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An investigation into the relationship between lottery sale and economic performance in four municipality cities of China

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Abstract:

It is common to see lottery shops not only in the mega cities of China, but also in rural areas, since lottery is a popular product in Chinese market. This research intends to find out whether the development of lottery industry can be a weather vane for Chinese economy to make predictions and plan policies beforehand. Using four municipality cities in China's mainland (Beijing, Tianjin, Chongqing, & Shanghai) as representatives, this study investigates the correlation between lottery sale and economic development, with a focus on four mainstream economic indicators including gross domestic product, average disposable income, aging population and unemployment rate. By examining the feasibility of using Pearson correlation coefficient in the study, and carry outing correlation test with the statistical tool relying on first hand data collection, this paper tries to analyze reasons for the differences between cities based on cultural difference and consumer preference differences behind.

Keywords: Pearson correlation analysis, lottery sale, economic indicators, Chinese municipality cities

1. Introduction

In the past decades, it is more common to see lottery shops on the streets, and lottery has become an increasingly popular choice of consuming and entertaining for all aging group consumers in China. The total sale of national lottery industry increased for 162.3% in 2022 compared with 2012 from 261.5 billion Yuan to 424.6 billions Yuan (National Bureau of Satistics, 2021). Additionally, the development of lottery industry is also accompanied by a significant improvement in China's economic performance in past few years. Compared to 2012, China's gross domestic product (nominal GDP) increased by 224.7%. People's average disposable income increased from 16510 Yuan per person in 2012 to 36883 Yuan per person in 2022 (China Business News, 2022). Moreover, China's population has also been growing, rising from 1.359 billion to 1.412 billion over the last ten years (National Bureau of Statistics, 2022).

As shown below, the total sale of Chinese lottery industry during the period from 2007 to 2022 displayed an overall increasing trend of sale, peaked at 2018. However, the tread, troughs, and peaks in different municipality cities differed, meaning there were different factors that influenced lottery sale differently in these four cities. For example, the sale of lottery in Beijing peaked at 2018 (125.55056 billion Yuan), but peaked at 2014 (10.38002 billion Yuan). The reason behind this phenomenon is also a question this research attempts to discuss.

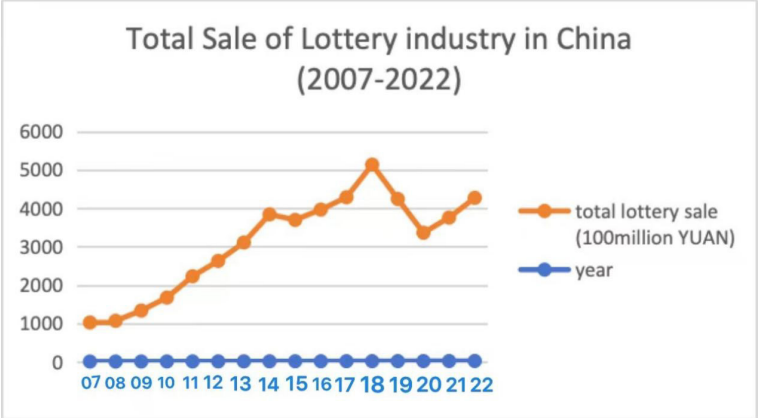

Figure 1 Total lottery sale in China from 2007 to 2022 (source: National Bureau statistics)

This research intends to explore the relationship between the sale of lottery industry and general economic performance in four municipality cities in China (Beijing, Shanghai, Chongqing, &Tianjin). Quantitative methods are adopted to analyze the collected data of aging population, average disposable income, nominal GDP and unemployment rate for past two decades in target cities (from 2022-2007). In addition, the research also aims to find out which factor is most closely related to economic performance and investigate into possible reasons behind it.

2. Literature Review

In this section, both influential factors and research methods in previous studies are discussed since the method of quantitative analysis is used most in investigating the correlation between these factors and lottery scale.

