21世纪经济管理类教材
21SHIJIJINGJIGUANLILEIJIAOCAI

[双语版]

Corporate Finance

公司金融

李 薇 / 编著

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前言

随着我国金融业的开放和经济金融领域国际交往与合作的日益密切，越来越多的高校在金融专业教育中加大了双语教学的力度，为我国的进一步开放和参与国际竞争培养出一批批高素质、高水平的金融人才。公司金融，作为高等院校金融学专业开设的一门重要的专业基础课，其内容和思维方法在实践中有广泛的应用性、参与国际交流的机会也最多，因此很多高校将之设定为双语教学课程。

近两年来，笔者专门从事金融专业本科中高年级公司理财、公司金融课程的双语教学工作。在教学实践中，选用过几个版本的教材，主要感觉有以下几点不足：(1)内容覆盖面过广，现有教学学时无法完成其全部的讲解；(2)偏重理论，更适合于研究生教学而不是本科生教学；(3)侧重投资分析中的股票、债券、衍生品和资产组合的收益和风险分析部分，与同步开设的“投资学”、“金融工程”课程讲授的内容有很大的重叠，造成教学资源的浪费。

正因为如此，年初笔者开始编写这本教材，主要是为金融学或财务管理学专业本科生提供一本简明的学习公司金融课程的双语教材。书中紧密按照资金在公司内部的流动顺序，依次介绍融资、投资和财务管理方面的内容。每一个部分都力求按照解决问题的思考逻辑，全面地、有条理地进行讲解，语言通俗易懂，并且大量使用图表、例题和案例说明较为复杂的问题，方便读者理解。

由于公司金融涵盖范围广泛，研究成果也是日新月异，因此对高校公司金融课程讲授内容的完善还需不懈努力，力求做到系统性、针对性与实践性的统一。

鉴于时间和编者学识有限，缺点和不足之处敬请同行专家和诸位读者批评指正。

李薇
2008年7月

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Part One

Foundations of Finance

（金融基础）

Chapter 1
The Time Value of Money (时间价值)

Section 1 Compound Interest

In business, there is probably no other single concept with more power or applications than that of the time value of money. So, it is essential for you to have a clear understanding of the time value of money(TVM).

1.1.1 Time value of money concepts(时间价值概念)

A fundamental concept in finance is that money has a time value associated with it: a dollar received today is worth more than a dollar received a year from now.

Intuitively this idea is easy to understand. We are all familiar with the concept of interest. Because we can earn interest on money received today, it is better to receive money earlier rather than later.

In other words, in order for money to have time value, it must be possible to invest it at a positive rate of return.

1.1.2 Time lines(时间线)

One of the most important tools in time value analysis is the time line. A time line is simply a diagram of the cash flows associated with a TVM problem, which is used by analysts to help visualize what is happening in a particular problem and then to help set up the problem for solution.

So it is often a good idea to draw a time line before you start to solve a TVM problem.

Time 0 is today(present). Time 1 is one period from today. Time 2 is two periods from today, or the end of period 2. Often the periods are years, but other time intervals such as semiannual periods, quarters, months, or even days can also be used.

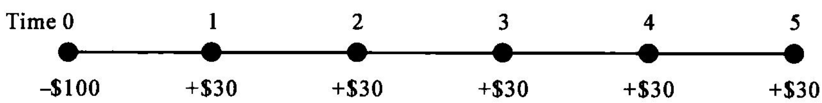
Note that each point mark corresponds to the end of one period as well as the beginning of the next period. For example, the point mark at time 1 represents the end of period 1, and it also represents the beginning of period 2 because period 1 has just passed.

Then we will add each cash flow to the very point on time line according to when it happens. A cash flow that occurs in the present(today) is put to time 0. Cash outflows(payments) are given a negative sign, and cash inflows (receipts) are given a positive sign.

Example 1-1:

Illustrates a time line for an investment that costs \$100 today and will return a stream of cash payments of \$30 per year at the end of each of the next 5 years.

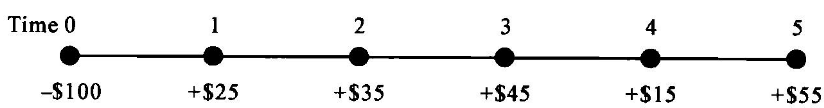
Answer:



Example 1-2:

Illustrates a time line for an investment that costs \$100 today and will return a stream of cash payments of \$25 at the end of year 1, \$35 at the beginning of year 3, \$45 at the end of year 3, \$15 at the beginning of year 5, \$55 at the end of year 5.

