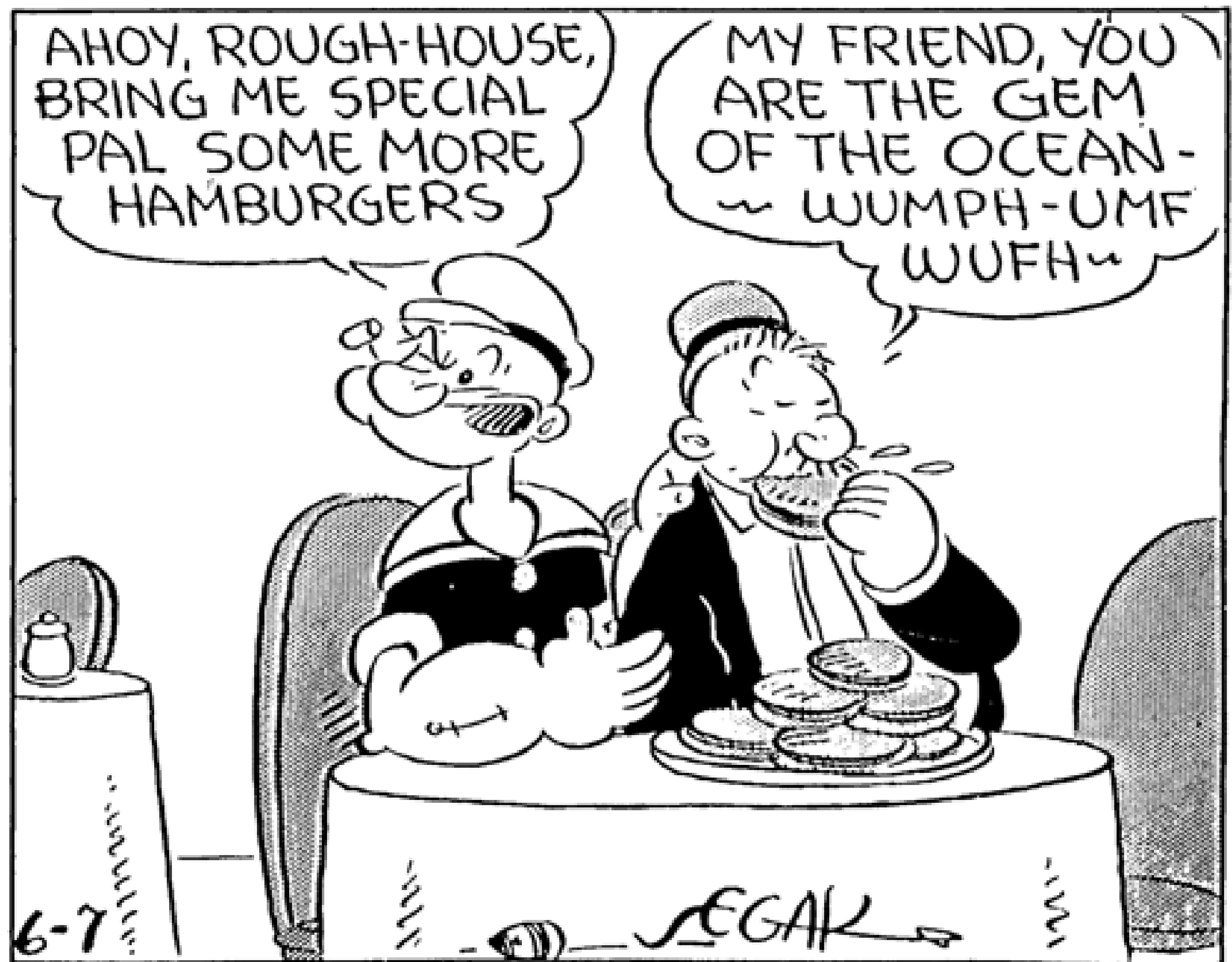


SOCIO-ECONOMIC ANALYSIS FOR FCC

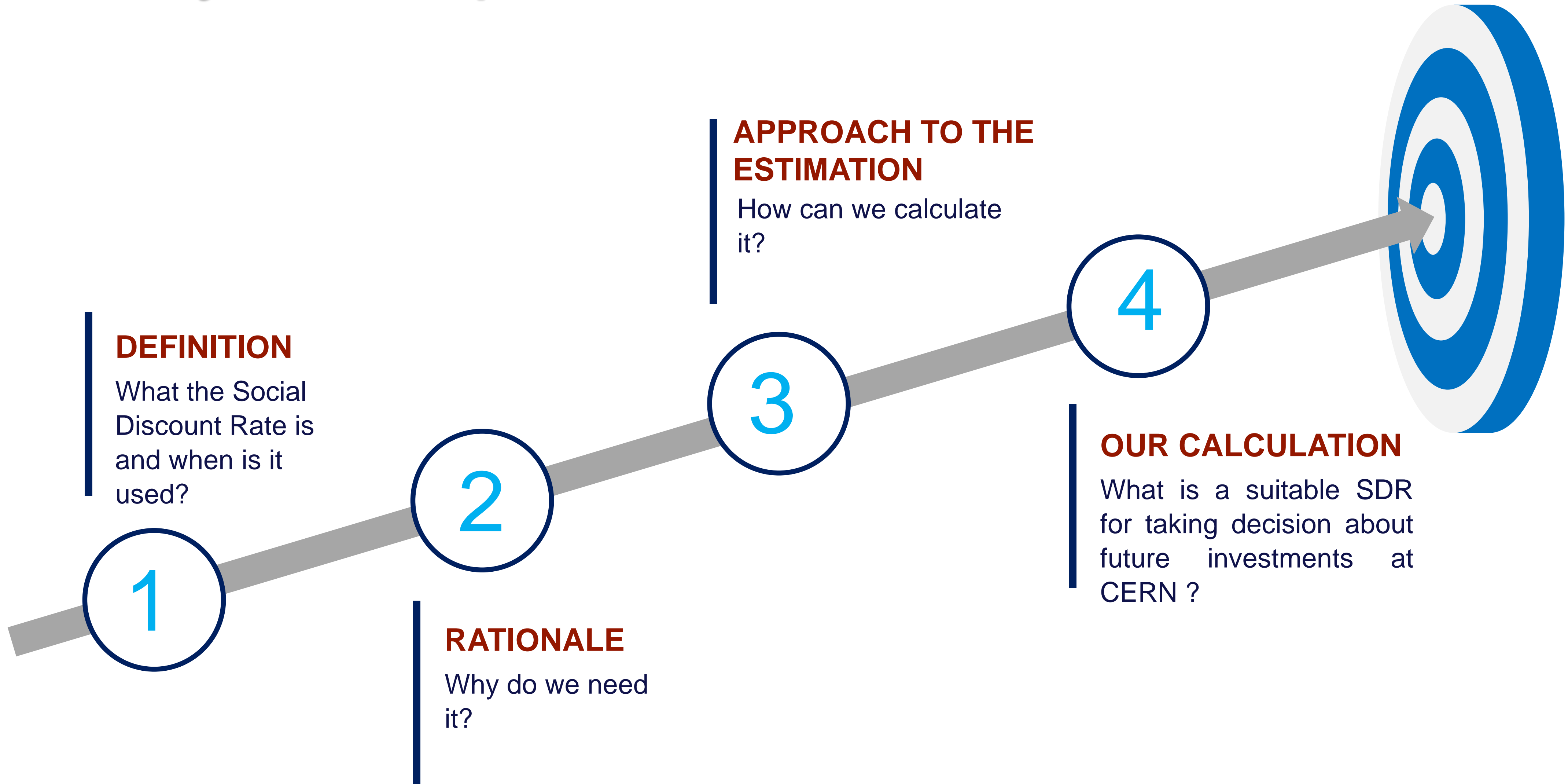
THE SOCIAL DISCOUNT RATE (SDR)

Jessica Catalano (CSIL)
Tuesday, 10 November 2020, 14:00-14:15

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Summary of the presentation



DEFINITION

- The SDR becomes relevant when **inter-temporal investment decisions*** are to be taken.
- It reflects the **social view of how future benefits and costs are to be valued against present ones.**
- In other words, it reflects the **opportunity cost of capital**** for the whole society.
- It is a **key parameter** used in the economic analysis of investment projects to **discount** future economic costs and benefits and to express them in terms of **present values.**

To clarify...

