Representation of different ethical frameworks in integrated assessment models

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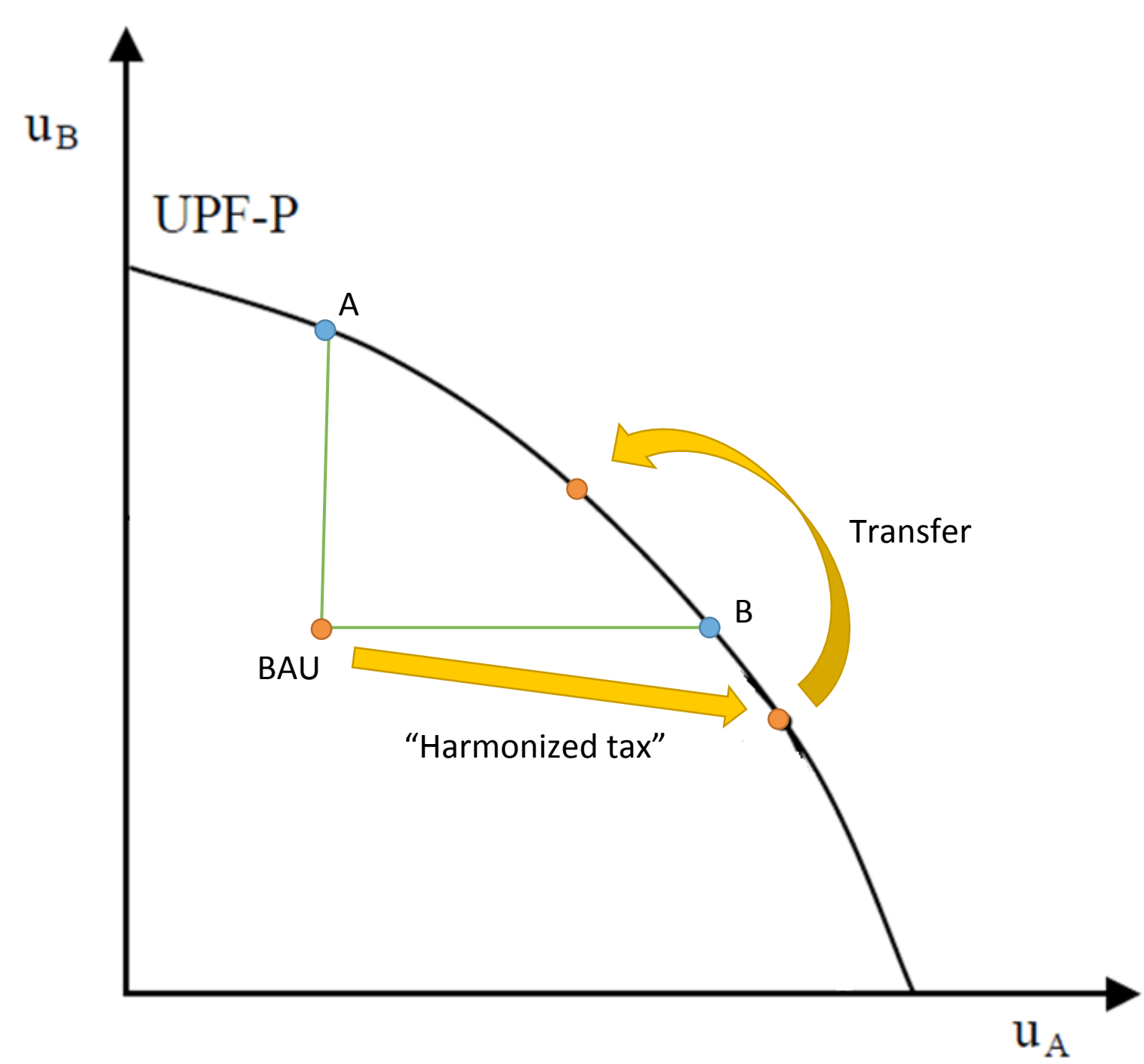
Outline

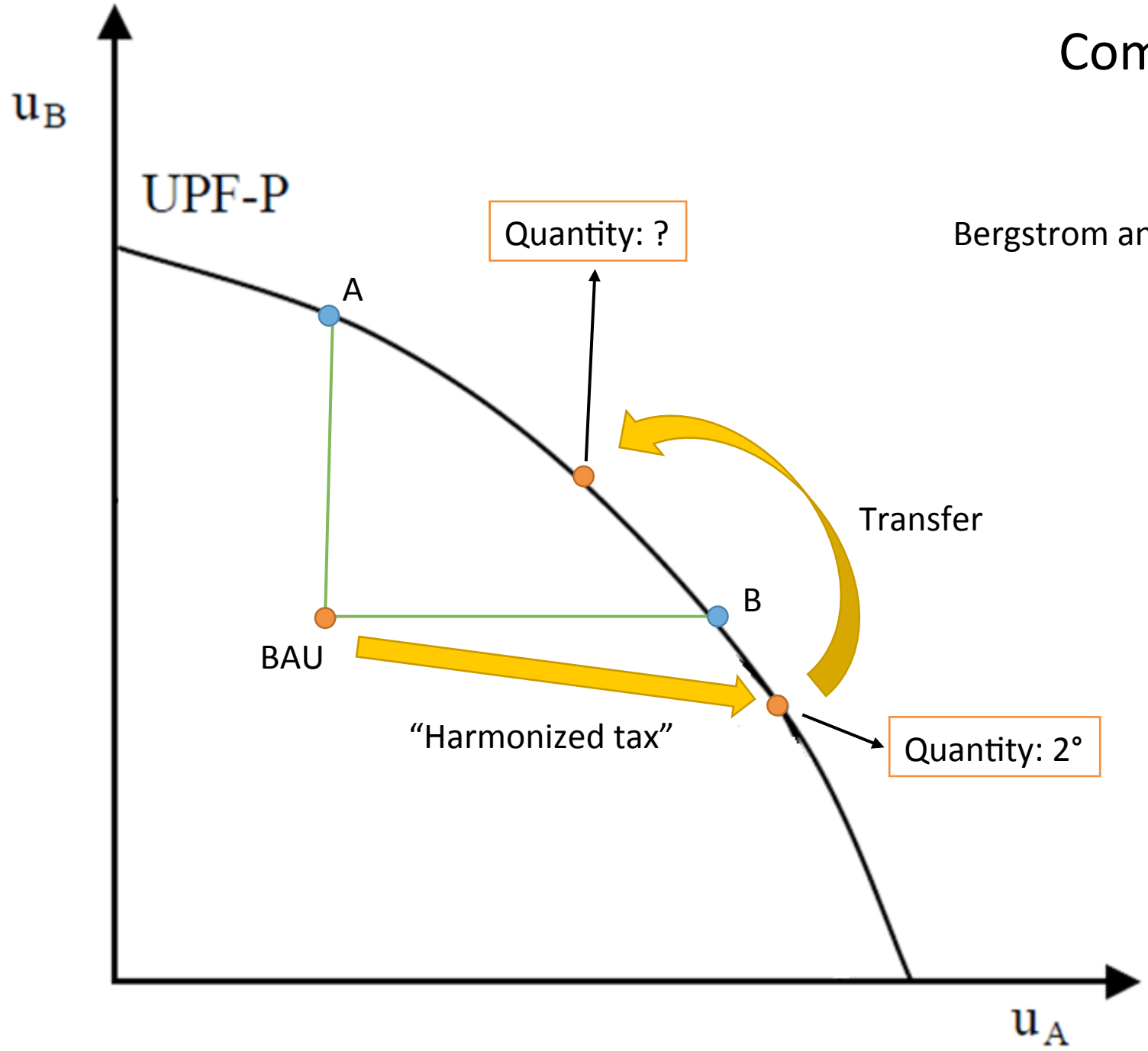
- **Taxonomy and some examples from the literature**
- Equity weighting
- Outlook