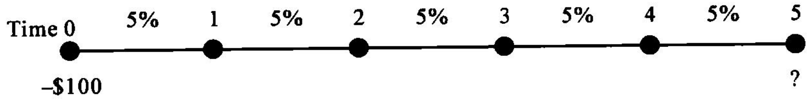
Answer:



When we face up to a real TVM problem, the interest rate should be added. Cash flows are placed directly below the point marks, and interest rates are shown directly above the time line. Unknown cash flows, which you are trying to find out in the analysis, are indicated by question marks.

Now consider this situation, where a \$100 cash outflow is made today, here the interest rate is 5% during the first three periods, but it rises to 10% during the forth and fifth period, so how much will we receive at the end of time 5?

You can visualize the problem by the time line shown as follows:



1.1.3 Compound interest(复利)[①]

The notion of compound interest and interest on interest is deeply embedded in TVM procedures. Compound interest occurs when interest(利息)paid is added to the principal(本金). When an investment is subjected to compound interest, the growth in the value of the investment from period to period reflects not only the interest earned on the original principal amount but also on the interest earned on the previous period's interest earnings, that is interest on interest.

For example, we place \$100 in a savings account that pays 8% interest, compounded annually. How will our savings grow?

At the end of the first year we earned 8%, that is

$$\begin{aligned} FV_1 &= PV(1+i) \\ &= \$100 \times (1+8\%) \\ &= \$108 \end{aligned} \tag{1-1}$$

Carrying these calculations one period further, we find that we now earn the 8% interest on a principal of \$108(including the original principal \$100 and the first interest \$8), that is

$$FV_2 = FV_1(1+i) \tag{1-2}$$

Which, for our example, gives

$$\begin{aligned} FV_2 &= \$108 \times 1.08 \\ &= \$116.64 \end{aligned}$$

If we substitute these values into equation(1-2), we get

$$\begin{aligned} FV_2 &= PV(1+i)(1+i) \\ &= PV(1+i)^2 \end{aligned} \tag{1-3}$$

We can generalize this formula to illustrate the value of our investment if it is compounded annually at a rate of i for n years to be

---

① 资金的时间价值一般都是按复利式进行计算的。所谓复利,是指不仅本金要计算利息,利息也要计算利息,即通常所说的"利滚利"。

$$FV_n = PV(1+i)^n \quad (1\text{-}4)$$

where

FV_n = the future value of the investment at the end of n years

n = the number of years during which the compounding occurs

i = the annual interest rate

PV = the present value or original amount invested at the beginning of the first year

Table 1-1 illustrates how this investment of $ 100 would continue to grow for the first 10 years at a compound interest rate of 8%.

Table 1-1 Illustration of Compound Interest with $ 100 Initial Investment and 8% Interest Rate

Period	Beginning Value	Interest Earned During Period	Terminal Value
1	$ 100.00	$ 8.00	$ 108.00
2	108.00	8.64	116.64
3	116.64	9.33	125.97
4	125.97	10.08	136.05
5	136.05	10.88	146.93
6	146.93	11.76	158.69
7	158.69	12.69	171.38
8	171.38	13.71	185.09
9	185.09	14.81	199.90
10	199.90	15.99	215.89

1.1.4 Fractional periods(不完整期间)

In our illustrations, we have computed the future value for whole years. Then, what about an investment is made for part of a year?

For example, suppose that $ 100 is invested for 7 years and three months. What is the future value at the end of the period?

Since 3 months is 1/4 of 1 year, n in the future value formula(1-4) is 7.25. Assuming an annual interest rate of 5%, the future value of $ 100 invested for 7 years and 3 months is $ 142.437, as shown below

$PV = \$100$

$i = 0.05$

$n = 7.25$

$$FV = \$100 \times (1.05)^{7.25}$$
$$= \$100 \times 1.424369$$
$$= \$142.437$$

1.1.5 Compounding more than one time per year[①](一年多次计息)

Up to now, we have assumed that interest is paid annually. While, what if we compounding the interest more than once per year?

