Institute for Accounting, Auditing and Analysis

(Institut für Rechnungswesen und Wirtschaftsprüfung)

COURSE SYLLABUS

Financial Statement Analysis and Valuation
(Unternehmensanalyse und Bewertung)

Winter Term 2024/25 (Wintersemester 2024/25)

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LSF:	Lecture and Tutorial
Moodle forum:	Link to Moodle *(please sign up a.s.a.p. to receive updates on this course)*
	Enrolment key: *valuation2025*
Exam registration period:	**TBD**

Welcome to *Financial Statement Analysis and Valuation*!

This syllabus intends to make the course objectives, contents, structure and requirements transparent for you. We hope that it will help you obtain the greatest possible benefit from the course. All relevant material and other information is uploaded to the Moodle forum.

Please read this syllabus carefully before the first interactive session!

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as of 23 JUL 2024

Syllabus has not yet been updated for 2024/2025!

You can use the enrolment key to enter the Moodle Forum. Please check again in a few weeks!

1. Objectives

Your previous coursework in accounting introduced you to financial reporting as the "language of business". It made you familiar with the architecture and interpretation of financial statements. This course builds on that knowledge and takes it towards application to real-world valuation tasks. You will learn to analyze and interpret financial statements in order to assess a firm's financial situation and conduct a sound fundamental equity valuation.

We will take the firm's financial statements as a basis for understanding the firm's *past* business activities and for forecasting its *future* business activities. From the perspectives of (external) equity investors and financial analysts as well as creditors (banks, rating agencies, bond investors), we will employ traditional financial ratios as well as forecasting and equity valuation techniques in order to develop a fundamental assessment of a firm's profitability, financial stability and prospects, thereby ultimately assessing firm value and its drivers. In this context, we will also consider the implications of recent developments - including the coronavirus pandemic, the climate crisis, and the increasing focus on sustainable development - for firm value.

Overall, this course adopts a specific financial accounting perspective on the analysis and forecasting process. The financial statements are our basis for understanding the firm's economic situation. This approach builds on academic valuation theory and is consistent with how firms are valued in practice.

While we will deal with analyzing financial statements and other real-world information relevant to firm valuation, time constraints force us to focus on a basic understanding of these topics - rather than require you to master all the practical issues involved in the collection of relevant information and in assessing a firm's strategy. However, the textbooks by Lundholm and Sloan (**LS**) and Ballwieser and Hachmeister (**BH**), which underlie this course (see descriptions below), will help those interested in deepening and applying their knowledge. As an ideal supplement to this course, consider attending the course "Transaktionsorientierte Unternehmensbewertung" by Professor Christian Aders (CEO of ValueTrust), which takes place later this semester.

Again, this course is about teaching you a framework for financial statement analysis with the main objective of equity valuation from a financial accounting standpoint. Here is what it is ***not*** about:

- It is not about teaching you all of the details of advanced valuation theory or corporate finance theory. We do use basic valuation theory but will not have the time to deal with advanced financial theories. In particular, the notion of uncertainty and its relation to the cost of capital is given relatively brief treatment in this course. Students interested in elaboration on this aspect are referred to the course "Corporate Finance".
- It does not endorse or use a specific valuation software or website.
- It is also not about teaching you US GAAP. Several in-class examples will rely on US firms who report under US GAAP rules. However, given that IFRS and US GAAP are converging, these accounting issues are easily applied to the IFRS world. We do not expect you to know US GAAP rules for the exam.

2. Competencies, learning objectives and professional uses

Our aim in this course is to instruct you in conceptually sound and practical approaches to valuing equity securities, based on *fundamental analysis*.

To this end, you will acquire the following **financial competencies**:

- Competency 1 - Accounting analysis: Critically assess the bias in reported financial statements to obtain an appropriate basis for analysis and valuation;
- Competency 2 - Financial ratio analysis: Apply financial ratios to bring out the story that the financial statements tell and identify the drivers of firm value;
- Competency 3 - Structured forecasting (financial modeling): Develop sound financial statement forecasts using a systematic, structured approach;
- Competency 4 - Valuation: Apply the most common valuation models and use your results to challenge the assumptions inherent in the market price; and
- Competency 5 - Uncertainty analysis: Assess and communicate the uncertainty inherent in your valuations.

For each of these competencies, we pursue **learning objectives** at three distinct levels:

1. Knowledge (WHAT?) - Acquiring and retaining facts;
2. Application (HOW?) - Applying knowledge to abstract and concrete use cases; and
3. Critical thinking (WHY?) - Critically assess and question the subject matter as well as its application in practice.

The skills acquired in this course are useful in a wide array of **professional areas**, including investment banking (particularly equity research), private equity and venture capital, security analysis, asset management, consulting, public accounting and auditing, corporate finance, and strategy. They will also help with personal investing.

3. Course overview

To help you develop our five financial competencies, the course is organized into five broad sections:

1. **Introduction, Key Financial Accounting Basics, and Accounting Analysis**
    - The valuation approach taught in this class is based on the idea that good valuations are based on good inputs. Good valuation inputs, in turn, are derived from sound forecasts of future balance sheets, income statements, and cash flow statements. Such forecasts rely on an understanding of the firm's business model, market position, and strategy.
    - To start off, we will discuss the objectives of financial statement analysis and valuation, which are linked to different valuation occasions and styles of investing. One possible objective of fundamental equity valuation is to identify mispriced stocks by assessing 'intrinsic value' and comparing it with market price.
    - We will then recap some basic financial accounting themes important for analyzing financial statements and deriving valuation model inputs. One of these key topics that you should be familiar with is the indirect cash flow statement, since future cash flows, which we will derive via forecasted indirect cash flow statements, are the basis for most valuation models.

- The financial statements reported by the firm may be distorted by different types of measurement error, which renders them a less-than-perfect basis for forecasting the firm's future cash flows. Accounting analysis aims at adjusting for these distortions.

2. **Financial Ratio Analysis**
   - Financial ratio analysis brings out the story that the financial statements tell. It captures the firm's financial performance, stability and liquidity in a set of ratios. One key ratio is Return on Equity (ROE).
   - An important task in financial ratio analysis is to understand the firm's operating and financing activities separately; to this end, we will apply Advanced Du Pont analysis.
   - Financial ratios capture certain relations among different parts of the financial statements, e.g. between sales and inventory in a ratio such as inventory turnover. These relations express important economic phenomena that characterize the firm's business model. Computing and interpreting these ratios allows us to develop a deep understanding of the firm's business model *through* the financial statements.

3. **Structured Forecasting**
   - Good forecasts are the most important ingredient of good valuations. Developing good forecasts hinges on a systematic, integrated, structured approach.
   - We start with the sales forecast, and then use financial ratios from our analysis of the *past* financial statements as a foundation for forecasting *future* financial statements (also called 'pro forma' financial statements) under appropriate assumptions.
   - This process will involve rearranging and simplifying the financial statements, as well as making adjustments to obtain data that is an appropriate basis for forecasting.
   - A full set of forecasted 'pro forma' financial statements provides key inputs to *any* valuation model.

4. **Valuation**
   - Valuation uses different approaches, which are subject to different assumptions. Our focus will be on valuation approaches based on discounted expected future cash flows (DCF models). We will first work on getting a broad overview of basic building blocks, generic valuation formulas, and different valuation models.
   - We will then introduce the notions of uncertainty and risk, which will lead us into a discussion of the appropriate discount rate to use in a DCF valuation context.
   - In addition to DCF models, we will cover other valuation techniques as well, including asset-based approaches, mixed-method approaches, and market-based approaches.

5. **Uncertainty**
   - Finally, we will acknowledge that there is no *one* 'correct' valuation, but that any valuation reflects our assumptions and the uncertainty inherent in them. Therefore, we will reflect on different possibilities of explicating and assessing the uncertainty inherent in our valuation assumptions.

4. Teaching philosophy and approach

For your maximum learning benefit, this course requires you to do some advance preparation, which you should ideally complete in advance of each class session. For this purpose, we provide a range of materials (described below), all of which will be available to you on the Moodle course website by the start of the semester. In a separate document on Moodle, we will also provide a Study Plan that will guide you in terms of *what* to do *when* (and *why*).

During our interactive lecture and tutorial sessions, we will add value by bringing this material and knowledge to a higher level of awareness by applying it to concrete examples as well as practice it in Excel. Financial statement analysis and valuation require more than applying standard, boilerplate tools and checklist-type approaches. Experience shows that the extent to which you become excited about this class and take away important lessons is directly proportional to your diligence in reading ahead, actively participating, and proactively working through the practice session materials.

5. Materials

5.1. Section Guides and Slides

All course materials are organized into distinct topic sections (see the list of sections under "Course Schedule" below). Short Section Guides for each section summarize each topic section in the form of an annotated reading list. Each one contains a problem-based introduction, learning objectives for the section, a list of relevant readings, and a summary of the material covered in the section to help you prepare for the final exam. We expect you to have read the relevant Section Guides before coming to class. To integrate new developments and current examples, we aim to update the Section Guide for each week's topic by Friday of the previous week, so please keep an eye on Moodle.

Our lectures and tutorials and their underlying slide decks are the basis of your learning. They focus on the core content of each section. To integrate new developments and current examples, we aim to upload each new slide deck by Friday of the previous week, so please keep an eye on Moodle. Since the slides overlap to a large degree with our videos, not each one may be covered in class.

5.2. Videos

Your learning experience will be greatly enhanced by watching our **videos** before attending the live sessions. Note that these videos, to which links are provided below, were originally recorded in the winter term of 2020/2021. Please use them to prepare for the class sessions, but do not expect in-class discussions to be entirely congruent with the content covered in these videos.

- LMUcast (Lecture videos)
- LMUcast (Tutorial videos)

Another video format that we offer, "**Expert Nuggets**", are short interviews with external experts on key course topics. They serve as additional input to deepen your understanding on selected topics and add practitioners' insights to the theoretical content.

- LMUcast (Expert Nuggets)

5.3. Interactive Live Sessions and Slides

Weekly **interactive live lectures** serve to deepen these learning contents and discuss current case studies, and weekly **interactive live tutorials** allow you to discuss exam-type exercises and related questions with the tutors. Use the opportunity of bringing your questions actively to the live sessions. To be clear: The more you participate, the more lively and informative those sessions will be. Please post your questions for these interactive live sessions into the Q&A Forum for the lecture or for the tutorial under the relevant section sufficiently ahead of time.

5.4. Excel Examples

In this course, we will illustrate important analysis and valuation techniques in Excel. The relevant Excel workbook will be made available on [Moodle](#) in due course.

5.5. Textbooks

To understand some of the more complex material in sufficient depth, selectively reading up on it in the following textbooks will be helpful.

Lundholm/Sloan, Equity Valuation and Analysis (with eVal), 5th edition, Boston et al.: McGraw-Hill/Irwin 2019, ISBN: 978-1079983357 [**LS**].

The textbook by Lundholm and Sloan takes a pragmatic approach to equity valuation and analysis with a distinct financial accounting emphasis. In contrast to some finance-based valuation texts, it focuses less on the theory of valuation models (although it does a good job there too) but discusses how understanding the financial statements helps in the valuation process.

While some of the **LS** textbook's material goes beyond what we can cover in this course, it will support the basic structure of this course in terms of a useful framework for equity valuation. The book's main advantages are the following: First, while it covers the whole financial statement analysis and equity valuation process from a sound theoretical basis, it is actually quite brief. Second, it comprises numerous case studies that you can use to deepen your understanding of the material and provide hands-on experience. We are sure that the **LS** textbook will prove to be a resource that many of you will find useful during your studies and professional lives far beyond this class.

We will upload chapters 1, 4, 5 and 7 of the 6th edition in Moodle; however, you might also find it helpful to access the whole textbook.

Ballwieser/Hachmeister, Unternehmensbewertung, 6th edition, Stuttgart: Schäffer-Poeschel 2021; ISBN: 978-3-7910-5079-9 [**BH**].

The textbook by Ballwieser and Hachmeister provides an in-depth overview of common valuation techniques. Spanning the whole valuation process, it focuses on detailed descriptions and critical assessments of common valuation models.

We will upload chapters 1, 2, 3, 5 and 8 of the 5th edition in Moodle (we will update the chapters to the 6th edition in the next weeks); however, you might also find it helpful to access the whole textbook.

Availability – Besides the uploaded chapters, a limited number of the **LS** and **BH** textbooks is available in the LMU library. Alternatively, you can purchase your own copy online, or order one at your local bookstore (ask for ISBN 978-1733498012 [**LS**] or 978-3-7910-5079-9 [**BH**]). If questions arise, please do not hesitate to contact us.

5.6. Other required materials

We will use current annual reports throughout the course to illustrate the material covered. One example is Bayer's, available on their [website](#). We will use other reports, cases, and research papers as needed.

5.7. Useful references

Interesting research papers and articles from the financial press that pertain to course discussions may be distributed as the class progresses.

U.S.-style books and research papers with a focus on security valuation:

- *Penman*, <u>Financial Statement Analysis and Security Valuation</u>, 5th edition, Columbus 2013.
- *Penman, S.*, <u>Accounting for Value</u>, Columbia University Press, 2011.
- *Lundholm/O'Keefe*; 2001, Reconciling Value Estimates from the Discounted Cash Flow Model and the Residual Income Model, Contemporary Accounting Research 18(2): 311-335.
- *Esplin et al.* (2014): Disaggregating operating and financial activities: implications for forecasts of profitability, Review of Accounting Studies (19): 328–362.
- *Ho et al. (2017):* A comparative analysis of accounting-based valuation models, Journal of Accounting, Auditing & Finance 32(4): 561-575.
- *Huang et al. (2022):* Valuation Uncertainty and Analysts' Use of DCF Models, Review of Accounting studies (2022): 1-35..
- *Allee et al. (2020):* The Characteristics, Valuation Methods, and Information Use of Valuation Specialists. Accounting Horizons 34(3): 23-38.

German textbooks with a focus on business valuation in the German institutional environment:

- *Mandl/Rabel*, <u>Unternehmensbewertung – Eine praxisorientierte Einführung</u>, Wien 2002.
- *Ernst/Heyd/Popp*, <u>Unternehmensbewertung nach IFRS – Bewertungsverfahren, Umsetzungs-technik, Fallstudie</u>, Berlin 2014.
- *Moxter*, <u>Grundsätze ordnungsmäßiger Unternehmensbewertung</u>, Wiesbaden 2012.

5.8. Useful websites

<u>Websites of expert committees on valuation</u>

- International Valuation Standards Council (IVSC): https://www.ivsc.org/.
- Expert committee of the Institute of Public Auditors in Germany (IDW) (German): https://caruso.idw.de/gremium_detail.jsp?g_nr=100102501109.

<u>Websites of financial accounting standard setters</u>

- International Accounting Standards Board (IASB): https://www.ifrs.org/.
- U. S. Securities and Exchange Commission: https://www.sec.gov/.
- Financial Accounting Standards Board (FASB): https://www.fasb.org/home.
- German Accounting Standards Committee (GASC): https://www.drsc.de/.

<u>Useful news sources on (international) financial accounting</u>

- Current news on (international) financial accounting developments on Deloitte's websites at https://www.iasplus.com/en (English) or https://www.iasplus.com/de/ (German).
- Subscribe to newsletters from CFO magazine (https://www.cfo.com/; English) and/or GASC (https://www.drsc.de/; German).

