Discussion on EVA Performance Evaluation Standard of Central Enterprise Based on WACC Valuation

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Abstract: Weighted average cost of capital (WACC) is a method of calculating a company's cost of capital by weighting the weight of each type of capital to the total source of capital.Economic Value Added (EVA) is the net operating profit after tax of an enterprise minus the opportunity cost of all invested capital including equity and debt. Given the "one-size-fits-all effect" of WACC in the evaluation of central enterprises' performance, this paper uses PetroChina as an example to verify whether there is an "inflated" or "overestimated" EVA in the evaluation of central enterprises' performance through the valuation of WACC. The results show that the relatively small WACC in EVA performance evaluation directly leads to the EVA overstatement of PetroChina. National industries are classified according to the competitiveness of industries in terms of economic value added creation and contribution. Replacing the current EVA evaluation criteria with EVA rate evaluation criteria or Delta EVA evaluation criteria is a more practical idea to solve the problem of "overstated" or "overestimated" national EVA.

1 Introduction

Ohlson J A. Earnings [1] found that the four revisions of EVA mark a change in the thinking of the State-owned Assets Supervision and Administration Commission (SASAC) on the business performance assessment of principals of central enterprises. That is to say, it is from the initial EVA performance appraisal oriented at setting budget target value, to the EVA performance appraisal oriented at overall budget management. Finally, it turns to the state-owned capital quality, efficiency, and scientific development-oriented EVA performance appraisal central enterprises.

Modigliani [2] found that the weighted average of "all-in-the-world effects" refers to the "three non-considerations" that apply to the current assessment system. Under this concept, WACC machinery is unified as the average cost of capital for different Chinese central enterprises in EVA performance evaluation. In addition, there are three grades: basic cost of capital (5.5%), reduced cost of capital (4.1%) and increased cost of capital (6.0%). The empirical analysis by Yangyang [3] shows that among the thirteen industries in China, the cost of equity capital was 9.61% over the ten-year period, which is an issue worth exploring. The base capital cost ratio (5.5%) is 9.61%, a decrease of 4.11 percentage points; (a) is the floating capital cost of 3.61 percentage points at 6.0%; an average decrease of 4.41%. The above three are underestimated on average by [2.61%, 8.13%], while the average underestimation is 5.37%. If these three ratios are compared with WACC, which takes into account creditors' equity, the average ratio of these three ratios in the performance assessment of central enterprises will be significantly lower. This not only biases the usefulness of the EVA assessment system but also deviates from its substance.

Based on the above analysis, and on the premise of sorting out the mechanism and difficulties of EVA performance assessment for the heads of central enterprises, this paper empirically proves whether EVA is "inflated" or "overestimated" through the estimation of WACC, combined with the basic data of PetroChina. Finally, the basic ideas and methods to solve EVA "inflated" or "overestimated" are proposed.

2 Eva Performance Appraisal Mechanism for Principals of Central Enterprises

2.1 Basic Method of EVA Calculation

According to the EVA assessment rules attached to the Interim Measures for The Assessment of Business Performance of The Heads of Central Enterprises, EVA is the balance of the after-tax net operating profit of central enterprises minus the cost of capital. Net operating profit after tax refers to the net profit in the income statement adjusted for taxable income and tax and expenses, and the cost of capital is equal to the adjusted capital and the average cost of the capital product. Adjusted average equity capital can be further combined with average total debt and average minus interest-free and average current liabilities and construction works [4]. That is:

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$$\begin{aligned}\text{EVA} &= \text{Net operating Profit after tax} - \text{Cost of Capital}\\ &= \text{Net operating profit after tax}\\ &- \text{Adjusted capital}\\ &\times \text{Average Cost of Capital ratio (WACC)}\\ &= \text{Net profit} + (\text{Interest expense} +\\ &\text{R\&D expense adjustment}) \times (1 - 25\%) -\\ &(\text{Average owner's equity} +\\ &\text{Average Total Liabilities} - \text{Average non} -\\ &\text{interest bearing current liabilities} -\\ &\text{Average under construction}) \times\\ &\{(\text{Cost of equity ratio} \times\\ &\text{ratio of equity to total capital}) +\\ &(\text{Debt cost of capital ratio} \times\\ &\text{ratio of debt to total capital}) \end{aligned} \quad (1)$$

Further, combining with the calculation of net operating profit after tax major adjustment items (debt interest expense, various accounting reserves, deferred tax, long-term investment expenses, net non-operating income and expenditure, subsidy income) and the calculation of the capital occupation of the main adjustment items (interest-free current liabilities, construction in progress, various accounting provisions, net non-operating income and expenditure, subsidy income) to deduce and adjust formula 2.

