



IP VALUATION: HOW TO CAPTURE UNCERTAINTY ?

LESI – IP Valuation

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Advancing the Business of Intellectual Property Globally



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OUTLINE OF OUR SESSION



Introduction : takeaways from April 25 session



Discounted Cash Flow Methodologies



Capturing uncertainty in the result



Capturing uncertainty in input data



Illustration



Other possible application



Introduction : takeaways from April 25 session



What you already know about IP valuation

- The evaluation exercise comes down to formulating an opinion on the evaluated IP: what we plan to do with it and the consequences of this use
- Usage differ from one entity to another
- There is no such thing as intrinsic value
- Estimation are usage values
- They have a (very) temporary validity
- They are based on projections
- These projections are based on assumptions
- The quality of the assumptions defines the reliability of the estimate
- And yet: a hypothesis is never exact..... It is uncertain



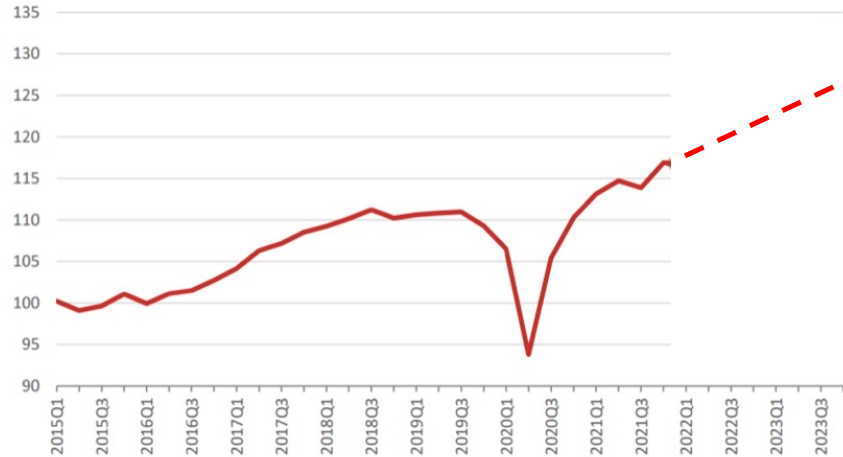
What is uncertainty ?

It is admitting that we do not know everything...

- Forecasts before

Chart 1: Volume of world merchandise trade, 2015Q1-2023Q4

Seasonally-adjusted volume index, 2015=100



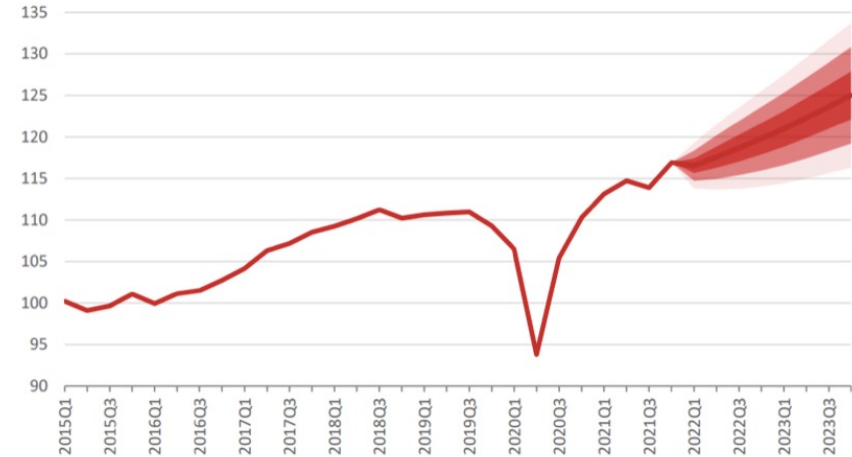
Source: WTO and UNCTAD, WTO Secretariat estimates.

The outlook for global imports and exports of goods is uncertain. Image: WTO

- Forecasts now

Chart 1: Volume of world merchandise trade, 2015Q1-2023Q4

Seasonally-adjusted volume index, 2015=100



Source: WTO and UNCTAD, WTO Secretariat estimates.

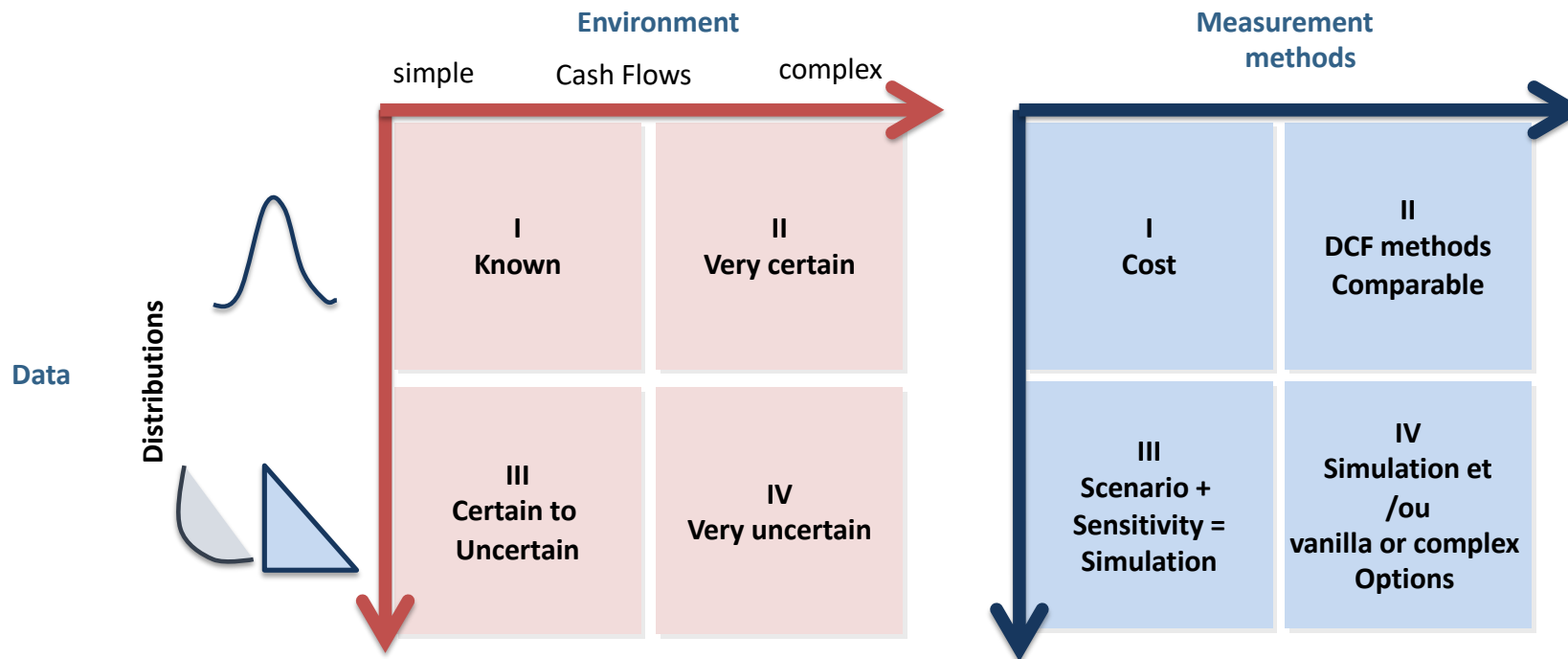
The outlook for global imports and exports of goods is uncertain. Image: WTO



