

# Sustainable consumption transformations: Should we just mobilize the younger generations?

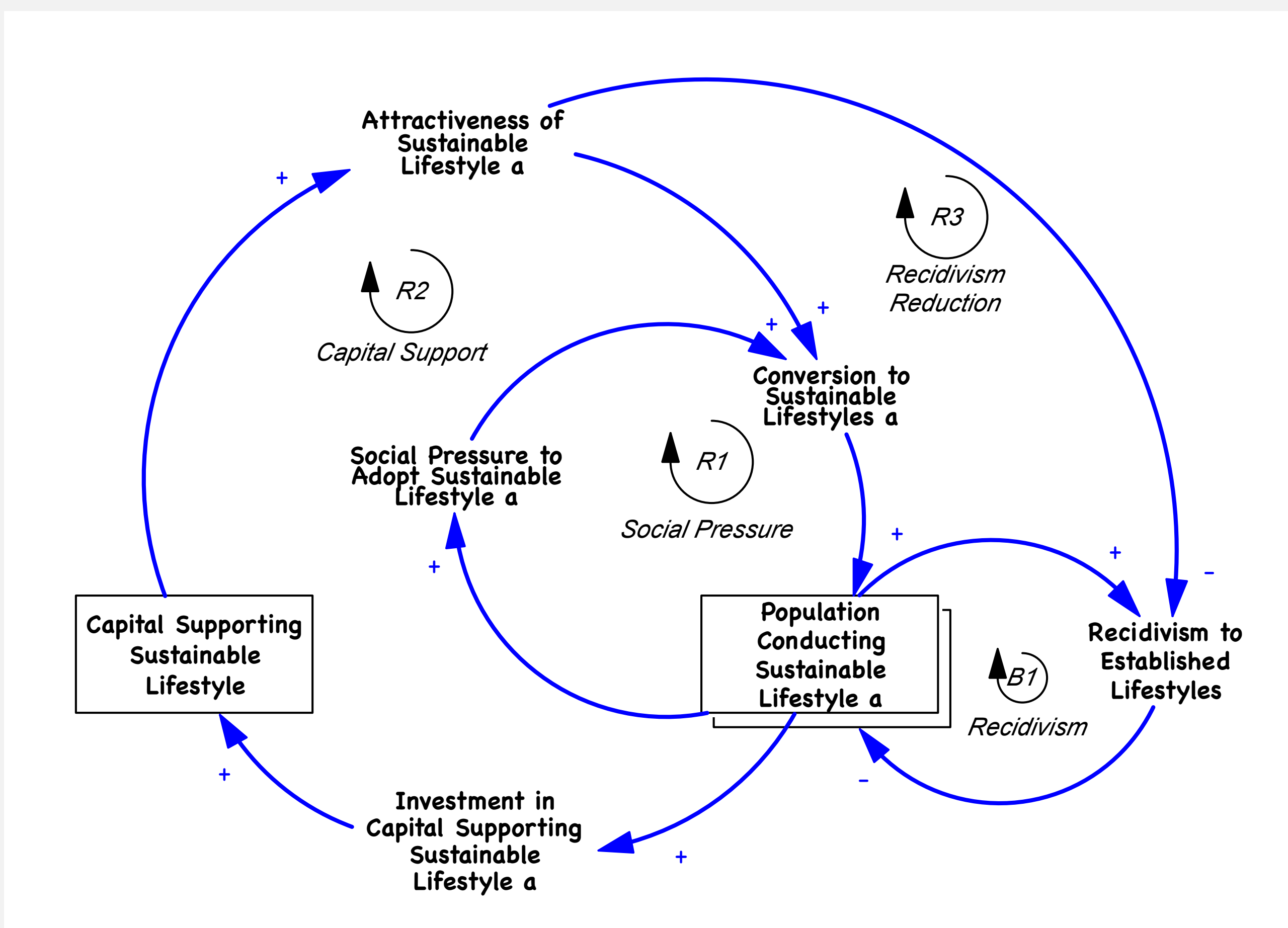
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## Introduction

