

Study on the Application of The Income Approach in The Valuation of Road Toll Rights

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Abstract: Highway toll rights are intangible assets dependent on the physical assets of highways, and their value assessment differs greatly from that of general intangible assets. On the basis of elaborating their special characteristics, this paper analyses the theoretical basis and calculation model of the present value of revenue method in the valuation of highway toll rights, and puts forward policy and technical suggestions for the future application of the revenue method in the act of transferring toll rights.

Keywords: Road toll rights, Asset valuation, Present value of revenues approach.

1. Introduction

Since the end of the last century, the transfer of highway toll rights and interests has gradually developed, and after only twenty years of exploration and practice, the transfer of toll rights and interests has revitalized a large number of highway assets, which has given a strong impetus to the rapid development of China's highway transportation industry. Since the transfer of road toll interests is an intangible asset, it will certainly involve the valuation of toll rights, which raises a series of questions such as what is the difference between the valuation of toll rights and the valuation of general intangible assets, why the Measures for the Transfer of Toll Road Interests stipulate the use of the present value of earnings method to assess its value, how to use the present value of earnings method for assessment and what are the shortcomings of using the present value of earnings method for assessment. In this paper, the author will draw on the experience of the former In this article, the author will draw on the research results of previous authors to provide some insights and opinions on these issues.

2. Special Characteristics of The Valuation of The Transfer Value of Road Toll Rights

It has only been more than twenty years since the emergence of toll right transfer activities in China, and the relevant research is still in its initial stage. During this period, China has successively promulgated the Measures for the Administration of Paid Transfer of Highway Operation Rights (Ministry of Communications Decree No. 9 (repealed)), the Highway Law of the People's Republic of China (President's Decree [2004] No. 19) and the Measures for the Transfer of Interests in Toll Roads ([2008] No. 11) to regulate the act of transferring interests in toll roads, which to a certain extent protects the interests of both parties to the transfer of interests. However, these laws and regulations only provide for the transfer of highway toll rights in a suggestive manner and the valuation methods to be chosen, but do not provide for specific matters. As a result, in the actual valuation process, appraisers often lack expertise in the transfer of highway toll rights, which makes the valuation of highway toll rights deviate significantly. In the author's view, compared to

general intangible assets, the valuation of road toll rights has certain special characteristics and the valuation methods chosen should be different.

There is almost no correspondence between the value of general intangible assets and their actual cost, while the road toll right is a special intangible asset relying on the physical assets of the road, and its profitability is closely related to the geographical conditions and technical level of the physical assets of the road. In addition, the transfer of toll rights and toll rates are subject to the review and approval of relevant government departments, and operating enterprises do not have the right to decide on their own; at the same time, the state has also stipulated the transfer period, and the value assessment can only be carried out within a certain period of time. These special regulations in respect of road assets have resulted in a wide variability in the appraised value.

In general, one or more of the income method, cost method and market method can be used in the valuation of intangible assets, while in view of the special nature of the valuation of road toll rights, the national policy on the selection of the valuation method of road toll rights has also undergone a change from "using a combination of the present value of income and replacement cost method" to "the valuation method should adopt the present value of income method". The national policy on the choice of valuation method for road toll rights has also undergone a change from "adopting a combination of the present value of revenue and replacement cost methods" to "the valuation method shall adopt the present value of revenue method". The State stipulates that only the present value of revenue method can be used for the valuation of road toll rights, which has its theoretical basis.

It is known from previous studies that the object of valuation of road assets is the road toll rights rather than the road physical assets themselves. The main purpose of valuation is to determine the future profitability of the toll rights and the evaluation criterion is the present value of expected future earnings. According to asset valuation theory, the choice of valuation method depends on the valuation object and the valuation purpose. The present value of earnings method is precisely to estimate the value of intangible assets by discounting the excess earnings that the intangible asset will bring to its investors within a certain period of time. In other words, when the road toll right is

transferred, the transferee is more concerned with the profitability of the toll operating right, not the actual cost of the physical assets consumed by the road; the road toll right can bring revenue to the transferee after the transfer, and the transferee pays no more than the discounted value of the expected revenue that the road toll right can bring to it. Therefore, the use of the present value of revenue method to assess the value of the transfer of highway toll rights, the assessment results are more easily accepted by both parties to the transfer, is the most preferred method of assessing the value of toll rights. This is also in line with the policy spirit of the Measures for the Transfer of Toll Road Interests issued by the Ministry of Communications and the Ministry of Finance.

3. Analysis of the Valuation Model for The Present Value of Earnings Method

The basic formula for the valuation of road toll rights using the present value of revenues method is:

$$P = \sum_{t=1}^n \frac{A_t}{(1+i)^t}$$

Where P is the appraised value of the fee right; A_t is the expected return value in year t, i.e. the net cash inflow in year t; i is the financial discount rate; and t is the term of the fee right transfer (in years).