6. Grading

Grading is 100% based on the final exam (120 min). The registration for the exam takes place via LSF (*please note that it is mandatory to register for online exams, so please make sure you do so)*. For guidance on how best to prepare for the exam, please carefully (re-) read this syllabus and follow the Study Plan for this course. Again, if you have questions, please post them into our Q&A Forum for the lecture or for the tutorial; they will then be addressed in the lectures and tutorials.

It is natural for you to wonder what material is particularly relevant for the exam. In terms of our learning objectives above, the exam will test your application (level 2) and critical thinking skills (level 3) more than your knowledge of facts (level 1). Therefore, we do not encourage you to focus on memorizing, but rather on understanding and challenging the material. That is one of the reasons why attending the interactive live sessions and participating actively with your questions and comments is so important!

Due to time constraints, we will have to prioritize. Do not expect every lecture slide to be discussed, or every aspect/topic to be explained at length. You will get a sense for the most important topics by paying attention to what we spend the most time and effort on in the material and in our interactive live sessions. This includes any guest lectures and workshops as well as Expert Nuggets videos - short interviews with external experts on key course topics - that we will be providing during the course.

The exam takes place on tba at tba. The exam will be in person and closed-book. Please keep in mind that it is obligatory to register for the exam between tba. **Only registered students can participate in the exam!** Towards the end of the course, we will summarize the relevant material for you. For all information regarding your study program and integration possibilities (PO 2008, PO 2015 etc.), please refer to LSF.

7. Course schedule

Please notice that the time slots in LSF are switched. The lecture takes place on Tuesdays, while the tutorial is on Wednesdays - the exception for this is Week 43 (22.10.2024 and 23.10.2024).

<u>Tuesday Lecture</u>: **10.15 to 11.45 am**, S005, Schellingstraße 3

<u>Wednesday Tutorial</u>: **8.30 to 10.00 am**, Lehrturm-W201, Prof.-Huber-Platz 2

Week	Lecture Section	Tutorial Section	Topics	Lecture Date and Time	Tutorial Date and Time
16 OCT 2024			**Tutorial**: Revisiting the Basics ==Introduction + Revisiting the Basics==	15 OCT 2024, 10:15 to 11:45	16 OCT 2024, 08.30 to 10.00
23 OCT 2024			***Attention***: *Lecture and Tutorial Slots are switched*	23 OCT 2024, 08.30 to 10.00 **[W201]**	22 OCT 2024, 10:15 to 11:45 **[S005]**
30 OCT 2024			Guest Lecture	29 OCT 2024, 10:15 to 11:45	30 OCT 2024, 08.30 to 10.00
06 NOV 2024			==Revisiting the Basics==	05 NOV 2024, 10:15 to 11:45	06 NOV 2024, 08.30 to 10.00
13 NOV 2024			Guest Lecture	12 NOV 2024, 10:15 to 11:45	13 NOV 2024, 08.30 to 10.00
20 NOV 2024			==Financial Statement Analysis==	19 NOV 2024, 10:15 to 11:45	20 NOV 2024, 08.30 to 10.00
27 NOV 2024			==Financial Statement Analysis (cont'd)==	26 NOV 2024, 10:15 to 11:45	27 NOV 2024, 08.30 to 10.00

04 DEC 2024			Financial Statement Analysis (cont'd) Forecasting	03 DEC 2024, 10:15 to 11:45	04 DEC 2024, 08.30 to 10.00
11 DEC 2024			Financial Statement Analysis Forecasting Valuation under uncertainty	10 DEC 2024, 10:15 to 11:45	11 DEC 2024, 08.30 to 10.00
18 DEC 2024			Cost of capital Approaches to valuation DCF valuation models Residual income valuation	17 DEC 2024, 10:15 to 11:45	18 DEC 2024, 08.30 to 10.00
Christmas Break					
08 JAN 2025			DCF valuation models (cont'd) Valuation ratios / pricing multiples	07 JAN 2024, 10:15 to 11:45	08 JAN 2024, 08.30 to 10.00
15 JAN 2025			Valuation ratios / PM (cont'd) Explicating uncertainty	14 JAN 2024, 10:15 to 11:45	15 JAN 2024, 08.30 to 10.00
22 JAN 2025			**ESG and valuation**	21 JAN 2024, 10:15 to 11:45	22 JAN 2024, 08.30 to 10.00
29 JAN 2025			Puffer	28 JAN 2024, 10:15 to 11:45	29 JAN 2024, 08.30 to 10.00
05 FEB 2025			Puffer	04 FEB 2024, 10:15 to 11:45	05 FEB 2024, 08.30 to 10.00
tba			**Final Exam**	**tba**	

Section Guide

Section Guide 1
Introduction

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1.   Introduction

This course covers approaches to valuing businesses, as well as equity securities issued by businesses, based on a fundamental analysis of financial statements and other information. This section guide describes the first 90-minute course session, which introduces key themes of the course, important theoretical concepts and definitions, as well as the sequence of course topics. There will be one section guide for each of the 12 course sections. Please make sure you read them all before class. Also, please prepare the relevant readings. For detailed information on this course, please refer to the course syllabus, which is available on LSF.

2.   Learning objectives

At the end of this section, you should:
- Be able to distinguish between different approaches to valuing a business, including the situations in which each is appropriate;
- Appreciate different notions of 'value';
- Understand important theoretical concepts relevant to financial statement analysis and valuation; and
- Clearly see the sequence of steps involved in conducting a sound fundamental analysis and valuation.

3.   Relevant materials

3.1.   Readings
- Lundholm and Sloan (2013), Section 1.
- Penman (2011), Accounting for Value, Introduction.
- Penman (2011), Accounting for Value, Section 1.

3.2.   Problem set
- Tutorial session 1

4.   Summary of section content

4.1.   Value

Value is a multifaceted phenomenon that is not easily observed. For example, firms change hands because parties can disagree over value. The predominant view is that value is 'in the eye of the beholder', i.e., it is context-specific. *There is no one 'correct' value, independent of purpose.* Rather, 'value' is a term used by humans to describe properties of a business or other assets, and valuation models are ways to describe value. It follows that valuation approaches will reflect the objectives, preferences, and assumptions (e.g., growth expectations) of the human beings conducting the valuation. As the results of valuations will typically have to be communicated to other parties, these assumptions and their effects on value will sometimes need to be made explicit. In any case, the valuer needs to be aware of these assumptions as well as the valuation outcome's sensitivity to changes in them.

4.2.   Valuation approaches

First, we will discuss **how** valuation works – i.e., we will consider different approaches to valuation that are commonly used in practice, including
  (1) valuation based on assets in place;
  (2) valuation based on future earnings or cash flows; and
  (3) valuation based on comparative-company multiples derived from market prices.

4.3.   Valuation objects

Second, we will focus on **what** is being valued – i.e., we will distinguish between
  (1) the value of the firm as a whole (aka 'entity value', or 'enterprise value', or 'unlevered value'); and
  (2) the value of the firm's equity, or net assets (aka 'equity value', or 'levered value').

4.4.   Drivers of value

Under most valuation approaches, value can be expressed as a function of three factors:
  (1) Profitability,
  (2) growth, and
  (3) uncertainty.

Whereas (1) and (2) manifest in the firm's (expected) future earnings or cash flows, (3) is represented by the discount rate.

4.5.   Notions of value

Third, we will clarify what we *mean* by 'value' – i.e., we will introduce three distinct notions of value:
  (1) Book values (in some contexts called 'carrying amounts') are those values at which firms or individual assets and liabilities are carried in the financial statements under accounting conventions and regulations, such as IFRS, German GAAP, tax law, or insolvency law.

  (2) Market value (also called 'price') is the value of a firm, asset or liability in a given market, such as a stock exchange or other organized, active markets in which supply and demand meet. Market value will typically be related to book value, but the magnitudes can differ substantially.

(3) <u>Fundamental value</u> (also called 'intrinsic' value) is the value of a firm, asset or liability as assessed using fundamental valuation techniques such as discounted cash flow models. Think of Warren Buffet.

We will see that these values are typically different from each other. In this course, we will try to establish the third (fundamental value) to challenge the second (market value) by using (in part) the first (accounting value).

4.6.   Framework for valuation and analysis

The approach underlying this course is based on the idea that value can be expressed as a function of the amount, timing, and uncertainty of expected future payments generated by the business being valued. The functional form in which future payments relate to value is called a valuation model. Therefore, a sound fundamental valuation is conducted in two steps: First, it requires forecasts of future payments and, second, it involves applying an appropriate valuation model to these forecasts. Both steps are covered in this course.

More specifically, Lundholm and Sloan (2013, Ch. 1) distinguish three steps in conducting a fundamental analysis and valuation:

- <u>Step 1—Understanding the past:</u> This step comprises the collection of information on the business being valued as well as its environment, understanding the business, analyzing the available past financial statements and accounting policies, a financial ratio analysis, and an analysis of past cash flows.
- <u>Step 2—Forecasting the future:</u> Based on the analysis of the business' past, the next step involves a systematic forecast of the future activities of a business and its income statement, balance sheet and cash flow implications.
- <u>Step 3—Valuing the business:</u> The final step consists of correctly applying valuation models to these forecasts, including the appropriate handling of uncertainty.

4.7.   Important theoretical concepts

The following theoretical concepts play crucial roles in this course:

- <u>Present value:</u> The idea that today's value of a series of expected future payments is a function of (1) the time value of money (embedded in the risk-free component of the discount rate), and (2) the uncertainty inherent in the expectations of future payments (embedded in the risk premium component of the discount rate).
- <u>Information asymmetry:</u> The notion that one party to a (potential) contract (perhaps a manager, or other 'agent') has private information not available to her counterparty (perhaps a shareholder, or other 'principal').
- <u>Signaling:</u> A method of informed individuals to communicate their private information to others through their actions (to be credible, a signal must be costly for the signaler to send if untrue).
- <u>Efficient markets theory:</u> A theory about the information reflected in market prices at any given point in time, and the speed at which new information is impounded.
- <u>Accounting equation:</u> The well-known balance sheet equation according to which *assets = equity + liabilities*, which makes *equity = assets – liabilities = net assets*.

- Clean surplus relation: An accounting assumption where *ending equity = beginning equity + change in equity*, and *change in equity = income – net dividend*, which makes *income = change in equity + net dividend*. The clean surplus relation is important; it means that all non-owner changes in equity (which manifest themselves in the net dividend = net cash flow to/from equity-holders) will pass through income.
- Accrual accounting: The idea that accounting profit reflects cash flows and accruals, where accruals reflect timing differences between cash flows and value creation. *Accruals = income – cash flow*, or *Profit = cash flow + accruals*. Accruals stem from transactions that affect profit and cash flow in different periods, e.g., credit sales, which are reflected in profit at the time of sale, but in cash flow only upon cash collection. A specific accrual, the change in accounts receivable, captures this timing difference.
- Financial statement analysis: (1) The purposeful analysis of available information, by those who have limited access to information commonly available to managers, in order to (2) make economic decisions (including investment decisions) based on an assessment of the performance and prospects of the firm.
- Earnings management: The notion of managers using judgment and discretion in financial reporting or structuring transactions to alter financial reports with a view to either misleading some stakeholders about the underlying economic performance of the firm, or to influence contractual outcomes that depend on reported accounting numbers.
- Polyvalence: The notion that fundamental values are not absolute in the sense that a 'correct' one exists for us to find out. Rather, fundamental value can be thought of as a function of (subjective) expectations (e.g., about future cash flows) and preferences (e.g., about risk). Therefore, it is useful to think of, and discuss, fundamental value as a polyvalent construct, i.e. a *range* of values under different assumptions.

Section Guide 2
Revisiting the Basics

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1. Introduction

The approach taken in this course requires a sound understanding of financial accounting, as all of the valuation approaches discussed here to some extent rely on inputs derived from reported or 'pro forma' (i.e., forecasted) financial statements. We therefore revisit a number of key financial accounting contents, especially the concept of accrual accounting as well as the core financial statements: balance sheet, income statement, and cash flow statement.

2. Learning objectives

At the end of this section, you should:
- Be comfortable with the notion of accruals;
- Understand the concepts and characteristics of separate and consolidated financial statements;
- Be familiar with the structure and elements of an annual report, including the balance sheet, income statement, statement of changes in equity, statement of cash flows, management report, and notes; and
- Be able to prepare a cash flow statement using the indirect method.

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), Sections 4.1 - 4.4 and 6.1 - 6.3.
- Ballwieser and Hachmeister (2016), Section 4.2.1.
- Harrison et al. (2014), Section 11.

3.2. Problem set
- Tutorial session 1

4. Summary of section content

4.1. Why financial accounting (again)?

Your first encounter with financial accounting probably involved double-entry book-keeping, journal entries, and T accounts. You may not immediately have found it very inspiring – but perhaps rather dull and technical. You probably wondered why (or *if*) double-entry book-keeping was important – especially as you never aspired to becoming a book-keeper yourself.

In this course, we will revisit and use double-entry book-keeping as a highly useful pedagogical device: It helps us understand what is going on. If you know how to record a transaction or event using journal entries and T accounts, this shows (to you and others) that you understand the economic substance of

that transaction or event. Ask any valuation practitioner – investment banker, private equity investor, financial analyst, or consultant: Most of them will readily claim that solid financial accounting skills – double-entry book-keeping! – are among the most important skills they ever learned. (And some will admit that they found out the hard way that they had *not*, in fact, sufficiently learned them.)

Likewise for the financial statements as a whole: they provide a succinct perspective on a firm's business model and related activities (i.e., operating, investing, and financing), as well as the resulting performance, financial position and prospects. All of these are drivers of value. Being comfortable reading financial statements and the corresponding footnotes (as *Warren Buffett* spends much of his time doing, we are told) will render you a much more effective business professional.

4.2. Cash flows, earnings and accruals

Finance professionals are fond of claiming that 'Cash is King'. They say this looking down their noses at the lowly accountant, who tinkers with double-entry book-keeping to calculate 'earnings', or profit. In many a finance professional's mind, cash flows are hard facts, whereas earnings are only somebody's opinion, a mere invention. (Similarly, balance sheets are suspect, because they show assets and liabilities at some point in time long in the past, and many value drivers are missing from them.) After all, an important branch of valuation models, *discounted cash flow valuation models*, takes future cash flow, not earnings and book values, as its main input.

True, earnings *are* based on assumptions, and they *are* easier to manipulate than cash flows. And also true, those valuing a business ultimately *are* after cash flows, as the value that their investment will ultimately generate is a function of the future cash flows that they will receive. Why then, and what for, might we need earnings? Why do many financial analysts focus their efforts on producing good forecasts of earnings per share (EPS), rather than cash flow?

It turns out that earnings and balance sheets are much better at predicting future cash flows than are the cash flows themselves. Consider a car dealer selling a car for €10,000 on credit this year, with the customer promising to pay next year. So cash flow this year is zero, and cash flow next year is expected to be €10,000. Just looking at this year's cash flow (0) does not help us predict next year's cash flow (€10,000). But earnings are actually €10,000 (ignoring the cost of sales), and the balance sheet reflects the customer's promise to pay as an account receivable (AR). The difference between cash flows and earnings is referred to as *accruals*, with cash flows + accruals = earnings. In our case, 0 cash flow + €10,000 change in accounts receivable = €10,000 earnings.

Understanding the associated journal entry makes that clear: Dr. AR €10,000 / Cr. Sales €10,000. It shows that the dealer generated earnings of €10,000 and received – *not cash*, but a *promise* of cash in the future. It is that promise of cash in the future – the change in accounts receivable, the accrual – that provides the information about future cash flows that facilitates forecasting. True, this accrual rests on an assumption (most accruals do), namely that the customer will indeed pay as promised – which makes the accrual an opinion. But that opinion is informative, and if we can be confident that it is relevant and reliable (e.g., due to being audited), we have better, more predictive information than considering cash flows alone.