To deal with the unprecedented sustainability challenges—the global climate crisis, pollution, biodiversity loss, degradation of natural resources—much attention has gone to supply-side solutions (clean technologies, alternative primary energy sources, carbon capturing technologies, etc.). Yet, at the core of a rapid and large-scale societal transformation that staves off disaster lie fundamentally-altered lifestyle-changing consumption choices and practices among the population. Requisite consumption changes must go far beyond choices about substituting goods and include fundamentally altered practices towards reuse and repair, bulk consumption, reduced consumption, and the reduction of conspicuous consumption. The main aim of this paper is to stimulate a research that helps better understand dynamics of transformations towards sustainable consumption practices. A starting point for such an analysis must be the social influence and habituation processes that lie at the core of how humans trap themselves into their consumption patterns, as they have done since long before the industrial revolution. Because of this importance, one logical question to explore is “can we focus on mobilizing just those who have greater willingness to change, ignoring those who are most habitualized to unsustainable practices?”. To generate more specific insights, with the above question as starting point, I develop a stylized model characterizing some basic aspects of the processes and conditions for lifestyle transformations. However, of course, lifestyle-related consumption choices are not independent of supply. Changes in production are accelerated with demand changes, and vice versa. For these reasons, whereas the main purpose is bringing attention to the consumption-side of sustainability transitions, this paper also highlights dynamic interplay of demand changes with supply (investment choices capital supporting sustainable lifestyles), as well as age-related population differences—in particular in terms of citizens’ willingness to change lifestyles and their control over relevant capital investment choices.

