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An extended OLG model for solving the Global Commons problem through intergenerational concern

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Ordem dos Economistas & SEDES, PT.

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Session S14,- Assessing Frontiers of Climate Change
8:30-10:00
ROOM New York 1 - Top Floor
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Abstract:

Udalov (2014) extended a collective goods problem through an Overlapping Generations Model where there is a decision regarding the **type of energy use**, either **fossil fuel versus renewable use energy**. Udalov introduced a politico-economic equilibrium contingent on the effort or commitment on renewable energy. We provide his framework but further extended it, by using an **eta** parameter which provides intergenerational concern among different generations, old versus youngsters. We depart from non-existent Udalov non-concern of intergenerational generations, and extend it to use a parameter –eta – which reflects this concern. We further provide a game, in the sense of game theory, where the politico economic equilibrium is contingent on the intergenerational concern, which reflects strategic interaction among youngsters and old people. Some politico-economic results at hand. As **higher intergenerational concern - eta parameter-** a tribute to Stern's (2004) report**, the faster the pace of recuperation of a global common good**, the **lower level of pollution**, and **politico-economic equilibria** recovers the **fastest (m) the investment in renewable energy**.

Key-words:OLG model; Fossil versus renewable energy; Intergenerational concern; Pollution; Global commons.
JEL Codes: C70; D64; D70; O13; O19.

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Active Research

Conclusions

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Introduction

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Intergenerational Concern| Cooperation | Climate Change | OLG model | Game Theory

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Theoretical Framework – Climate Change

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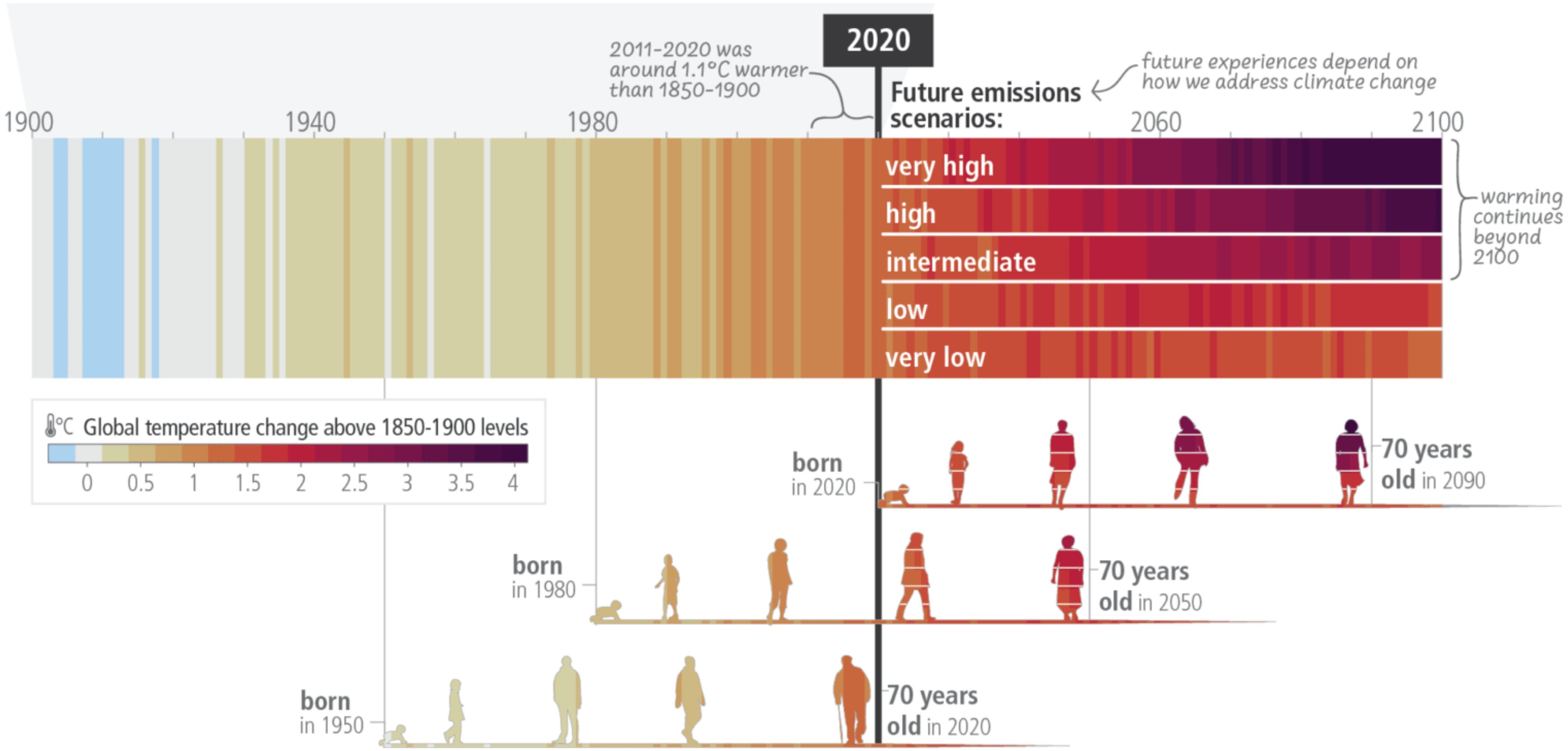

Figura 1
Observed (1900–2020) and projected (2021–2100) changes in global surface temperature (relative to 1850–1900)
Source: (IPCC, 2023)