This property of accruals is especially important when trying to predict a firm's long-term performance. Consider a growing firm that invests €100m in a new, modern production plant. This investment will deprive the firm of €100m in cash in the short term, which is being invested in the hope of higher revenues in the future. Cash flow for the year is a negative €100m – pretty bad. But the journal entry makes transparent what is really going on: Dr. Property, Plant and Equipment (PP&E) / Cr. Cash. Earnings are not affected, showing that the firm has not been destroying value, as the negative cash flow alone would

suggest. Instead, the accrual (the change in PP&E) makes clear that the investment is expected to generate future revenues with a present value of (at least) €100m. (We assume that, if the firm did not consider the PP&E a positive-NPV investment, it would not have undertaken it.) Again, the accrual predicts future cash flows better than current cash flow does.

Make sure you freshen up your financial accounting skills with these considerations in mind. Your TbR, I&E, and UR materials will help you. If you want additional pointers, please come talk to us.

4.3. Consolidated versus separate financial statements

For several reasons, it is important to distinguish between consolidated financial statements (also referred to as the group accounts) and separate financial statements (also referred to as unconsolidated, legal-entity, or parent-company financial statements). Whereas the latter are required for most legal entities under German commercial law ('HGB') and tax law, the latter are prepared only by parent companies. In a sense, much of this course deals with converting several firms' legal-entity financial statements into a set of consolidated financial statements.

For example, the parent-company balance sheet of Volkswagen AG displays investments in Volkswagen AG's subsidiaries (i.e., firms that Volkswagen AG controls, such as Audi AG, Scania AB, or SEAT S.A.) as financial assets. In contrast, the consolidated balance sheet of Volkswagen AG contains all of the assets and liabilities of these subsidiaries, its income statement contains all of their income and expense, and its cash flow statement contains all of their cash inflows and cash outflows.

This is true even where Volkswagen AG controls a firm without holding 100% of its voting shares. For example, Volkswagen AG currently holds 75.3% in MAN SE's equity (See Volkswagen Group, Annual Report 2014, p. 53). This means that there are other MAN shareholders, called non-controlling interests, holding the remaining 24.7%. Although legally they are not part of Volkswagen Group, for accounting purposes they are, because the consolidated financial statements show 100% of all accounting items of subsidiaries. However, the amounts on the balance sheet and income statement that relate to the non-controlling shareholders are shown separately from those attributable to the shareholders of Volkswagen AG.

Why are consolidated financial statements required? In a group of firms ("Konzern"), legal-entity financial statements are not sufficient for assessing the parent's or the subsidiaries' financial positions. For example, if a subsidiary is heavily financed with debt, this high leverage may not be apparent from the parent's legal-entity financial statements alone, if the parent has lower leverage. Only the consolidated financial statements will make transparent that the group as a whole relies heavily on debt.

4.4. Annual reports and full sets of financial statements

In Germany, publicly traded firms publish their annual financial statements within the annual report. As German publicly traded firms report under International Financial Reporting Standards (IFRS) in their consolidated financial statements, the financial statements in their annual reports are prepared under IFRS. Besides the financial statements, annual reports consist of a "glossy" part with pictures of management and products and associated narrative, as well as the management report (*Lagebericht*).

IFRS financial statements are 'general-purpose' financial statements, i.e., they are intended for users that do not have access to tailor-made information from the firm, for example shareholders in public equity markets who hold only a small fraction of the firm's shares ('retail investors'). According to IAS 1.10, a complete set of financial statements comprises:

- a statement of financial position (aka balance sheet);
- a statement of profit and loss (aka income statement) and other comprehensive income;
- a statement of changes in equity;
- a statement of cash flows (aka cash flow statement); and
- notes, comprising a summary of significant accounting policies and other explanatory information.

Whereas many other national accounting systems (including the German Commercial Code as it pertains to large corporations) define detailed structures and required line items, IAS 1 only lays out a limited number of minimum items to be presented in each of the financial statements. Firms report comparative information for prior periods in the financial statements as well as in the notes.

Please make sure you download your personal copy of the Bayer annual report 2016 for reference throughout the course: Google 'bayer annual report 2016'.

4.5. The cash flow statement

Among the financial statements listed above, the cash flow statement plays a critical role. It displays the firm's cash position and explains its change during the reporting period in terms of three cash flow measures that reflect the firm's primary business activities:

(1) Cash flow from operations (or operating cash flow, CFO);
(2) Cash flow from investing activities (CFI); and
(3) Cash flow from financing activities (CFF).

Future cash flows are an important input into valuation models, and they are taken from forecasts of future cash flow statements. These cash flow statements, in turn, are derived from forecasts of future balance sheets and income statements in a somewhat involved process referred to as the 'indirect method' of preparing cash flow from operations. It reconciles a notion of earnings to cash flow from operations by adjusting for operating-related accruals such as changes in accounts receivable as well as depreciation and amortization. Understanding this process is a critical skill that is highly valued in practice, not least because it documents and enhances your understanding of the value creation process as a whole.

> ## *Section Guide 3*
> ## *Financial Statement Analysis*

1.   Introduction

In this section, we prepare for the actual financial statement analysis and valuation tasks. These preparatory steps include the collection of information necessary to understand the firm's business model, performance, financial position, and market environment. We then discuss ways of getting the firm's past financial statements ready for financial ratio analysis, as well as rendering them an appropriate basis for forecasting the firm's future prospects. This involves an understanding of how accounting information relates to value, and the circumstances under which accounting numbers may be imperfect indicators of value. To see this clearly, we need to remind ourselves that financial accounting has a number of potential objectives and users, and that valuing the firm directly is not generally considered one of them. Instead, among other objectives, the financial statements can be thought of as providing *inputs* to the valuation tasks performed by others, including users outside of the firm. The extent to which financial accounting provides good valuation inputs is limited by *accounting measurement error*, i.e., the degree to which the accounting numbers measure the economic fundamentals with error. In this section, we discuss the concept of this measurement error as well as its most common sources and potential remedies. In this context, we will also focus on non-recurring items as a potential threat to the usefulness of financial accounting numbers as a basis for forecasting future valuation inputs.

Shareholders and other stakeholders of the firm extract information from the firm's disclosures using techniques of financial statement analysis. For example, potential investors may look at earnings to assess the firm's dividend payout potential or, in combination with stock price, whether the firm's shares are reasonably priced. Potential lenders may be interested in the firm's debt-servicing capacity, as reflected in financial ratios such as net debt and financial leverage. Antitrust agencies and the public might assess the firm's profitability, including financial ratios such as return ratios and margins, for indicators of monopoly power.

Financial statement analysis using financial ratios has two main objectives: First, it facilitates stakeholders' assessment of a firm's past performance and current financial position, i.e., its liquidity and financial stability. Second, it forms the basis of financial statement forecasts (discussed in section 4) for the purpose of firm valuation and bankruptcy prediction.

2.   Learning objectives

At the end of this section, you should:
- Be able to collect information relevant to understanding a firm's business model and financial situation;
- Appreciate the firm's business model and strategy;
- Understand the relation of accounting 'book' value to 'true' economic value;
- Be able to explain accounting measurement error and its sources;
- Have the ability to identify one-time items that might impair predictability; and

- Know how to conduct initial horizontal and vertical analysis.
- Recognize key steps in preparing the financial statements for analysis;
- Understand the main categories of financial ratios and be able to calculate as well as interpret them; and
- Be able to analyze a firm's financial statements to separately assess its operating and financial activities.

3.   Relevant materials
3.1.   Readings
- Lundholm and Sloan (2013), Section 2 and 3
- Lundholm and Sloan (2013), Section 4.5
- Lundholm and Sloan (2013), Sections 5.1 - 5.9
- Ballwieser and Hachmeister (2016), Section 4.2
- Penman, Financial Statement Analysis and Security Valuation, Section 10: pp. 293-301.
- Esplin et al. (2014): Disaggregating operating and financial activities: implications for forecasts of profitability, RASt, pp. 329-331

3.2.   Problem set
- Tutorial session 2 & 3

4.   Summary of section content
4.1.   Collecting relevant information
In section 2, we reviewed the financial statements as our primary source of information about the firm. However, there are other sources at our disposal that we can, and *should*, use for a fuller picture. Naturally, the availability of information depends on whether the valuer is an insider to the firm (e.g., one of the main owners), or has outsider status (e.g., a hostile bidder). In this course, we assume for the most part that little, if any, inside information is available. The information we have access to can be categorized as follows:
- Internal (firm-initiated) information: This includes the annual report and other mandatory or voluntary reporting provided by the firm.
- External information: This refers to information produced and disseminated by parties external to the firm, e.g., by analysts, rating agencies, bloggers, the press, or other financial intermediaries.

4.2.   Assessing business model and strategy
A firm's business and strategy describe the way in which the firm proposes to create value using a sustainable competitive advantage. To some degree, this value proposition can be derived from information in the financial statements. Consequently, financial statement structure vary across industries. In class, we will consider a few examples, and we talk more about strategies in section 4.

4.3.   Identifying accounting measurement error
4.3.1.   Accounting and value

In section 2, we discussed the notions of cash flows, earnings, and accruals. We stressed the fact that accruals provide information that is useful in forecasting future cash flows, and that they do so better than cash flows themselves.

As an important concept in this context, recall from section 1 the clean surplus relation (*income* = *change in equity* + *net dividend*). Realize that *net dividend* = *net cash flow to/from equity-holders*, and the *change in equity* can be thought of as reinvested income, or retained earnings. Furthermore, recall from basic investing / capital budgeting theory that the value of an(y) asset can be expressed as the present value of the cash flows that the owner expects to derive from that asset. This is also true for firms. In fact, the Dividend Discount Model holds that firm value (from the perspective of the firm's owners) can be expressed as the present value of the future dividends that the firm is expected to pay to its equity-holders.

Therefore, we can express firm value as the present value of future earnings less changes in the book value of equity. This is important, as we see that, in order to value the firm's equity, we cannot simply discount future earnings, but we have to account for changes in the book value of equity. Suppose we sell two consulting jobs for €1,000 each, with one sold for cash and the other sold on credit. Earnings, then, is €2,000. Let's assume further that we distribute as a dividend only the cash received, i.e., €1,000. In this case, *income* €2,000 = *change in equity* €1,000 + *net dividend* €1,000, with the *change in equity* being that (non-cash) part of earnings that corresponds to the increase in accounts receivable (an asset) and was retained within the firm (resulting in an increase in equity). In other words, if earnings were €2,000, and €1,000 was retained within the firm, an amount of €1,000 must have been paid out to shareholders. The clean surplus relation dictates that it cannot be any other way.

This example shows that we can infer the *net dividend* (= net cash flow to/from equity-holders) by observing earnings and changes in the book value of equity. This allows us to derive expected future cash flows from forecasts of future income statements (yielding expected future earnings) and balance sheets (yielding expected future changes in the book value of equity). In section 4, we will argue that sound valuation will invariably require sound forecasts of future income statements, balance sheets, and (by implication) cash flow statements.

4.3.2.   Accounting value, economic value, and measurement error

Only in the most stylized circumstances can accounting measure value perfectly. Lundholm and Sloan (Ch. 4) illustrate this point using the example of a savings account, where the *interest rate* earned can be expressed as the ratio of interest over the beginning balance in the account. Since interest is either paid out in cash (= withdrawal) or retained (increasing the balance), *interest expense* = *withdrawals* + *increase in balance*. Then, the rate of return on the savings account, the interest rate, is (*withdrawals* + *increase in balance*) divided by the *beginning balance*.

Applying this to a firm, which generates a return for the equity-holders, we get *rate of return on equity* (ROE) = (*distributions to equity* + *increase in equity*) / *beginning equity* = (*net dividends* + *increase in equity*) / *beginning equity* = *earnings* / *beginning equity*. Earnings and equity are accounting constructs, measured under accounting conventions. ROE measures the rate of return on equity well (only) if the accounting rules measure earnings and equity well. Recall from above that this might not be the primary objective of accounting.

We refer to the extent by which the book value of equity misrepresents the 'true' underlying (intrinsic) economic value of equity as the accounting measurement error. Changes in measurement error arise to the extent that accounting earnings misrepresents the 'true' underlying (intrinsic) economic earnings. ROE, then, measures its 'perfect' economic equivalent, the economic rate of return on equity (ERR = economic income / beginning economic value of equity), with error: (1) The numerator (accounting earnings) misrepresents its economic equivalent (economic earnings) by the change in measurement error. (2) The denominator (accounting book value of equity) misrepresents its economic equivalent (economic value of equity) by the

beginning measurement error. These distortions can go either way in any given period. As accounting earnings can over- or understate economic earnings, and accounting book value can over- or understate economic value, a number of scenarios is possible.

4.3.3. Sources of measurement error and possible remedies

Accounting numbers misrepresent their economic equivalents for potentially three reasons:

- **Accounting requirements**: Because financial accounting has objectives other than measuring economic value and economic earnings, accounting requirements dictate certain deviations of accounting numbers from their economic equivalents. For example, whereas accounting standards prohibit firms from recognizing certain research and development expenditures, the economically 'correct' depiction of these investments in intangible assets would arguably involve capitalizing them at the present value of future cash flows. Therefore, in the context of R&D investments, accounting earnings will frequently understate economic earnings, and accounting book values will frequently understate economic values.

- **Uncertainty**: Accounting requires judgment, for example in the context of estimates that require forecasts, and this judgment can turn out to be in error *ex post*. For example, a firm may estimate that it will cost €20m to dismantle its nuclear power plant and restore the sight in 20 years; therefore, it will recognize a provision for future dismantling cost at the corresponding present value. If the ultimate dismantling costs should turn out to be higher or lower than that estimate, or arise later or sooner than originally thought, the associated accounting number will have included measurement error.

- **Earnings management**: Finally, measurement can be introduced by management's purposeful action. "Earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers" (Healy and Wahlen (1999), p. 368). For example, managers might attempt to use low discount rates when conducting a goodwill impairment test in order to avoid having to take a write-off against earnings. Managers might also distract investors' attention away from undesired (expense) items that it purports to be one-time in nature, such as restructuring charges or certain write-offs. Earnings management leads to accounting numbers misrepresenting their economic equivalents *on purpose*.

Diligent analysis of the firm's accounting policies and notes disclosures, as well as striking trends and structural breaks in financial ratios will help detect and adjust for measurement error.

4.4. Initial analyses

An effective way of starting a financial statement analysis is to import the reported numbers into a spreadsheet program. This can be done by manually typing up the information, downloading ready-made Excel files provided on firms' websites, or accessing the firm's financial statement through a commercial data provider (the latter will typically alter the reported numbers to some degree). You may then want to adjust and simplify the information by regrouping individual line items into larger categories, calculating meaningful subtotals, and/or renaming them according to a standard template to create comparability with other firms.

Two additional steps easily performed in Excel will provide a good starting point for subsequent analyses:

- Using horizontal analysis, you can assess time trends in balance sheet and income statement numbers by computing year-over-year percentage changes or other comparisons across periods. This facilitates within-firm comparisons over time as well as across-firm comparisons.

- Using vertical analysis, you can assess the structure of the financial statements by expressing all balance sheet line items as a percentage of total assets and all income statement line items as a percentage of sales. This facilitates primarily comparisons across firms of different sizes.

