Corporate & Project Finance Valuation Techniques for Maximizing Returns & Superior Growth Strategies

Saïd Business School, University of Oxford, UK

Nicholas Burgess

nburgessx@gmail.com

August 2020

1. Introduction

In this paper we review corporate and project finance techniques used to maximize investor returns and create superior growth strategies. We review the corporate finance concepts and tools used to evaluate investor returns and compare projects. Time value of money concepts can be used to evaluate the free cash flows generated by a project or corporate capital structure. Such studies empower managers to maximize returns, invest in projects that increase the firm value and prune or remedy activities that reduce firm value.

Firstly we introduce the concept that a company or project can be considered as a collection of cash flows and present the tools required to value such cash flows. Secondly we look at corporate & project finance techniques to estimate the cash flows of a broad range of corporate activities and projects. We conclude with a series of case studies where we evaluate a firm's value, company takeover and acquisition premia and estimate bond financing costs. Finally we consider project finance initiatives, reviewing how to identify profitable investment opportunities and when to accept/reject a project. An Excel example workbook is provided with this paper[1].

2. Concepts & Tools

[1] Kindly contact the author should you wish to receive a copy of the Excel case study workbook.

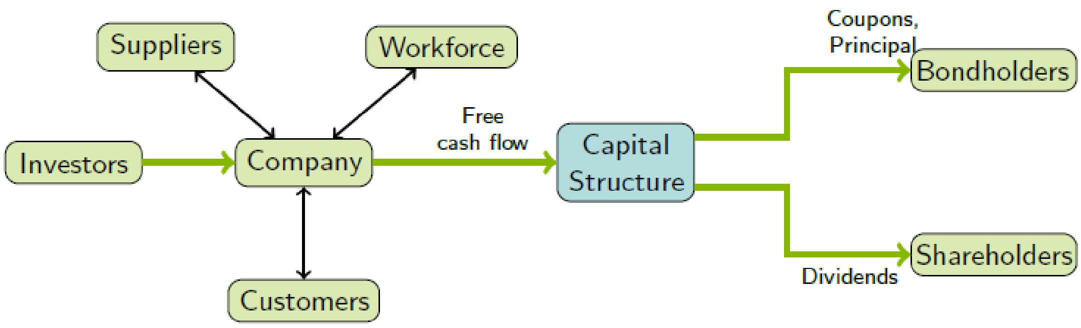
In order to manage a project or company strategy it is vital that we learn how to assess the value the company or a project. In this section we introduce the concept that a company or project can be considered as a collection of cash flows and consider how to value such cash flows.

Once in a position of understanding a manager can then leverage upon activities that add value and scale back or remedy activities that destroy value, paying close attention to extreme cases and projects that add most value and those where most value is depleted.

2.1 Free Cash Flows (FCFs)

To be able to calculate the fair value of a company or project we need to be able to price and value their **free cash flows** (FCFs), which are the collective cash-flows of the company or project to be paid to investors after tax and expenses.

Figure 1 Free Cash Flow Illustration



2.2 Time Value of Money

The value of a cash flow depends to some extent on the when the cash flow is paid or received this is called the time value of money, see (Berk and DeMarzo, 2016).

Only cash flows to be received future or today have value and cash flows in the past have no value (Think what would you pay for cash you have already received, nothing!!!).

A cash flow received today is more valuable than the same cash flow received in the future. Consider $100 received today, time t(0), compared to $100 received in one year's time t(1). If one year interest rates are at 10% say then the $100 received today could be placed on deposit for one year and receive interest of $10. Therefore in one year's time the t(0) cash flow is worth $110 whereas the t(1) cash flow is only worth $100. Clearly near term cash flows are more valuable than the same cash flows in the future[2].

Example 1 Future Cash Flow Value

Cash flow, t(0)	$100	Received now at time, t(0)
Cost-of-capital	10%	per year
Interest, r	$10	per year
Future Value of Cash flow, t(0)	$110	Value in one year's time
Cash flow, t(1)	$100	To be received in one year's time

Equivalently and more generally the future value can be calculated by scaling the cash flow by a future value factor, which adds interest.

Formula 1 Future Value Factor

$$\text{FV Factor} = (1+r)^t$$

where r is the cost-of-capital and t represents the number of years.

Example 2 Future Value Calculation using the FV Factor

Consider a cash flow of $100 received today and a cost of capital of 10%. What is the future value of this cash flow in two year's time?

