Modelling DD based on complexity

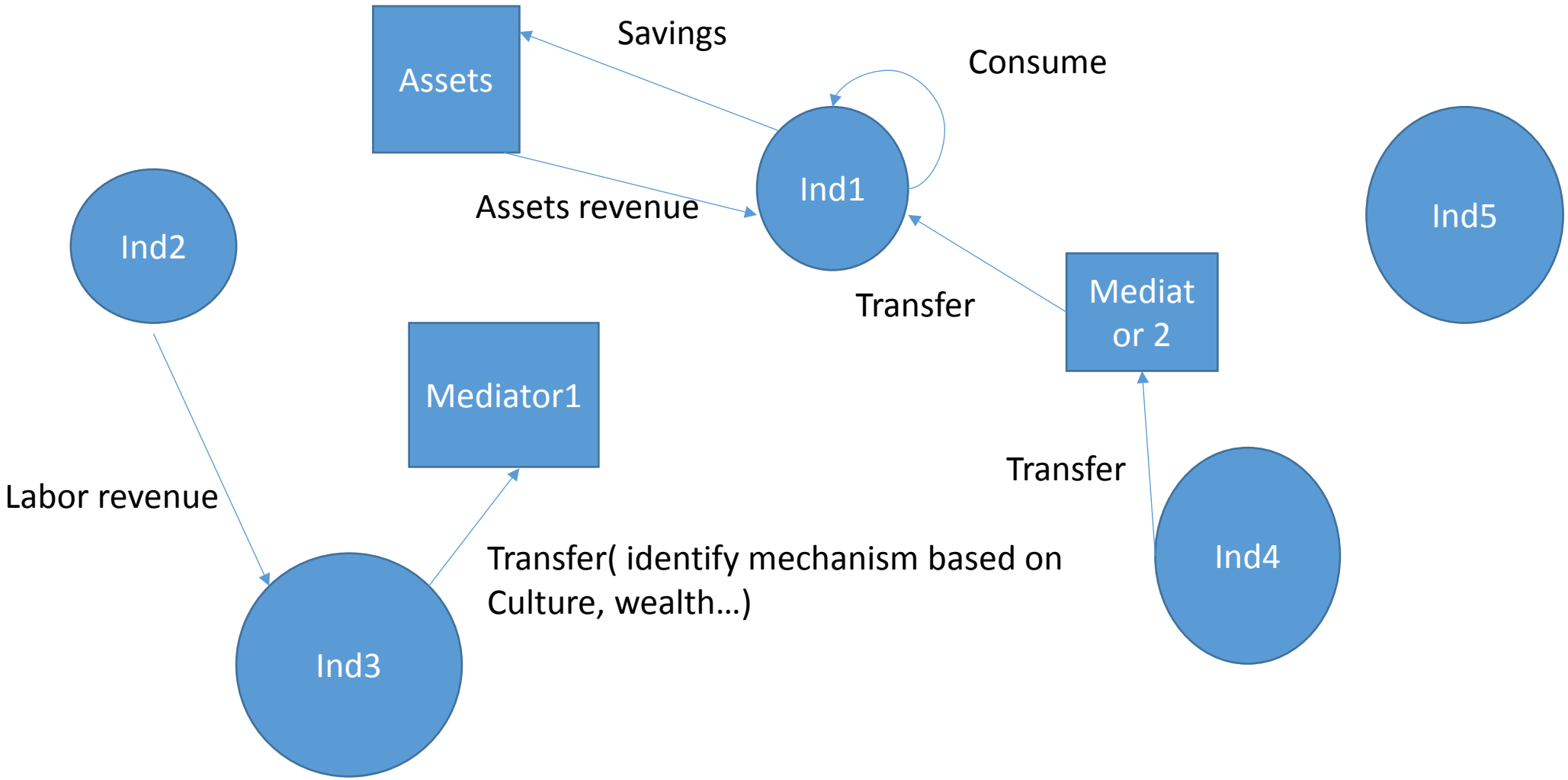
Mamadou Bousso and Latif Dramani

Complicated vs Complex

- Problem difficult to solve but
  - Well defined
  - Have clear set of steps
  - A procedure or algorithm to resolve them
  - **Problems rich in detail (Peter Senge)**
  - Example: build the highest, most robust tower

- Situations where you **lack information** or have an **incomplete understanding** is called **natural complexity (Atlan)**
- **Natural complexity** allied with **multiple interactions** is called **dynamic complexity (Senge)**
- **The problem and the solution have to be invented**
- Example: build the best toy for children