4.5.   Financial ratio analysis
4.5.1.   Financial ratios

Financial ratios are fractions that relate individual financial statement items or subtotals to each other. For example, the return on equity (ROE) divides profit (an income statement flow variable) to average equity (a balance sheet stock variable). Or take operating margin, which relates operating profit (an income statement flow variable, aka EBIT) to sales (another income statement flow variable). Be careful when relating flow variables (measured over a period of time) to stock variables measured at a point in time.

Ratios exist for each of the three aspects of the firms' financial situation:
- To assess **profitability**, you will mainly use return ratios and profit margins.
- The firm's **liquidity** can be captured by relating the firm's current assets (including cash) to the current liabilities that need to be paid in the short term.
- The firm's longer-term **financial stability** can be assessed using measures of its financial leverage and debt-servicing capabilities.

The choice of financial ratio will always depend on the goal of your analysis. There is no standard guiding the use of financial ratio names and acronyms in practice or in textbooks. For example, be aware that different people mean different things when they talk about "leverage" or "earnings" or even return on assets. Always ask for, and insist on, a clear definition. Also, when you communicate financial ratios to others, always be clear and transparent about the definitions underlying your analyses.

Calculating ratios is never the last step in a financial statement analysis. To be useful, the analysis has to be complemented by an interpretation of these ratios and an overall assessment of the picture that emerges. Not only do you have to be clear in what each ratio means. You also need to discuss whether the ratios' values are favorable or less promising. In other words, there is no financial statement analysis without proper comparisons. These come in three basic forms:
- Time-series analysis compares ratio values over time within the firm. The horizontal analysis described above is one primitive form of time-series analysis. When comparing over time, be aware of seasonality (variation of business activities within a year) and cyclicality (variation of business activities across several years).
- Cross-sectional analysis compares ratios across firms and is typically done in the form of benchmarking across competitors in an industry.
- Target-actual analysis involves assessing whether the firm has reached its objectives for certain ratios. For example, management will typically receive a bonus only when certain profitability targets have been met.

Analyzing individual financial ratios is of little use if one neglects their underlying drivers. For example, a decline in gross margin (i.e., gross profit divided by sales) can be caused by a decline in sales (at constant cost of sales), an increase in cost of sales (at constant sales), or a combination of both. Unless we

understand these drivers, we cannot recommend corrective action. Therefore, we complement ratio analysis by a more detailed investigation of the drivers of certain key ratios. One such analysis is often referred to as DuPont analysis. It takes advantage of the fact that return on equity (ROE), a key performance indicator from the perspective of shareholders, can be expressed as the product of three distinct ratios: Net profit margin (net profit divided by sales) times asset turnover (sales divided by total assets) times leverage (total assets divided by equity). As such, DuPont analysis allows a deeper understanding of the firm's profitability than ROE alone.

4.6.   Assessing operating and financial activities

However, DuPont analysis is not perfect. Many (potential) investors are interested in analyzing the firm's operating activities separately from its financing activities. The underlying idea, well-known from the Modigliani-Miller world of thought, is that value is created primarily in the operations, whereas the financing activities typically create little or no value – or at least that the two sources of value are not logically be linked to each other and should thus be viewed in isolation. For example, most private equity (PE) firms will radically change a target's capital structure post-acquisition by loading it with external debt. Therefore, they are primarily interested in the debt-servicing capacity provided by the target's operations. They need financial ratios that focus on the firm's operations, abstracting away from the financing activities.

Basic DuPont analysis does not accommodate this separation. For example, one of the basic DuPont components of ROE, profit margin, is the fraction of bottom-line profit divided by sales. Whereas sales clearly is an operating item (it represents the firm's primary operating activity: selling its product or service), bottom-line profit is a combination of pre-tax operating profit (EBIT), interest expense (I), and income tax expense (T). Advanced DuPont analysis helps with this problem. It is a method that retains the basic idea of understanding the drivers of ROE, but implements that idea in a way that allows separation of operating and financing performance. In doing so, advanced DuPont analysis provides separate, 'clean', after-tax measures of operating profitability and financing costs.

Advanced DuPont analysis requires a reformulation of the reported financial statements that separates operating assets, operating liabilities, operating income and operating expense from financial assets, financial liabilities, financial income and financial expense. Using these ingredients, we can then calculate two key ratios:

- **Return on net operating assets (RNOA)** is the fraction of after-tax net operating income (NOI) and net operating assets (NOA, i.e., total assets less financial assets and operating liabilities). It represents a 'clean', operating measure of profitability, based on the idea that the firm's assets consist of two categories: The operating assets are necessary for the operations, whereas the financial assets (such as short-term financial investments or idle properties) are not, and can in principle be liquidated to repay debt. At the same time, operating liabilities (e.g., supplier credit in the form of accounts payable) originate incidental to the operations and do not represent financial debt. RNOA accommodates the fact that the benefit from the tax-deductibility of interest expense ('tax shield') stems from the financing activities, not the operations. Therefore, we use a measure of operating income that is calculated as if the firm had no debt. RNOA can be disaggregated into its two primary drivers: net operating profit margin and net operating asset turnover.
- We compare RNOA to **net borrowing cost (NBC)**, a measure of percentage after-tax financial expense. NBC divides net financial obligations (NFO, i.e., total liabilities less financial assets and operating liabilities) by net financial expense (NFE, i.e., the difference of financial income

and financial expense adjusted for the tax shield). It provides a 'clean' measure of borrowing cost that clearly shows that the benefit from the tax-deductibility of interest expense arises in the financial sphere, not the operations.

We combine these measures to explain ROE by applying the well-known leverage formula, which expresses ROE as a function of the firm's operating profitability (RNOA), its financial leverage (i.e., NFO divided by equity), and the 'spread' between operating profitability (RNOA) and borrowing costs (NBC) that the firm earns.

4.7.   Earnings per share (EPS) and EBITDA

Two other key performance indicators play crucial roles in the context of M&A transactions: Earnings per share (EPS) and earnings before interest, taxes, depreciation and amortization. One key skill we focus on in this course is understanding – as early on in the process as possible – how M&A transactions and their characteristics affect future (post-deal) values of these KPIs.

Earnings per share (EPS), the fraction of bottom-line profit divided by the average number of shares outstanding, is commonly used as an indicator of dividend payment capacity. Especially when forecasted, it also functions as a fundamental anchor for assessing stock price. In the latter context, the price-earnings ratio (P/E ratio), the fraction of stock price per share divided by (current, expected, or 'sustainable') EPS acts as a gauge of the 'expensiveness' of a stock, with low (high) P/E ratios signaling inexpensive (expensive) stocks.

Calculating EPS is only straightforward when there is only one category of stock (typically common stock), and when there are no potentially dilutive securities outstanding that, if converted into equity, would dilute EPS by affecting either its denominator only or both numerator and denominator. In the latter, a firm calculates both basic (undiluted) and diluted EPS, where diluted EPS is based on the idea that shareholders are interested in the EPS they will be entitled to in the future when all currently possible 'potential' shares are issued. These 'potential' shares can, for example, stem from share options or warrants outstanding which, when exercised, will lead to new shares being issued by the firm. New shares can also arise from convertible bonds outstanding which, when converted, will affect both numerator (less interest expense increases profit) and denominator of EPS (more shares issued in return for bonds retired).

EBITDA is another commonly used KPI in the context of M&A transactions. It is a measure of operating profit (EBIT) with an important category of non-cash expense – depreciation and amortization – added back. As such, it combines two advantages: First, it captures operating performance separately from financing effects. Second, consistent with the maxime "cash is king", it approximates cash flow from operations by disregarding depreciation and amortization expense, which do reduce profit, but are irrelevant (in the current period) for the firm's cash position. For this reason, EBITDA can act as a measure of the firm's debt-servicing capacity, which makes it widely used in ratios such as EBITDA divided by net financial obligations. Knowing that investors are interested in this measure, many firms display EBITDA and adjusted versions of it prominently in their financial communication. Valuation professionals work hard to make adjustments to reported EBITDA values that are intended to tease out "underlying", "normalized", or "recurring" EBITDA, i.e., EBITDA net of one-time effects, such as restructurings.

Section Guide 4
Structured Forecasting

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1. Introduction

Having understood the firm's past through financial statement analysis, we are now in a position to forecast the expected future cash flows and other key performance indicators as inputs to the valuation models that will be discussed in the subsequent sections. Good forecasts are the most important ingredient of good valuations, and forecasts are based on our assumptions about how the combined entity's business will unfold under different scenarios, with multiple factors interacting in complex ways. As LS put it (p. 166): "Forecasting the future financial statements represents the ultimate goal of all the analysis we have discussed so far." In this section, we introduce a systematic approach to generating these forecasts.

2. Learning objectives

At the end of this section, you should:
- See the need for forecasting full sets of financial statements if we are going to derive sound forecasts of future cash flows, earnings, equity and assets;
- Recognize the two pillars of firm value, and how they relate to each other;
- Be aware of important forecasting implementation problems;
- Be able to apply a structured approach to forecasting the financial statements; and
- Be able to evaluate and analyze your forecasts

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), Sections 5.4-5.5; Chapters 7 and 8.
- Ballwieser and Hachmeister (2016), Section 4.3.

3.2. Problem set
- Tutorial session 4 & 5

4. Summary of section content

4.1. What are we forecasting, and why?

As discussed above, firm value derives from the firm's prospects, and in order to assess it, we have to make predictions about how the firm will evolve in the future. As we will see in more detail starting in section 5, the most common valuation approaches require forecasts of future cash flows or other performance indicators. Where do those come from?

We have seen that cash flows alone are a poor basis for forecasting themselves, because they measure value distributed rather than value created. Consider cash flows paid to owners, which we referred to as *net dividend* (= net cash flow to/from equity-holders) above. Dividends represent management's decision on how much of the firm's value to *distribute* to shareholders, and they can be a poor measure of the value *created* during the period. We have argued above that earnings is a better indicator of value created, and that earnings and dividends differ by that portion of earnings that is retained in the firm. Consider also that the balance sheet contains information about the firm's future earnings potential, as well as about its future dividend-paying potential (i.e., the level of retained earnings and cash available). All of this suggests that cash flows are difficult to forecast in isolation, and that information in earnings and balance sheets can help.

We have also seen that the financial statements, i.e., the balance sheet and income statement, provide a description of the firm's business model in terms of accounting numbers. This means that our expectations about how the firm's business (along with its cash flows and associated dividend-paying potential) will evolve in the future can be usefully organized in the structure that the financial statements provide. Importantly, this structure accommodates the considerable complexity and interdependencies that affect how the firm will evolve.

Therefore, we adopt here an approach that derives cash flow-based valuation model inputs from forecasts of financial statements, so-called 'pro forma financial statements'.

4.2. Pillars of firm value

Two key drivers of firm value are profitability and growth.

- From the perspective of shareholders, profitability is typically expressed in terms of return on equity (ROE).
- Growth measures the change in the magnitude of invested capital that the firm can deploy to earn that return. Whereas in a steady-state situation, growth rates in earnings, cash flows, equity and assets are determined by the rate of sales growth, growth rates will vary during unsteady periods.

Value creation hinges on achieving high growth, but that growth is not an end in itself: It simultaneously needs to be profitable. There is another connection between the growth and profitability: The *sustainable growth rate* (SGR) describes the rate at which the firm can grow without having to raise additional capital externally, with SGR = ROE x (1- dividend payout ratio). This is intuitive, as cash paid out in dividends will limit the firm's ability to reinvest and grow faster. Firms going through phases of strong growth will therefore typically limit their dividend distributions.

Note that, empirically, individual firms will occasionally experience extreme values of ROE and/or growth. However, these values will typically revert to average values very quickly. This phenomenon is called *mean reversion*, and it should make us very skeptical of projections that predict several periods of sustained high growth and/or profitability. After all, most firms are not *Apple*.

4.3. Structured forecasting
4.3.1. Overview

Financial statement analysis does not necessarily culminate in forecasting and valuation – this depends on our objective. However, valuation necessarily requires sound analysis and forecasting. In what follows, we will focus on our firm-specific analysis conducted in the previous sections to make forecasts not only of ROE and growth, but to forecasts of valuation model inputs from forecasts of the financial statements as a whole.

Developing good forecasts hinges on a systematic, integrated, structured approach. That is, we use the financial statements as a structure to organize our assumptions, deriving forecasted balance sheets, income statements, and cash flow statements. We start with forecasted sales growth, and then use financial ratios from our analysis of the past financial statements as a foundation for forecasting future financial statements (also called 'pro forma' financial statements) under appropriate assumptions.

This process will involve reformulating and simplifying the financial statements, as well as making adjustments to obtain data that is an appropriate basis for forecasting. A full set of forecasted 'pro forma' financial statements provides key inputs to any valuation model.

4.3.2. Approach

Starting with the forecast of next-period sales, we move down the income statement or balance sheet, forecasting the individual line items by applying financial ratio analysis 'in reverse'. Assuming we start with the income statement (which conforms to the function-of-expense method; *UKV*), the next line item to forecast is next-period cost of sales, or cost of goods sold (COGS). Knowing that sales less COGS yields gross profit, one way to forecast COGS is by forecasting next-period *gross margin* (i.e., gross profit divided by sales), calculating gross profit, and backing out COGS. Our forecast of the gross margin will consider the past development of gross margin, as well as our assumptions about the firm's future cost structure. Specifically, to the extent that COGS primarily contains variable costs, it should grow at approximately the same rate as sales. However, if COGS contains substantial fixed costs, these are not expected to rise proportionately. The case in which sales grow more quickly than COGS can reflect economies of scale or scope.

We will proceed in this way until we come to a point where information from the other financial statement is required. For example, predicting next-period COGS in detail requires us to understand the degree to which depreciation and amortization are part of COGS, and how these specific expenses will behave when sales grow as predicted. In order to answer that question, we will have to shift our focus to the balance sheet, as the levels of PP&E and intangibles, respectively, as well as their respective useful lives determine next-period depreciation and amortization. Forecasting next-period PP&E and intangibles will involve assessing the levels of these assets that are needed to generate the projected sales volume. For example, if we forecast a 10% sales growth for McDonald's for next year, we will have to consider the type and level of investments needed to achieve that growth. Will McDonald's open new stores, will it use the existing ones more efficiently, or will it acquire and redeploy a competitor's stores? The answers to these questions will ultimately manifest in an assumed relation between the forecasted sales volume and the forecasted levels of assets needed to generate it. Recall that this relation is captured by a financial ratio we referred to as *asset turnover*. Asset turnovers can be calculated for different asset classes; they describe the amount of the specific type of asset that is needed to support a given level of sales.

In this manner, we will alternate between the balance sheet and income statement, using predicted values of financial ratios such as mainly *margins*, *turnovers*, and notions of *leverage*, to forecast each of the line items of the balance sheet and income statement. As we come to the end of that process, we will have to leave *one* balance sheet position open, which will serve as the 'plug' that makes the balance sheet balance. In our approach, this is the equity position. That is, we actively project all asset and liability positions, as well as the income statement items down to the net income line. Then we will make a dividend payout assumption. These steps determine the change in retained earnings; the remaining equity position (i.e., subscribed capital and capital reserves) will then serve as the plug that adjusts automatically to make the balance sheet balance.

This structured forecasting approach is highly flexible and instructive, as it explicates the interactions among the financial statement positions, which reflect the complexity of real-world decisions. It is best studied in Excel.

