# Financial Management 7th Edition

## 김용석 CPA/CFA

# Errata

# 2019.9.9.

➲ p.2-25 상3~4 삭제

03. Apple Inc. adopted a plan to accumulate $1,000,000 by September 1, Year 5. Apple plans to make four equal annual deposits to a fund that will earn interest at 10% compounded annually. Apple made the first deposit on September 1, Year 1. ~~Future value and future deposit on September 1, Year 1.~~ Future value and future amount factors are as follows :

➲ p.2-30 문제 10 정답 수정

10. PMT = ($100,000 − 20,000 × 0.57) ÷ 3.60 = $25,611

$25,611 ➠ $24,611

➲ p.6-7 하4~5 삭제

where : SV = pre-tax cash proceeds from sale of fixed asset
BV = book value of the fixed asset

~~는 투자된 자본의 회수이므로 과세로운 투자의사결정은 고정자산에 대한 투자뿐만 아니라 유동자산이나 유동부채와~~

➲ p.6-12 하7 수정

Initial Investment Outlay = −60,000 + 5,600 + 3,000 = −$51,400

➠ -3,000 = -$57,400

➲ p.6-18 중간 수정

(4) Disadvantages

- It ignores cash flows beyond the payback period.
- Based on accounting values, not cash flows.
- Uses an arbitrary benchmark cutoff rate.

➠ It ignores the time value of money

➲ p.6-19 상6 수정

$$NPV_A = -2{,}000 + \frac{1{,}000}{1.1} + \frac{800}{(1.1)^2} + \frac{600}{(1.1)^3} + \frac{200}{(1.1)^4} = \$158$$

$$NPV_A = -2{,}000 + \frac{1{,}000}{1.1} + \frac{800}{(1.1)^2} + \frac{600}{(1.1)^3} + \frac{200}{(1.1)^4} = \$99$$

➠ $NPV_B = -2{,}000 + \frac{200}{1.1} + \frac{600}{(1.1)^2} + \frac{800}{(1.1)^3} + \frac{1{,}200}{(1.1)^4} = \$99$

➲ p.6-21 하1~2수정

$$2{,}000 = \frac{1{,}000}{1+IRR} + \frac{800}{(1+IRR)^2} + \frac{600}{(1+IRR)^3} + \frac{200}{(1+IRR)^4} \rightarrow IRR_A = 14.5\%$$

$$2{,}000 = \frac{200}{1+IRR} + \frac{600}{(1+IRR)^2} + \frac{800}{(1+IRR)^3} + \frac{1{,}200}{(1+IRR)^4} \rightarrow IRR_B = 11.8\%$$

➠ $IRR_A$

➠ $IRR_B$

➲ p.6-27 하3수정

$$2{,}000 = \frac{3{,}159}{(1+MIRR)^4}$$

$$MIRR = 12.11\%$$

➠ $(1+MIRR)^4$

➲ p.6-28 문제6-6 정답추가

➠ 정답 : b

➲ p.6-32 하10 수정

**(2) Market Value Added (MVA)**

시장부가가치(MVA)는 경제적 부가가치(EVA)를 자본비용으로 할인한 현재가치이다.

$$MVA = \sum_{t=1}^{n} \frac{EVA_t}{(1+WACC)^t}$$

➠ $EVA_t$

➲ p.7-24, 7-25 회계처리 수정

➠ 정오표 반영 본문 참고

➲ p.부록 4 상2 수정

$$PVIF_a = \frac{1-\frac{1}{(1+i)^n}}{i}$$

PVIFa ➠ PVIFA

➲ p.부록 5 상1~2 수정

**3 종가표(Compound Value of Interest Factor : CVIF)**

$PVIF = (1+i)^n$ ($n$=기간, $i$=기간당 할인율)

Compound ➠ Future

CVIF ➠ FVIF

PVIF ➠ FVIF

➲ p.부록 6 상1~2 수정

**4 연금의 종가표(Compound Value of Interest Factor for Annuity : CVIFA)**

$$PVIF_a = \frac{(1+i)^n-1}{i}$$

Compound ➠ Future

CVIFA ➠ FVIFA

PVIFa ➠ FVIFA

**03.** Apple Inc. adopted a plan to accumulate $1,000,000 by September 1, Year 5. Apple plans to make four equal annual deposits to a fund that will earn interest at 10% compounded annually. Apple made the first deposit on September 1, Year 1. Future value and future amount factors are as follows :

| | |
|---|---|
| Future value of 1 at 10% for 4 periods | 1.46 |
| Future amount of ordinary annuity of 1 at 10% for 4 periods | 4.64 |
| Future amount of annuity in advance of 1 at 10% for 4 periods | 5.11 |

Apple Inc. should make four annual deposits (rounded) of

a. $250,000
b. $215,500
c. $195,700
d. $146,000

**04.** Facebook, Inc. has $75,000 in a bank account as of December 31, Year 1. If the company plans on depositing $4,000 in the account at the end of each of the next three years and all amounts in the account earn 8 percent per year, what will the account balance be at December 31,Year 4? Information on future value factors is as follows

| Periods | Future value of 1 at 8% | Future value of ordinary annuity of 1 at 8% |
|---|---|---|
| 1 | 1.08 | 1.00 |
| 2 | 1.17 | 2.08 |
| 3 | 1.26 | 3.25 |
| 4 | 1.36 | 4.51 |

a. $88,000
b. $96,070
c. $107,500
d. $120,400

## Solution

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| B | A | C | C | A | D | B | B | C | B |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | |
| C | B | B | B | A | D | D | | | |