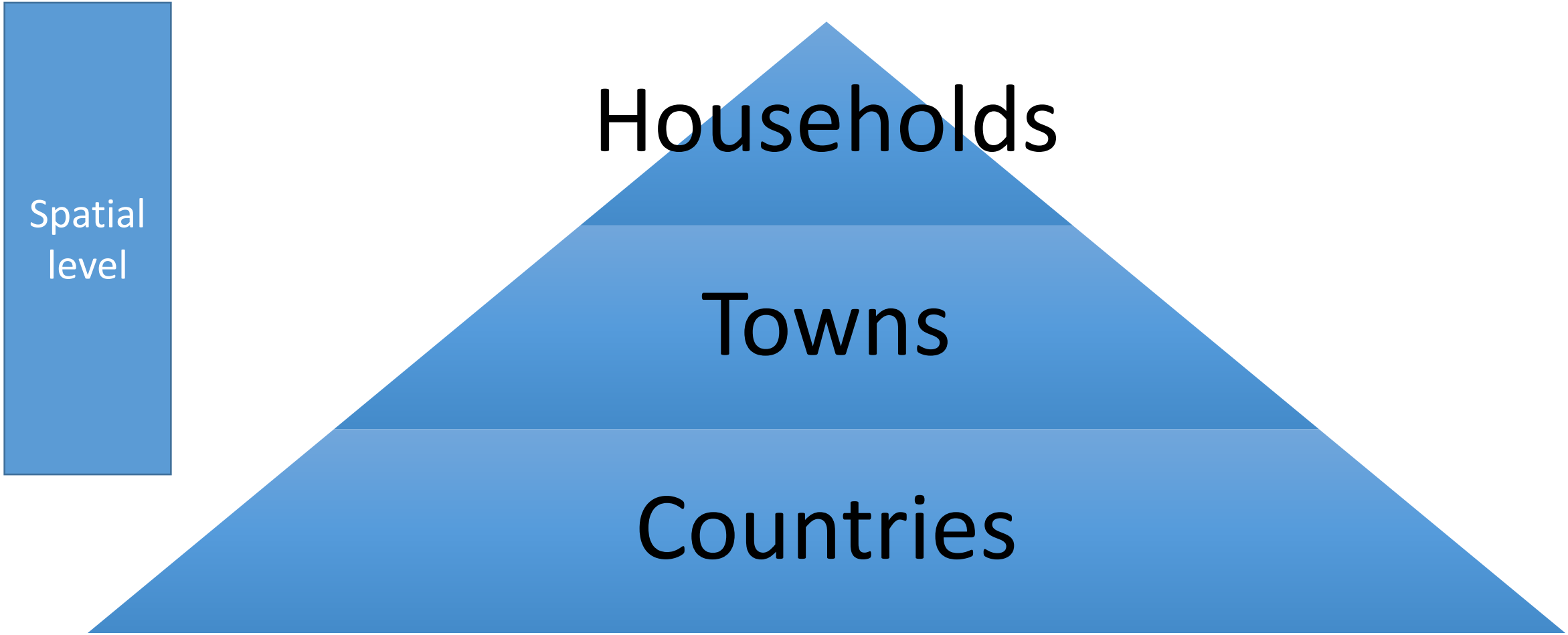
A complex system



Why is this system complex?
Composed of simple components such as individuals

Why is this system complex?

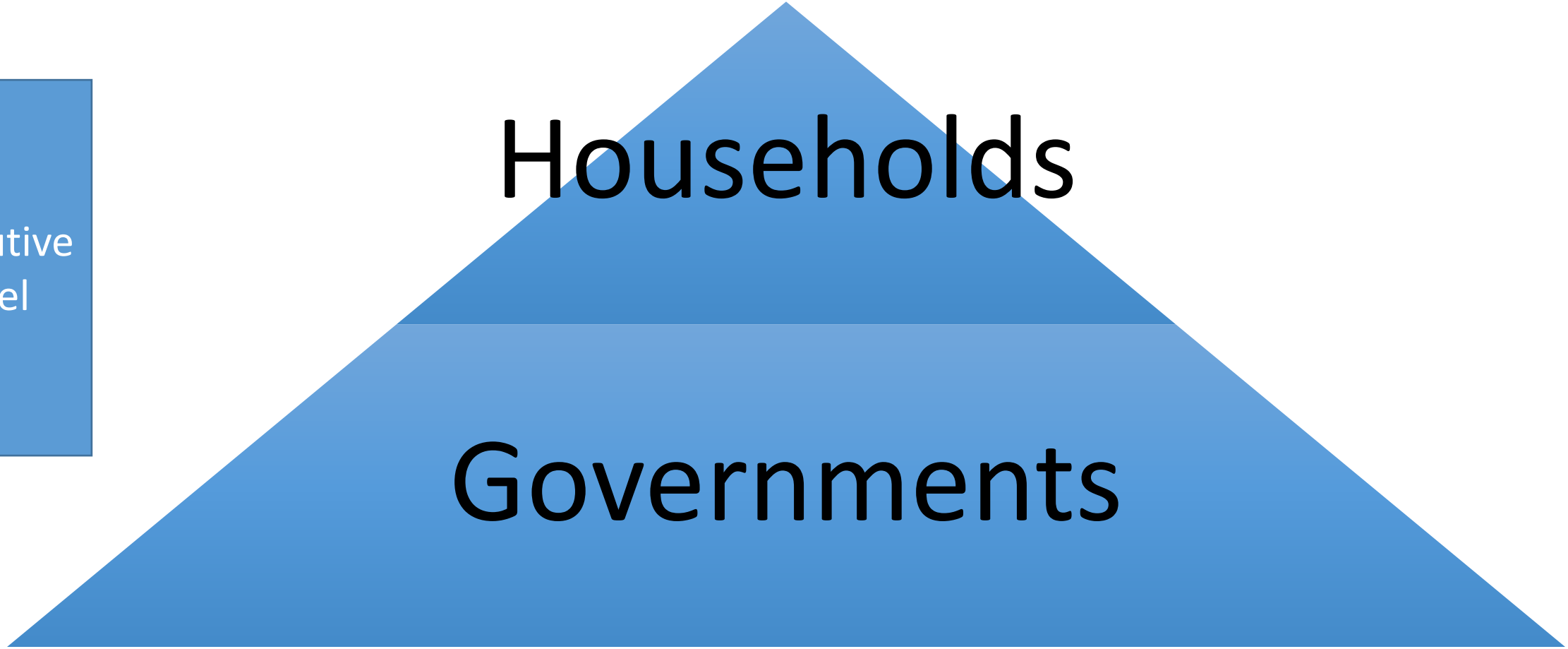
Economical and social interactions between individuals