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Nicholas Stern

Arthur Pigou

William Nordhaus

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Nicholas Stern

Arthur Pigou

William Nordhaus

Theoretical framework – Economics and Environment

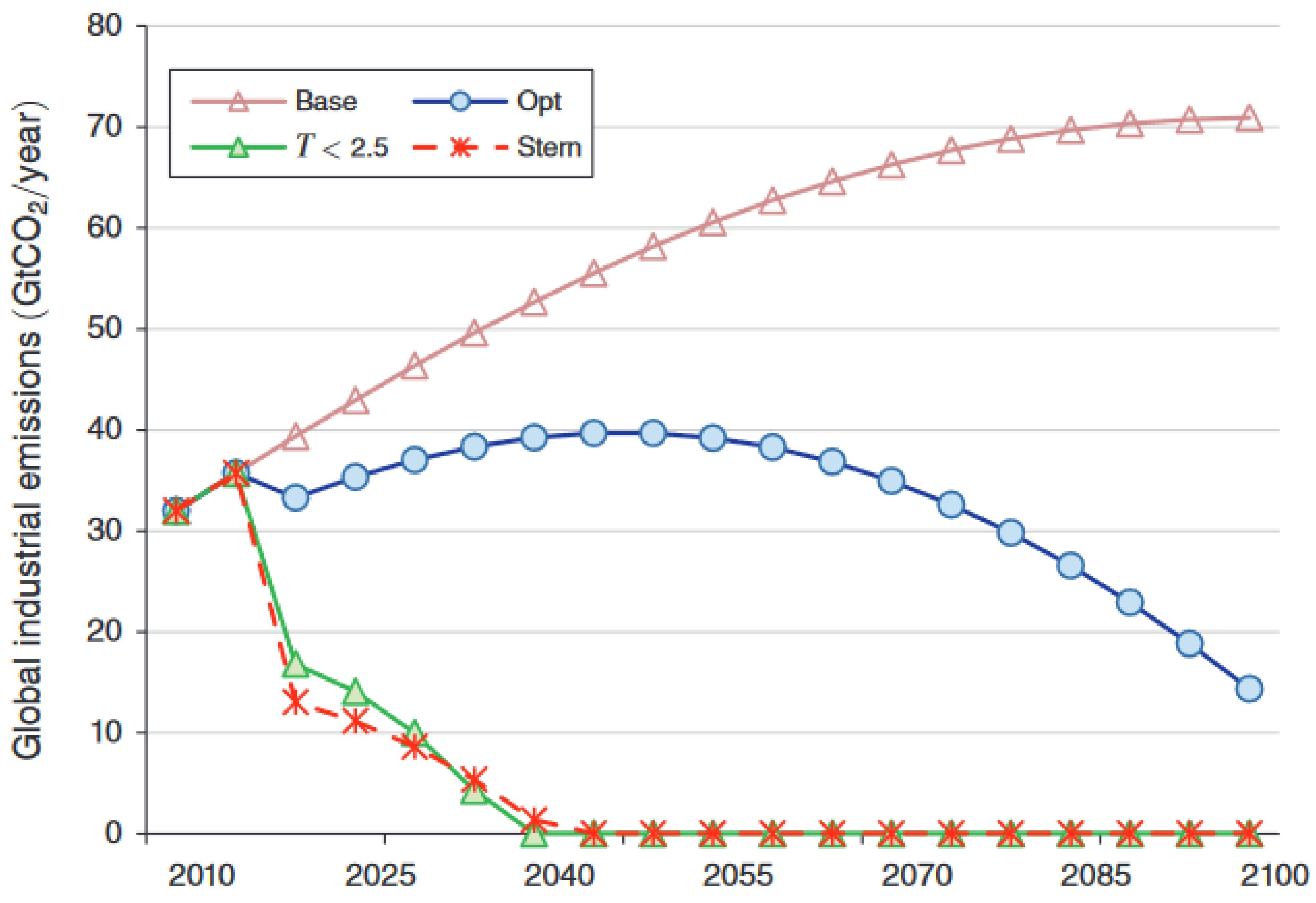

Figura 2
Global industrial greenhouse gas (GHG) emissions

Source (Nordhaus, 2018, p. 347)

Theoretical framework – **Economics and Environment**

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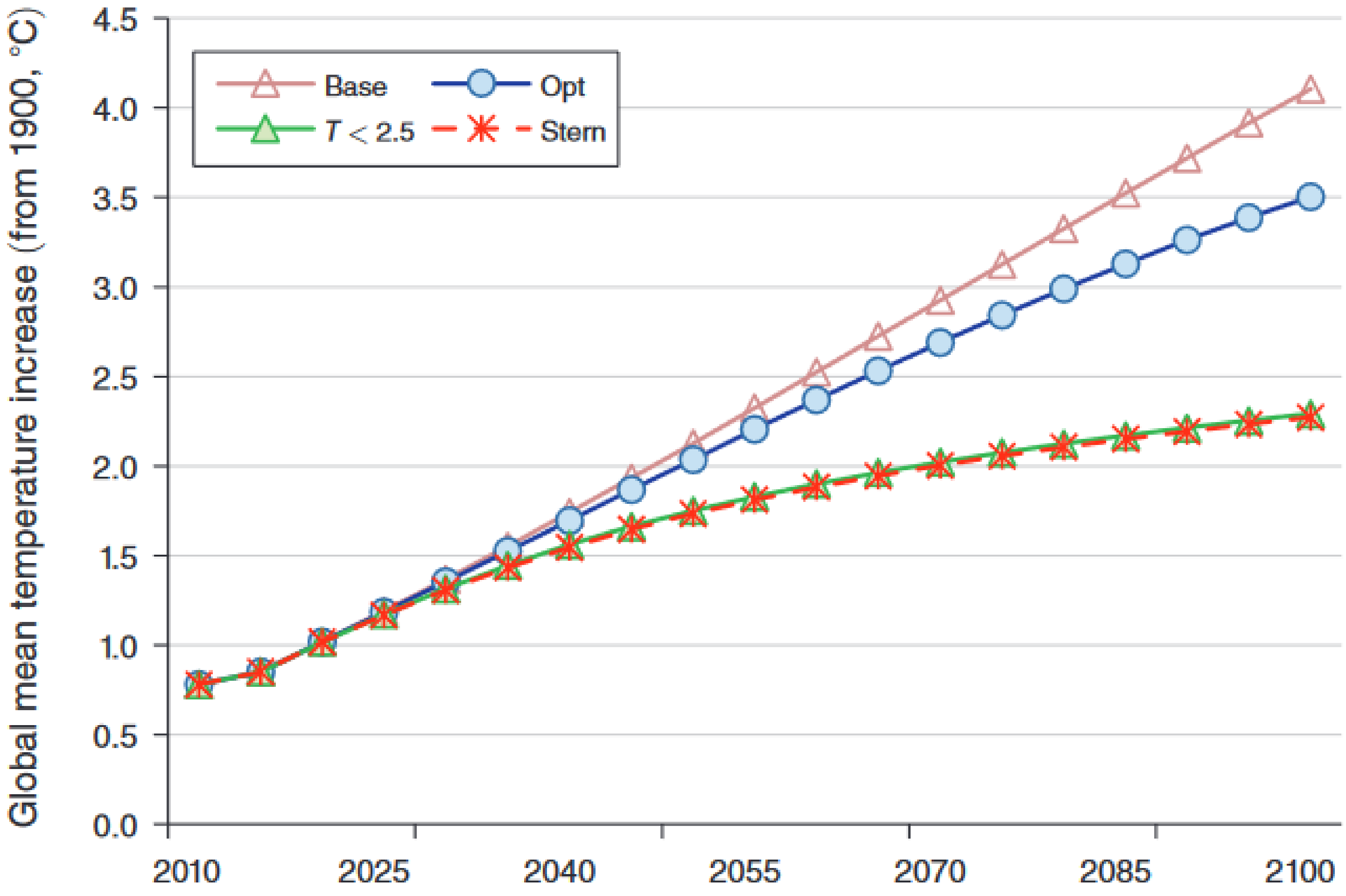

Figura 3
Average temperature rise under different scenarios (since 1900, ºC)Source: (Nordhaus, 2018, p. 348)

John von Neumann e Oskar Morgenstern

John Nash

Fudenberg e Tirole

John von Neumann e **Oskar Morgenstern**

John Nash

Fudenberg e Tirole

John von Neumann e Oskar Morgenstern

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Fudenberg e **Tirole**

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Gary Becker

Maurice Godelier

Richard Thaler

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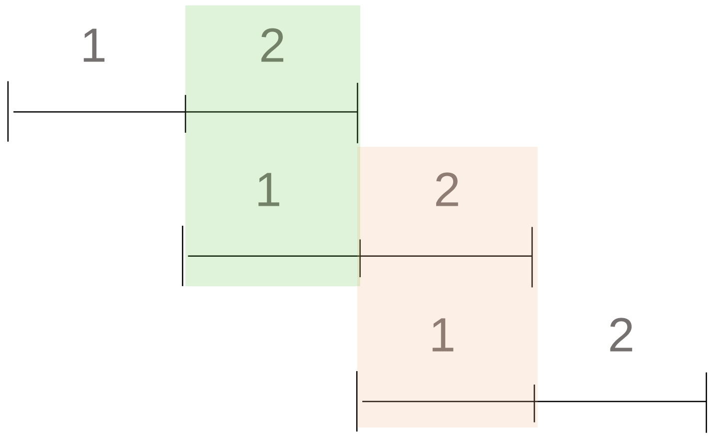
Richard Thaler

