An Evaluation of the DDM Model and FCFF Model Using in valuing the Large Listed State-owned company——Taking China Mobile as An Example

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Abstract. This article introduces the basic role and methods of company valuation and then link the valuation of the listed company to the value of its stock. Listed state-owned companies hold an important position in the Chinese financial market. This article evaluates the advantages and disadvantages of the dividend discount model and the free cash flow to the firm model in the valuation of large listed state-owned companies. Taking China Mobile as an example, two models were used to calculate the value per share and compare it with the value per share evaluated by authoritative institutions. The results obtained from both models overestimate the value of the company's stock, with FCFF having a larger error and is almost ineffective in valuing China Mobile. This is related to the special nature of China Mobile, like the cyclical characteristics of this company and its functions of infrastructure construction. And it also related to the COVID-19 epidemic in 2019-2022.

Keywords: company valuation, dividend discount model, free cash flow to the firm model, infrastructure construction with non-profit, cyclical.

1 Introduction

Company valuation refers to evaluating a company's intrinsic value by focusing on the company itself. The intrinsic value of a company is determined by its assets and profitability [1].

Company valuation is a prerequisite for conducting financial activities targeting a company in the financial market. When investment institutions inject funds into a company, they usually do so in the form of owning equity in the company. The value of the equity held mainly depends on the company's value. How much is a developing enterprise worth? This is a question worth discussing extensively. At the same time, accurately assessing the intrinsic value of the company and its industry to determine pricing standards for various transactions is beneficial for the efficiency of the financial market.

For investors, conducting company valuation based on financial models is an important research method. Models can transform our abstract understanding of industries and companies into concrete and quantifiable investment plans. Therefore, it can predict the impact of company strategy and actions on its value [2]. Through the model, investors can gain a deeper understanding of the interactions between various variables

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related to company value. Adopt this method. It can promote the company's pragmatic style and contribute to the formation and development of its core competitiveness. Please note that the company's financial model and valuation are important ways to achieve this ultimate goal.

2 The IPO pricing and company valuation

IPO pricing is the price determined jointly by the company and its underwriters for the initial public offering of shares to specific or unspecified investors.

Everyone believes three points of IPO pricing. Firstly, IPO pricing and company valuation cannot be equated. Secondly, the valuation of a company is the basis for IPO pricing [3], which can be roughly divided into two parts. One is to use models or quantitative analysis to determine the company's value, that is, the company's valuation. The other part is determining the factors that affect the price by selecting an appropriate release mechanism to finalize the price and, ultimately, price discovery. Thirdly, the contradictions faced in company valuation and IPO pricing are different. IPO pricing is the result of the interaction among the company valuation, underwriters, and investors, while valuation mainly solves the contradiction of information asymmetry

The securities and financial market are an important component of the national economy, and listed companies are the cornerstone and core of the securities market. In China, a group of companies is significant in scale and related to the construction of national infrastructure and the core of the national economy [4]. They have become listed state-owned companies. The valuation of these companies, which will be ultimately shown in their stock valuation, is becoming increasingly important.

3 Two methods of valuation

3.1 Overall introduction

Valuation is a comprehensive assessment of listed companies, whether macro analysis, capital market analysis, industry analysis, or financial analysis. The discount method is an important approach in company valuation theory.

The valuation of corporate equity is based on a universally recognized theoretical framework, and it also depends on the future benefits of that portion of equity. The future benefits should be discounted at an appropriate discount rate. Up to now, valuation discount models can be classified into three types: dividend discount model, free cash flow discount model, and earnings discount model. These methods are the most complete and rigorous systems in theory and logical reasoning, and they are widely adopted in practice, but different models also have their shortcomings. This paper mainly discusses the dividend discount model and free cash flow model in the discount method.

3.2 The dividend discount model

The dividend discount model was firstly proposed by Williams in 1938, which holds that the value of a stock is equal to the present value of the dividend income that the holder expects to receive during the company's operating period, calculated at an appropriate discount rate. This is widely recognized as the most basic valuation model. However, due to the current development status of China's capital market and other reasons, dividend policy is more of a subjective decision-making behaviors of company management, and the distribution of dividends is not necessarily related to value. The phenomenon of profitable companies not paying dividends and loss-making companies paying dividends often occurs, making this model sometimes inadequate.

