An Analysis of Internet Enterprise Value Evaluation Method Based on ARIMA

Ling Chen*
Fuzhou University of International Studies and Trade, Fuzhou 350200, China

*Corresponding author e-mail: chenling@fzfu.edu.cn

Abstract. With the rapid development of the times, the Internet has been deeply integrated into various fields, and many Internet companies have emerged at the historic moment, and economic activities such as mergers, reorganizations, acquisitions, issuance and listing, equity swaps, mortgages, bankruptcy and liquidation of Internet companies have also increased frequently. This has led to more and more value evaluation activities related to Internet companies, and the business model of Internet companies is different from traditional companies, so traditional corporate value evaluation methods cannot fully meet the special requirements of Internet company value evaluation. Therefore, we need to establish a sound Internet enterprise value evaluation system, and use more scientific and reasonable evaluation methods to ensure the interests of all parties to the transaction. Starting from the operating characteristics of Internet companies, this article analyzes the characteristics and difficulties of Internet corporate value evaluation, clarifies the effectiveness and limitations of the income method in Internet enterprise value evaluation, introduces the ARIMA model to improve the traditional income method and takes NetEase as an example. This method is applied to practice to verify its feasibility. So as to provide a scientific and reliable reference basis for Internet enterprise value evaluation.

Keywords: Internet, Enterprise Value Evaluation, Income Approach, ARIMA Model

1. Introduction
With the rapid development of the Internet and its continuous penetration into people’s lives, in order to achieve further growth, various industries regard "Internet +" as a new driving force for corporate development. Internet companies are growing rapidly and are related to Internet companies. Activities are becoming more frequent. At this time, Internet enterprise value evaluation becomes especially important. Based on the particularity of Internet enterprise operations, traditional enterprise value evaluation methods cannot meet the needs of Internet enterprise value evaluation. Therefore, we urgently need to seek a more scientific and reasonable Evaluation system, establish a more complete enterprise value evaluation model to meet the needs of Internet enterprise value evaluation. This paper chooses to use the ARIMA model to predict the future free cash flow of Internet companies, while eliminating the influence of various factors in the forecasting process, to make up for the inaccuracy of
the expected income forecast in the traditional income method, so as to construct a new type of
Internet enterprise value evaluation model [1].

2. Characteristics of Internet Enterprise Value Evaluation

Internet companies refer to companies that use computer technology to build platforms and operate on
the Internet. It can be divided into: network service providers, internet service providers, internet
content providers, application service providers, internet data centers, and application infrastructure
providers. This type of enterprise is different from ordinary enterprises, so Internet enterprise value
evaluation cannot copy the experience and process of ordinary enterprise value evaluation [2].

Summarizing the characteristics of the value assessment of Internet companies are as follows:
(1) There are many influencing factors for Internet companies, resulting in high uncertainty in the
future development of companies, and Internet companies have the characteristics of high risks and
long return periods. This requires companies to have a certain asset scale to meet the large number of
As a result, the previous financial statements cannot fully represent the value of the company. Instead,
it requires a certain period of free cash flow statistics to judge future profitability to be more
reasonable [3].
(2) Enterprises mainly rely on the Internet to generate operating profits, and intangible assets
account for a relatively large proportion of the overall Internet enterprise assets. As non-physical
assets, the value evaluation of intangible assets lacks a scientific and reasonable value evaluation
system, and the accounting confirmation of intangible assets has defects, which leads to There are
unavoidable difficulties in the valuation of Internet companies [4].
(3) The development of most Internet companies is still in its infancy, with few historical data. The
Internet sector is mainly led by a few large companies, but their economic activities involve staggered
but different content, such as Baidu’s main strategy areas on the search engine side, Alibaba’s main
business area is e-commerce, so it is difficult to conduct comparative analysis among Internet
companies [5].

3. ARIMA Model

3.1. Introduction of ARIMA Model

The ARIMA model is a commonly used time series analysis model. It is a model that can perform
autoregression based only on the variable data in the equation. The differential integrated moving
average autoregressive model in the ARIMA model is a different approach. By observing the
historical data of the time series, an explanation about its past path (behavior) can be obtained, and
only the data of the variable itself can be modeled [6].