SDR=0	Equal weights are given to the utilities occurring at any point in time, i.e. today's and future consumptions are indifferent from the utility point of view
SDR>0	Indicates a preference for current over future consumption
SDR<0	Indicates a preference for future consumption over current consumption

**Entailing that cost and benefits occur at different points of time*

***It is the consumption rate of interest measuring the subjective value of present versus future consumption.*

RATIONALE for discounting (1)

Three main arguments are suggested by the literature:

- 1. Pure time preferences:** consumers generally prefer to receive the same amount of goods and services sooner rather than later. This preference for near term consumption is related to psychological factors (also demonstrated through experiments) such as *impatience*, *myopia* and the *risk of not being alive in the future*.
- 2. Increasing growth:** societies are expected to grow wealthier over time due to economic growth. Therefore, future generations will benefit from increasing levels of income/consumption and, *it would not be efficient to adopt an egalitarian approach* that trades one unit of consumption today for one unit of consumption in the future
- 3. Opportunity cost of resources:** they could be employed in another investment. Therefore, the expected return of an investment should be *at least high as the SDR*, representing the opportunity cost of funding for the economy as a whole.

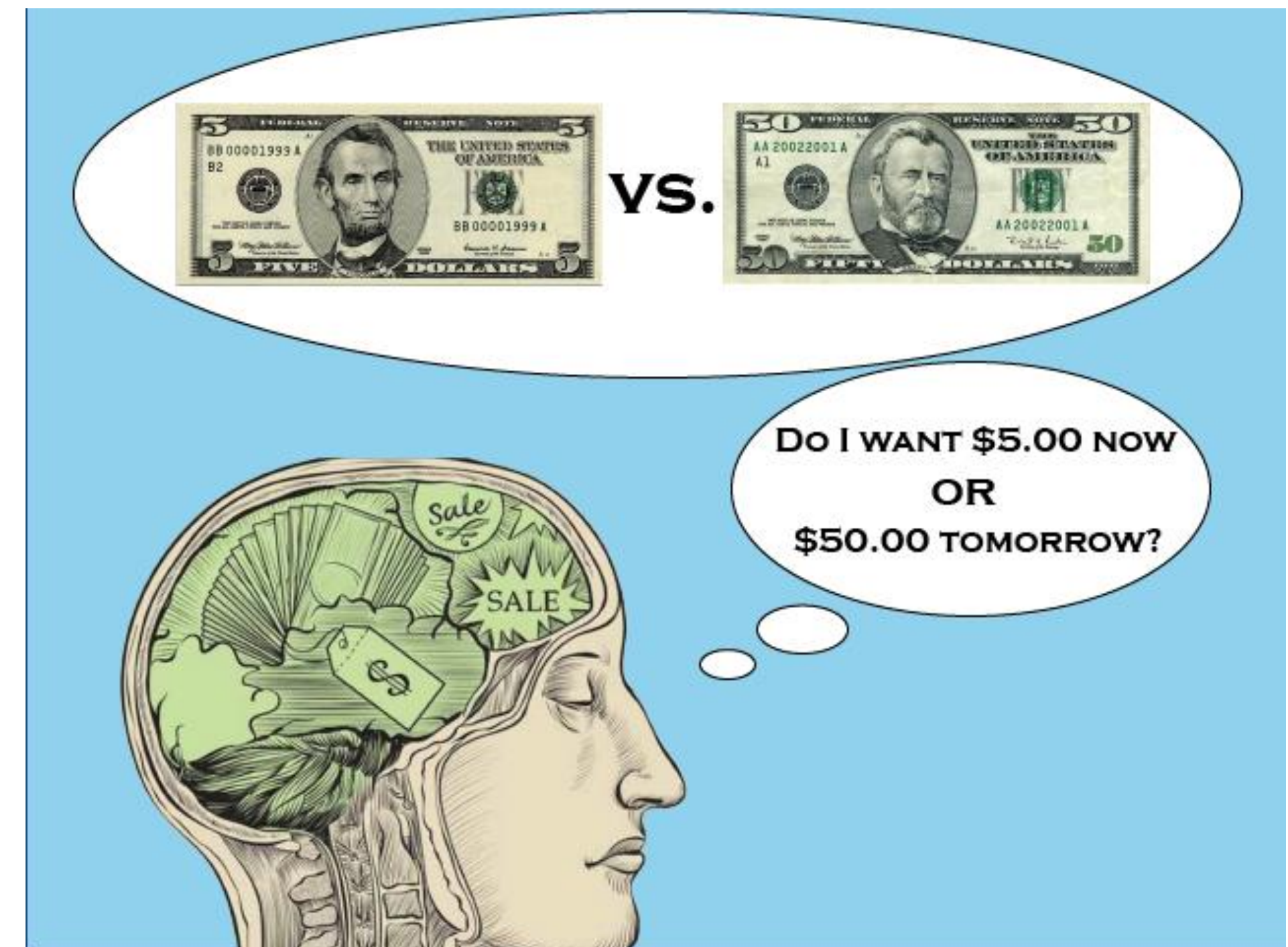
**Why we
need to
discount?**



RATIONALE for discounting (2)

