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Research Article

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Present situation, forecasting and the analysis of fixed assets investment in Zhejiang province

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ABSTRACT

As an effective means to stimulate economy, investment in fixed asset has become the foundation of urban and rural economic activities. In the case of economy in transition of our country, fixed assets investment from government is particularly important for promoting the transition and development of economic. We select data of fixed assets investment of Zhejiang province, during 2000-2013. Using ARIMA model, we forecast the investment in fixed assets of Zhejiang, during 2014-2016, so as to make a reference to relevant departments for investment decision.

Keywords: fixed assets investment; WOT analysis; RIMA model

INTRODUCTION

Investment, consumption and trade are three engines of economic growth. Investment in fixed assets is an effective way to enlarge reproduction of society. Investment in fixed assets is an economy active, which are the projects to be constructed or purchased, including energy projects, transportation projects, raw material industrial projects, industrial projects, agricultural equipment, forestry, ecological and environmental conservation projects, commercial and service projects, and so on. Investment in fixed assets is the fundament of various economic activities and other social activities of city and country, so as to make them act smoothly (Hu, et, al. 2013).

As a developing country in transition period, Chinese government plays a very important role in promoting the economics' transition and growth. Investment in fixed assets is one of the government's tactics to enhance the growth of economy. Considering the long-lasting factors of economic growth, while Chinese capital stock per worker is relatively low, the formation of social fixed assets play an important role for a sustained, steady, and rapid economic growth in the 30 years of reform and opening up. To sum up, in the background of transition and development, the public investment of Chinese government plays a very important role in promoting economic growth (Guo, 2010; Wu, ET, al. 2013).

1. The Status Quo of Fixed Assets Investment in Zhejiang

In 2013, fixed assets investment in Zhejiang province was 2019.4 billion Yuan, 18.1% over the previous year. That of the primary industry is 20.1 billion Yuan, 26.8% over the previous year, while that of the second industry is 706.4 billion Yuan, 15.9% over the previous one; Moreover, that of the third industry is 1292.9 billion Yuan, 19.2% over the previous one.

Investment in fixed assets of Zhejiang mainly concentrated in the third industry. With the fast development of Zhejiang province, investment in fixed assets is reasonable distributed in the whole industry.

2. Forecasting of Fixed Assets Investment in Zhejiang Province

Fan and Mei (2013) studied the relationship between fixed assets investment and performance of the telecom

industry of each province. They found that, there is a inverted U typical relationship between them. Through VAR analysis, Wu et al (2013) found that, there is a significant positive effect on economic growth from state-owned infrastructure investment, while there is no obvious positive effect on economic growth from the business investment of the state's capital. This paper uses the ARIMA model to forecast fixed assets investment in Zhejiang province, so as to give some suggestions to the decision making of government.

(1) The selection of model

This paper uses the data of fixed assets investment in Zhejiang Province during 2000-2013, as shown in table 3.1:

Table3.1: Investment in fixed assets of Zhejiang Province during 2000-2013

Year	Investments in fixed assets of Zhejiang province(Billion Yuan)
2000	220.7
2001	276.9
2002	345.8
2003	494.7
2004	594.5
2005	665.2
2006	759.3
2007	843.28
2008	929.98
2009	1074.2
2010	1248.8
2011	1429
2012	1709.6
2013	2019.4

(Date from: Zhejiang Provincial Bureau of Statistics)

According to the statistical data of Table 3.1, we can draw a line diagram of fixed assets investment in Zhejiang Province during 2000-2013, as shown in figure 3.1.

