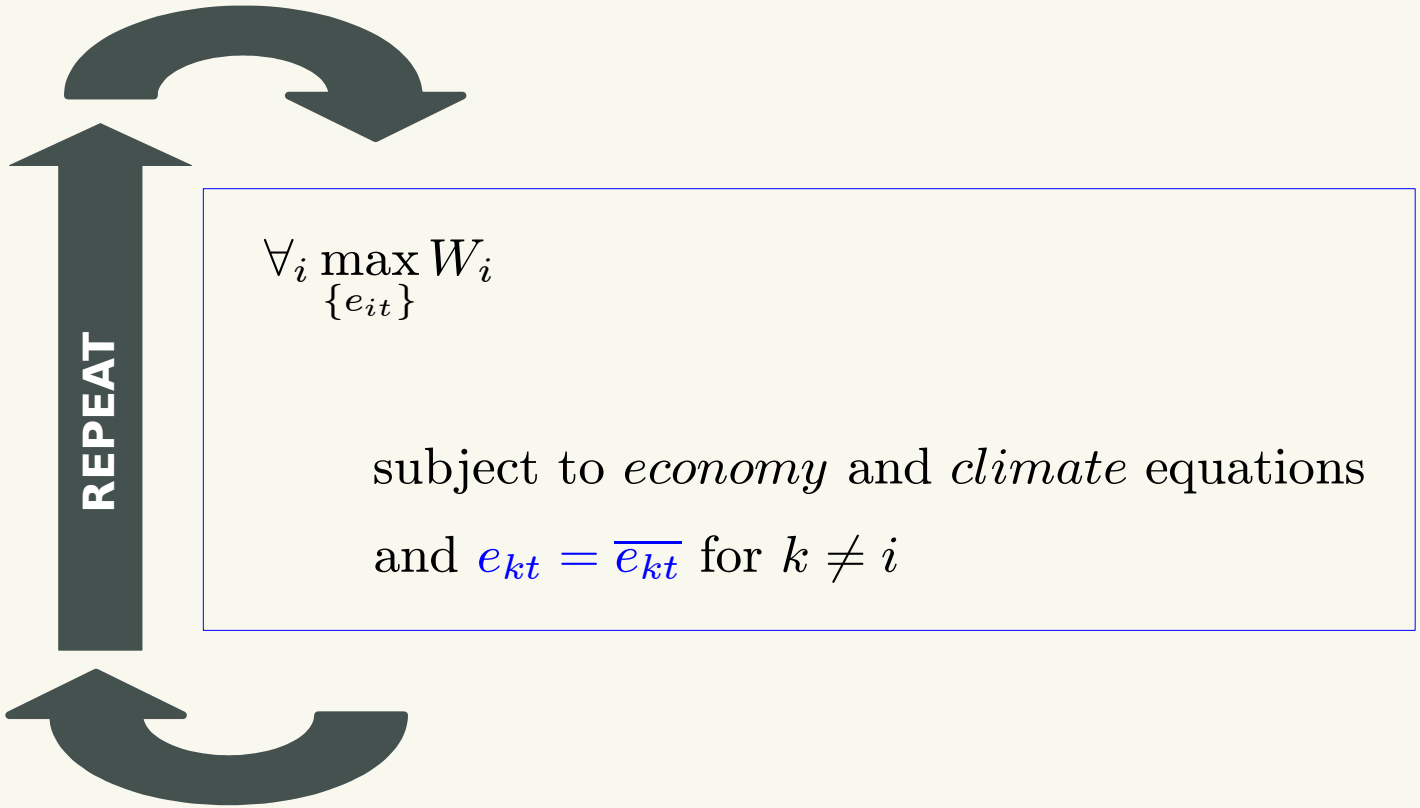
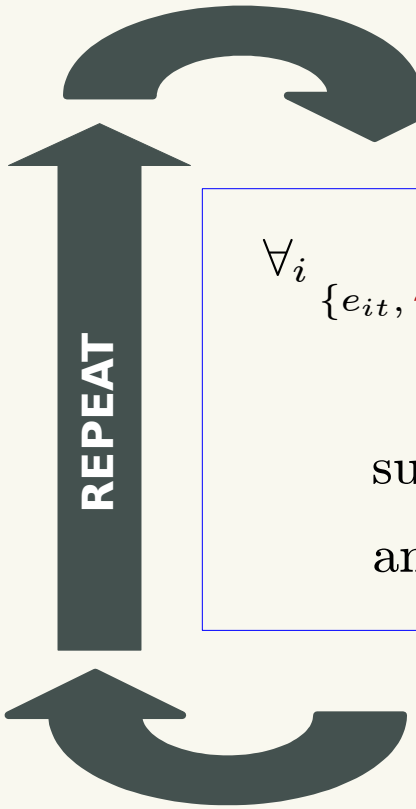
# Numeric solution:
# Nash Equilibrium (no trade, externality)

