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Combining sensitivity for the interests of the present with respect for the interests of the future

Geir B. Asheim

University of Oslo

International Conference on
Science and Technology for Sustainability 2008
In Search of Sustainable Well-Being
Tokyo, 12-13 September 2008

Brundtland commission's definition of sustainability

"Believing that **sustainable development**, which implies *meeting the needs of the present without compromising the ability of future generations to meet their own needs,* should become a central guiding principle of the United Nations, Governments and private institutions, organizations and enterprises"

- Points to a conflict between the interests of the **present** and the interests of **future** generations
- But does not indicate how this conflict should be resolved

Three different problems

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1. Clarifying the concept of individual well-being
   (as discussed in Professor Pattanaik's keynote address)

2. Aggregating individual well-being into
   a concept of aggregate well-being for one generation

3. Aggregating generational well-being into a measure
   that can be used for evaluating policies that have
   intergenerational effects

Utility will refer to a specific cardinal scale for generational well-being and a *utilitarian criterion* will make use of such a scale

Outline

- Discuss how various criteria for intergenerational equity
  - discounted utilitarianism
  - undiscounted utilitarianism
  - ordinary/lexicographic maximin

  fail to take into account the interests of both present and future generations
- *Alternative I:* Sustainable preference (Chichilnisky, 1996)
- *Alternative II:* Sustainable recursive social welfare function (Asheim, Mitra and Tungodden, 2008)
- *Special case:* Sustainable discounted utilitarianism (Asheim and Mitra, 2008) Illustrate how this criterion takes into account the interests of both the present and the future

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- Discounted utilitarianism
- Undiscounted utilitarianism
- Ordinary/lexicographic maximin

The failure of discounted utilitarianism

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- Maximize the sum of utilities discounted at a positive rate
- Positive utility discounting entails that generations are treated in an unequal manner

Consequence in growth models

In the Dasgupta-Heal-Solow-Stiglitz model of capital accumulation and resource depletion, it forces consumption to approach zero as time goes to infinity, even though sustainable streams with constant or increasing consumption are feasible

Consequence in the DHSS model

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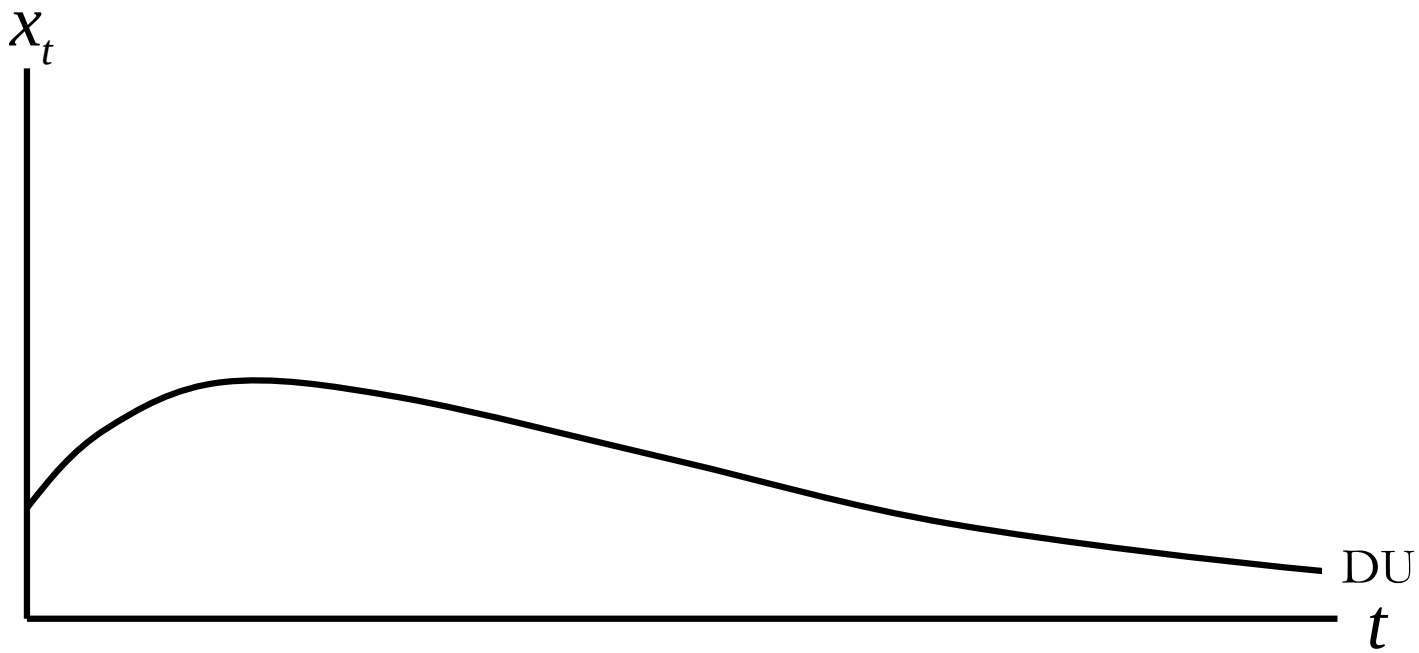

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The black stream might be preferred

The failure of undiscounted utilitarianism

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- Maximize the undiscounted sum of utilities
- It demands that the present make sacrifices for the future

Consequence in growth models

In the one-sector Ramsey model
and in the Dasgupta-Heal-Solow-Stiglitz model
of capital accumulation and resource depletion,
it results in consumption growth beyond all bounds, thereby
leading to gross inequalities between the present and the future