Taxonomy

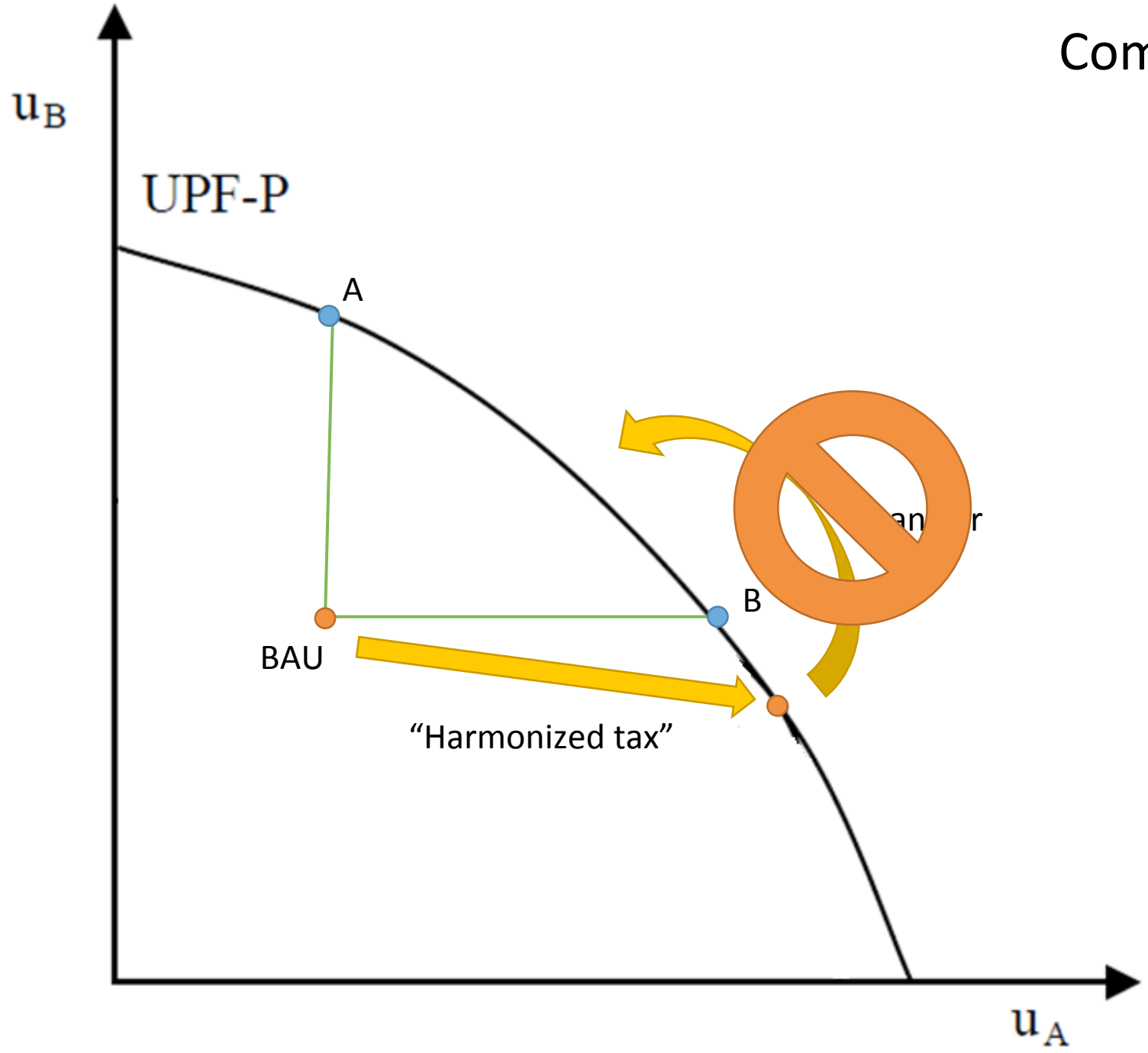
- Pareto improvements/efficiency
- Self enforcing
- Ethics