The formula commonly used in practice for EVA calculation can be obtained:

$$\text{EVA} = \text{D} + (\text{E} + \text{F} + \text{G} - \text{H} - \text{I})\text{x}(1 - 25\%) - [\text{C} + \text{B} - \text{J} - \text{K} + (\text{G} - \text{H} - \text{I})]\text{x}\left\{\frac{\text{B1}}{\text{AXCDC}} + \frac{\text{CI}}{\text{AxCEC}}\right\}\text{x}(1 - 25\%) \quad (2)$$

$$\text{WACC} = \left\{\frac{\text{B1}}{\text{AXCDC}} + \frac{\text{xC1}}{\text{AxCEC}}\right)\text{x}(1 - 25\%) \quad (3)$$

A for different annual year-end total assets; B said not same year's average debt; B1 represent the different annual total amount of liabilities; C represent different annual average total net; C1 said at the end of the annual total net assets; different D represents a different annual net profit; E represent different interest expense total annual spending; F represents the r&d expenses adjusted in different years; G shows the non-operating expenses in different years; H represents the non-operating income in different years; I represents the subsidy income in different years; J represents the average non-interest bearing current liabilities in different years; K represents the average total amount of construction under construction in different years; CEC represents the Cost of Equity Capital (CEC) and CDC represents the Cost of Debt Capital (CDC).

Therefore, on the premise of determining the data of central enterprises A, B, C, D, E, F, G, H, J, K, CEC and CDC in different years, relevant data can be imported into Formula 3 to estimate EVA of central enterprises in different years. This is the basic mechanism for assessing the EVA performance of the principals of central enterprises and the basic idea of estimating the EVA of central enterprises.

2.2 Core and Difficult Points of EVA Calculation

In Formula 2, the measure of CEC is the difficulty of WACC estimation and the core of EVA calculation. The essence of CEC is the expected return on risk of financial capital owners. The diversity of the expected return on risk measurement methods and the uncertainty of the valuation results determine that CEC has implicit characteristics and is a hidden cost of equity capital. The measurement method of implicit equity cost of capital, the valuation technology of implicit equity cost of capital and the valuation model of implicit equity cost of capital are mutually substitutable synonyms. From the existing literature on equity capital, CAPM is represented by Markowitz [5] mean-variance technology to measure returns and Errunza and Miller [6] using the Market Index (MI, MI, the market valuation model which estimates the expected return of single stock (or risk portfolio capital) and the equity capital cost valuation method which is supported by historical data of the external capital market and tested empirically. Since various measures under the CAPM framework system are based on the realized historical data after the event, the thought of risk-free return plus risk-compensation returns to estimate the expected return of equity capital, Compared with the dividend discount model, which can combine the analyst's forecast data from the external capital market and the company's internal financial accounting data through the clean earnings relationship and linear dynamic relationship of accounting information, and determine the cost of equity capital by backwards deducting the stock embedded return rate from the future cash flow discount. Various measurement Methods under the CAPM framework system are called ex-post Measure Methods (EPMM) by researchers, which are correspondingly based on analyst forecast data and public equity.

Based on different valuation needs, these estimation methods may have many different forms, but their common characteristics are that they must solve the following two problems: (1) Set the effective forecast period artificially; (2) Artificially set the growth rate of residual income after the forecast period. This is determined by the influence of the growth rate on the implicit equity capital estimation result and the tolerance error in the different forecast periods and after the forecast period. According to sun Huiguo's [7] classical citation statistics of domestic and foreign empirical researchers on these different estimation methods, the citation statistics table shown in Table 1 can be obtained.

Table 1. Different Measurement Method

Measurement methods	citation frequency	percentage
GLS	13	32.50
CT	4	10.00
GGM	2	5.00
AGR	1	2.50
PEG	6	15.00

MPEG	4	10.00
EP	2	5.00
OJN	8	20.00
Total	40	100.00

Table 1 intuitively shows that the GLS model and OJN model are the main methods widely used by researchers at home and abroad among the numerous pre-measurement methods of implicit equity capital. Deng Xiaojun [8] applied three different valuation models, namely 2001-GLS, 2004-PEG and 2005-OJ, to obtain the CEC of Chinese enterprises, as shown in Table 2 to Table 4. Furthermore, the mean value of CEC was 0.0832, and the reasonable range was [0.0086, 0.9578]. Limited by the length of the paper, the mean CEC of 8.32% was used to estimate WACC, and then EVA was calculated by combining the basic data of PetroChina.

