

## Decision-making Research about Cash Discounts Offered by Vendors

Xijuan Shao, Hui Meng\*  
 School of Business Administration  
 South China University of Technology, Guangzhou, China.  
 \*E-mail: menghuihongan@126.com

**Abstract:** This paper mainly discusses how to make the decision-making about whether the supplier's downstream enterprises should enjoy cash discounts. First, for the limitation of knowledge in current textbooks, this paper illustrates the difference and the different method of calculation between the real cost of capital and the nominal cost of capital. Second, analyzing the decision-making process in each case that may exist in a cash discount, and summarizing the decision-making steps, drawing the decision-making flowchart. Third, promoting the decision-making analysis process with a cash discount to a number of cash discounts, and introducing the decision tree diagram of a general form to facilitate the enterprises.

**Keywords:** Cash discounts; the cost of capital; flow chart of decision-making; the decision tree diagram

Logistics, capital flow and information flow are three important factors in the operations of supply chain. With the increased competition in the global supply chain, the impact of capital flow to the supply chain is further increasing, as the normal operation of cash flow is the most important factor to protect the normal operation of enterprises and establish a sound management system. More and more enterprises begin to attach importance to factors of cash flow such as financial payback period (or pay period) and the proportion of funds used, which will impact their own income, and they are all trying to establish a cash flow business model with lowest capital cost.

Capital flow comes from the consumers, and through retailers, wholesalers, logistics companies, manufacturers and achieves suppliers at last. This paper stands the perspective of suppliers' downstream companies, researches on the case of that suppliers offer cash discounts frequently in order to expand sales on credit and also to recover funds as soon as possible, how for the downstream companies to make decision about the time of pay for the funds and whether cash discounts should be enjoyed. Because the activities that the suppliers provide cash discounts for downstream companies to buy on credit is prevailing in the reality, and decisions about whether the enterprises enjoy the cash discounts decides the speed of the suppliers of funds withdrawn from circulation ultimately, and also affects the operation and using speed of the cash flow, so it is a subject worthy of studying in capital flow management of the supply chain.

To make decision about the problem whether enterprises should enjoy the cash discount, we must first calculate the cost of capital when giving up the cash discount, and then compare with the other values. With regard to the cost of capital, many people mistakenly think that it is equal to the discount rate provided by the suppliers in reality; Although most of the textbooks give the method of calculating the cost of capital, but using those methods we can only get the nominal cost of capital and has not converted to the actual cost of capital, while making decision we should use the actual cost of capital; In addition, we do not find the related literature describe which values should be compared with the cost of capital that have been calculated. At the same time, the current studies are more care about the case containing a cash discount, then how to make decisions when the case contains a number of cash discount? This article will analyze the above problems, it will give the method to calculate the actual cost of capital; And this paper will indicate the objects which the cost of capital should compare with in different situations when the case contains only a cash discount, on this basis, summing up steps of such decision-making problem and drawing flowchart; while the case contains a number of cash discounts, we analyze the decision-making methods we have always used, and arrive at the conclusion that it is wrong. Then give the general application decision tree diagram at the general form to facilitate enterprises application, and also provide theoretical support for enterprises to manage their operation of flow of funds in supply chain better.

### I. Two Kinds of Capital Cost and Their Calculation Methods

In capital flow management of the supply chain, it includes financial management, investment management and other financial management activities, while enjoying the cash discounts provided by suppliers are belong to short-term financing. The cost of capital refers to how much the economic cost each 1 yuan of funds used should pay for in the short-term financing. It is generally expressed as a percentage with the years. In reality, there exist the nominal cost of capital and the actual cost of capital. First of all, we will explain differences and similarities between the two.

The nominal cost of capital, also known as the nominal interest rate or marking rate, is the interest rate announced by the financial institutions or marked by financial transactions<sup>[1]</sup>; while the actual cost of capital is the true cost people who use capital should pay. For example, the

three-month bank lending rate is 8%, 8% is the interest rate announced or marked by the bank. It is the name of cost rather than the actual cost for lenders, because 8% is annual percentage, and the loan period is three months, then the cost of three months for each yuan is  $8\% / 4 = 2\%$ , if we use the financing continuously for one year, that is to say, use the loan 4 times continuously, then the actual cost we pay for is  $(1 + 2\%)^4 - 1 = 8.24\%$ . Thus, there is a difference between the two kinds of capital cost in values, in the actual decision-making, we should use the actual cost of capital which reflects the true cost.