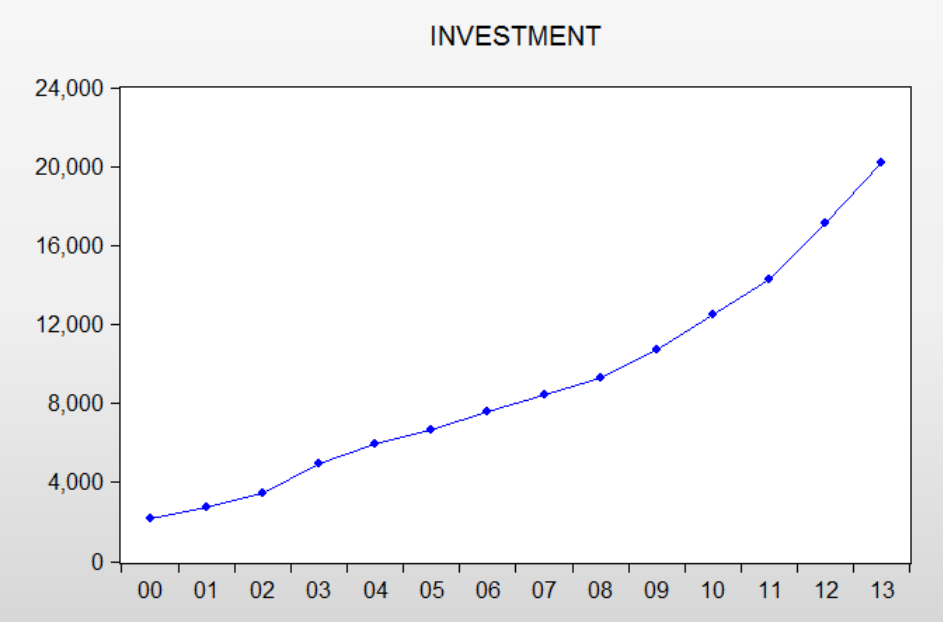
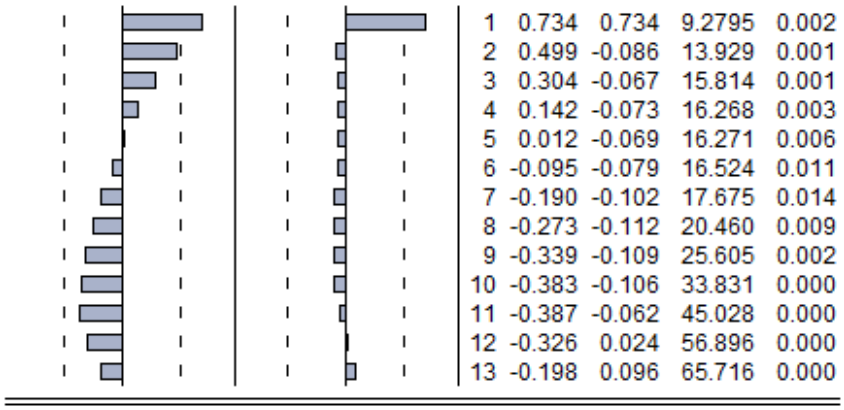


Fig.3.1: The line chart of fixed assets investment in Zhejiang province during 2000~2013

We can see from Figure 3.1 that, investment in fixed assets of Zhejiang province has shown a steady upward trend. Time series get steeper with time flows. So, we can make a conclusion that, the time series is nonlinear.

Therefore, we propose the null hypothesis of H1: There is no autocorrelation series of INV.

Date: 05/25/14 Time: 11:45
Sample: 2000 2013
Included observations: 14



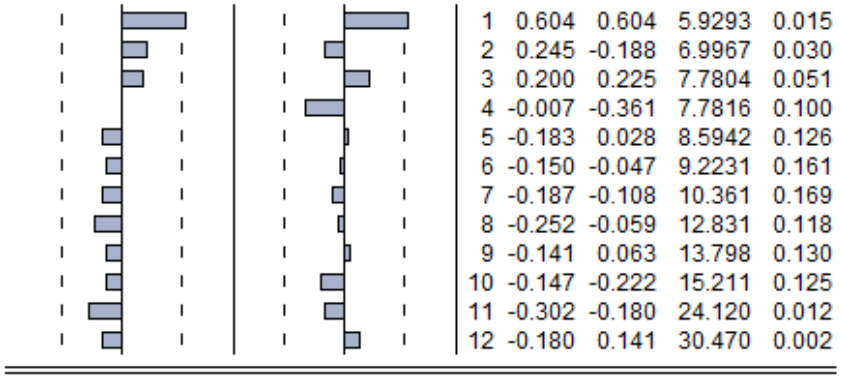
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.734	0.734	9.2795	0.002
		2	0.499	-0.086	13.929	0.001
		3	0.304	-0.067	15.814	0.001
		4	0.142	-0.073	16.268	0.003
		5	0.012	-0.069	16.271	0.006
		6	-0.095	-0.079	16.524	0.011
		7	-0.190	-0.102	17.675	0.014
		8	-0.273	-0.112	20.460	0.009
		9	-0.339	-0.109	25.605	0.002
		10	-0.383	-0.106	33.831	0.000
		11	-0.387	-0.062	45.028	0.000
		12	-0.326	0.024	56.896	0.000
		13	-0.198	0.096	65.716	0.000

Fig.3.2: The autocorrelation test of INV

We can see from Fig. 3.2 that, the probability of the first, the second, and the third lag series from INV is less than 0.05. So, there is an autocorrelation series with INV.