This is a common formula for valuing assets, and in practice, it can be distinguished as (1) different returns in the first few years, with returns remaining the same in subsequent years; (2) increasing or decreasing returns in equal steps in future benefit years; (3) increasing or decreasing returns in equal steps in future benefit years, and many other cases, simply by transforming on the basis of the common formula.

Specifically for the valuation of road toll rights, which method should be chosen? The author believes that, at present, China's highway toll right transfer period is generally as long as 20 to 30 years, the future of various factors can not be determined, to accurately predict the annual revenue value is impossible, therefore, taking into account the special nature of highway right revenue, can use the way of segmentation for value assessment. Generally speaking, the change in road traffic flow shows a certain pattern, i.e. the traffic flow grows rapidly after the road is completed and opened to traffic, reaching the design standard in about 10 years, and the expected return in these 10 years needs to be accurately predicted and discounted and accumulated year by year; thereafter, the traffic flow will be maintained at this level, assuming that the toll rate increases year by year at a certain growth rate, but taking into account the inflation rate and the fact that the traffic flow may decrease later due to the rate. However, considering that the inflation rate and the traffic volume may decrease in the later years due to the rate increase, offsetting the rate increase, the final revenue is still stable at a certain level, for the convenience of calculation, we can assume that the expected revenue in the later years is equal. Based on the above analysis, the author believes that when using the present value of revenue method to assess the value of road toll rights, it is most appropriate to transform the formula according to the first form mentioned above. That is:

$$P = \frac{A_1}{(1+i)} + \frac{A_2}{(1+i)^2} + \dots + \frac{A_m}{(1+i)^m} + \frac{A_m}{i(1+i)^m} \left[1 - \frac{1}{(1+i)^{n-m}} \right]$$

where the expected return in year m and all subsequent years is A_m .

From the above analysis, it can be seen that the use of the present value of earnings method to assess the value of road toll rights involves three important indicators: (1) the expected return A, (2) the toll period n, (3) the financial discount rate i. In order to improve the practicality of the present value of earnings method in the evaluation of road toll rights, the author briefly analyses the uncertainty of the three elements.

3.1. Forecasting of expected return values

In the valuation of road toll rights, the author believes that future net cash flow is a more reasonable way to determine revenue, with the net cash inflow in each future year being the balance of road toll revenue less maintenance costs, management costs, taxes and fees and various other expenses. Toll revenue is generally the product of the volume of traffic charged by vehicle type and the respective toll rates. In calculating the relevant deductions for costs and expenses, it is important to note that interest charges and expenses that fall within the scope of a road operating business should not be included.

3.2. Determination of the fee period

In accordance with the provisions of the Measures for the Transfer of Interests in Toll Roads, the maximum cumulative toll collection period for the transfer of operating highway toll rights shall not exceed 25 years, and the maximum period shall not exceed 30 years in the central and western provinces and municipalities as determined by the State. It is thus clear that the State has set a restrictive limit on the number of years for the transfer of road toll rights, and the specific number of years for the transfer is the result of a mutual agreement between the transferring parties and the asset appraisal agency within this range. However, this agreement is not arbitrarily determined. In the case of an investor, the transfer term can be considered as the dynamic recovery period of the road segment, so that the transfer term is M, according to the formula

$$\sum_{t=1}^M \frac{A_t}{(1+i)^t} = P$$

Assuming that the net cash flows are equal in each year, i.e. $A_1=A_2=\dots=A_M=A$, then

$$M = \frac{\ln A - \ln(A - Pi)}{\ln(1+i)}$$

As can be seen, although the scope of the road tolling period is regulated by the State, for investors, if the actual period of transfer is shorter than their dynamic payback period, investors will lose their incentive to invest in the right to be transferred to that road toll.

3.3. Determination of financial discount rate

The financial discount rate used in the assessment of the value of road toll rights in the present value of earnings method can be considered as the expected rate of return of the transferee or the rate of return on investment of the transferor

at the time of investment. The regulations relating to the transfer of road toll rights do not specifically involve provisions on the financial discount rate. According to the relevant principles of financial management, the rate of return on investment can be divided into two parts: risk-free rate of return and risk-based rate of return. Namely

$$r = R_g + (R_m - R_g) \times \beta$$

where r is the discount rate, R_g is the risk-free rate of return and R_m is the average market rate of return.

This is the basic model for calculating the rate of return in financial management theory, which has a certain reference role in determining the financial discount rate in the valuation of road toll rights. However, in the actual operation process, it can be considered that the asset appraisal agency does not establish a complex mathematical model to calculate the financial discount rate of this indicator, its value is often "the result of bargaining between the two sides of the road toll right transferee, can also be called 'fair rate of return on investment' ". Therefore, the author believes that, when assessing the value of road toll rights, it is not necessary to use complex mathematical formulas to calculate a so-called precise but possibly unacceptable discount rate value for both sides of the transaction, and both sides of the transaction can negotiate based on their respective knowledge of risk-free rate of return and risk-reward theory, and use this as the main basis for determining the discount rate.

