

# Forecast and Analysis on Economic Vitality of Economic Zone Based on the New Trend of Enterprises

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## Abstract

Urban economic vitality is an important indicator of urban development. Based on the number of new enterprises, this paper forecasts the regional economic vitality of the city. First of all, this paper uses ARIMAX model to predict the number of enterprises in different regions, and finds that the number of new enterprises in the four major economic zones shows a J-shaped upward trend. Secondly, we judge the economic vitality of economic zones by the growth rate of new enterprises. The results show that the economic vitality of the top ranked regions is higher than that of the lower ranking regions. Finally, we analyze the impact of the surviving enterprises and permanent residents on the economic vitality of the city. The results show that the number of resident population has no obvious impact on the number of new enterprises, while the number of new enterprises is different in the number of existing enterprises.

## Keywords

Urban economic vitality, ARIMA, Enterprise increment.

## 1. Introduction

Since 2013, the number of enterprises in China has been increasing rapidly. No matter what area, though the growth rate is different, it is increasing at exponential growth rate. From a regional perspective, the economic vitality of different geographical locations is different. In order to scientifically reflect the social development of China's four economic regions, we divide China into four economic regions according to the characteristics of geographical location. In terms of the number of enterprises registered in different economic regions, the eastern region still has great advantages, the strength of the first tier cities can not be underestimated, and there is still a large gap between the second tier and the third tier cities. However, if we look at the development potential and vitality of a city from the perspective of development, we can not only consider the existing situation. This paper will analyze the urban vitality of different economic zones by time series analysis method, predict the future development trend of urban vitality with the development perspective, and analyze the impact of different variables on urban vitality and talent attraction by using the method of principal component extraction, and provide suggestions for improving economic vitality and expanding talent attraction of cities.

The number of new enterprises in different economic regions is time series data. We take the number of new enterprises in the four major economic zones from 2009 to 2018 as the reference index of urban vitality and attractiveness (when the growth rate of new enterprises is relatively high, the vitality of enterprises is stronger, and the city's development prospects are better, the attraction to talents is higher, and the city where the new enterprise is located also faces better development opportunities) [3-6]. Through the time series analysis of this index, we predict the number of new enterprises in the future 10 years.

With the prediction of the number of new enterprises in the next ten years, we calculate the growth rate of new enterprises in the four major economic regions. By comparing the size of

the growth rate, it is concluded that the region with high growth rate is dynamic area (assigned as 1), while the area with low growth rate is lack of vitality (assigned as 0). It should be noted that the number of enterprises in the first tier cities is large, but this is only the existing economic development conditions, which does not represent the vitality of enterprises in the analysis of this paper. The vitality of enterprises here has a certain expectation effect, which is determined by the future growth conditions and opportunities, and has certain unknowns. This point will be detailed in the following analysis of the number of surviving enterprises.

## 2. Research methods

This paper uses ARIMAX model to forecast the number of enterprises in different regions.

The basic idea of the model is to assume the corresponding sequence  $\{y_t\}$  and input sequence (i.e. independent variable sequence),  $\{x_1t\}, \{x_2t\}, \dots, \{x_nt\}$  are stationary sequences [1-2].

Firstly, the regression model of the corresponding sequence and input sequence is constructed.

$$y_t = \mu + \sum_{i=1}^k \frac{\theta_i(B)}{\phi_i(B)} B^i x_{it} + \varepsilon_t \tag{1}$$

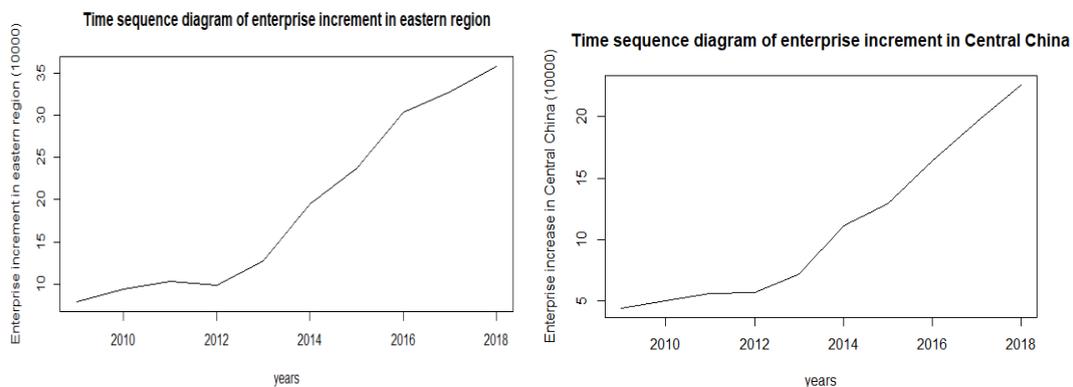
Because both the input variable sequence and the corresponding sequence are stationary, the residual sequence obtained is also stationary.