u_B
UPF-P
A
B
BAU
Transfer
“Harmonized tax”
u_A

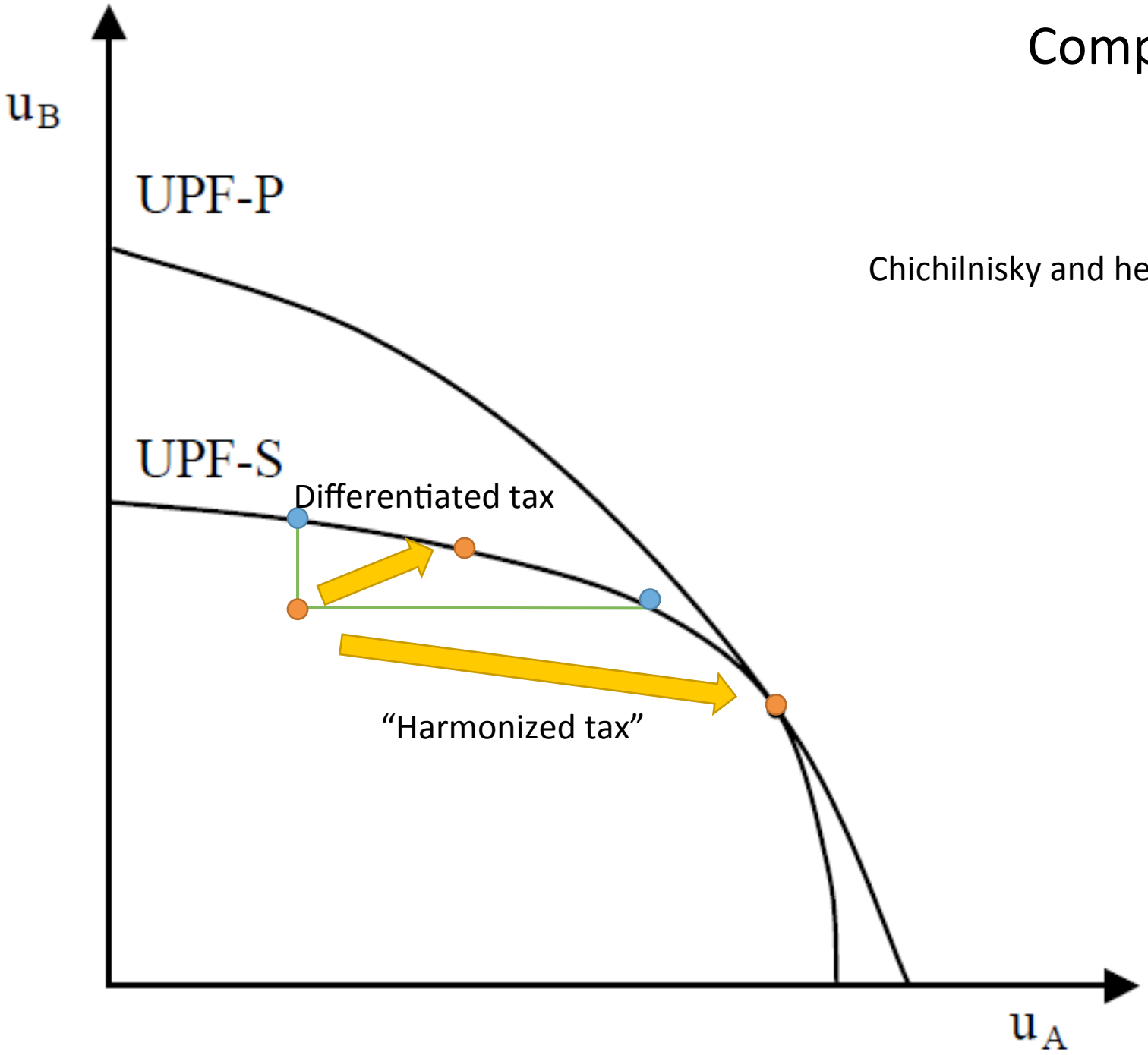
Complication 1



Complication 2



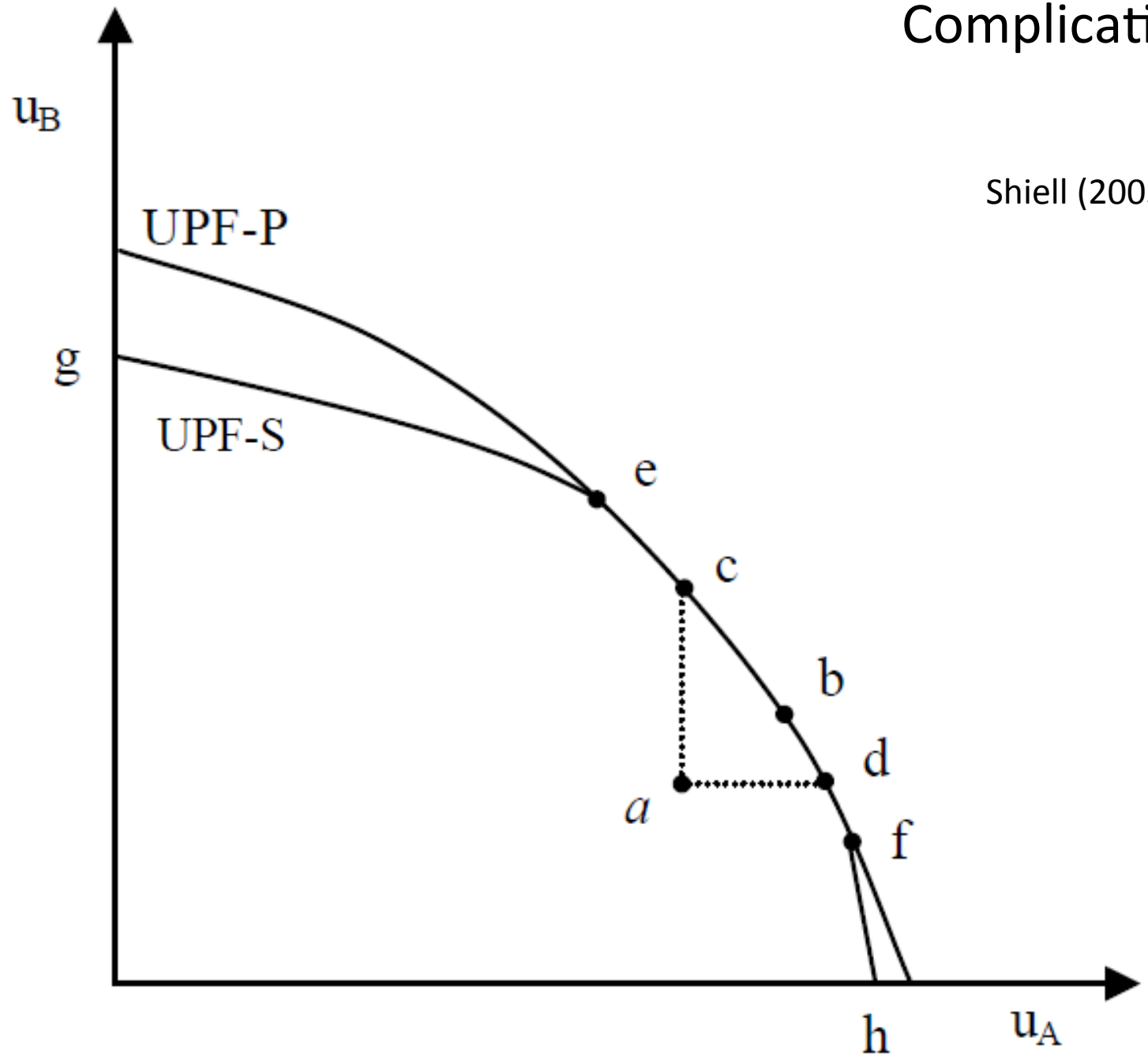
Complication 2



Chichilnisky and heal (1994)

