Retain the Vitality, Retain the Future. Comprehensive Evaluation Analysis and Recommendations for Regional Economic Dynamism

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Abstract. Various factors influence the economic dynamism of a region (city or province). Shenzhen has become a first-tier city in China rapidly under the influence of the policy of special economic zones. To analyze the short-term and long-term effects of economic policy transitions on the economic dynamics of the region (city or province), we selected Shenzhen as the target city. We studied the economic policy of Shenzhen from 1978 to 2018 (such as reform and opening up). We have consulted the relevant papers on regional economic vitality, and combined with the requirements of the topic, made the definition of regional economic vitality clear and the relevant factors that affect regional economic vitality. We increase the required data and then analyze the long-term and short-term impact of economic policy transformation on regional economic vitality. We selected Shenzhen's population and enterprise vitality data from 1979 to 2018 from the data released by the National Bureau of statistics. After preprocessing the data, we set up a multiple linear regression model and made a linear regression analysis with the urban regional vitality index. The correlation index R^2 is 0.976. The t-test was carried out to prove its rationality. And $t = 6.733$, $t = 12.792$. Finally, according to the conclusion of the analysis, some suggestions are put forward.

Keywords: Linear Regression Analysis · Analytic hierarchy process · Regional Economic Vitality

1 Introduction

Regional (or city or province) economic vitality is an important part of a region's overall competitiveness. In recent years, in order to improve economic vitality, some regions have introduced many preferential policies to stimulate economic vitality, such as shortening the approval process to attract investment, providing financial support for start-ups,

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and lowering the settlement threshold to attract talent [1]. However, the impact of these policies varies across regions due to differences in resource endowments. A topic worthy of study is how to harness the key factors to effectively improve regional economic vitality [2].

2 Analysis and Assumptions

First of all, we analyze the impact on the change of regional economic vitality from the perspective of the changing trend of population and enterprise vitality. We believe that the stronger the economic vitality is, the faster the economic development is, and the faster the GDP growth is. There are many factors that affect security check. To simplify the problems and make it convenient for us to simulate real-life conditions, we make the following basic assumptions, each of which is properly justified: (1) Assume that the collected statistical data can reflect the dynamic changes of urban economic vitality; (2) Assume that economic vitality can be measured by changes in urban GDP growth rates; (3) Assume that the data used is reliable and can reflect the real situation; (4) Assume that the errors in the calculation process will not have a great impact on the results; (5) Assume that selected indicators can explain changes in economic vitality. In terms of population measurement, as Shenzhen is a city with a large number of floating population, the permanent population can better reflect the available human resources of the city than the registered population, so we choose to use the permanent population to measure the population. Therefore, we can examine whether there is a correlation between the number of permanent residents and the number of enterprises and the growth rate of GDP, establish a multiple linear programming model, and judge the impact of population and enterprise vitality on the change of regional economic vitality according to the results [3]. We look for population and enterprise vitality data of Shenzhen from the data released by the National Bureau of statistics. For population data, in terms of population measurement, since Shenzhen is a city with a large number of floating population, the permanent population can better reflect the available human resources of the city than the registered population [4], so we choose to use the permanent population to measure the population. For the enterprise vitality data, it is difficult to measure the enterprise vitality, but the stronger the general enterprise vitality is, the more enterprises exist in the region. So we think we can use the number of registered enterprises to measure the vitality of enterprises [5]. Based on the above methods, the data are preprocessed, in order to visualize the data, we have made the visualization Fig. 1 and Fig. 2 as follows:

3 Establishment of Multiple Linear Regression Model

In order to analyze the influence of the change trend of population and enterprise vitality on the change of regional economic vitality, we use linear regression analysis, taking the number of resident population and the number of enterprises as independent variables and the growth rate of GDP as dependent variables [5, 6], and judge the relationship between them according to the results.

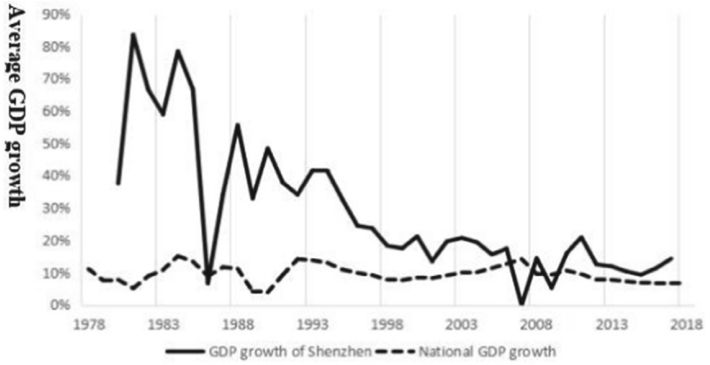

Fig. 1. Comparison between the growth rate of GPD in Shenzhen and the nation

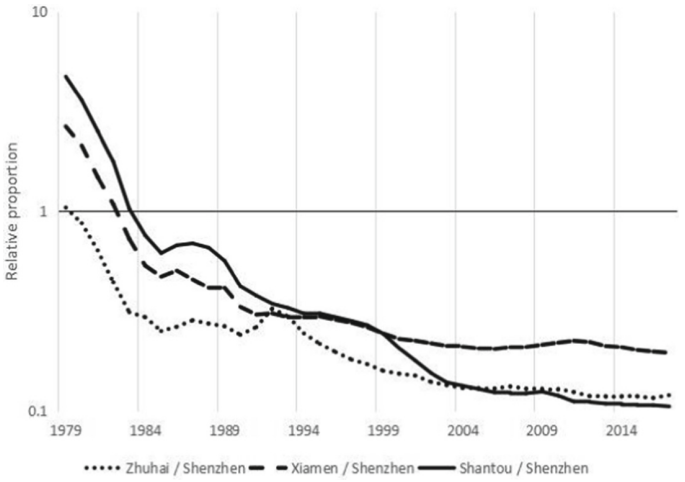

Fig. 2. Change of GDP ratio of other three special economic zone cities to Shenzhen

