

# Application of Intervention Analysis Model in Yu Ebao Yield Prediction

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## Abstract

This paper used the intervention analysis model to fit the data of seven-day annualized yield of Yu Ebao, by regarding the Niu's comment as intervention. We constructed the linear model and the intervention model. The result showed that though Niu's comment was not the most important cause of the decline of the yield, its effects cannot be ignored. And it caused the yield of Yu Ebao fallen 0.148% faster than before.

## Keywords

Yu Ebao, Yield, Intervention Analysis Model

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## 1. Introduction

Recently, a series of internet financial products were launched by many internet companies and fund management companies, which attracted a lot of investors' attention. Yu Ebao is one of these products. Yu Ebao was a balance value-added service built by the third party payment platform Alipay, which was launched in June 13, 2013. Essentially, it is a monetary fund launched by the Alipay cooperated with the Tianhong Asset Management Company. The users will access certain benefits by transferring the money to Yu Ebao. Due to that fact that its yield was higher than the bank current deposit interest rate, and the account funds could be used for on-line shopping or transferring at any time, it attracted a large number of young people fascinated in online shopping. As of February 27, 2014, Yu Ebao user amount has exceeded 81 million, and its asset size was larger than 5 hundred billion.

The yield of Yu Ebao was increased steadily since its launch (**Figure 1**), even broke through 6.7%, and lasted for 10 days long. However, nothing gold can stay, at the beginning of 2014, major banks had teamed up with other fund companies to launch their own internet financial products. Besides, under the pressure of other like products which came from Baidu and Jingdong companies, the yield of Yu Ebao was all the way down after the

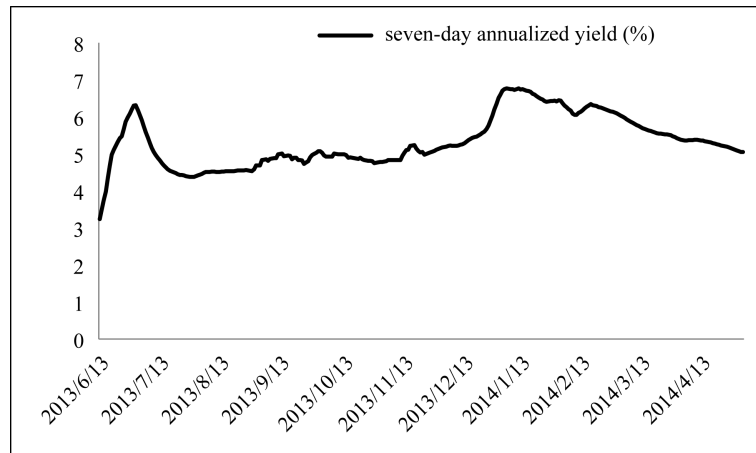


Figure 1. The seven-day annualized yield of Yu Ebao.

peak.

On the day of February 21, 2014, Wenxin Niu whom is the chief executive editor and chief commentator of CCTV security information channel, accused that Yu Ebao was a “vampire” lying on the bank, a typical “financial parasite”, and advocated to ban this product. Niu’s comment was reported by many authoritative media, and sent shock waves throughout the internet. Because of this, the yield of Yu Ebao fallen sharply. Even though on March 4, Xiaochuan Zhou, president of the people’s bank of China, indicated that they won’t ban the Yu Ebao, that’s unable to block the yield decline. Based on the background above, we regarded Niu’s comment as the intervention, applying the intervention analysis model to analyze and predict the trend of seven-day annualized yield, quantitatively studying its running track.

## 2. Intervention Analysis Model

The intervention analysis model is proposed by Box and Tiao, professors of University of Wisconsin, department of statistics [1]. Intervention analysis is to evaluate the impacts of policy events or emergency on the economic environment and process from the angle of quantitative analysis [2]. The intervention parameters fall into two categories, continuous and transitory. The continuous parameter refers that the intervention event still affects the changes after the moment  $T$ . The basic variable of intervention analysis model is the intervention variable, *i.e.*

$$S_t^T = \begin{cases} 0, & \text{before the intervention } (t < T) \\ 1, & \text{after the intervention } (t \geq T) \end{cases}$$

The intervention model is  $Z_t = \frac{\omega}{1 - \delta B} S_t^T$ , where  $\omega$  represents the unknown parameter of the intervention effect strength,  $\delta$  represents the intervention duration,  $B$  is delay operator.

Four kinds of intervention type concluded as below:

- 1) The influence of intervention appears all of a sudden, and continues for a long time;
- 2) The influence of intervention appears gradually, and continues for a long time;
- 3) The intervention occurs suddenly, and the influence is temporary;
- 4) The intervention occurs gradually, and the influence is temporary.