In financial management textbooks [2] [3], the calculation formula for the cost of capital is as follows:

$$\frac{\text{the economical costs of this financing}}{\text{the actual funds used from the financing} * \text{the period of using the funds}} * 100\% \quad (1)$$

In Equation (1), the period of using the funds in the denominator is less than or equal to 1, because it is short-term financing.

However, these textbooks do not clearly point out that the cost of capital which we calculate from the formula (1) is either the nominal cost of capital or the actual cost of capital. On the last example, the economic cost that each yuan used three months in this financing is 2%, then substitute into formula (1) and get the cost of capital in the financing is  $2\% / (1 / 4) = 8\%$ . This shows that we get the cost of capital from formula (1) is the nominal cost of capital. The actual cost of capital can be calculated with the nominal cost of capital and the number of cycles within a year, namely:

$$\left(1 + \frac{\text{the nominal cost of capital}}{\text{the number of cycles within a year}}\right)^{\text{the number of cycles within a year}} - 1 \quad (2)$$

In Equation (2), "the number of cycles within a year" refers to the number we can carry out the financing continuously in one year. Its value is:  $360 / \text{the number of days using funds in one financing}$ .

Equation (1) is easy to understand and memory, therefore, in the practical application, we can first use formula (1) and get the nominal cost of capital, then substitute into the formula (2) and get the actual cost of capital.

## II. The Calculation of Capital Cost in Cash Discount Decision-Making

Giving up the cash discounts provided by the supplier belongs to the short-term financing which must pay cost, its formula for calculating the cost of capital is formula (3) as follows [4][5]:

$$\frac{\text{the rate of discount}}{1 - \text{the rate of discount}} * \frac{360 \text{ days}}{\text{the limited day which you give the payment} - \text{the period in which you can enjoy the discount}} * 100\% \quad (3)$$

Contrasting formula (1) and (3), it is easy to find that formula (3) is formula (1)'s specific application. In the case of giving up cash discounts, therefore, what we get according to formula (3) is a nominal cost of capital. In other

words, we can not make decisions according to the cost of capital calculated by formula (3) directly, but need to substitute into formula (2) to calculate the real cost of capital. We can illustrate the relationship between the above three formulas with example 1.

[Example1] Company G's supplier provides credit conditions: "2 / 10, n/30". Namely, if the company gives the payment within 10 days, they can get 2% cash discount; if it gives the payment on 11th to 30th day, it would take to pay the full purchase price A. If company G pays the purchase price until the 30th day, it is payments late, that equals to supplier provides financing for the company, then how much the cost of capital in this financing?

Full payment is A, if the payment is given on the first 10 days, company G simply needs to pay  $(1-2\%) A$ , namely, 0.98A; if does not pay on the first 10 days, the company owes supplier 0.98A, it means that supplier offers short-term funding 0.98A for G company; until to the 30th day, the company is required to pay A, that is to say, after returning the actual number of 0.98A, the company needs to pay an extra 0.02A, which is equivalent to the price that G Company enjoy 20 days of short-term funds 0.98A provided by the supplier. In this financing, the cost which the company pays is 0.02A, the actual funds the company uses is 0.98A, financing age limit is 20/360. Substituted into formula (1) and then we can get: the cost of capital =  $0.02A / (0.98A \times 20/360) \times 100\% = 36.73\%$ .

According to formula (3): the nominal cost of capital =  $2\% / (1-2\%) * 360 / (30-10) * 100\% = 36.73\%$ . This verifies that we only can get the nominal cost of capital both from formula (3) and formula (1).

But substitute the value gets from formula (3) into formula (2) and then we can get: The actual cost of capital =  $(1 + 36.73\% / (360/20))^{360/20} - 1 = 43.86\%$ . In fact, we also can analyze: here credit period is 20 days ( $30-10 = 20$ ), and the discount rate is 2%, the cost rate of each 20 days is  $2\% / 98\% = 2.041\%$ , there are  $18(360/20 = 18)$  periods in each year. Therefore, the actual cost rate is:  $(1 + 2.041\%)^{18} - 1 = 43.86\%$ , the value is equivalent to the value calculated by formula (2).