In the actual application of the ARIMA model, the following process is generally followed. The
first is to test the stationarity of the data. Non-stationary data cannot be used for time series analysis,
otherwise various problems such as false regression will occur [7]. If the time series is stable, you can
directly proceed to the next step. If it is non-stationary, the time series should be smoothed by
difference method until the series reaches a plateau. Then the parameters of the ARIMA model are
determined according to the autocorrelation graph and partial autocorrelation graph. Then use
statistical software to estimate the model parameters and test the significance of the statistical data.
After the model passes the test, the modeling work is improved, and finally the model is used for time
series forecasting [8].

3.2. The Formula of ARIMA Model

Establish the ARIMA model and use the differential integrated moving average autoregressive model,
which can better eliminate the influencing factors that are not stable in the forecasting process. The
expression is the formula [9]:

\[
\left\{ \left[ \sum_{i=1}^{p} \phi_i L^i \right] \left[ 1 - d \right]^s \right\} \ X_t = \left\{ \left[ \sum_{i=1}^{q} \phi_i L^i \right] \right\} \epsilon_t ,
\]

(1)
Among them,
p: the number of autoregressive terms
q: the number of moving average terms
d: the difference order
L: the likelihood function
\( Xi \) can be represented by selected sample data from \( X1 \) to \( Xt-i \)
Use to indicate that the random interference item in the measurement model refers to the sum of all other factors that are not included in the independent variable but the corresponding variable affects all other factors.
t: the length of time

4. Establishment of Internet Enterprise Value Evaluation Model—Taking NetEase as an Example

4.1. Case Overview
NetEase’s main business scope includes Internet application development, provision of Internet services and provision of Internet technology support. Since its inception, NetEase has been involved in Chinese search, free mail systems, online virtual communities, etc., and has independently developed many online games based on this. In recent years, NetEase’s game business revenue accounted for 73.3% of NetEase’s revenue. At the same time, NetEase also began to pay more attention to the service area, ensuring basic services and also launched NetEase Koala, NetEase Cloud Music and other projects [10].

4.2. Evaluation Base Date Selection
This article selects January 1, 2020 as the evaluation base date.

4.3. Selection of Free Cash Flow of Enterprises
According to the formula: free cash flow = profit before interest and tax × (1-tax rate) + depreciation and amortization-capital expenditure-increase in working capital, select NetEase's corresponding financial data from 2001 to 2019.
Query NetEase’s financial data in the open market and calculate the following table:

| Table 4-1. NetEase 2010-2019 corporate cash flow statement (1) (unit: 100 million yuan) |
|---------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Date                           | 2001    | 2002    | 2003    | 2004    | 2005    | 2006    | 2007    | 2008    | 2009    |
| Net profit                     | 2.33    | 0.16    | 3.23    | 4.41    | 9.32    | 12.42   | 12.64   | 15.97   | 18.37   |
| Income tax expense             | 0       | -0.02   | 0.21    | 0.29    | 0.95    | 1.32    | 0.03    | 3.01    | 3.14    |
| Interest expense               | -0.08   | -0.06   | -0.11   | -0.18   | -0.58   | -0.94   | -1.13   | -1.45   | -1.28   |
| EBIT                           | 2.25    | 0.08    | 3.33    | 4.52    | 9.69    | 12.8    | 11.54   | 17.53   | 20.23   |
| Working capital                | -1.86   | 0.27    | 3.74    | 6.14    | 11.05   | 15.96   | 13.8    | 20.18   | 20.94   |
| Net increase in working capital| 0       | 2.13    | 3.47    | 2.4     | 4.91    | 4.91    | -2.16   | 6.38    | 0.76    |
| Capital expenditure            | 0.21    | 0.13    | 0.28    | 0.6     | 0.3     | 1.43    | 0.98    | 1.62    | 6.13    |
| Depreciation and amortization  | 0.17    | 0.22    | 0.21    | 0.34    | 0.49    | 0.83    | 0       | 0       | 0       |
| Free cash flow                 | 2.21    | -1.94   | -0.42   | 1.57    | 4.02    | 5.97    | 12.69   | 6.52    | 10.2    |