There are four steps to modeling the intervention analysis model. First of all, we construct a univariate time series model by using the data before intervention, then applying the model to make the prediction, the prediction data we get is without intervention. Secondly, with the real value minus the predicted value, the difference is the intervention value. Then we estimate the parameter of the intervention model. Thirdly, we combine the real data before the intervention and the prediction data which came from the intervention model as a complete data. Then we construct another univariate time series model. At last, with the last univariate time series model and the intervention model, the combination is the final intervention analysis model.

### 3. Data Analysis

#### 3.1. Data Specification

This paper uses the seven-day annualized yield of Yu Ebao from January 1 to April 30, 2014 as data. The data is collected from the official website of the Tianhong Asset Management Company (<http://www.thfund.com.cn>). The data is shown in the **Appendix**.

#### 3.2. Model Construction before the Intervention

According to the observation of the data before the intervention (before February 21), and the comparison of several models fitted effect, we chose the linear model. The model we constructed is:

$$\hat{x}_{0t} = 6.774 - 0.013t$$

where the model goodness of fit  $R^2 = 0.807$ , model  $F$  Test  $F = 217.787 (P = 0.000)$ , and all the parameters in the model is significant under the significant level 0.05, all of these show that the model fitting effect is great.

#### 3.3. Intervention Model Construction

With the linear model we got above, we predict the yield  $\hat{x}_{0t}$  from February 21 to April 30. Then we compute the intervention effect value  $Z_t = x_t - \hat{x}_{0t}$ ,  $Z_t$  is the quantitative impact value of Niu's comment on Yu Ebao's yield. We estimate the parameters of the intervention model and get this:

$$Z_t = -\frac{0.014}{1 - 0.928B}$$

where the model goodness of fit  $R^2 = 0.985$ , model  $F$  Test  $F = 4108.933 (P = 0.000)$ , and all the parameters in the model is significant under the significant level 0.05, all of these show that the model fitting is great.

#### 3.4. Purified Series Model Construction

The purified series refer to the series without the intervention impact, *i.e.*  $y_t = x_t - \frac{\omega}{1 - \delta B} S_t^T$  ( $T = 51, t = 1, 2, \dots, 120$ ). We still chose the linear model to fit the purified series, the result is:

$$\hat{y}_t = 6.774 - 0.013t$$

where the model goodness of fit  $R^2 = 0.979$ , model  $F$  Test  $F = 5377.901 (P = 0.000)$ , and all the parameters in the model is significant5, all of these show that the model fitting is great.

#### 3.5. The Final Intervention Analysis Model

Combining the intervention model and the purified series model, we get the final intervention analysis model:

$$x_t = 6.774 - 0.013t + \frac{-0.014}{1 - 0.928B} S_t^T$$

$$S_t^T = \begin{cases} 0, & \text{before February 21, 2014 } (t < 51) \\ 1, & \text{February 21, 2014 and after } (t \geq 51) \end{cases}$$

By comparing the prediction value of intervention analysis model and the raw data (**Figure 2**), we know that the two series are highly consistent, which shows that the model we constructed is reasonable.

According to the analysis above, we conclude that Niu's comment made the yield fallen faster and faster, the average impact is  $-0.148\%$ , *i.e.* after the comment, the yield of Yu Ebao fallen 0.148% faster than before.

### 4. Conclusion and Improvement

There are a lot of factors affecting the financial product yield [3]. The direct factors include national polity, rate changing, the company's own development, etc. The indirect factors include economic environment, comment, especially the famous scholars' comment, which will first affect the investors' psychology. Then the investors

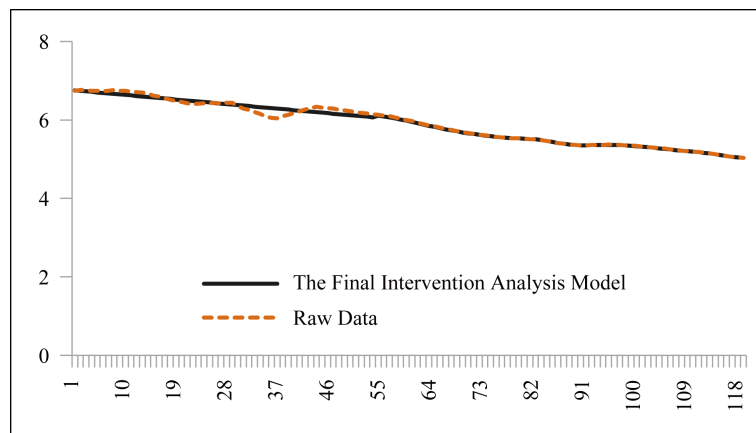


Figure 2. Intervention analysis model prediction effect.

will make their own choices to enter or exit the market according to the good or bad news; what's more, that will affect yield of the product. Through the intervention analysis model, we fitted the impact of "ban Yu Ebao" comment on its yield accurately.