Make a first-order difference of series INV, to generate the series of DINV. We put forward the hypothesis H2: There is no autocorrelation series with DINV.

Date: 05/25/14 Time: 11:50
Sample: 2000 2013
Included observations: 13



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.604	0.604	5.9293	0.015
		2	0.245	-0.188	6.9967	0.030
		3	0.200	0.225	7.7804	0.051
		4	-0.007	-0.361	7.7816	0.100
		5	-0.183	0.028	8.5942	0.126
		6	-0.150	-0.047	9.2231	0.161
		7	-0.187	-0.108	10.361	0.169
		8	-0.252	-0.059	12.831	0.118
		9	-0.141	0.063	13.798	0.130
		10	-0.147	-0.222	15.211	0.125
		11	-0.302	-0.180	24.120	0.012
		12	-0.180	0.141	30.470	0.002

Fig.3.3: The first differential autocorrelation test of INV

Using the software of eviews7, we could find that the autocorrelation function series of DINV are all beneath two times of the standard deviation range, except for the first lag one. The series DINV experiences a declining trend, after the lag of 4 orders. What's more, the autocorrelation function goes beyond the confidence region of 95%, in the first-order lag, while the rest lag orders are located beneath the confidence region. We can simply draw a conclusion that, the autocorrelation functions are not significantly different from 0 in statistics. In addition, partial autocorrelation function goes beyond the confidence region in the first-order lag, while the rest lag ones are beneath the confidence region.

After the lag of 4 orders, the partial autocorrelation function of series DINV becomes very small. So, the autoregressive process of ARIMA model may be of 4 orders. The autocorrelation function of series DINV became smaller after the lag of 4 orders, which means that the moving average process of MA should be of low order. According to the analysis above, we estimated 2 models as follow, which are the model of ARIMA (4, 1, 1) and

ARIMA (4, 1, 2).

The p values from lag of 3 to 10 order are all larger than the test level of 0.05; therefore, we can not reject the null hypothesis. It is considered that the series of DINV does not exist in autocorrelation. Make a self-correlation test, getting the series of DINV_AC.

By the Spike figure of DINV_AC, we can see that DINV_AC attenuates fast, and smoothly.

We use the ARIMA model as follow:

$$r1 = d(\log(inv)) \quad (1)$$

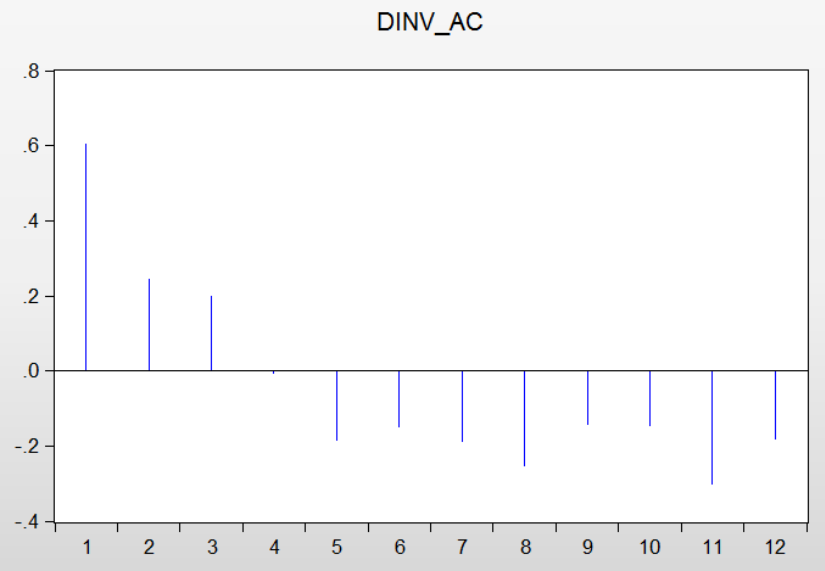


Fig.3.4: The first-order differential autocorrelation of INV

(2) Reliability and validity testing

Let $p = 4, q = 1$ or $p = 4, q = 2$.