2.1 Background of Lottery

A lottery ticket is a ticket with a number on it, sold at face value. After the drawing, those who hold the winning number ticket may claim the prize according to the regulations. Lottery is a kind of voucher issued for the purpose of raising funds, printed with numbers, graphics, text and value, which is purchased by buyers voluntarily according to certain rules, and determining whether to obtain rewards (Ministry of Finance of China, 2018). However, economists consider lottery as "the tertiary distribution" of economy, while the primary distribution refers to people's direct income, and the secondary distribution is people's actual income adjusted for tax and other factors. To some extent, lottery is the redistribution of income of people from different social classes with market mechanism (Sun & Wu, 2004). In China, lottery industry contributes a lot to national tax revenue, economic growth, current account balance, and provision of job opportunities (China's Daily, 2013).

There are mainly two types of lottery, namely welfare lottery and sports lottery. Welfare lottery aims to raise social welfare funds and set up welfare undertakings for those who need help such as the disabled, the elderly and orphans (Xinhua Dictionary). By definition, sports lottery refers to a written note issued to raise funds for the development of sports, printed with numbers, graphics, or text, which people can voluntarily purchase and obtain the right to win prizes according to certain rules, such as guessing the results of sports events.

2.2 Nominal GDP & Aging Population

Gross domestic product (GDP) is the total value of goods and services produced in a country in a year (Cambridge Dictionary, fourth edition). Nominal GDP does not include income from a country's investments in other countries (Collins Dictionary, 13th edition). According to National Bureau of Statistics, from 2013 to 2022, China's nominal GDP increased from 59300 billion Yuan to 121000 billion Yuan, showing an steady trend of 6% of increase per year. For recent three years, the average growth rate of China's economy reached 4.5%, exceeding the rest of world for approximately 2.5 percentage points (Xinhua News Agency, 2023).

Since China's first lottery was sold in 1987 in Hebei, lottery has created thousands of newborn millionaires, which contributed to the formation of a new class in society called "one night rich class", injecting loads of possible investment and energy to national economy. According to government reports, Shenzhen has created 83 new millionaires by lottery alone, Guangzhou has more than 200 lottery millionaires since 1993 till today, and the population of lucky ones in online lottery reached 817 at the end of 2001, with 2.74 billion Yuan of prize paid. Some scholars predicted that the single-note cap limit is likely to be canceled in the future, which means there is no upper limit of money for people to bet on one note, thereby causing a further increase in the number of millionaires born in lottery market in future (Dong & Sun, 2015).

The aging of the world's populations is the result of the continued decline in fertility rates and increased life expectancy. This demographic change has resulted in increasing numbers and proportions of people who are over 60 (World Health Organization, 2010). China's population has been aging more quickly in recent years, while its population growth has slowed down. Most regions are witnessing a moderate growth in population, whilst some are even experiencing negative growth. Since the sixth national population census in 2010, China's population development has undergone major internal and external changes, including a fall in the inertia of population growth, a decrease in the volatility of the working-age population, and a deepening of aging (Yin, 2020). When the number and proportion of the population aged 60 and over continues to increase in a society, population aging occurs (WHO, 2016).

By the end of 2022, the number of people aged 0-15 was 25.615 million, accounting for 18.1% of the total population. The working-age population aged 16-59 was 875.56 million, accounting for 62.0%. The population aged 60 or above was 280.04 million, accounting for 19.8%, of which 209.78 million, or 14.9%, were aged 65 or above. Compared with 2021, the working-age population aged 16-59 decreased by 6.66 million, or 0.4 percentage points. The number of people aged 60 and above increased by 12.68 million, or 0.9 percentage points. The number of people aged 65 and above increased by 9.22 million, or 0.7 percentage points (National Bureau Statistics, 2022).

The accelerated arrival of the aging society and the continuous improvement of the overall education level of residents are superimposed on each other, which inevitably imposes an impact on the development of the sports lottery business that cannot be ignored. According to analysis of the relationship between population aging and consumption propensity of sports lottery based on the provincial based data from 2005 to 2020, it can be found that population aging during this period maintained a significant negative correlation with the consumption tendency of sports lottery. And when the aging level increased by 1%, the consumption tendency of sports lottery decreased by 0.256%. Further research reveals that aging still has a inhibitory effect on the consumption tendency of sports lottery in the western region, but it has gradually shown a positive promotion trend in both eastern and central regions (Liu, Bai & Song 2023).