- *Fictitious Play:* Search for Nash Equilibrium as a fixed point of the iteration:



# Numeric solution:
# Nash Equilibrium (trade + externality)

- *Fictitious Play:* Search for Nash Equilibrium as a fixed point of the iteration:




$$\forall_i \max_{\{e_{it},\, m_{ijt},\, x_{ijt}\}} W_i$$

$m_{ijt}$ : imports from j

$x_{ijt}$ : export to j

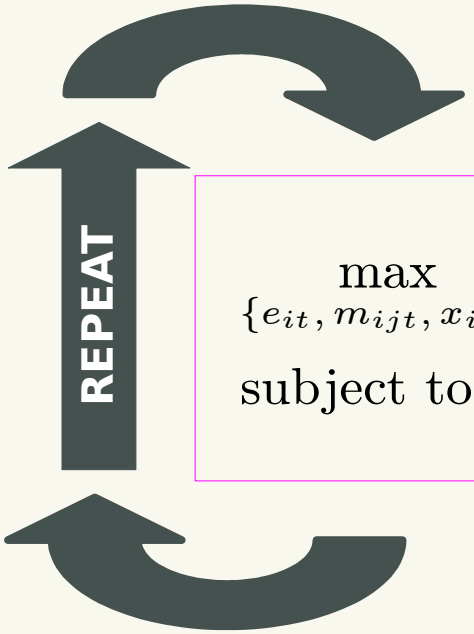
subject to *economy* and *climate* equations

and $e_{kt} = \overline{e_{kt}}$ for $k \neq i$

- Problem: $m_{ijt}, x_{ijt}$: market price levels unknown

# Numeric solution:
# Nash Equilibrium (trade, no externality)

- Determine competitive equilibrium using Negishi's Approach




$$\max_{\{e_{it},\, m_{ijt},\, x_{ijt}\}} \sum_i \delta_i W_i$$

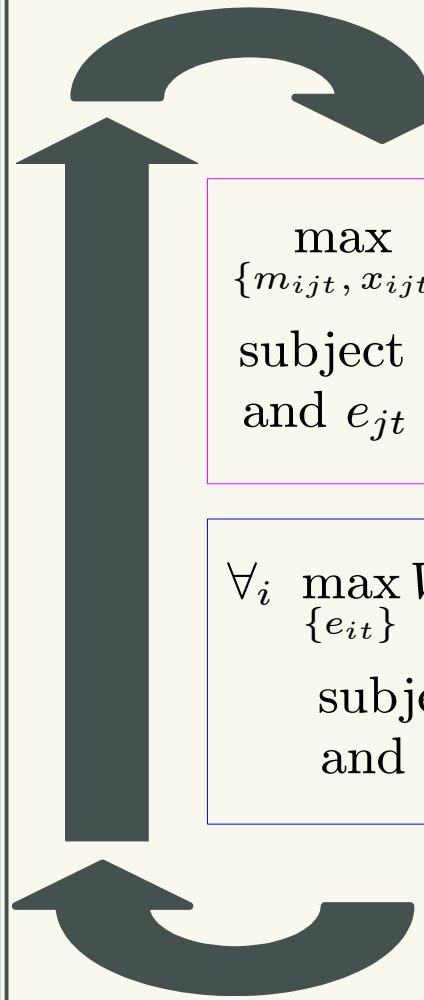
subject to *economy* and *climate* equations

- Find $\boldsymbol{\delta_i}$ such that the intertemporal budget constraint holds:

$$\int_0^\infty \sum_{j \neq i} p^m_{ijt}\, m_{ijt}\ \mathrm{dt} = \int_0^\infty \sum_{j \neq i} p^x_{ijt}\, x_{ijt}\ \mathrm{dt}$$

# My solution algorithm: Nash Equilibrium (trade + externality)

- Alternately **fix** emissions (in Negishi's Approach) and trade (in Fictitious Play)



$$\max_{\{m_{ijt},\, x_{ijt}\}} \sum_i \delta_i W_i$$

subject to *economy* and *climate* equations
and $e_{jt} = \overline{e_{jt}}$

$\Rightarrow \quad m_{ijt},\ x_{ijt}$

$$\forall_i \quad \max_{\{e_{it}\}} W_i$$

subject to *economy* and *climate* equations
and $m_{ijt} = \overline{m_{ijt}}, x_{ijt} = \overline{x_{ijt}}, e_{kt} = \overline{e_{kt}}$ for $k \neq i$

$\Rightarrow \quad e_{it}$

- Published as Lessmann et al. 2009, *Economic Modelling*