Lecture: Basic Elements

Lutz Kruschwitz & Andreas Löffler

Discounted Cash Flow, Section 1.1

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Outline

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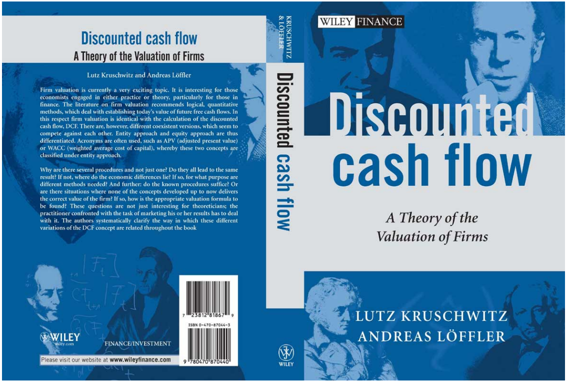
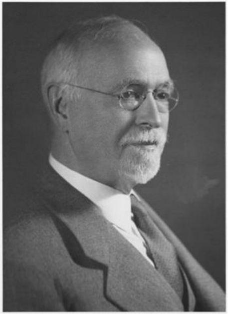
DCF is short for



Irving Fisher (1867–1947)

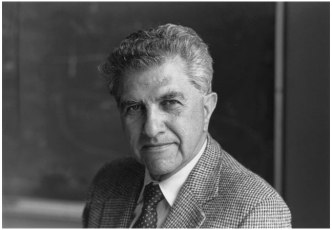


Fisher is one of the earliest American Neoclassicals. He studied Mathematics, Social Science and Philosophy. 1892 Professor at Yale.

Franco Modigliani (1918–2003)

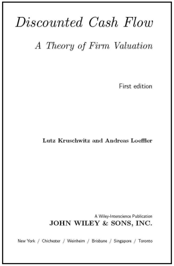
Modigliani was born in Italy, moved to USA in 1939. 1962 Professor at Massachusetts Institute of Technology. 1985 Nobel Laureate in Economics.

Merton H. Miller (1923–2000)



1961 Professor at University of Chicago. 1990 Nobel Laureate in Economics.

Aims of the book



Discounted Cash Flow

A Theory of Firm Valuation

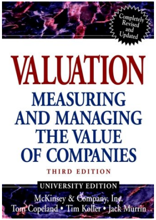
First edition

Lutz Kruschwitz and Andreas Loeffler

A Wiley-Interscience Publication
JOHN WILEY & SONS, INC.

New York / Chichester / Weinheim / Brisbane / Singapore / Toronto

1. To put **taxes and uncertainty together** into one model and
2. To give **precise formal definitions** of several concepts such as
   - cash flows (gross, net, free, . . . ?)
   - taxes (firm income, personal income or both, . . . ?)
   - cost of capital (discount rates, returns, . . . ?)
3. While **maintaining** the following **principles**:
   - no free lunch (goes back to Modigliani–Miller!)
   - no revelation of stochastic structure of future cash flows.

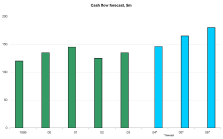


Copeland/Koller/Murrin

Valuation based on discounted cash flow (DCF) involves discounting

- of future payment surpluses
- after consideration of taxes
- using appropriate cost of capital.

Future cash flows



CF forecast

What matters are **future** cash flows.

But, the question of **how to forecast cash flows** will not be considered here,

nor the question of how to derive **cash flows from balance sheets**.

Furthermore, the investment policy (expansion and replacement investments) will be given.

EBIT, gross and free cash flows

International Accounting Standards Board®

International

accounting standards

	EBIT
+	Accruals
=	Gross cash flows before taxes
−	Corporate income taxes
−	Investment expenses
=	Free cash flow
−	Interest, debt service
−	dividends, capital reduction
=	Zero

Department of the Treasury
Internal Revenue Service

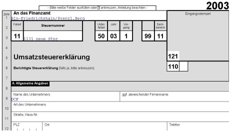
US Tax

Authority

We consider two different types of income tax:

- Corporate income tax (Chapter 2).
- Personal income tax (Chapter 3).

Value-based and sales taxes are ignored.


- Bitte weiße Felder ausfüllen oder ☒ ankreuzen, Anleitung beachten -
2003
An das Finanzamt
Bln-Friedrichshain/Prenzl.Berg
Eingangsstempel

Fallart	Steuernummer	Unterfallart	Jahr	Vorgang		Sachbereich
11	1131 neue Stnr	50	03	1	99	11

Umsatzsteuererklärung
121
Berichtigte Steuererklärung (falls ja, bitte ankreuzen) 110

A. Allgemeine Angaben
Name des Unternehmers: DCF
ggf. abweichender Firmenname
Art des Unternehmens
Straße, Haus-Nr.
PLZ
Ort
Telefon

German tax file

Characteristics are

- the tax subject (who?)
- the tax object (why?)
- the tax due (how much?), which is a product of the tax base and a linear tax scale.

Notice that in our model the **tax rate is deterministic**.

Reuters monitor

It is obvious what the cost of capital is in a one-period context. In a multi-period context there are at least **three different notions** of this concept: cost of capital can be

- returns,
- discount rates, or
- yields.

How now?

First, let us ignore uncertainty.

Notation:

FCF	firm's free cash flow
V	value of the firm

Idea:

Cost of capital is used for **discounting** (we are very loose here), hence

$$V_0 = \frac{FCF_1}{1+k_0} + \frac{FCF_2}{(1+k_0)(1+k_1)} + \dots$$

This idea shall also be applied in the future: at $t = 1$ we want to have

$$V_1 = \frac{FCF_2}{1 + k_1} + \frac{FCF_3}{(1 + k_1)(1 + k_2)} + \dots$$

where k_1 is the **same cost of capital from the last slide!**

Then the definition of cost of capital should run

$$\boxed{k_t =_{\text{Def}} \frac{FCF_{t+1} + V_{t+1}}{V_t} - 1}$$

Implication: Costs of capital are inevitably (expected) returns.

A different approach could be

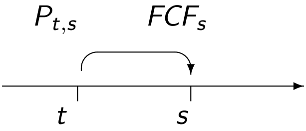
$$V_0 = \frac{FCF_1}{1+k_0} + \frac{FCF_2}{(1+k_1)^2} + \dots$$

$$\text{but then} \implies V_1 \stackrel{?}{=} \frac{FCF_2}{1+k_1} + \frac{FCF_3}{(1+k_2)^2} + \dots$$

Here the costs of capital are **yields**. We do not think much along this course (this is a different concept), because it is difficult to observe yields empirically.

Cost of capital: discount rates

You pay at time t a price $P_{t,s}$ for cash flow FCF_s due at s:



We would then define a discount rate as

$$P_{t,s} =_{\text{Def}} \frac{FCF_s}{(1+\kappa_{t,s})^{s-t}}$$

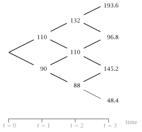
What relation exists between these discount rates and (expected) returns (=cost of capital)?

Will be understood later. . .

Time

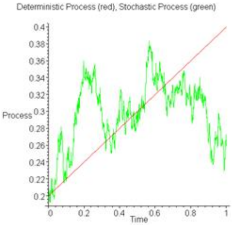
Different notions of time

discrete (easy to handle)



Binomial tree in the finite example.

continuous (elegant, but laborious)



Time horizon

- finite
- infinite: Here we assume transversality, which is equivalent to saying ‘nothing strange happens when $T \to \infty$’.

Valuation requires knowledge of

- free cash flows,
- taxes,
- cost of capital.

Costs of capital are returns, not yields.