Table 2. 2001-GLS

	2016	2015	2014	2013	2012	2011	2010	Mean value
Maximum	0.3396	0.3196	0.2868	0.2961	0.1471	0.2154	0.1399	0.2492
Minimum	0.0007	0.0010	0.0018	0.0007	0.0005	0.0015	0.0004	0.0009
Mean value	0.0524	0.0514	0.0525	0.0352	0.2732	0.0461	0.0179	0.0755
Standard deviation	0.0390	0.0354	0.0372	0.0280	0.0198	0.0350	0.0125	0.0296
Median	0.0453	0.0467	0.0454	0.0296	0.0240	0.0403	0.0159	0.0353

Table 3. 2001-PEG

	2016	2015	2014	2013	2012	2011	2010	Mean value
Maximum	0.8616	1.5288	0.8697	1.1130	0.8739	2.9687	0.7376	1.2790
Minimum	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mean value	0.0628	0.0821	0.0625	0.0538	0.0825	0.1234	0.0390	0.0723
Standard deviation	0.1002	0.1251	0.1038	0.0871	0.1004	0.1858	0.0785	0.1116
Median	0.0000	0.0412	0.0000	0.0000	0.0649	0.0679	0.0000	0.0249

Table 4. 2005-OJN

	2016	2015	2014	2013	2012	2011	2010	Mean value
Maximum	0.9079	1.5735	0.9084	1.1382	0.9204	3.0786	0.7630	1.3272
Minimum	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250	0.0250
Mean value	0.0932	0.1106	0.0911	0.0833	0.1106	0.1538	0.0691	0.1017
Standard deviation	0.1019	0.1249	0.1031	0.0856	0.0999	0.1871	0.0774	0.1114
Median	0.0475	0.0658	0.0430	0.0887	0.0887	0.0938	0.0413	0.0612

3 Calculation Results and Analysis

3.1 Data Sources

Gan Bo [9] found that based on the preliminary and final data of A, B, C, D, E, F, G, H, J, and K of PetroChina (stock code 601857) collected from the Guotai, a database, the basic number of EVA estimation of PetroChina can be obtained as shown in Table 5 after further analysis and collation according to the above-mentioned EVA estimation needs of PetroChina.

3.2 Estimation of WACC

Table 5. A, B1 and C1 required for WACC estimation

	2016	2015	2014	2013	2012	2011	2010
A	99409200	119490100	145074200	165636800	191752800	216883700	234200400
B	26328500	31645500	44557700	59444900	74061500	91151700	103008000
B1	27902100	34717600	54263100	64626700	83496200	98807100	107209600

C	64133300	81556400	87827500	95910600	104633000	113167000	122534000
C1	71507100	84772500	90811100	101010100	108256600	118076600	126990800
D	14349400	12594600	10637800	15067500	14600700	13061800	14222900
E	17300	15500	0	0	0	0	0
F	0	0	0	0	0	0	0
G	423100	629900	867900	805400	972100	1019900	1243000
H	309800	1806700	368100	416200	948000	1157800	3873500
I	0	0	0	0	0	0	0
J	14641700	16048300	23010100	30818500	36906100	41784500	43361300
K	8514300	13304900	18661800	22126900	24558000	27221000	28269200

Formula 3 shows that the estimation of WACC depends on five factors. Elements: CDC, CEC, A, B1, C1. Table 5 has provided the data information of A, B1 and C1 required for WACC estimation so that WACC can be determined by estimation on the basis of CDC and CEC determination.

Determination of CDC estimates. This paper uses the benchmark interest rate of medium and long-term bank loans published by the People's Bank of China to estimate and determine CDC. The results are shown in Table 6. The largest number was in 2011. It is 7.60. The second year, however, was the smallest which is 5.94.

Table 6. 2010-2016-CDC (units: %)

	2010	2011	2012	2013	2014	2015	2016
CDC	7.30	7.60	5.94	5.97	6.81	6.82	6.55

According to formula 3, and on the basis of the determination of CDC in Table 6, the CEC mean determined by the method of 2001-GLS in Table 2 was 7.55%, the CEC mean determined by the method of 2005-OJN in Table 3 was 10.17%, the CEC mean determined by the method of 2004-PEG in Table 4 was 7.23%. The required 5.5% standard can be used to estimate the annual EVA of PetroChina.

As this paper focuses on the analysis of the impact of WACC estimation on the EVA performance assessment of PetroChina, the average value of different CEC obtained by the three valuation formulas is 8.32% ((7.55% + 10.17% + 7.23%) ÷3) to estimate WACC and determine the EVA corresponding to different WACC of PetroChina. For example, when estimating WACC in 2010, CEC is 5.5%, CDC is 7.3%, and then the WACC of CNPC in 2010 is calculated according to Formula 5.