In fact, interest may be paid semiannually, quarterly, monthly, weekly, or daily. To begin, suppose interest is paid semiannually(半年计息)and \$ 100 is deposited in an account at 8%. This means that for the first 6 months the return rate is one half of 8%, or 4%. Thus, the future value(FV) at the end of 6th month will be

$$FV_{1/2} = \$100 \times \left(1+\frac{0.08}{2}\right) = \$104.00$$

and at the end of a year it will be

$$FV_1 = FV_{1/2} \times \left(1+\frac{0.08}{2}\right)$$

$$FV_1 = \$100 \times \left(1+\frac{0.08}{2}\right)^2 = \$108.16$$

This amount compares with \$ 108.00 if interest were paid only once a year, the \$ 0.16 difference is attributable to the fact that during the second 6 months, interest is earned on the \$ 4.00 interest paid at the end of the first 6 months.

To continue, suppose that in our previous example interest were paid quarterly(季度计息)and that we wished again to know the future value at the end of 1st year. It would be

$$FV_1 = \$100 \times \left(1+\frac{0.08}{4}\right) \times \left(1+\frac{0.08}{4}\right) \times \left(1+\frac{0.08}{4}\right) \times \left(1+\frac{0.08}{4}\right)$$

$$FV_1 = \$100 \times \left(1+\frac{0.08}{4}\right)^4 = \$108.24$$

which, of course, is higher than it would have been with semiannual or annual compounding.

The future value at the end of 3rd year for the example with quarterly interest payments is

$$FV_3 = \$100 \times \left(1+\frac{0.08}{4}\right)^{4\times 3} = \$126.82$$

---

① 在前面的讨论中，利息是一年计一次的，但实际上，利息可以半年计息一次、每季度计一次(一年四次)、每月计一次(一年十二次)或者一年计息多次，计息次数的不同会显著地影响资金的实际收益率，我们将在后面的内容里作具体的解释。

compared to a terminal value with semiannual compounding of

$$FV_3 = \$100 \times \left(1+\frac{0.08}{4}\right)^{2\times 3} = \$126.53$$

and with annual compounding of

$$FV_3 = \$100 \times \left(1+\frac{0.08}{1}\right)^{1\times 3} = \$125.97$$

The greater the number of years, the greater the difference in terminal values arrived at by two different methods of compounding is.

Mathematically, we can express the future value when interest is paid m times per year as follows

$$FV_n = PV\left(1+\frac{i}{m}\right)^{mn} \quad (1\text{-}5)$$

where

i = annual interest rate

n = number of years

m = times per year the interest is paid

From the formula we can see, the more times during a year that interest is paid, the greater the terminal value at the end of a given year.

Example 1-3:

Suppose that a portfolio manager invests \$1 million in an investment that promises to pay an annual interest rate of 10% for 6 years. Interest on this investment is paid quarterly. What is the future value?

Answer:

$PV = \$1\ 000\ 000$

$n = 6$

$i = 0.10$

$m = 4$

$$FV = PV\left(1+\frac{i}{m}\right)^{mn}$$

$$FV = \$1\ 000\ 000 \times \left(1+\frac{0.10}{4}\right)^{4\times 6}$$

$$= \$1\ 808\ 726$$

1.1.6 Infinite compounding(连续计息)

In the formula $FV_n = PV\left(1+\frac{i}{m}\right)^{mn}$, as m approaches infinity, the term

$\left(1+\frac{i}{m}\right)^{mn}$ approaches $e^{i\times n}$①, where e is approximately 2.71828.

So, the terminal value at the end of n years of an initial deposit of PV where interest is compounded continuously at a rate of i is

$$FV = PV \cdot e^{i\times n} \tag{1-6}$$

1.1.7 Effective annual rate(实际年利率)

Financial institutions usually quote rates as stated annual interest rates (名义年利率), or nominal rates, along with a compounding frequency, as opposed to quoting rates as periodic rates(the rate of interest earned over a single compounding period).

For example, a bank will quote a savings rate as 8%, compounded quarterly, rather than 2% per quarter. The rate of interest that investors actually realize as a result of compounding is known as the effective annual rate(EAR).

EAR represents the annual rate of return actually being earned after adjustments have been made for different compounding periods.

EAR may be determined as follows

$$EAR = \left(1+\frac{i}{m}\right)^{m} - 1② \tag{1-7}$$

where

i = annual interest rate

m = times per year the interest is paid

Obviously, whenever compound interest is being used, the stated rate and the effective(actual) rate of interest are equal only when interest is compounded annually($m=1$). Otherwise, the EAR is greater than the stated rate.