4.3.3. Implementation

Applying the structured forecasting approach in practice requires a number of decisions:

- <u>Quarterly versus annual forecasting:</u> To avoid unnecessary complexity, it is commonly recommended to forecast on an annual basis. However, quarterly financial information can help detect seasonality and thereby help improve forecasts.
- <u>Forecast horizon:</u> The forecast horizon is the number of years over which we have sufficient information (or confidence) to make specific forecasts. It ends when we reach a point where we can no longer do better than make simplified assumptions. Under these assumptions, we view the firm as operating in a steady *state*, which is characterized by a constant growth rate in sales, and by all balance sheet and income statement items growing at that same rate. This implies constant margins, turnovers, and leverage, and cash distributions to shareholders also growing at the same rate as sales. For more mature firms, we can use longer forecast horizons than for start-ups. A typical range is 3-5 years.
- <u>Terminal value assumptions:</u> Terminal value assumptions are a large determinant of value, as they reflect our assumptions about what will happen to the firm during the years after the forecast horizon (e.g., year 5) through infinity. In steady state, the firm's sales should not be assumed to grow faster than the rest of the economy. (However, they might grow more *slowly* if we assume the firm's products to eventually become obsolete.) Further, margins, turnovers, and leverage ratios should typically combine to yield a forecasted ROE that is equal to the cost of equity capital rate. This is intuitive, as competitive forces will erode the firm's competitive advantage in the long run, forcing it to earn no more than the required return (i.e., its cost of equity capital). However, accounting measurement error may permanently distort ROE as a measure of the economic rate of return. Lundholm/O'Keefe (2001) explain in detail how to implement sound terminal value assumptions in an Excel-based valuation model. They recommend that the valuation model input parameters be inferred from the last explicitly forecasted period, where net income and equity both grow at the long-term growth rate. This will yield the appropriate starting points for calculating terminal value.
- <u>Persistence:</u> Financial statements are the result of accounting rules and should describe the performance of a firm as realistically as possible. However, accounting conservatism (losses are reported more quickly than gains) and unusual and/or infrequent "one-time" events can "bias" the true and fair view of the financial statements of a firm. These biases and time series properties need to be taken into account when forecasting future balance sheets and income statements.

Furthermore, a more or less complex model can underpin each of the balance sheet and income statement items that we need to forecast. For example, the sales forecast is the most important number we have to predict, and it deserves large portions of the time we invest into the forecasting task. Sales, of course, is the number of units sold times price per unit, so it has a volume and a price component. The price component alone reflects several factors, including our bargaining position relative to the customer, but might also be affected by foreign-currency effects in internationally active firms. In large groups with multiple product lines and geographic segments, the task of forecasting sales is truly daunting, and this is to some extent true for all balance sheet and income statement items. This complexity again calls for a systematic approach. For example, it is common to employ a top-down approach that predicts firm-level sales by first considering macroeconomic and industry-wide developments.

Chapter 8 in LS discusses these forecasting details. Ultimately, all balance sheet and income statement items are more or less strongly related to the growth in the magnitude of the firm's operations, which of course is reflected primarily in the sales forecast. This is especially true as the firm approaches *steady state*, i.e., a phase of sustainable growth and constant relations among the balance sheet and income statement items.

4.4. Cash flow analysis

Cash is the ultimate goal of the company's activities. Forecasting future income statements and balance sheets yield forecasted cash flow statements as well. However, you should check your assumptions for economic sense. You should understand the cash consequences of the firm's operating, investing and financing activities. Sometimes, your assumptions force you to circle back. Evaluating the cash flow from operations, the cash flow from investing, and the cash flow from financing in detail gives you hints whether your assumptions to forecast income statement items and balance sheet items make sense.

4.5. Excursus: Regression approaches to forecasting ROE

Regression approaches allow us to forecast ROE using large samples of data. Recall that we disaggregated ROE into several components:

- In <u>basic DuPont decomposition</u>, we decomposed ROE into net profit margin (net profit divided by sales) times asset turnover (sales divided by total assets) times leverage (total assets divided by equity).
- In <u>advanced DuPont decomposition</u>, also referred to as *'operating/financial disaggregation'*, we decomposed ROE into return on net operating assets (RNOA) plus its financial leverage (i.e., net financial obligations, NFO, divided by equity) times the 'spread' between operating profitability (RNOA) and borrowing costs (NBC) that the firm earns.

Using the latter approach, we can use regression analysis to forecast ROE in two ways (refer to Esplin et al. 2014):

- The <u>aggregate forecasting approach</u> first regresses current ROE on lagged (i.e., prior period's) RNOA, NBC, and leverage, in order to derive coefficient estimates, i.e., estimates of the multiples that link these ratios to ROE. In a second step, current values of RNOA, NBC, and leverage are then multiplied with these coefficient estimates to forecast *next period's* ROE. This procedure is referred to as 'out-of-sample forecasting', as future ROE is predicted using coefficients estimated using data from *within* a certain sample of firms and periods.
- The <u>components forecasting approach</u> also uses out-of-sample forecasting, but proceeds first by separately regressing current RNOA, NBC, and leverage on their drivers, again yielding a set of coefficient estimates. The second step involves using current values of these drivers and their coefficient estimates to forecast next period's RNOA, NBC, and leverage out of sample. In a third step, these predicted values of RNOA, NBC, and leverage are then combined to yield forecasted ROE.

Note that these regression approaches to forecasting ROE use little firm-specific insight, but instead rely on large quantities of data to identify statistical relations between key ratios and their drivers. Thus, they have to be distinguished from the structured forecasting approach where we make forecasts of valuation model inputs from forecasts of the financial statements as a whole (see part 4.3 of this section guide).

Section Guide 5
Valuation under uncertainty

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1. Introduction

About 95% of the workload in practice relates to collecting and analyzing information (particularly financial information) about the firm and finally forecasting its future financial statements to derive valuation model inputs such as cash flows and earnings. But however important this preparatory work is – ultimately, we need to apply this information accurately in the final step: the actual valuation.

2. Learning objectives

At the end of this section, you should:
- Clearly see the sequence of steps involved in conducting a sound fundamental analysis, forecasting the future cash flows and valuation.
- Be able to distinguish between different approaches to valuing a business, including the situations in which each is appropriate;
- Understand important theoretical concepts relevant to valuation and the implications from the including assumptions
- How to deal with uncertainty in valuation
- The important role of financing policy in DCF models

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), Chapter 7 - 8.
- Ballwieser and Hachmeister (2016), Chapter 4.1; 4.4; 4.5; 4.6; Chapter 6 and Chapter 7.

3.2. Problem set
- Tutorial session 6 & 7

4. Summary of section content

4.1. Purposes of valuation
Value is unobservable; it is in the eye of the beholder. That does not mean that we cannot find ways to derive value in ways that are theoretically and practically sound. It does mean, however, that value will vary depending on the purpose of a given valuation. For example, the value of a business to an owner under financial distress is different from the value of that same business for a potential buyer who views it as an ideal strategic fit with its own operations. Therefore, that purpose guides the valuation exercises.
The purpose also determines the extent to which the valuer considers the following factors:

- <u>Importance of avoiding valuation errors:</u> This is obviously more crucial when much is at stake, e.g., when a valuation is the basis of real decisions, including investment decisions involving one's own or other people's funds;
- <u>Importance of high verifiability:</u> Valuation is based on assumptions and therefore fraught with discretion. Restricting that discretion, e.g., by standardizing certain assumptions, makes valuations more objective and replicable. This is important especially when valuations are communicated – and need to be understood – by third parties.
- <u>External communication and disclosure:</u> On certain occasions valuations, or at least key assumptions and parameters, need to be disclosed, e.g., in the context of financial reporting.

This course focuses on valuations for preparing investment decisions. Passive investors have little use for fundamental valuation, as they essentially trust in efficient markets and the resulting 'price protection'. Fundamental investors are more skeptical. Among them, defensive investors challenge market value using fundamental valuation before they take a position, whereas active investors purposefully use fundamental valuation to identify what they deem to be 'mispriced' investments.

Fundamental investors (think *Warren Buffett*) adhere to a number of investing principles, the most important of which probably is: 'Beware of paying too much.'

4.2. Objects of valuation

This course covers approaches to valuing businesses, as well as equity securities issued by businesses. (We refer to these as 'firms', for simplicity.) Before beginning a valuation task, it is important to delineate the object being valued. For example, it may be a legal entity, or group of legal entities, or a business representing a subunit of a legal entity.

4.3. Approaches to valuation

Recall that, in section 1, we introduced basic approaches to valuation that are commonly used in practice. We are now ready to consider these approaches in more detail, and to delve into each one. In what follows, we distinguish between the following:

- Discounted cash flow approaches;
- Asset-based approaches;
- Mixed-method approaches; and
- **M**arket-based approaches.

4.4. Dealing with uncertainty

4.4.1. Overview

Value depends on the distributions expected in the future from the firm being valued. These are uncertain. Uncertainty is therefore a key feature that valuation approaches must address. The influence of uncertainty (in terms of extent and direction) on value depends on the valuer's attitude towards risk (i.e., their *risk preferences*), which is formally explicated in their *risk utility function*. We distinguish between:

- **Risk aversion**, described by a concave risk utility function, describes individuals for whom uncertainty of a payoff diminishes the utility they derive from it.
- For **risk-neutral** individuals, uncertainty does not affect the utility they derive from a payoff, consistent with a linear risk utility function. Choices among alternatives take place using the expected value criterion.
- Finally, **risk-seeking** individuals' utility increases in the uncertainty of the payoff, yielding a convex risk utility function.

One of the key challenges for valuation lies in the task of incorporating the valuer's individual risk preferences into the valuation. This can be done in two principal ways described next. This is done using a very basic valuation model that expresses value as the present value of a cash flow, *CF*, being received in perpetuity, i.e., CF divided by the discount rate, *r*.

4.4.2. Risk discount approach

The risk discount approach transfers expected future cash flows into *certainty equivalents*, *CE*, based on individual risk utility functions, which are then discounted using a risk-free discount rate, $r_{RF,}$ that only captures the time value of money. This approach is also referred to as the 'numerator approach' to dealing with uncertainty, as uncertainty is considered in the numerator of the valuation formula. In practice, however, it is difficult to observe and account for individuals' risk utility functions, let alone aggregate them.

Section Guide 6
Cost of Capital

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1. Introduction

In the realm of firm valuation, the Cost of Capital stands as a critical parameter. It signifies the expected return on investment that creditors and investors anticipate when providing funds to a company. This vital metric forms the nexus between a firm's operations and its financial well-being, serving as a barometer for investment attractiveness and financial decision-making. The Cost of Capital reflects the compensation required for assuming the risks associated with investments, be it through equity or debt. In this pursuit of understanding firm valuation, we explore the dynamic nature of the Cost of Capital, influenced by market dynamics, financial structure, and risk profiles.

2. Learning objectives

At the end of this section, you should:
- Understand the concept of the risk premium;
- Be aware of the influence of the capital structure of the firm on the discount rate; and
- Be able to calculate the appropriate discount rate.

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), sections 9
- Ballwieser and Hachmeister (2016), Chapter 4.6

3.2. Problem set
- Tutorial sessions 6 & 7

4. Summary of section content

4.1. Risk premium approach

Under the risk premium approach, value consists of expected values of future cash flows, *CF*, which are then discounted using a risk-adjusted discount rate, r_{RA}, that reflects the risk preferences of the valuer, making the discount rate a measure of the opportunity cost of an investment foregone that has the same risk. The discount rate is also referred to as the *cost of capital rate*, because firms must earn at this rate to satisfy investors' expectations. Importantly, cash flows and discount rates need to be consistent with respect to a number of relevant dimensions, including: currency, time to maturity, inflation, personal taxes, and importantly, risk.

The risk-adjusted discount rate, r_{RA}, consists of at least two elements:

- The risk-free rate, r_{RF} (typically derived from high-quality government bond yield curves); and
- The risk premium, *z* (typically derived from the *Capital Asset Pricing Model*, or *CAPM*). Under the CAPM, the expected rate of return to equity investors given the firm's risk (i.e., the cost of equity capital, r_{EQ}) consists of the risk-free rate, r_{RF}, plus a risk premium, z_{CAPM}. That risk premium consists of a market risk premium, r_M, for holding equities generally, and the firm's undiversifiable, systematic risk, *β*. Beta represents the covariance of the firm's stock return with the market return, standardized by the market return; it captures the degree to which holding the firm's stock exposes the investor to risks that cannot be diversified away. Additional risk factors that are frequently considered include capital structure risk, liquidity risk, size, limits to diversification, country risk, and insolvency risk. It is not clear to what extent all of these risk factors are actually priced, i.e., if investors are actually justified in demanding a risk premium as compensation for them, or whether they can be diversified away.

One of these risks, **capital structure risk**, deserves closer inspection. Although the riskiness of the firm's operations (*operating risk*) are independent of its capital structure, leveraged firms (i.e., those using large amounts of debt to finance parts of their operations) are clearly riskier than those not facing the burden that comes from future interest and principal payments. That is, we need to consider *financing risk* as well. On the other hand, unlevered firms forgo the tax savings of tax-deductible interest payments (the so-called *tax shield*; see section 8). Financing risk is a function of the firm's exposure to debt (i.e., its debt ratio), the riskiness of that debt, and the tax implications of debt. We can express firm value as the value of the unlevered firm (i.e., its operations), $V_{unlevered}$, plus the value of the tax shield, V_{TS} (i.e., the value of the tax benefits of using debt). This value is shared by the equity-holders and debt-holders, i.e., it equals the sum of the values of equity and debt, V_{EQ} and V_D; such that: $V_{unlevered} + V_{TS} = V_{EQ} + V_D$. An analogous relation can be expressed in terms of the returns on these components: $r_{EQ\ unlevered} \cdot V_{unlevered} + r_S \cdot V_{TS} = r_{EQ} \cdot V_{EQ} + r_D \cdot V_D$. Resolving this equation for the cost of equity capital of the levered firm, r_{EQ}, allows us to express that required return on the levered firm as a function of (1) the unlevered cost of equity capital ($r_{EQ\ unlevered}$), which captures the firm's operating risk, and a risk premium for debt. Similarly, the CAPM beta can be adjusted for the effects of leverage (so-called *relevering* versus *unlevering*). (For details on this paragraph, refer to BH section 4.6.6.4.)

Observed market prices and forecasts can be used to 'reverse-engineer' the discount rate (or cost of capital rate) *implicit* in the current market price.

In practice, cost of equity capital rates range between 8.5 and 10%. These values have remained pretty stable even in the recent interest rate downturn; this has been argued is due to risk-free rates falling, but market risk premiums rising in proportion.

4.2. Discount rate

To derive value, future cash flows are discounted using an estimate of the firm's (appropriately defined) cost of capital. Recall that the discount rate in a present value calculation represents the *opportunity cost* of the individual considering an investment that is expected to generate future cash flows of a

given amount, timing and uncertainty. This opportunity cost is also called the investor's expected rate of return; consequently, from the firm's perspective we refer to it as the *cost of capital*. In valuation models valuing the firm's equity, the cost of *equity* capital, r_{EQ}, is relevant. When the overall entity (i.e., the unlevered equity) is being valued, we use the *weighted average* cost of capital (WACC) rate, r_{WACC}, i.e., an average rate of return expected by the equity-holders and lenders, weighted using the relative proportions of equity financing and non-equity financing in the firm's capital structure. Importantly, as discussed above, both rates capture any *risk* inherent in the investment. Furthermore, different discount rates may have to be used for discounting cash flows expected to arrive at different future dates, consistent with differences existing between short-term and long-term interest rates (yield curve).