## Conceptual Model

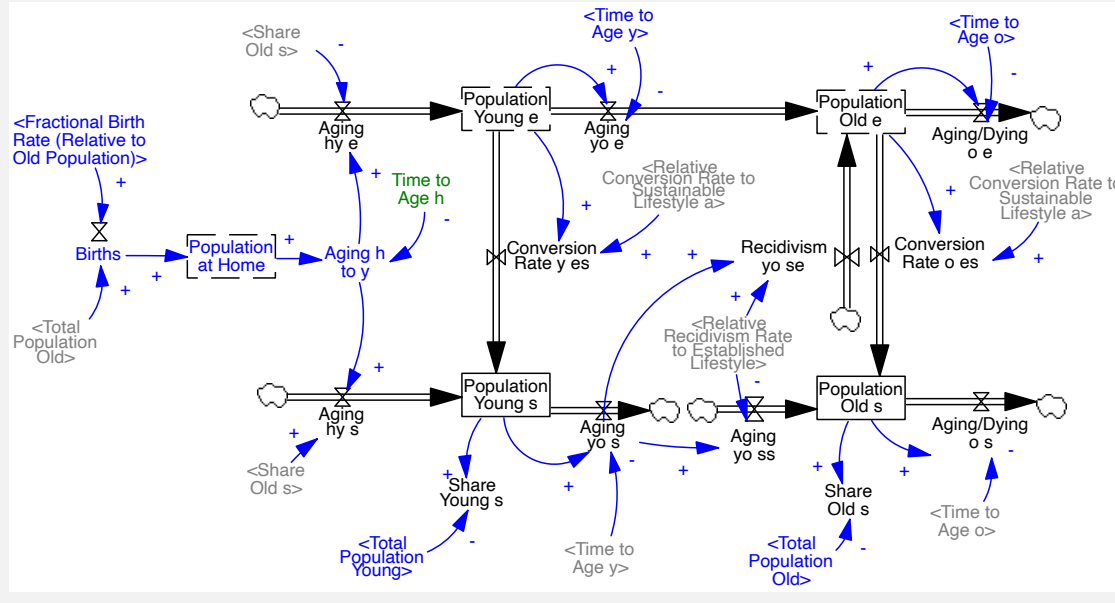


### Model Description

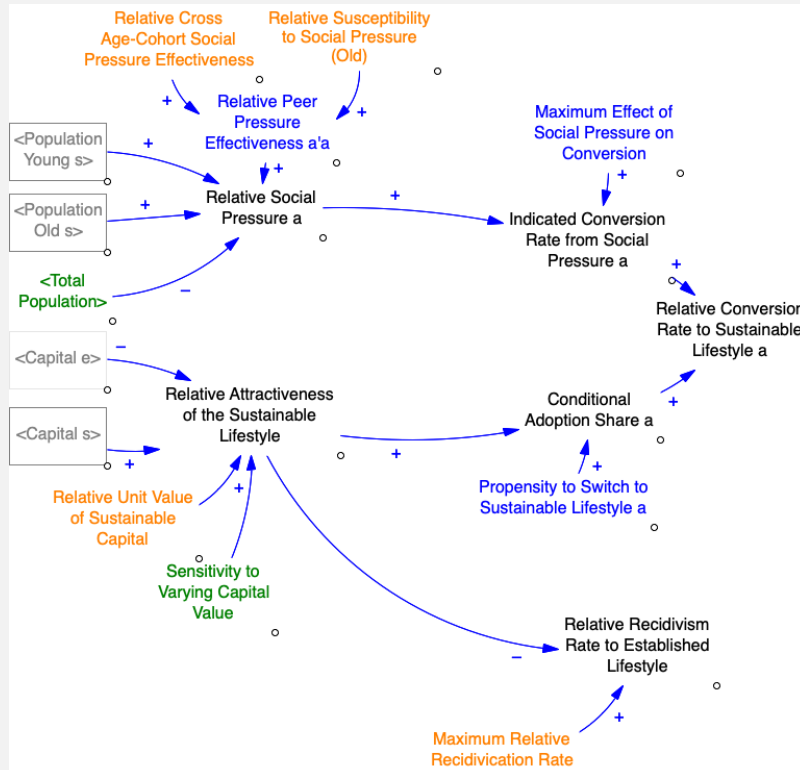
In the model citizens may, on an ongoing basis, decide about changing their consumption practices from “established” to “sustainable” (stock “population conducting a sustainable lifestyle”). As some citizens take on new habits and practices they may influence their peers to do the same (feedback R1, social pressure). However, this process is conditioned by the attractiveness of the sustainable lifestyle, compared to that of the conventional. Lifestyle changes depend on availability on relevant infrastructure (bulk stores, public transit opportunities, bike lanes, repair services, access to farm based/unprocessed food, reduced packaging, etc.). This infrastructure requires capital supporting sustainable practices (Stock on the left). However, investment in such choices requires a population of regulators and investors believing in the need for or strategic opportunities of the lifestyle. This, in turn depends on the stock of adopters of the sustainable lifestyle. Together these relations close a second loop (R2, Capital Support). Citizens may also make a number of critical lifestyle choices as they age. The model captures one such process through a third loop, resulting from the possibility of young citizens following sustainable lifestyle recidivating to established practices as they begin to settle down (feedback R3, Recidivism).