Thus, the conversion between the actual cost of capital and the nominal cost of capital is correct, and the difference between the actual cost of capital and the nominal cost of capital when giving up the cash discount is very large, so when make decisions, we should not use the nominal cost of capital similarly to instead of the actual cost of capital.

## III. Decision-Making with A Cash Discount

### Analysis of decision-making process

For ease of presentation, we still use example 1 to analyze the decision-making process.

Because in any day within the first 10 days we have to pay the same amount (0.98A), so the payment should be given on the 10th day rather than first 9 days; if does not pay on the 10th day, the company can not enjoy cash discounts, but

if pays during the 11th to 30th day, the company is required to pay A, so the company should pay the payment on the 30th day, rather than the first 11-29 days. That is to say, the question we faced with is: should we enjoy the cash discount and pay the payment in advance on the 10th day, or give up cash discounts and extend the payment to the 30th day?

In this decision-making process, the key is determining whether it is worth to pay the cost of capital (43.86%) by giving up the cash discount? Companies may face three scenarios: (1) have sufficient funds to pay the purchase price in advance and enjoy the cash discount; (2) lack of funds but can borrow money from bank and pay the purchase price; (3) no funds to pay, and also no borrowing capacity.

Scenario (1): we should compare the cost of capital with the return rate of holding cash. In reality, the return rate of holding cash is almost 0, so it should give the payment on the 10th day.

Scenario (2): we should compare the cost of capital with the actual cost of bank borrowings. If the cost of capital is less than the actual cost of borrowing, we should pay for the payment on the 30th day; or we should pay on the 10th day. In general, in order to attract customers to give the payment early, the cost of capital generated by cash discounts offered by the suppliers (such as 43.86% in example 1) is far greater than the actual cost of bank borrowings, so we should take advantage of bank borrowings and give the payment on the 10th day.

Scenario (3): we should compare the cost of capital with profits generated by each with 1 yuan of funds the companies used (profit margin on asset operating). If the cost of capital is less than the profit margin on asset operating, that is to say we obtain profits from using these funds higher than the cost of capital, then we should give the payment on the 30th day, but rather on the 10th day.

**Steps and flow chart of decision-making**

In section 3.1 of this paper, we use an example to describe the analysis process of decision-making when enterprise is offered a cash discount, and now we extend the example to the general form: credit condition is "d / t, N / T" (T and t both indicate the number of days, and T is larger than t), it is actually a decision-making problem about paying for the payment on the t day or on the T day in the end, as shown in Figure 1.

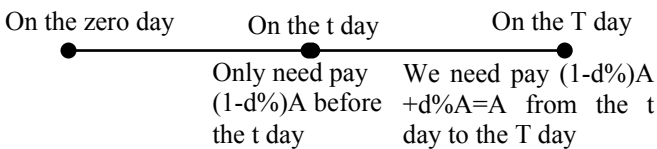


Figure 1 Schematic diagram of a cash discount for payment

In conjunction with the decision analysis process in part 3.1, we can sum up the decision-making steps as follows.

Step 1: Calculate the cost of capital. Calculate the nominal cost of capital because of giving up the cash discount

according to formula (3), and then substituted into formula (2) to get the actual cost of capital;

Step 2: Decision-making of scenario (1). We must know whether the company has sufficient funds to cover, if it has, due to the return rate of cash is low, so we should choose on the t day to give the payment; if not, then go to step 3.

Step 3: Decision-making of scenario (2). As the company does not have money, we should know whether it can borrow from banks to pay, if it can, then calculate the actual cost of borrowing, and if the actual cost of borrowing is less than the actual cost of funds to give up the cash discount, then it should get borrowing from banks and pay for on the t day; if not, give the payment on the T day (this rarely occurs in reality). If the company can not borrow money from banks, then enter Step 4.

Step 4: Decision-making of scenario (3). Company does not have money and also is not available to get loan, then we should compare the company's profit margin on asset operating with the cost of capital, if the profit margin on asset operating is less than the actual cost of capital, we pay on the t day; otherwise, do on the T day.