Discounted Cash Flow Methodologies (DCF)

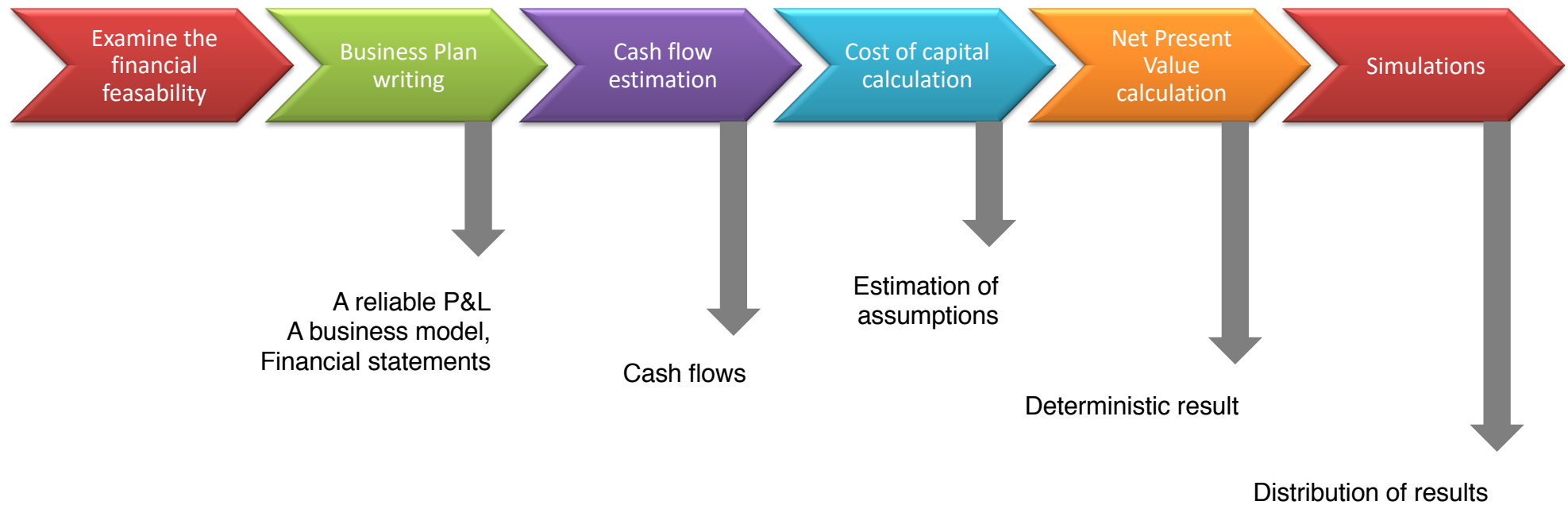


First, understand the context





DCF methods: the analysis process

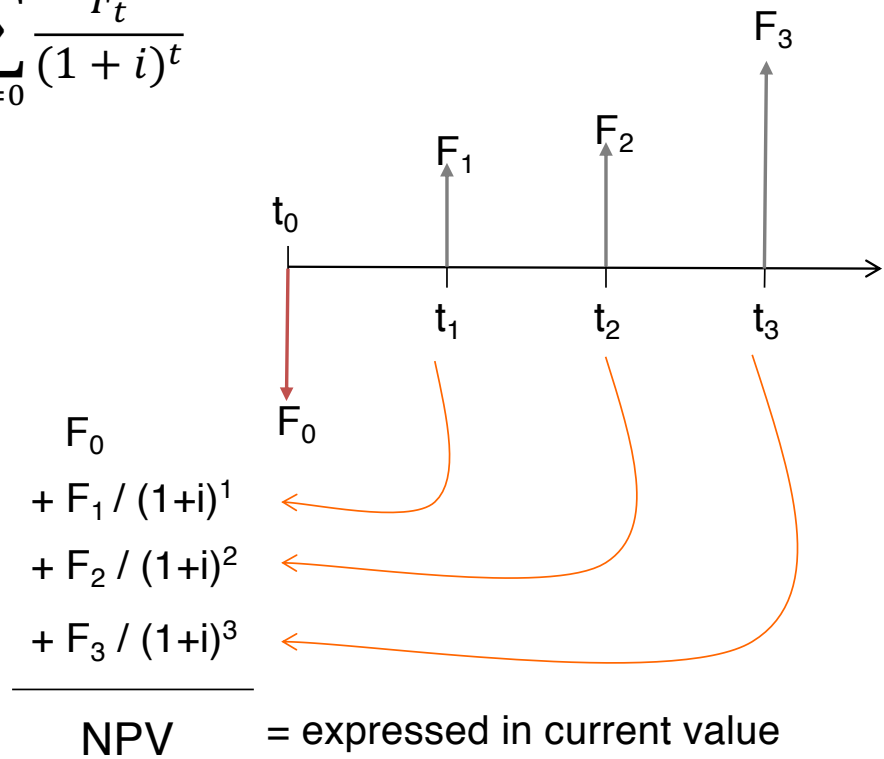




DCF applied

	0	1	2	3
Price		100	110	121
Volume		10	20	30
Revenues		1 000	2 200	3 630
Variable costs		500	1 100	1 815
Fixed costs		300	300	300
EBITDA		200	800	1 515
Tax		40	160	303
Net Income		160	640	1 212
Investment	-20			
CF	-20	160	640	1 212