1. 총이자수익 = Inflows − outflows = 5,009 × 5 − 19,485 = $5,560

2. Annuity in advance이므로 PV = $60,000 × (4.36 + 1) = $321,600

3. Annuity in advance이므로 PMT = $1,000,000 ÷ 5.11 = $195,695

4. FV= $75,000 × 1.26 + $4,000 × 3.25 = $107,500

5. Annuity in advance이므로 PMT = $323,400 ÷ (3.99 × 1.08) = $75,049
   총이자수익 = Inflows − outflows = 75,049 × 5 − 323,400 = $51,845

6. Ordinary annuity 이므로 PMT = $323,400 ÷ 3.99 = $81,053
   총이자수익 = Inflows − outflows = 81,053 × 5 − 323,400 = $81,865

7. PMT = ($323,400 − 5,000 × 0.68) ÷ (3.99 × 1.08) = $74,260
   총이자수익 = Inflows − outflows = 74,260 × 5 + 5,000 − 323,400 = $52,900

8. $60 = $5 ÷ R → R = $5 ÷ $60 = 0.0833

9. PV = ($1,000 × 0.422) + ($1,000 × 6% × 6.418) = $807

10. PMT = ($100,000 − 20,000 × 0.57) ÷ 3.60 = $24,611

11. FV = $50,000 × 1.469 = $73,450 → PV = $73,450 × 0.57 = $41,867

12. PV = ($50,000 × 0.57) + ($50,000 × 8% × 3.60) = $42,900

13. 액면이자율 < 시장이자율(만기수익률) : 할증발행
    다른 조건이 변하지 않고, 시간이 경과하면 할증금액은 감소

14. 채권이나 주식의 가격은 요구수익률이 감소하면 증가한다.

15. 채권의 액면이자율이 감소하면 현금흐름이 감소하여 가격은 감소한다.

16. EAR = 12 ÷ (100 − 12) = 0.1364

17. $Re = (1+\frac{0.08}{4})^4 = 8.24\%$

### (6) Changes in working capital

새로운 투자의사결정은 고정자산에 대한 투자뿐만 아니라 유동자산이나 유동부채와 같은 운전자본에 대한 투자를 필요로 한다. 신규투자가 가져오는 추가적은 순운전자본의 변화액은 추가적인 투자금액으로 인식하여야 한다. 즉, 순운전자본의 증가액은 현금유출의 증가이며, 순운전자본의 감소액은 현금유입의 증가이다. 그러나 주의할 것은 순운전자본의 변동액은 그 개념상 기업의 영업활동주기에 따라 투자와 회수가 반복된다는 것이다. 즉, 기초의 순운전자본 증가액만큼의 투자는 기말에 회수된다.

$$\text{working capital} = \text{non-cash current asset} - \text{non-debt current liability}$$
$$\triangle\text{working capital} > 0 \rightarrow \text{cash outflow}$$
$$\triangle\text{working capital} < 0 \rightarrow \text{cash inflow}$$

### (7) Salvage value after tax

투자에서 회수되는 잔존가치(SV)와 법인세법의 장부가액(BV)이 다르게 될 경우, 설비의 매각손실이나 매각이익이 발생하게 되고 그에 따른 세금효과를 고려하여야 한다.

$$\text{Sale of fixed asset after tax} = SV - (SV - BV) \times T$$

where : SV = pre-tax cash proceeds from sale of fixed asset
BV = book value of the fixed asset

### (8) FCF (Free cash flow)

실물시장에서의 영업현금흐름, 자본적 지출 및 순운전자본의 변동에 따른 현금흐름을 모두 반영한 기업에 귀속되는 잉여현금흐름(free cash flow)은 다음과 같다.

$$FCF = \text{영업활동 현금흐름} - \text{자본적지출} - \text{순운전자본지출}$$
$$= OCF - \text{Capital Expenditure(CAPEX)} - \triangle\text{Working Capital}$$

## 3 Estimating Cash Flows

### (1) Initial investment outlay (t = 0)

1) Capital expenditure (CAPEX)

2) Changes in working capital

3) Sale of old fixed asset after tax = SV − (SV − BV) × T

### (2) Operating cash flow(OCF) (t = 1~n)

$$\begin{aligned} OCF &= \triangle EBITDA \times (1 - T) + \triangle Depreciation \times T \\ &= \triangle EBIT \times (1 - T) + \triangle Depreciation \end{aligned}$$

### (3) Terminal cash flow (t = n)

1) Sale of new fixed asset after tax = SV − (SV − BV) × T

2) Changes in working capital

**Example 6-5**

Maxgo Company is considering replacing its current computer system. The new system would cost Maxgo $60,000 to have it installed and operational. It would have an expected useful life of 4 years and an estimated salvage value of $12,000. The system would be depreciated on a straight-line basis for financial statement reporting purposes and use the MACRS depreciation method for income tax reporting purposes. Assume that the percentages of depreciation for MACRS are 25%, 40%, 20%, and 15% for the four-year life of the new computer.

Maxgo's current computer system has been fully depreciated for both financial system and income tax reporting purposes. It could be used for 4 more years, but not as effectively as the new computer system. The old system currently has an estimated salvage value of $8,000. It is estimated that the new system will save $15,000 per year in operating costs. Working capital would increase by $3,000 if the new system is purchased, but it would be recovered at the end of the project' 4-year life. Maxgo expects to have an effective income tax rate of 30 percent for the next four years. What is the net cash flow of the project that the firm should use in a capital budgeting analysis?

**Solution**

(1) Initial investment outlay (t = 0)

1) Capital expenditure = −$60,000

2) Sale of old fixed asset after tax = $8,000 − (8,000 − 0) × 0.3 = $5,600

3) Changes in working capital = −$3,000

Initial Investment Outlay = −60,000 + 5,600 − 3,000 = −$57,400

(2) Operating cash flow (t = 1∼n)

△EBITDA = $0 − (−$15,000) = $15,000

$OCF_1$ = $15,000 × 0.7 + $60,000 × 0.25 × 0.3 = $15,000

$OCF_2$ = $15,000 × 0.7 + $60,000 × 0.40 × 0.3 = $17,700

$OCF_3$ = $15,000 × 0.7 + $60,000 × 0.20 × 0.3 = $14,100

$OCF_4$ = $15,000 × 0.7 + $60,000 × 0.15 × 0.3 = $13,200

### (2) Decision rule

#### 1) Independent projects

ARR 〉 the benchmark ARR → accept the project

ARR 〈 the benchmark ARR → reject the project

#### 2) Mutually exclusive projects

Choose the project with the highest ARR as long as its ARR is higher than the benchmark ARR

### (3) Advantages

- Easy to calculate.
- Needed information will usually be available.