Theoretical framework – **OLG Model**



Allais, Samuelson and Diamond

John and Pecchenino

Vladimir Udalov

Theoretical framework – **OLG Model**

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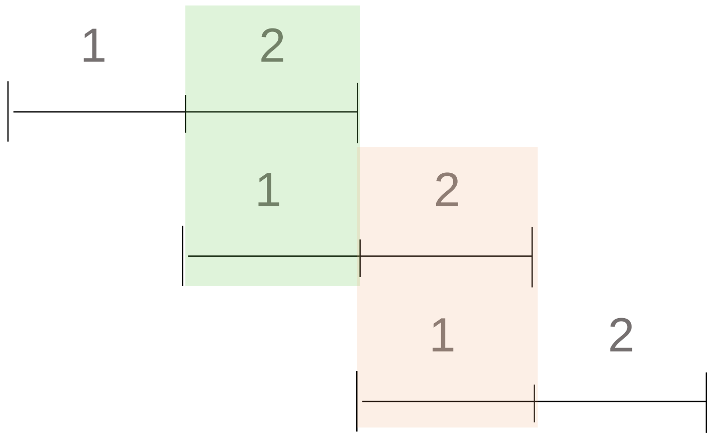

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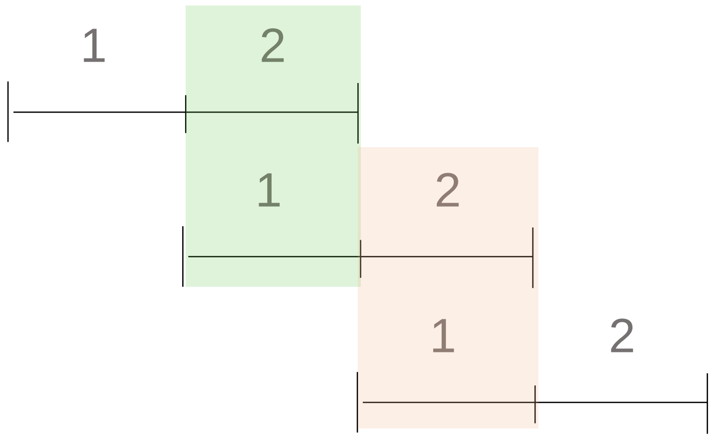

Allais, Samuelson and Diamond

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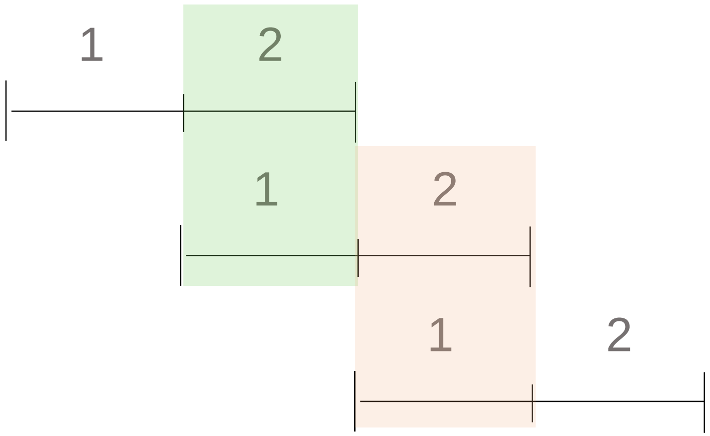
Theoretical framework – **OLG Model**



Allais, Samuelson and Diamond

John and Pecchenino

Vladimir Udalov

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Acitve Research – Intergenerational Concern

Envionmental Quality
At Present day

Consumption
Next Period

Environmental Quality
Next Period

$$U_t = \ln c_t^1 + \ln Env_t + \frac{1}{1+\delta}\left(\ln c_{t+1}^2 + \eta \ln Env_{t+1}\right)$$

Current
Consumption

Intertemporal
Discount rate

Intergenerational
Concernl

Active Research – Youngsters

Interest rate

Environmental Degradation

$$\left[\frac{\bar{c}}{\overline{\overline{Env}}}\right]^{young} = \left(\frac{\bar{r}-\delta}{1+\delta}\right)\frac{\omega}{\eta} + \mu^{1}$$

Base value Assigned to Consumption

$$c_t^1 = c_{t+1}^2 = \bar{c}$$

$$Env_t = Env_{t+1} = \overline{Env}$$

$$r_{t+1} = \bar{r}$$

Active Research – **Youngsters**

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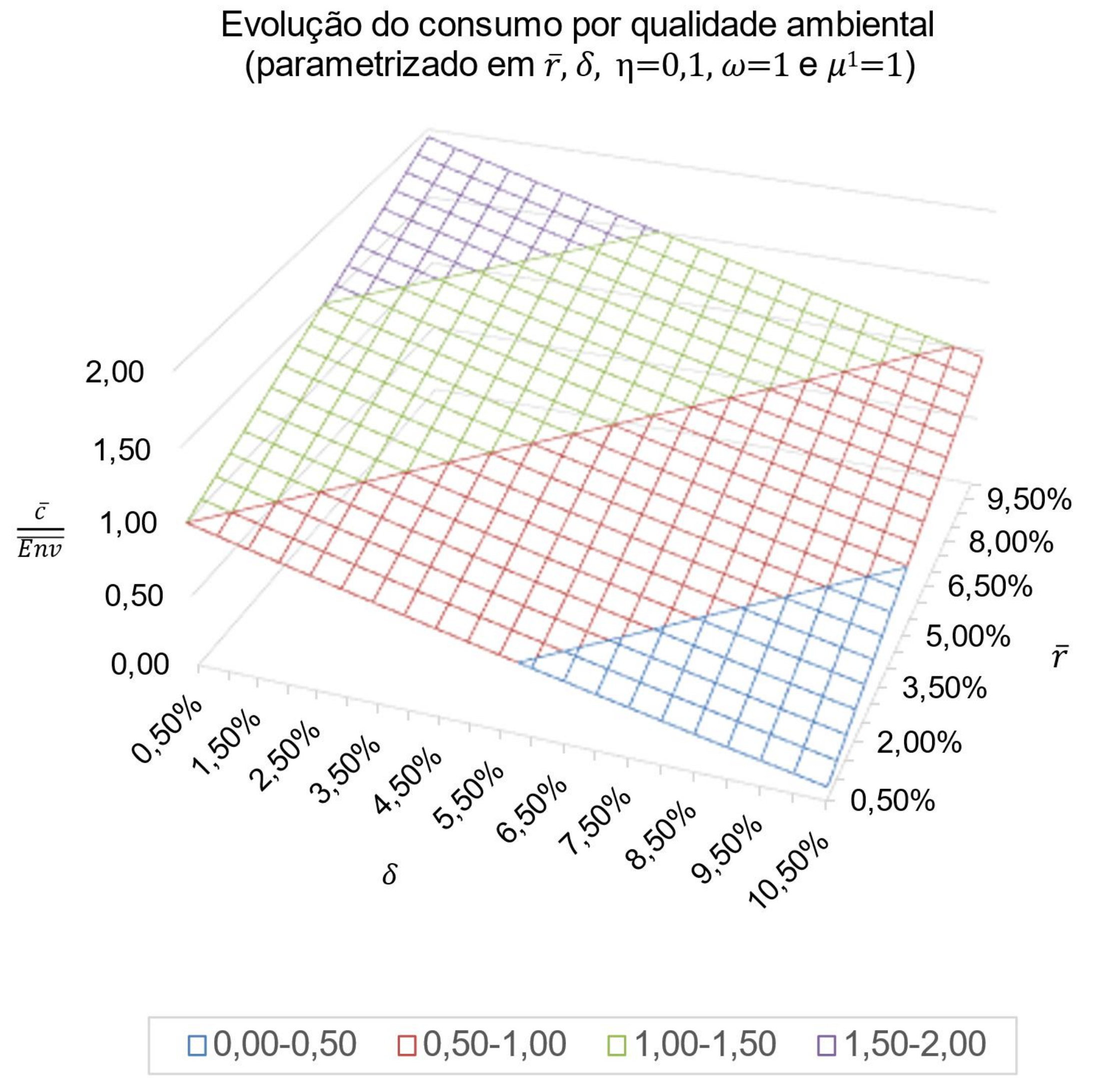