According to the steps of decision-making, we draw the decision-making process shown in Figure 2, when the supplier offers a cash discounts, the firm will be able to make decisions using the map easily.

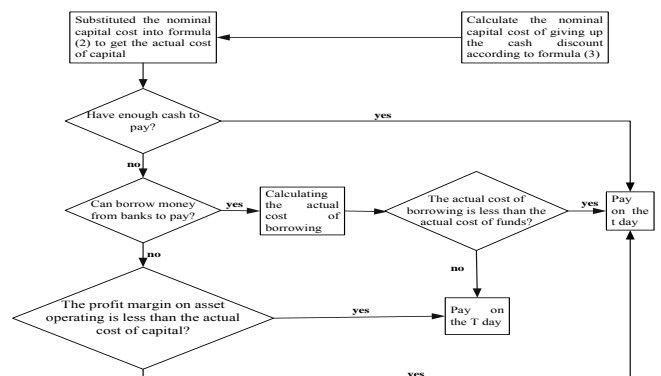


Figure 2 flow chart of decision-making about whether enjoy cash discounts

**IV. Decision-Making about Containing a Number of Cash Discount**

With the development of market economy, business has become increasingly fierce competitive. In order to expand sales further, as well as to be better and more effective repatriating their capital, in reality, the credit terms provided by suppliers contain not only one cash discount, but also t a number of cash discount, now how should the company make decision? Look at the analytical methods generally accepted, such as Example 2.

[Example 2] according to credit conditions : "3.7 / 0,2.5 / 30,1.3 / 60, N/90", a company purchase goods with 10,000 yuan, the company is unable to pay within 90 days, if it

wants to pay, it is required to get loan from banks at the interest rate of 14%. Then which day the Company pays is the most favorable? At present, most people think that the analysis method of such situation is as follows:

Firstly, calculate the cost of capital to give up the cash discount: the cost of capital to give up the cash discount of 3.7% is  $3.7\% \div (1-3.7\%) \div (90-0) \times 360 = 15.369\%$ ; the cost of capital to give up the cash discount of 2.5% is  $2.5\% \div (1-2.5\%) \div (90-30) \times 360 = 15.385\%$ ; the cost of capital to give up the cash discount of 1.3% is  $1.3\% \div (1-1.3\%) \div (90-60) \times 360 = 15.805\%$ . As the three kinds of capital cost giving up the cash discount are all higher than the lending rate from banks 14%, so the company can not give up cash discounts, and should give the payment on the highest point of giving up the cash discount (that is to say enjoy the biggest income of cash discount), so the company should borrow money and pay on the 60th day.

Zhang Shui-ying (2009) pointed out that this decision seems very reasonable, but in fact it does not guarantee payments on that day is the best interest for the company, he said: such decision-making issues are in fact that chooses a less expensive mode of financing between the accounts payable and bank loan. In this issue, the cost rate of using the 60-day accounts payable financing:  $(3.7\% - 1.3\%) \div (1-3.7\%) \div 60 \times 360 = 14.95\%$ , its value is greater than the lending rate from banks 14%, so using the 60-day bank loan financing (that is, give the payment immediately after getting the loan, and then repay money to the bank on the 60th day) is more better than the 60-day payables financing (give the payment on the 60th day), so he believes that the above decision-making method is unscientific, and proposes a new approach to make decision - decision tree method to solve this problem. This paper agrees the point of Zhang Shui-ying (2009), he considered that the analytical method of most people was wrong, and also agrees with his new line of analysis, however, by the analysis of part 1 and 2, we know all of the formula which used to calculate the cost of capital to give up the cash discount can only obtain the nominal cost of capital, and in addition, the interest rate of bank loan is not the actual cost of borrowing, so it is incorrect to use it as a comparison. And the other hand, decision tree in Zhang Shui-ying's text are all expressed by words, so it is relatively a little complicated. This article will address these shortcomings and propose measures for improvements, and give the decision tree which is generally applicable for the companies to make decisions when they face credit condition containing a number of cash discount. As following Figure 3:

Credit conditions are assumed as: " $N_1/t_1, N_2/t_2, N_3/t_3, N/T$ ", and  $t_1 < t_2 < t_3 < T$ ,  $r$  stands the cash proceeds when there is sufficient funds to pay the purchase price, or the actual cost of borrowing when there is no cash to pay but has enough borrowing capacity, or the asset operating margins when there is neither funds to pay nor the borrowing capacity;  $K_{t_1-t_2}$  stands the actual cost of capital when giving up the cash

discount before the  $t_1$  days and the credit period is  $t_2-t_1$ , and the rest are the same means.