### (4) Disadvantages

- It ignores the time value of money.
- Based on accounting values, not cash flows.
- Uses an arbitrary benchmark cutoff rate.

## 4 Net Present Value (NPV)

### (1) NPV

The difference between the present value of cash inflows and the present value of cash outflows over a period of time.

순현가는 투자안의 수행으로 예상되는 미래현금유입을 적절한 할인율로 할인하여 사출한 현재가치에서 투자소요액을 차감한 값을 말한다.

$$\begin{aligned}\text{NPV} &= \text{PV of cash inflows} - \text{PV of cash outflow} \\ &= -CF_0 + \frac{CF_1}{1+k} + \frac{CF_2}{(1+k)^2} + \frac{CF_3}{(1+k)^3} + \ldots + \frac{CF_n}{(1+k)^n} \\ &= \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}\end{aligned}$$

k = Hurdle rate = minimum rate of return = required rate of return = Cost of capital (WACC)

$$NPV_A = -2{,}000 + \frac{1{,}000}{1.1} + \frac{800}{(1.1)^2} + \frac{600}{(1.1)^3} + \frac{200}{(1.1)^4} = \$158$$

$$NPV_B = -2{,}000 + \frac{200}{1.1} + \frac{600}{(1.1)^2} + \frac{800}{(1.1)^3} + \frac{1{,}200}{(1.1)^4} = \$99$$

❖ **Spreadsheet Solution**

[EXCEL] [재무] NPV

A1 = −2,000, A2 = 1,000, A3 = 800, A4 = 600, A5 = 200

NPV(10%, A2:A5) + A1 = +158

* NPV는 투자시점의 현금유출을 인식하지 않는다.

## (2) Decision rule

### 1) Independent projects

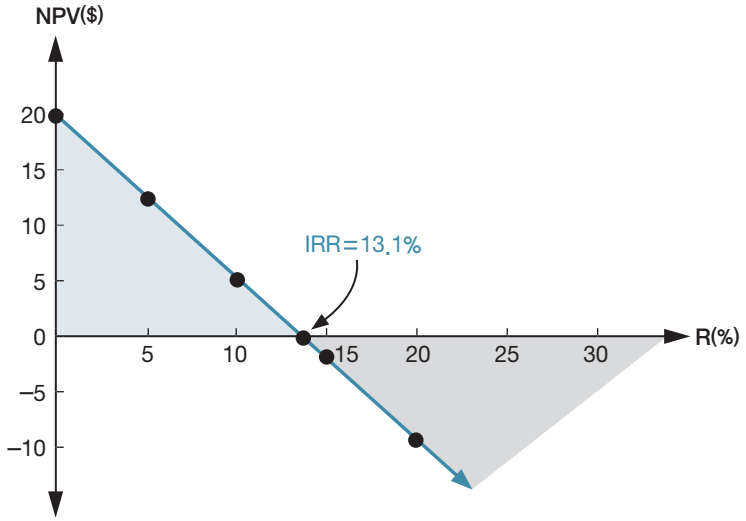
NPV 〉 0 → accept the project

NPV 〈 0 → reject the project

### 2) Mutually exclusive projects

Choose the project with the highest NPV

[Figure 6-1]




## 5 Internal Rate of Return (IRR)

### (1) IRR

The discount rate that makes the NPV of an investment zero. IRR must be calculated either through trial-and-error or using software programmed.

내부수익률은 투자로 인하여 발생하는 현금유입의 현재가치와 현금유출의 현재가치를 일치시켜 주는 할인율이다. 즉, 순현가(NPV)=0이 되는 할인율이다.

$$CF_0 = \frac{CF_1}{1+IRR} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_3}{(1+IRR)^3} + \ldots + \frac{CF_n}{(1+IRR)^n}$$

$$NPV = 0 = \sum_{t=0}^{n} \frac{CF_t}{(1+IRR)^t}$$

$$2{,}000 = \frac{1{,}000}{1+IRR} + \frac{800}{(1+IRR)^2} + \frac{600}{(1+IRR)^3} + \frac{200}{(1+IRR)^4} \rightarrow \text{IRR}_A = 14.5\%$$

$$2{,}000 = \frac{200}{1+IRR} + \frac{600}{(1+IRR)^2} + \frac{800}{(1+IRR)^3} + \frac{1{,}200}{(1+IRR)^4} \rightarrow \text{IRR}_B = 11.8\%$$

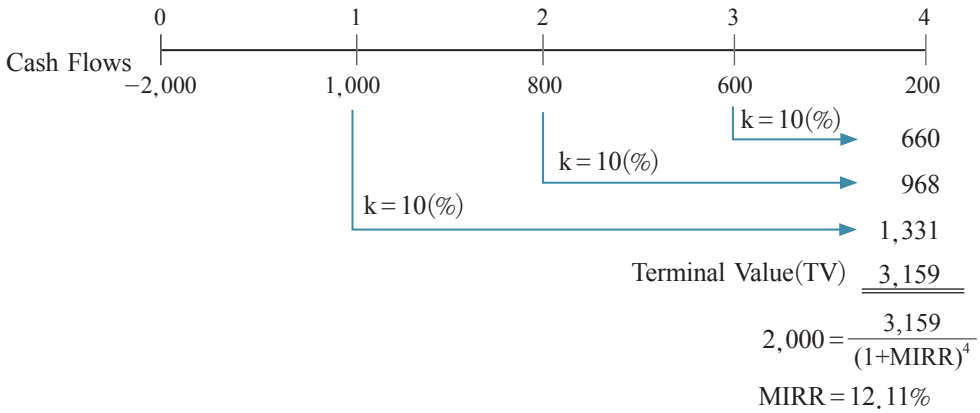
NPV법은 투자안으로부터 유입되는 현금이 자본비용과 동일한 수익률로 재투자된다고 가정하고, IRR법은 내부수익률로 재투자된다고 가정한다. 하지만 시장에서 공통적으로 평가하는 자본비용수준의 수익률로 재투자된다고 보는 것이 합리적이며 현실적이다.

