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Regional Patterns in the Marketization Index and GDP Growth Across China's Provinces

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Abstract: The paper focuses on the fields of marketization degree and economic growth. The research questions include two parts: What is the relationship between the marketization index and the GDP of China's provinces? What are the reasons for the differences in the marketization index and GDP growth among the four types of provinces? The study finds a positive relationship between the marketization index and GDP of China's provinces from 2008 to 2016. By drawing line charts of the marketization index and the GDP each year, the research classifies 31 provinces into four types of provinces according to their growth stab ilities (R^2 values). Based on previous research, the marketization degree contributes to economic development. As a result, the study concludes that GDP increases along with the growth of the marketization index in the long term. The essay also explores the reasons for the differences among the four groups of provinces. The government can reduce its intervention in the economy and cultivate highly qualified workers to enhance the marketization degree and economic development.

Keywords: Marketization index; GDP; China's provinces; Line chart; R^2 value.

1. Introduction

In a small village in Anhui Province in 1978, the first practice of the household contract responsibility system initiated the process of marketization in China. After exploring ways of reforming for years, China has developed a relatively complete market system. In December 2001, China joined the World Trade Organization (WTO), accelerating the process of marketization. Since then, the degree of marketization has achieved a systematic breakthrough. According to Marketization Index of China's Provinces: NERI Report 2018, the average marketization index of China has increased from 5.45 in 2008 to 6.72 in 2016. [1] In the meantime, the economy has achieved a significant boost in development. The most obvious signal was that the Chinese GDP total has increased from 32.43 trillion yuan in 2008 to 76.12 trillion yuan in 2016 according to National Bureau of Statistics of China. Because of the common proliferation in the marketization index and the GDP growth of China during this specific period, the purpose of this research is to apply the performance of the entire country to provinces in China. In other words, the research aims to study the relationship between the marketization index and the GDP of provinces in China.

The marketization index is used to measure the level and degree of regional marketization development. The study of the marketization process is conducive to understanding the achievements and shortcomings of Chinese marketization reforms. Nevertheless, the marketization index is not only practical in the market economy, but it can also be put to use in other fields, such as studying the crime rate [2]. Studying the relationship between the marketization index and GDP is practical according to previous research. Through studying the relationship between the marketization index and GDP, we can summarize patterns and gain a deeper understanding of the marketization index. In this way, the governors and the country will establish a more complete free market system to promote the growth of GDP through a well-developed theoretical framework, improving social welfare and employment.

2. Literature Review

Many scholars have studied the marketization index since 1997, when Professor Fan Gang first proposed the research on the marketization index. Many of these researchers studied the marketization index in different surroundings, such as the marketization index in China's medical services [3] or the internal corporate governance [4]. Others discussed the degree of Chinese marketization at different periods. For instance, some scholars measured the marketization index over the 30 years of reform and opening up. [5] These kinds of essays usually talk about quantitative research on marketization indices and the ways to construct a measurement and evaluation system for the marketization index.

Thanks to remarkable research advancements in the construction of the marketization index, there are many articles concerning the relationship between the marketization index and other indices. For example, there is a relatively relevant paper that is about the relationship between the marketization index and GDP per capita. The paper used Panel Data of marketization indices and per capita GDP from various regions to conduct an empirical analysis on the relationship between the degree of marketization and per capita GDP in different regions. The results show that there is a positive correlation between the marketization index and per capita GDP, indicating that the higher the degree of marketization, the higher the per capita GDP and the faster its growth. [6] Inspired by this article, the marketization index may correlate with the GDP of China's provinces. According to previous research, the study infers that there is a positive relationship of growth between the marketization index and GDP.

Since 1997, researchers have done a lot of work on the contributions of China's marketization process to economic growth. Most essays have conducted theoretical and case analyses, revealing that the process of marketization provides comprehensive support and contributions to economic growth. In one essay, the researcher expounded on five aspects of China's marketization process's contributions to economic

growth. For example, the process of marketization is conducive to narrowing the regional economic gap. [7] Another article also illustrates the manifestations of contributions of the marketization process to economic growth, including improving economic growth vitality, reducing regional economic disparities, regional characteristic economic development, new market economic development, and market competition economic construction. [8] According to the explanation from the International Monetary Fund, "GDP is important because it gives information about the size of the economy and how an economy is performing. The growth rate of real GDP is often used as an indicator of the general health of the economy. In broad terms, an increase in real GDP is interpreted as a sign that the economy is doing well." [9] Based on previous research, we knew that the marketization degree might result in GDP growth.