Example 1-4:

Using a stated rate of 6%, compute EARs for semiannual, quarterly,

---

① as $e=\lim_{m\to\infty}\left(1+\frac{1}{m}\right)^{m}$, so $\lim_{m\to\infty}\left(1+\frac{i}{m}\right)^{m\times n}=\lim_{m\to\infty}\left[\left(1+\frac{i}{m}\right)^{\frac{m}{i}\times i\times n}\right]=\lim_{m\to\infty}\left[\left(1+\frac{i}{m}\right)^{\frac{m}{i}}\right]^{i\times n}=e^{i\times n}$

② \$1 invest at i for one year, compounding m times per year, will actually get $\$1\times\left(1+\frac{i}{m}\right)^{m\times 1}$, so its actual rate of return is $\frac{\$1\times\left(1+\frac{i}{m}\right)^{m\times 1}-\$1}{\$1}$, that is $EAR=\left(1+\frac{i}{m}\right)^{m}-1$.

monthly, daily, and continuous compounding.

Answer:

Semiannual effective rate$=\left(1+\frac{0.06}{2}\right)^{2}-1=1.06090-1=0.06090=6.090\%$

Quarterly effective rate$=\left(1+\frac{0.06}{4}\right)^{4}-1=1.06136-1=0.06136=6.136\%$

Monthly effective rate$=\left(1+\frac{0.06}{12}\right)^{12}-1=1.06168-1=0.06168=6.168\%$

Daily effective rate$=\left(1+\frac{0.06}{365}\right)^{365}-1=1.06183-1=0.06183=6.183\%$

Continuous effective rate$=e^{0.06}-1=1.06184-1=0.06184=6.184\%$

Section 2 Future Value and Present Value

1.2.1 Future value(终值)

Future value is the amount to which a current deposit will grow over time when it is placed in an account paying compound interest.

The process to computing FVs involves projecting the cash flows forward, on the basis of an appropriate compound interest rate, to the end of the investment's life.

The process of going from today's values, or present values (PVs) to future values (FVs) is called compounding.

The formula for finding the FV of a single cash flow is

$$FV_n=PV\left(1+\frac{i}{m}\right)^{mn} \tag{1-8}$$

where

PV = the present value or original amount invested at the beginning of the first year
n = the number of years during which the compounding occurs
i = the annual interest rate
m = times per year the interest is paid

As the determination of future value can be quite time-consuming when an investment is held for a number of years, the future value interest factor ($FVIF_{i,n}$)① defined as $(1+i)^n$, has been compiled for various value of i and

① 复利终值系数。

n. An abbreviated compound interest or future value interest factor table appears in Table 1-2. Note that the compounding factors given in this table represent the value of \$1 compounded at rate i at the end of the nth year. Thus, to calculate the future value of an initial investment, we need only to determine the $FVIF_{i,n}$ then multiply this times the initial investment. In effect, we can rewrite equation(1-8) as follows

$$FV_n = PV(FVIF_{i,n}) \quad (1\text{-}9)$$

Table 1-2 Future value interest factor($FVIF_{i,n}$)

	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100
2	1.020	1.040	1.061	1.082	1.102	1.124	1.145	1.166	1.188	1.210
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331
4	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611
6	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358
10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594
11	1.116	1.243	1.384	1.539	1.710	1.898	2.105	2.332	2.580	2.853
12	1.127	1.268	1.426	1.601	1.796	2.012	2.252	2.518	2.813	3.138
13	1.138	1.294	1.469	1.665	1.886	2.133	2.410,	2.720	3.066	3.452
14	1.149	1.319	1.513	1.732	1.980	2.261	2.579	2.937	3.342	3.797
15	1.161	1.346	1.558	1.801	2.079	2.397	2.759	3.172	3.642	4.177

Example 1-5:

If we invest \$500 in a bank where it will earn 8% compounded annually, how much will it be worth after seven years?

Answer:

Looking at Table 1-2 in the row $n=7$ and column $i=8\%$, we find that $FVIF_{8\%,7}$ has a value of 1.714, so we find

$$\begin{aligned} FV_n &= PV(FVIF_{8\%,7}) \\ &= \$500 \times 1.714 \\ &= \$857 \end{aligned}$$

Example 1-6:

If we invest \$500 in a bank where it will earn 8% compounded