As a consequence of the above reasons, one can observe that:

- Different SDRs are adopted by governments across the world. This divergence is due to the **different perception of the social opportunity cost of public funds**: the impatience of individuals and their preference of immediate over future consumption is related to their level of wealth.
- Poor individuals have **more urgency** to consume today considered the **high risk and uncertainty about the future** (the fact that in some distant future it can be richer is less important for them); therefore their opportunity cost is higher as compared to rich individuals.

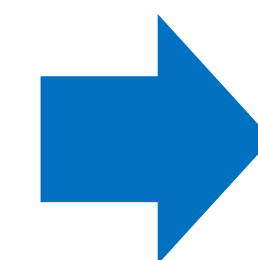


APPROACHES TO THE ESTIMATION

The social rate of time preference (SRTTP)

- It is found to be the **main and most suitable approach** to determine the SDR, since grounded on a robust theoretical basis, which consider not only financial data but, above all, social preferences.
- It represents the rate at which **society is willing to postpone a unit of current consumption** in exchange for more consumption in the future.
- The logic of this approach is that government should consider the **welfare of both current and future generations**.
- It can be estimated on a formula obtained from the **Ramsey growth model**.

	DEFINITION	PROXY
p	pure time preference (related to individuals' impatience and myopia and to the risk of death or human race extinction)	Annual crude death rate of the population (Eurostat, 2018)
ϵ	elasticity of marginal utility of consumption (how much consumption they wish to transfer across people over time)	Progressivity of national personal income tax rates (OECD Tax Database, 2019)
g	expected growth rate per capita consumption	Per capita Gross Domestic Product real growth (IMF, October 2020)



$$SDR \equiv SRTTP = p + \epsilon \cdot g$$

OUR CALCULATION (1)

- We calculated the SRTP for **selected countries** (EU27 and CERN Member States).
- The average value for the **EU27 Member States is 3.63%** with the lowest value of 0.80% applying to Italy and the highest value of 8.13% applying to Estonia.
- **The simple average value for CERN Member States is 3.01%** with the lowest value of 0.80% applying to Italy and the highest value of 7.62% applying to Lithuania.

This calculation takes into account the preliminary effects of COVID-19 on the economic growth (past and forecast trend of GDP)

CERN Contributor EU27 MS €	Country	G (PPP, 2000-2021)	P (2018)	E (2019)	SRTP (CSIL calculation)
⊗ €	Austria	0.88	0.95	1.44	2.22
⊗ €	Belgium	0.85	0.97	1.69	2.40
⊗ €	Bulgaria	4.06	1.54	n/a	n/a
⊗ €	Croatia	2.32	1.29	n/a	n/a
⊗ €	Cyprus	0.94	0.66	n/a	n/a
⊗ €	Czech Republic	2.39	1.06	1.29	4.14
⊗ €	Denmark	0.82	0.95	1.44	2.12
€	Estonia	3.92	1.19	1.77	8.13
⊗ €	Finland	1.17	0.99	1.77	3.06
⊗ €	France	0.63	0.91	1.41	1.79
⊗ €	Germany	1.05	1.15	1.33	2.55
⊗ €	Greece	0.15	1.12	1.74	1.37
⊗ €	Hungary	2.53	1.34	1.00	3.87
€	Ireland	3.26	0.64	1.88	6.78
⊗ €	Italy	-0.14	1.05	1.70	0.80
€	Latvia	4.51	1.50	1.24	7.08
⊗ €	Lithuania	5.05	1.41	1.23	7.62
€	Luxembourg	0.97	0.71	1.80	2.47
€	Malta	1.88	0.76	n/a	n/a
⊗ €	Netherlands	0.91	0.89	1.88	2.59
⊗ €	Poland	3.58	1.09	1.07	4.90
⊗ €	Portugal	0.62	1.10	1.65	2.13
⊗ €	Romania	4.41	1.36	n/a	n/a
⊗ €	Slovak Republic	3.38	1.00	1.28	5.32
⊗ €	Slovenia	1.92	0.99	1.27	3.43
⊗ €	Spain	0.74	0.91	1.63	2.11
⊗ €	Sweden	1.20	0.91	1.72	2.98
⊗	United Kingdom	0.85	0.92	1.66	2.34
⊗	Switzerland	0.72	0.79	1.56	1.92
⊗	Israel	1.26	n/a	2.08	n/a
⊗	Norway	0.68	0.77	1.47	1.77
⊗	Serbia	4.05	1.46	n/a	n/a
⊗	India	4.83	n/a	n/a	n/a
⊗	Pakistan	1.77	n/a	n/a	n/a
⊗	Turkey	3.13	0.52	1.36	4.77
⊗	Ukraine	2.98	1.40	n/a	n/a
	Min (Selected Countries)	-0.14	0.52	1.00	0.80
	Max (Selected Countries)	5.05	1.54	2.08	8.13
	Average (Selected Countries)	2.06	1.04	1.53	3.49
	Min EU27	-0.14	0.64	1.00	0.80
	Max EU 27	5.05	1.54	1.88	8.13
	Average EU27	2.00	1.05	1.51	3.63
	Average EU14	0.94	0.95	1.65	2.53
	Average EU13	3.15	1.17	1.27	5.56
	Min (CERN contributors)	-0.14	0.52	1.00	0.80
	Max (CERN contributors)	5.05	1.54	2.08	7.62
	Average CERN MS contributors	1.93	1.05	1.51	3.01