Consequence in the DHSS model

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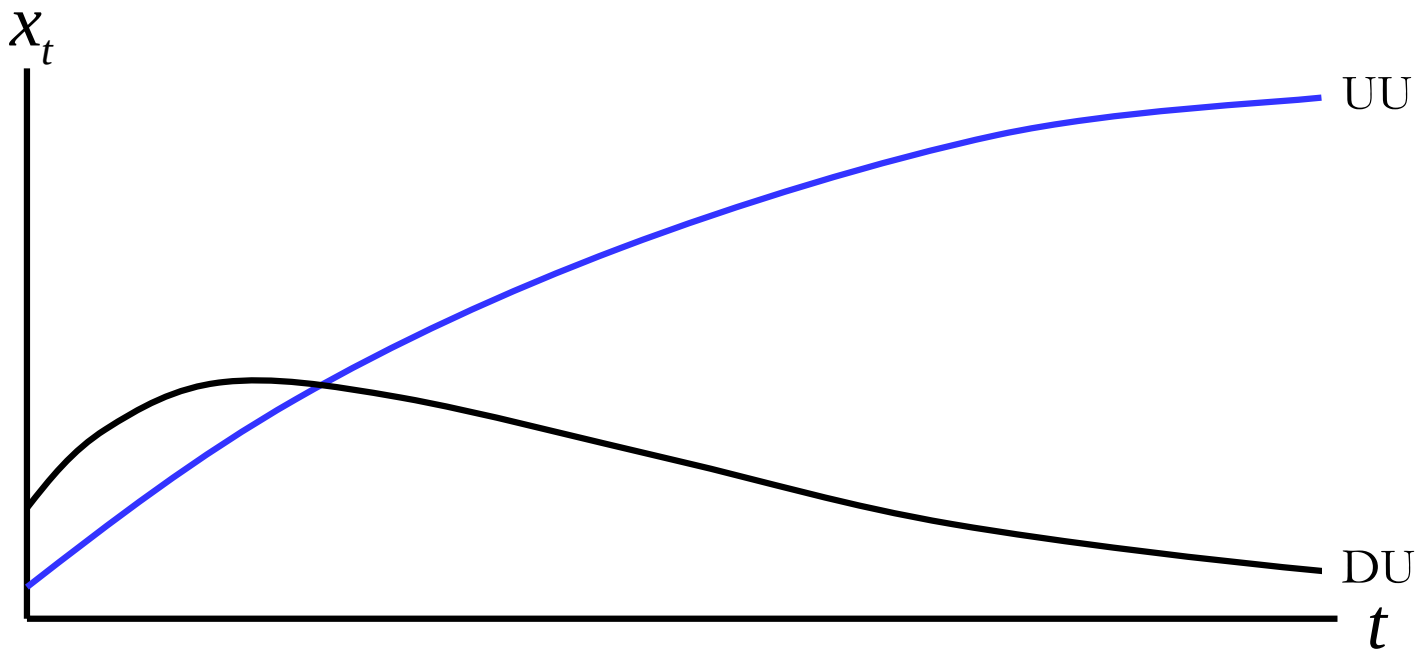

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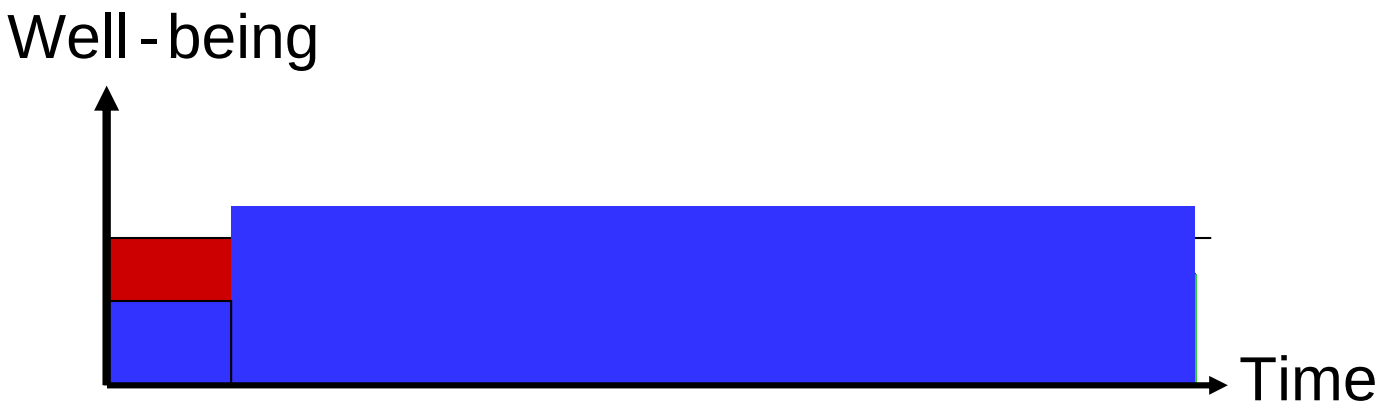

The blue stream is always preferred

The failure of ordinary/lexicographic maximin

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- Maximize the well-being of worst-off generation
- It does not allow trading off the interests of the present for the benefit of future prosperity

Consequence in growth models

In the one-sector Ramsey model
and in the Dasgupta-Heal-Solow-Stiglitz model
of capital accumulation and resource depletion,
it does not permit growth and development,
thereby perpetuating poverty