Data source: Oriental Fortune Network
Table 4-2. NetEase 2010-2019 corporate cash flow statement (1) (unit: 100 million yuan)

| Date     | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Net profit | 22.32 | 32.23 | 35.87 | 44.45 | 47.96 | 68.37 | 117.93| 108.49| 86.16 | 134.7 |
| Income tax expense | 3.44  | 3.93  | 6.92  | 5.31  | 6.63  | 12.73 | 21.02 | 21.62 | 24.61 | 29.15 |
| Interest expense | -1.41 | -2.58 | -4.24 | -5.06 | -6.02 | -5.97 | -7.42 | -10.29| -5.87 | -8.22 |
| EBIT      | 24.35 | 33.58 | 38.55 | 44.7  | 48.57 | 75.13 | 131.53| 119.82| 104.9 | 155.63|
| Working capital | 28.55 | 40.73 | 42.24 | 52.36 | 58.73 | 80.77 | 154.88| 118.89| 134.16| 172.16|
| Net increase in working capital | 7.61  | 12.18 | 1.51  | 10.12 | 6.37  | 22.04 | 74.11 | -35.99| 15.27 | 38    |
| Capital expenditure | 2.98  | 4.11  | 1.79  | 2.2   | 6.18  | 10.31 | 11.4  | 25.24 | 68.37 | 33.29 |
| Depreciation and amortization | 0    | 2.93  | 2.34  | 1.58  | 1.75  | 1.83  | 3.28  | 8.02  | 20.6  | 26.14 |
| Free cash flow | 10.32 | 16.29 | 30.67 | 28.65 | 31.14 | 31.88 | 28.28 | 116.97| 17.25 | 81.33 |

Data source: Oriental Fortune Network

4.4. Modeling and Analysis Based on ARIMA-TREND Model

4.4.1. ARIMA model establishment and data analysis

(1) Model Fit Analysis

Use SPSS to perform model regression analysis, and input the above variables into the SPSS variable view in turn. NetEase's free cash flow from 2001 to 2019 is quantitatively input into the system for regression analysis.

Table 4-3. Model fit test table

| Model summary |
|---------------|
| Model | R2 | Adjust R2 |
|       |    |          |
|       | 0.692 |          |
|       | 0.782 |          |

It can be found from Table 4-3 that the model fitness test table shows that the model's fitness R2 is greater than 0.5, and the adjustment R2 is greater than 0.5 and is close to 1, so there is sufficient data to prove that the model fits well and its data interpretation ability Stronger, it is very appropriate to use this model to predict future earnings with the free cash flow of the enterprise as a variable.

(2) Stationarity test and processing

Before the formal data modeling, the stationarity test of the data should be performed at the first time. This important step is ignored. Once the data is non-stationary, various problems will occur, which will directly lead to inaccurate forecast data. Just as any theory is inseparable from certain assumptions. Therefore, the first thing to do before the follow-up work is to check the stability of the data. At this stage, the mainstream method used in the test is the unit root test. Taking the research object of this article as an example, if the free cash has a unit root, the data is not stable, and if there is
no unit root, the data is stable. Among the many statistical variables of unit root test, the ADF statistical variable is widely used. The test results are as follows:

Table 4-4. ADF stability analysis table

| Variable | ADF statistics | 5% critical value in the original sequence | Stationary conclusion |
|----------|----------------|-------------------------------------------|-----------------------|
| FCF      | -0.846950      | -3.32096                                  | unstable              |

Since the ADF test result of the free cash flow time series is greater than the 5% critical value of the original series, it is considered unstable. Therefore, it needs to be processed by first-order difference, and the processed result is:

Table 4-5. ADF stability analysis table after first-order difference

| Variable | ADF statistics | 5% critical value in the original sequence | Stationary conclusion |
|----------|----------------|-------------------------------------------|-----------------------|
| FCF      | -2.942187      | -2.841819                                 | stable                |

According to Table 4-5 ADF stability analysis table, it is not difficult to know that after the difference processing, the critical value of the ADF test result in the original sequence is that x is less than the ADF statistic, so it can be judged that the new sequence obtained is stable. You can use this data to make the next prediction. At the same time, linking the formula of the moving average autoregressive model of the appeal difference integration and the stability analysis table after the first-order difference, it is determined that the difference order is 1, that is, d=1.

(3) Determine the parameters p, q of AR and MA

According to the application process of the ARIMA model, the AR and MA data need to be analyzed and selected next, and the AR and MA values can be obtained through the function image of the residual value ACF and residual value PACF. AR is model autoregressive, p is the number of autoregressive terms, MA is the moving average of the model, and q is the number of moving average terms. Through the intuitive judgment of the function, its parameters can be directly selected.

