussed in previous research literature. The first result, the increase of old-age dependency ratio is an important reason for decreasing household consumption which is consistent with conclusions from Mao, Sun, & Hong (2013) but not the same with Wang (2011). Furthermore, the child dependency ratio's influence effect is different from preceding articles. Some of them concluded that the increasing child dependency ratio significantly raises people's consumption expenditure level but this paper demonstrates a negative relationship among child dependency ratio and residents' consumption tendency.

Until today, research conclusions based on the effect of population aging to consumer demand has been controversial no matter inland China and foreign research. For the positive views, older people have more leisure to spend their money as compensatory consumption for themselves. Also, they will need to spend a certain amount of money for their children to get married, purchase houses etc. One more factor that drives the old population to spend more is about their medical costs since their body's physical

condition is getting worse. On the other hand, some papers stated that there is a negative influence on citizens' consumption level in an overall perspective. Purchasing power on older people is relatively lower down since their main sources of income are coming from old-age pension and funds supported by their children. Moreover, higher old dependency ratio also emphasizes that the nation's labor productivity has been decreasing which may lead to lack of updating technology and slower consumption growth. Furthermore, old people's savings decreased because of lower income. When a country's aging population gets into a serious situation, the national saving rate will be affected since the capital accumulation is relatively declined. This will finally result in the country's economic development decline and consumers' spending needs also lower down.

Some different results between this paper and previous studies may result from variables' units. The dependent variable used the consumption tendency ratio which calculated the consumption expenses divided by disposable income per capita. Many researchers used the exact monetary spending number as their dependent variable. The main control variable in the paper used the percentage of the number of old-age people (65+) in the total amount of the labor force whose age is between 15 to 64. Whereas other research papers may use the exact number of old age people in each province as their major research variable. Different measuring indicators among papers may lead to different research results.

5: Conclusions

5.1 Summarizations

The paper used 31 provinces' panel data in China for ten years from 2011 to 2020 and considered integrated development in both urban and rural areas. By using the ordinary least square (OLS) model to examine the impact of the elderly population dependency ratio on the propensity to consume of Chinese citizens, as well as the three different regions effects which are east, middle, west, and impacts of the epidemic. Results from

the previous process of running data partially support hypotheses. The following conclusions are obtained from the model analysis:

(1) The old age dependency ratio is an important factor that influences residents' consumption tendency in an overall look of the nation. Increasing the proportion of population aging to the labor force will significantly reduce the propensity to consume residents. The child dependency ratio also shows a negative effect on the consumption tendency ratio.

(2) A comparison of three regions (east, middle, west) show that the impact of old age support ratio on consumption tendency is from eastern, central land, western in descending order. However, only the eastern region has a significant negative effect on the dependent variable. The impact of child dependency ratio on consumption tendency is from western, eastern, central land in descending order. All three areas show that increasing the proportion of the number of children in the labor force will significantly decrease people's consumption tendency ratio.

(3) After the outbreak of epidemic, it is hard to measure the impact of dependency ratio on propensity to consume in society. There is no significant relationship after the period of pandemic, but the child dependency ratio does show an obvious negative impact on dependent variables before the outbreak of COVID.

5.2 Limitations

Factors that affect people's consumption tendencies are various. This may lead to results with certain flaws inside. Firstly, the number of populations in each province are not fixed which may lead to the population mobility constraints. The data we collected may not be that accurate. Also, different provinces of China have various developmental levels, the average income and living consumption standards are not fair enough among regions. Thirdly, there are still other indicators from cultural and economic environments which were not included in the model, the lack of data may affect the estimation results to some extent. Fourthly, the sample size is not big enough when doing research on the epidemic period since there are only two years available data resources can be obtained from websites which may lower down the statistical power. Lastly, the main data resources from thirty-one provinces of China that does not

include Hongkong, Macao and Taiwan since they are relatively independent statistical regions with their respective statistical systems and legal provisions to do their statistical work independently. These might be the direction for further research papers should be considered in their deeper analysis.