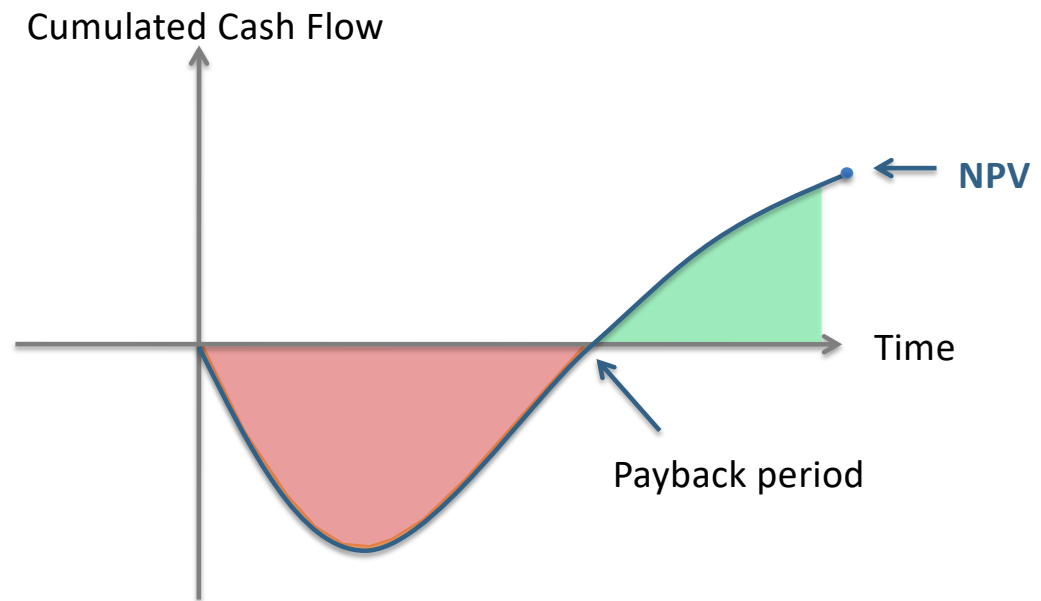
$$NPV = \sum_{t=0}^n \frac{F_t}{(1+i)^t}$$





NPV and Payback period

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

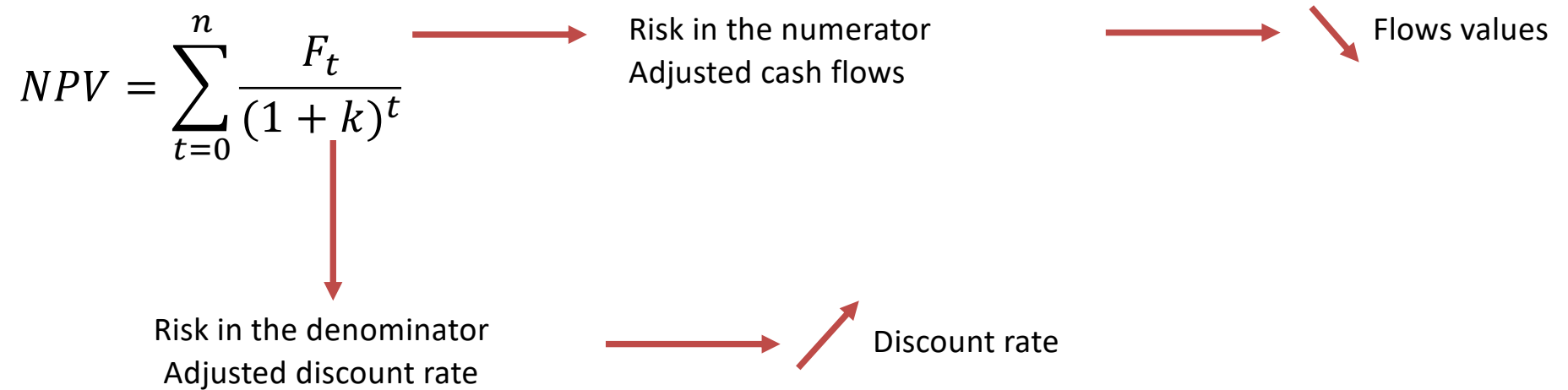




Capturing uncertainty in the result



Simple methods : adjusting the result to uncertainty





Simple methods : adjusting the result to uncertainty

Adjusting cash flows

- Estimation of certainty equivalents
- Stage 1 : 30% of chances of success
- Stage 2 : 45 % of chances of success
- Stage 3...

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Models the increase of risk with time
Terminal value is more “reasonable”
Objectified capture of risks

-

Probabilistic but remains deterministic
Ignores opportunity risks (upward)

Discount rate adjustment

- Build a list of risks the IP is exposed to:
 - Technological risks
 - Market risks
 - Activity risks...
- Subjective Valuation

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Easy to operate and standardize
Most commonly adopted approach
Acceptable heuristic

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Probabilistic but remains deterministic
Terminal value is often weighting a lot in the total value



How to adjust discount rates – KPMG 2021

Stage of development	Plummer / QED median ⁽⁷⁾	Scherlis and Sahlman ⁽⁸⁾	Sahlman, Stevenson and Bhide ⁽⁹⁾	Damodaran ⁽¹⁰⁾
Seed stage	50% - 70%	50% - 70%	50% - 100%	50% - 70%
First stage	40% - 60%	40% - 60%	40% - 60%	40% - 60%
Second stage	35% - 50%	30% - 50%	30% - 40%	35% - 50%
Bridge/Initial Public Offering ("IPO")	25% - 35%	20% - 35%	20% - 30%	25% - 35%

James L. Plummer, QED Report on Venture Capital Financial Analysis (Palo Alto: QED Research, Inc., 1987)

Daniel R. Scherlis and William A. Sahlman, - A Method for Valuing High-Risk, Long Term, Investments: The Venture Capital Method, Harvard Business School Teaching Note 9-288-006 (Boston: Harvard Business School Publishing, 1989)