A cash flow grows in value by its Future Value, FV scaling factor,

$$\text{FV Factor} = (1+r)^t = (1+10\%)^2 = 1.21$$

[2] Unless we have negative interest rates, where we have to pay to deposit funds, such as in Japan.

The Future Value of \$100 in two year's time,

$$FV(100) = 100 \text{ x FV Factor} = 100 \text{ x } 1.21 = \$121$$

2.3 Cost of Capital

Given the interest rate it is straightforward to calculate the value of a cash flow in the future. The constant or flat rate of interest to be used is called the **cost-of-capital.** The cost of capital[3] is the rate of return investors demand to be willing to accept the risk and invest in a company or project.

For an equity the cost of capital is calculated using the Capital Asset Pricing Model formula (CAPM) see formulae 2, for debt securities the cost of capital is the par yield of the bond and for a corporation comprising of both equity and debt we can compute the weighted average cost of capital or WACC, see formula 3. For a detailed overview of cost of capital evaluation, the CAPM model and WACC calculations, see (Berk and DeMarzo, 2016) and (Brealey et al, 2014).

Formula 2 Capital Asset Pricing Model (CAPM)

$$r_E = r_F + \beta \, (r_M - r_F)$$

where r_E is the equity cost of capital, r_F the risk-free rate typically associated with government bonds and treasury securities, β the measure of equity returns relative to the market and r_M the market return often measured as the returns generated by the principal equity index for the respective market e.g. FTSE 100 for GBP, Dow Jones or S&P 500 for USD, DAX Index for EUR etc.

Formula 3 Weighted Average Cost of Capital (WACC)

$$WACC = r_E (E / V) + r_D (D / V)$$

where r_E is the equity cost of capital, r_D is the debt cost of capital, E the present value of equity, D the present value of debt and V the total value of the firm i.e. V = E + D.

---

[3] The capital asset pricing model or CAPM model is often used to evaluate the cost of capital for a company or project.

2.4 Present Value, PV

Although we can use the cost-of-capital and FV factor to calculate the **future value** (FV) of a cash flow, it is more typical to want to do the reverse and calculate the present value of a cash flow. That is to say if we know a company or project will generate a stream of cash flows in the future; what would we be willing to pay today to receive that set of cash flows? i.e. how do we work out the **present value** (PV) of such cash flows?

2.5 Discount Factors, DF

Discount Factors are needed to calculate the present value of a cash flow. Just as we can add interest to a cash flow to imply its future value, we can also subtract interest to do the reverse and imply a cash flow's present value.

We showed in (2.2) that a future value can be achieved by scaling a cash flow by the FV Factor from formula 1. The inverse of the FV Factor is the **discount factor**, which reverses the process and scales a future value to a present value[4].

Formula 4 Discount Factor

$$\text{Discount Factor} = \frac{1}{(1+r)^t}$$

where r is the cost of capital and t represents the number of periods or years.

Example 3 Present Value Calculation using Discount Factors

Consider example 1, where we receive $100 in one year's time and have a cost-of-capital or one year interest of 10%. We can use formula 2 to imply the present value of the future cash flow.

Future Cash Flow	$100
Discount Factor	$\frac{1}{(1+r)^t} = \frac{1}{(1+10\%)^1} = \frac{1}{1.1} = 0.9090$
Present Value	$100 \times 0.\overline{9090}$ = $90.91

[4] Note this formula assumes simple compounding.

Therefore $100 in one year in the future is worth $90.91 today, or conversely if we deposit $90.91 today it will grow with 10% interest to become $100 in one year's time.

3. Corporate & Project Finance Techniques

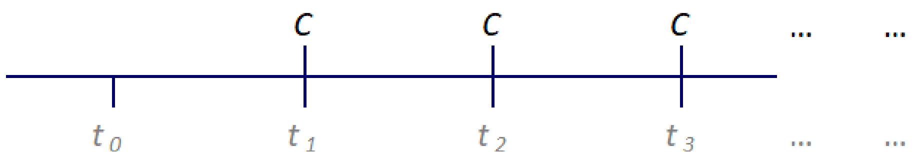
Corporate and project finance valuations are made by discounting cashflows. It can be tricky and complex to estimate and evaluate the present value of all of the free cash flows of a corporation or project, which can potentially perpetual with no end or long-dated and far in the future. Fortunately we can compute the present value of such cash flows using one or more combinations of the perpetuity and annuity formulae below.