Figure 4
Evolution of consumption by environmental quality
Authors, 2023

Active Research – **Youngsters**

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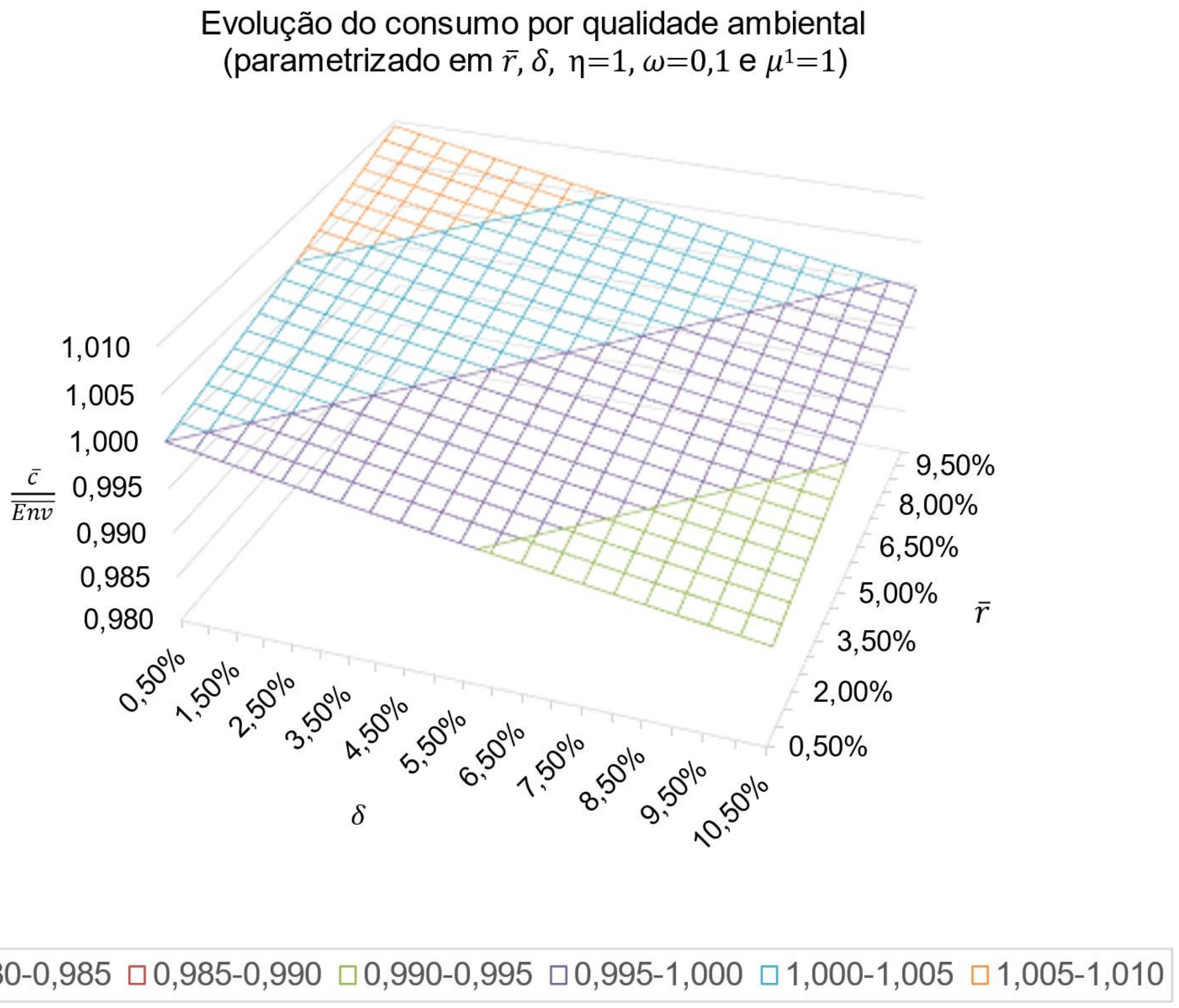

Figure 5
Evolution of consumption by environmental quality
Autors, 2023

Active Research – **Old / elderly**

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Without Intergenerational concern

$$V_t^{old} = \ln c_t^2 + \ln Env_t$$

With Intergenerational concern

$$U_t^{old} = \ln c_t^2 + \ln Env_t + \frac{\eta}{1+\delta} \ln Env_{t+1}$$

Active Research – **Old / Elderly**

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$$\left[\frac{\bar{c}}{\overline{Env}}\right]^{old} = -\frac{1}{\omega} + \mu^2$$

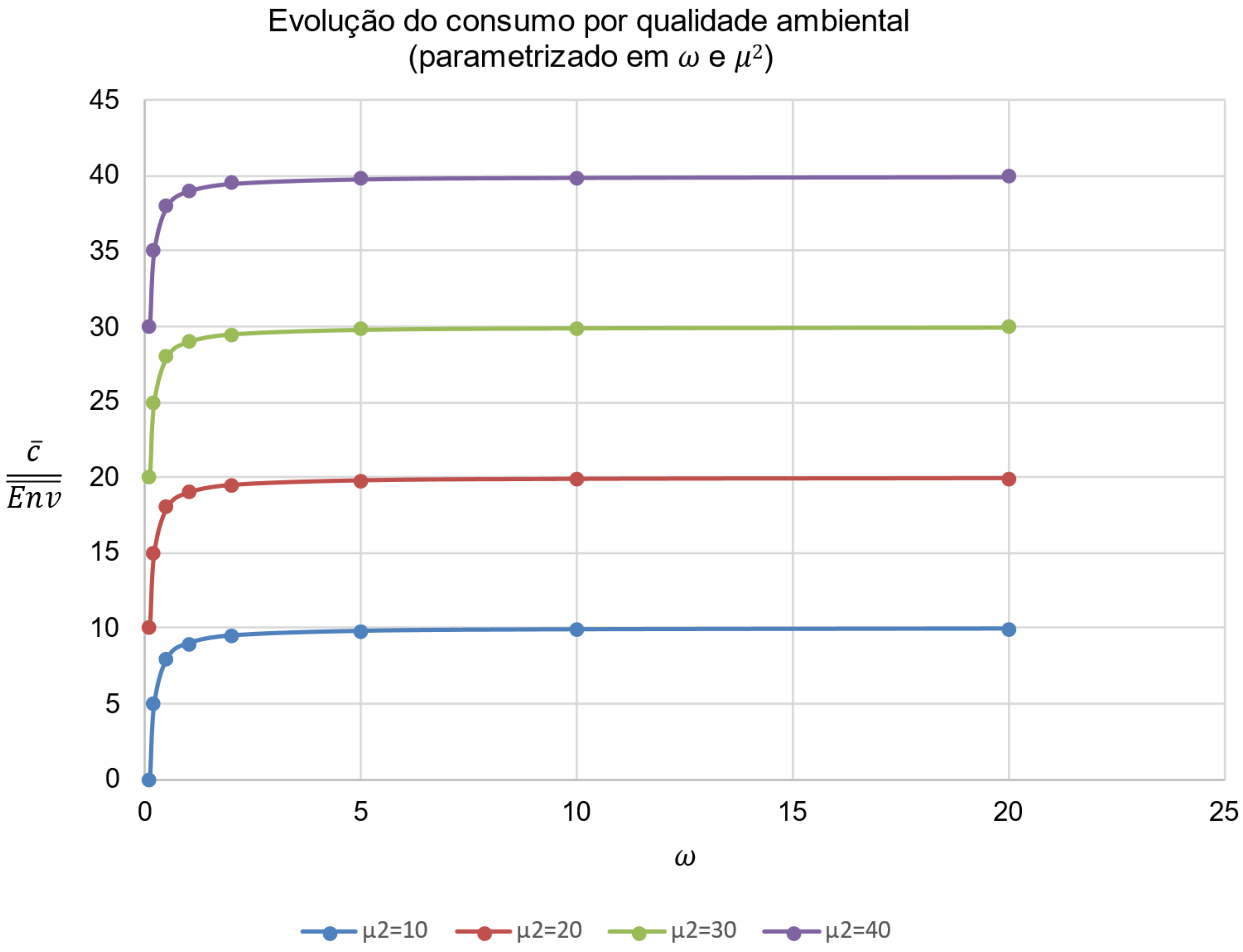

Figure 6
Evolution of consumption by environmental quality
Autors, 2023

Active Research – Strategic Interaction: Nash Equilibria

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$$\eta = \left(-\omega + \mu^{*}\right)\frac{\omega\left(\bar{r} - \delta\right)}{\left(1 + \delta\right)}$$