$$\varepsilon_t = y_t - \left( \mu + \sum_{i=1}^k \frac{\theta_i(B)}{\phi_i(B)} B^i x_{it} \right) \tag{2}$$

$$\begin{cases} y_t = \mu + \sum_{i=1}^k \frac{\theta_i(B)}{\phi_i(B)} B^i x_{it} + \varepsilon_t \\ \varepsilon_t = \frac{\theta(B)}{\phi(B)} at \end{cases} \tag{3}$$

## 3. Growth trend of new enterprises in four City Economic Zones

The ARIMAX model is used to measure the growth of enterprises in the four economic regions, and the time sequence diagram of new enterprises in the four economic regions is obtained, as shown in Figure 1.



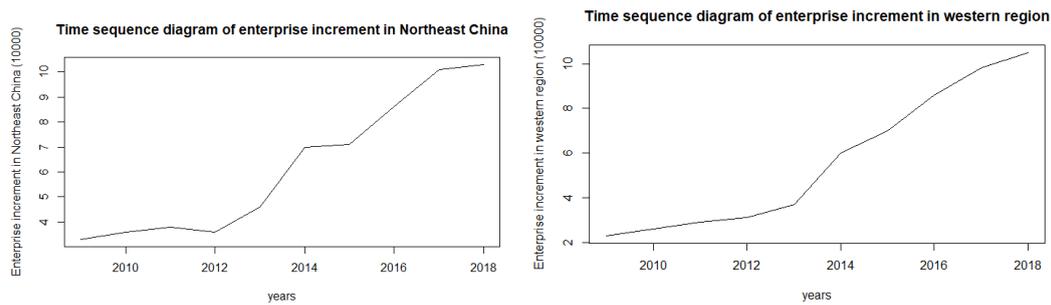


Figure 1: Sequence diagram of newly added enterprises in four economic zones

Through the time series analysis of the number of new enterprises in the four economic zones, it can be found that the number of new enterprises in the four economic zones shows a J-shaped upward trend, which can be said to be in a good situation.

In this paper, since the selected data is time series data, the autocorrelation coefficient can be used to measure the impact of the past number of new enterprises on the current number. The larger the autocorrelation coefficient is, the greater the impact of the number of new enterprises in the past on the number of new enterprises. We can measure the influence of the past on the present according to the correlation coefficient between the number of new enterprises in the past few years and the number of new enterprises now. By determining the delay order of different sizes, the new number of enterprises is greatly affected by the number of new additions in the past few years, so the model is determined in a new step. The partial autocorrelation coefficient (PACF) is to exclude the role of other variables, only to analyze the impact of one variable on the current number.

In this paper, the delayed order of ARIMA model is determined by analyzing the delayed 9-order autocorrelation coefficient and partial autocorrelation coefficient of the number of newly added enterprises in four economic zones (although the automatic modeling can be realized through the zoo and forecast package of R software, the analysis of autocorrelation and partial autocorrelation is indispensable). Taking the eastern region as an example, the results are shown in Figure 2.

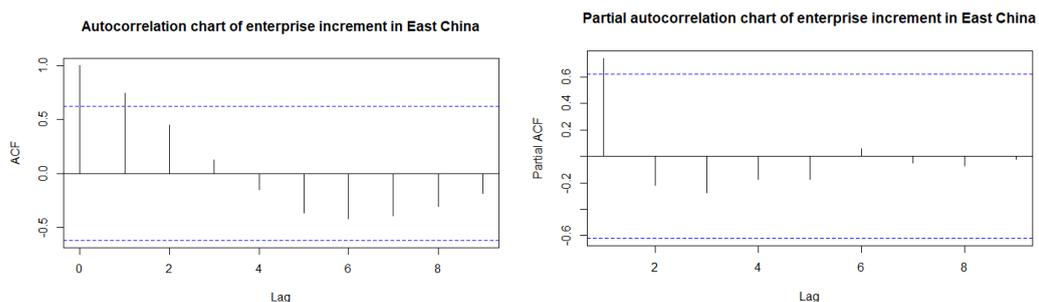


Figure 2: Autocorrelation and partial autocorrelation coefficient of newly added enterprises in eastern region

Through the analysis of the autocorrelation partial autocorrelation coefficient graph of the time series data of the four major economic zones, we can draw the following conclusion: the autocorrelation coefficient and partial autocorrelation coefficient of the number of newly added enterprises in the four economic zones all reflect the characteristics of truncation, which is more typical in the eastern, Central and northeast regions.