Section Guide 7
Approaches to Valuation

1. Introduction

This section is at the core of the valuation part of this course. Equipped with our forecasted financial statements (section 4), and aware of the different ways to address uncertainty (sections 5 and 6), we are now in a position to look at different valuation models.

2. Learning objectives

At the end of this section, you should:
- Appreciate the purpose of valuation; and
- Be able to distinguish between different approaches to valuing a business,including the inputs used, according to either the equity approach or the entity approach.

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), sections 10
- Ballwieser and Hachmeister (2016), Chapter 3

3.2. Problem set
- Tutorial sessions 6 & 7

4. Summary of section content

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Section Guide 8
Discounted Cash Flow Valuation Models

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1. Introduction

Discounted cash flow models are based on the idea that the firm is essentially an investment opportunity that requires an initial investment and will yield a series of uncertain cash flows, which are subject to income taxes, in the future. In other words, they represent different ways in which value can be rendered as a mathematical expression involving cash flows, discount rates, and income taxes.

2. Learning objectives

At the end of this section, you should:
- Understand the principal building blocks of DCF models, i.e., future cash flows, discount rate, and income taxes;
- Appreciate how different ways of structuring the forecasting task give rise to different generic valuation formulas, i.e., the finite-horizon model, the perpetuity model with and without growth, and combinations of both in the form of phases models with and without growth;
- See how different assumptions about the firm's future financing are consistent with different valuation approaches;
- Be familiar with the DCF equity model and the various DCF entity models;
- Be able to calculate the cash flow inputs needed to apply each of these models;
- Understand the discount rates appropriate for each of these models.

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), Sections 6.3; 6.4; 6.5; 10.3; 10.4.
- Ballwieser and Hachmeister (2016), Chapter 5.

3.2. Problem set
- Tutorial sessions 6 & 7.

4. Summary of section content

4.1. Buildings blocks of discounted cash flow models

Any DFC model consists of three basic elements from which valuations are constructed. The first two elements are based on the simple idea that value derives from a function of future cash flows and the discount rate. The third element, income taxes, needs to be considered separately.

- Future cash flows: Firms create value by generating future cash flows that can be paid out to the providers of capital. Valuing the firm from the perspective of equity-holders requires forecasting (net) distributions to equity-holders, also referred to as free cash flows to equity, or *flows to equity* for short. In contrast, if we are interested in the firm's entity value, or enterprise value, we project future net payments to equity-holders, lenders, and other providers of capital (e.g., hybrid capital), sometimes referred to as *free cash flows*. The notion of free cash flow versus actual distributions reflects the idea that cash retained and cash paid out creates equal value for shareholders; of course, there may be several reasons why that assumption does not always hold. In forecasting future cash flows, we typically assume an infinite investment horizon. To make the forecasting task manageable, we first consider a detailed forecast period that spans the foreseeable future, and then make assumptions about the cash flows expected beyond that period.
- Discount rate: (see section 6)
- Income taxes: Income taxes diminish the firm's value because they reduce the cash flows available to the providers of capital. In Germany, there are three kinds of income taxes: Corporate income tax (*Körperschaftsteuer*), personal income tax (*Einkommensteuer*), and business tax (*Gewerbesteuer*). Importantly, interest expense on the firm's external debt is tax-deductible, creating a subsidy for firms using debt and other qualifying non-equity financing to leverage their activities. This benefit is referred to as the *tax shield* on debt. Firms are commonly valued without regard to the personal income tax situation of the individual conducting the valuation. Rather, stylized assumptions are made to value the firm from the perspective of an anonymous, average (and typically well-diversified) investor holding a small stake. However, if we are interested in valuing the firm from the personal perspective of a specific individual, we need to consider how the firm's future cash flows will be taxed under that individual's personal tax situation. Doing the latter leads us beyond what this course can accomplish.

Textbooks differ in the extent of discussion dedicated to these three elements. Whereas textbooks adopting an accounting perspective tend to focus on the process of deriving high-quality cash flow projections, finance-based textbooks often assume a set of future cash flows that we just 'happen to know', and go on to discuss at length the intricacies of deriving the appropriate discount rates. Whereas most textbooks do discuss the effect of corporate income taxes (including the deductibility of interest expense), few consider in detail the notion of personal income taxes. The two textbooks used in this course, LS and BH, both cover elements 1 and 2, with element 3 covered in more detail in BH.

4.2. Generic valuation formulas

Valuation formulas are mathematical representations of the relations among the elements described above. There are endless possibilities of expressing value in this way. In this course, however, we distinguish between the following four generic alternatives, which differ in terms of the assumptions made about element 1 above, the future cash flows. (Note that future cash flows are always uncertain expectations; however, we omit the expectation operator, $E[\cdot]$, for simplicity reasons.)

- Finite horizon model: Under the finite horizon model, we express value as the sum of discounted future cash flows that are individually projected for a finite number of periods that comprise the (finite) forecast horizon. In practice, investments in firms are typically considered to have an infinite horizon, which limits the practical applicability of this model. Note that, even if our investment horizon *were* actually finite, we

would have to forecast the cash flow expected upon selling or liquidating the firm at the end of the finite horizon (sometimes called the liquidating dividend). That value, again, would have to be calculated as a discounted cash flow over subsequent periods of the firm's life.

- Perpetuity model: The simplest model available, the perpetuity model assumes that the firm generates a certain fixed cash flow (i.e., a constant annuity) in perpetuity, and that the discount rate is also stable into infinity. In that case, value equals the fixed cash flow divided by the discount rate, *CF* / *r*.
- Perpetual growth model: This model, also called Gordon growth model, is equivalent with the perpetuity model, with one notable exception: It assumes constant cash flow growth at a growth rate *g* into infinity. In this case, value equals the fixed cash flow divided by the difference between the discount rate and the growth rate, *CF* / (*r* − *g*). Plausibly, should not exceed the growth rate of the overall economy. Also, note that *g* > *r* will yield a negative value, which is problematic to interpret.
- Phases models: The above models may be too simplistic to adequately capture the evolution of a firm's future cash flows. Phases models accommodate this fact by partitioning the forecasting task into two phases. The first phase represents the detailed forecast period *T*; it extends as far into the future as the valuer can still confidently make detailed projections. The length of *T* depends on the dynamics of the industry and the firm, with highly stable firms being easier to forecast over long periods. The growth rates expected during *T* will reflect the firm's competitive advantage and its sustainability. The second phase makes assumptions about the evolution of cash flows beyond the detailed forecast horizon. For example, a phase model could assume variable *CF* over a detailed forecast horizon *T*, followed by a constant annuity in perpetuity subsequent to *T*. Assumptions for the second phase are highly influential and determine a large proportion of the resulting value. This is especially true if cash flows are expected to grow in perpetuity.

4.3. Role of financing assumptions

Financing assumptions play a key role in valuation, as the capital structure (i.e., the relative amounts of equity financing, debt financing and other non-equity financing) determines the capital structure risk as well as the costs of borrowing and associated benefits from the tax deductibility of interest expense (*tax shield*). Whereas the Adjusted Present Value (APV) model (described below) assumes *autonomous financing*, i.e., fixed absolute amounts of debt, all other models (also described below) assume that the firm adjusts its financing needs according to a predetermined *target capital structure*, in which the percentage proportions of equity and debt (measured at market values) are constant over time. The former assumption is consistent with more certain tax shields, whereas the latter assumption reflects less certain tax shields.

4.4. DCF valuation models

As a first cut, DCF valuation models can be distinguished into those that value the firm's equity directly (equity models), and those that value all of the financial claims (i.e., the entity, or enterprise), and then deduct the value of debt to arrive at equity value (entity models). Using consistent assumptions, all models will yield the same equity values.

4.4.1. Equity models: Flow-to-equity (FTE) model

Under the equity model (also referred to as the *dividend discount model* or, in Germany, as *Ertragswertverfahren*), the firm's cash flows to equity-holders, or flows to equity, *FTE*, are discounted using the firm's cost of equity capital, or required rate of return on equity, r_{EQ}, yielding equity value, V_{EQ}. The *FTE* can

be derived from our forecasted financial statements in three different (but equivalent) ways, all of which try to get at the net amounts expected to be distributed in cash to the firm's equity-holders.

- First, if the clean surplus relation holds, we can derive the *FTE* from forecasted balance sheets and income statements. That is, *FTE* = earnings – increase in equity. Intuitively, if changes in equity can only result from either (1) payments between the firm and equity-holders, or (2) earnings (as per the clean surplus relation), whatever earnings the firm generated must be either retained (increasing equity) or paid out, yielding *FTE*. If the firm did not pay out anything, and/or even raised equity, *FTE* will reflect this as well. For example, if the firm earned 200 and retained 80, *FTE* = 200 – 80 = 120, i.e., a *dividend payout ratio* of 60%. As a further example, if the firm made 0 earnings, and raised new equity of 100, *FTE* = 0 – 100 = -100; this is intuitive as the cash flow going out to equity-holders is negative.
- Second, we can use the cash flow statement to derive the *FTE* indirectly. Intuitively, equity-holders are paid out whatever is left of the firm's operating cash flow after deducting (1) how much was invested (cash flow from investing activities), (2) how much was paid out to other (i.e., non-equity) providers of capital, and (3) how much cash was retained.
- Third, again using the cash flow statement, we can look at the financing cash flows between the firm and equity-holders directly. That is, we calculate the net amount of any cash dividends paid and any net issuance of equity.

German valuation law (*Bewertungsgesetz*; see sections 199-203 *BewG*) refers to a simplified *Ertragswertverfahren* for the valuation of private (i.e., not publicly traded) firms. It expresses firm value as the product of a sustainable income number, *SI*, and a capitalization factor, *c*, that is prescribed by the Ministry of Finance. This procedure is akin to a perpetuity model with cash flow equal to a constant annuity *SI*, and discount rate $1/r$ $(c=1/r)$.

4.4.2. Entity models: Adjusted present value (APV) model

The APV model is based on the idea that firm value is driven by two separate elements: (1) unlevered entity value, which reflects the cash flows generated in the firm's operating activities (regardless of how these are financed); and (2) the tax benefits produced by the firm's financing policy, i.e., its use of tax-deductible debt. This two-step process holds separate the two sources of value: operating and financing.

- Unlevered entity value ($V_{unlevered}$): The entity value of the (fictitiously) unlevered firm (i.e., assuming the firm is purely equity-financed) is calculated as the present value of free cash flows, *FCF*, i.e., the sum of operating cash flows and investing cash flows (the latter is typically a negative amount). As the *FCF* are intended to reflect the operating activities of the unlevered firm, they are discounted at the (fictitious) cost of equity capital rate of the unlevered firm, $r_{EQ\ unlevered}$.
- Tax shield (V_{TS}): Another component of value stems from the firms' use of interest-bearing debt to finance part of its operations. Using debt yields tax advantages in most jurisdictions, including Germany, as interest expense is deductible for tax purposes. V_{TS} captures the present value of the firm's expected future tax benefits from using debt. It is calculated as the present value of future tax-deductible interest expense multiplied by the applicable tax rates. The discount rate corresponds to the cost of debt, r_D.

The (levered) entity value, V_{ENT}, then results from adding the two elements: $V_{ENT} = V_{unlevered} + V_{TS}$. Subtracting the value of debt, V_D, yields equity value: $V_{EQ} = V_{ENT} - V_D$. For the APV model, we need the *FCF*, which can be derived in two ways:

- Starting with operating cash flow before interest and taxes, we deduct tax payments of the unlevered firm (again, assuming no debt) and add investing cash flow, to yield *FCF*.

- Alternatively, we calculate FCF indirectly by starting with net profit (after interest expense and after taxes). We add back interest expense, add the so-called "fictitious" taxes (i.e., the difference between the tax expense of the unlevered firm and the actual tax expense of the levered firm), and adjust for non-cash income (e.g., sales on credit) as well as non-cash expenses (e.g., depreciation and amortization), and add investing cash flow.

4.4.3. Entity models: Weighted-average cost of capital (WACC) models

Compared to the APV model, the WACC models calculate entity value, V_{ENT}, in one step, i.e., without separating the tax shield from the unlevered operating strength of the firm. The appropriate discount rate used in both models is the weighted-average cost of (equity and non-equity) capital (r_{WACC}). The two WACC models differ on the question of how the value of the tax shield is taken into account.

4.4.3.1.   Deriving the WACC

The WACC reflects the expected rates of return of both equity-holders, r_{EQ}, and lenders (and other non-equity capital providers), r_D. It can be thought of as the expected return on net operating assets (RNOA). The weights are provided by the relative proportions of equity and debt in the firm's capital structure (calculated in terms of market values). The challenge in calculating the WACC primarily lies in the so-called *circularity problem*: In order to calculate the WACC, we would have to know the values of equity, V_{EQ}, and debt, V_D; however, these are the values that we need the WACC for deriving. This circularity problem is resolved using a recursive approach explained in BH, section 5.3.2, as well as in the lecture slides.

Alternatively, one can value V_{EQ} directly (using the FTE model) and find the matching WACC by solving for r_{WACC} in the WACC equation. This approach does not generate new information, because if the ultimate objective is to derive V_{EQ}, we would have already achieved that. However, in practice it is sometimes desirable to present firm value in terms of several, or all, of the models discussed here, and this can be consistently achieved using the approach described here.

4.4.3.2.   Free cash flow (FCF) model

The FCF model uses free cash flows of the unlevered firm, which reflect taxes that an unlevered firm would have to pay. In other words, the *FCF* are the same as those used in the APV model, i.e., they do not reflect the tax shield. In other words, the *FCF* are too low, as they contain tax elements that a levered firm does not have to pay. This "error" is compensated in the denominator of the valuation formula, by using as a discount rate an after-tax WACC, $r_{WACC,FCF}$. The after-tax WACC can be thought of as a pre-tax WACC multiplied by (1 – *taxf*) (*taxf* being the tax rate).

4.4.3.3.   Total cash flow (TCF) model

In contrast, the TCF model uses free cash flows of the levered firm, which reflect the tax shield. In other words, the total cash flows, *TCF*, are the *FCF* with the tax shields added back: *TCF* = *FCF* + *s* · interest expense. Consistently, the denominator of the valuation formula uses as a discount rate the pre-tax WACC, $r_{WACC, TCF}$.

4.4.3.4.   Summary comparison

All of the four models are commonly used in practice, and since they can all be mathematically transformed into one another, none of them is theoretically superior. In practice, identical results across models will depend on using consistent assumptions. Particularly, the cost equity capital, r_{EQ}, needs to be adjusted to reflect capital structure risk (refer to section guide 7).

Section Guide 9
Residual Income Valuation

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1. Introduction

In practice, DCF models are prevalent, but other valuation approaches also play a role. In this section, we introduce valuation based on the firm's assets in place (measured using accounting values), as well as models that combine the logics of accounting values and present value techniques. The latter are based on the idea that accounting book value cannot fully capture firm value, as synergy benefits and growth expectations are not considered, but that it provides a sound 'anchor', or lower bound, for firm value. On this basis, the value of synergy benefits and growth expectations is cautiously added to get closer to firm value.

2. Learning objectives

At the end of this section, you should:
- Understand the asset-based and mixed-method approaches to valuation, as well as the situations in which each is appropriate;
- Understand the principal building blocks of residual income models, i.e., book value of equity, residual income, and discount rate;
- Be familiar with the link of the residual income model and the DCF model;
- Be able to calculate the residual income and firm value according to the equity and entity approach.