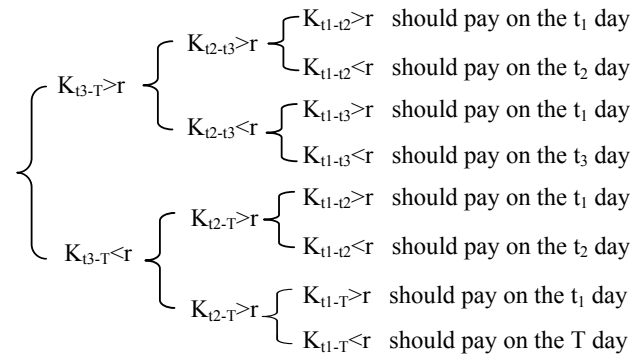


Figure 3 the decision tree diagram when contains a number of cash discount

### V. Conclusion

From the analysis in this paper, we get that: (1) In reality, when people face with that whether enjoy the cash discount, they usually view the nominal capital cost of giving up cash discount as the actual cost of capital similarly, but after analysis, we found that the two can not be substituted simply for making decisions, because the difference between the two is very large, and it may lead to wrong decisions, and therefore we should distinguish the two kinds of capital cost, and then according to the formula pointed out by this article to get the actual cost of capital. (2) For the decision-making problems about a cash discount, there does not find literature sums up the logic of decision-making process and flow chart, but this paper analyzes the possible existence of decision-making process in each case, and sums up the decision-making steps, and paints out the decision-making flow chart, so it will be convenient for enterprise applications. (3) For the decision-making problems about a number of cash discount which studied less, this article extends the analytical method in a cash-discount to this case, and gets the universal decision tree diagram derived from general form, the decision tree diagram is simple and easy to understand, and also easy to use. All these will help enterprises to better address the decision-making problems about whether should enjoy the cash discount, and also provide the basis for enterprise management the financial resources.

### References

- [1] Stepen•Ross, Randolph•Wisterfer, Bradford•Jordan, 2008. Essence of Corporate Finance (the fourth edition). Beijing: People's Posts & Telecom Press, 87
- [2] Arth J. Keown, David F.Scott John D.Martin Jay william Pretty. 1997. Infrastructure of modern financial management. Beijing: Tsinghua University Press
- [3] Cui Yi, Shao Xi-juan. 2004. Modern financial management, Guangzhou: South China University of Technology Press, 312-315.

- [4] Zhang Shui-ying. The improvement of financing decision-making with account payable in credit terms with a number of cash discount, *Accounting magazine*, 2009 (4),57-58
- [5] Lu Wei-jian, Li Yu-bao. The cost of cash discounts with accounts payable, *Business Studies*, 2004 (23),67-68
- [6] He Lin, Liao Dong-sheng. Financing cost analysis of accounts payable, *Monthly Accounting (Accounting)*, 2007 (5)。 29.

## **Background of Authors**

**SHAO Xi-juan** (1965-), female (Han), Shanxi, Ph.D., Associate Professor of School of Business Administration in South China University of Technology in China; Master instructor  
Research Interest: Decision-making method of finance and financial.  
Address: School of Business Administration, South China University of Technology at Wushan Road of Tianhe District in Guangzhou, China  
Zip Code: 510640  
Contact Phone: 13760737906  
E-mail: [xjshao@scut.edu.cn](mailto:xjshao@scut.edu.cn)

**Meng Hui** (1985-), female (Han), Hubei, Master graduate student of School of Business Administration in South China University of Technology;  
Major: Management decision-making and system theory,  
Research Interest: Decision-making method of finance and financial.  
Address: School of Business Administration, South China University of Technology at Wushan Road of Tianhe District in Guangzhou, China  
Zip Code: 510640  
Contact Phone: 15902076539  
E-mail: [menghuihongan@126.com](mailto:menghuihongan@126.com)