Despite a large number of studies on the contributions of China's marketization process to economic growth, few papers used the method of statistical analysis. The most authoritative one is also written by Fan Gang and Wang Xiaolu. The research used the provincial marketization index of China to quantitatively examine the contribution of marketization reforms to economic growth. In detail, the study created a model and utilized tables, a scatter diagram, and a line chart to show results. The conclusion is that from 1997 to 2007, the contribution of the marketization index to economic growth averaged 1.45 percentage points per year. Besides, the essay also mentions that there is a clear positive correlation between the GDP growth rate of each province and the marketization index. [10] Nonetheless, the study is not perfect because the marketization index didn't consider emerging fields such as the digital economy and green finance from 1997 to 2007. [11] Moreover, the assessment of the legal environment, such as intellectual property protection, remains relatively weak in the early framework, whereas my research uses the marketization indices from 2008 to 2016, which involve more detailed aspects, like intellectual property protection.

This essay focuses on the data processing and analysis, instead of theoretical reasoning. The research collects a lot of data not only to find the common character of growth between the marketization index and GDP of Chinese provinces, but also to discover some exceptions of provinces beyond the regular pattern. These special provinces may give us a new perspective to see the marketization progress and GDP growth. That's the most significant innovation point in this essay.

3. Methodology

3.1. Research Approach

This essay uses a quantitative method to show the results of the relationship between the marketization index and GDP of China's provinces. The research collects all 31 provinces' marketization indices and GDP from 2008 to 2016 to establish the general relationship between them. In addition, the study uses existing datasets as structured data collections.

In order to present the relationship and exceptions clearly and directly, the research uses tables and line charts to illustrate the results better. The study makes use of a statistical analysis method to find the relationship between the marketization index and GDP growth.

3.2. Research Procedure

There are several steps to collect the data and design the charts to show results.

Firstly, the study found the official website of the National Bureau of Statistics of China and searched the book Marketization Index of China's Provinces: NERI Report 2018 from the library.

Secondly, the study chose the data from Tables 1-1 and 6-1 in the book, and searched for the annual GDP data of China's 31 provinces. Then, the researcher designed a 10×3 table in Excel. The top left corner was written separately with the indices and the years. The leftmost columns wrote "(e.g. Fujian's) marketization index" and "(Fujian's) GDP/ trillion yuan". The top rows show each year from 2008 to 2016. At last, the data could be filled into the table based on each year and different indices. Likewise, the other 30 provinces were completed by the same standards.

Thirdly, the study drew line charts by using Excel, based on the statistics from the table. For instance, in the Fujian province's table, the line charts of the marketization index and GDP growth were drawn. The titles were "Fujian marketization index" as well as "Fujian GDP/ trillion yuan;" and there were primary vertical and horizontal axes in the chart. At last, on the basis of the broken line, the computer could draw a trendline, a dotted line, through the broken line. The trend line enables a quick identification of the overall direction in which the data changes over time or in response to other variables. Then, calculate the R^2 value (fitting goodness) by using the trendlines. Other provinces' charts were drawn in this way.

3.3. Data Collection Method

As mentioned in the procedure. The marketization indices were from the book Marketization Index of China's Provinces: NERI Report 2018 in the library. The research chose this book mainly because of its author, Professor Fan Gang. Since Fan first put forward and modified China's marketization index, he is well-known in the field of marketization degree. For this reason, this long report is fairly trusted in the academic field.

The China Marketization Index consists of five aspects, each reflecting a specific aspect of marketization. They are the relationship between government and market, the development of non-state-owned economy, the development of product market, the development of factor market, and the development of market intermediaries and the legal environment. To comprehensively reflect the changes in various aspects of marketization, each aspect index is composed of several sub-indices, and some sub-indices also have secondary sub-indices. We call the sub-indices of the lowest level the base index. The market-based index system consists of 18 basic indices. To maintain the objectivity of the marketization index, the calculation of the basic index is based on statistical data from authoritative institutions or enterprise survey data, and the method of scoring by a few experts based on subjective evaluations is not adopted. Additionally, unreliable data is avoided as much as possible.

The calculation of the basic index is based on the base period year. The relative scoring system of 0 to 10 points is used in the base period year. The province with the highest degree of marketization in this sub-item is 10 points, and the province with the lowest is 0 points. The scores for the remaining provinces range from 0 to 10, calculated based on the relative difference between this indicator and the provinces with the highest and lowest scores. The five aspects

of market indices are synthesized by the sub-indices under their jurisdiction using the calculation method of equal weight (i.e., arithmetic mean). The market total index is composed of five aspects of indices based on the principle of equal weighting. The sub-indices, aspect indices, and overall indices of the country are combined with the corresponding indices of each province with equal weights [1].