3. Relevant materials

3.1. Readings
- Lundholm and Sloan (2013), Chapter 10.2.
- Ballwieser and Hachmeister (2016), Chapters 6, 7, and 8.
- Lundholm/O'Keefe (2001): Reconciling Value Estimates from the Discounted Cash Flow Model and the Residual Income Model, p. 315-332.

3.2. Problem set
- Tutorial sessions 8 & 9.

4. Summary of section content

4.1. Asset-based valuation
Asset-based approaches are based on the idea that the firm's balance sheet, on which its assets and liabilities are listed at (accounting) book values, provides an adequate basis – or at least a suitable lower bound – for valuation. Two variants are common:

- **Replacement cost approach:** This approach assumes that the value of a firm can be expressed by the amounts that would have to be invested to "build the firm from scratch", i.e., to acquire the firm's operating assets, net of its operating liabilities. Non-operating assets are assumed to be liquidated and the cash proceeds used to pay down the firm's financial liabilities. The replacement cost approach views the firm as a *going concern*; however, it fails to capture synergy effects among the firm's assets, as well as the firm's growth expectations.
- **Liquidation value approach:** Under the liquidation value approach, the firm is assumed to be liquidated (*gone concern*). Consequently, assets are valued at the amounts assumed to be generated under a liquidation scenario, and liabilities are valued at redemption amounts.

4.2. Mixed-method valuation

4.2.1. Idea

Mixed-method valuation tries to remedy the main problem with the replacement cost approach (see subsection 4.1 above): the failure to capture the firm's *goodwill*, i.e., the synergy effects among the firm's assets, as well as the firm's growth expectations. Goodwill can be expressed as the difference between the firm's DCF-based value, $V_{EQ,DCF}$ (which includes the goodwill), and replacement cost, $V_{EQ,RC}$, which excludes it: $V_{EQ,MM} = V_{EQ,DCF} - V_{EQ,RC}$. Mixed-method approaches, generically, add to the replacement cost value some fraction of the goodwill, which is represented by the parameter $b > 0$. Typically, $b < 1$, consistent with replacement cost providing a sound 'anchor', or lower bound, for firm value, and the value of synergy benefits and growth expectations being cautiously added to approximate firm value.

4.2.2. Generic excess profit model

Considering a special case of the above idea, we can express the parameter b as the product of the cost of equity capital, r_{EQ}, and a number of years, n, such that $b = r_{EQ} \cdot n$. Note that, in the perpetuity model, $CF = V_{EQ,DCF} \cdot r_{EQ}$. With this, we can express value under the mixed-method approach as $V_{EQ,MM} = V_{EQ,RC} + r_{EQ} \cdot n (V_{EQ,DCF} - V_{EQ,RC}) = V_{EQ,RC} + n (V_{EQ,DCF} \cdot r_{EQ} - V_{EQ,RC} \cdot r_{EQ}) = V_{EQ,RC} + n (CF - V_{EQ,RC} \cdot r_{EQ})$. Examining this last expression, we see that value ($V_{EQ,MM}$) is the sum of replacement cost ($V_{EQ,RC}$) and the number of years (n) over which the firm earns cash flows (CF) in excess of the cost of capital charge on the replacement cost value of assets ($V_{EQ,RC} \cdot r_{EQ}$). This difference between CF and ($V_{EQ,RC} \cdot r_{EQ}$) is referred to as *excess profit*; it captures the extent to which the firm is in a competitive position that allows it to deploy its asset base to earn cash flows in excess of its cost of capital. This model is called a generic *excess profit model* (where we abstract from discounting the future excess profits). It underlies influential performance measurement concepts such as *Economic Value Added* (EVA) or *Economic Profit* (EP).

4.2.3. Residual Income Model

The residual income model (RIM) is a special case of the above excess profit model. It anchors on the firm's accounting book value of equity, EQ, and adds goodwill in the form of the firm's expected future *residual income* amounts. Very similar to excess profit above, residual is defined as the firm's accounting profit (or loss), PL, less its normal profit, where *normal profit* equals beginning-of-the-period EQ multiplied by the cost of equity capital: $EQ_{t-1} \cdot r_{EQ}$. As an additional feature of the RIM (compared to the above generic excess profit model without discounting), the expected future *residual income* amounts are discounted at the cost of equity capital rate. In the perpetuity model, firm value under the residual income model, $V_{EQ,RIM} = V_{EQ,RC} + RI / r_{EQ}$. In other words, firm value is conceived as accounting book value providing a lower bound, or anchor. To that anchor, we add the expected future residual income amounts for as long as we expect the firm to earn at a rate that exceeds its cost of capital.

The firm's ability to earn these excess profits (or residual income amounts) expresses its *competitive advantage* - only competitive firms are worth more than book value. If the competitive advantage is *sustainable*, the firm can be expected to earn positive residual income amounts for an extended period of time. Importantly in valuation, therefore, we have to consider the origin of the firm's competitive advantage, if any, and how long it will take until market forces have "competed away" the competitive advantage. For example, the firm's competitive advantage may be based on legally protected (e.g., patented) technology, which, for a while at least, deters potential competitors from entering the market. This allows the firm to earn at rates above the cost of capital until the patent protection erodes.

The RIM has the following advantageous features:

- It forces us to be explicit about the firm's competitive advantage, the duration of which we need for forecasting the number of years over which we expect RI to be positive. (Note that, when the competitive advantage has eroded, RI will become zero, as $PL = EQ_{t-1} \cdot r_{EQ}$).
- The RIM accommodates the same generic formulas we discussed for DCF models in section 8, i.e. finite horizon model, perpetuity model, perpetual growth model, and different phases models.
- The above description introduces an equity version of the RIM: Equity value ($V_{EQ,RIM}$) is expressed as book value of *equity* plus the present value of expected future residual *net income* amounts. However, the RIM can also be applied as an *entity version*, with entity value ($V_{ENT,RIM}$) expressed as book value of *net operating assets* ($V_{NOA,RC}$) plus the present value of expected future residual *net operating income* amounts discounted at the WACC. In the perpetuity model, therefore, $V_{ENT,RIM} = V_{NOA,RC} + RNOI / r_{WACC}$. Subtracting V_D yields $V_{EQ,RIM}$.
- If the *clean surplus relation* (see sections 1 and 3 above) holds, the RIM can be mathematically transformed into the respective DCF models.
- Under the clean surplus relation, the RIM, although based on accounting constructs (book values and profit numbers), is robust to accounting measurement error. Intuitively, this is because, if book value (the 'anchor') is overstated (understated), the present value of expected future RI will be understated (overstated), because the cost of capital charge on book value is too high (too low). These effects will exactly offset each other.

Section Guide 10
Valuation Multiples

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1. Introduction

In practice, initial estimates of firm value are often derived from (adjusted) market prices of the firm's own shares (if the firm is publicly traded) or from the market prices of similar firms. For example, someone might say that "pharma firms are priced at 8 times EBITDA". That is to say, the average ratio of entity value (i.e., market capitalization plus value of debt) to EBITDA for a certain basket of pharma firms is eight. Using this information, one might be tempted to conclude that another (non-publicly traded), which shows EBITDA of, say, €150m, is worth (8 · €150m =) €1.2b. We will critically discuss this approach in this section.

2. Learning objectives

At the end of this section, you should:
- Understand the idea underlying market-based approaches to valuation;
- Be able to critically assess the notion of "grossing up" the price of a subset of a firm's shares to derive its overall equity value;
- Appreciate the notion of valuation multiples; and
- Be able to apply, as well as critically discuss, the most common equity and entity multiples.

3. Relevant materials

3.1. Readings
- Ballwieser and Hachmeister (2016), Chapter 9.
- Penman, Financial Statement Analysis and Security Valuation, Chapter 5: 141-151 and Chapter 6: 178-190.
- Liu, Jing, Doron Nissim, and Jacob Thomas. "Equity valuation using multiples." *Journal of Accounting Research* 40.1 (2002): 135-172.
- Bhojraj, Sanjeev, and Charles Lee. "Who Is My Peer? A Valuation-Based Approach to the Selection of Comparable Firms." *Journal of Accounting Research* 40.2 (2002): 407-439.

3.2. Problem set
- Tutorial session 8 & 9.

4. Summary of section content

4.1. Idea

Market-based approaches are based on the idea that firm value can be derived from market prices. It is quite common to grant market prices (of the firm itself, or of publicly traded peers) a certain degree of primacy when valuing firms. We either look at the market value of the firm's shares to help us value the firm as a whole, or we value the firm by considering the market prices of comparable firms. For example, private-equity firms almost exclusively rely on what is called multiple-based valuation (see subsection 4.3 below).

4.2. Grossing-up approach

Under the grossing-up approach, we value the firm based on the market price of its stock. Challenges frequently encountered in this context include the following:

- Available stock prices for the firm may be stale (i.e., outdated), based on thin trading, or influenced by non-fundamental (irrational) factors.
- The firm is part of a consolidated group; therefore, prices may not reflect the free interplay of supply and demand.
- The overall value of the firm may deviate from a naïve grossing-up of its publicly traded stock, e.g., due to a *control premium*.

4.3. Valuation multiples

4.3.1. Generic elements

Valuation using multiples assume that accounting numbers or other "fundamentals" can serve as anchors to derive firm value. For example, we might argue that firms can be valued by applying a certain *multiple* to earnings per share (EPS). That multiple, referred to as the *price-earnings ratio* (P/E ratio), captures the idea that the firm is worth X times its earnings: P/E ratio = price per share / EPS. In this example, EPS is referred to as the *fundamental*, or anchor, in terms of which price is expressed, or which is assumed to drive value. These fundamentals include accounting numbers and certain non-financial performance indicators, such as web site hits or customers. Multiples are typically derived from the market valuations and fundamentals of a group of comparative firms, or peers. The inverse of the multiple (in the example: 1 divided by the P/E ratio = / price per share) can be thought of as a (book) rate of return generated by the stock. High multiples typically signal high growth expectations in (and/or high persistence of) the underlying fundamentals. Valuation takes place by applying a multiple (derived from some peer comparison) to the fundamentals of the firm being valued.

4.3.2. Approaches

Analogous to the DCF equity models, equity multiples derive equity value directly. Relevant fundamentals include accounting earnings (per share) and book value of equity (per share). Analogous to the DCF entity models, entity (aka enterprise value) multiples derive equity value indirectly by calculating entity value and subtracting the value of debt. Relevant fundamentals include accounting EBIT, EBITDA or sales and enterprise book value.

4.3.3. Reconciling multiples and DCF valuation

We can reconcile valuation multiples and DCF models. For the example of the P/E ratio (PE), recall that PE_0 = price per share today (P_0) divided by EPS today (EPS_0). In the perpetual growth *FTE* model, $P_0 = FTE_1 / (r_{EQ} - g)$. Recall that *FTE* is the firm's net cash flow to equity-holders, i.e., its dividend. (In this section, assume *FTE* is a *per share amount*.) Therefore, $FTE_1 = EPS_0 \cdot$ payout ratio$_0 \cdot (1 + g)$. Dividing P_0 by EPS_0, we obtain the P/E ratio as PE = payout

$\text{ratio}_0 \cdot (1 + g)$. This version of the P/E ratio, expressed in terms of DCF valuation parameters, is referred to as the *trailing* P/E ratio, as it expresses current price in terms of *past* EPS. Other versions include the *forward* P/E ratio, which expresses current price in terms of *expected future* EPS.

In a similar fashion, we can reconcile other valuation multiples (e.g., the price-to-book value, price-to-sales, and price-to-free cash flow ratios) to the DCF valuation logic.

4.3.4. Critical assessment

Valuation based on multiples is often touted as a pragmatic shortcut to valuation that has advantages over the more complex DCF approaches. However, these arguments neglect the fact that multiples rely on certain key assumptions to work. The following aspects need to be considered when assessing valuation multiples:

- Valuing firms based on valuation multiples is to some extent inconsistent with the notion of fundamental valuation, which uses fundamental analysis techniques to assess the firm's intrinsic value – and to *challenge* its market price, if any. Therefore, market-based approaches are more accurately described as *pricing* methods rather than (fundamental) valuation methods.
- Multiples will be misleading if the peer group from which they are derived are incompatible in terms of risk and growth characteristics with the firm being valued. The same is true if peer firms' prices deviate from fundamental values, e.g., in a "bubble" scenario.
- The fundamental, or anchor, may reflect accounting measurement error (*garbage in - garbage out*). This may affect both the firm being valued, as well as the peer firms.

> ### *Section Guide 11*
> ### *Explicating Uncertainty*

1. Introduction

Throughout the course, we have tried to be critical of the idea that financial statement analysis and valuation is about "finding out" the one 'true' firm value – as if fundamental value were an observable concept out there for us to discover. It should have become clear that the firm values we will derive by applying the tools and techniques discussed in this class will reflect the quality of our input parameters, i.e., data and assumptions. Some of these parameters, e.g., *CF*, *r* and *g*, will be more, some less influential, but essentially all of them are to some degree uncertain. It is a matter of intellectual honesty to transparently communicate the resulting polyvalence (*Mehrwertigkeit*) in firm value to those in whose name the valuation is undertaken.

2. Learning objectives

At the end of this section, you should:
- Understand the need for explicating the uncertainty inherent in firm valuation; and
- Be familiar with the most common techniques for this purpose: sensitivity analysis, scenario analysis, and Monte Carlo simulation.

3. Relevant materials

3.1. Readings
- Ballwieser and Hachmeister (2016), Chapter 12.

3.2. Problem set
- Tutorial Session 6.

4. Summary of section content

The uncertainty in our estimate of firm value can be explicated using a number of different techniques discussed below.

4.1. Sensitivity analysis
Sensitivity analysis varies selected input parameters that are crucially important for firm value, e.g., the cost of capital (*r*) and growth rate assumptions (*g*). The resulting sensitivities, or elasticities, of firm value to these parameters can be expressed verbally ("If the discount rate drops by one percentage point, firm value rises by €120m") or in graphical form.

4.2. Scenario analysis

Scenario analysis calculates value under a number of scenarios that are characterized by distinct sets of values for the valuation parameters. Typically, three scenarios are considered: A realistic 'base case', a pessimistic 'worst case', and an optimistic 'best case'. Subjective probabilities may or may not be given for the scenarios.

4.3. Monte Carlo simulation

Scenario analysis and sensitivity analysis are limited because variations that can be observed are limited to a small number of cases and to variations in a small number of key parameters. Monte Carlo simulation is a statistical technique that overcomes these limitations. Under Monte Carlo simulation, we define the underlying probability distributions (or probability density functions) for all of the important input parameters to firm value, and calculate an arbitrarily large number of scenarios. The outcomes of these scenarios can be expressed in a graphical form. Furthermore, using confidence levels and intervals we can answer questions like: "Given the underlying assumptions, what is the probability that firm value is below €1.5b?" Monte Carlo simulation is therefore extremely instructive and powerful; however, it may be difficult to communicate to those who are interested in *one* number.