2.3 Average Disposable Income & Unemployment

Per capita disposable income is the average of the disposable income of residents divided by the number of permanent residents. Residents' disposable income, as the name implies, is the income that residents can freely spend, which is the sum of residents' final consumption expenditure and savings, including both cash income and income in kind (National Beau Statistics, 2023). Previous researchers concluded two effects. One is the decline in income. Generally, the decline in income leads to austerity in all aspects, of course, including the decline in the sales of lottery. A prolonged downturn of the economy makes people worried about the future, which can easily result in depression. The other is the substitution effect. As people's expectations turn pessimistic and the hedonistic utility of other aspects decreases, people tend to acquire more hedonistic utility from the lottery to compensate, which causes the decline in income to stimulate the sales of lottery tickets. Two effects sound opposite, but in general, the substitution effect is greater than the income effect. Therefore, lottery tickets are inferior goods (Si, 2023).

In China, the unemployment rate means the percentage of unemployed workers in percentage of total labour force (sum of employed and unemployed workers, who have willingness and ability to work). As in many countries, Chinese government often sends surveyors to residents' homes to count the number of people who have claimed unemployed (National Bureau statistics, 2018). Other scholars in USA have performed research by employing the panel smooth transition autoregressive model to evaluate the threshold effect of the unemployment rate on lottery sales and its persistence. It has been found that a rise (decrease) in unemployment can lead to a higher (lower) effect of lottery sales. However, reducing the unemployment rate is not a practical instrument for state governments to stabilize lottery markets (Po, Shiao & Kou, 2015).

Overall, through studying the relationship between these four variables and the lottery sale in China, previous scholars have concluded that aging population, nominal GDP, people's average disposable income, and unemployment rate are positively correlated with the total lottery sale respectively. However, there are few articles that focus on the situation of these variables in multiple cities, even in different countries, reaching different conclusions, which inspires this research.

3. Methodology

This paper only utilizes the method of secondary research. The reason for this is that it is not feasible to collect first hand data about the selected variables that need to be analyzed (aging population, average disposable income, nominal GDP, unemployment rate), which can all be found on Internet from official sites and reports, especially from "Annual Reports" from government and international websites, not only providing more reliable information, but also saving time for researchers. Information collected is further checked by the comparison of data between various information sources including "Our World in Data" "Statista" and "Chinese National Bureau of Statistics", which are all well known in related fields, thus reassuring the accuracy of information. "Our World in Data" is a source with "research and data to make progress against the world's largest problems", which does not involve vested interests and provides objective and unbiased data.

This research is a longitudinal study, which requires more than a decade of data. Therefore, data from 2007 to 2022 are collected to observe and analyze trend and detailed changes by years. The reason for the selection of years is because the data integrity of some variables was found to be low before 2007. Four municipalities in China are chosen for the research: Beijing, Tianjing, Shanghai, and Chongqing. Geographically, these four municipalities cover more than 2/3 of area of China, with large built-up areas and more residential populations, which not only play an important role in the country's politics, economy, science, culture, transportation and so on, but also exhibit great representation among the rest of 30 provincial administrative regions in China. Moreover, municipalities tend to possess more mature and comprehensive databases compared to other cities, which can offer convenience for this research.

Correlation statistics and analysis is a commonly used method in economics. Correlation refers to that one vari-

able changes accordingly with the other variable when there is a relationship between two factors. Correlation can be divided into positive correlation and negative correlation. Compared to other methods, it can give a more direct result about the extent that the variables chosen are related to the lottery sale.

Correlation is carried out through Pearson's correlation coefficient, a measurement quantifying strength of association between two variables. Four presuppositions need to be clear before using Pearson's coefficient. First, variables should be interval or proportional scale variables, which suggests that variables should be analyzed in universal units. In this research, units in all variables are unified. Second, variables should be linear instead of any other functions such as quadratic function.