Consequence in the DHSS model

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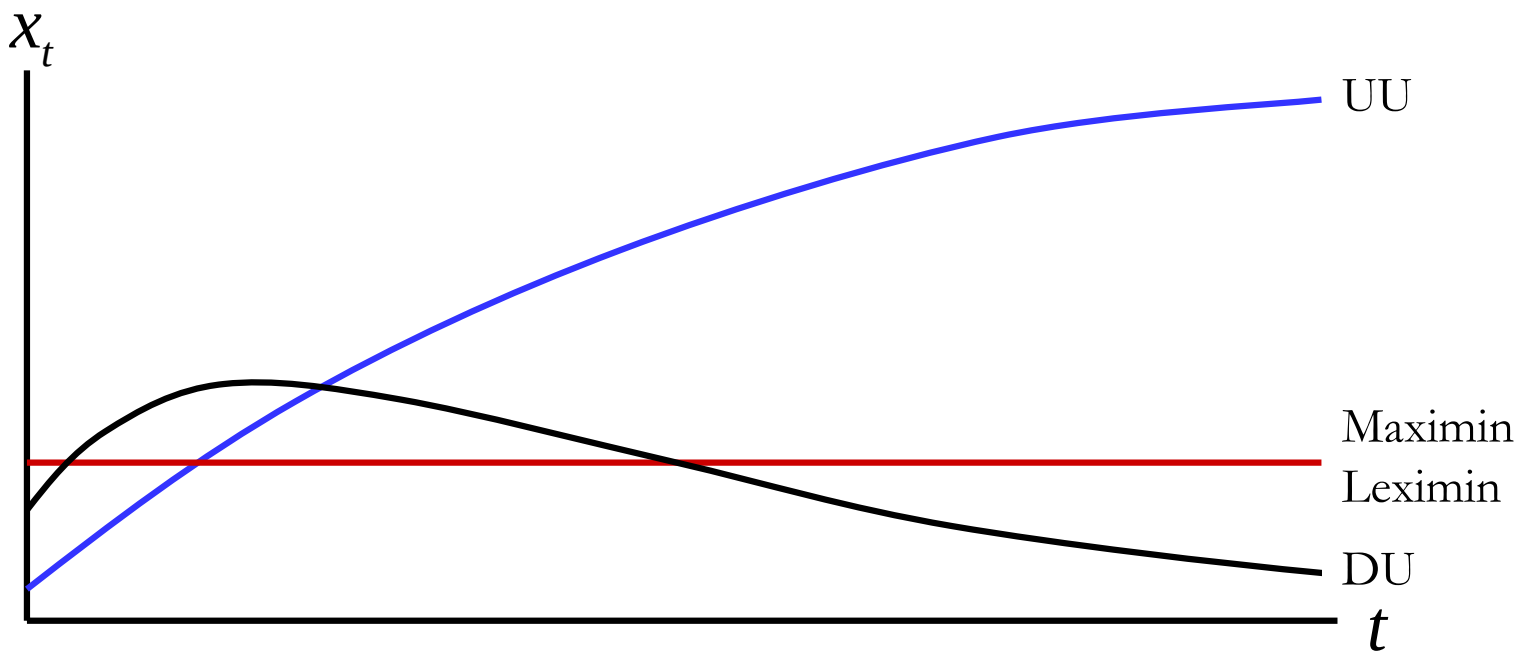

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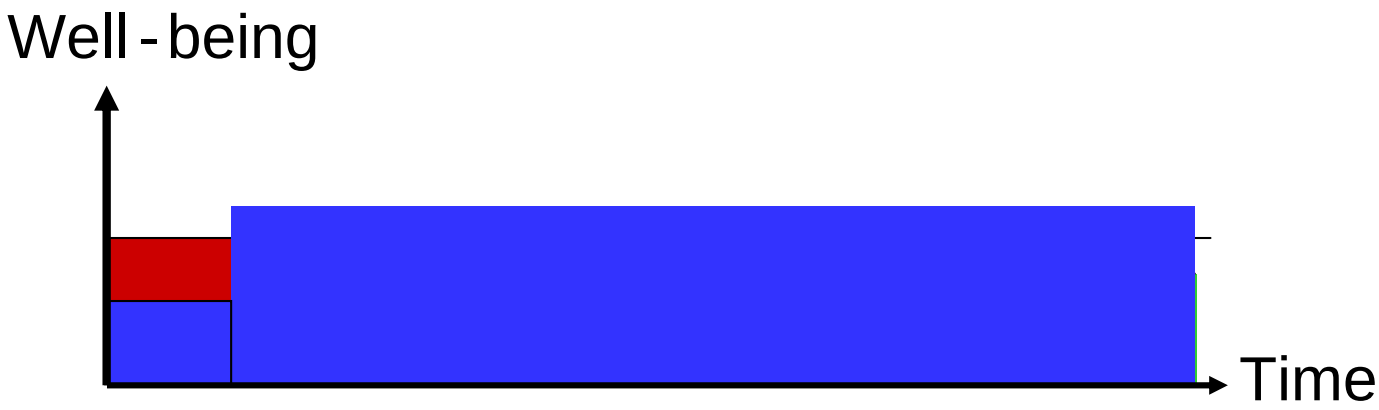

The blue stream is never preferred

Sustainable preference
Chichilnisky *SCW* (1996)

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- **Numerically representable social welfare function**
  Not satisfied by Undiscounted utilitarianism
  Not satisfied by Lexicographic maximin
- **Strong Pareto** (**SP**):
  Sensitivity for the interests of each generation
  Not satisfied by Ordinary maximin
- **No Dictatorship of the Present** (**NDP**):
  Not that only what happens before a finite T matters
  Not satisfied by Discounted utilitarianism
- **No Dictatorship of the Future** (**NDF**):
  Not that only what happens beyond a finite T matters

Existence and properties of a **Sustainable preference**

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The following social welfare function is a sustainable preference:

$$\alpha\Big(\underbrace{(1-\delta)\sum_{t=0}^{\infty}\delta^t U(x_t)}_{\text{Discounted utilitarianism}}\Big) + (1-\alpha)\underbrace{\liminf_{t\to\infty} U(x_t)}_{\text{Depends on the infinite future}}$$

- Does not satisfy **Independent Future** (**IF**)
  Lead to time-inconsistent optimal streams
- Non-existence of optimal streams in growth models
  No optimal stream in the one-sector Ramsey model and in the Dasgupta-Heal-Solow-Stiglitz model of capital accumulation and resource depletion