## Computational Model

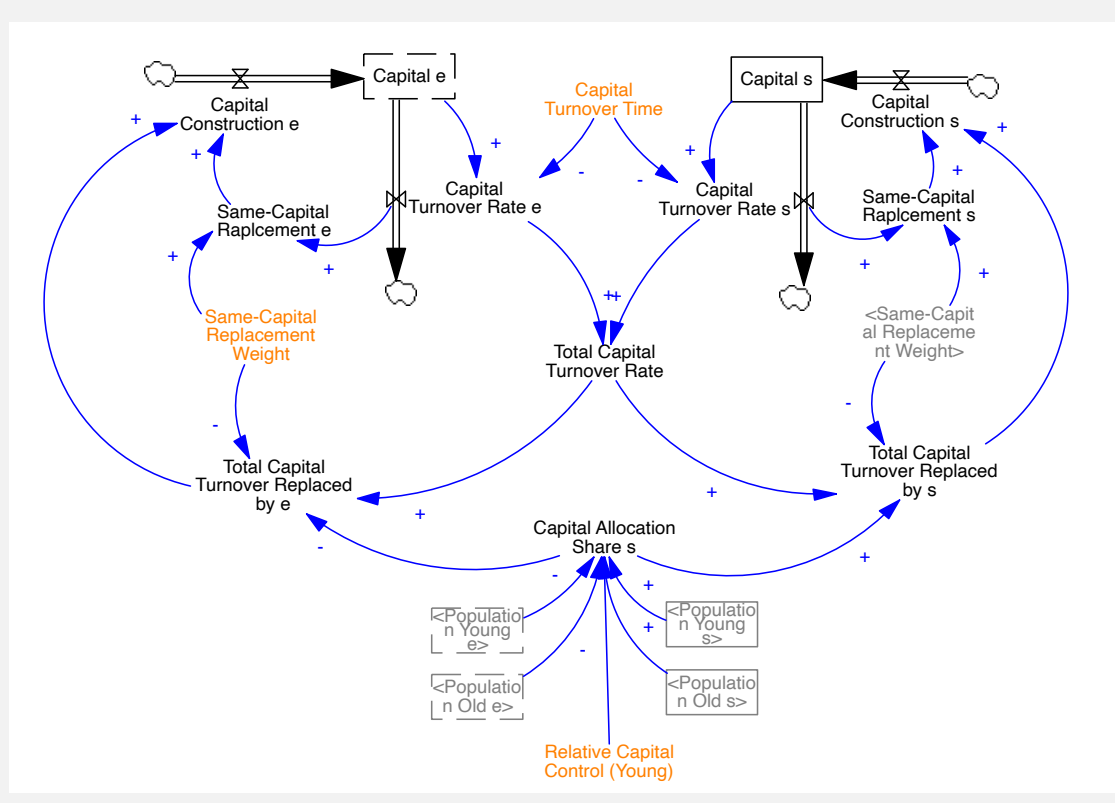
### Population aging and lifestyle



### Lifestyle conversion and recidivism



### Capital turnover



Young population transition rates ( $l \in \{e, s\}$ ):

$$\frac{dP_{hl}}{dt} = [\delta_{ls} - \delta_{le}]Y_l P_{ye} + \frac{P_{hl}}{\tau_h} - \frac{P_{hl}}{\tau_y}$$

- $P_{hl} = (P_{ol}/P_o) \cdot P_h$
- $\delta_{ij} = 1 \forall i = j; \delta_{ij} = 0 \forall i \neq j$  (Kronecker delta)

Old population transition rates:

$$\frac{dP_{ol}}{dt} = [\delta_{le}\rho + \delta_{ls}(1-\rho)]\frac{P_{ys}}{\tau_y} + [\delta_{ls} - \delta_{le}]Y_o P_{oe} - \frac{P_{ol}}{\tau_o}$$

Relative conversion rate for age-cohort  $a$ :

$$Y_a = \gamma P_a \cdot \sigma_a$$

- $\gamma P_a = \gamma_0 \left( \sum_a \pi_{a,a} \frac{P_{sa}}{P} \right)$
- $\pi_{a,a}$ : Relative Peer Pressure Effectiveness
- $P$ : Total Population

Conditional adoption share of the sustainable lifestyle:

$$\sigma_a = \frac{\chi_a u_a}{\chi_a u_a + 1}$$

- $u_a$ : relative attractiveness (utility) sustainable lifestyle
- $\chi_a$ : propensity to convert to sustainable lifestyle

Relative attractiveness of the lifestyle:

$$u_a = e^{\beta(v_a - K_a)}$$

- $v_a$ : relative (age-specific) unit value of capital supporting sustainable (compared to established) lifestyles
- $\beta$ : sensitivity to variation in the stock of capital.
- $K_l$ : relative deployment of capital supporting lifestyle  $l \in \{e, s\}$

Recidivism to the established lifestyle:

$$\rho = \frac{\rho_0 u_a}{u_a + 1}$$

- $\rho_0$ : maximum relative recidivism rate

Capital turnover:

$$\frac{dK_l}{dt} = r \cdot (w \cdot K_l + (1-w) \cdot K) - r \cdot K_l$$

- $w$ : replacement weight of the same capital replacement  $l$
- $r$ : fractional capital replacement rate
- $K = \sum_l K_l$ : Total capital

Allocation share of capital replacement to  $l$ :

$$K_s = \frac{\varphi \cdot P_{ys} + (1-\varphi) \cdot P_{os}}{\sum_l \varphi \cdot P_{yl} + (1-\varphi) \cdot P_{ol}}; K_e = 1 - K_s$$