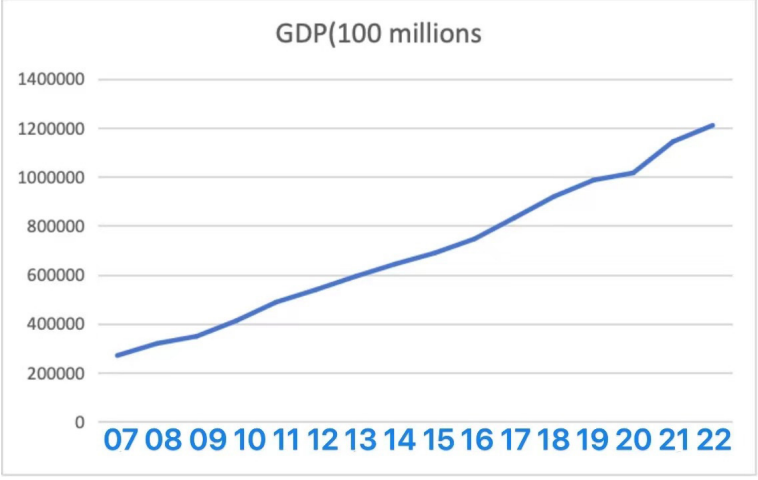

Figure 2 : China's GDP from 2007 to 2022 (source: National Bureau of Statistics)

The figure above presents the visual form of one of the variables, which is linear and fits assumptions. Third, it is assumed the collected data conform to normal distribution, to make sure the population is continuous. Last, there should be no abnormal data, such as data that are extremely huge or tiny. Since the data obtained in this research are consistent with all hypotheses, Pearson's correlation test is available as a statistical tool to be applied in the study.

The Pearson value r, calculated by covariance of the two variables divided by the product of their standard deviation, takes within a range from -1 to +1, with values of -1 or +1 indicating a perfect linear relationship between two variables whereas the value of 0 suggests no linear relationship.

In this research, there will be four pairs of random variables (X,Y).

X represents nominal GDP, average disposable income, unemployment rate, and aging population in Beijing, Shanghai, Tianjin and Chongqing.

Y represents the total lottery sale in a year for China. Hence, Pearson correlation test is conducted repeatedly four times.

$$\rho_{X,Y} = \frac{\operatorname{cov}(X,Y)}{\sigma_X \sigma_Y} = \frac{E[(X-\mu_X)(Y-\mu_Y)]}{\sigma_X \sigma_Y}$$

There are also alternatives, such as Kendall correlation coefficient, whose target objects are ordered category variables, such as ranking, age, obesity grade (severe obesity, moderate obesity, mild obesity, not obesity), etc. It can measure the strength of the monotonic relationship between two ordered variables. Kendall correlation coefficient determines the strength of the correlation coefficient by virtue of the concept of "pairs". Since this research does not involve any paired variables, using Kendall correlation coefficient is not a good idea (HCigmoid, 2019).

Another alternative is Spearman correlation coefficient, also known as Spearman rank correlation coefficient, which is a kind of rank correlation coefficient. "Rank" or order, can be understood as an order or sort that is calculated based on the position of variables within the data. In the selection of the Pearson correlation coefficient and the Spearman correlation coefficient, the Pearson correlation coefficient is preferred if the data are continuous, normally distributed, and linear. Certainly, Spearman test can be effective under such circumstance, but not as efficiently as Pearson (need to sort the data). In this regard, this research considers using Pearson correlation coefficient at first place (Chinese Software Developer Network, 2023).

The research starts with the determination of variables investigating, based on the reading of literature in related fields. Then data related to variables are collected from reliable sources and made up into sheets. After that, the collected and sorted out data are inserted into SPSSAU to carry out a Pearson correlation test and the results given are analyzed.

4. Results

4.1 Beijing

Table 1 Results of Pearson tests of Beijing

Pearson Beijing		
		Total lottery sale (10 thousands
GDP(100millions	coefficient	0.719**
	p value	0.002
	Sample	16
average disposable income	coefficient	0.714**
	p value	0.002
	Sample	16
unemployment rate	coefficient	0.058
	p value	0.831
	Sample	16
aging population(60+ thousands)	coefficient	0.737**
	p value	0.001
	Sample	16

1. The correlation value between the total lottery sale and nominal GDP is 0.719, with a significance level of 0.01, indicating a significant positive correlation between the total lottery sale and GDP.
2. The correlation value between the total lottery sale and average disposable income is 0.714, with a significance level of 0.01, which indicates that the total lottery sale and average disposable income maintain a significant positive correlation.
3. The correlation value between the total lottery sale and unemployment rate is 0.058, close to 0, and the P-value is 0.831>0.05, indicating no correlation between the total lottery sale and unemployment rate.
4. The correlation between the total sale of lottery tickets and aging population is 0.737, with a significance level of 0.01, suggesting a significant positive correlation between the total lottery sale and aging population.