William A. Sahlman, Howard H. Stevenson, Amar V. Bhide, et al., – Financing Entrepreneurial Ventures, Business Fundamental Series (Boston: Harvard Business School Publishing, 1998)

Damodaran, A., 2009 - Valuing Young, Start-up and Growth Companies: Estimation Issues and Valuation Challenges (Stern School of Business, New York University)



How to adjust cash flows

Phase	Transition probabilities	Cumulated
R&D to preclinical	25%	
Preclinical to Phase I	45%	11,25%
Phase I to Phase II	60%	6,75%
Phase II to Phase III	65%	4,38%
Phase III to registration	75%	3,29%
Registration to market approval	85%	2,8%



Capturing uncertainty in input data



Input data is indeed uncertain

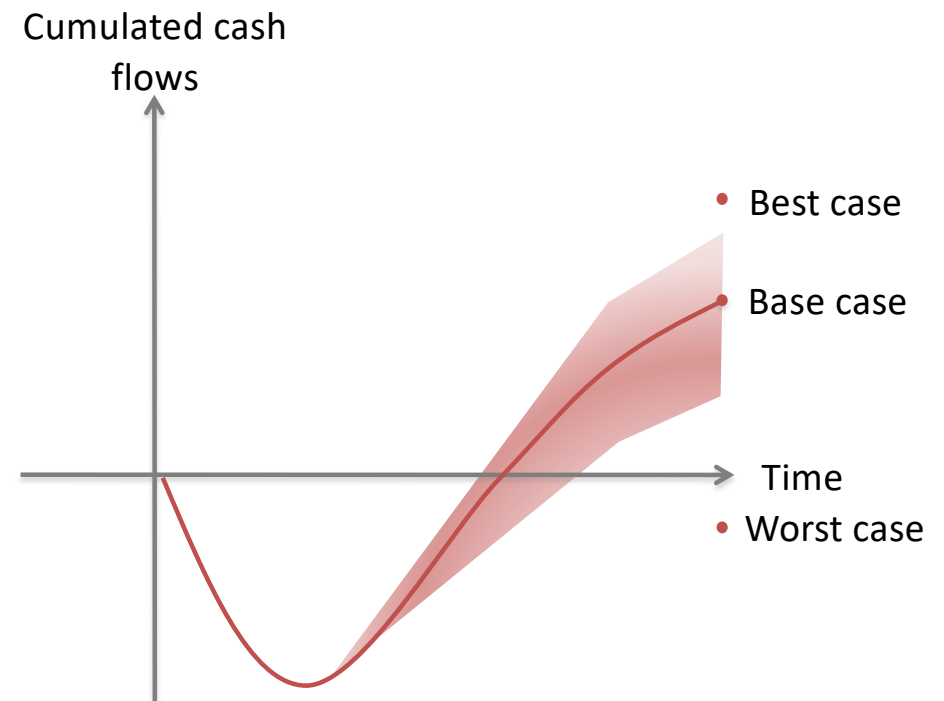
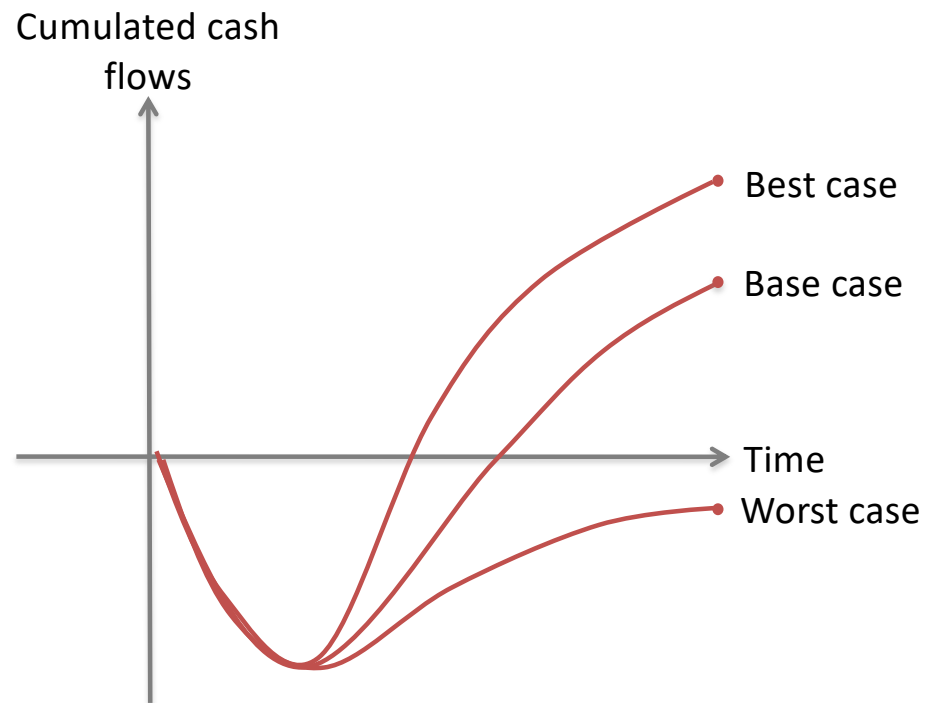
Parameters defining cash flows are indeed poorly known and uncertain