3.1 Perpetuity

A useful tool to value a project's cashflows is the **Perpetuity**. An endless stream of cashflows received on regular intervals forever, with no end. The present value of a project with perpetual income can be valued using perpetuity formula 3 below.

Figure 2 Perpetual Cash Flows

Perpetual cash flows C received at regular time intervals t with no end. Importantly cash flow payments start at time one and the present value is ***one period before*** *at time zero.*



Formula 5 Present Value of Perpetuity Cash Flows

$$PV(Perpetuity) = C / r$$

The present value, PV of a regular stream of perpetual cash flows C with cost-of-capital r can be determined using the above formula, which we derive in appendix A. Importantly this formula gives the PV as at ***one period before*** *the first cash flow.*

Example 4 Project with Perpetual Cash Flows

A project pays perpetual cash flows of $100,000 every year, starting in year one, and the cost-of-capital is 10%. What is the value of the project?

Present Value = C / r = 100,000 / 10% = $1,000,000

2.7 Annuity

Similar to a perpetuity an **Annuity** is a stream of regular cash flows, however we receive these cash flows only until a fixed maturity T.

Figure 3 Annuity Cash Flows

Annuity cash flows C received at regular time intervals t until Maturity T

Formula 6 Present Value of Annuity Cash Flows

$$PV(Annuity) = {}^{C}/_{r} \left(1 - \frac{1}{(1+r)^T}\right)$$

The present value, PV of a regular stream of annuity cash flows C with maturity T, cost-of-capital r and maturity discount factor DF(T) can be calculated using the above formula.

PV(Annuity) = PV(Perpetuity) at Start – PV(Perpetuity) at Maturity x DF(Maturity)

$$PV(Annuity) = {}^{C}/_{r} - {}^{C}/_{r}\, DF(T) = {}^{C}/_{r}\,(1 - DF(T))$$

The annuity formula is nothing more than the difference between two perpetuities; long a perpetuity as at the start date and short a discounted perpetuity as at maturity.

Example 5 Project with Annuity Cash Flows

A project pays regular annuity cash flows of \$100,000 for 10 years and the cost-of-capital is 10%. What is the value of this project?

$$\text{Present Value} = C/_{r}\left(1 - \frac{1}{(1+r)^T}\right)$$

$$= 100,000 / 10\% \times (1 – 1/(1+10\%)^{10})$$

$$= 1,000,000 \times (1 – 0.3855)$$

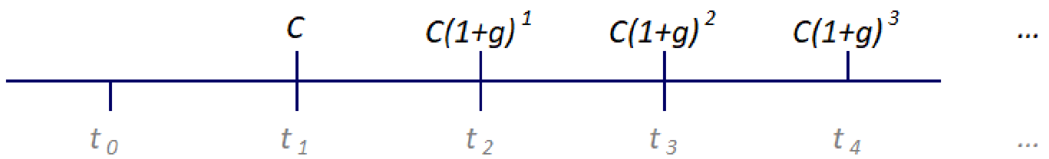
$$= \$614,457.71$$

2.8 Perpetuity with Growth

Another concept and tool we can use to evaluate a project is the perpetuity with growth. This is the same as a regular perpetuity, namely an endless stream of cashflows received on regular intervals forever, with no end. However in the case of the perpetuity with growth the first cash flow is fixed, but subsequent cash flows grow at a rate of g%.

Figure 4 Perpetuity with Growth Cash Flows

Perpetual cash flows are received at regular time intervals t with no end. We receive cash flow C at time one, which grows g% every year. Importantly the first coupon is at time one, growth payments start at time two and the present value is as at time zero, ***one period before*** *the first cash flow C.*



Formula 7 Present Value of a Perpetuity with Growth

$$PV = C / (r - g)$$

The present value, PV of a regular stream of perpetual cash flows C with cost-of-capital r and growing at a rate of g% can be determined using the above formula, *which we derive in appendix B. Importantly this formula gives the PV as at* ***one period before*** *the first cash flow.*

Example 6 Project with Perpetual Cash Flows with Growth

A project pays perpetual cash flows of $100,000 every year, starting in year one, with growth of 2% effective from year two and the cost-of-capital is 10%. What is the value of the project?

Present Value = C / (r - g) = 100,000 / (10% - 2%) = $1,250,000

Note the PV is as at year zero i.e. ***one period before*** *the first perpetual cash flow and growth starts from the second cash flow.*

4. Corporate & Project Finance Case Studies

Corporation and project finance valuations are performed by discounting cash flows to estimate the present value of the corporation or project. The perpetuity, annuity and perpetuity with growth formulae outlined above help with this process as shown in the below case studies.