Consequence in the DHSS model

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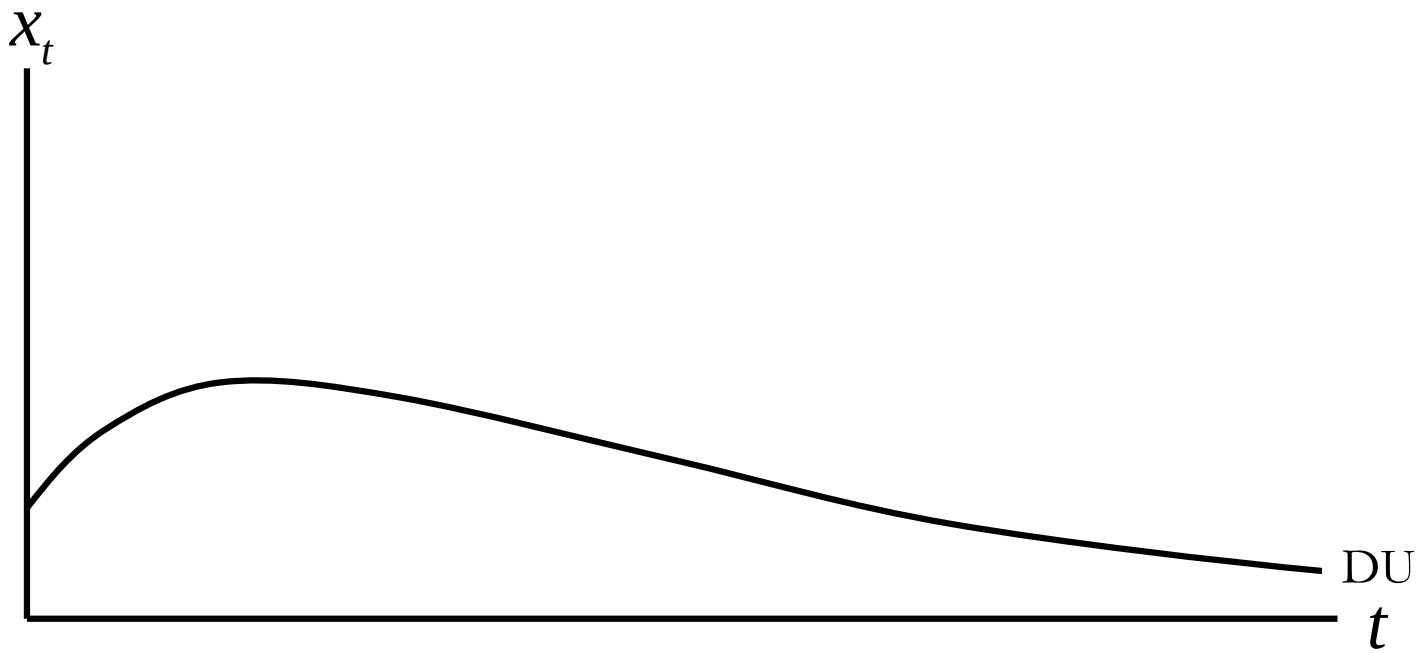

Sustainable recursive social welfare function
Asheim, Mitra and Tungodden (2008)

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- **Order** (**O**): *A complete and transitive binary relation*
- **Monotonicity** (**M**): *More is not worse*
- **Restricted Dominance** (**RD**)
- **Independent Future** (**IF**):
  Future choice does not depend on present well-being
  Not satisfied by Ordinary maximin
- **Hammond Equity for the Future** (**HEF**):
  Priority for the future if the present is better off
  Not satisfied by Discounted utilitarianism
- **Restricted Continuity** (**RC**): *Supnorm continuity when approaching a stream with constant future well-being*
  Not satisfied by Undiscounted utilitarianism
  Not satisfied by Lexicographic maximin

Existence and properties of a **Sustainable recursive SWF**

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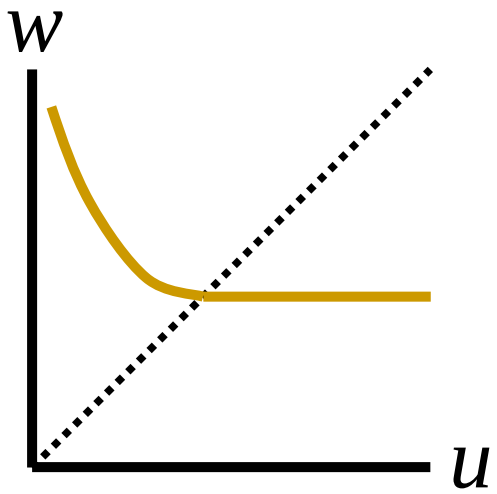
Exists a *utility function* U and an *aggregator function* V s.t.

$$\begin{aligned} W(x,x,x,\dots) &= U(x) \\ W(x_0,x_1,x_2,\dots) &= V\left(U(x_0), W(x_1,x_2,x_3,\dots)\right) \end{aligned}$$



Properties of a sustainable recursive SWF

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The black stream is never preferred

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Resolving the conflict between the present and the future

The blue stream is sometimes preferred

Special case: **Sustainable disc. utilitarianism** Asheim and Mitra (2008)

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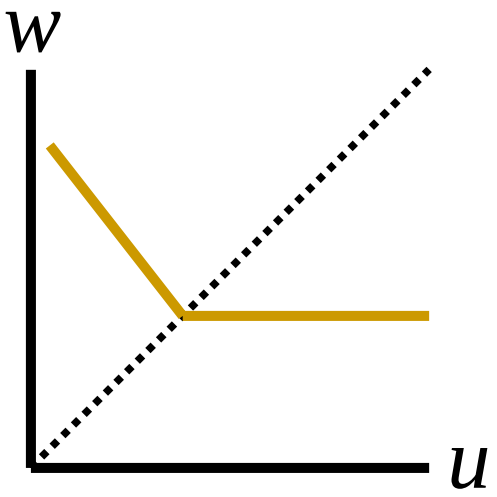
Departs from DU by requiring that the SWF be insensitive to the interests of the present if the present is better off than the future

$$W(x_0, x_1, x_2, \dots) = \begin{cases} (1-\delta)U(x_0) + \delta W(x_1, x_2, x_3, \dots) \\ \qquad \text{if } U(x_0) \leq W(x_1, x_2, x_3, \dots) \\ W(x_1, x_2, x_3, \dots) \\ \qquad \text{if } U(x_0) > W(x_1, x_2, x_3, \dots), \end{cases}$$



Existence and properties of a **Sustainable discounted utilitarian SWF**

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- General existence of a Sustainable disc. utilitarian SWF
- Satisfies (**O**), (**M**), (**RD**), (**IF**), (**HEF**) and (**RC**)
  $\Rightarrow$ Special case of a Sustainable recursive SWF
- Appealing optimal streams in growth models
  Optimal stream in the Dasgupta-Heal-Solow-Stiglitz model of capital accumulation and resource depletion allows for growth and development initially when the economy is highly productive, while protecting the future from the grave consequences of discounting when resource depletion and capital accumulation undermines capital productivity