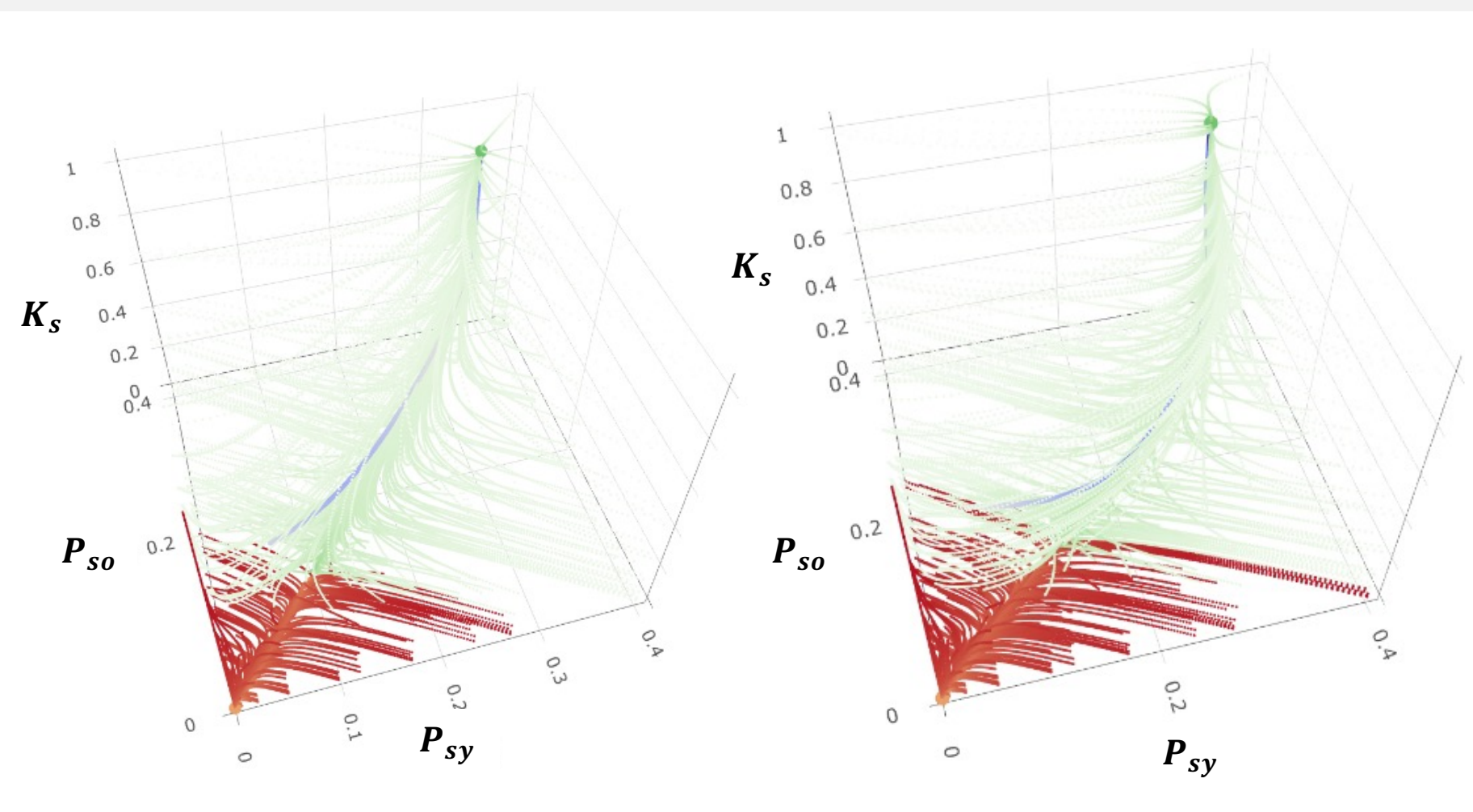
- $\varphi (\leq 1)$ : Relative capital control of the young age cohort

Color codes for variables and constants:

- black: endogenous variables;
- blue: constant, derived (Appendix of paper);
- green: fixed parameter;
- orange: sensitivity parameter.
- $l \in \{e, s\}$ : lifestyle (established) sustainable
- $a \in \{h, y, o\}$ : population age-segment (at home, young/old)