In addition to the choice of China's marketization index, the study collected GDP statistics from the official website of the National Bureau of Statistics of China (NBSC), which has the most reliable data in China. The GDP statistics from NBSC are converted into the currency value of 2024. They are usually written in two decimal places in trillion yuan.

3.4. Data Analysis Method

After completing tables and charts, the study can start analyzing trends, patterns, and even exceptions.

First of all, observing the overall trends of two different line charts in one province is important.

Moreover, pay attention to the R^2 value. The R^2 value (coefficient of determination) is used to evaluate the reliability of the trendline. The closer the R^2 value is to 1, the trendline is more reliable. The reliability of the trend line ensures the stability of the growth by eliminating interference, warning of systemic risks, and restricting policy fluctuations. Hence, if the R^2 value is close to 1, it indicates that the growth is stable. On the contrary, if the R^2 value is small, it demonstrates that the province's indices grow unsteadily.

Finally, notice the first and last marketization indices and GDP of the province. It helps reveal the pace of growth and the increasing extent of the marketization index and GDP of the province. Based on these observations, the study can divide 31 provinces into several types.

4. Results

4.1. Overall Trend

According to the line charts of all 31 provinces in China, the study concludes that there is a positive relationship between the marketization index and GDP among all provinces except Tibet and Yunnan.

4.2. A provinces

The research defines "A provinces" as the provinces that always have increase in the marketization index and GDP each year, and their growth is relatively steady. And these provinces have R^2 values of the marketization index above 0.9 (lower than 1).

For example, in charts of Guangdong province, it is obvious that both of the broken lines are upward. Besides, all of the points of broken lines gradually increase, which means the marketization index and GDP of Guangdong increased steadily. What's more, you can see that the trendlines are very close to broken lines, especially in the GDP chart. This means the growth rates of two indices each year are approximate.

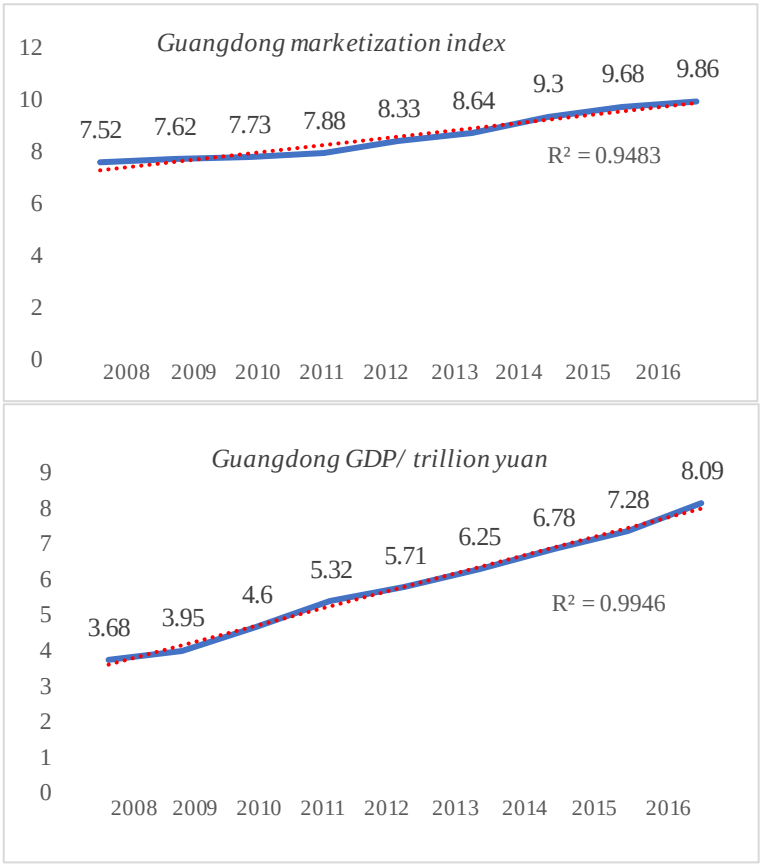


Figure 1. The trend chart of the steady growth of the marketization index and GDP in Guangdong from 2008 to 2016

Henan province also has this circumstance. This kind of provinces normally grow rapidly and steadily in marketization degree and the economy. However, this scene is not common among 31 provinces. The study concludes that A provinces is a small group.