Yu Ebao as a monetary fund product, is restricted by the deposit rate of the bank, so that its yield won't never keep on the high level [4]. Dengfeng Wang, fund manager of the Tianhong asset management company, explained that the reason why the yield was so high is that the money is in short supply at the end of the year and before the Spring Festival, so the investors who invest the monetary fund enjoyed a higher income. But after the Spring Festival, the money supply tension reduced, the yield of Yu Ebao is returned to the normal level. Therefore, though Niu's comment was not the most important cause of the decline of the yield, with the analysis above, its effects cannot be ignored [5].

This paper only considered the linear and curve regression model when we constructed the model. We haven't considered applying some general time series model, such as ARIMA model, ARCH model, etc. So in the future research work, we will apply more types of model and compare their fitting effect.

## Acknowledgements

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## Appendix

Date	Yield (%)	Date	Yield (%)	Date	Yield (%)
2014/1/1	6.74	2014/2/10	6.225	2014/3/22	5.526
2014/1/2	6.763	2014/2/11	6.263	2014/3/23	5.516
2014/1/3	6.753	2014/2/12	6.298	2014/3/24	5.511
2014/1/4	6.745	2014/2/13	6.334	2014/3/25	5.496
2014/1/5	6.738	2014/2/14	6.311	2014/3/26	5.472
2014/1/6	6.726	2014/2/15	6.298	2014/3/27	5.445
2014/1/7	6.738	2014/2/16	6.286	2014/3/28	5.415
2014/1/8	6.761	2014/2/17	6.259	2014/3/29	5.395
2014/1/9	6.737	2014/2/18	6.241	2014/3/30	5.374
2014/1/10	6.738	2014/2/19	6.22	2014/3/31	5.361
2014/1/11	6.721	2014/2/20	6.201	2014/4/1	5.356
2014/1/12	6.703	2014/2/21	6.183	2014/4/2	5.357
2014/1/13	6.695	2014/2/22	6.165	2014/4/3	5.362
2014/1/14	6.67	2014/2/23	6.147	2014/4/4	5.367
2014/1/15	6.618	2014/2/24	6.136	2014/4/5	5.37
2014/1/16	6.595	2014/2/25	6.114	2014/4/6	5.373
2014/1/17	6.554	2014/2/26	6.093	2014/4/7	5.373
2014/1/18	6.517	2014/2/27	6.062	2014/4/8	5.368
2014/1/19	6.48	2014/2/28	6.031	2014/4/9	5.36
2014/1/20	6.46	2014/3/1	6.001	2014/4/10	5.351
2014/1/21	6.423	2014/3/2	5.971	2014/4/11	5.339
2014/1/22	6.398	2014/3/3	5.928	2014/4/12	5.327
2014/1/23	6.413	2014/3/4	5.895	2014/4/13	5.315
2014/1/24	6.422	2014/3/5	5.864	2014/4/14	5.3
2014/1/25	6.424	2014/3/6	5.835	2014/4/15	5.287
2014/1/26	6.434	2014/3/7	5.805	2014/4/16	5.272
2014/1/27	6.416	2014/3/8	5.774	2014/4/17	5.253
2014/1/28	6.441	2014/3/9	5.744	2014/4/18	5.239
2014/1/29	6.432	2014/3/10	5.716	2014/4/19	5.224
2014/1/30	6.36	2014/3/11	5.69	2014/4/20	5.21
2014/1/31	6.293	2014/3/12	5.668	2014/4/21	5.2
2014/2/1	6.253	2014/3/13	5.647	2014/4/22	5.188
2014/2/2	6.205	2014/3/14	5.628	2014/4/23	5.171
2014/2/3	6.158	2014/3/15	5.61	2014/4/24	5.152
2014/2/4	6.085	2014/3/16	5.592	2014/4/25	5.13
2014/2/5	6.051	2014/3/17	5.568	2014/4/26	5.109
2014/2/6	6.044	2014/3/18	5.555	2014/4/27	5.087
2014/2/7	6.096	2014/3/19	5.544	2014/4/28	5.067
2014/2/8	6.135	2014/3/20	5.538	2014/4/29	5.048
2014/2/9	6.174	2014/3/21	5.535	2014/4/30	5.04

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