Case Study 1, Company Value

CW Ltd has just paid a dividend (past cash flows have no value) of £1.50 per share. Dividends are expected to grow at a rate of 5% for 3 years and at a rate of 2% thereafter. The cost of capital and appropriate discount rate for CW shares is 10%. What is the current fair value of CW per share?

The project cashflows look as follows,

Project Cash Flows

time, t	FCF	
0	1.50	Paid Dividend
1	1.58	Growth of 5%
2	1.65	Growth of 5%
3	1.74	Growth of 5%

thereafter growth of g = 2%

Equivalently we can represent these free cash flows (FCF) using the perpetuity with growth formula. Remembering that the perpetuity with growth is valued **one period before** its first cash flow with growth starting on its second cash flow gives equivalent cash flows as follows,

Equivalent Cash Flows using Perpetuity with Growth

time, t	FCF
0	1.50
1	1.58
2	1.65 + P

Perpetuity with Growth, P

P	21.71

where P = C / (r – g) = 1.74 / (10% - 2%) = £21.71

Discounting these cashflows using a cost of capital of 10% gives a present value of £20.74 per share as shown below.

Project Valuation

time, t	FCF	DiscFactor	PV	
0	1.50	1.0000	0.00	Past payments have no value
1	1.58	0.9091	1.43	
2	23.36	0.8264	19.31	

Cost of Capital		**Total PV**
r	10%	20.74

Case Study 2, Acquisition Premia

CW Ltd is considering a takeover bid for NF Ltd, a smaller competitor. CW has identified £80,000 of potential annual efficiency savings at NF. The corporate tax rate is 35% and CW shareholders require a real rate of return of 9% for the acquisition. The expected inflation rate is 2%. What is the maximum premium that CW should be prepared to pay over the NF pre-bid value?

Firstly we need to compute the net or nominal rate of return, which is our cost of capital, as follows,

Rate of Return

Nominal		Inflation		Real
$(1+r_N)$	=	$(1+r_I)$	x	$(1+r_R)$
Net				**Gross**

Real Rate	9%
Inflation Rate	2%
Nominal Rate	11.18%

Next we transform the annual efficiency savings into free cash flows,

Free Cash Flow

Annual Savings	£80,000	pre-tax
Tax Rate	35%	

Equivalent Annual Coupon

52,000

Free cash flows are after tax

We compute the present value of the efficiency savings as a perpetuity, since the savings are annual savings with no end date, which gives us the maximum premium CW Ltd should pay over the NF pre-bid value.

Takeover Premium as a Perpetuity		
Coupon	52,000	
Nominal	11.18%	Net Rate
Perpetuity	465,116	Max Premium

Case Study 3, Bond Financing

CW will finance part of the acquisition, from case study 2, by issuing a 5 year bond. The bond will have a nominal value of £1,000 and a coupon rate of 6% per annum. Coupon payments will be made at the end of each quarter. The Annual Percentage Rate (APR) required by bond investors for CW's risk is 5%. What will be the fair price of the bond at issuance?

We can price the bond as a stream of cashflows comprising of bond coupons and an exchange of notional. Firstly we convert the bond conventions and parameters from Annual to Quarterly,

Bond with Quarterly Coupons		
Nominal	£1,000	
Time Conversion	Annual	Quarterly
Time to Maturity	5	20
Coupon Rate %	6%	1.5%
Coupon	£60	£15
Cost of Capital %	5%	1.25%

Secondly we compute the value of the bond cash flows as an annuity as follows,

Bond Coupons as an Annuity		
C	£15	
r	1.25%	
Time, t	20	quarterly periods

Annuity = $C / r \times (1 - 1 / (1 + r)^t)$

PV	£264

Next we compute the value of the final exchange of notional, note we exclude the initial notional as it is paid upfront and considered in the past with zero value.

Bond Final Notional Exchange as a Cash Flow

FCF	DiscFactor	PV
£1,000	0.7800	£780

Finally we sum the present value of the bond coupon and final exchange cash flows to imply the bond price.

Bond Fair Value

Bond PV = PV(Coupons) + PV(Final Notional Exchange)
We ignore the Initial Exchange which is in the past having zero value

Coupons	Final Exch	Price	%
£264	£780	£1,044	104.40%

The price is higher than par, since the bond pays coupons which are larger than the cost of capital yield.