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Glossary

Concept	TS	LS	BH	German
Accounting basics				
Income statement	P&L	/	GuV	Gewinn- und Verlustrechnung
Earnings (i.e. bottom-line accounting profit or loss)	E	/	E_t	Ertrag
Accounting profit or loss under GAAP	PL	/	PL	Gewinn- und Verlust
Net income (or profit)	NI	NI	G	Gewinn
Accounting book value of equity / common equity	EQ/BV_{EQ}	CE	EK_{BW}	Buchwert des Eigenkapitals
Property, Plant And Equipment	PP&E	PP&E	PP&E	Sachanlagen
Earnings before interest and taxes	EBIT	EBIT	EBIT	Gewinn vor Zinsen und Steuern
Earnings before interest, taxes, depreciation and amortization	EBITDA	EBITDA	EBITDA	Gewinn vor Zinsen, Steuern und Abschreibungen
Earnings before taxes	EBT	EBT	EBT	Gewinn vor Steuern
Net dividends to shareholders	DIV	D	DIV	Dividende
Accounting book value of net operating assets	NOA	NOA	BV_{NOA}	Buchwert des netto-betriebsnotwendigen Vermögens
Price-to-book ratio	P/BV	P/BV	P/BV	Kurs-Buchwert-Verhältnis
Price-to earnings ratio	P/E	P/NI	P/E	Kurs-Gewinn-Verhältnis
Return on equity	ROE	ROE	ROE	Eigenkapitalrendite
Valuation				
Cash flow (generic)	CF	C	CF	Cash Flow vor Zinsen und Unternehmenssteuern
Cash flow (generic) at the end of period t	CF_t	C_t	CF_t	Cash Flow vor Zinsen und Unternehmenssteuern in Periode t
Free Cash Flow	FCF	FCF	FCF	Free Cash Flow
Total Cash Flow	TCF	/	TCF	Total Cash Flow
Present value	PV	P	PV	Barwert
Terminal value	TV	/	TV	Endwert
Residual income	RI	RI	R	Residualgewinn
Net present value	NPV	/	/	Kapitalwert
Number of periods in (finite) horizon	n	/	n	Anzahl an Perioden für einen Übergewinn
Time index	t	t	t	Zeitindex

End of forecast period	T	T	T	Planungshorizont
Risk premium in the discount rate (generic)	z	/	z	Risikozuschlagssatz
Growth rate	g	G	w	Wachstumsrate
Combined income tax rate at firm level	tax_f	tx	s	Unternehmensbezogener Gewinnsteuersatz
Personal income tax rate	tax_p	/	s_A	Persönlicher Steuersatz
Discount rate (generic)	r	/	r	Diskontsatz
Discount rate (generic) for period t	r_t	/	r_t	Diskontsatz in Periode t
Cost of debt rate (Required rate of return on debt)	r_D	r_d	r_{FK}	Zins auf Fremdkapital
Cost of equity capital rate (required rate of return on equity)	r_{EQ}	r_e	r_{EK}	Renditeforderung der Eigentümer
Cost of equity capital rate of unlevered firm (APV approach)	$r_{EQ, unlevered}$	/	r_{EK}^{u}	Renditeforderung der Eigentümer eines unverschuldeten Unternehmens
Market rate of return (CAPM)	r_M	r_m	r_M	Rendite des Marktportfolios
Risk-adjusted discount rate (generic)	r_{RA}	/	r_{RA}	Risikobereinigter Diskontsatz
Risk-free discount rate (generic)	r_{RF}	r_f	i	Sicherer Zinsfuß

Concept	TS	LS	BH	German
Rate of return on the tax shield / after-tax cost of debt	r_{tax}	$(1-tx)r_d$	r_{tax}	Unternehmensbezogener Gewinnsteuersatz für den Steuervorteil (Tax Shield) des Fremdkapitals
Weighted-average cost of capital rate	r_{WACC}	r_w	k	WACC (gewogene durchschnittliche Kapitalkosten) im Free-Cash-Flow-Verfahren
(After-tax) weighted-average cost of capital rate used in FCF model	$r_{WACC, FCF}$	/	k_s	WACC (gewogene durchschnittliche Kapitalkosten) nach persönlichen Steuern im Free-Cash-Flow-Verfahren
(Pre-tax) weighted-average cost of capital rate used in TCF model	$r_{WACC, TCF}$	/	k_{TCF}	WACC (gewogene durchschnittliche Kapitalkosten) im Total-Cash-Flow-Verfahren
Weighted-average Cost of Capital	WACC	WACC	WACC	Gewogene durchschnittliche Kapitalkosten
Capital Asset Pricing Model	CAPM	CAPM	CAPM	Preismodell für Kapitalgüter
Discounted Cash Flow	DCF	DCF	DCF	Discounted Cash Flow
Dividend Discount Model	DDM	/	DDM	Dividend Discount Model
Residual income model	RIM	RIM	RIM	Residualgewinnmethode
Flow-to-Equity	FTE	/	FTE	Flow to Equity
Value (generic)	V	P	V	Wert
Value (generic) at the end of period t	V_t	P_t	V_t	Wert (generisch) am Ende von Periode t
Value of tax shield	V_{TS}	/	V_s	Wert der Steuervorteile aus Unternehmenssteuern wegen Verschuldung in t=0
Value of debt (interest-bearing liabilities)	V_D	P_d	V_D	Fremdkapitalwert
Entity value	V_{ENT}	P_f	V_{ENT}	Unternehmenswert

Equity value	V_{EQ}	P_e	UW	Eigenkapitalwert
Equity value of unlevered firm (APV approach)	$V_{EQ,\ unlevered}$	/	$V_{EQ,\ unlevered}$	Eigenkapitalwert eines unverschuldeten Unternehmens (APV-Ansatz)
Book value of equity under GAAP	$V_{EQ,BV}$	/	$V_{EQ,BV}$	Buchwert des Eigenkapital unter GAAP
Book value of net operating assets under GAAP	$V_{NOA,BV}$	/	$V_{NOA,BV}$	Buchwert des netto-betriebsnotwendigen Vermögens unter GAAP
Equity value under a generic DCF approach (Gesamtbewertungsverfahren)	$V_{EQ,DCF}$	/	EW	Eigenkapitalwert unter einem allgemeinen DCF-Ansatz
Equity value under a generic mixed-method approach	$V_{EQ,MM}$	/	$V_{EQ,MM}$	Eigenkapitalwert unter einem allgemeinen Mixed-Method-Ansatz
Equity value under the replacement cost approach (Substanzwertverfahren)	$V_{EQ,RC}$	/	SW	Eigenkapitalwert unter dem Substanzwertverfahren
Equity value under the residual income model	$V_{EQ,RIM}$	/	$EK_{BW,t}$	Eigenkapitalwert unter dem Residual-Income Modell
<u>**Advanced DuPont**</u>				
Net operating assets	NOA	NOA	/	
Return on net operating assets	RNOA	RNOA	/	
Net borrowing cost	NBC	NBC	/	
Net financing expense	NFE	NFE	/	
Net financial obligations	NFO	NFO	/	
Net operating income, after tax	NOI	NOI	/	
Residual net operating income	RNOI	RNOI	/	

TS: Thorsten Sellhorn (Financial Statement Analysis & Valuation materials);
LS: Lundholm & Sloan (Equity Valuation and Analysis);
BH: Ballwieser & Hachmeister (Unternehmensbewertung)

Notes

Block 2: Basics

Part 1: Key concepts

- Value generation and business model – how does the firm create value, and for whom? Financial flows (and the resulting financial statements) often ignore certain potentially important ESG-related value drivers that are important not only for non-investor stakeholders in assessing the firm's *impact on* society and the environment) but also for capital providers (shareholder and lenders) in assessing the firm's *exposure to* ESG-related risks and opportunities. Understanding and measuring these externalities is an increasingly critical element in FSA&V. They can be reflected either in the numerator (CF) or in the denominator (r) of our generic valuation model, V = CF / r.

Part 2: Information collection

- Financial statements and related financial disclosures, e.g., in annual reports, especially the forward-looking information in the management report, used to be the alpha and omega of FSA&V. Today, ESG-related information is becoming increasingly important.
    - <u>Voluntary</u> ESG information provided by many large public firms includes integrated reports according to the standards of the International Integrated Reporting Council (now part of the Value reporting Foundation, which was recently consolidated into the IFRS Foundation) and sustainability reports prepared under guidelines provided by the Global Reporting Initiative (GRI).
    - <u>Mandatory</u> ESG information in the EU is reported by Public Interest Entities (PIEs) under the national transpositions of the EU Non-financial Reporting Directive (NFRD); in Germany, the CSR-Richtlinie-Umsetzungsgesetz (CSR-RUG). Currently, the EU is finalizing a successor to the NFRD, the Corporate Sustainability Reporting Directive (CSRD). which will enter into effect from 2024 onwards, and will extend the scope of the NFRD to over 50,000 European firms with 250 or more employees.

Block 3: Financial statement analysis

Part 1: Assessing accounting measurement error

- Two questions: To what extent does the firm's current financial reporting
    - faithfully represent the firm's current economic position (stocks) and performance (flows)?

- - o provide a good basis for forecasting the firm's future economic position and performance?
- What is the benchmark for assessing measurement error?
    - Economic value (position) and economic profit (performance) *[103]*
    - ERR vs ROE
- Types of measurement error
    - Aggressive accounting
    - Conservative accounting
- Sources of distortions
    - Accounting standards
    - Uncertainty
    - Earnings management
- ***DISCUSS:*** Do IFRS F/S faithfully represent the firm's exposure to climate-related risks and opportunities?
    - Physical versus transition risks
    - Affected assets and liabilities
    - How does this affect ROE?
    - Some readings
        - o [Carbon Tracker's recent study](#)
        - o [IFRS educational material](#)
        - o [IDW study](#)

Part 2: Financial ratio analysis

- Browsing the annual report (management report, financial statements, basic notes)
- Accounting analysis: adjust as-reported numbers for one-time effects and (where possible) measurement error
- Horizontal analysis (year-over-year changes) and vertical analysis (standardize numbers by a common denominator)
- Financial ratios
    - Profitability
        - Returns (ROE, ROA, … ROCE, RONA, RONIC,...)
        - Relation between ROE and ROA: Leverage effect
        - Margins

- ○ Financial stability
    - ■ Financial leverage (capital structure) ratios
- ○ Liquidity
    - ■ Liquidity ratios (current, quick, cash)
    - ■ Working capital analysis (operating cycle, cash conversion cycle)
- ○ Comparisons
    - ■ Cross-sectional (to peers / competitors)
    - ■ Inter-temporal (to the firm's history)
- Value driver analysis: Understanding what drives ROE
    - ○ Idea: Separate OP from FIN
    - ○ Basic DuPont - not clean
    - ○ Leverage Formula - not clean
    - ○ Better: Advanced DuPont
        - ■ Clean measure of operating profitability (after tax)
        - ■ Clean measure of cost of borrowing (after tax)
- Earnings per Share (basic EPS and diluted EPS)
- Cash flow analysis: Understand where cash came from and where it went
    - ○ Operating: Core business
    - ○ Investing: Acquiring/selling non-current assets
    - ○ Financing: Acquiring/repaying equity and debt capital

Part 3: Value driver analysis

- Advanced DuPont analysis: Modifies basic DuPont to separate OP and FIN activities "better"
    - ○ ROA => RNOA
    - ○ LIAB / EQ => NFO / EQ
    - ○ Spread = ROA - interest rate => RNOA - NBC (which is NFE * (1 - tax rate))
- Application

Block 4: Structured forecasting (= financial planning/modeling)

- Steps/elements
    - (Understanding the past …FSA etc.)
    - Critically evaluate *management's* own forecasts and expectations
    - Forecast future sales
    - Forecast income statement => RIM valuation models, valuation multiples
    - Forecast balance sheet => RIM valuation models, valuation multiples
    - Derive cash flow statements (using the indirect method) => DCF valuation models
- Think through the financial statement implications of future material transactions or events; ask: "How does this impact on future (a) sales growth, (b) margins, (c) asset turnovers (including operating cycle and cash conversion cycle), (d) leverage (capital structure), (e) remaining useful lives of assets, (f) liquidity ratios, (g) effective income tax rate, and (h) interest rate on debt
- Such future material transactions or events could include
    - Climate change mitigation and adaptation (physical and transition risks)
        - Don't start writing: "I think …"
        - Decide on some structure… discuss in terms of (a), (b) … above.
    - Mergers and acquisitions (active or passive)
    - Initial or seasoned public offerings
    - Expansion into a new market
    - Major restructuring/cost-cutting project
    - Supply-chain disruptions
    - Price increases in important input factors (e.g., energy)
    - …

Block 5: Valuation under uncertainty

Part 1: Formulas

- XXX

Guest lecture

Key take-aways

- ESG = environmental, social and governance "aspects" (risks and opportunities)
- ESG ratings diverge across ratings providers - possible reasons:
  - different ESG data provided by firms under different (are no) guidelines; not all of it is easily quantifiable
  - different methodologies
    - different attributes of interest
    - different measurements/metrics for the same attribute of interest (e.g., "E")
    - different weightings for these measurements/metrics
- Gap between book value and market value (and fundamental value) - partly explained by ESG factors
- ESG factors affect value…
  - through the (growth rate in) future CFs (via the margins, turnovers and leverage), e.g., direct government subsidies
  - through the cost of capital
    - cost of equity
      - risk-free rate
      - risk premium
        - systematic (non-diversifiable, beta) risk - ESG needs to dampen firms' return volatility relative to market's (e.g., less volatile supply and prices of renewables)
        - unsystematic (diversifiable) risk, e.g., ESG-related reputational risk - <u>irrelevant in the CAPM world</u> but may be **very** relevant for less-diversified individual investors
    - cost of debt; e.g., "greener" firms have better access to (cheaper) debt capital ("green bonds", ESG-linked loans and bonds, government guarantees)
- Inflation and (terminal) growth - firms' ability to pass on inflation to customers

Block 9: Residual income model

Robustness to accounting measurement error

- When BV is overvalued (undervalued), residual income will be undervalued (overvalued) due to a lower beginning BV that creates cost of capital

Block 10: Multiples

Naive grossing up (concluding that firm value is $11b because 9% stake sold for $1b): Underlying assumptions

- Equal bargaining power of the parties
- Liquid market in the firm's shares
- No minority discount (control premium)
- No special rights (preferred treatment in next funding round)

Multiples

- Important assumptions
    - The **prices of the peer firms are on average "right"** (neither over- nor undervalued relative to their fundamental values) - assumes equity markets are (at least semi-strong-form) efficient (Efficient Markets Hypotheses)
        - We don't really believe that, though… we use multiples to assess…
            - how "the market" would price a company like the one we are valuing (e.g., Canyon)
            - to what extent our results from other valuation approaches (DCF, RIM) seem "reasonable" given market prices of peers
    - Peer firms have to be **"truly comparable"** (not exceptional "outliers" like Tesla or Apple); in terms of:
        - Growth expectations (that reflect in future cash flows)
        - Risk exposure (that reflects in the cost of capital)
        - Industry membership is often used as an approximation - but is not important *per se*
    - **Accounting "drivers"** (e.g., earnings or EBIT(DA)) have to be comparable; in terms of
        - expected growth
        - accounting measurement error
- Now we compare firms with different extent of Joint Ventures based on the EBIT multiple - problems?
    - Firms could differ in <u>where</u> they present the results from Joint Ventures
        - within EBIT
        - below EBIT

  ○ RIMAC and VW/Mercedes

What are the three approaches?

- Sensitivity analysis: Varies one assumption at a time (e.g., cost of capital up or down by 1pp)
- Scenario analysis: Varies more than one assumption (potentially *all*) at a time
- Monte Carlo simulation: Specifies
    - probability distributions for each assumption, and
    - correlations among the different assumptions;
    - then makes a large number of repeated draws of values from the probability distributions and calculates the value implied for each;
    - then displays the results as a probability distribution of possible firm values
- Drawbacks of MC
    - Difficult/costly to apply - large number of inputs
    - Difficult to communicate