OUR CALCULATION (2)

- We calculated the SDR for FCC as a **weighted average of the social discount rates** estimated for the countries contributing to finance CERN.
- The weight was given by the **contribution of each country to CERN budget.**
- **SDR for FCC is equal to 2.25:** it represents 95% of contribution to CERN.

CERN Status	Country	SRTP (CSIL calculation)	Contribution to CERN budget (%)*
Member State	Austria	2.22	2.1
Member State	Belgium	2.40	2.6
Member State	Bulgaria	n/a	0.3
Member State	Czech Republic	4.14	1.0
Member State	Denmark	2.12	1.7
Member State	Finland	3.06	1.3
Member State	France	1.79	13.6
Member State	Germany	2.55	20.3
Member State	Greece	1.37	1.0
Member State	Hungary	3.87	0.6
Member State	Italy	0.80	10.0
Member State	Netherlands	2.59	4.4
Member State	Poland	4.90	2.7
Member State	Portugal	2.13	1.1
Member State	Romania	n/a	1.1
Member State	Slovak Republic	5.32	0.5
Member State	Spain	3.43	6.9
Member State	Sweden	2.11	2.5
Member State	United Kingdom	2.98	15.5
Member State	Switzerland	2.34	4.0
Member State	Israel	n/a	1.8
Member State	Norway	1.77	2.3
Member State	Serbia	n/a	0.2
Associate Member State	Croatia	n/a	0.1
Associate Member State	India	n/a	1.3
Associate Member State	Lithuania	7.62	0.1
Associate Member State	Pakistan	n/a	0.2
Associate Member State	Turkey	4.77	0.5
Associate Member State	Ukraine	n/a	0.1
Associate Member State in the pre-stage to Membership	Cyprus	n/a	0.1
Associate Member State in the pre-stage to Membership	Slovenia	3.43	0.1
FCC SDR (Weighted Average)		2.25	100

Note: For some CERN contributors – such as Bulgaria, Croatia, Cyprus, Romania, Israel, Serbia, India, Pakistan and Ukraine – it was not possible to estimate the SDR because of the lack of one of the three parameters needed for the calculation. However, these missing countries account lower than 5% of contribution to CERN budget

OUR CALCULATION (3)

- We compared our calculation with social discount rates adopted in different countries worldwide building on a review of existing literature and guidelines.

- FCC SDR = 2.25% - was found to be in line with the value suggested for an international governmental organization by a recent survey to economists:
 - The average value recommended by respondents is 2.27%. More than three-quarters of experts are comfortable with the median SDR of 2%, and over 90% of respondents find an SDR in the range of 1 to 3% acceptable.