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

→ or ↗ Flow values



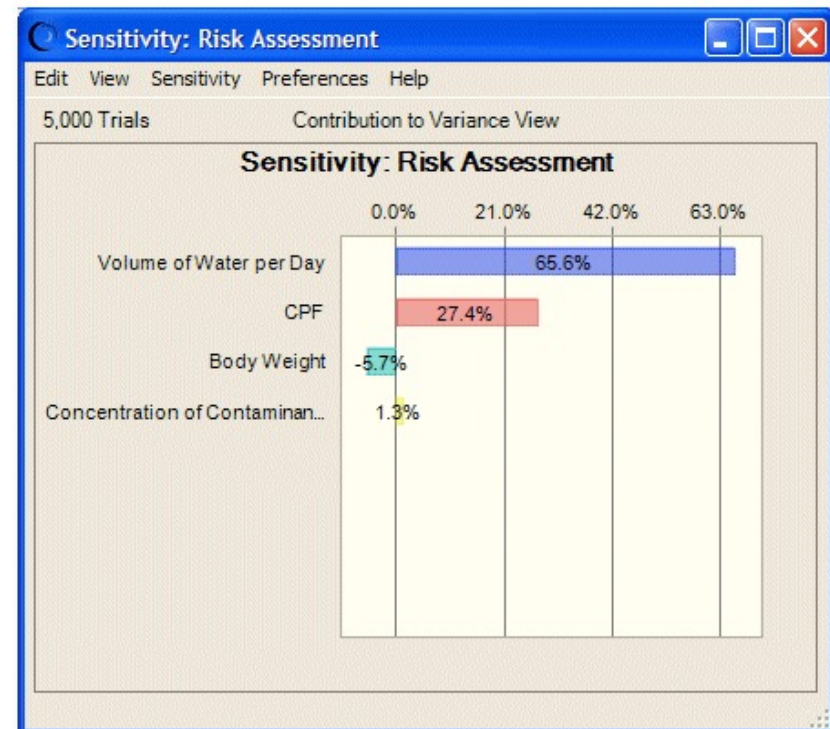
Scenario and sensitivity analysis





Sensitivity charts

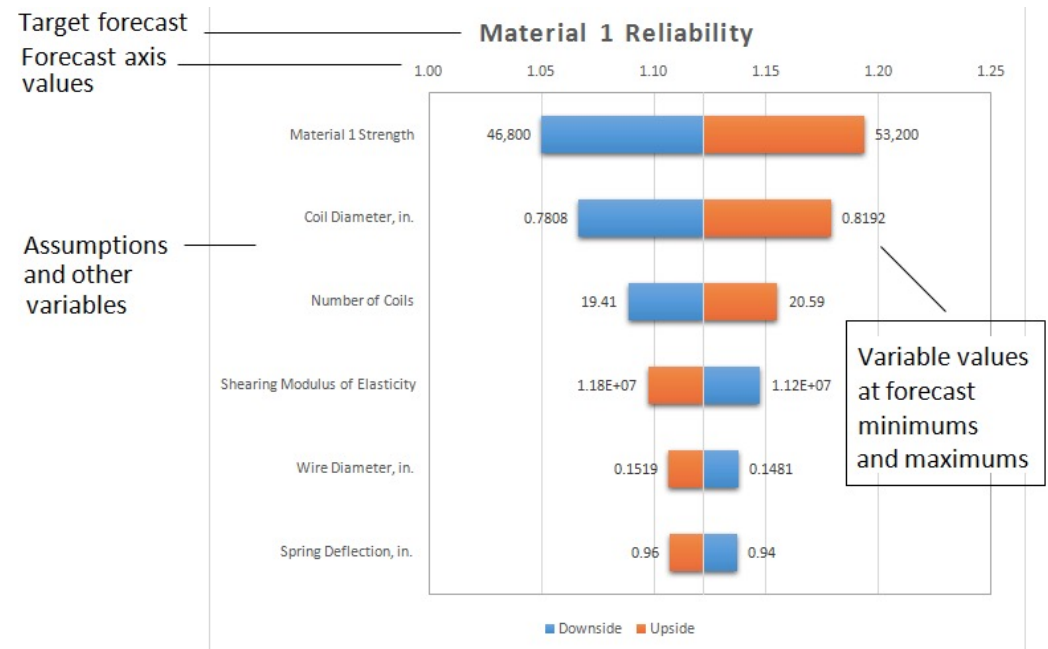
- Sensitivity charts show the influence of each assumption cell on a particular forecast cell. The overall sensitivity of a forecast to an assumption is a combination of two factors:
 - The model sensitivity of the forecast to the assumption
 - The assumption's uncertainty
- *Ex : Crystal ball by Oracle*





Tornado chart

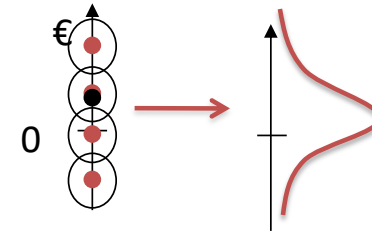
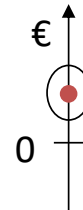
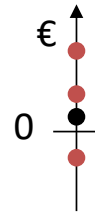
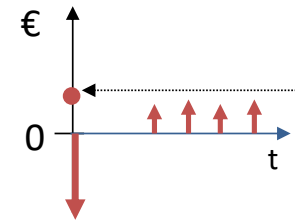
- The Tornado Analysis tool tests the range of each variable at percentiles you specify and then calculates the value of the forecast at each point.
- The tornado chart illustrates the swing between the maximum and minimum forecast values for each variable.
- The variable that causes the largest swing is displayed at the top and the variable that causes the smallest swing is displayed at the bottom.
- The upper variables have the most effect on the forecast, and the lower variables have the least effect on the forecast.
- *Ex : Crystal ball by Oracle*