Consequence in the DHSS model

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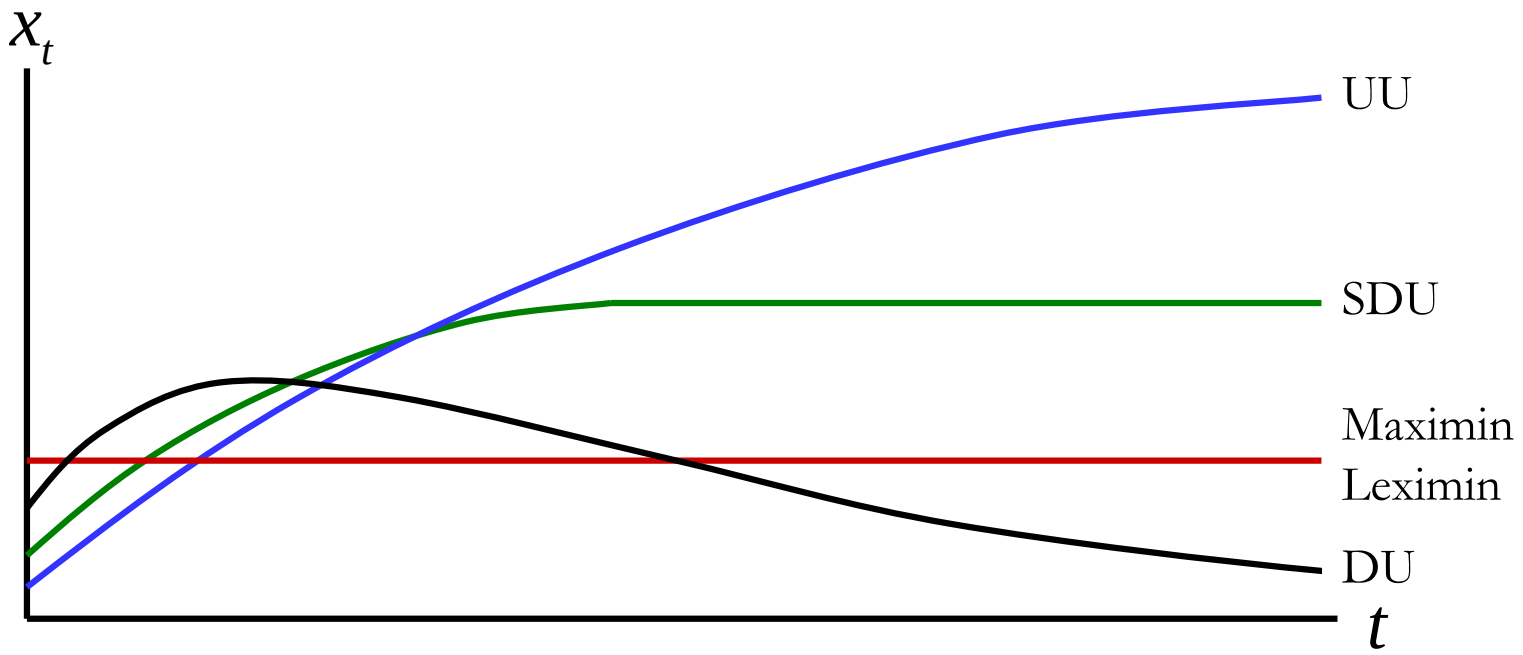

Global warming and intergenerational equity

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- **The effects of global warming are uncertain**
  Perhaps future generations will be able to adapt
  Or perhaps future productivity will be undermined
- **State-dependent utility discounting**
  Perhaps we wish to (in effect) discount the future less if future productivity is undermined, to ensure the livelihood of generations in the far future
- **A purpose of this research**
  To show existence of and characterize classes of social welfare functions that allow for such discounting

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- **The debate in the wake of the Stern Review**
  has been limited to what parameters to use in a(n) (un)discounted utilitarian criterion

- **This research shows that**
  that there is a wider set of criteria for intergenerational equity that should perhaps be considered for evaluating climate policies and policies for sustainable development

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SP

RD

IF

HEF

- Strong Pareto (SP)
- Restricted Dominance (RD)
- Independent Future (IF)
- Hammond Equity for the Future (HEF)

Strong Pareto (SP)