It can be seen that the autocorrelation coefficients of the number of new enterprises in the four economic zones are all first-order censored, and the partial autocorrelation coefficients are also first-order censored. After fitting the ARIMA (1,1,0) model and comparing the final AIC values, it is considered that the number of new enterprises in the eastern region satisfies the ARIMA (0,1,0) model with a drift of 3.1; the central region satisfies the ARIMA (0,2,0) model; the

northeast region satisfies the ARIMA (0,1,0) model with the drift term of 0.78; and the western region satisfies the ARIMA (0,1,0) model with the drift term of 0.91.

Table 1: Forecast of the number of new enterprises in the next ten years

Region	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Eastern Region	39.2	42.5	45.9	49.2	52.6	55.9	59.3	62.1	66	69.3
Central Region	25.8	28.9	32	35.1	38.2	41.3	44.4	47.5	50.7	53.8
Northeast Region	11.3	12.2	13.1	14	14.9	15.8	16.7	17.6	18.5	19.3
Western Region	11.5	12.5	13.6	14.6	15.6	16.6	17.6	18.6	19.7	20.7

Exponential smoothing method, also known as Holt winters prediction method, is a common prediction method in time series data [8]. The moving average method assumes that the weight of each period is  $1/n$ , but in this paper, the weight of each period is different, so the exponential smoothing method is used to forecast. Assuming that the series has a relatively fixed linear trend, that is, the number of new enterprises increases or decreases  $r$  every year, then the estimated value of  $t$  period should be equal to the observation value of  $t-1$  period plus the trend change value of each period. Through the way of graph, we can see the situation of prediction more intuitively. The left side is the fitting comparison chart, and the right side is the prediction interval map (taking the eastern region as an example).

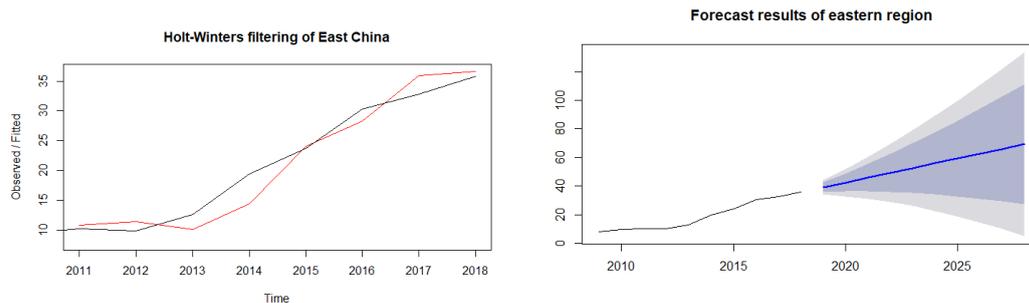


Figure 3: Comparison chart of eastern China (left) and prediction interval (right)

Table 2: Ranking of enterprises' incremental growth in the next ten years in the four major economic regions

Region	Central Region	Western Region	Eastern Region	Northeast Region
Growth of enterprise increment	108.65%	79.5395%	77.0417%	71.0778%
ranking	1	2	3	4

The economic vitality of the top ranked regions is higher, while the economic vitality of the lower ranking regions is lower. The central and western regions ranked No.1 and No.2 are the regions with economic vitality, while the eastern and northeast regions are the regions lacking economic vitality.

According to the division of administrative regions, we know that the central region and the western region include: Henan, Anhui, Hubei, Shanxi, Hunan, Jiangxi; Guangxi, Tibet, Chongqing, Qinghai, Yunnan, Gansu, Shaanxi, Ningxia, Sichuan, Xinjiang and Guizhou. The eastern and northeast regions include: Beijing, Shanghai, Tianjin, Guangdong, Jiangsu, Hebei, Shandong, Zhejiang, Fujian and Hainan; Heilongjiang, Jilin, Liaoning and Inner Mongolia. Therefore, we set the economic vitality of cities in the central and western regions as 1, and the economic vitality

of cities in the eastern and northeast regions as 0, and analyze the effects of different variables according to this setting.

#### 4. Analysis of the impact of the existing enterprises and permanent residents on the economic vitality of enterprises

Taking the number of enterprises and resident population as examples, the box diagram is drawn. In this figure, 0 indicates lack of economic vitality and 1 indicates high economic vitality. As can be seen from the figure, the average number of existing enterprises is about 51, the city often lacks vitality, while when the number of surviving enterprises is about 48, the economic vitality of the city is relatively ideal, while the change of resident population in the number of new enterprises is not so obvious.