## (5) Modified IRR (MIRR)

The discount rate at which the present value of a project' cost is equal to the present value of its terminal value, where the terminal value is found as the sum of the future values of the cash inflows, compounded at the firm' cost of capital.

투자안의 재투자수익률로서 자본비용을 사용해서 구한 내부수익률을 수정된 내부수익률(MIRR)이라고 한다.

투자안 A의 MIRR을 계산해 보면 다음과 같다.




[Figure 6-3] MIRR

**Example 6-6**

Assume a project has a normal cash flow pattern, which of the following statements is most correct?

a. All else equal. IRR increases as the cost of capital declines
b. All else equal. NPV increases as the cost of capital declines
c. All else equal. MIRR increases as the cost of capital declines
d. All else equal. PI decreases as the cost of capital declines

**Solution**

k 감소 → NPV, PI : 증가
k 감소 → MIRR 감소
k 감소 → IRR, payback period : no effect

**정답** : b

## 8 Unequal lives

투자수명이 서로 다른 투자안들을 NPV법으로 비교하는 경우 각 투자안들이 투자수명이 종료된 후에도 각각 똑같은 투자안을 다시 수행할 기회가 있다고 가정하여 다음과 같이 평가한다.

| | Project C | Project D |
|---|---|---|
| NPV | +$184 | +$205 |
| Useful life | 3 | 4 |
| Discount rate | 10% | |

# 11 Economic Value Added

## (1) Economic Value Added (EVA)

경제적 부가가치(EVA)는 세후 영업이익(NOPAT : net operating profit after taxes)에서 투자자본의 자본비용을 차감하여 산출하며, 투자자본의 자본비용은 타인자본비용과 자기자본비용을 모두 포함한다. 따라서 EVA는 자본비용을 공제한 후의 잔여이익으로서 경제적 이익(EP : economic profit) 또는 초과이익(excess earnings)이라고도 하는데, 다음과 같은 식으로 측정한다.

$$EVA = NOPAT - \text{Total cost of capital}$$

$NOPAT = EBIT \times (1 - t)$
Total cost of capital = Invested capital × WACC
Invested capital = Assets − Operating Liabilities

## (2) Market Value Added (MVA)

시장부가가치(MVA)는 경제적 부가가치(EVA)를 자본비용으로 할인한 현재가치이다.

$$MVA = \sum_{t=1}^{n} \frac{EVA_t}{(1+WACC)^t}$$

**Economic Thinking**

코카콜라는 1980년대 들어 라이벌인 펩시사와의 경쟁에서 시장점유율 등 기업 경쟁력이 악화되면서 새로운 경영관리기법인 EVA를 1987년부터 도입하기 시작하였다. 자본비용을 상회하는 수익률을 올리는 프로젝트에 집중 투자하고 저수익 사업부문에서는 과감히 철수함으로써 기업 가치를 증대시키는 전략을 사용한 것이다. 또한 EVA를 이용하여 영업 이익률의 개선, 집중 구매에 의한 경비 절감 및 운전자본의 삭감과 같은 효율성의 향상을 가져왔다. 이러한 노력의 결과 평균자본비용을 16%에서 12%로 낮추고, 52개 생산부문을 40개로 축소하여 집중 생산하도록 하는 방식을 채택했다. 결과적으로 코카콜라사의 EVA는 1987년에 490 달러에서 95년에는 2,172 달러로 상승하였고, 주가도 같은 기간 동안 9.53 달러에서 74.25 달러로 상승하였다.

**Example 7-9**

On 11/1/20X1, AIFA purchased an at-the-money call option for $9,000 to purchase 100,000 gallons at $15 per gallon on 2/1/20X2. AIFA designates the derivatives as speculation. The market price of fuel and time value of the call option follow:

| | 11/1/20X1 | 12/31/20X1 | 2/1/20X2 |
|---|---|---|---|
| fuel | 15 | 13 | 14 |
| call option-time value | 9,000 | 3,000 | 0 |

| | | | |
|---|---|---|---|
| 11/1/20X1 | Call option(Asset)<br>Cash | 9,000 | <br>9,000 |
| 12/31/20X1 | Loss on call option<br>Call option(Asset) | 6,000 | <br>6,000 |
| 2/1/20X2 | Loss on call option<br>Call option(Asset) | 3,000 | <br>3,000 |
| Settlement | No entry | | |

**Example 7-10**

On 11/1/20X1, AIFA issued an at-the-money call option for $9,000 to purchase 100,000 gallons at $15 per gallon on 2/1/20X2. AIFA designates the derivatives as speculation. The market price of fuel and time value of the call option follow:

| | 11/1/20X1 | 12/31/20X1 | 2/1/20X2 |
|---|---|---|---|
| fuel | 15 | 13 | 14 |
| call option-time value | 9,000 | 3,000 | 0 |

| | | | |
|---|---|---|---|
| 11/1/20X1 | Cash | 9,000 | |
| | Call option(Liability) | | 9,000 |
| 12/31/20X1 | Call option(Liability) | 6,000 | |
| | Gain on call option | | 6,000 |
| 2/1/20X2 | Call option(Liability) | 3,000 | |
| | Gain on call option | | 3,000 |
| Settlement | No entry | | |