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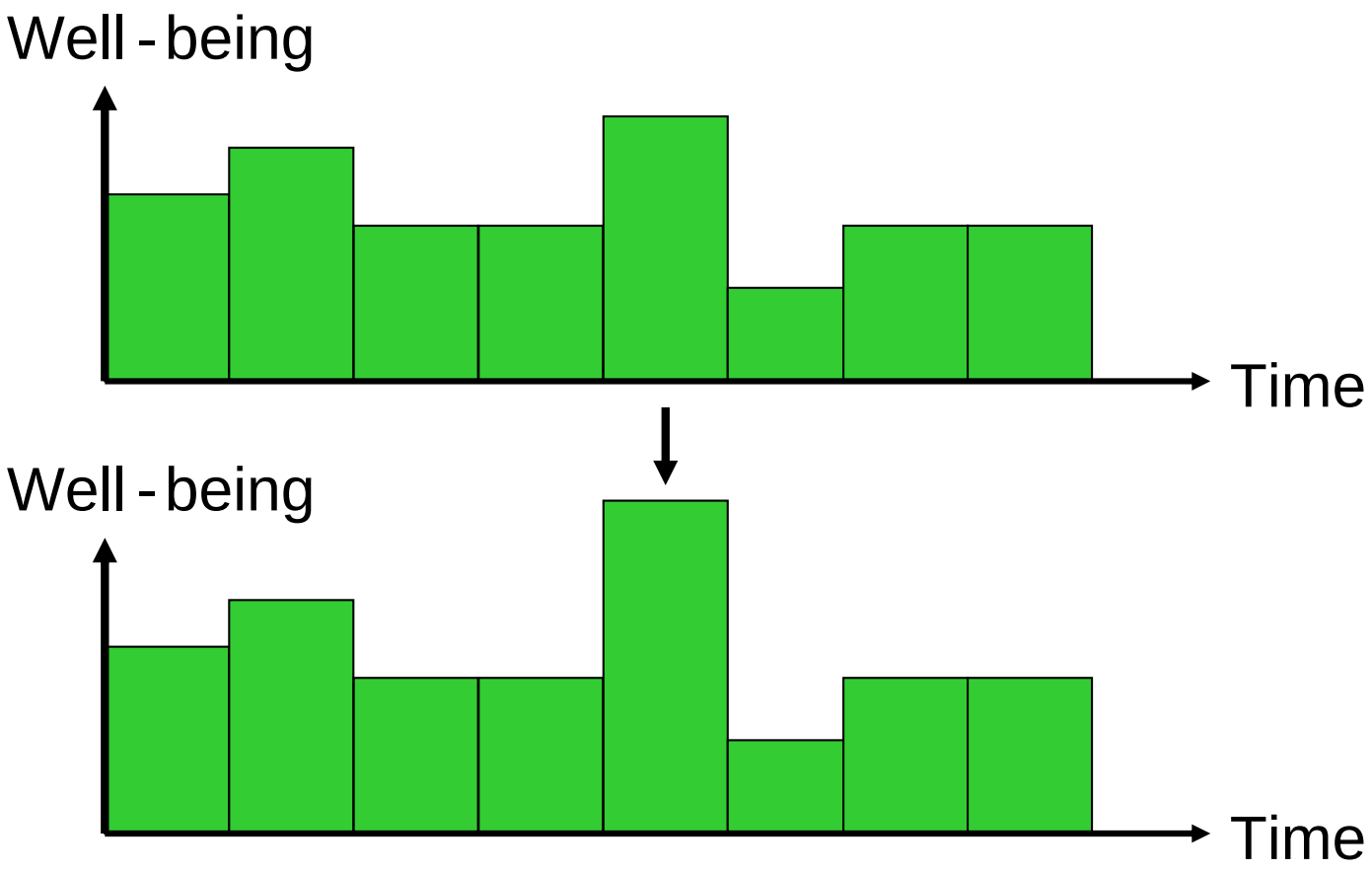

The lower stream is preferred

Restricted Dominance (RD)

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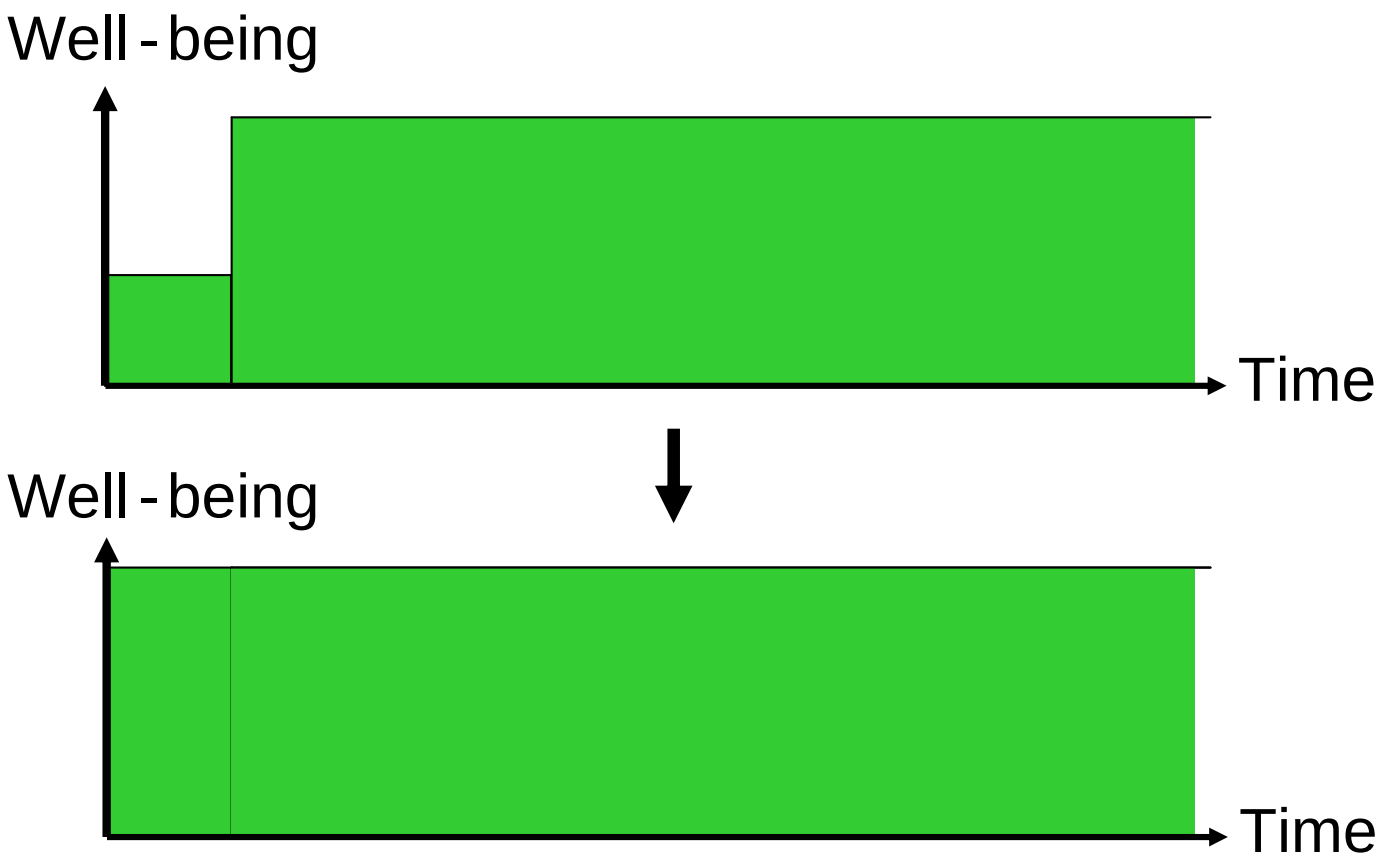