Table 1. Comparison of the R^2 value of marketization index and GDP growth in Guangdong and Henan

	Marketization index R^2	GDP R^2
Guangdong	0.948	0.995
Henan	0.964	0.995

According to the table above, we know that these two provinces have very high R^2 values, which means they grew steadily not only in the marketization progress, also in economic development.

The study speculates that the most vital reason for the steady growth in the marketization degree and GDP is their huge amount of population. From 2008 to 2016, Guangdong and Henan's populations exceeded one billion successively, ranked first and third, respectively (NBSC). Owning an enormous population enables the province to have an abundant labor force, increasing the marketization degree and economic growth, consequently.

4.3. B Provinces

Many Chinese provinces have some small fluctuations during the rise of the marketization index. Nevertheless, these provinces have fairly good development in the growth of the marketization index, so they usually have increase in the marketization index of more than 1 from 2008 to 2016. We call the provinces that have R^2 values of the marketization index between 0.5 to 0.9 as "B provinces."

Fujian province sets an example of having fluctuations in the marketization index growth. From 2009 to 2010, the marketization index dropped from 6.89 to 6.72. However, after only one year, the marketization index was higher than the number in 2009. Unlike Guangdong, Fujian didn't have a steady growth of the marketization index every year, and its broken lines have disparities with the trendlines. Despite this, the marketization index grew from 6.79 to 9.15 in 9 years. Besides, the GDP continued rising from 2008 to 2016, even though the increasing extent is very different each year. The GDP of Hebei province increased from 1.08 to 2.88 trillion yuan in 9 years.

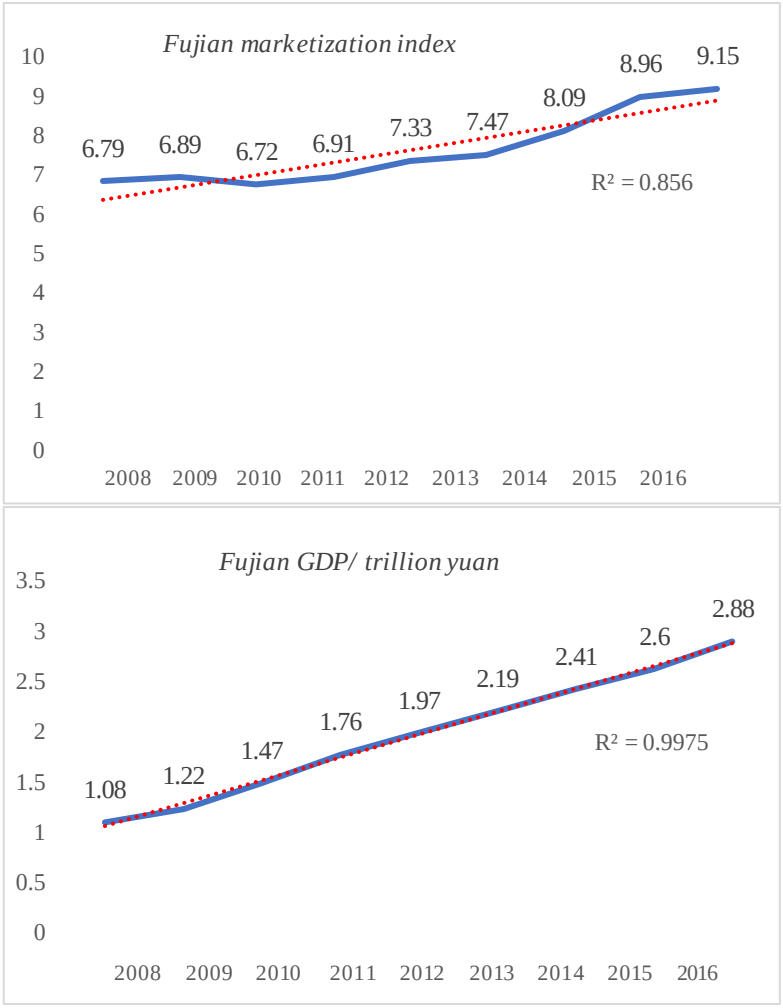


Figure 2. The changes in the marketization index and GDP of Fujian from 2008 to 2016

Table 2. Comparison of the R^2 value of marketization index and GDP growth in Fujian, Jiangsu and Shandong

	Marketization index R^2	GDP R^2
Fujian	0.856	0.998
Jiangsu	0.535	0.997
Shandong	0.864	0.996

Most provinces in China are regarded as B provinces. Even developed provinces, such as Jiangsu and Shandong, have similar situations. Although these provinces have fluctuations in the short term, their marketization indices and GDP grow rapidly in the long term. The research also finds that these provinces usually have increase of at least 1 trillion yuan from 2008 to 2016. The study also finds that these provinces' rankings in the marketization index and GDP are often ahead of 31 provinces.