4.2 Shanghai

Table 2 Results of Pearson tests of Shanghai

Pearson Shanghai		
		total annual lottery sale(ten thousand
GDP(100 million	coefficient	0.647**
	p value	0.007
	Sample	16
average disposable income	coefficient	0.660**
	p value	0.005
	Sample	16

Pearson Shanghai		
		total annual lottery sale(ten thousand
aging population(60+ thousands)	coefficient	0.688**
	p value	0.003
	Sample	16
unemployment rate	coefficient	-0.309
	p value	0.245
	Sample	16

1. The correlation value between the total lottery sale and nominal GDP is 0.719, with a significance level of 0.01, which indicates that the total lottery sale and nominal GDP have a significant positive correlation.
2. The coefficient value between the total lottery sale and average disposable income is 0.714, with a significance level of 0.01, which reveals that the total lottery sale and average disposable income have a significant positive correlation.
3. The correlation value between the total sale of lottery tickets and aging population is 0.737, with a significance level of 0.01, implying a significant positive correlation between the total lottery sale and aging population.
4. The correlation value between the total lottery sale and unemployment rate is 0.058, close to 0, and the P-value is 0.831>0.05, which illustrates that there is no correlation between the total lottery sale and unemployment rate.

4.3 Tianjin

Table 3 Results of Pearson tests of Tianjin

Pearson Tianjin		
		total annual lottery sale(ten thousand
GDP(100 million	coefficient	0.746**
	p value	0.001
	Sample	16
average disposable income	coefficient	0.681**
	p value	0.004
	Sample	16
aging population(60+ thousands)	coefficient	0.697**
	p value	0.003
	Sample	16
unemployment rate	coefficient	0.134
	p value	0.620
	Sample	16

In Tianjin, by using Pearson correlation coefficient, it is shown from the figure above that:
1. The correlation between the total annual lottery sale and nominal GDP is 0.746, with a significance level of 0.01, which manifests a remarkable positive correlation between the total annual lottery sale and nominal GDP.
2. The correlation between the total annual lottery sale and average disposable income is 0.681, with a significance level of 0.01. Therefore, there is a remarkable positive correlation between the total annual lottery sale and average disposable income.
3. The correlation between the total annual lottery sale and aging population is 0.697, with a significance level of 0.01, which reveals a significant positive correlation between the total annual lottery sale and aging population.
4. The correlation between the unemployment rate and total lottery sale is 0.134, which is close to 0, and the p value is 0.620>0.05. Therefore, there is no correlation between the total annual lottery sales and unemployment rate.

4.4 Chongqing

Table 4 Results of Pearson tests of Chongqing

Pearson Chongqing		
		total annual lottery sale(ten thousand
GDP(100 million	coefficient	0.875**
	p value	0.000
	sample	16
average disposable income	coefficient	0.864**
	p value	0.000
	sample	16
aging population(65+ thousands)	coefficient	0.892**
	p value	0.000
	sample	16
unemployment rate	coefficient	-0.219
	p value	0.416
	sample	16

As the official standards released by Chongqing's government of aging population is 65 years old or more, the variable aging population will differ from other three cities.

By carrying out same procedure, the results show that:

1. The total annual lottery sale and nominal GDP have a correlation value of 0.875, with a significance level of 0.01. Therefore, there is a significant positive correlation between the total annual lottery sale and nominal GDP.
2. The correlation between the total annual lottery sale and average disposable income is 0.864, with a significance level of 0.01, which leads to the conclusion that there is a significant positive correlation between the total annual lottery sale and average disposable income.
3. The correlation between the total annual lottery sale and aging population is 0.892, with a significance level of 0.01. As a result, there is a significant positive correlation between the total annual lottery sale and aging population.
4. The correlation between the total annual lottery sale and unemployment rate is -0.219, close to 0, and p value is 0.416>0.05, demonstrating that there is no correlation between the total annual lottery sale and unemployment rate.