The lower stream is preferred

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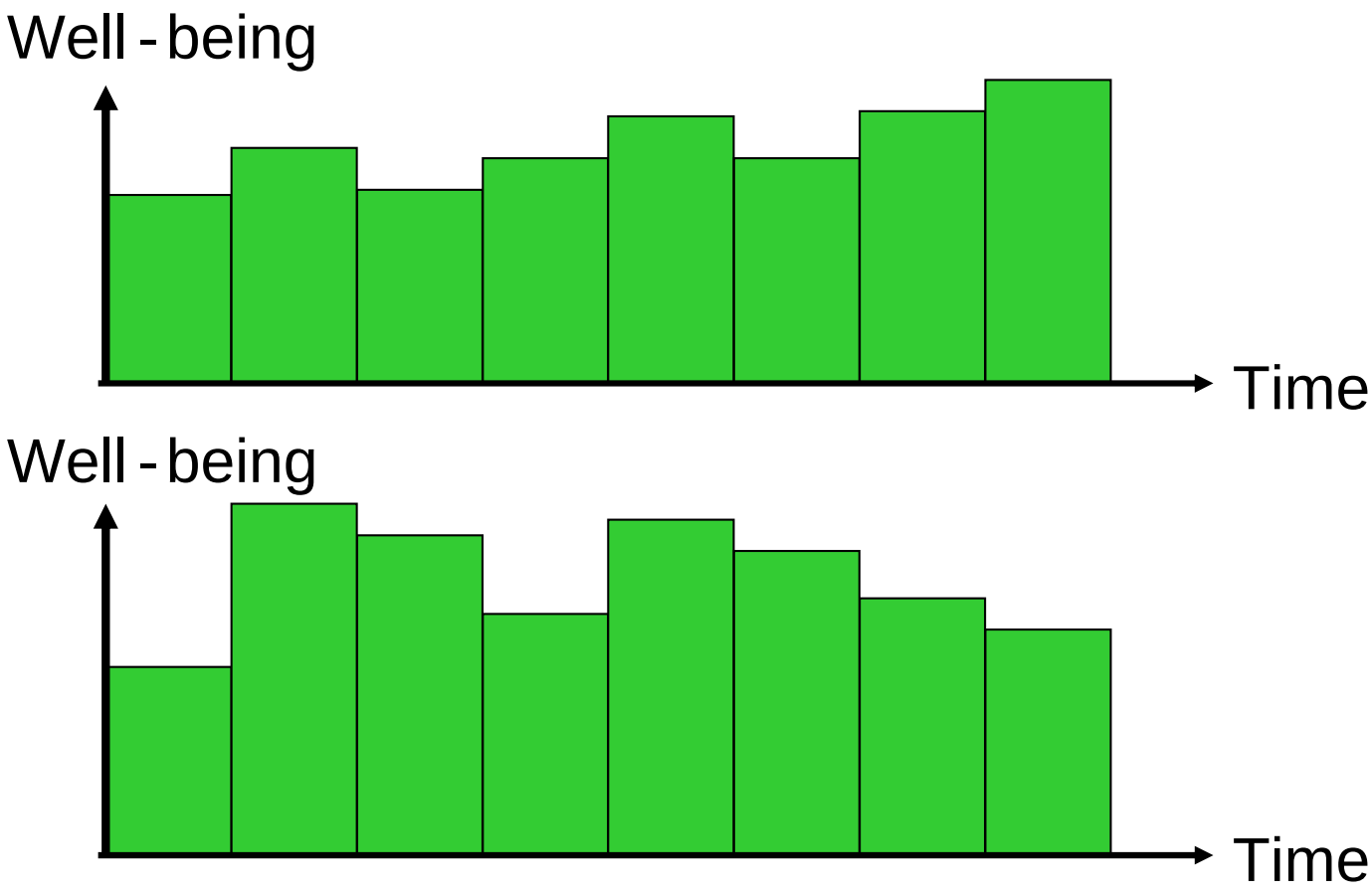

If the top is as good as the bottom, …

Independent Future (IF)