6: Recommendations

Population aging is not only a social issue but also an economic problem, and the impact of population age structure changes is very important on both social and economic development. Based on data from the Seventh National Population Census, it indicates that there is an important transitional change in China's population development. The total population growth rate of the country has been weakened, and the structural contradictions of population with population aging as the core point has been increasingly prominent as time passes. Under the background of serious trend of population aging and insufficient consumer demand, the paper took the relationship between population aging and the consumption level of Chinese residents as the entry point to study the impact of aging dependency ratio on residents' propensity to consume by researching on both domestic and foreign literature, as well as analysis the current situation. The implications for government and policymakers are shown as follows:

- (1) Declining fertility rate also increases pressure on middle age people to care for their family members like their parents and children. National fertility policies plus increased life expectancy among the elderly have significantly reduced the proportion of the working population. It is necessary for the government to encourage childbirth in accordance with local conditions by offering certain subsidies for medical and education expenses, and related incentives to promote the number of newborns in our country to alleviate the serious situation of population aging in the future. At the same time, the state can raise the retirement age to a certain level and eliminate incentives for early retirement. In this way, the country can raise up a proportion of the labor force.

- (2) In an overall look, the country is supposed to further improve its social security system in order to avoid future uncertainty on older people's consumption. For those developed cities or provinces that have relatively high living costs, the money spent on elderly is a lot. Increasing the burden rate of old people causes consumers' spending for the region to drop more. Therefore, the government should perfect both the pension system and social security system. Upgrading of healthcare services to become better integrated, age-friendly and wellness-oriented. Reducing the cost of raising the elderly can release more consumer demand in the market and promote the nation's economic development through the expansion of domestic demand.
- (3) Regionally, the government should narrow down the income gap among regions and continue to increase support on poor regions to boost the regional economic growth, like cultivating skilled talents, developing leading enterprises, and increasing subsidies for new industries to start businesses there. Increasing employment rate can reduce the outflow of talented people from poor areas and easier attract people from outside to make investments. Policymakers can create a sophisticated income distribution system and set up separate tax starting point standards according to the different economic development conditions among regions in order to increase efforts on residents' subsidies in areas with backward economic development.
- (4) The government should vigorously develop the pension finance industry to improve old peoples' pension protection. Since pension finance refers to the sum of financial activities around various pension needs of members in the society, most developed countries have established a three-pillar pension system and strengthened the association with financial markets. However, the three pillars of pension insurance are unevenly developed in China, and the nation's existing pension system still mainly relies on the first and second pillar which are underwritten by government and corporation respectively. It is important for the nation to accelerate the construction of the "third pillar" based on the individual pension account system.
- (5) For the old age group of people, the government can encourage the public to develop an aging industry, explore more business models for senior citizens to

release their consumption power. Since the higher old dependency ratio will lower down the consumption tendency ratio on average, enterprises should capture opportunities that are brought by the aging trend. Focusing more on elderly industry chain's markets, expanding products' range and actively developing new products to enrich old markets. Letting an old group of people have more available choices to choose in their life which can further explore their potential consumption ability. Such as for food and clothing industries, enterprises are supposed to pay more attention to satisfy geriatric living needs. Establishing more recreation centers for elderly to meet their spiritual needs, the cultural and entertainment industries should be emphasized.



Appendixes

Appendix Table 1

Data Information
<p>Old and Children dependency ratio: national population census - in years of “0” 1% sample survey - in the year of “5” 1‰ of sample survey - remaining years</p>
<p>Consumption tendency ratio = consumption expenses / disposable income</p>
<p>Old dependency ratio = (number of group of people above 65) / (number of labor force between age 15 to 64)</p>
<p>Child dependency ratio = (number of group of people below 14) / (number of labor force between age 15 to 64)</p>
<p>Disposable income: (4 categories) wage, net operating, net property, and net transfer income.</p>
<p>Consumer price index: retail prices' changing on consumer goods and services on actual living expenses of the country's residents</p>
<p>Interest rate: one-year fixed period savers received interests</p>
<p>Indices of gross regional product: indicator based on the previous year to be calculated at constant prices (GDP for that region)</p>