$$\mu^2 - \mu^1 = \mu^*$$

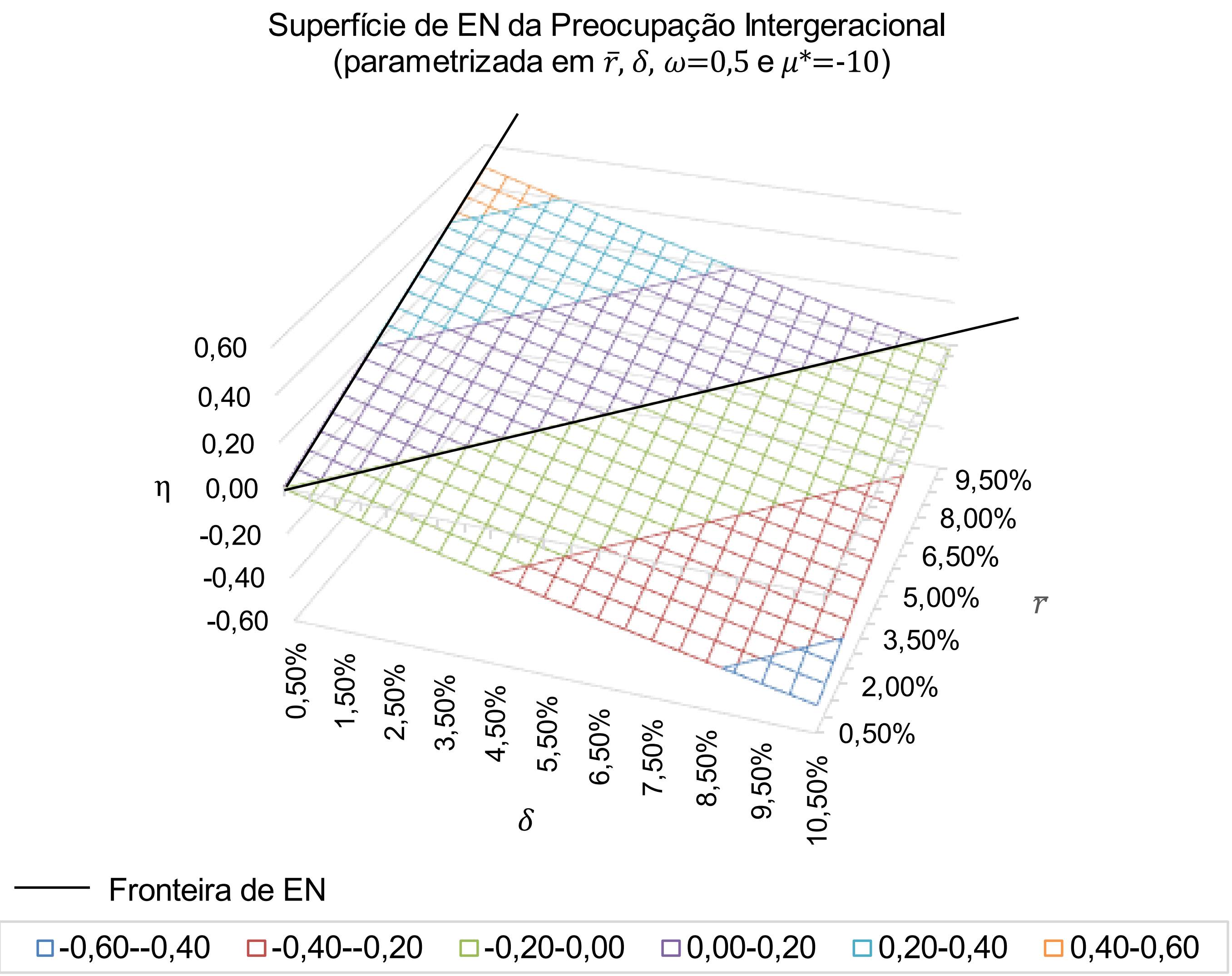

Figure 7
NE Surface of Intergenerational Concern
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Active Research – Strategic Interaction: Nash Equilibria

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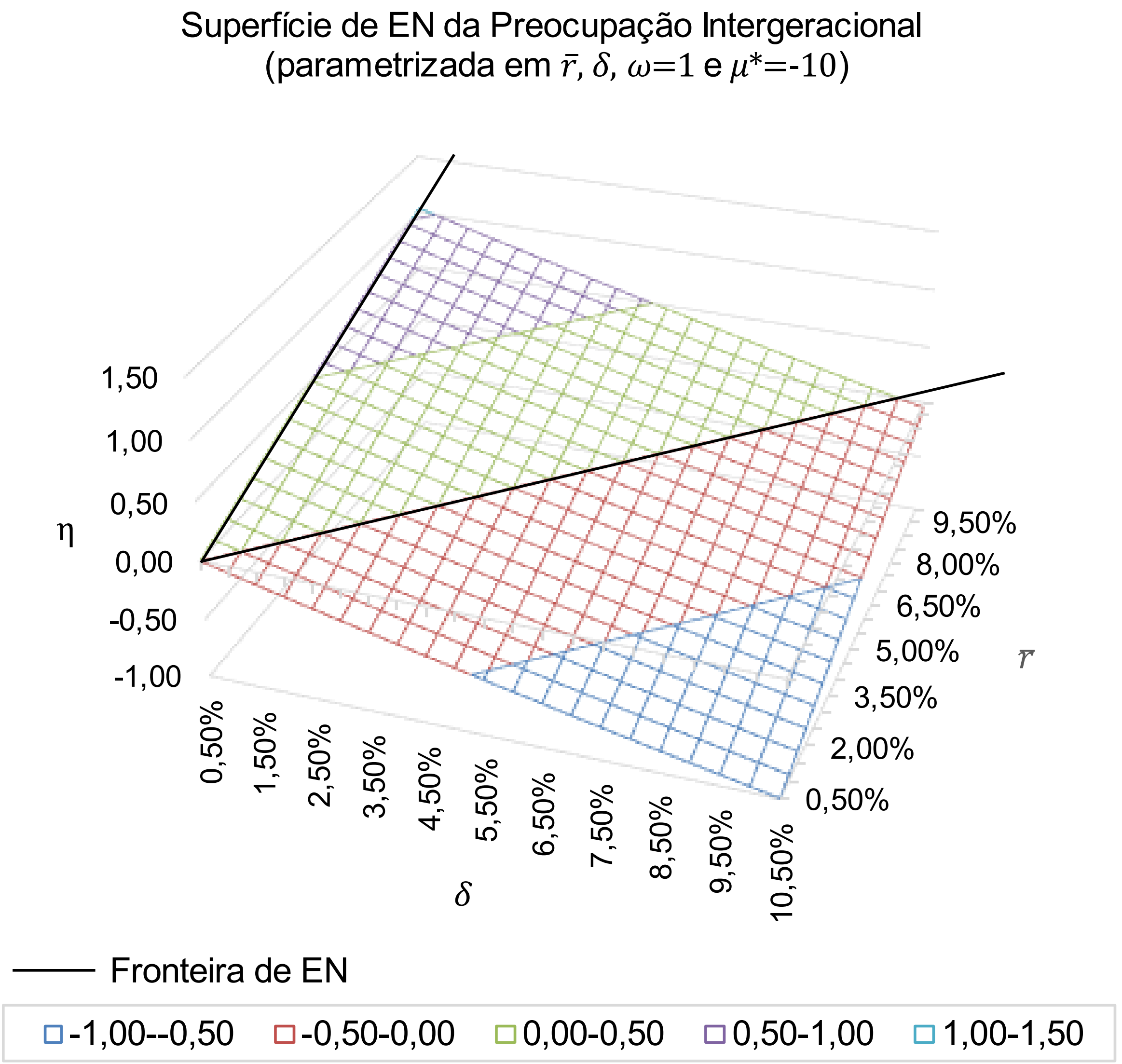