First, we use model ARIMA (4, 1, 1).

$$r1_t = c + c(1)r1_{t-1} + c(2)r1_{t-2} + c(3)r1_{t-3} + c(4)r1_{t-4} + c(5)\varepsilon_{t-1} + \varepsilon_0 \quad (2)$$

The results are shown as follows:

Using least squares estimation, we get the value of C, C (1), C (2), C (3), C(4) and C(5) as follow: 0.152953, 0.780722, -0.308720, 0.236670, -0.268737, -4.063663. Modified coefficient of determination is: 0.967088. So that, the model fits well.

We can get the predictive value, which are1437.342, 1681.295, and1976.072 billion Yuan, of the year of 2011, 2012, and 2013.

Table3.2: Fitting results of ARIMA (4.1.1) during 2011-2013

Year	2011	2012	2013
The actual value	1429	1709.6	2019.4
The predicted value	1437.342	1681.295	1976.072
The relative error	0.584%	-1.656%	-2.146%

We can see from table 3.2 that, the relative error between predicted and true value is less than 5%, which indicates that the predictive value of the model is good. The reliability and validity of model are good, too.

The estimation results of ARIMA (4.1.2) Model is:

$$r1_t = c + c(1)r1_{t-1} + c(2)r1_{t-2} + c(3)r1_{t-3} + c(4)r1_{t-4} + c(5)\varepsilon_{t-1} + c(6)\varepsilon_{t-2} + \varepsilon_0 \quad (3)$$

Using least squares estimation, we get the value of C, C (1), C (2), C (3), C (4), C(5)and C(6) as follow: 0.147302, 0.603684, -0.240082, 0.190165, -0.269072, -5.069315, 2.187755. Modified coefficient of determination is: 0.977613. The model fits well.

We can get the predictive value, which are 1435.36, 1685.079, and 1974.722 billion Yuan, in the year of 2011, 2012, 2013.

Table3.3: Fitting results of ARIMA (4,1,2) during 2011-2013

Year	2011	2012	2013
The actual value	1429	1709.6	2019.4
The predicted value	1435.36	1685.079	1974.722
The relative error	0.445%	-1.434%	-2.212%

It can be seen from table 3.3 that, the relative errors, which indicates that the forecast effect, between the predicted and true values are less than 5%. But, with the increase of the forecast period, the relative errors of predicted model are also greater. Because of the errors between actual and predicted value is very small, the reliability and validity of the model are of good shape.

(3) The predictive results
ARIMA(4,1,1)and ARIMA(4,1,2)are two different moving average process. Two models have different distribution of relative errors. Make a sum of the absolute value of relative errors from table 3.2 and table 3.3, we could get the absolute value of relative errors of model ARIMA (4, 1, 1), that is 4.386%, while the one of ARIMA (4, 1, 2) is 4.091%.

Therefore, the predicted errors of ARIMA (4, 1, 1) for the first and second period in future is relatively large, while the latter ones are small. The distribution of predicted errors of ARIMA (4, 1, 2) is on the opposite. Overall, the predicted errors of ARIMA (4, 1, 2) for 3 periods is smaller than that of ARIMA (4, 1, 1). Therefore, we could select model according to the researching need. If the overall error precision for research is high, you should choose ARIMA (4, 1, 2) model, else or if the research need rigorous prediction for the third period in future, ARIMA (4, 1, 1) model is better.

According to ARIMA (4, 1, 1) model, we can predict fixed assets investment, which are 2355.518, 2766.043, and 3229.134 billion Yuan, in Zhejiang during 2014-2016.

According to ARIMA (4, 1, 2) model, we can predict fixed assets investment, which are 2332.043, 2712.022, and 3136.345 billion Yuan, in Zhejiang during 2014-2016.

CONCLUSION

(1) Annual growth rate of fixed assets investment of Zhejiang Province
We can draw the annual growth rate of fixed assets investment of Zhejiang Province during the year of 2001~2013, as shown in table 4.1:

Table4.1: Annual growth rate of fixed assets investment of Zhejiang Province during 2001-2013

year	Annual growth rate of fixed assets investment in Zhejiang Province
2001	25.46%
2002	24.88%
2003	43.06%
2004	20.17%
2005	11.89%
2006	14.15%
2007	11.06%
2008	16.25%
2009	15.51%
2010	16.25%
2011	14.43%
2012	19.64%
2013	18.12%

It can be seen from table 4.1 that, the rate of the fixed assets investment maintained beyond 20%, during 2001-2004. Especially in 2003, the rate came to 43.05%, which is the highest rate in this period. Later, the rate tended to be stable, which maintained above 10%, dating during 2005-2013.