Based on this table, we knew that the B provinces' R^2 values of the marketization index are a bit lower than the A provinces' R^2 values. Despite this, both A and B provinces have R^2 values that are extremely close to 1 in GDP growth.

B provinces also have large numbers of residents. The research discovers that many B provinces are coastal provinces in China. These coastal provinces have more opportunities to do overseas trade, so they attract a lot of

foreign companies to invest in their provinces, developing the non-state-owned economy, and then enhancing the marketization degree. In this way, GDP also grows excellently.

4.4. C Provinces

Like B provinces, C provinces also have fluctuations in the growth of the marketization index, but their fluctuations are bigger than B provinces'. Their R^2 values of the marketization index are from 0.1 to 0.5. Fluctuations are notable during their growth.

For instance, Inner Mongolia had big differences in the marketization index from 2008 to 2016. In the line chart of the marketization index, there are a "trough" and a "peak." From 2009 to 2010, the marketization index decreased from 4.74 to 4.46. Surprisingly, it proliferated from 4.53 to 5.19 in only one year. Then it declined rapidly in the following years. Conversely, the GDP kept growing in this period, but there is a gap between the trendline and the broken line. The growth of GDP also seems like a small hill. It grew fast at first and then became slow, so its GDP increase was not significant during these 9 years.

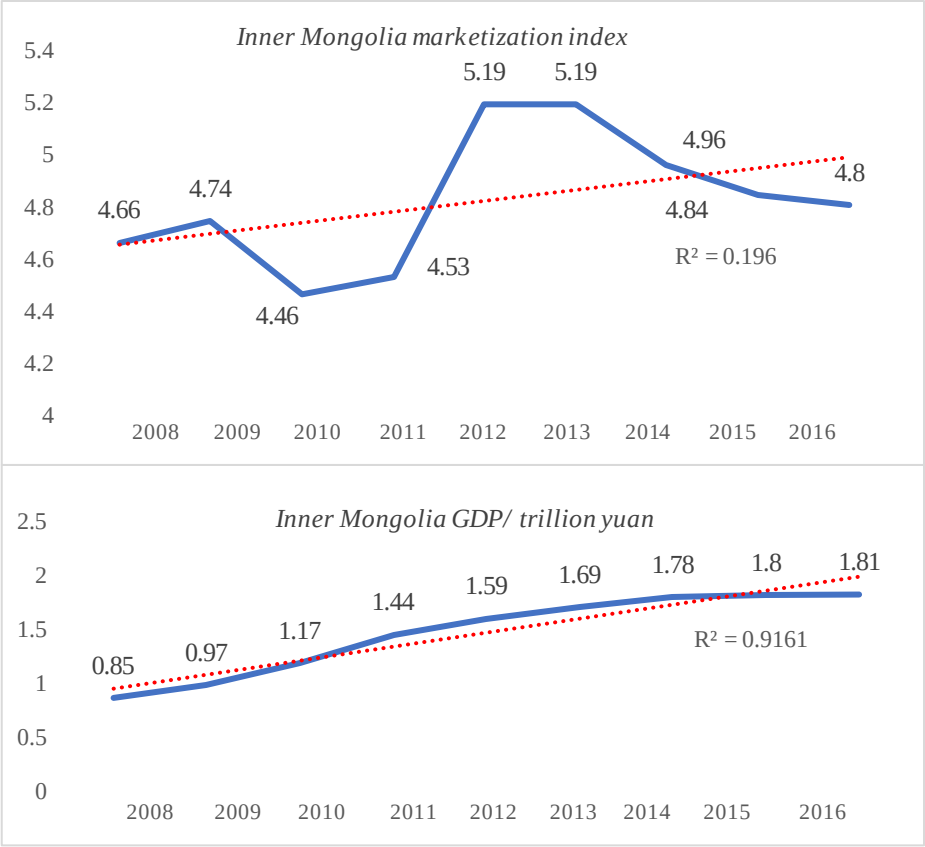


Figure 3. The marketization index and GDP trends in Inner Mongolia from 2008 to 2016

Apart from Inner Mongolia, Qinghai, Guizhou, and Xinjiang have the same circumstances. Because of large fluctuations in growth, they usually cannot improve their marketization indices a lot. Thus, the improvement of the marketization index of a C province is below 1 from 2008 to 2016. Their increase in the GDP from 2008 to 2016 is less than 1 trillion yuan. For this reason, their rankings in these two indices are frequently at the bottom in China.