4. Deficiencies of the Income Approach to Valuing Road Toll Rights

The Transfer of Rights and Interests in Toll Roads Act stipulates that the present value of revenue method shall be used as the valuation method. This does not mean that the present value of revenue method is perfect in assessing the value of road toll rights, which is affected by various factors and there are some shortcomings in the application of the revenue method, mainly in:

4.1. Uncertainty in the choice of parameters

According to the valuation ideas of the income approach, the key point in assessing the value of the toll rights is the forecast of the future revenue of the road and the selection of the financial discount rate, and the determination of these two factors is highly subjective, where the financial discount rate can be obtained indirectly through the expected revenue, so the forecast of the revenue becomes the most important. In forecasting the amount of return, the volume of traffic, which determines the annual net cash inflow, is the main factor affecting the expected return. The size of the traffic flow depends on the level of economic development of the region and the status of the road grade, and the level of economic development depends to a certain extent on the inclination of national policies, while the transfer period is generally as long as 20 to 30 years, during which the state will introduce what kind of policies, highway construction and expansion plans are also unknown, and there is no relevant successful experience for the transfer of toll rights to learn from. Therefore, how to accurately predict the traffic flow is a difficult problem for the present value of revenue method to assess the value of toll rights, still need scholars to conduct in-depth exploration and establish a suitable prediction model.

4.2. The relevant system for income approach valuation has not yet been established

The appraisal of road toll rights is a highly professional appraisal business, requiring appraisers to be proficient in both asset appraisal knowledge and familiar with toll road policies. In practice, such talents are few and far between, and it is difficult for general appraisers to grasp the uncertainty of the changing social situation in the country, and they tend to conduct appraisals based on general intangible asset valuation theories. In addition, the valuation of road assets in China has not yet established the relevant normative standards for the valuation of toll rights, and appraisers do not have a reliable theoretical basis to support their valuation using the income approach, which leads to significant differences in valuation results between different personnel and cannot truly meet the valuation needs of both parties to the transaction.

5. Suggestions for the Future Application of The Income Approach to The Valuation of Road Toll Rights

5.1. Policy recommendations

In view of the fact that the Measures for the Transfer of Equity in Toll Roads do not make detailed provisions on the valuation of toll rights, and in view of the current lack of a theoretical system relating to toll rights in China, it is suggested that the relevant authorities issue corresponding guidelines to regulate relevant factors such as traffic flow forecasts, the determination of financial discount rates and the determination of expected revenue, so as to provide a theoretical basis for appraisers and to reduce to a certain extent the valuation of toll rights. The Government and the asset appraisal industry should also be consulted. At the same time, it is also necessary for the government, asset valuation groups and other organisations to work together to gradually establish relevant laws and regulations for the valuation of toll rights, to regulate the order of the toll rights valuation market, to strengthen government supervision and to prevent the loss of state-owned assets. In addition to regulating theoretical and methodological approaches to asset valuation, China also urgently needs to cultivate relevant professional and technical valuation talents. Consideration can be given to establishing a nationwide professional and technical qualification examination system for the valuation of road toll rights, so as to implement qualification management for valuation personnel and ensure professionalism and technicality in the valuation of road toll rights.

5.2. Technical recommendations

The establishment of the relevant institutional system requires a long-term process and cannot be achieved overnight. Therefore, considering the current valuation needs, we can first make improvements in the valuation techniques. In assessing the value of road toll rights using the income approach, the result obtained cannot be equal to the actual value of the toll rights, but can only be an approximate figure. In the author's view, a benchmark floating ratio can be introduced when using the present value of income approach to make the assessment result more in line with the actual. The benchmark floating ratio is determined by experienced appraisers based on a large amount of historical appraisal data and should be fixed and very small, e.g. $\pm 10\%$. So how should

the benchmark float be determined in practice? In the author's view, it is inappropriate for either party to the transaction to determine it. It can be determined by government departments on the basis of consultation with all parties, and each appraisal agency will choose a suitable range within that range for the actual situation.

6. Conclusion

This paper addresses the specificities of valuing road toll rights, explains the specific application of the present value of earnings method in its valuation, and puts forward policy and technical recommendations to address the shortcomings of the earnings method of valuation. Through the discussion in this paper, we hope to provide some reference for related research. In the future, we still need to continue to conduct in-depth exploration and research to find long-term effective ways to protect the rights and interests of both assignees to a

certain extent, balance the risks of both parties, and provide ideas for the establishment of a standardised system for the valuation of fee rights in the future.

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