Sophisticated methods

- Net Present Value
- Scenarios
- Sensitivity
- Monte Carlo Simulation





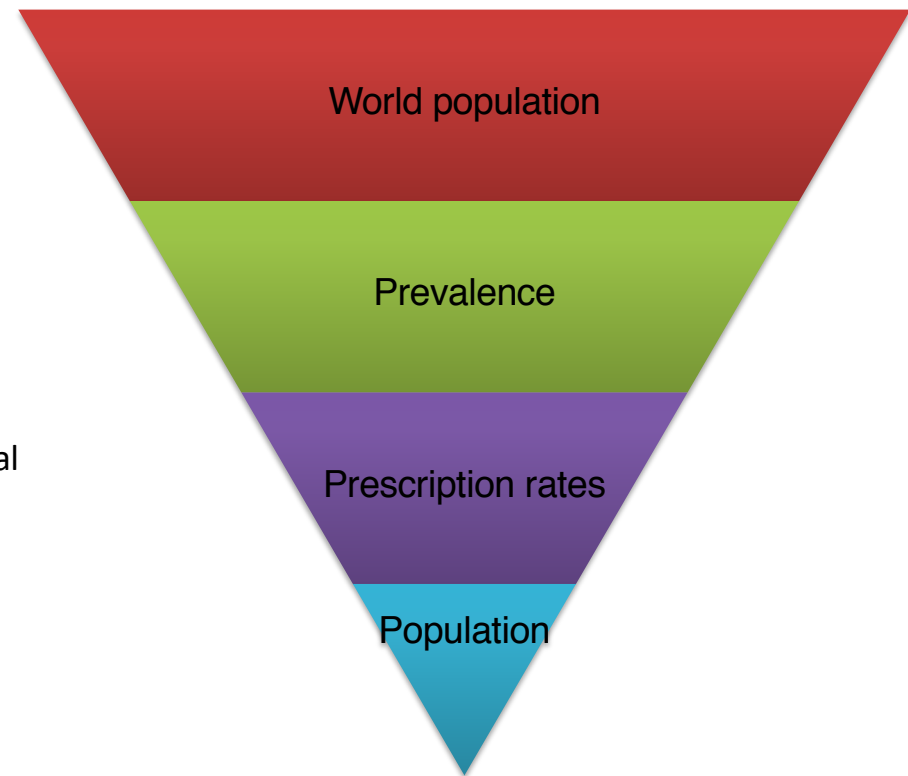
Illustration



Financial Value: Hypothesis

Sources for assumptions

- World population in Europe and US
 - UN
 - Smoothed annual growth rate
- Prevalence
 - Scientific journals of 2014 et 2018
 - Remove the results out of the geographical area
- Prescription rates
 - Statistics from CSA / Europe Assistance





Financial Value : Hypothesis

Hypothesis as per the Annual report of BIOTECH

- Business model
 - Licensing agreement
 - No production
- Earnings models
 - Royalties between 6% & 10 %
- Patent horizon
- Market shares definition, as per the company's strategy
- Drug prices: pharmacist margin deducted from market price

Package	Start MA	End MA	Operations begin	Operations end
Disease1	2022	2023	2023	mid 2038
Disease 2	2023	2024	2024	mid 2038
Disease 3	2021	2021	2021	mid 2038

MA : Market access approval by the sovereign authority

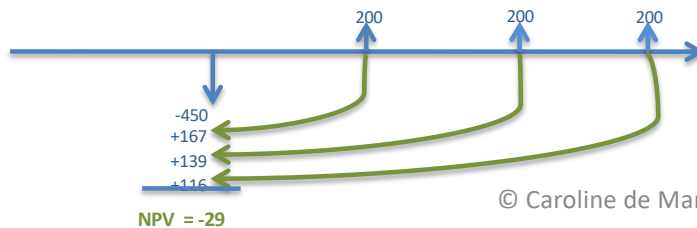


Financial Value: IFRS compliant approaches to DCF calculation

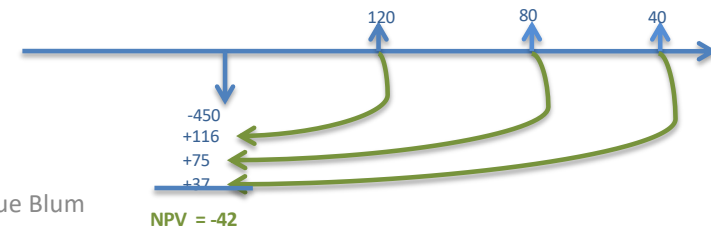
- First approach : risks are captured in the discount rate
 - Discount rate comprises a premium

- Second approach : risks are allocated to revenues
 - Discount rate is that of the equity (in the absence of financial debt)

	0	1	2	3
Investment	- 450,00 €			
Cash Flows		200,00 €	200,00 €	200,00 €
Discounted 20%		166,67 €	138,89 €	115,74 €
NPV	-28,70 €			



	0	1	2	3
Investment	(210,00 €)			
Cash Flows		120,00 €	80,00 €	40,00 €
Discounted 3%		120,00 €	80,00 €	40,00 €





Financial Valuation : Results

**NPV – Discount rate adjusted
expected return by venture capitalists per the stage
development**

STAGE	VC target return
Early stage	25% - 70 %
First stage	40 – 60 %
Later stage	35 – 50 %
Bridge / IPO stage	25 – 35 %

NPV – Cash Flows adjusted by probability of success

Discount rate estimation/ CAPM:

- Weekly data
- History = Quotation time : 3 years
- Geometric profitability
- S&P MIDCAP 400
- Market premium 5,65%
- Risk free rate : 1,23%

STAGE	Milestone	Probability of success	Stage 2	Stage 1
R&D to preclinical	End of preclinical study	25%		
Preclinical to stage I	End stage I	45%		45%
Stage I to stage II	End stage II	63%	63%	28%
Stage II to stage III	End stage III	31%	20%	9%
Stage III FDA	FDA	58%	11%	5%
FDA to launch	Launch	85%	10%	4%
R&D to launch	Launch	1,27%		



Financial Valuation : Results

NPV – Discount rate adjusted expected return by venture capitalists per the stage development

▪Discount rate: 25 % (Damodaran)

▪NPV

VALUATED PROGRAMMS & COMBINATIONS	Horizon	VALUE
Diseases1 & 2	20 y	96 739 K €
Disease3 (orphan)	20 y	64 687 K €
TOTAL	20 y	161 606 K €

▪Compensation valuation

Disease 1 contribution 0,85 %	326 K€
Disease 2 contribution 0,15 %	88 K€
Disease 3 Contribution 1,7%	1 103 K€
Patents ownership value	1 516 K€

NPV – Cash Flows adjusted by probability of success

▪Discount rate : 4,39 %

▪NPV

VALUATED PROGRAMMS & COMBINATIONS _y	Horizon	VALUE
Diseases1 & 2	20 y	77 425 K €
Disease3 (orphan)	20 y	12 459 K €
TOTAL	20 y	89 884 K €