Table 3. Comparison of the R^2 value of marketization index and GDP growth in Inner Mongolia, Qinghai, Guizhou, Xinjiang

	Marketization index R^2	GDP R^2
Inner Mongolia	0.196	0.916
Qinghai	0.441	0.961
Guizhou	0.298	0.985
Xinjiang	0.250	0.964

From the table, it is obvious that the C provinces' R^2 values of the marketization index are always below 0.5, though their GDP R^2 values can be above 9. The study finds that C provinces are mainly centralized in the western regions of China, where the conditions are severe. The poor degree of marketization is one of the causes for the slow development of these provinces' economy; moreover, a lack of resources, including technologies, human resources, and financial resources, is also a vital reason for the slow growth of GDP.

4.5. Tibet and Yunnan

Considering the special geological locations of Tibet and Yunnan, the extremely poor marketization degree and the economic development is reasonable.

From 2008 to 2013, Tibet's marketization index plunged from 1.27 to -0.23. And then, it came back to 1.02 in 2016. However, because the marketization index in 2016(1.02) is less than the index in 2008(1.27), Tibet becomes one of the only two provinces that have downward trendlines. Although the dramatic changes occurred in this period, GDP grew steadily and slowly from 0.04 to 0.12. Due to the little growth of GDP and a retrogress of the marketization index, Tibet is considered an exception to other provinces.

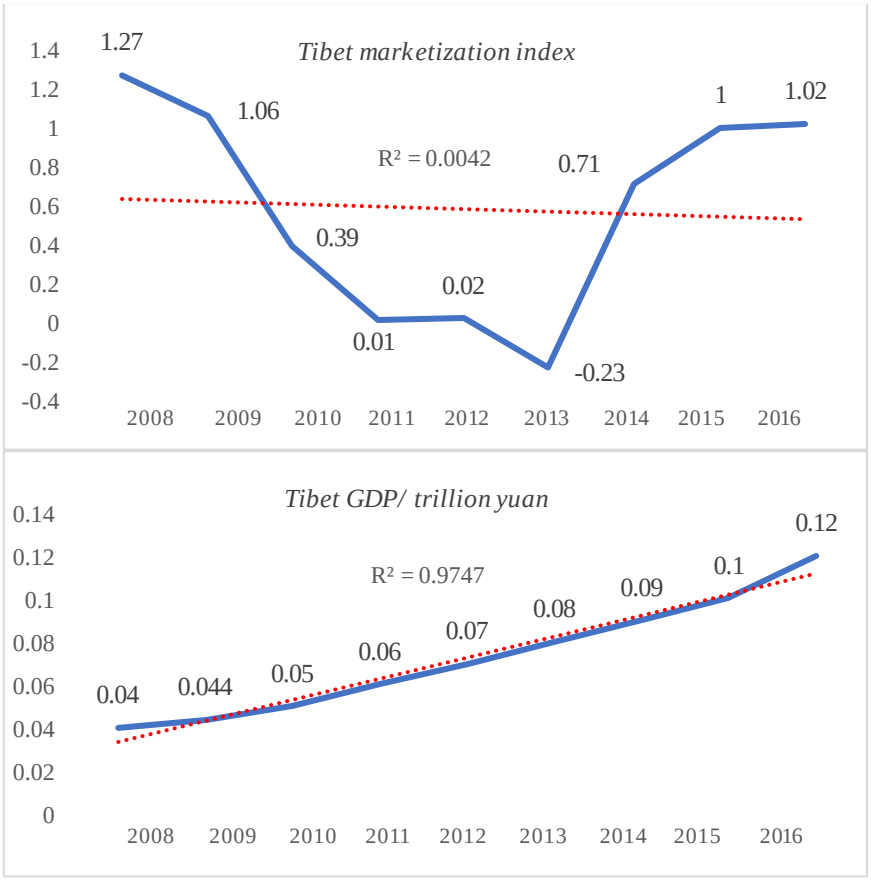


Figure 4. The marketization index and GDP trends in Tibet from 2008 to 2016

Although Tibet's R^2 value of GDP is 9.75, its R^2 value of the marketization index is nearly 0. As mentioned before, Tibet province's geographical features limit its development of the factor market and the product market. Consequently, its marketization degree is slow and degraded. Besides, its population ranking is always at the bottom in China, reflecting that it has insufficient talent resources to promote economic growth (NBSC). Therefore, its development of GDP is slow. Same geographic limitations in Yunnan can be reflected on its downward trendline too.