Theoretical basis	Country	Social Discount Rate (real)	Source
SRR	Australia	a) 6.5%, with a sensitivity range from 4.5% to 8.5% b) 4% c) 7% with a sensitivity range from 3% to 10%	a) Abelson, P., & Dalton, T. (2018). b) Parliament of the commonwealth of Australia (2018) c) Australian Government (March 2020)
	Canada	8%, with sensitivity test over the range 3-10%	Treasury Board Secretary (2007) confirmed by the policy on Cost-Benefit Analysis issued on 2018 ¹
	Denmark	4% under 35 years (given by the sum of 3% risk-free rate and 1% risk premium). Reduced to 3% from 36 to 70 years and to 2% from year 71 onwards.	Mouter, N. (2015).
	India	3% (sanitation)	Cronin, A. A., Ohikata, M., & Kumar, M. (2014)
	Japan	4%	ITF (2015)
	Norway	4% under 40 years (given by the sum of 2.5% risk-free rate and 1.5% risk premium). Reduced to 3% from 40 to 75 years and to 2% from year 76 onwards.	Norwegian Ministry of Finance (2012)
	New Zealand	From 4% to 7% depending on the sector	New Zealand Government (2008) confirmed by New Zealand Government (2015) and the Treasury
	Pakistan	12%	Zhuang et al. (2007)
	The Netherland	5.5% (2.5% real risk-free + 3% premium for macroeconomic risk)	CPB and PBL (2013)
	Philippines	15%	Zhuang et al. (2007)
Weighted average approach	United States	For CBA: 3%, with sensitivity up to 7% OMB (2003) recommends lower rate for 'intergenerational' projects, US EPA (2010) recommends 2.5%	OECD, 2018 and Cahill, N. and Dr O'Connell, L. (2018).
	People's Republic of China	For short- and medium-term projects: 8% For long term projects: lower than 8%	Zhuang et al. (2007)
	European Union	5% is used in Cohesion countries and 3 % for the other Member States	European Commission (2014)
	France	2.5% (falling to 1.5% from 2070) and a risk premium of 2% (rising to 3% from 2070) multiplied by a sector specific beta value. With a beta value = 1, the standard discount rate is 4.5%.	Quinet (2013)
	Germany	UBA (environmental agency) suggests 1.5% for inter-generational assessments and 1% in the context of climate effects	ITF (2015)
	Ireland	Range from 2.6% to 3.9% for all sectors. 1.7% for carbon emissions and other long-term environmental damage	Cahill, N. and Dr O'Connell, L. (2018)
	Italy	3%	Invitalia (2014)
	Malta	5.5%	Planning and Priorities Co-ordination Division (2013)
	Portugal	4%	Florio (2006)
	Slovak Republic	5%	OECD (2007)
SRTTP	Spain	For transport: 6% For water: 4%	Florio (2006)
	Sweden	3.5%	ASEK Guidelines (2018)
	United States	For CEA: 2% No guidance on long-term CEA	OECD, 2018 and Cahill, N. and Dr O'Connell, L. (2018).
	UK	a) 3.5% for years 0-30, 3% years 31-75, 2.5% from year 76 onwards. For health projects: 1.50% for years 0-30; 1.29% years 31-75 and 1.07% % from year 76 onwards. b) a short-run SDR of 4.5% declining to 4.2% in the very long-run	a) Freeman, M. et al (2018) and HM Treasury (2018) b) Groom, B., et al (2019)
	Value recommended for an international governmental organization	The mean recommended SDR is 2.27%, with a range from 0 to 10%. More than three-quarters of experts are comfortable with the median SDR of 2%, and over 90% of respondents find an SDR in the range of 1 to 3% acceptable.	Drupp, M. A., et al (2015 and 2018) ²
	OECD countries	Average rate of 4.78% for energy and 4.64% for transport	OECD, 2018
	Latin American countries ³	On average SDR is 3.77%, ranging from 2.14% for Paraguay to 5.83% for Chile.	Moore, M. A. et al. (2020)

OUR CALCULATION: concluding remarks

1. We calculated an ad hoc SDR for the FCC according to the **Social Rate of Time Preference method**.
2. This value was estimated as the **weighted average of SDRs** calculated for countries which contribute to finance CERN.
3. FCC SDR was found to be equal to **2.25**.
4. This value reflects the social view of how **benefits and costs deriving from future investments at CERN** should be valued **against the present ones** (2020 perspective).
5. This value was found to be in line with a recent survey of economists for an international governmental organization and **takes into account COVID-19 preliminary effects on the economic growth**.

More details and references on this topic will be included in the **Deliverable D4.1** “*Plan for research infrastructure socio-economic impact analysis*” (M10).

THANK YOU

Any questions or suggestions?

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