In addition, the highest value of the rectangle in the figure represents the highest and lowest value of the number of enterprises or permanent residents in cities with or without economic vitality. As can be seen from the figure, cities without economic vitality cover a wide range.

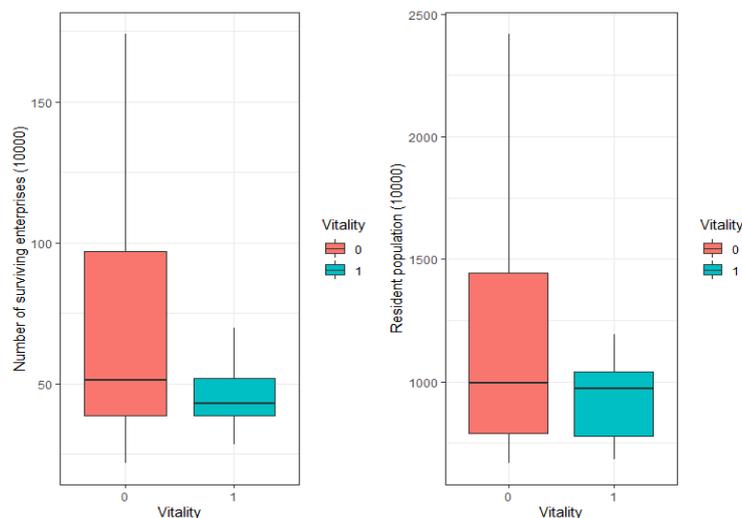


Figure 4: The impact of the number of surviving enterprises (left) and resident population (right) on the future vitality of cities

It can be found that the number of surviving enterprises has a more significant impact on the number of new urban enterprises. The number of resident population has no obvious effect on the number of new enterprises. However, there are differences in the number of new enterprises in the number of existing enterprises. It can be seen that the vitality of the cities with a high number of existing enterprises is not high, that is, the growth rate of new enterprises in the next decade is not high. This is also easy to understand. Most of these cities are first tier cities such as Beijing, Shanghai and Guangzhou, and their development opportunities are close to saturation. Therefore, the growth rate of new enterprises in second and third tier cities is higher, which also indicates that enterprises in second and third tier cities have more development opportunities. Based on the above analysis, it can be said that the talent competition in the second and third line is of great practical significance.

#### 5. Conclusion

Based on the number of new enterprises, this paper forecasts the regional economic vitality of the city, and gets the following conclusions: first, the ARIMAX model is used to predict the number of enterprises in different regions, and it is found that the number of new enterprises

in the four major economic regions shows a J-shaped upward trend. Second, the economic vitality of the economic zone is judged by the growth rate of new enterprises. The results show that the economic vitality of the top ranking regions is higher, while the economic vitality of the lower ranking regions is lower. Thirdly, the influence of the number of resident population on the number of new enterprises is not obvious, but the number of new enterprises is different in the number of existing enterprises.

## References

- [1] Y.Z.Ding. House price forecasting and fluctuation analysis based on time series model. Shandong University, (2018).
- [2] P.L.Zou. Epidemiological characteristics and time series prediction of scarlet fever in Xinjiang. Xinjiang Medical University,(2019).
- [3] L.Jin. Strengthening the vitality of enterprises is the central link of urban economic system reform. Fujian Forum (economic and Social Edition), (1984)No.11,p.5-8.
- [4] T.N.Song. Reform, opening up and development: a written talk on the 5th anniversary of the founding of economic horizons (Continued) to enhance the vitality of enterprises is still the central link of urban reform [J]. Economic horizons, (1991)No.1,p.1-2.
- [5] H.H.Leng, et al. Dynamic enterprises contribute vitality to Qingdao. China Merchants weekly, Vol.47 (2004)No.7,p.13 + 15.
- [6] X.M.Wang. Research on the evaluation of high quality economic development in Anhui Province. Journal of Anhui Radio and Television University, (2019)No.4,p.11-15.
- [7] C.N.Lei, et al. Construction of aroma quality evaluation model of virgin olive oil based on principal component analysis. Acta cerealis Sinica,(2019),p.1-7.
- [8] J.W.Wu. An empirical analysis of the integration of digital Inclusive Finance in the Yangtze River Delta -- Based on the method of functional principal component analysis. Wuhan finance, (2019)Np. 11,p.23-28 + 44.
- [9] J.Dong, L.Li, Y.H.Fang. Groundwater quality evaluation and prediction based on improved fuzzy synthesis exponential smoothing method. Journal of Ocean University of China (NATURAL SCIENCE EDITION), Vol.50 (2020)No.1,p.126-135.
- [10] C.Lu. Analysis of the development level of China's information industry. Hebei University, (2018).