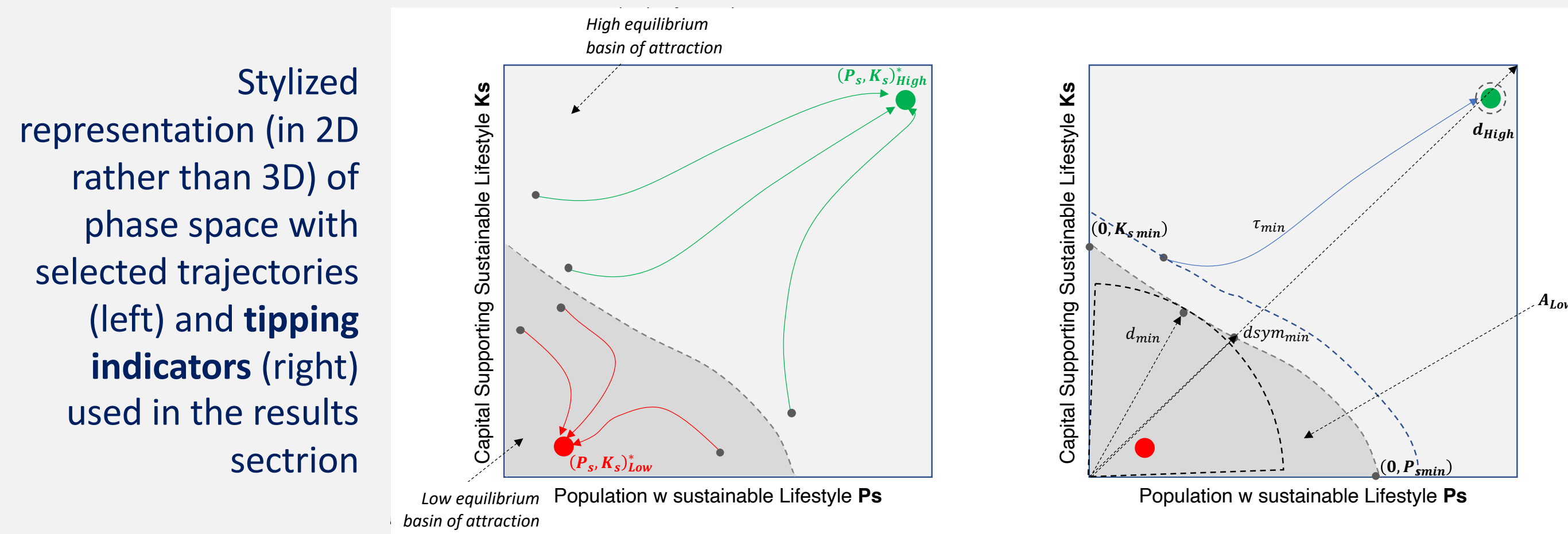
## Analysis of tipping behavior

The behavior of interest of this 3rd order system is the tipping behavior its positive feedback structure generates:



3D phase space plot for the base case (left) and alternative scenario (right). (For parameter values see paper.) The basin of attraction for the low equilibrium (red dot and pathways to it) and for the high equilibrium (green dot and pathways to it) can be identified. In blue the trajectory with the lowest time to high equilibrium  $\tau_{min}$ .

A central focus for analysis is therefore understanding factors (strength of social influence, capital turnover rates, willingness to try alternative habits, and social influence mixing, etc.) that influence and characterise this tipping behavior. For this the paper develops a number of tipping indicators:



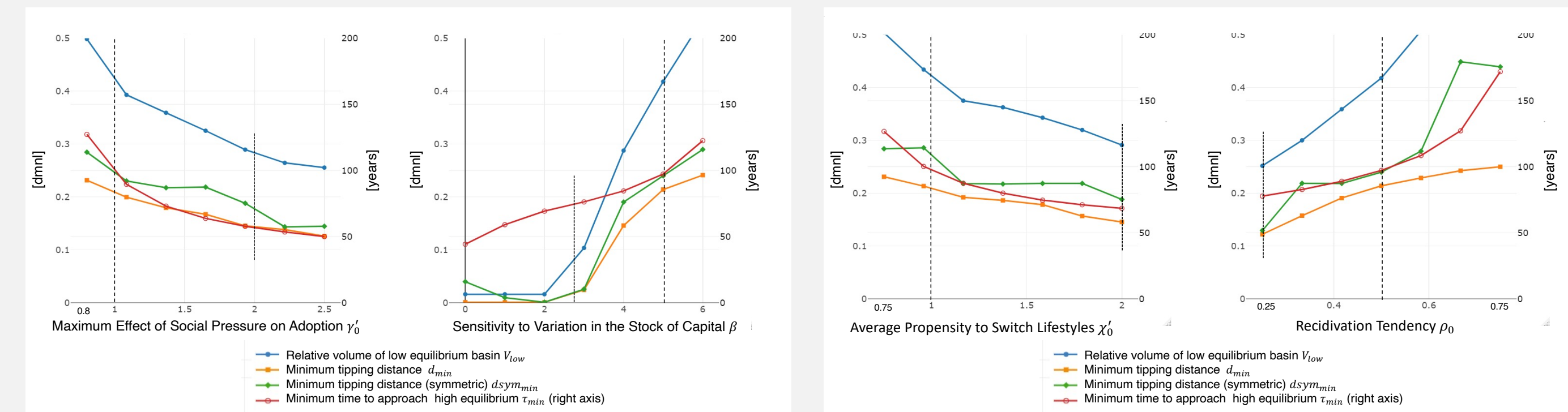
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## Results

All figures below show the sensitivity of tipping behavior to a change in the x-axis variable. (For all: Baseline case is indicated with the dashed lines. For parameters see paper.)