Appendix Table 2

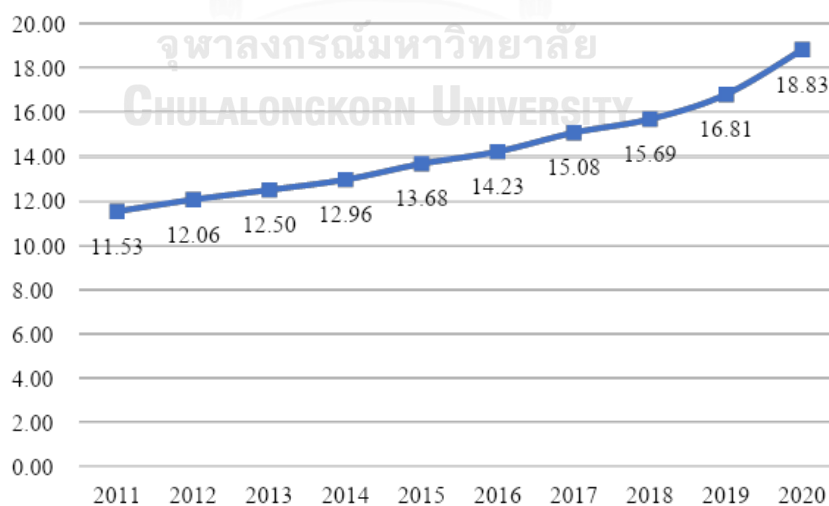
Consumption tendency ratio among provinces in China from 2011 to 2020										
Region	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
East										
Beijing	0.56	0.64	0.64	0.65	0.67	0.70	0.70	0.71	0.72	0.73
Tianjin	0.65	0.75	0.76	0.75	0.77	0.77	0.77	0.77	0.77	0.77
Hebei	0.66	0.70	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.73
Liaoning	0.63	0.70	0.72	0.74	0.76	0.70	0.70	0.72	0.72	0.73
Shanghai	0.59	0.66	0.68	0.67	0.69	0.70	0.72	0.72	0.73	0.77
Jiangsu	0.60	0.64	0.66	0.67	0.69	0.70	0.71	0.72	0.74	0.74
Zhejiang	0.60	0.64	0.64	0.64	0.66	0.68	0.69	0.69	0.70	0.74
Fujian	0.68	0.71	0.70	0.71	0.73	0.74	0.76	0.76	0.78	0.78
Shandong	0.64	0.65	0.64	0.64	0.65	0.64	0.64	0.63	0.64	0.65
Guangdong	0.69	0.74	0.73	0.75	0.77	0.75	0.75	0.74	0.75	0.76
Guangxi	0.67	0.70	0.70	0.67	0.67	0.68	0.66	0.68	0.70	0.71
Hainan	0.68	0.73	0.71	0.68	0.69	0.72	0.71	0.71	0.72	0.71
Middle										
Shanxi	0.62	0.67	0.67	0.67	0.67	0.66	0.66	0.67	0.69	0.70
Inner Mongolia	0.63	0.68	0.69	0.72	0.75	0.77	0.79	0.80	0.80	0.81
Jilin	0.67	0.74	0.75	0.73	0.74	0.74	0.74	0.75	0.75	0.75
Heilongjiang	0.68	0.75	0.75	0.73	0.73	0.72	0.73	0.76	0.75	0.79
Anhui	0.67	0.72	0.71	0.72	0.74	0.70	0.70	0.70	0.73	0.73
Jiangxi	0.64	0.67	0.66	0.66	0.66	0.67	0.66	0.67	0.68	0.70
Henan	0.65	0.68	0.69	0.68	0.69	0.69	0.70	0.70	0.71	0.71
Hubei	0.69	0.76	0.76	0.71	0.73	0.71	0.71	0.71	0.73	0.74
Hunan	0.71	0.74	0.75	0.74	0.75	0.74	0.75	0.75	0.75	0.77

West										
Chongqing	0.70	0.72	0.73	0.74	0.74	0.75	0.75	0.76	0.77	0.79
Sichuan	0.75	0.78	0.79	0.79	0.79	0.79	0.79	0.78	0.77	0.79
Guizhou	0.68	0.72	0.75	0.78	0.79	0.76	0.75	0.75	0.74	0.75
Yunnan	0.72	0.71	0.71	0.69	0.70	0.72	0.72	0.70	0.73	0.73
Tibet	0.61	0.67	0.67	0.67	0.68	0.67	0.68	0.65	0.64	0.67
Shaanxi	0.66	0.71	0.72	0.72	0.74	0.75	0.77	0.78	0.79	0.80
Gansu	0.80	0.83	0.84	0.82	0.84	0.81	0.81	0.82	0.81	0.82
Qinghai	0.76	0.78	0.80	0.82	0.85	0.86	0.88	0.89	0.91	0.90
Ningxia	0.68	0.75	0.75	0.75	0.79	0.80	0.78	0.78	0.76	0.78
Xinjiang	0.69	0.75	0.75	0.76	0.77	0.76	0.79	0.83	0.84	0.82

(Source: Author's calculations based on data from stats.gov.cn, 2021)

Appendix Table 3

Old Dependency Ratio of China from 2011 to 2020 in %



(Source: Author's analysis based on data from stats.gov.cn, 2021)

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