According to the model's prediction, investment in fixed assets in Zhejiang province will continue to maintain a steady growth of more than 10 percent in the next three years.

(2) Stimulating from fixed assets investment of Zhejiang province to the local economy
The investment in fixed assets of a province plays an important role in promoting the development of local economy. Take Xiasha Higher Education Zone of Hangzhou city as an example, we find that the local economy experiences a fast development, with the increase of fixed assets investment from government.

We can see from Figure 4.1 that, in Xiasha Higher Education Zone of Hangzhou, around the residential areas, catering services, entertainment facilities are developed, along with the fixed assets investment from government, which include: hospital, post office, police station, subway, colleges and so on. Furthermore, the residential area has promoted the development of local service area. For example, the entertainment and dining areas are located around the residential one. In conclusion, the entertainment, dining and residential area are all affected by college area and they are gradually developed based on infrastructure.

Therefore, the investment to infrastructure of Zhejiang province plays an important role in promoting the development for local residential area, and related industries.

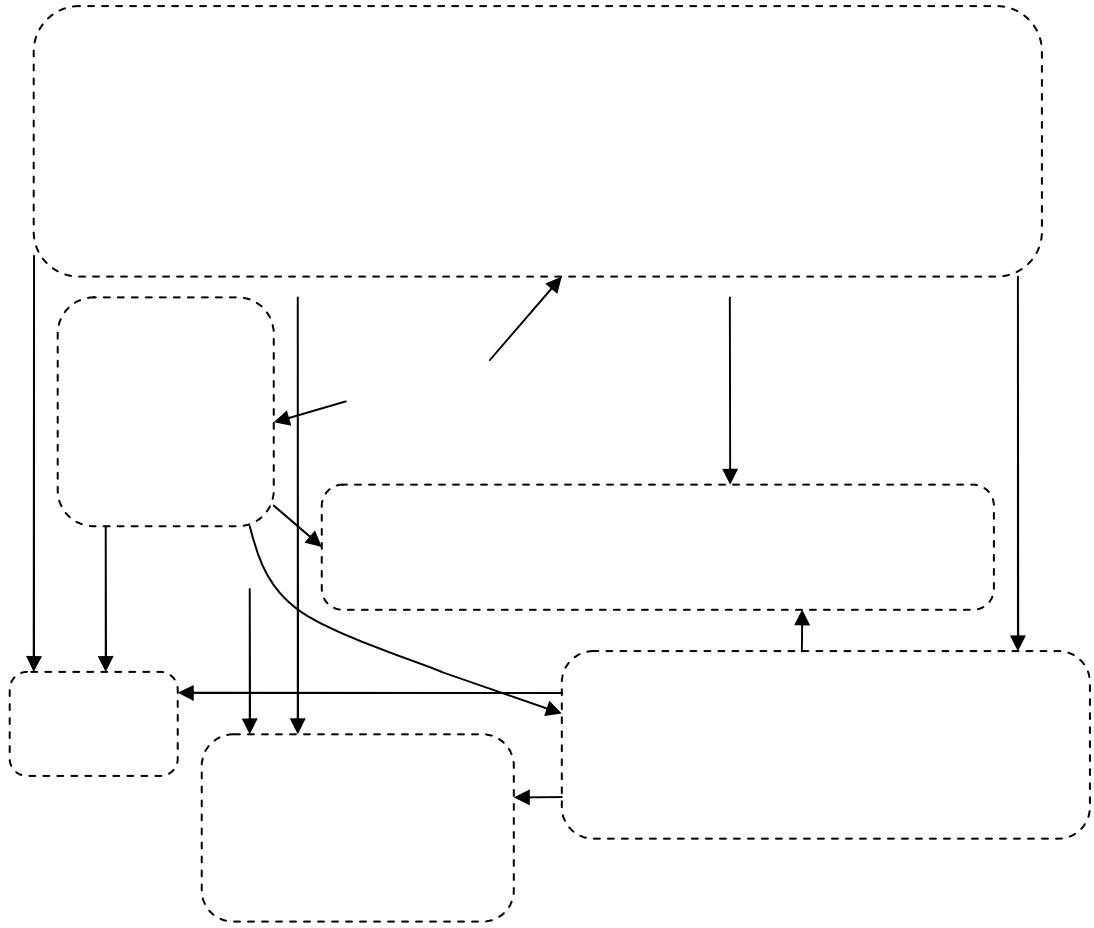


Fig.1: the influential chart of fixed assets investment in Xiasha Hangzhou

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