Figure 8
NE Surface of Intergenerational Concern
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Active Research – Strategic Interaction: Nash Equilibria

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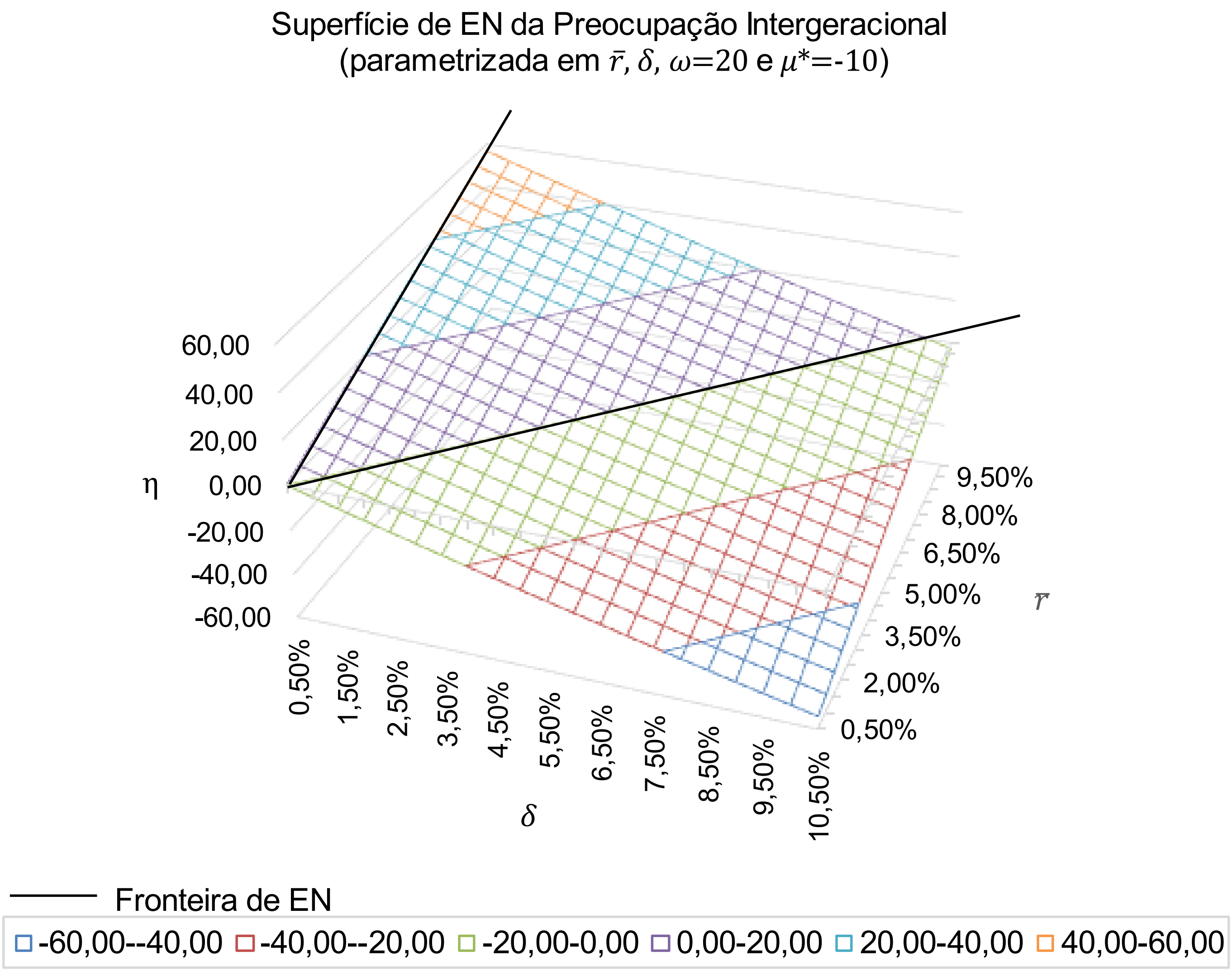

Figure 9
NE Surface of Intergenerational Concern
Authors, 2023

Active Research – Strategic Interaction: Nash Equilibria

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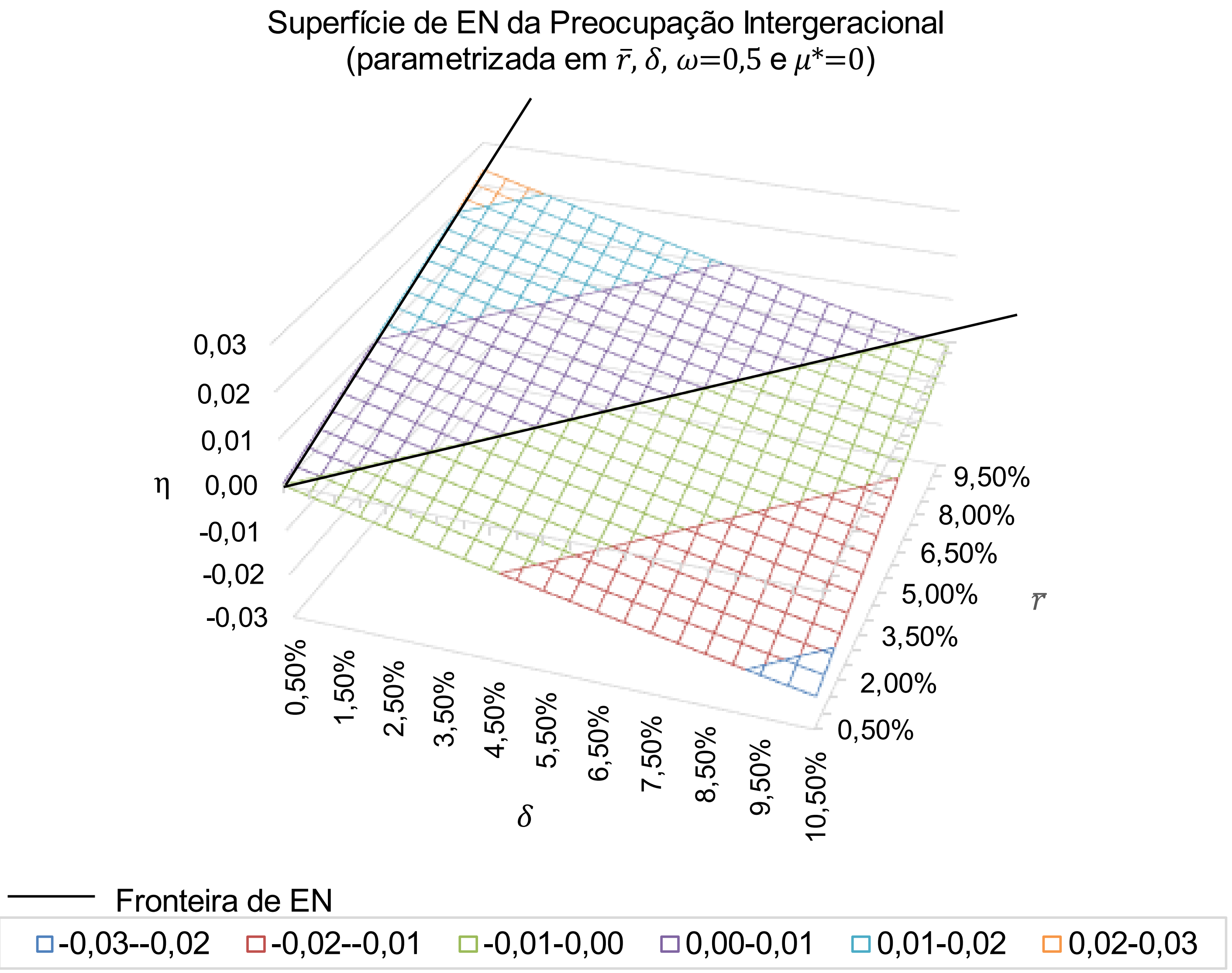