The multiple linear regression model first finds out several independent variables that affect the dependent variable, and then through the mathematical calculation method, with the goal of minimizing the error of the result, the linear function relationship between the dependent variable and the independent variable is established [7, 8]. By calculating the correlation index, we can test the correlation of the results and evaluate whether the prediction results are accurate or not. According to the general form of multiple linear regression model:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + ... + \beta_k X_{ki} + \mu_i \ (i = 1,2,3,...,n) \tag{1}$$

We establish a multiple linear regression model as follows:

$$\alpha = k_0 + k_1\beta_1 + k_2\gamma \tag{2}$$

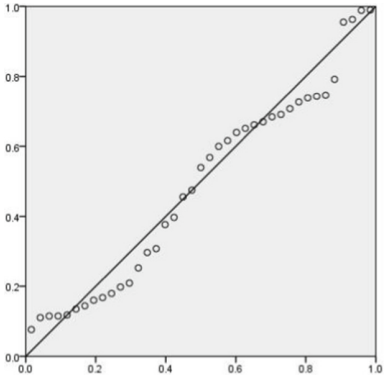

Fig. 3. Normal P-P diagram of regression standardized residuals

Among them, α represents the regional economic vitality, β represents the population, and γ represents enterprise vitality. From the statistical yearbook of Shenzhen City, we collected the number of permanent residents, enterprises and GDP from 1979 to 2017, and then imported the data into SPSS software, using the linear regression analysis function for analysis [9].

4 Result Analysis of Multivariate Linear Model

The calculation results of multiple linear regression model are as follows, and the coefficients are as follows:

$$\begin{cases} k_0 = -1096.273 \\ k_1 = 5.508 \\ k_2 = 0.010 \end{cases} \tag{3}$$

Make P-P diagram for data fitting results, in which the vertical axis is predicted cumulative probability and the horizontal axis is measured cumulative probability. It can be seen that the predicted value is close to the actual value, most of the points are on the diagonal, which shows that the model results can reflect the change of the real value. And the Fig. 3 shows the Normal P-P diagram of regression standardized residuals.

For the overall evaluation of the model, the calculation shows that the overall correlation coefficient $R^2 = 0.976$, which is close to 1, indicating that the model prediction can well explain the real data.

5 Model Rationality Analysis

Based on the establishment of the model in the previous step, we analyzed the rationality of the model and tested the coefficients with t-test. The results are as follows:

$$\begin{cases} t_\beta = 6.733 \\ t_\lambda = 12.972 \end{cases} \tag{4}$$

It can be seen that the value of t-test is high. According to the table of t-test, 99% of them believe that there is a correlation between the two variables and the dependent variables, that is to say, population and enterprise vitality have a strong correlation with the change of regional economic vitality. From the perspective of correlation test, in order to analyze the influence of two factors on the change of regional economic vitality, we calculated the Pearson correlation of several results. The results are as follows:

The Pearson correlation between resident population and GDP is 0.861. The Pearson correlation between the total number of enterprises and GDP is 0.946.

$$\begin{cases} R_{\beta}^{2} = 0.861 \\ R_{\gamma}^{2} = 0.946 \end{cases} \tag{5}$$

This shows that the two independent variables have a strong correlation with the dependent variables, which also supports the conjecture that both variables are related to the regional economic vitality. Generally speaking, the calculation results of various statistical data support the original hypothesis [10, 11], which can be considered to be true. That is to say, the trend of population and enterprise vitality has a correlation with the change of regional economic vitality.

6 Conclusion

Based on the model establishment and research analysis, we come to the conclusion that the change of population and enterprise vitality has a great impact on the change of urban economic vitality. Among them, the enterprise vitality has a greater influence on the urban economic vitality. Combined with the conclusion and related research materials [12–14], the plan to enhance the economic vitality of the city is given as follows, by implementing these strategies, a city can enhance its economic vitality and create a more prosperous and sustainable future for its residents.

1. Foster a business-friendly environment: Create a regulatory and taxation environment that is favorable to businesses. This can attract new businesses to the city and encourage existing businesses to expand.
2. Support small businesses: Small businesses are the backbone of the economy, and they need support to thrive. Provide incentives and resources to help small businesses grow and succeed.
3. Invest in infrastructure: Infrastructure improvements, such as roads, bridges, public transit, and high-speed internet, can attract new businesses and facilitate economic growth.
4. Develop workforce training programs: Developing training programs that are aligned with the needs of local businesses can help ensure that the workforce has the skills needed to succeed in the local job market.
5. Promote tourism: Tourism can be a significant source of revenue for a city. Promote the city's unique attractions and cultural offerings to attract visitors.
6. Encourage innovation and entrepreneurship: Encouraging innovation and entrepreneurship can lead to the development of new businesses and products that can drive economic growth.

7. Foster public-private partnerships: Public-private partnerships can facilitate collaboration between the government and the business community, leading to the development of joint initiatives that benefit the local economy.

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