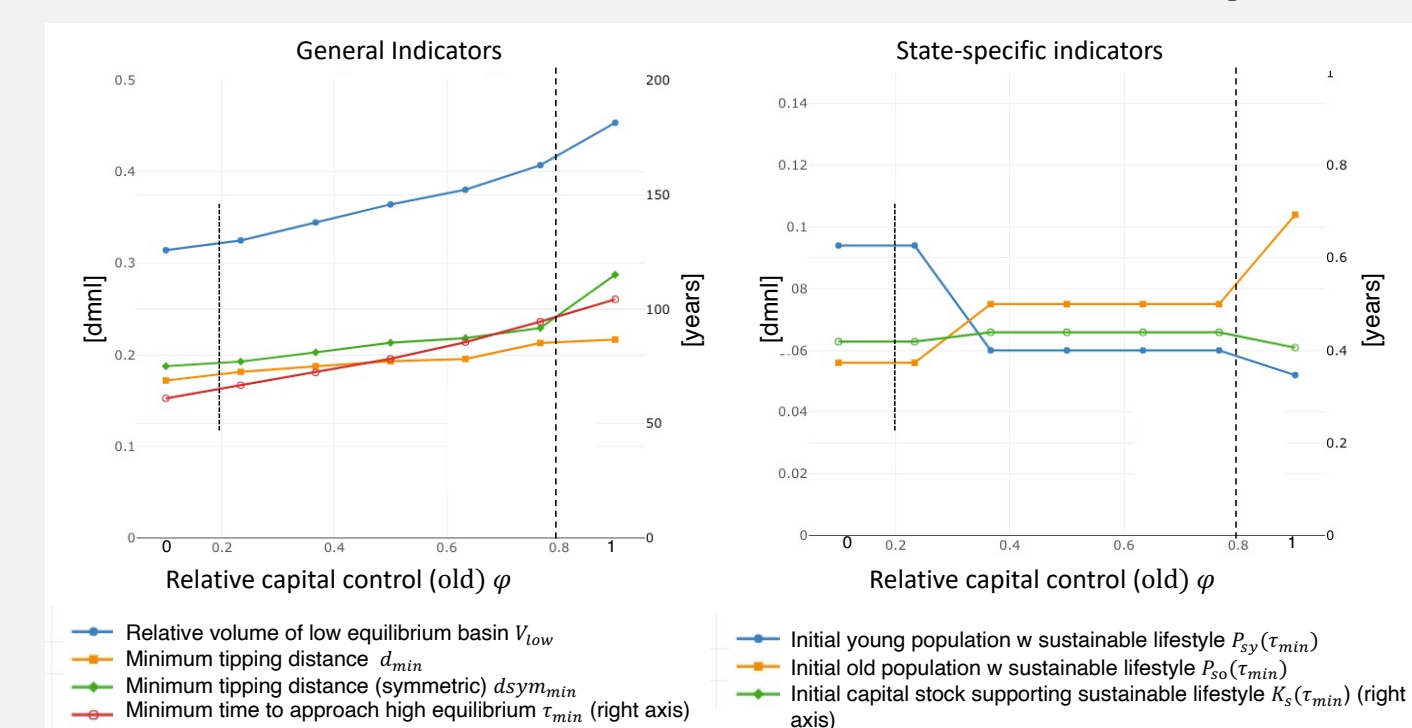
### Symmetric cases



**Proposition P1:** Social pressure (about the benefits of sustainable lifestyles) is important for reducing transition times towards sustainability, given that we overcome the tipping boundary.