It can be estimated as follows:

$$\mathrm{WACC} = (\mathrm{B1/AxCDC} + \mathrm{C1/AxCEC}]\mathrm{x}(1 - 25\%) = (27902100 + 99409200\mathrm{x}7.3\%) + (71507100 + 99409200\mathrm{x}5.5\%)]1 - 25\%) = 4.5\% \quad (4)$$

Similarly, according to the above algorithm, WACC in 2010 with an average value of 8.32% can be obtained.

$$\mathrm{WACC} = [(27902100 \div 99409200 \times 7.3\%) + (71507100 \div 99409200 \times 8.32\%)] \times (1 - 25\%) = 6.03\% \quad (5)$$

3.3 Estimate EVA of PetroChina in Different Years

In this way, WACC from 2010 to 2016 can be determined as shown in Table 7.

Table 7. WACC

	WACC	
	（1）	（2）
2010	4.5 (7.3%, 5.5%)	6.03% (7.3%, 8.32%)
2011	4.58% (7.6%, 5.5%)	6.08% (7.6%, 8.32%)
2012	4.25% (5.94%, 5.5%)	5.57% (5.94%, 8.32%)
2013	4.26% (5.97%, 5.5%)	5.55% (5.97%, 8.32%)
2014	4.55% (6.81%, 5.5%)	5.75% (6.81%, 8.32%)
2015	4.58% (6.82%, 5.5%)	5.73% (6.82%, 8.32%)
2016	4.49% (6.55%, 5.5%)	5.63% (6.55%, 8.32%)

CDC value and WACC are estimated at 5.5%. For example, WACC (N, 5.5%) corresponds to the WACC estimated in 2010 when the CDC was 7.3% 2010 and the CEC required by SASAC was 5.5%. The meaning of WACC (N, 8.32%) can be compared with that of WACC (N, 5.5%). The WACC (5.5%) number was the largest in 2010. It is 11413490. The WACC (8.32%) was the smallest in 2016 which is 3732954.7.

3.4 Comparison of Results

Further, Zhao Zhigang [10] found that if the difference of EVA in different years estimated by different WACC results in Table 7 is made and compared with the corresponding WACC difference, for example, △EVA= 11413490-10381978 = 1031512 (ten thousand yuan) in 2010, The WACC difference of corresponding year was △ = 4.5-6.03% = -1.53%. By circulating the above calculation method to 2016, the EVA difference and WACC difference results of CNPC in different years can be obtained as shown in Table 8.

Table 8. EVA, WACC

	EVA（2010）	EVA（2011）	EVA（2012）	EVA（2013）	EVA（2014）	EVA（2015）	EVA（2016）
WACC（N，5.5%）	11413490	7937252	7136093.2	10980149.72	9283695.25	6767364.26	5457558.1
WACC（N，8.32%）	10381978	6697173.5	5932080.3	9654038.85	7876641.25	5212830.31	3732954.7

4 Conclusion

The implicit cost of equity capital directly affects the size of the WACC and the EVA performance assessment of the central enterprises. Table 8 shows that under the premise that the different implicit cost of equity capital estimated by the three valuation formulas may affect the WACC, the difference between the 5.5% WACC determined by SASAC and the 8.32% estimated WACC is 1.53 percentage points on average. In other words, PetroChina's 5.5% WACC was estimated to be 8.32%.

The WACC recognized by PetroChina averaged 1.3 percentage points smaller over the seven-year period. PetroChina's inflated EVA confirms that the "one-size-fits-all effect" of the WACC directly affects the size of EVA. If the "one-size-fits-all effect" of WACC increases the financial value created by central enterprises, which superficially improves the ability of central enterprises to create value for social stakeholders, it is actually a disguised destruction and erosion of the capital invested by social stakeholders, departing from the value created by central enterprises for the whole society. Therefore, it is urgent to break the rigid ratio and model of 4.1%, 5.5% and 6.0% of WACC designed by the person in charge of EVA performance evaluation of central enterprises and increase the scale of WACC of central enterprises.

Without considering the impact of implicit equity capital cost on WACC, the designed EVA performance evaluation system lacks scientific rationality and lacks customer-view fairness in specific evaluations. WACC is smaller than the mean value of debt capital cost, indicating that the preference of the heads of central enterprises to borrow a large amount of financing depends on the current EVA performance evaluation system, which cannot be contained or eliminated. The above objective reality and the dual economic structure of Our country caused by the owner are not in place due to unclear property rights. Insider control problems will inevitably lead to the scientific rationality and objective fairness of the design of EVA performance evaluation of the head of the central enterprise doubt.

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