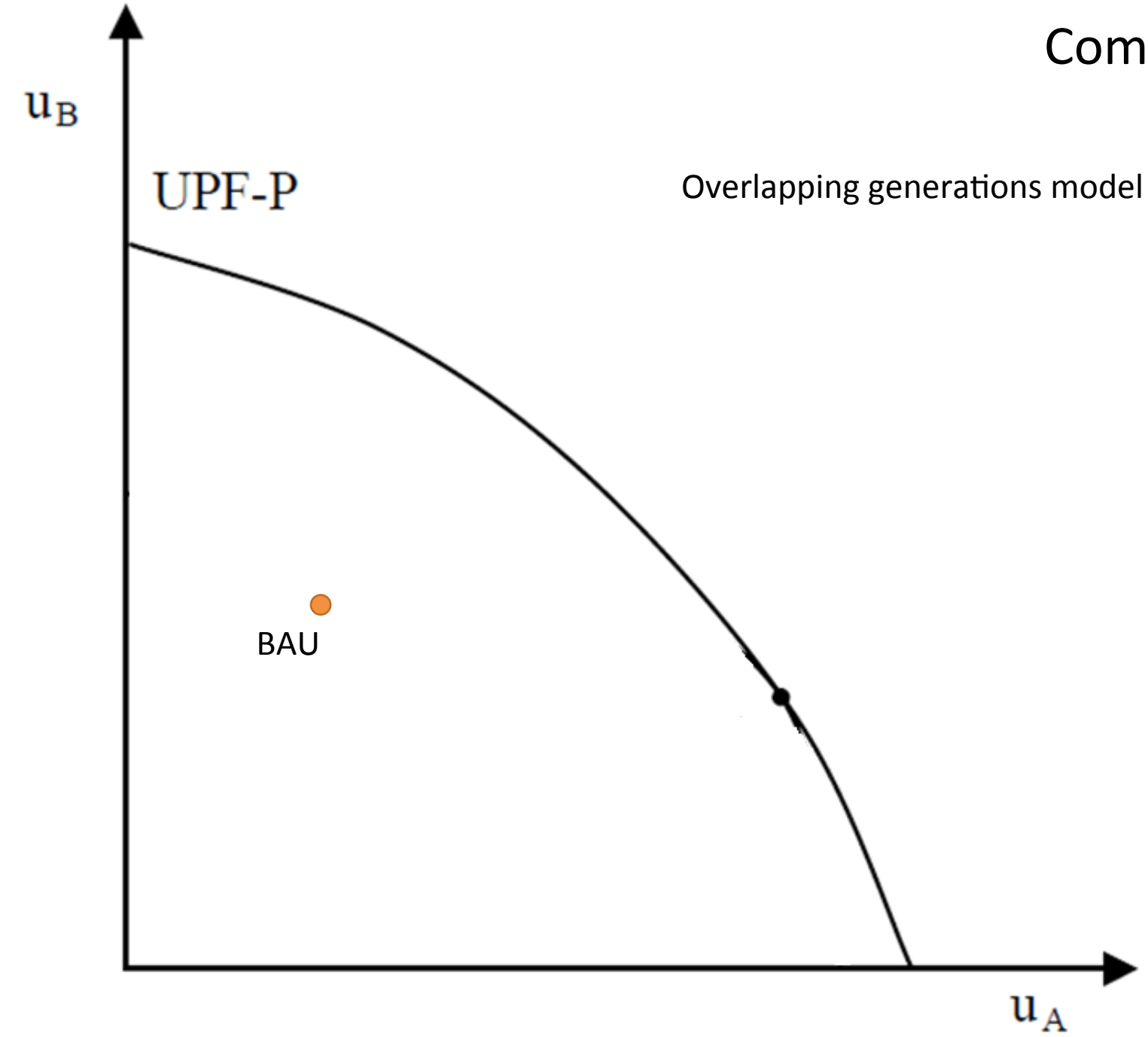
Complication 2

Shiell (2003)



Complication 3

Overlapping generations model



Ethics

- Issue specific
- Comprehensive

Benefits

	USA	EU	China	…
2010	5	7	3	…
2011	6	8	6	…
2012	8	9	5	…
…	…	…	…	…

[redacted]

Costs

	USA	EU	China	…
2010	5	7	3	…
2011	6	8	6	…
2012	8	9	5	…
…	…	…	…	…

[redacted]

Issue specific

Net Benefits

	USA	EU	China	…
2010	5	7	3	…
2011	6	8	6	…
2012	8	9	5	…
…	…	…	…	…

$$Y\downarrow tr = \mathrm{Y}\downarrow tr + B\downarrow tr - C\downarrow tr$$

	USA	EU	China	…
2010	Y_{tr}	Y_{tr}	Y_{tr}	…
2011	Y_{tr}	Y_{tr}	Y_{tr}	…
2012	Y_{tr}	Y_{tr}	Y_{tr}	…
…	…	…	…	…

Comprehensive

Issue specific
Comprehensive

Ethics

- Consequentialism
  - Utilitarian framework/equity weighting/inequity aversion (large literature)
  - Cost-effectiveness (large literature)
  - Burden sharing (large literature), no-envy (Varian, 1974; Tol, 2001)
- Rule based ethics (deontological ethics)
  - Kantian (Tol, 2001)
- Virtue ethics