Figure 10
NE Surface of Intergenerational ConcernAuthors, 2023

Active Research – Strategic Interaction: Nash Equilibria

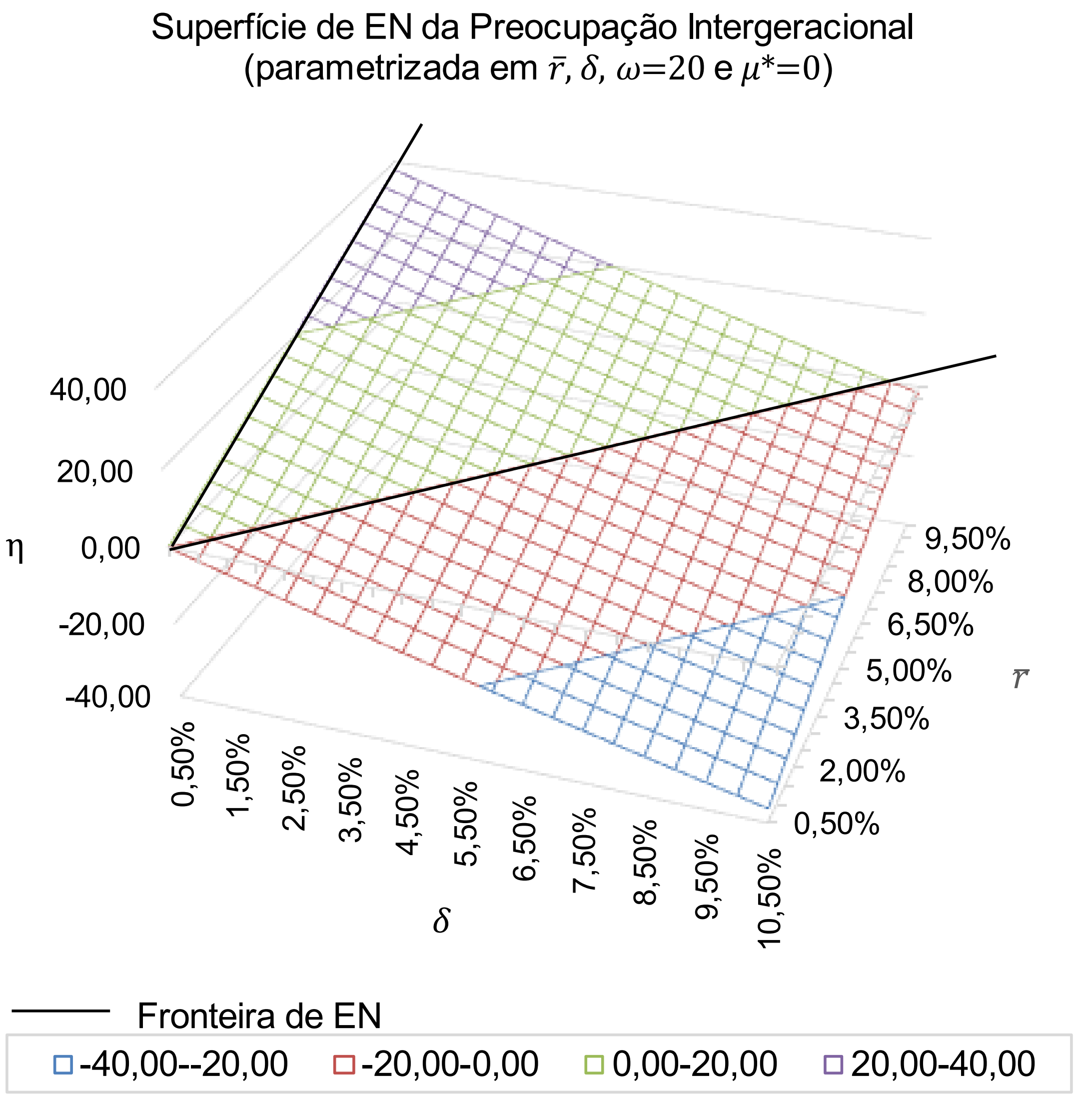

Figure 11
NE Surface of Intergenerational Concern
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Active Research – Strategic Interaction: Nash Equilibria

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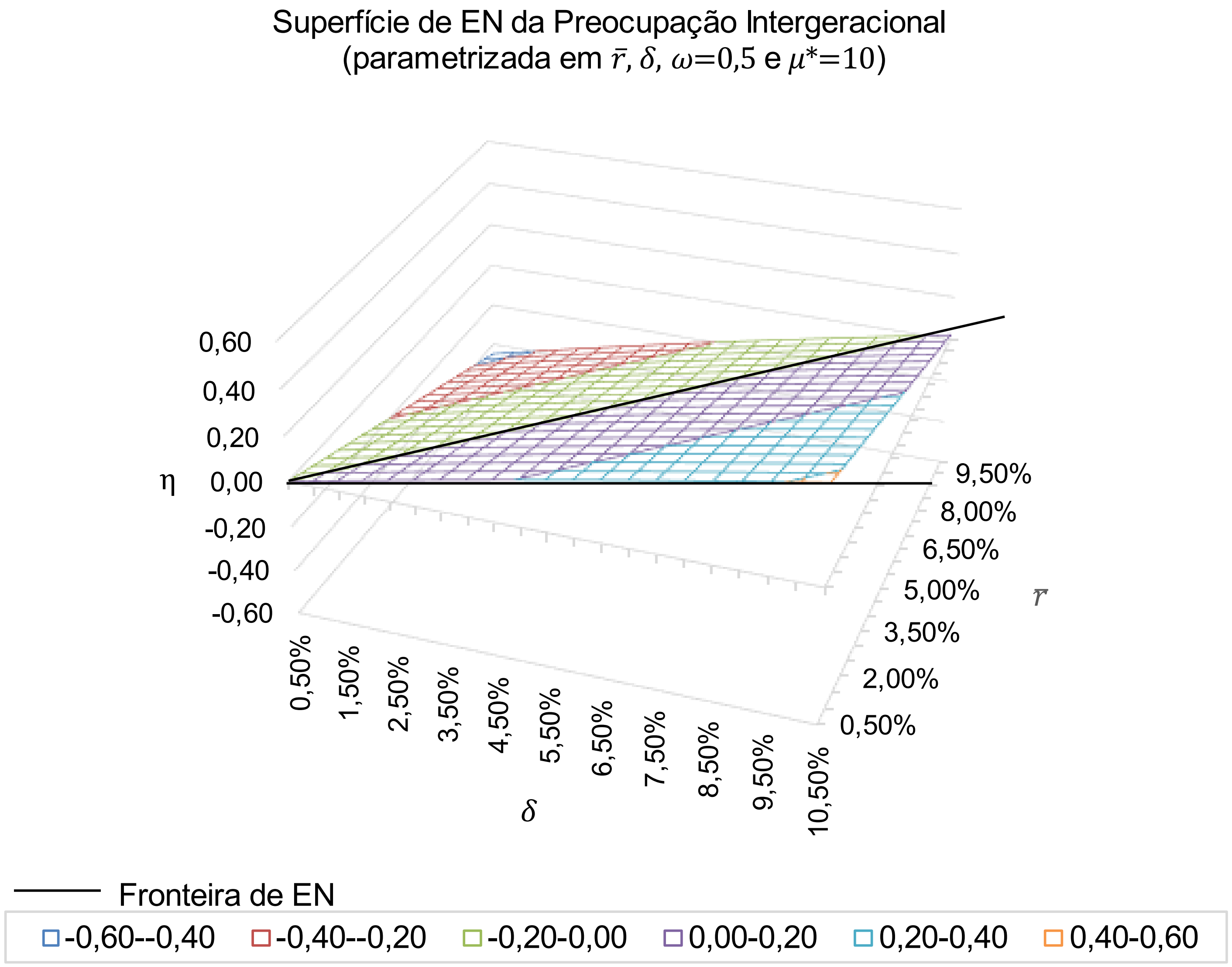