5. Discussion

The above results manifest that the total lottery sales in all four municipality cities are positively correlated with three variables: aging population, average disposable income and nominal GDP. Among them, nominal GDP occupies the highest correlation and plays the most important role in Tianjin, and aging population is the most significant variable for rest of three cities. The unemployment rate is not correlated with the total lottery sale in four municipality cities. In economics, nominal GDP, average disposable income and unemployment rate all have a direct effect on the consumption performed by aging population. The better the GDP, the higher per capita income, and the more pocket money ordinary families will give to the elderly. More importantly, the government will also increase pension subsidies. The elderly will consume more lottery tickets as their purchasing power increases.

Additionally, aging population is most positively correlated with total lottery sales in four multiplicity cities, with Chongqing presenting the closest relationship among the four cities. According to Bulletin of the seventh National Census (2021), the percentage of people aging over 60 showed an overall increasing trend within China, including four municipality cities. Elderly people are crucial consumers to lottery sellers in Chongqing. It is because most of the elderly have certain pension savings and more free time, and lottery is interesting and stimulating, which can meet the needs of the elderly for leisure and entertainment and allow them to obtain a sense of accomplishment, thus making them psychologically dependent and produce purchase behavior. According to the population report of Chongqing's Bureau of statistics in 2020, there were 7,010,400 people considered as aged population (60+), accounting for 21.87% out of total population. With the large elderly population, Chongqing's lottery market tend

to be deeply influenced by elderly people's preference and tastes, which can partly explain the reason why Chongqing's lottery sale is mostly correlated with aging population out of four cities.

However, another study suggested that aging population is negatively correlated with lottery sale (Liu, Bai & Song, 2023), which is different from results produced in this research. The reasons behind could be the rage of selecting samples. Liu et al. performed their research analysis on lottery of the whole China on a larger and more complicated sample, possibly generating different conclusions.

Similarly, average disposable income is also positively correlated with total lottery sales within all four municipality cities, where Chongqing is also most closely related with average disposable income. Disposable income serves as the determining factor for consumers to make decisions when they exhibit purchase intention, which includes buying of lottery. For the past decades, the average disposable income in cities in China increased stably. In 2023, Shanghai and Beijing remained the cities with the highest per capita disposable income, exceeding 80,000 yuan for the first time. In addition, cities such as Shenzhen, Guangzhou, Suzhou, Hangzhou, Nanjing, Ningbo and Xiamen also tend to achieve per capita disposable income of more than 70,000 yuan (Shanghai Daily, 2024). The higher the people's disposable income, the more purchasing power consumers have. With the increasing number of the lottery news published on various platforms, consumers are motivated to pay lottery tickets that are more expensive and have higher price, dragging the lottery sale up (Wu, 2023).

The finding is supported by Xie and Wu (2015), who employed the Pearson correlation coefficient method to analyze the overall correlation between national sports lottery sales data and macroeconomic, social and demographic data from 1994 to 2013 and highlighted that within a certain income limit, per capita income and sports lottery sales are positively correlated. Interestingly, they also pointed out that when the income reaches a certain level, the per capita income will be negatively correlated with sports lottery sales. According to articles from Sports Lottery Agency of Chongqing (2023), the high Pearson value produced in Chongqing can be explained by the high number of lottery stores available in the city. Chongqing Sports Lottery adheres to carrying out lottery promotion activities through normalization, in order to strengthen interaction with the public, making the concepts of responsible lottery such as "rational betting", "minors shall not buy lottery and exchange prizes" and "stay away from illegal lottery" more popular. In addition, Chongqing Sports Lottery also submits the annual Chongqing Sports Lottery Social Responsibility Report to stakeholders, buyers and the public every year, focusing on issues such as distribution and sales, compliance management, and lottery redemption that the public is most concerned about, so as to sincerely accept public supervision while fully presenting the work and responsibility of lottery. Such action has created a fair and open lottery industry atmosphere and gained trust from consumers, which is the key of high lottery sale in Chongqing (Chongqing Sport Lottery, 2023).