3.3 The free cash flow to the firm model

The free cash flow model is a valuation method that comprehensively considers the impact of time series and the category of company investments. It calculates the sum of the present value of the company's future free cash flows at different stages using an appropriate discount rate, and excludes the debt undertaken by the company to obtain the stock value representing the company's investment and development capabilities. The premise of this model is a complete financial market, in which there is a long-term unchanged system and a relatively stable operating environment [5]. If the company can continue to grow, if investors are rational and have consistent expectations, pursuing the maximization of benefits, this model can work out. The problem lies here, as the model is not applicable to companies with primary objectives other than earning profits, nor is it suitable for situations where the economic cycle conflicts with the company's business cycle. In this model, some companies are suitable for FCFF model, while others are suitable for FCFE model, depending on the data provided in the company's annual report and company size.

4 China Mobile is an example worth discussing

China Mobile is one of the world's largest mobile communication service providers, providing diversified services such as communication services, cable broadband, and Internet [6]. China Mobile China Telecom and China Unicom constitute the three major state-owned enterprises operating in China's communication network.

China Mobile has the following five characteristics that make it a suitable example.

First, as a company rooted in the country and oriented towards infrastructure construction, it has multiple subsidiaries and a stable funding chain. It continuously provides a certain percentage of dividends for the stock market and demonstrates the company's value by evaluating stock value. Second, the cash flow from personal expenses and income is huge, and the funds used for dividends are also huge, which can avoid fluctuations caused by small data and make the two models have more minor deviations in calculations. Third, it provides standardized and searchable financial quarterly and annual reports with complete data. Fourth, in its business field, it dominates the market and resources with two other companies [7]. The three companies operate the same

business, which is regulated by both the market and the state, so there will be no fierce competition, and it will not have a significant impact on annual revenue. Fifth, the main business of the operation is communication networks and signal networks, which belong to the primary industries with stable demand and no significant changes. Regardless of the overall economic situation, there is a basic guarantee for annual revenue. At the same time, with the support and backing of the country, there will not be a significant decline.

5 DDM model with China Mobile

When valuing ordinary shares using the dividend discount model, the most straightforward approach assumes that the dividend per share (DPS) grows constantly yearly—typically based on historical DPS growth rates. PV of a constantly growing stream of dividends is given by Equation (1).

$$PV_0 = \frac{DPS_1}{r - g} \tag{1}$$

DPS_1 is the dividend per share one year in the future, and g is the growth in dividends. In this case, it will be the average growth rate. r is the return required by ordinary shareholders. In this case, it will be the return on invested capital.

Table 1. The analysis of DDM

(million yuan)	2023	2022	2021	2020
Dividend	131766	125459	116148	107843
Growth rate	5.0%	8.0%	7.7%	1.1%
(million yuan)	2019	2018	2017	2016
Dividend	106641	117781	114279	108741
Growth rate	-9.5%	3.1%	5.1%	0.2%

Taking into account the impact of the COVID-19 epidemic, the maxima and minima have been removed. And the average growth rate is 3.7% (Table 1) [8]. China Mobile's return on invested capital for fiscal years ending December 2019 to 2023 averaged 7.7%. Assumed that this is the cost of capital equity for China Mobile. China Mobile issues 21449.84152 million shares annually. Between them, 7.59 million shares are Current share capital.

DDM is a commonly used quantitative model for valuing companies over a timeline. The basic principle of this model is that the current price of a company's stock is equal to the total future dividends that the company can predict, taking into account time series discounting [9]. It takes both dividend payment factors and expected market returns into account.

Estimating the future of a company is not easy. Analysts may make some assumptions, such as dividend payments growing at a fixed rate each year. These can help identify trends based on past dividend payment history to estimate future dividends. If we assume that China Mobile had a fixed dividend growth rate before becoming permanent, this reflects two points. One is that China Mobile has predictable cash flows for almost unlimited time in the future. The second is that future cash flows can follow

certain patterns, and the final calculation can be simplified by segmenting time and taking the average within each time period. During this period, the constant dividend growth rate was 3.7%.