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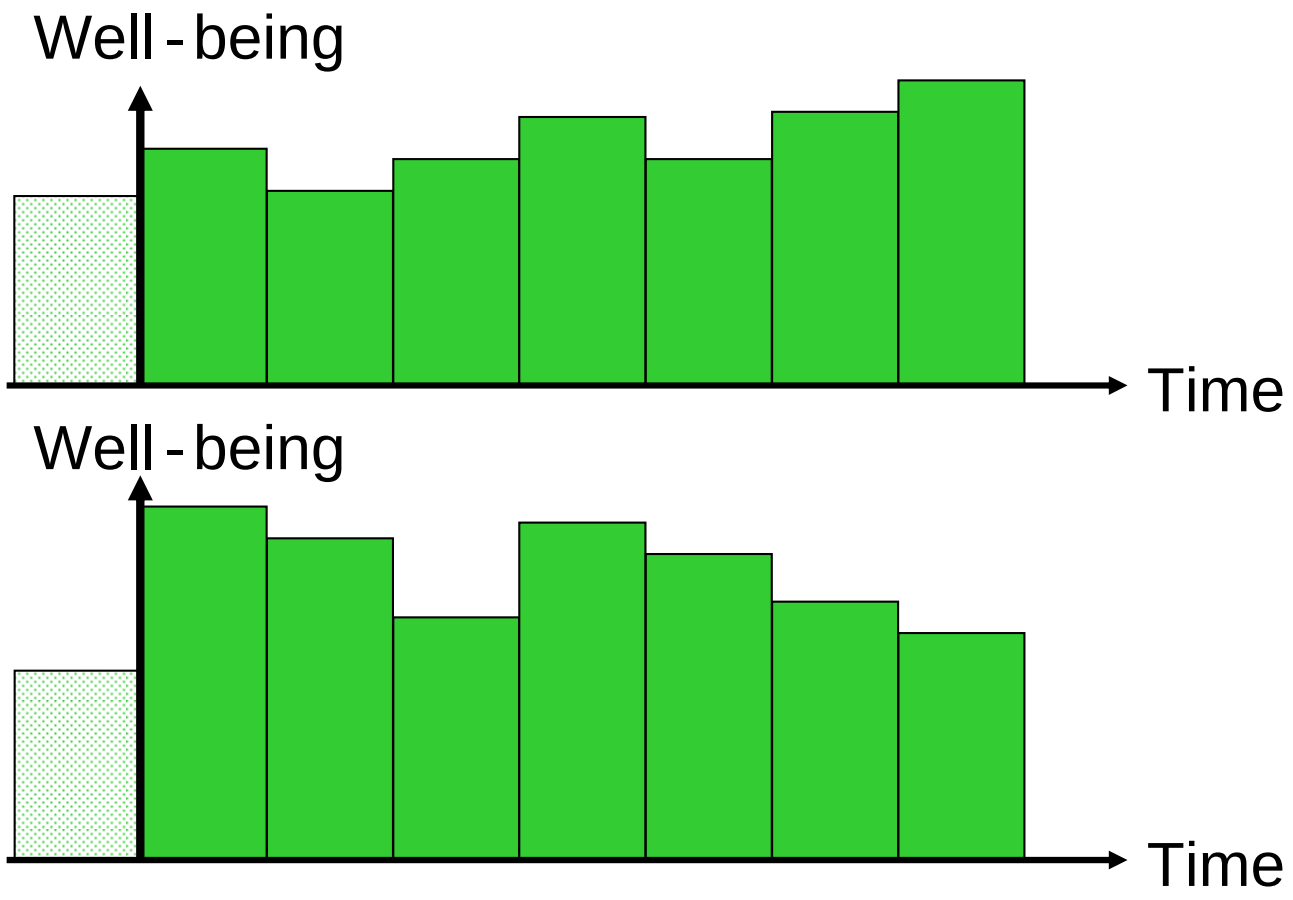

then the top is still as good after the first period

Hammond Equity for the Future (HEF)

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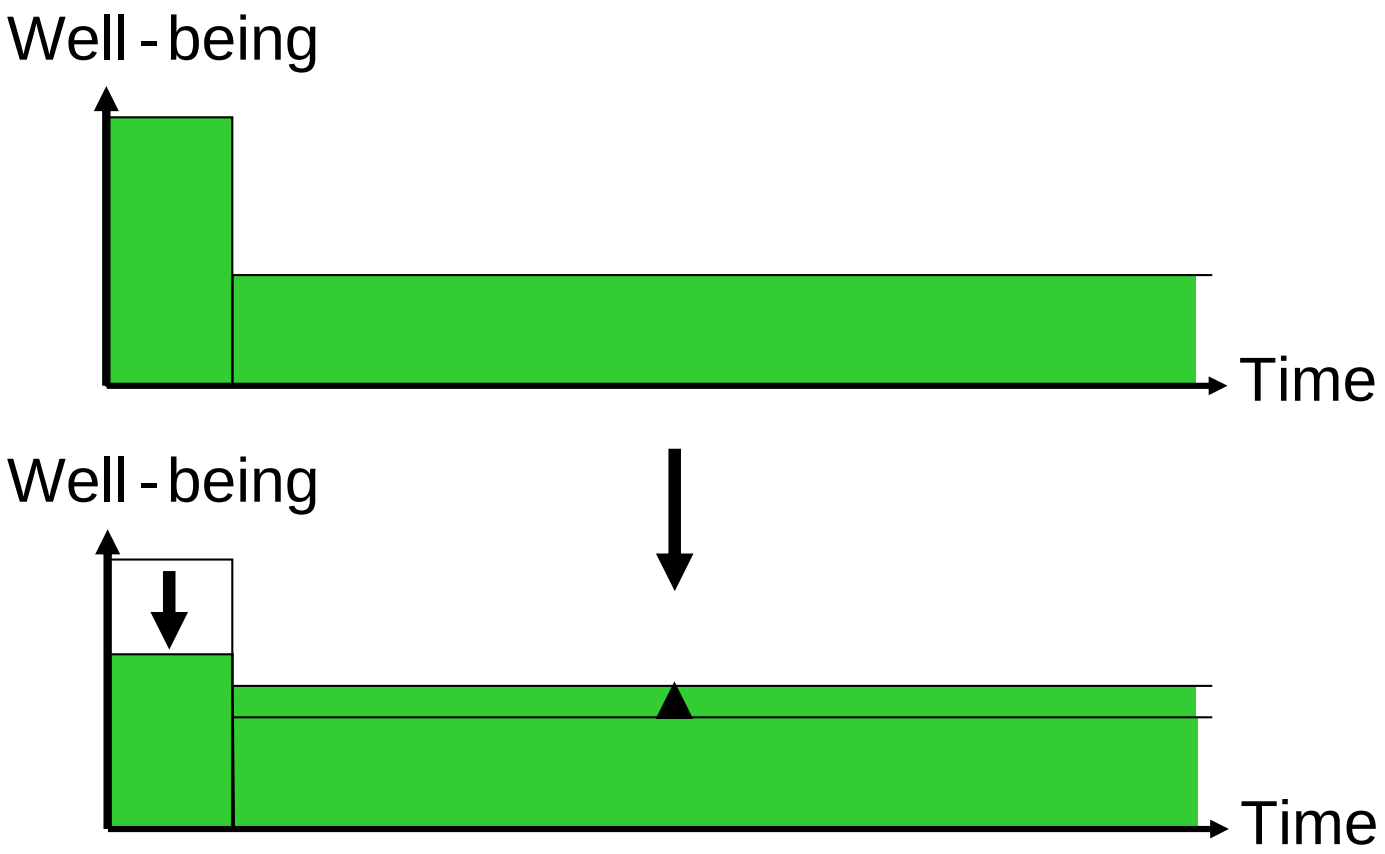

The upper stream is not preferred