Complications

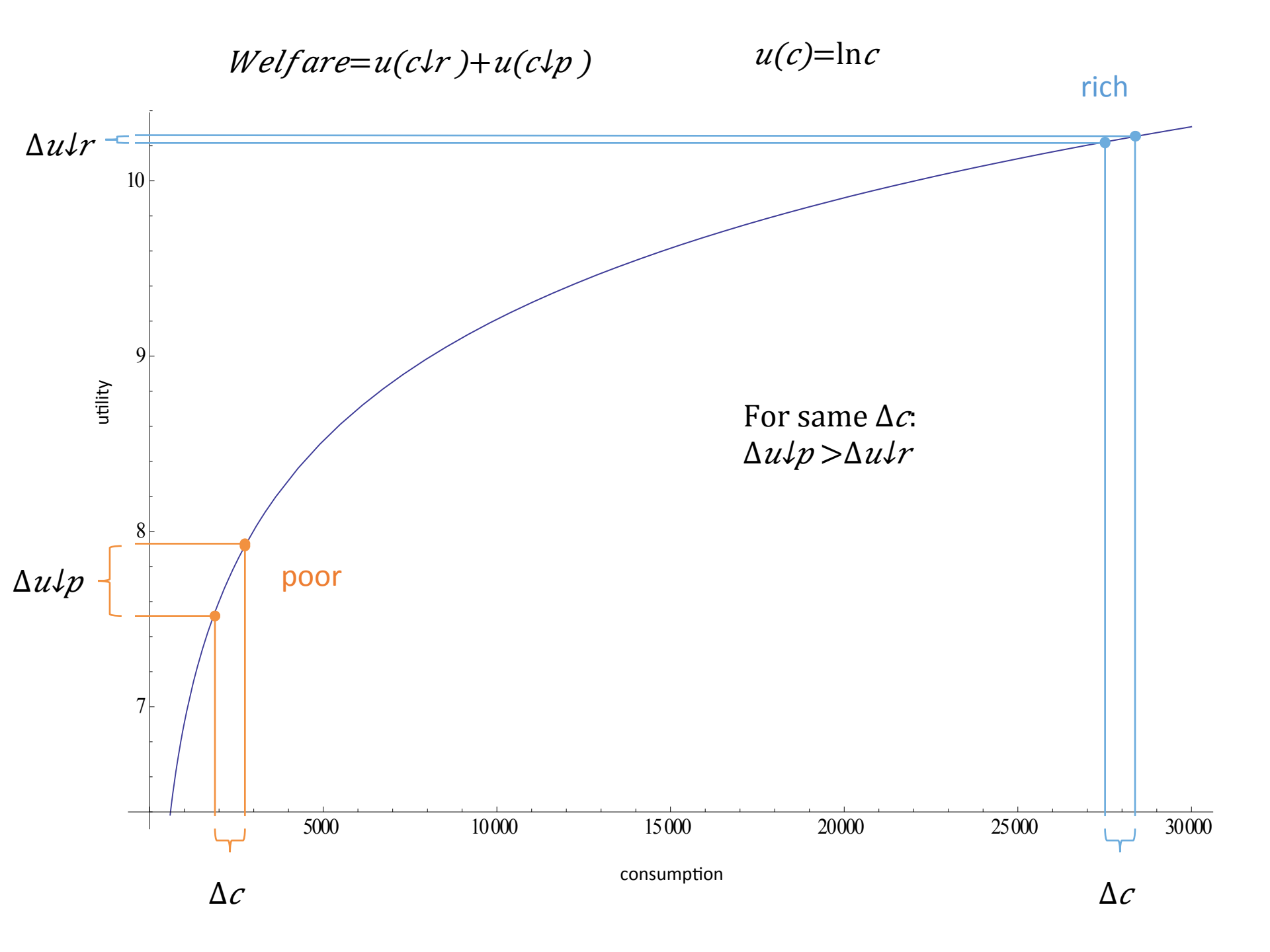
- Time
- Risk

Outline

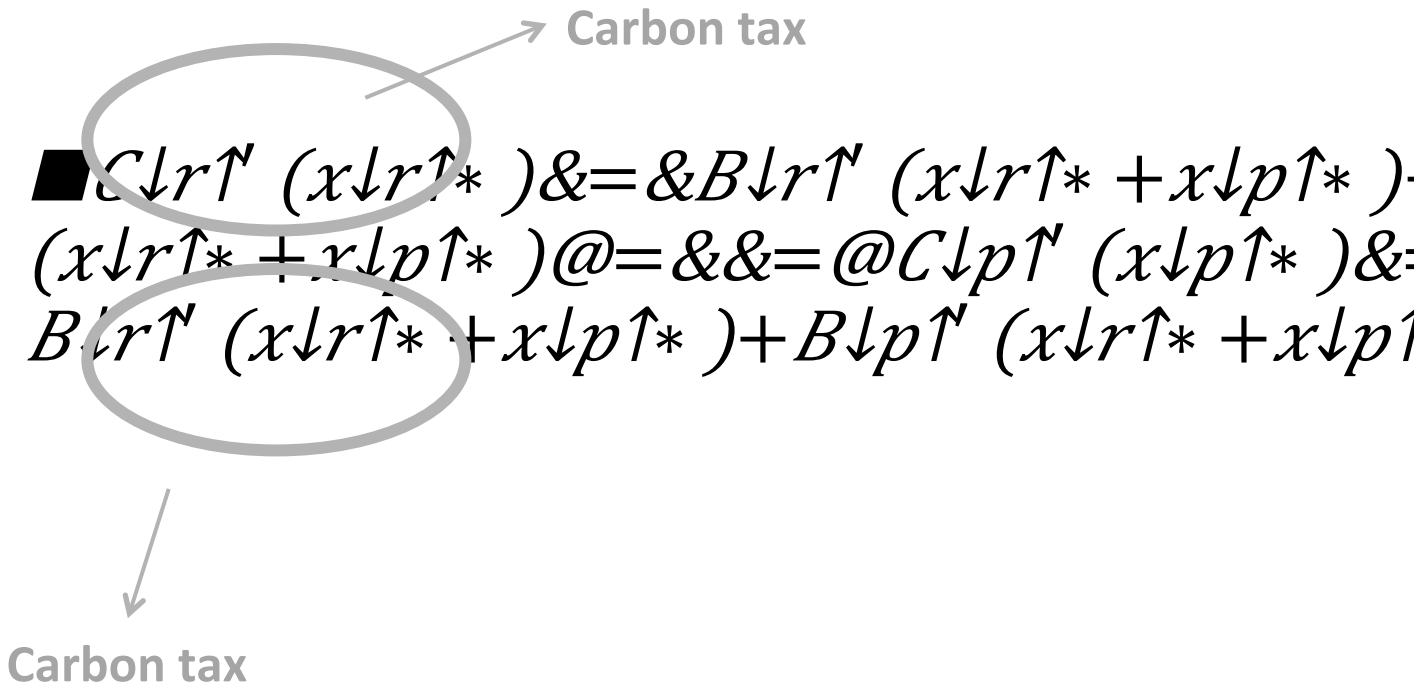
- Taxonomy and some examples from the literature
- **Equity weighting**
- Outlook

Previous Work

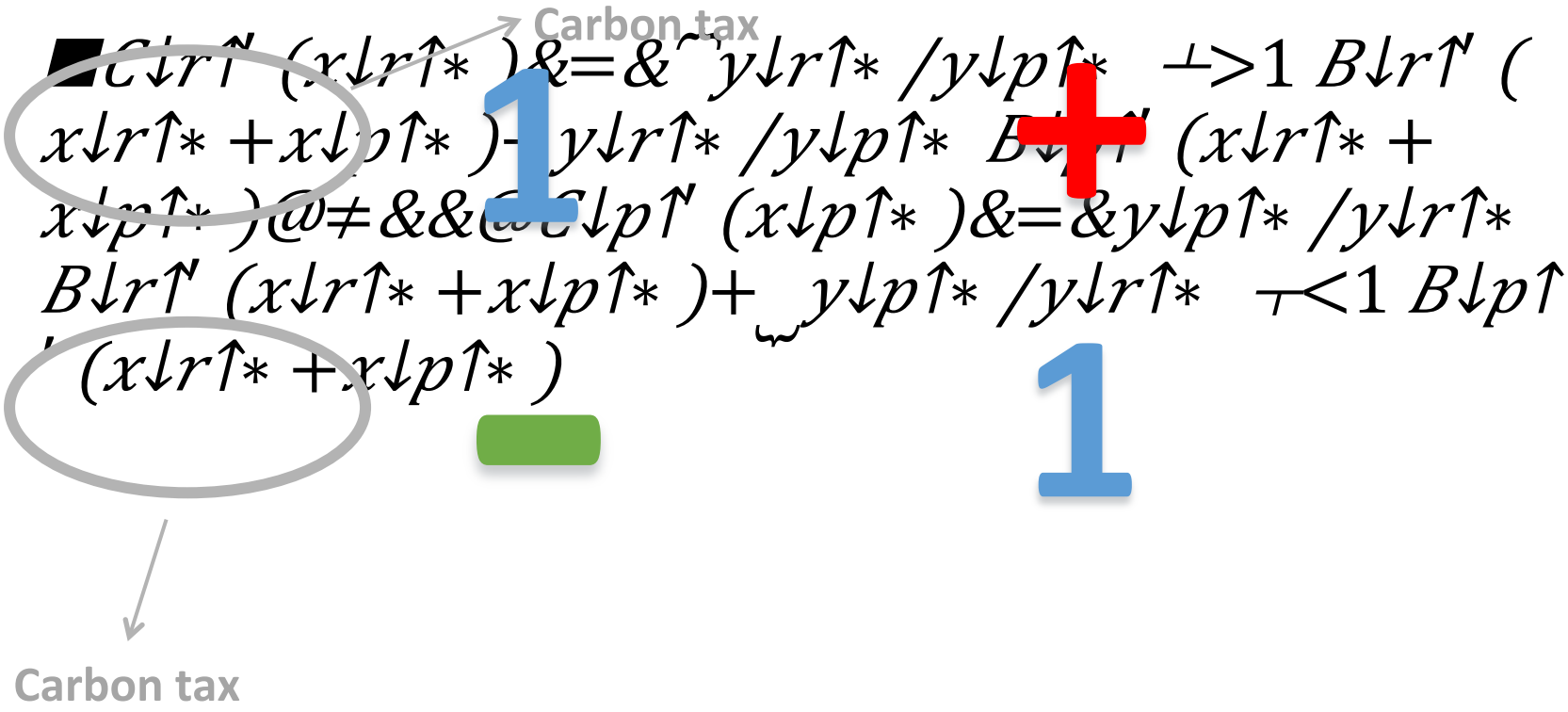
- Optimal taxation
  - Sandmo (2006)
- Equity weights
  - Azar and Sterner (1996), also Azar (1999), Fankhauser, Tol and Pearce (1997), Hope (2008), Anthoff, Hepburn and Tol (2009), Anthoff and Tol (2010)
  - RICE, PAGE and FUND: Nordhaus (2011), Hope (2011)
- Real World
  - DEFRA studies
  - Stern Review (?)


$Welfare = u(c_r) + u(c_p)$
$u(c) = \ln c$
rich
Δu_r
10
9
utility
8
Δu_p
poor
7
For same Δc:
$\Delta u_p > \Delta u_r$
5000
10000
15000
20000
25000
30000
consumption
Δc
Δc

Simple Model with transfers



Simple Model without transfers



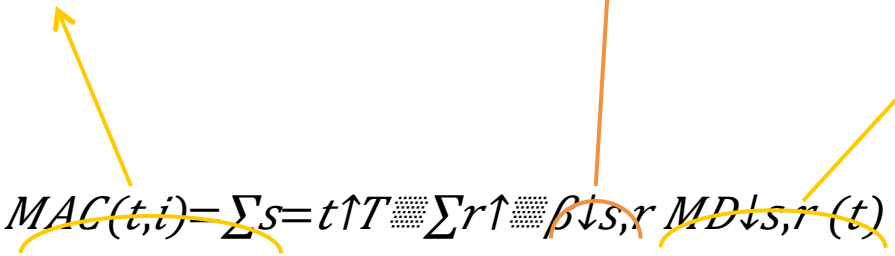
$$W=\sum t\uparrow\blacksquare\sum r\uparrow\blacksquare P\downarrow tr\ U(C\downarrow tr\ )(1+\rho)\uparrow-t$$