Case Study 4, Project Finance

CW is evaluating a project. It will require an initial investment of £1,000,000 and generate expected free cash flows of £50,000 for 3 years, after which the cash flows will grow at 2% forever. The market beta of the project is 0.8, market returns are at 6% and the risk free rate is 1%. Compute the net present value (NPV) of the project. Should CW accept the project?

We first calculate the cost of capital required for discounting using the capital asset pricing model (CAPM) formula,

Cost of Capital using CAPM

$r_P = r_F + \beta\,(r_M - r_F)$

Project Beta, β	0.8
Market Returns, r_M	6%
Risk-Free Rate, r_F	1%
Project CoC, r_P	**5%**

Second we determine the project cash flows as follows,

Project Free Cash Flows

time, t	FCF
0	-£1,000,000
1	£50,000
2	£50,000
3	£50,000

thereafter growth of g = 2%

Equivalently we can represent these cash flows as a perpetuity with growth giving,

Equivalent Cash Flows using Perpetuity with Growth

time, t	FCF
0	-£1,000,000
1	£50,000
2	£50,000 + P

Perpetuity, $P = C / (r - g)$

P	£1,666,667
r	5%
g	2%

Finally we discount the project free cash flows to evaluate the project present value.

Project Valuation

time, t	FCF	DiscFactor	PV	
0	-£1,000,000	1.0000	-£1,000,000	Initial investment, yet to be paid
1	£50,000	0.9524	£47,619	
2	£1,716,667	0.9070	£1,557,067	

Cost of Capital		**Total PV**
r	5%	£604,686

The positive NPV of £604,686 indicates the project generates an excess return above the required project return. The project cost of capital incorporates the risk premium above the risk-free rate required. All projects with present value greater than zero should be accepted, hence we should accept and invest this project.

6. Conclusion

In summary we introduced corporate and project finance concepts and tools to estimate and value the free cash flows of a company or project. The notion of cost of capital was presented, which incorporates the expected return required for a given the level of risk into cash flow valuations. Furthermore we looked at advanced corporate and project finance techniques to calculate the present value of an entire corporation or project.

As demonstrated in our case study series the value of a corporation or project can be determined from its cash flow projections, which are often transformed into an equivalent set of cash flows for simplicity. This allow us to value a corporation or project using corporate and project finance techniques, which includes the use of perpetuity, annuity and perpetuity with growth cash flow structures.

The case studies highlighted how to calculate a firm's value, the acquisition premium of a takeover target, bond finance costs and demonstrated how to assess if a project or investment will add or deplete firm value. Such studies empower managers to maximize returns, invest in projects that increase the firm value and prune or remedy activities that reduce firm value.

Appendix A Derivation of Perpetuity Formula

Firstly consider the PV of a perpetuity by discounting individual cash flows as follows,

$PV = C / (1 + r) + C / (1 + r)^2 + C / (1 + r)^3 + \ldots$ (Equation 1)

multiply by (1 + r),

$PV (1 + r) = C + C / (1 + r) + C / (1 + r)^2 + \ldots$ (Equation 2)

subtract equation 1 from equation 2 to get,

$PV (1 + r) - PV = C$

expanding terms leads to,

$PV + PV \times r - PV = C$

PV terms cancel to give,

$PV \times r = C$

rearranging gives the solution,

$PV = C / r$

Appendix B Derivation of Perpetuity with Growth Formula

Similar to the perpetuity formula derived in appendix A, we firstly consider the PV of a perpetuity with growth by discounting the individual cash flows as follows,

$PV = C / (1 + r) + C (1 + g) / (1 + r)^2 + C (1 + g)^2 / (1 + r)^3 + \ldots$ (Equation 3)

multiply by (1 + r) / (1 + g),

$PV (1 + r) / (1 + g) = C / (1 + g) + C / (1 + r) + C (1 + g) / (1 + r)^2 + \ldots$ (Equation 4)

subtract equation 3 from equation 4 to get,

$PV (1 + r) / (1 + g) - PV = C / (1 + g)$

multiplying LHS and RHS by (1 + g) gives,

$PV (1 + r) - PV (1 + g) = C$

expanding terms leads to,

$PV (1 + r - 1 - g) = C$

unit terms cancel giving,

$PV (r - g) = C$

rearranging gives the solution,

$PV = C / (r - g)$

References

(Berk and DeMarzo, 2016)

Book: Corporate Finance, Global Edition, 2016. Published by Pearson

(Brealey et al, 2014)

Book: Principles of Corporate Finance, Global Edition, 2014. McGraw Hill Education.