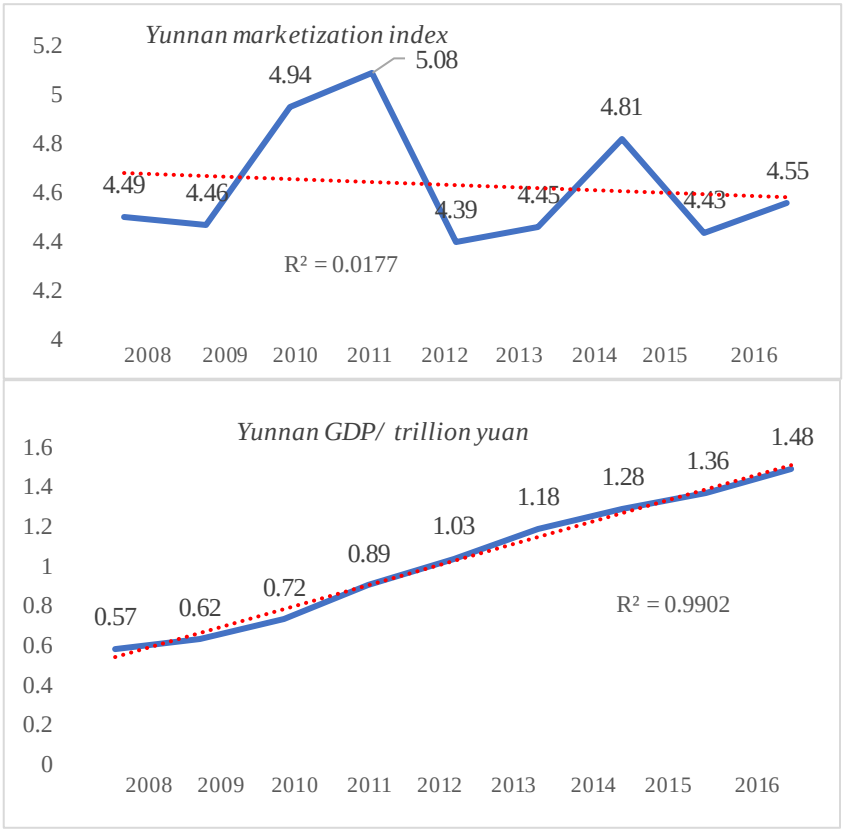


Figure 5. The marketization index and GDP trends in Yunnan from 2008 to 2016

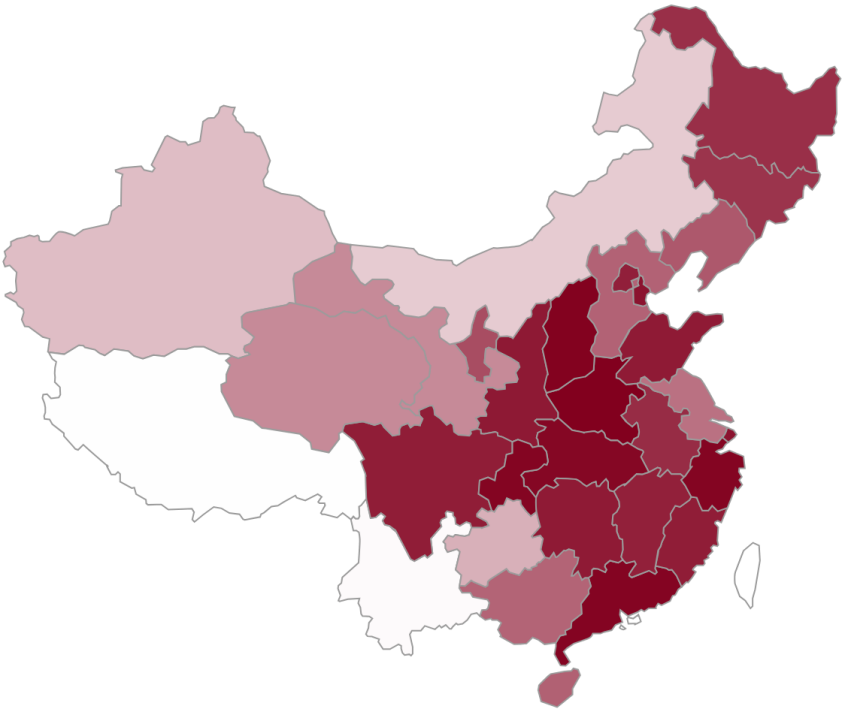


Figure 6. Marketization index R^2 in China

At the end of the results, the Chinese map of marketization index R^2 can show the differences of regional development in marketization degree in China. From the map, the darker the red is, the higher the marketization index R^2 is. Hence, it's clear that the coastal and central areas have relatively high marketization index R^2 because their resource advantages and overseas trade chances as mentioned above, while the western regions have lower marketization index R^2 due to lack of technologies and resources.