Roughly

Marginal Abatement Cost
or
Carbon Tax

Discount Factor

Marginal Damage Cost



Marginal Damage of Emission

1 tCO_2

	US	WEU	CHI	…
2010				
2011				
2012				
2013				
2014				
2015				
2016				
…				

$MD\downarrow 2013, US\ (2012)$

$MD\downarrow 2016, CHI\ (2012)$

Optimal Taxes - Efficiency

Marginal Abatement Cost
or
Carbon Tax

Ramsey Discount Factor

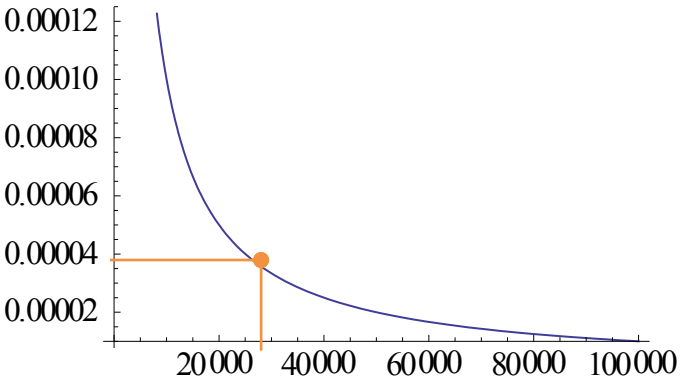
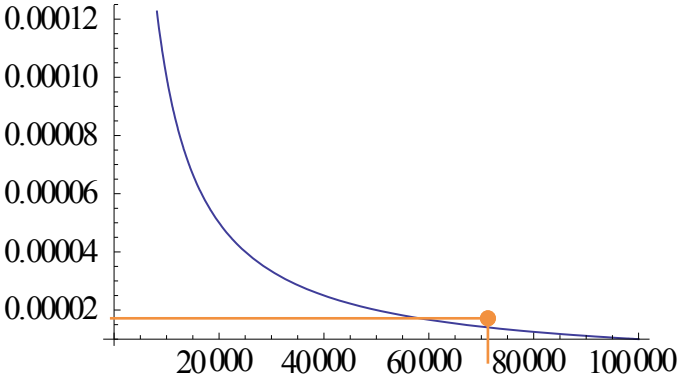
Marginal Damage Cost

$$MAC(t,i) = \sum_{s=t}^{T} \sum_{r} 1/(1+\rho+\eta g_t)^t \; MD_{s,r}(i)$$

Same for all Regions

Social Cost of Carbon

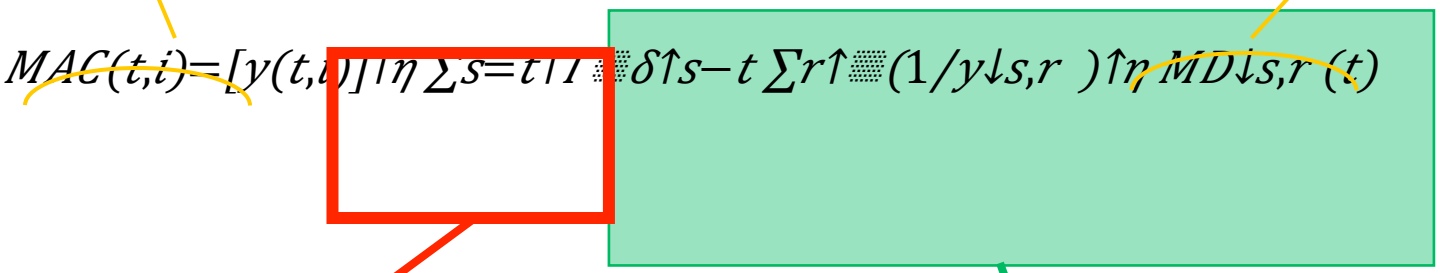
Ramsey Discount Rate

Present	
Future	

Optimal Taxes – No Transfers

Marginal Abatement Cost
or
Carbon Tax

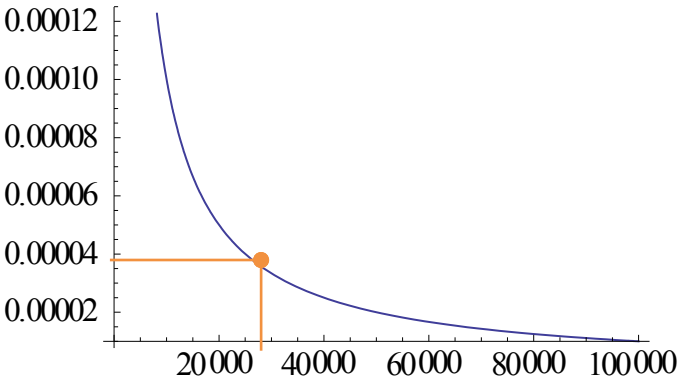
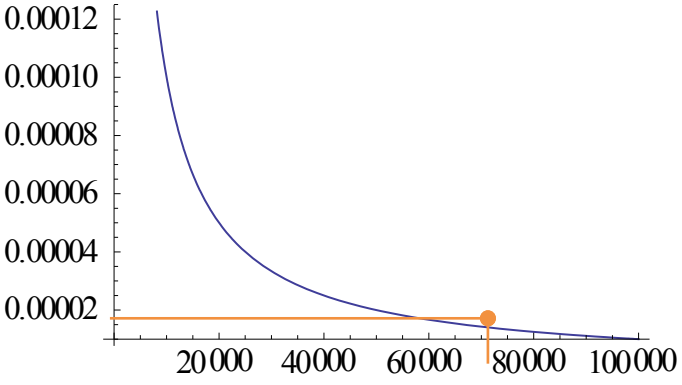
Marginal Damage Cost