From 2007 to 2022, nominal GDP in Tianjin surged from 415.84 billion yuan to 1569.51 billion yuan, an increase of 377% (Tianjin Bureau of Statistics, 2023). In addition, nominal GDP has a positive correlation with lottery sales. This is supported by Xie and Wu (2015), who suggested that no matter vertical or horizontal comparison, sports lottery sales and nominal GDP are positively correlated. It may be because that the appearance of lottery winners in society can motivate consumers' vitality and fasten money flow in economy, which turns to contributions of rise in consumption, investment, and government expenditure funded by lottery revenue, finally leading to an increase in nominal GDP. In Tianjin, GDP growth gives consumers great motivation to purchase cheap entertainments like lottery (usually ten Yuan). Such trend offers confidence to local lottery sellers. By searching for lottery keywords in the map software in Tianjin, it can be found that there are 6-9 shops or stalls per kilo-square, and even self-service ticket machines are placed at convenience stores after going around institutions of sports lottery and welfare lottery. Under the high rate of GDP growth, the speed of opening shops in Tianjin has risen rapidly (The Time Weekly, 2023). Consequently, the increasing availability of lottery shops in Tianjin caused by GDP growth pushes up lottery sale.

Lastly, the unemployment rate has no correlation with lottery sales in four municipality cities. This is different from previous studies that emphasize that lottery sales and unemployment are positively correlated, but occasionally they resonate with each other. Economic upside and decline in unemployment are generally consistent, which is also the mechanism behind growth of lottery sales (Sina Pantone, 2022). Other scholars have investigated the precariousness of the job market and the stagnation of economic growth. The sharp increase in ticket sales in recent months in the face of a slowing economy and a difficult job market has been linked to concerns about the future. Therefore, more people feel hopeless about the future and expect to get rid of financial difficulties by lottery. Indeed, buying lottery for a chance of getting rich overnight will provide psychological comfort that can alleviate the life pressure that people surge after losing jobs (Wu, 2023). The difference between prior research and this research may be that prior research has investigated a wider range

of cities and selected a longer time period.

6. Evaluation

This research has some strengths. In particular, the epidemic in the past three years has caused a huge impact on the entire economy, slowing down economic growth, increasing unemployment rate and squeezing consumer spending. By exploring and analyzing the correlation of various factors to the lottery sale, this study can provide possibilities for scholars to use nominal GDP as an indicator of economic activities and performances, and even predict future changes to some extent. By observing and discussing lottery sales, scholars are also able to capture reflections of aging population issues and change in people's disposable income, which will be beneficial for Chinese government in policy formulation and some investment institutions to avoid loss. Moreover, the selection of authoritative and reliable data sources can help eliminate uncertainty caused by wrong or insignificant data, thus producing convincing results.

However, there are some limitations. Firstly, only Beijing, Tianjin, Shanghai, and Chongqing are selected for research, which is not comprehensive enough to produce persuasive results for being applied in China's economy. This can be improved by broadening the number of cities studied within China to conclude a universal correlation between lottery and economic activities within China. Secondly, only four factors encompassing aging population, disposable income of residents per capital, nominal GDP, and unemployment rate are considered. However, there are other variables that may influence the sales of lottery. Future research can also concentrate on factors such as CPI and GINI coefficients for further investigation. Moreover, some qualitative research methods such as interviews can be adopted, as they can contribute to first hand data to support the investigation. Last, in terms of data collection, the official definition of aging population in Chongqing (65+) differs from that released by other three cities (60+), which may bring difficulties when comparing and produce confusing results.

7. Summary

This article takes the total lottery sales in four municipality cities (Beijing, Tianjin, Shanghai &Chongqing) as the research object, selecting four factors: aging population, people's average disposable income, unemployment rate, and nominal GDP. Statistical data from secondary surveys from 2007 to 2022 are collected and verified based on various sources. Pearson correlation coefficient is employed to calculate the index and analyze the correlation between the total lottery sale and the four variables.

Through analysis, this article draws the following conclusions:

1. Nominal GDP, average disposable income and aging population are positively correlated with four municipality cities.

2. Aging population is the most significant one in Beijing, Chongqing, and Shanghai. However, in Tianjin, the most significant variable is nominal GDP.

2. All four cities do not show significant correlation between total lottery sales and the unemployment rate.

Overall, the research offers reference and guidance for economists to conclude the cycle of economic development through monitoring related data and for lottery running departments to change their lottery marketing strategies to cope with economic change and more accurately predict future prospect. This research provides a great example in collection of data and how to identify variables related to determine the range of variables studying.

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