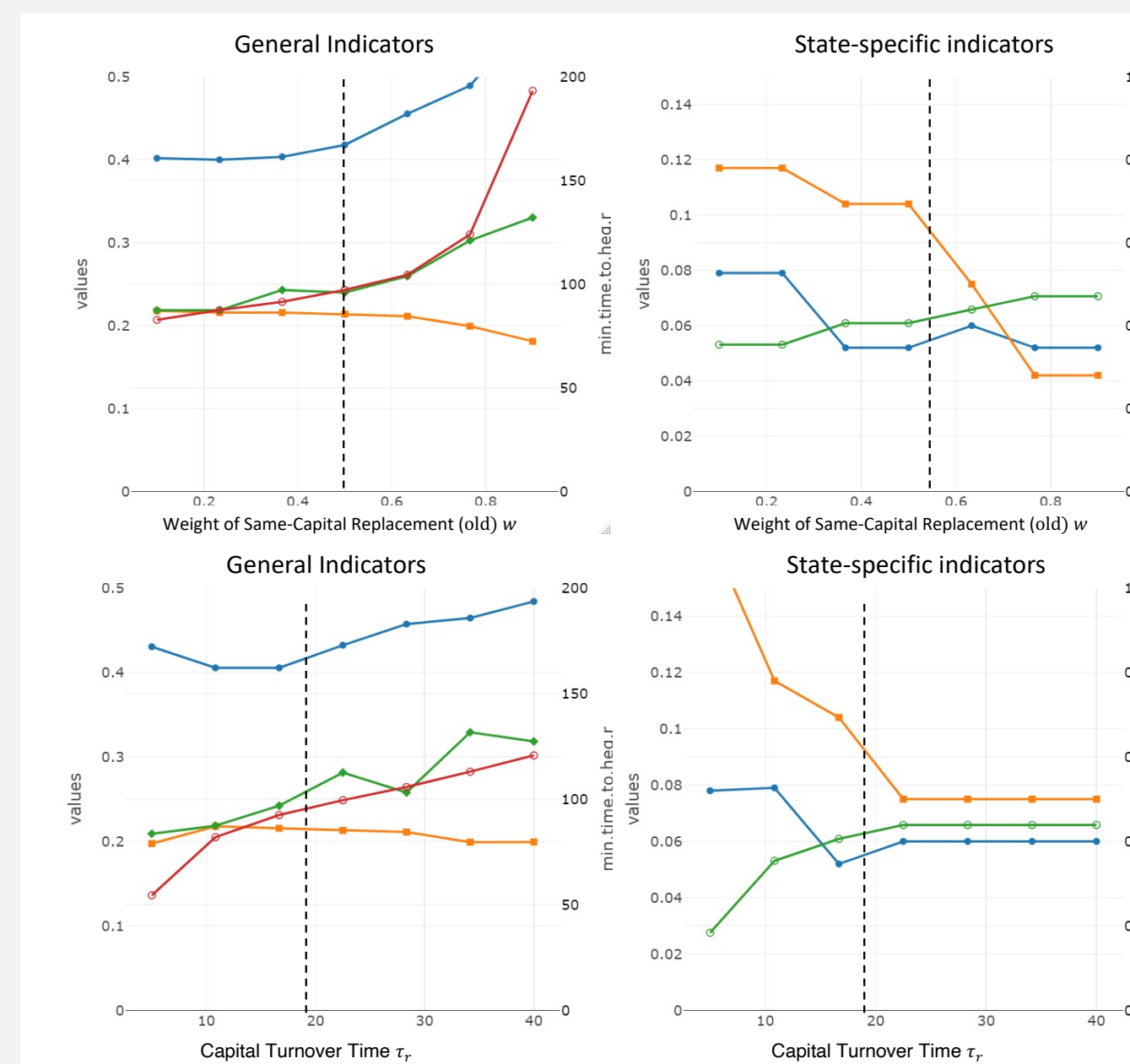
**Proposition P2:** Focusing consumers attention to the principle of sustainable consumption practices (rather than on their intrinsic value) can help reduce tipping boundaries.

### Asymmetric cases



**Proposition P4a:** Even when the younger population is more susceptible to peer pressure, greater control of resources that affect capital construction supporting sustainable lifestyles by the older active population (compared to by the younger population) requires stimulating sustainable lifestyle adoption by the older population.

**Proposition P4b:** Granting the younger population greater control of resources that affect capital construction supporting sustainable lifestyles combined with stimulating younger population sustainable lifestyle adoption is an effective transformation strategy.



## Discussion

This paper brings attention to the age-dependent consumer lifestyle side of sustainable transformations. 5 propositions, listed above, summarised specific insights about the levers for speeding up sustainability transitions. Importantly, whereas successful sustainability transformations hinge on lifestyle choices by the youth being sustainable, stimulating this is not a high-leverage strategy by itself. Perhaps the most effective supplementing strategy involves granting the youth earlier control over the relevant capital investment choices. One may envision a stream of research with focus on extensions/elaborations beyond the stylized analysis presented here, including, for example, one more accurate representation of the real portfolio of lifestyle-related choices. Ex-ante it is not clear whether adopting initially only some green practices will help the transition (stepping stone) or hurt this because of stagnation (due to, e.g. moral licensing problems). Further, research can increase attention to the role of capital turnover, the buildup of attention/willingness to consider alternative practices, advertising regulation, and, finally, the different types of consumption, including conspicuous consumption.

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