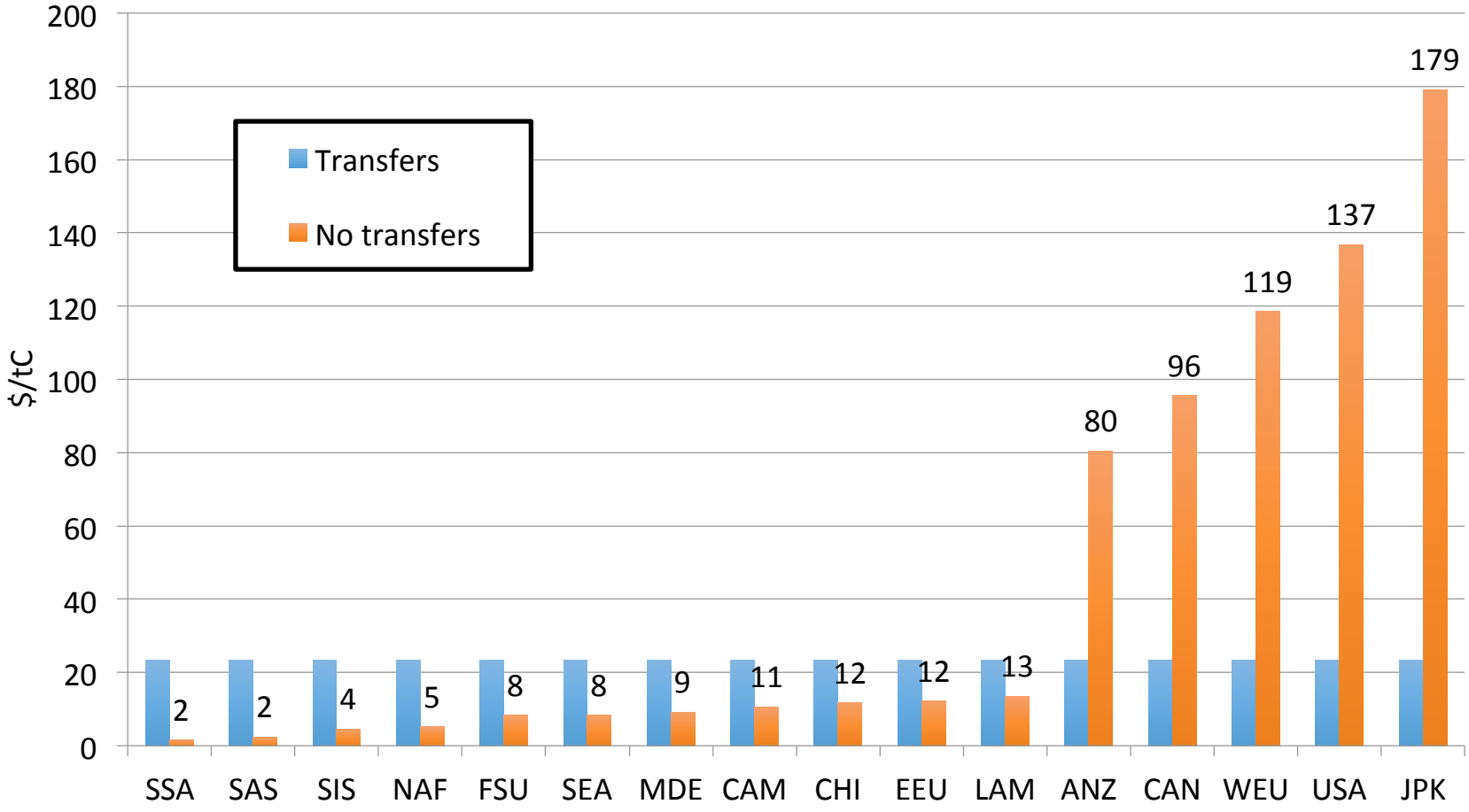
Higher for rich regions
Lower for poor regions