Using Gordon's growth model in the dividend discount model, the value of stock is represented as Equation (2).

$$value\ of\ stock = \frac{the\ expected\ dividend\ per\ share}{cost\ of\ capital\ equity - dividend\ growth\ rate} \quad (2)$$

In this case, the dividend per share in 2023 is 6.143 RMB, so the expected dividend per share in 2024 will be 6.370 RMB. The cost of capital equity is 7.7%, and the dividend growth rate is 3.7% so the stock value will be 159.25 RMB. According to data from Sina Finance, a highly authoritative evaluation agency, the value of stock for China Mobile in 2023 is 122.16 RMB. In this case, the DDM model overestimates the company's value, but the error is relatively small.

6 FCFF model with China Mobile

The formula of this model is shown by Equation (3).

$$FCFF = EBIT - Tax + Depreciation - net\ change\ of\ working\ capital - capital\ expenditure. \quad (3)$$

In order to forecast the FCFF in the future, there should be a constant and stable growth rate of FCFF, which could be predicted by the past eight years date of China Mobile. When using FCFF, the WACC of China Mobile is used as the discount rate.

Table 2. The analysis of FCFF

(million RMB)	2023	2022	2021	2020	2019	2018	2017	2016
EBIT	170,531	162,872	152,184	142,359	142,133	153,895	148,137	144,462
tax	38,596	37,278	35,878	34,219	35,342	35,944	33,723	35,623
depreciation	207,132	200,077	193,045	172,401	182,818	154,154	150,295	138,589
net change of working capital	16,505	-90,189	-49,246	-5,330	7,081	32,504	-22,042	22,597
capital expenditure	180,312	185,278	184,234	183,467	165,900	166,100	162,832	150,300
FCFF	142,250	230,582	174,363	102,404	116,628	73,501	123,919	74,531
the growth rate of FCFF	-38%	32.2%	70.3%	-12.2%	58.6%	-40.6%	66.2%	38.2%

Table 3. information of China Mobile

average growth rate	39.4%
WACC of China Mobile	2.86%
value of the ordinary share (million RMB)	396,433.5
value of each ordinary share (million RMB)	522.310

To avoid the influence of COVID-19, the maxima and minima have been removed. And the average growth rate is 39.4% (Table 2 and Table 3) [8]. The country mainly controls China Mobile, and the company's liquid capital is used for free issuance to ordinary shareholders. So, it will be 7.59 million shares of ordinary share capital.

FCFF represents the operating cash flow that can still be distributed after experiencing depreciation expenses, taxes, capital expenditures, investments, and debts. In other words, it demonstrates the cash available for further investment after the company has paid all related business costs and invested in long-term assets [10]. FCFF has considered that the company's cash outflows after revenue and expenses will be used to develop existing businesses, which requires multiple reinvestments. After completing all these operations, the remaining money represents the FCFF available for the company to dispose of.

Free cash flow can be said to be the most important financial indicator of a company's stock value. The value of stock is closely related to the total expected future cash flows of the company. Understanding a company's FCFF can allow investors to test whether it meets their needs or not. Meanwhile, FCFF also represents the company's ability to pay dividends and repay debt holders, which is an important indicator of risk tolerance.

A positive FCFF value indicates that the company still has cash after expenditure. A negative FCFF value indicates that the company has not generated enough revenue to cover its costs and investment activities. In this case, calculated by FCFF model, the stock value is 522.310 RMB, much higher than 122.16 RMB. In this case, the stock value is 522.310 RMB, much higher than 122.16 RMB. The excessive error indicates that this model is ineffective for the valuation of China Mobile.

7 Result analysis

7.1 Both methods overvalue the China Mobile

Both the DDM and FCFF models overvalue the China Mobile. That is because g is in the denominator position in the calculation formula of DDM. The deviation of g estimation will significantly impact the company's valuation. Here, g is taken as the average value after removing the range from 2023 to 2016. It turns out that the dividends have experienced negative growth in some of the years. This is due to the impact of a huge grey rhinoceros: COVID-19. In the main years of 2019 and 2020, China Mobile's dividends were significantly reduced. Still, in adjacent years, due to the slowdown of

the impact of the epidemic and the economy's recovery, dividends have increased significantly. Such fluctuations make it difficult to predict the future g.