## 2 연금의 현가표(Present Value of Interest Factor for Annuity : PVIFA)

$$PVIFA = \frac{1-\frac{1}{(1+i)^n}}{i}$$

| $n/i$ | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.99010 | 0.98039 | 0.97087 | 0.96154 | 0.95238 | 0.94340 | 0.93458 | 0.92593 | 0.91743 | 0.90909 |
| 2 | 1.97039 | 1.94156 | 1.91347 | 1.88609 | 1.85941 | 1.83339 | 1.80802 | 1.78326 | 1.75911 | 1.73554 |
| 3 | 2.94098 | 2.88388 | 2.82861 | 2.77509 | 2.72325 | 2.67301 | 2.62432 | 2.57710 | 2.53129 | 2.48685 |
| 4 | 3.90197 | 3.80773 | 3.71710 | 3.62990 | 3.54595 | 3.46511 | 3.38721 | 3.31213 | 3.23972 | 3.16987 |
| 5 | 4.85343 | 4.71346 | 4.57971 | 4.45182 | 4.32948 | 4.21236 | 4.10020 | 3.99271 | 3.88965 | 3.79079 |
| 6 | 5.79548 | 5.60143 | 5.41719 | 5.24214 | 5.07569 | 4.91732 | 4.76654 | 4.62288 | 4.48592 | 4.35526 |
| 7 | 6.72819 | 6.47199 | 6.23028 | 6.00206 | 5.78637 | 5.58238 | 5.38929 | 5.20637 | 5.03295 | 4.86842 |
| 8 | 7.65168 | 7.32548 | 7.01969 | 6.73275 | 6.46321 | 6.20979 | 5.97130 | 5.74664 | 5.53482 | 5.33493 |
| 9 | 8.56602 | 8.16224 | 7.78611 | 7.43533 | 7.10782 | 6.80169 | 6.51523 | 6.24689 | 5.99525 | 5.75902 |
| 10 | 9.47130 | 8.98259 | 8.53020 | 8.11090 | 7.72174 | 7.36009 | 7.02358 | 6.71008 | 6.41766 | 6.14457 |
| 11 | 10.36763 | 9.78685 | 9.25262 | 8.76048 | 8.30642 | 7.88687 | 7.49867 | 7.13896 | 6.80519 | 6.49506 |
| 12 | 11.25508 | 10.57534 | 9.95400 | 9.38507 | 8.86325 | 8.38384 | 7.94269 | 7.53608 | 7.16073 | 6.81369 |
| 13 | 12.13374 | 11.34837 | 10.63495 | 9.98565 | 9.39357 | 8.85268 | 8.35765 | 7.90378 | 7.48690 | 7.10336 |
| 14 | 13.00370 | 12.10625 | 11.29607 | 10.56312 | 9.89864 | 9.29498 | 8.74547 | 8.24424 | 7.78615 | 7.36669 |
| 15 | 13.86505 | 12.84926 | 11.93793 | 11.11839 | 10.37966 | 9.71225 | 9.10791 | 8.55948 | 8.06069 | 7.60608 |
| 16 | 14.71787 | 13.57771 | 12.56110 | 11.65230 | 10.83777 | 10.10590 | 9.44665 | 8.85137 | 8.31256 | 7.82371 |
| 17 | 15.56225 | 14.29187 | 13.16612 | 12.16567 | 11.27407 | 10.47726 | 9.76322 | 9.12164 | 8.54363 | 8.02155 |
| 18 | 16.39827 | 14.99203 | 13.75351 | 12.65930 | 11.68959 | 10.82760 | 10.05909 | 9.37189 | 8.75563 | 8.20141 |
| 19 | 17.22601 | 15.67846 | 14.32380 | 13.13394 | 12.08532 | 11.15812 | 10.33560 | 9.60360 | 8.95011 | 8.36492 |
| 20 | 18.04555 | 16.35143 | 14.87747 | 13.59033 | 12.46221 | 11.46992 | 10.59401 | 9.81815 | 9.12855 | 8.51356 |