Figure 12
NE Surface of Intergenerational Concern
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Active Research – Strategic Interaction: Nash Equilibria

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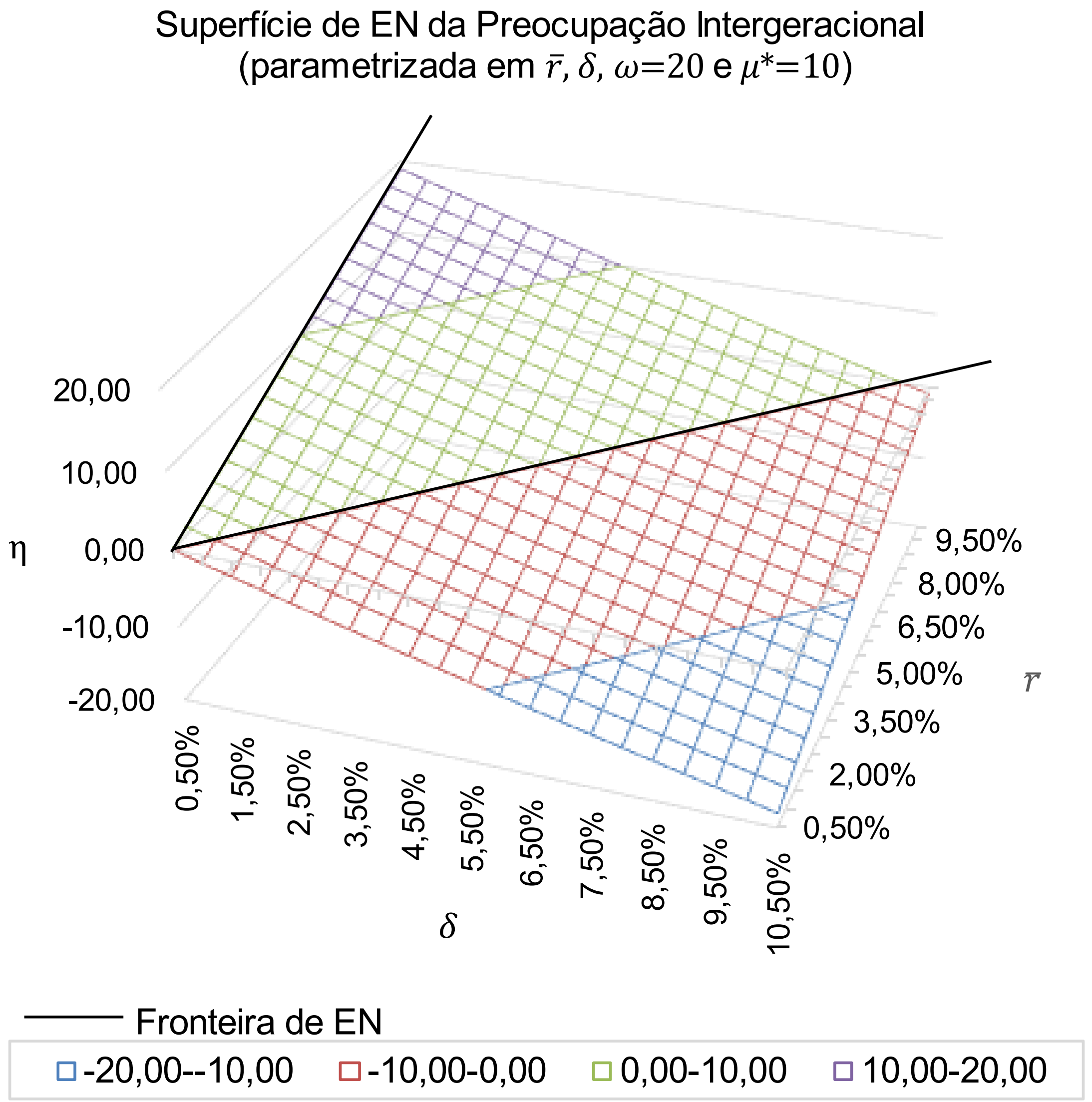

Figure 13
NE Surface of Intergenerational Concern
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Active Research – Discussion of Results

youngsters

Intergenerational Concern ↗ ⟶ Consumption ↘

η

Active Research – Discussion of Results

Elderly

Consumption Evolution $\longrightarrow$ μ^2

(consumption base value)

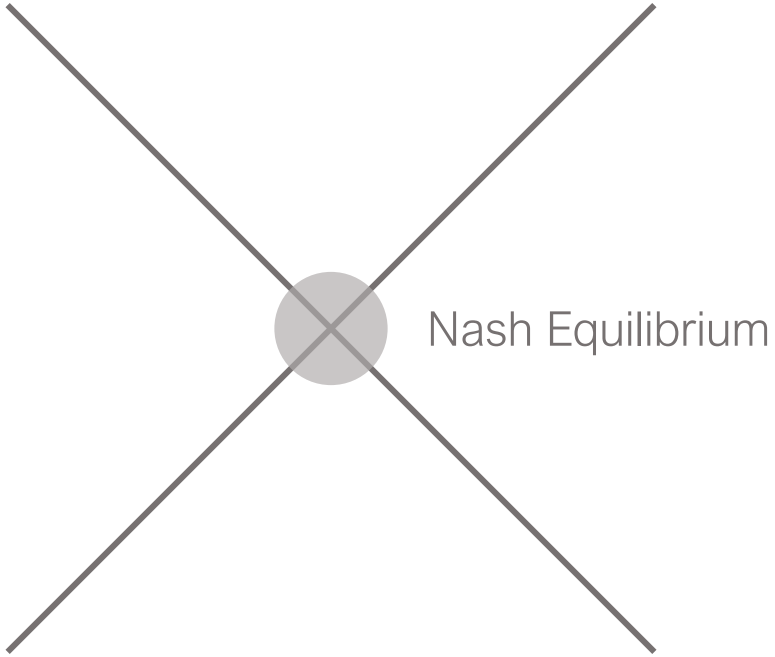
Active Research – **Discussion of Results**

Strategic Interaction

$\mu^1 > \mu^2$

$\mu^2 = \mu^1$

$\mu^2 > \mu^1$



Environmental degradation

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Conclusion

Environmental Heritage

Cooperation

Sustainable Development

Limits of Analysis and Further Work

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- Log linear deterministic model

  Stochastic model

- Simulations contingent on the positive ortant

  Cover the most important results to other ortants

- Equal intergenerational concern for young and old

  Extend to different parameters for both generations


“Climate change is the greatest market failure the world has ever seen”
(Stern, 2007)