Figure 4-1. Residual value ACF, PACF function diagram

(4) According to Figure 4-1 autocorrelation function (ACF) image and partial autocorrelation residual function (PACF) image, ACF is truncated in the fourth period, and PACF is truncated in the
third period, so the ARIMA model \((p,q,d)\) is \((4,3,1)\). In order to verify whether there is a more reasonable model, several other permutations and combinations of reference data models are tested, and finally the most reasonable data \((4,3,1)\) is selected as the final model for prediction.

(5) Under the parameters of the model \((4,3,1)\), the free cash flow of NetEase is predicted to obtain its forecast chart:

![Figure 4-2. The free cash flow forecast of an enterprise](image)

The predicted value of free cash flow of the enterprise in the next three years is obtained after the software's operation prediction of the model, as follows:

Table 4-6. Enterprise Free Cash Flow Forecast

| Year   | 2020   | 2021   | 2022   |
|--------|--------|--------|--------|
| Free cash flow | 60.97 | 93.21 | 85.73 |

4.4.2. NetEase's corporate value evaluation. The weighted average cost of capital (WACC) forecast is shown in Table 4-7. At the same time, NetEase's growth rate \(g\) was 0.0475 through open market research. Finally, the data is substituted into the income method model to determine the final evaluation value.

Table 4-7. WACC prediction table

| Year   | 2020   | 2021   | 2022   |
|--------|--------|--------|--------|
| E      | 673.38 | 737.38 | 4.35%  |
| D      | 386.28 | 429.39 | 497.57 |
| Ke     | 19.04% | 23.95% | 28.86% |
| Kd     | 4.35%  | 4.35%  | 4.35%  |
| T      | 25%    | 25%    | 25%    |
| WACC   | 0.1329 | 0.1634 | 0.1928 |

\[
W’ = \sum_{t=0}^{n} \frac{FCFF_t}{(1+WACC)^t} + \frac{FCFF_{n+1}}{WACC - g} \times \frac{1}{(1+WACC)^{n+1}}
\]

\[
= \frac{60.97}{(1+0.1329)+\frac{93.21}{(1+0.1634)}+\frac{85.73}{(1+0.1928)}+\frac{85.73}{(1+0.1973)}+\frac{1}{(1+0.1973)}}
\]

\[
= 506.4356
\]
Through calculation, it can be obtained that NetEase's assessment value on the assessment base date is 50.64356 billion yuan.

5. Conclusion
At present, most Internet companies are in the start-up or growth stage, and the existing basic financial data is not enough to support the needs of Internet enterprise value evaluation, nor can it accurately reflect the value of the enterprise. However, the future growth trend of the enterprise is the main Internet enterprise value evaluation. Through the analysis of the ARIMA model, the paper clarifies the advantages and effectiveness of the model in predicting the future cash flow of Internet companies, and can make up for the limitations of traditional methods to a certain extent. However, the growth of Internet companies is still affected by many factors. Therefore, the value evaluation system of Internet companies needs to be further improved and optimized.

References
[1] Wang Yatong. Research on expected return based on time series model. Hebei University of Economics and Trade, 2019.
[2] Yang Haimin, Pan Zhisong, Bai Wei. Review of time series forecasting methods. Computer Science, 2019, 46(01): 21-28.
[3] Zhi Minsi, Hu Qianwen. Research on rice target price insurance based on ARIMA price prediction model. Modern Economic Information, 2019(24): 319-321.
[4] Lv Shurui. Research and forecast of securities interest rate time series based on ARIMA model. Journal of Science & Technology Economics, 2019, 27(14): 188.
[5] Zhao Qiang. Exploring the three major issues in the evaluation of the enterprise value income method . China Accounting Journal, 2018-07-13(007).
[6] Wang Jingya. Research on enterprise value evaluation in the pharmaceutical industry based on free cash flow method . Henan University of Economics and Law, 2017.
[7] Li Baochan, Wang Siying, Lin Junliang. Analysis of the Income Method of Enterprise Value Evaluation Based on ARIMA-TREND——Taking the Value Evaluation of Company A as an Example Coastal Enterprises and Technology, 2018(04): 36-41.
[8] Zhang Qi. Prediction of free cash flow of enterprises in enterprise value evaluation based on ARIMA model . Hebei University of Economics and Trade, 2018.
[9] Ren Dongsheng. A case study on the corporate value evaluation of M company based on the modified ARIMA model . Liaoning University, 2019.
[10] Ou Xiaolong. Comparative analysis of Wanda Commercial and Evergrande Real Estate based on FCFF valuation . Chongqing University, 2017.