| $n/i$ | 11.0 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 | 19.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.90090 | 0.89286 | 0.88496 | 0.87719 | 0.86957 | 0.86207 | 0.85470 | 0.84746 | 0.84034 | 0.83333 |
| 2 | 1.71252 | 1.69005 | 1.66810 | 1.64666 | 1.62571 | 1.60523 | 1.58521 | 1.56564 | 1.54650 | 1.52778 |
| 3 | 2.44371 | 2.40183 | 2.36115 | 2.32163 | 2.28323 | 2.24589 | 2.20959 | 2.17427 | 2.13992 | 2.10648 |
| 4 | 3.10245 | 3.03735 | 2.97447 | 2.91371 | 2.85498 | 2.79818 | 2.74324 | 2.69006 | 2.63859 | 2.58873 |
| 5 | 3.69590 | 3.60478 | 3.51723 | 3.43308 | 3.35216 | 3.27429 | 3.19935 | 3.12717 | 3.05764 | 2.99061 |
| 6 | 4.23054 | 4.11141 | 3.99755 | 3.88867 | 3.78448 | 3.68474 | 3.58918 | 3.49760 | 3.40978 | 3.32551 |
| 7 | 4.71220 | 4.56376 | 4.42261 | 4.28830 | 4.16042 | 4.03857 | 3.92238 | 3.81153 | 3.70570 | 3.60459 |
| 8 | 5.14612 | 4.96764 | 4.79877 | 4.63886 | 4.48732 | 4.34359 | 4.20716 | 4.07757 | 3.95437 | 3.83716 |
| 9 | 5.53705 | 5.32825 | 5.13166 | 4.94637 | 4.77158 | 4.60654 | 4.45057 | 4.30302 | 4.16333 | 4.03097 |
| 10 | 5.88923 | 5.65022 | 5.42624 | 5.21612 | 5.01877 | 4.83323 | 4.65860 | 4.49409 | 4.33894 | 4.19247 |
| 11 | 6.20652 | 5.93770 | 5.68694 | 5.45273 | 5.23371 | 5.02864 | 4.83641 | 4.65601 | 4.48650 | 4.32706 |
| 12 | 6.49236 | 6.19437 | 5.91765 | 5.66029 | 5.42062 | 5.19711 | 4.98839 | 4.79323 | 4.61050 | 4.43922 |
| 13 | 6.74987 | 6.42355 | 6.12181 | 5.84236 | 5.58315 | 5.34233 | 5.11828 | 4.90951 | 4.71471 | 4.53268 |
| 14 | 6.98187 | 6.62817 | 6.30249 | 6.00207 | 5.72448 | 5.46753 | 5.22930 | 5.00806 | 4.80228 | 4.61057 |
| 15 | 7.19087 | 6.81086 | 6.46238 | 6.14217 | 5.84737 | 5.57546 | 5.32419 | 5.09158 | 4.87586 | 4.67547 |
| 16 | 7.37916 | 6.97399 | 6.60388 | 6.26506 | 5.95424 | 5.66850 | 5.40529 | 5.16235 | 4.93770 | 4.72956 |
| 17 | 7.54879 | 7.11963 | 6.72909 | 6.37286 | 6.04716 | 5.74870 | 5.47461 | 5.22233 | 4.98966 | 4.77463 |
| 18 | 7.70162 | 7.24967 | 6.83991 | 6.46742 | 6.12797 | 5.81785 | 5.53385 | 5.27316 | 5.03333 | 4.81220 |
| 19 | 7.83929 | 7.36578 | 6.93797 | 6.55037 | 6.19823 | 5.87746 | 5.58449 | 5.31624 | 5.07003 | 4.84350 |
| 20 | 7.96333 | 7.46944 | 7.02475 | 6.62313 | 6.25933 | 5.92884 | 5.62777 | 5.35275 | 5.10086 | 4.86958 |

## 3 종가표(Future Value of Interest Factor : FVIF)

$$FVIF = (1+i)^n \ (n=\text{기간},\ i=\text{기간당 할인율})$$

| $n/i$ | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.01000 | 1.02000 | 1.03000 | 1.04000 | 1.05000 | 1.06000 | 1.07000 | 1.08000 | 1.09000 | 1.10000 |
| 2 | 1.02010 | 1.04040 | 1.06090 | 1.08160 | 1.10250 | 1.12360 | 1.14490 | 1.16640 | 1.18810 | 1.21000 |
| 3 | 1.03030 | 1.06121 | 1.09273 | 1.12486 | 1.15762 | 1.19102 | 1.22504 | 1.25971 | 1.29503 | 1.33100 |
| 4 | 1.04060 | 1.08243 | 1.12551 | 1.16986 | 1.21551 | 1.26248 | 1.31080 | 1.36049 | 1.41158 | 1.46410 |
| 5 | 1.05101 | 1.10408 | 1.15927 | 1.21665 | 1.27628 | 1.33823 | 1.40255 | 1.46933 | 1.53862 | 1.61051 |
| 6 | 1.06152 | 1.12616 | 1.19405 | 1.26532 | 1.34010 | 1.41852 | 1.50073 | 1.58687 | 1.67710 | 1.77156 |
| 7 | 1.07214 | 1.14869 | 1.22987 | 1.31593 | 1.40710 | 1.50363 | 1.60578 | 1.71382 | 1.82804 | 1.94872 |
| 8 | 1.08286 | 1.17166 | 1.26677 | 1.36857 | 1.47746 | 1.59385 | 1.71819 | 1.85093 | 1.99256 | 2.14359 |
| 9 | 1.09369 | 1.19509 | 1.30477 | 1.42331 | 1.55133 | 1.68948 | 1.83846 | 1.99900 | 2.17189 | 2.35795 |
| 10 | 1.10462 | 1.21899 | 1.34392 | 1.48024 | 1.62889 | 1.79085 | 1.96715 | 2.15892 | 2.36736 | 2.59374 |
| 11 | 1.11567 | 1.24337 | 1.38423 | 1.53945 | 1.71034 | 1.89830 | 2.10485 | 2.33164 | 2.58043 | 2.85312 |
| 12 | 1.12682 | 1.26824 | 1.42576 | 1.60103 | 1.79586 | 2.01220 | 2.25219 | 2.51817 | 2.81266 | 3.13843 |
| 13 | 1.13809 | 1.29361 | 1.46853 | 1.66507 | 1.88565 | 2.13293 | 2.40984 | 2.71962 | 3.06580 | 3.45227 |
| 14 | 1.14947 | 1.31948 | 1.51259 | 1.73168 | 1.97993 | 2.26090 | 2.57853 | 2.93719 | 3.34173 | 3.79750 |
| 15 | 1.16097 | 1.34587 | 1.55797 | 1.80094 | 2.07893 | 2.39656 | 2.75903 | 3.17217 | 3.64248 | 4.17725 |
| 16 | 1.17258 | 1.37279 | 1.60471 | 1.87298 | 2.18287 | 2.54035 | 2.95216 | 3.42594 | 3.97030 | 4.59497 |
| 17 | 1.18430 | 1.40024 | 1.65285 | 1.94790 | 2.29202 | 2.69277 | 3.15881 | 3.70002 | 4.32763 | 5.05447 |
| 18 | 1.19615 | 1.42825 | 1.70243 | 2.02582 | 2.40662 | 2.85434 | 3.37993 | 3.99602 | 4.71712 | 5.55992 |
| 19 | 1.20811 | 1.45681 | 1.75351 | 2.10685 | 2.52695 | 3.02560 | 3.61653 | 4.31570 | 5.14166 | 6.11591 |
| 20 | 1.22019 | 1.48595 | 1.80611 | 2.19112 | 2.65330 | 3.20713 | 3.86968 | 4.66096 | 5.60441 | 6.72750 |