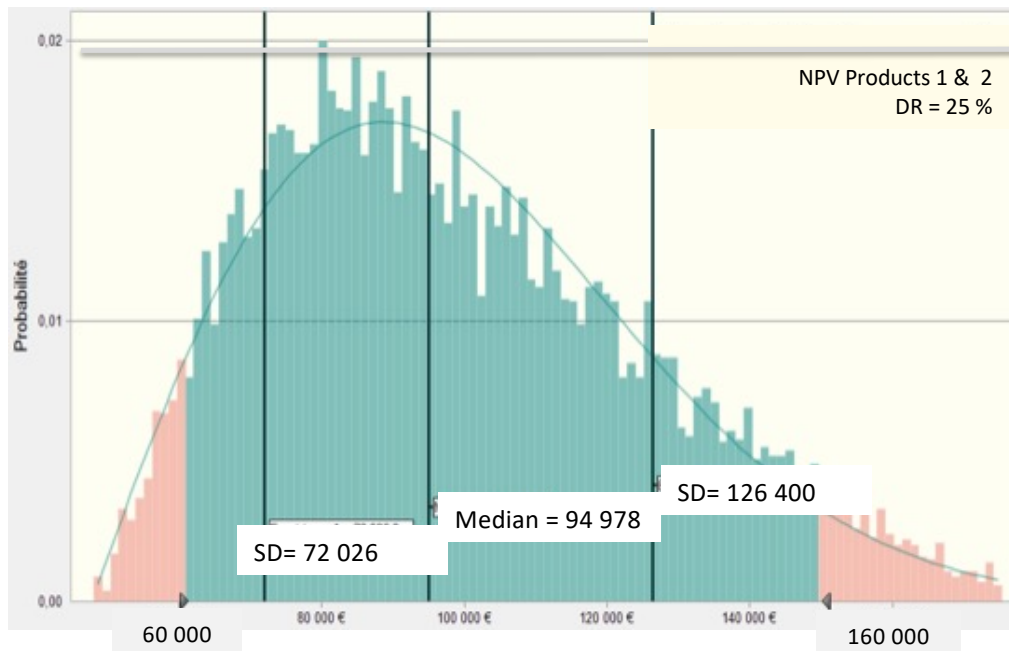
▪Compensation valuation

Disease 1 contribution 0,85	230 K€
Disease 2 contribution 0,15 %	76 K€
Disease 3 Contribution 1,7%	212 K€
Patents ownership value	518 K€

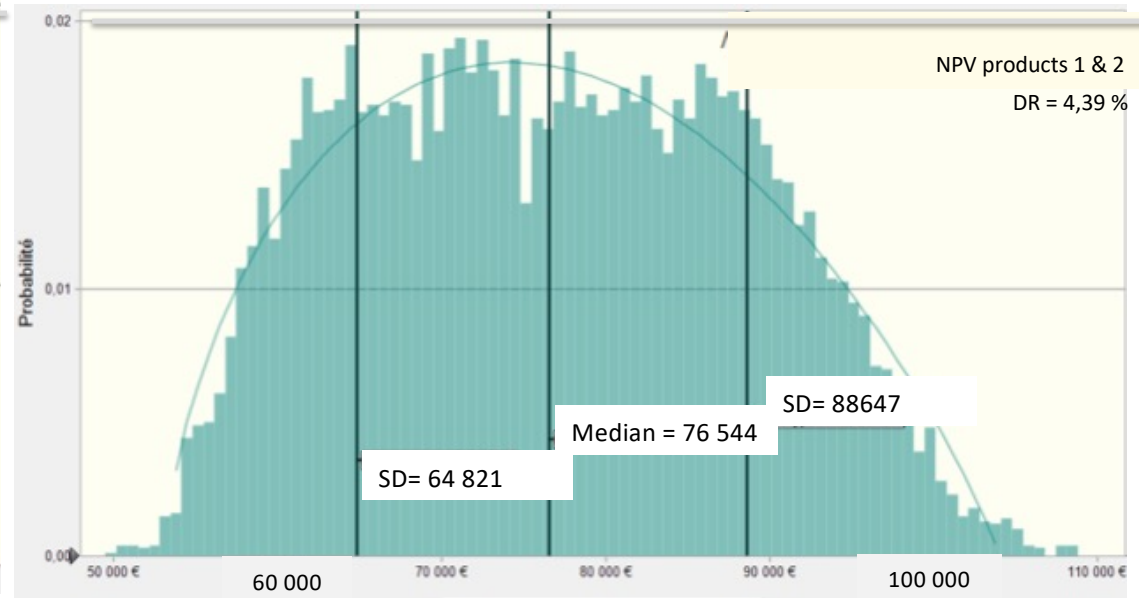


Financial Value: Results – Monte Carlo Simulation

NPV – Discount rate adjusted expected return by venture capitalists per the stage development