5. Discussion

5.1. Analysis

The research studies the relationship between the marketization index and GDP of China's provinces from 2008 to 2016. Through using line charts, the study shows that there is a positive relationship between the marketization index and GDP. And based on research from scholars before, we knew that the marketization degree is one of the reasons for the growth of GDP. As a result, the research concludes that GDP increases along with the growth of the marketization index in the long term.

In addition, the study classifies 31 provinces into 4 groups by analyzing their increase with the trendlines, comparing their R^2 values. From the results, the essay finds that A and B provinces that had high R^2 values during the growth of the marketization index grow steadily in GDP. And these provinces are well-performed in the rankings of marketization degree and economic development. The essay concludes that population and excellent coastal locations make it happen. In contrast, those C provinces that have large fluctuations and low R^2 values in growth each year increase their GDP slowly. Thus, they are often ranked at the back of 31 provinces in China. In conclusion, R^2 values in the growth of the marketization index may affect GDP development. Tibet and Yunnan are the most unique provinces that have a downward trendline in the marketization index chart, while their GDP grew slowly from 2008 to 2016. Hence, when we discuss the relationship, we exclude these two exceptions, since their marketization degree and GDP are immensely influenced by the lack of resources, including human resources and financial resources.

5.2. Limitations

5.2.1. Time constraints

The period of research extent, only from 2008 to 2016, is short. A Nine-years period of time is too short to conclude accurate and thorough results. If it is available in the library, the study should collect the data of the marketization index from 1997 to 2019. Because China joined the WTO in 2001, leading to a great change in the marketization degree, adding the marketization indices that are before and after 2001 can contrast with the GDP growth.

5.2.2. Data constraints

Although all data are from authoritative and official sources, it doesn't mean they are all perfect. First, for the marketization index from Marketization Index of China's Provinces: NERI Report 2018, some of the data from the enterprise questionnaire may be affected by sample selection or subjective evaluation. [12] Besides, the composition of the marketization index is simple, only using the NERI index. Comparing the NERI index with the multi-dimensional evaluations of international transition indices, such as the EBRD or World Bank, will be more persuasive.

Second, the research finds that there are some suspicious details in the data on GDP. Some provinces, particularly those with lower rankings of GDP in China, descended GDP from 2015 to 2018. For example, Tianjin dived from 1.85 to 1.34 trillion yuan from 2017 to 2018. Inner Mongolia, Heilongjiang, and Jilin also have familiar problems. The research finds that the causes for the deviant decline may include adjustment of accounting methods, pressure from economic structure transformation, and systematic manipulation of economic data by local governments. [13] Therefore, the study believes that the data on GDP in some individual provinces is not exactly correct from 2008 to 2016, which may be lower than we expected.

5.3. Policy Implications

There are two policy implications for the government to implement, aiming to improve the marketization degree and economic development.

First, reduce excessive intervention in the economy. [10] Reducing the government's intervention in enterprises is an important component of the marketization index. [1] This measure helps develop the growth of private enterprises, promoting the development of the non-state-owned economy. Thus, it can enhance GDP and the degree of marketization at the same time.

Second, cultivate highly qualified workers. [7] Since human resources are considered to be a significant part of the marketization index, cultivating talents is a helpful practice to enhance the marketization degree. [1] Moreover, skillful workers can drive technological advances, raise productivity, and promote economic development.

6. Conclusion

In the paper, the study mainly focuses on the marketization index. Due to the inspiration coming from the positive relationship between the marketization index and GDP per capita of provinces, the essay aims to study the relationship between the marketization index and GDP. Based on previous research, marketization degree is the cause for economic development; hence, the study supposes a positive relationship between the marketization index and GDP of provinces in China. By using line charts and analyzing R^2 values, the research classifies 31 provinces into 4 types. And the findings show that the hypothesis is consistent with the result. The results also find that fluctuations in the growth of the marketization degree will influence the growth of GDP. The paper also guesses at and explores the reasons for the different features of the 4 kinds of provinces. Although there are some limitations regarding time and data, the study successfully infers the overall trend of 31 provinces. At last, the government can reduce its intervention in enterprises and cultivate talents to enhance the marketization degree as well as economic development.

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