Meanwhile, China Mobile is not always focused on profitability as its primary objective. In 2018 and 2019, the rise of 5G technology accelerated the iteration of China Mobile's technology [11], increased spending on real estate and technological innovation, and naturally reduced stock dividends. China Mobile is responsible for the construction of national infrastructure and network communication. When faced with significant national policies, it will adjust its development goals, resulting in positive and negative fluctuations in dividends.

Due to the grey rhino incident, g may have been underestimated, adding uncertainty to future dividends. Since China Mobile's infrastructure construction is not profit-oriented, the theoretical estimate should be lowered to adapt to China Mobile's unique position.

7.2 FCFF model is ineffective for China Mobile

This result has two reasons. The first reason is that China Mobile's expenditure and income are cyclical rather than linear. People follow the assumption of instalment when making financial statements, dividing the company's operating cycle into annual and quarterly units. However, instalment reports often do not match the company's operating cycle, especially for companies with infrastructure attributes like China Mobile, where many investments and expenditures require a longer timeline to generate final returns. Therefore, in Table2, China Mobile’s cash flow is sometimes insufficient. For example, a non-cyclical and cyclical company may have an average annual profit of 200 million in the next twenty years. However, the valuation of a non-cyclical company maybe 5 billion, while the valuation of a cyclical company may only be 2 billion or even 1 million. What leads to this? From a profit perspective, there is no problem. But the reason lies in the time. Cyclical companies often need to increase working capital and long-term operating assets to achieve the same level of profitability [12]. In order to obtain the same net present value income, the free cash flow of cyclical companies is much lower than that of non-cyclical companies. Companies like China Mobile may need extensive and longer FCFF data to obtain more accurate estimates. However, the elongation of the year will increase the impact of various factors on FCFF data, so FCFF will always be inaccurate here.

The second reason the FCFF model is inefficient here is that China Mobile's expenses are rigid. Like airlines or power companies, China Mobile must ensure sufficient and stable capital expenditure every year [13]; otherwise, there is a risk of a collapse of the communication network. Therefore, whether it is a decrease in income caused by the epidemic or in other years when income has declined, China Mobile must allocate a considerable amount of funds for infrastructure maintenance and construction, as well as for personnel salaries and related costs. This will cause FCFF to fluctuate between positive and negative. At the same time, China Mobile's listed company has multiple subsidiaries that operate various enterprises, from hardware to software. This makes many data only estimates or averages, and FCFF requires many data, most of which will have errors compared to reality.

7.3 other factors that influence the valuation

In practice, valuation is influenced by both macro and micro factors, and after considering the first two factors that affect China Mobile, there are other factors as well.

Firstly, the macro attributes of a company are commonalities rather than characteristics, such as its size, market share, capital structure, and corporate governance. Especially the internal asset structure and company management system, they determine the allocation of company resources, and therefore also determine the source of motivation for company members to contribute. These factors will play a comprehensive role. Companies with large scale, high market share, and sound corporate governance have better pricing advantages and lower operational risks [14]. Companies with sufficient cash flow and reasonable capital structure have lower financial risks, which represents the potential for rapid development.

The second is the industry in which the company operates. The type of industry and profit cycle determine the company's development model and competitive structure. Some industries may have natural monopolies, while others require policy monopolies, both of which can bring stable growth in profits [15]. Traditional and highly competitive industries, such as civil engineering and machinery manufacturing, have low profitability but higher operational risks and more fragile cash flows. China Mobile is shifting from the traditional communication industry to high-tech industries and new era communication technologies, which plays an important role in its valuation.

The third is the expectations of investors. Expectation is a comprehensive reflection of investors' consideration of trading systems, macroeconomic factors, micro attributes of companies, and other factors. It mainly reflects investors' preferences and tolerance for risk, as well as their profit needs.

8 Conclusion

The valuation analysis of large listed state-owned enterprises in China plays an important role in the country's economy and society. The discount method is generally used for companies with large amounts of funds, and the DDM and FCFF models are discussed in detail. In the case of China Mobile, the DDM model plays a more applicable role than the FCFF model, mainly due to the periodicity and infrastructure attributes of mobile companies, as well as the disturbance of the COVID-19 epidemic. To deal with companies with different characteristics, it is necessary to use valuation methods reasonably and compare the results between different methods to obtain new results.

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