NPV – Cash Flows adjusted by probability of success

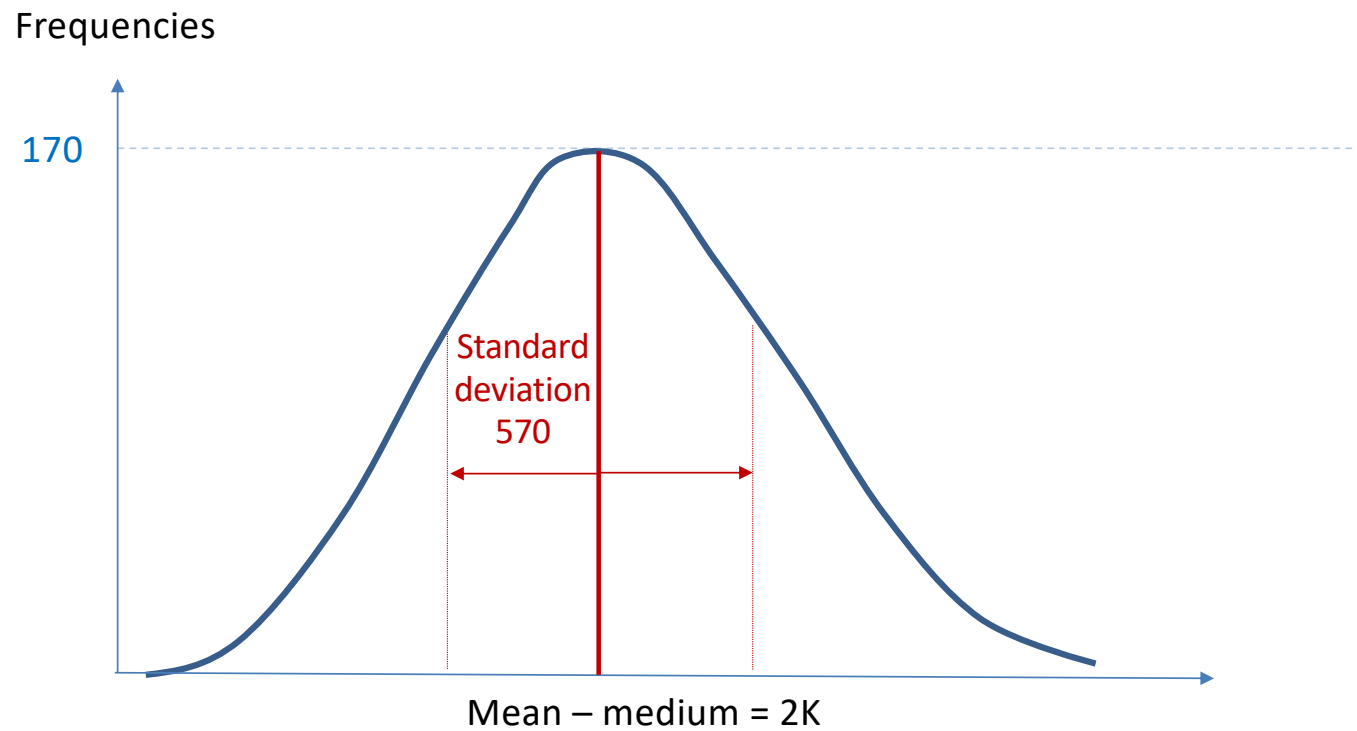




Other possible applications

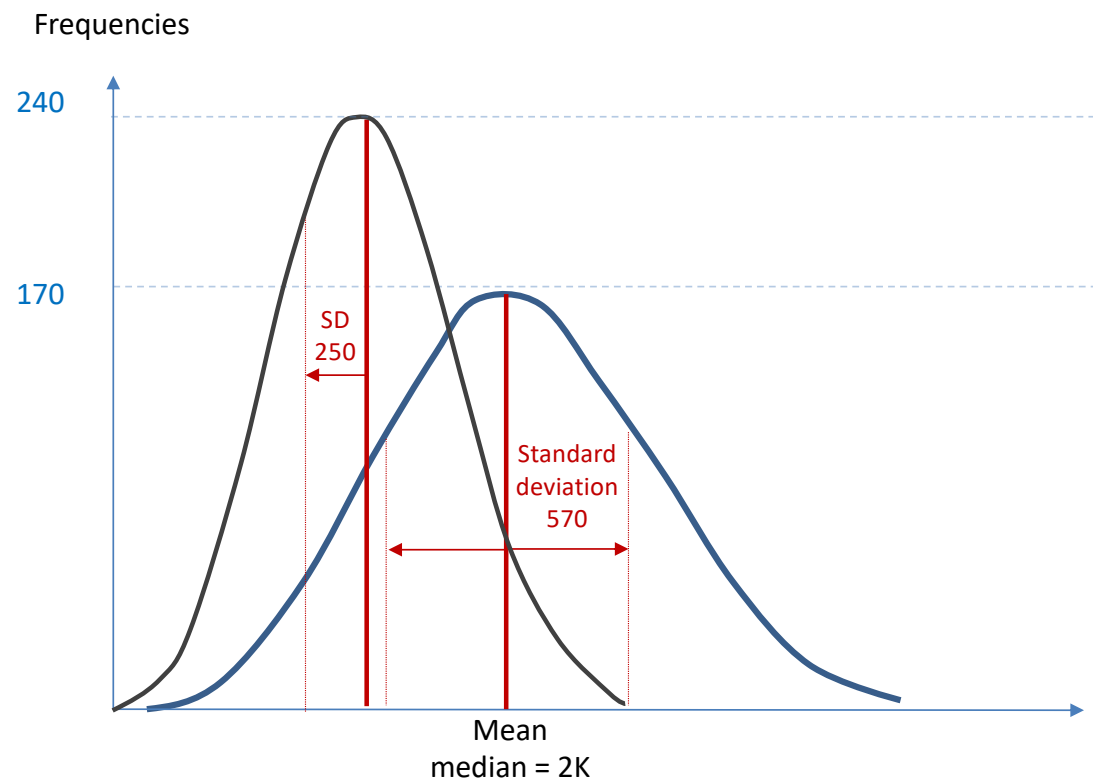


Valuation & revaluation





Impairment tests





THANK YOU FOR YOUR ATTENTION

Created by Gan Khoo Lay
from Noun Project



Thank You and Be Safe

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<https://amavi.net>



17/05/2022

LES International - IP Valuation Committee



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Dr. Véronique Blum holds two High School Graduation Diplomas (French and USA). She graduated from Institut d'Administration des Entreprises (Nancy, 1992, Grenoble, 1993). She obtained a PhD in Management Sciences from Paris Ovest La Défense and a Habilitation to direct research from Paris Saclay (2021).

She started her career as a consultant in Internal Control in private organizations with a state delegation and worked for companies such as Renault, Cogema, or Decathlon. In Grenoble Ecole de Management (until 2007), she built the first engineer-manager diploma in France, with IMT-Atlantique and taught MBA and E-MBAs. Véronique teaches Corporate Finance and Financial Accounting. She taught in Russia and Italy.

She specializes in valuation of intangible, uncertain and strategic assets, with a focus on better risks representation for decision under uncertainty. Her work seeks the development of non-deterministic methodologies, and their follow-up, including when impairment matters. Her research has been published in top ranked international journals such as *Ecological Economics*, *Accounting, Auditing and Accountability Journal* or *Critical Perspectives on Accounting*.

She is currently a member of the academic panel of EFRAG (advisor of the European Commission), member of the MIAI - Multidisciplinary Institute in Artificial Intelligence in Grenoble, member of the Human Enterprises at Collège des Bernardins. At the Association Francophone de Comptabilité, she co-chairs a working group dedicated to Intangibles. She is a member of several scientific societies and the President of a unit of the Chartered Public Accountant national exam. In 2021, she is president of the Intangible Trophies granted by l'Observatoire de l'Immatériel, where she developed a Start-Up trophy.

She currently acts as a valuation expert and co-chairs the IP Valuation Committee of LES France. At LES France, she is also a board member, and a member of the steering committee of the SMEs committee. At LES International, she is a board member of IPV committee .

She is the newly appointed President of AMAVI, an association supported by LESI which delivers a certificate in IP valuation.: <https://amavi.net>