Same for all regions

Modified Discount Rate

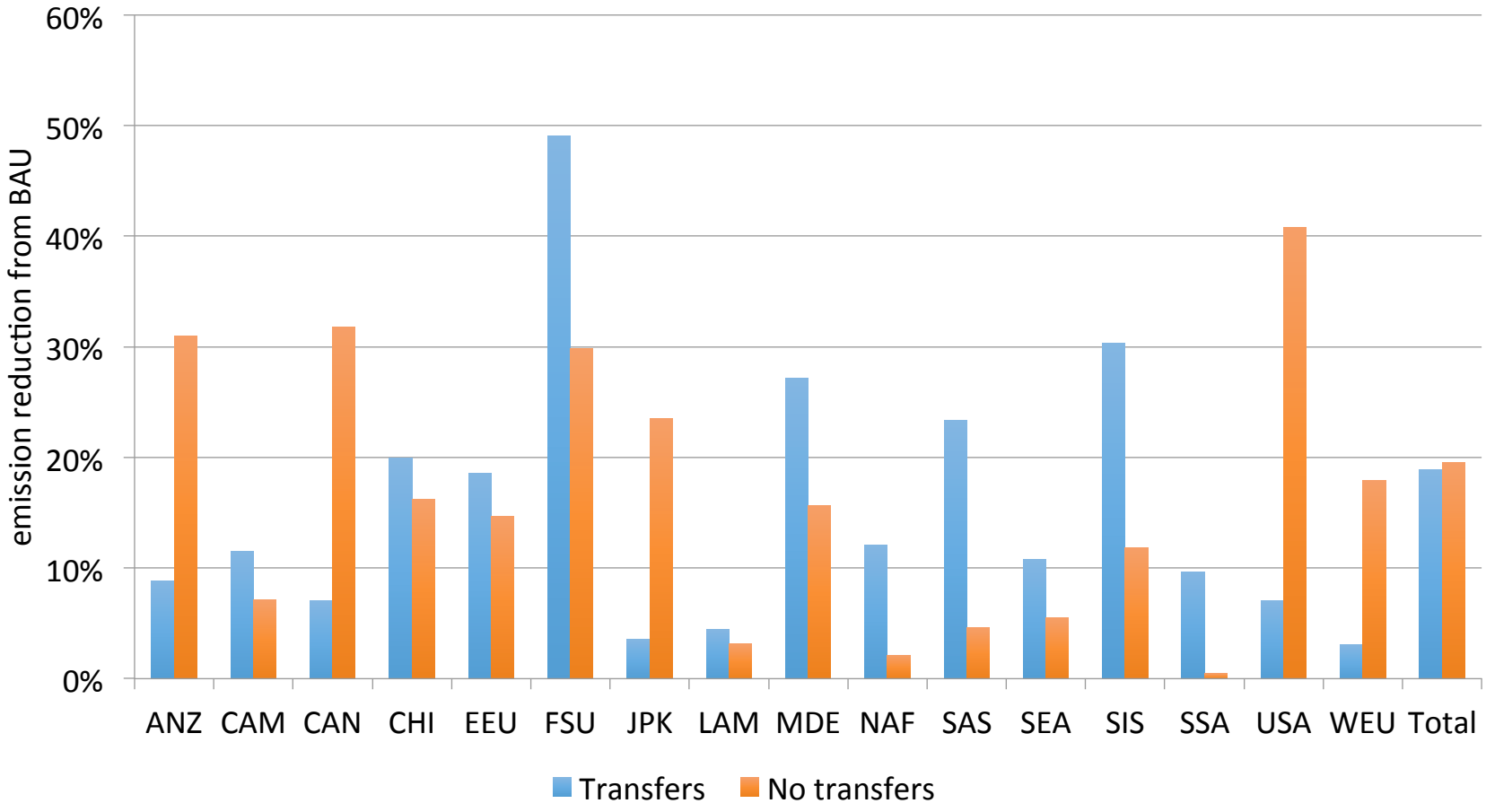
Present	
Future	

Optimal taxes in 2005



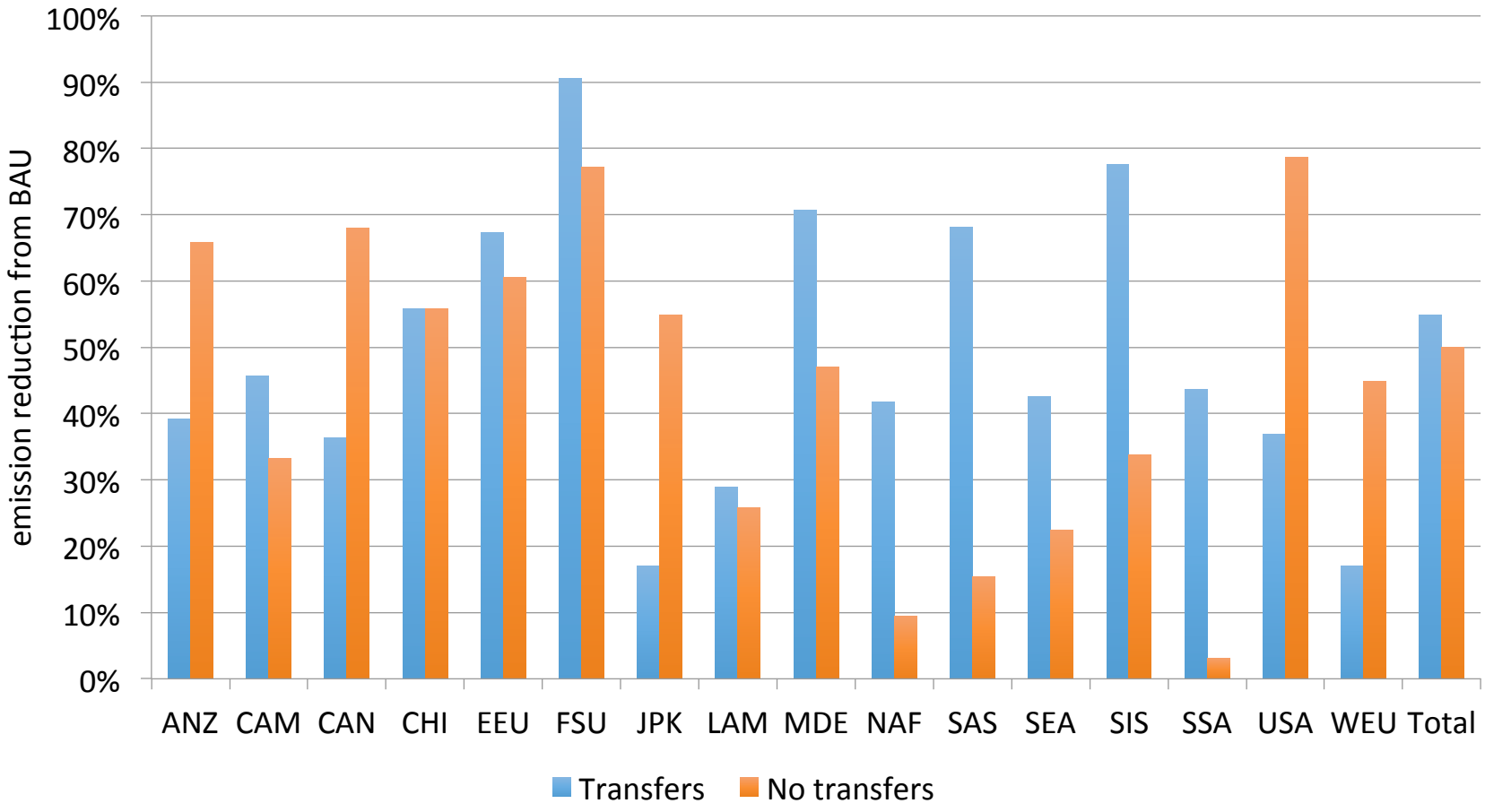
FUND 3.4; η=1; ρ=1%; USD 1995

Mitigation- 2050



FUND 3.4; η=1; ρ=1%; USD 1995

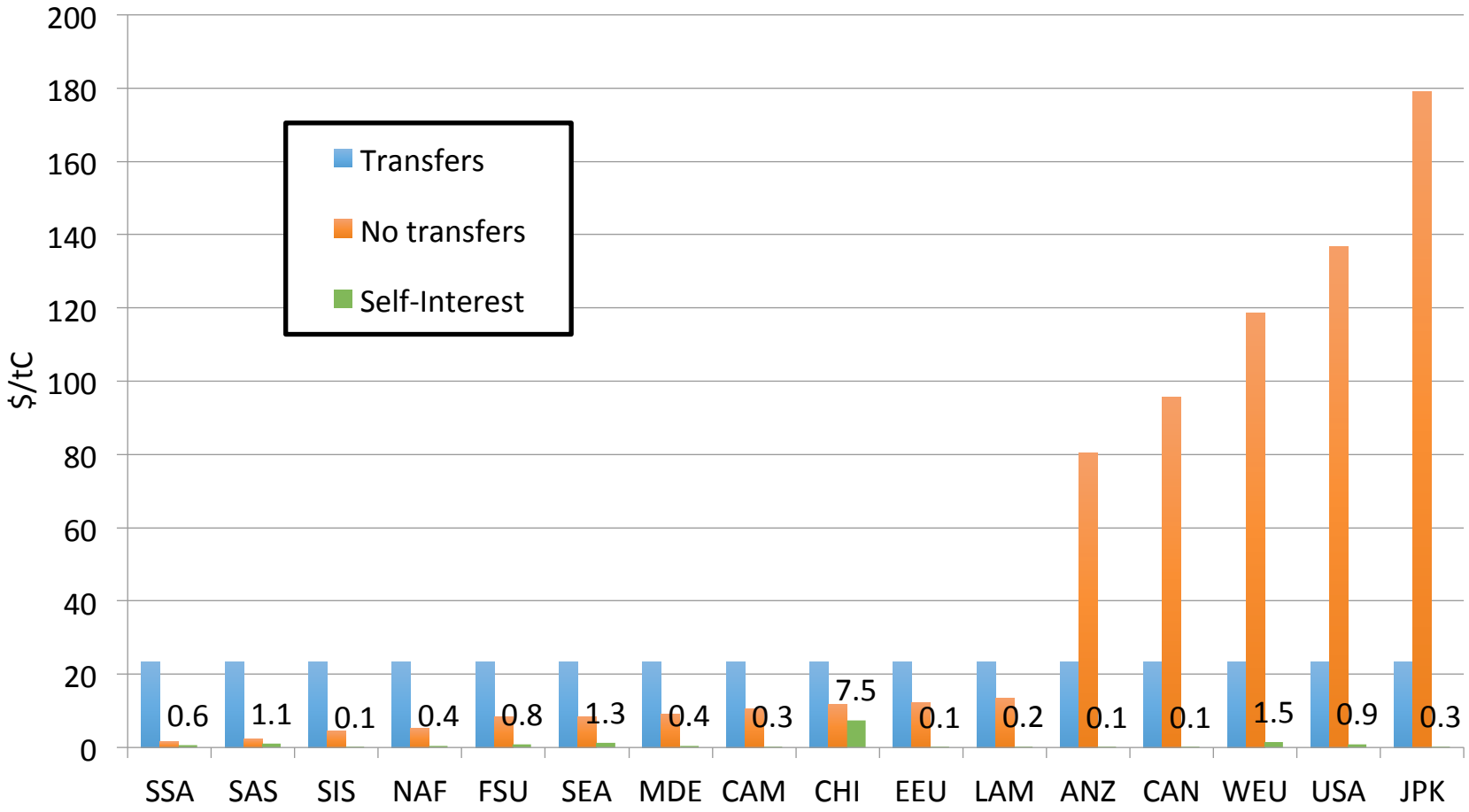
Mitigation - 2100



FUND 3.4; η=1; ρ=1%; USD 1995

Business as usual warming: 3.17		
Utility calibration	No transfers	Transfers
η=1		
prtp=0.1%	2.41	2.34
prtp=1.0%	2.92	2.91
prtp=3.0%	3.12	3.12
η=1.5		
prtp=0.1%	2.65	2.75
prtp=1.0%	2.96	3.03
prtp=3.0%	3.13	3.13
η=2		
prtp=0.1%	2.69	2.98
prtp=1.0%	2.95	3.09
prtp=3.0%	3.13	3.14

Optimal Taxes in 2005



FUND 3.4; η=1; ρ=1%; USD 1995

Outline

- Taxonomy and some examples from the literature
- Equity weighting
- **Outlook**

Outlook

- Implementing existing economic theory
- Extend “standard” utilitarian framework
- Apply “non-standard” ethics to climate change
  - On a theoretical level match it to quantities in IAMs
  - On a practical level see whether it matters for policy choice
- Open questions
  - Does this pass the philosophers laugh test?
  - Non cooperative game theory (?)

Thank you!

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