| $n/i$ | 11.0 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 | 19.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.11000 | 1.12000 | 1.13000 | 1.14000 | 1.15000 | 1.16000 | 1.17000 | 1.18000 | 1.19000 | 1.20000 |
| 2 | 1.23210 | 1.25440 | 1.27690 | 1.29960 | 1.32250 | 1.34560 | 1.36890 | 1.39240 | 1.41610 | 1.44000 |
| 3 | 1.36763 | 1.40493 | 1.44290 | 1.48154 | 1.52087 | 1.56090 | 1.60161 | 1.64303 | 1.68516 | 1.72800 |
| 4 | 1.51807 | 1.57352 | 1.63047 | 1.68896 | 1.74901 | 1.81064 | 1.87389 | 1.93878 | 2.00534 | 2.07360 |
| 5 | 1.68506 | 1.76234 | 1.84244 | 1.92541 | 2.01136 | 2.10034 | 2.19245 | 2.28776 | 2.38635 | 2.48832 |
| 6 | 1.87041 | 1.97382 | 2.08195 | 2.19497 | 2.31306 | 2.43640 | 2.56516 | 2.69955 | 2.83976 | 2.98598 |
| 7 | 2.07616 | 2.21068 | 2.35261 | 2.50227 | 2.66002 | 2.82622 | 3.00124 | 3.18547 | 3.37931 | 3.58318 |
| 8 | 2.30454 | 2.47596 | 2.65844 | 2.85259 | 3.05902 | 3.27841 | 3.51145 | 3.75886 | 4.02138 | 4.29982 |
| 9 | 2.55804 | 2.77308 | 3.00404 | 3.25195 | 3.51788 | 3.80296 | 4.10840 | 4.43545 | 4.78545 | 5.15978 |
| 10 | 2.83942 | 3.10585 | 3.39457 | 3.70722 | 4.04556 | 4.41143 | 4.80683 | 5.23383 | 5.69468 | 6.19173 |
| 11 | 3.15176 | 3.47855 | 3.83586 | 4.22623 | 4.65239 | 5.11726 | 5.62399 | 6.17592 | 6.77667 | 7.43008 |
| 12 | 3.49845 | 3.89598 | 4.33452 | 4.81790 | 5.35025 | 5.93603 | 6.58007 | 7.28759 | 8.06424 | 8.91610 |
| 13 | 3.88328 | 4.36349 | 4.89801 | 5.49241 | 6.15279 | 6.88579 | 7.69868 | 8.59936 | 9.59645 | 10.69932 |
| 14 | 4.31044 | 4.88711 | 5.53475 | 6.26135 | 7.07570 | 7.98752 | 9.00745 | 10.14724 | 11.41977 | 12.83918 |
| 15 | 4.78459 | 5.47356 | 6.25427 | 7.13794 | 8.13706 | 9.26552 | 10.53872 | 11.97374 | 13.58953 | 15.40701 |
| 16 | 5.31089 | 6.13039 | 7.06732 | 8.13725 | 9.35762 | 10.74800 | 12.33030 | 14.12902 | 16.17154 | 18.48842 |
| 17 | 5.89509 | 6.86604 | 7.98608 | 9.27646 | 10.76126 | 12.46768 | 14.42645 | 16.67224 | 19.24413 | 22.18610 |
| 18 | 6.54355 | 7.68996 | 9.02427 | 10.57517 | 12.37545 | 14.46251 | 16.87895 | 19.67324 | 22.90051 | 26.62332 |
| 19 | 7.26334 | 8.61276 | 10.19742 | 12.05569 | 14.23177 | 16.77651 | 19.74837 | 23.21443 | 27.25161 | 31.94798 |
| 20 | 8.06231 | 9.64629 | 11.52309 | 13.74348 | 16.36653 | 19.46075 | 23.10559 | 27.39302 | 32.42941 | 38.33758 |

## 4 연금의 종가표(Future Value of Interest Factor for Annuity : FVIFA)

$$FVIFA = \frac{(1+i)^n - 1}{i}$$

| $n/i$ | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 |
| 2 | 2.01000 | 2.02000 | 2.03000 | 2.04000 | 2.04500 | 2.06000 | 2.07000 | 2.08000 | 2.09000 | 2.10000 |
| 3 | 3.03010 | 3.06040 | 3.09090 | 3.12160 | 3.13702 | 3.18360 | 3.21490 | 3.24640 | 3.27810 | 3.31000 |
| 4 | 4.06040 | 4.12161 | 4.18363 | 4.24646 | 4.27819 | 4.37462 | 4.43994 | 4.50611 | 4.57313 | 4.64100 |
| 5 | 5.10100 | 5.20404 | 5.30914 | 5.41632 | 5.47071 | 5.63709 | 5.75074 | 5.86660 | 5.98471 | 6.10510 |
| 6 | 6.15201 | 6.30812 | 6.46841 | 6.63298 | 6.71689 | 6.97532 | 7.15329 | 7.33593 | 7.52333 | 7.71561 |
| 7 | 7.21353 | 7.43428 | 7.66246 | 7.89829 | 8.01915 | 8.39384 | 8.65402 | 8.92280 | 9.20043 | 9.48717 |
| 8 | 8.28567 | 8.58297 | 8.89234 | 9.21423 | 9.38001 | 9.89747 | 10.25980 | 10.63663 | 11.02847 | 11.43589 |
| 9 | 9.36853 | 9.75463 | 10.15911 | 10.58279 | 10.80211 | 11.49132 | 11.97799 | 12.48756 | 13.02104 | 13.57948 |
| 10 | 10.46221 | 10.94972 | 11.46388 | 12.00611 | 12.28821 | 13.18079 | 13.81645 | 14.48656 | 15.19293 | 15.93742 |
| 11 | 11.56683 | 12.16871 | 12.80779 | 13.48635 | 13.84118 | 14.97164 | 15.78360 | 16.64549 | 17.56029 | 18.53117 |
| 12 | 12.68250 | 13.41209 | 14.19203 | 15.02580 | 15.46403 | 16.86994 | 17.88845 | 18.97713 | 20.14072 | 21.38428 |
| 13 | 13.80933 | 14.68033 | 15.61779 | 16.62684 | 17.15991 | 18.88214 | 20.14064 | 21.49530 | 22.95338 | 24.52271 |
| 14 | 14.94742 | 15.97394 | 17.08632 | 18.29191 | 18.93211 | 21.01506 | 22.55049 | 24.21492 | 26.01919 | 27.97498 |
| 15 | 16.09689 | 17.29342 | 18.59891 | 20.02359 | 20.78405 | 23.27597 | 25.12902 | 27.15211 | 29.36091 | 31.77248 |
| 16 | 17.25786 | 18.63928 | 20.15688 | 21.82453 | 22.71933 | 25.67252 | 27.88805 | 30.32428 | 33.00339 | 35.94973 |
| 17 | 18.43044 | 20.01207 | 21.76158 | 23.69751 | 24.74170 | 28.21287 | 30.84021 | 33.75022 | 36.97370 | 40.54470 |
| 18 | 19.61474 | 21.41231 | 23.41443 | 25.64541 | 26.85508 | 30.90565 | 33.99903 | 37.45024 | 41.30133 | 45.59917 |
| 19 | 20.81089 | 22.84056 | 25.11686 | 27.67123 | 29.06356 | 33.75998 | 37.37896 | 41.44626 | 46.01845 | 51.15908 |
| 20 | 22.01900 | 24.29737 | 26.87037 | 29.77807 | 31.37142 | 36.78558 | 40.99549 | 45.76196 | 51.16011 | 57.27499 |

| $n/i$ | 11.0 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 | 19.0 | 20.0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 | 1.00000 |
| 2 | 2.11000 | 2.12000 | 2.13000 | 2.14000 | 2.15000 | 2.16000 | 2.17000 | 2.18000 | 2.19000 | 2.20000 |
| 3 | 3.34210 | 3.37440 | 3.40690 | 3.43960 | 3.47250 | 3.50560 | 3.53890 | 3.57240 | 3.60610 | 3.64000 |
| 4 | 4.70973 | 4.77933 | 4.84980 | 4.92114 | 4.99337 | 5.06650 | 5.14051 | 5.21543 | 5.29126 | 5.36800 |
| 5 | 6.22780 | 6.35285 | 6.48027 | 6.61010 | 6.74238 | 6.87714 | 7.01440 | 7.15421 | 7.29660 | 7.44160 |
| 6 | 7.91286 | 8.11519 | 8.32271 | 8.53552 | 8.75374 | 8.97748 | 9.20685 | 9.44197 | 9.68295 | 9.92992 |
| 7 | 9.78327 | 10.08901 | 10.40466 | 10.73049 | 11.06680 | 11.41387 | 11.77201 | 12.14152 | 12.52271 | 12.91590 |
| 8 | 11.85943 | 12.29969 | 12.75726 | 13.23276 | 13.72682 | 14.24009 | 14.77325 | 15.32699 | 15.90203 | 16.49908 |
| 9 | 14.16397 | 14.77566 | 15.41571 | 16.08535 | 16.78584 | 17.51851 | 18.28471 | 19.08585 | 19.92341 | 20.79890 |
| 10 | 16.72201 | 17.54873 | 18.41975 | 19.33729 | 20.30372 | 21.32147 | 22.39311 | 23.52131 | 24.70886 | 25.95868 |
| 11 | 19.56143 | 20.65458 | 21.81432 | 23.04451 | 24.34927 | 25.73290 | 27.19993 | 28.75514 | 30.40354 | 32.15041 |
| 12 | 22.71318 | 24.13313 | 25.65018 | 27.27074 | 29.00166 | 30.85016 | 32.82392 | 34.93106 | 37.18021 | 39.58049 |
| 13 | 26.21163 | 28.02911 | 29.98470 | 32.08865 | 34.35191 | 36.78619 | 39.40399 | 42.21865 | 45.24445 | 48.49659 |
| 14 | 30.09491 | 32.39260 | 34.88271 | 37.58106 | 40.50470 | 43.67198 | 47.10266 | 50.81801 | 54.84090 | 59.19591 |
| 15 | 34.40535 | 37.27971 | 40.41746 | 43.84241 | 47.58041 | 51.65949 | 56.11012 | 60.96525 | 66.26067 | 72.03509 |
| 16 | 39.18994 | 42.75327 | 46.67173 | 50.98034 | 55.71747 | 60.92501 | 66.64883 | 72.93899 | 79.85019 | 87.44210 |
| 17 | 44.50083 | 48.88367 | 53.73906 | 59.11759 | 65.07508 | 71.67301 | 78.97913 | 87.06801 | 96.02173 | 105.93052 |
| 18 | 50.39592 | 55.74971 | 61.72513 | 68.39405 | 75.83635 | 84.14069 | 93.40559 | 103.74025 | 115.26585 | 128.11662 |
| 19 | 56.93947 | 63.43967 | 70.74940 | 78.96922 | 88.21180 | 98.60320 | 110.28453 | 123.41349 | 138.16636 | 154.73994 |
| 20 | 64.20282 | 72.05243 | 80.94682 | 91.02491 | 102.44357 | 115.37971 | 130.03290 | 146.62792 | 165.41797 | 186.68792 |