Why is this system complex?

Economical and social interactions between individuals

Executive level



Why is this system complex?
Non linearity

« The whole is more than the sum of the parts »

- The deficit of a country is not the sum of the deficit of its citizens

Why is this system complex?
No central control

« Individuals are not under control, just mediation by households and governments and the system reorganizes itself »

- We can’t oblige an individual to be productive

Why is this system complex?
Emergent behaviors

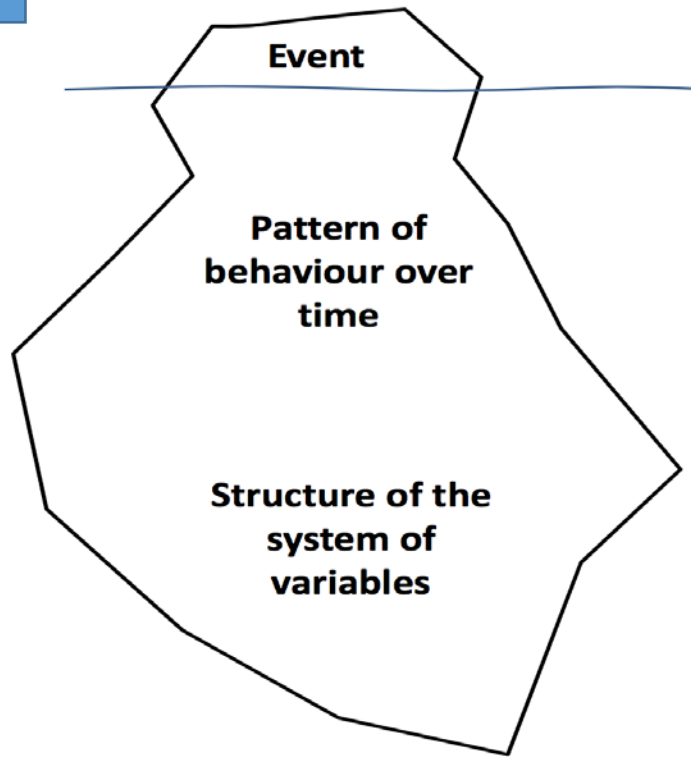
Why is this system complex?
Evolution

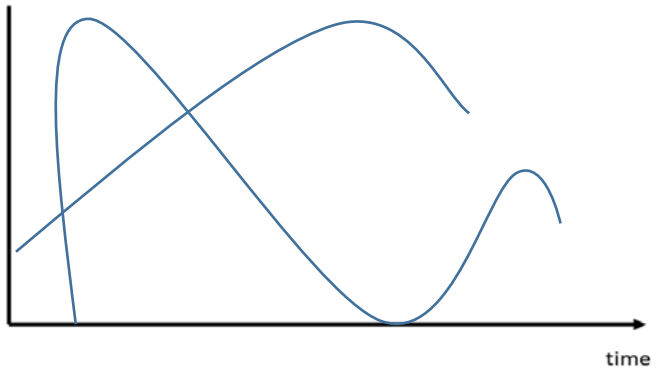
- Changes in hierarchical organization and social mutations
- Information processing in the whole system for adaptation
- Dynamics: changes in pattern
- Evolution and learning

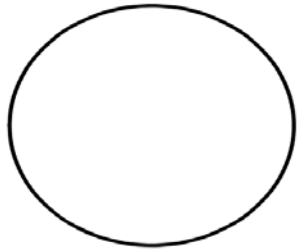
Complex system: Iceberg

seen

unseen







What is changing ?

How is it changing ?

Why is it changing? Understanding the relationship, insights, uncertainty and leverage for change ?

How to model it?
Agent Based Model

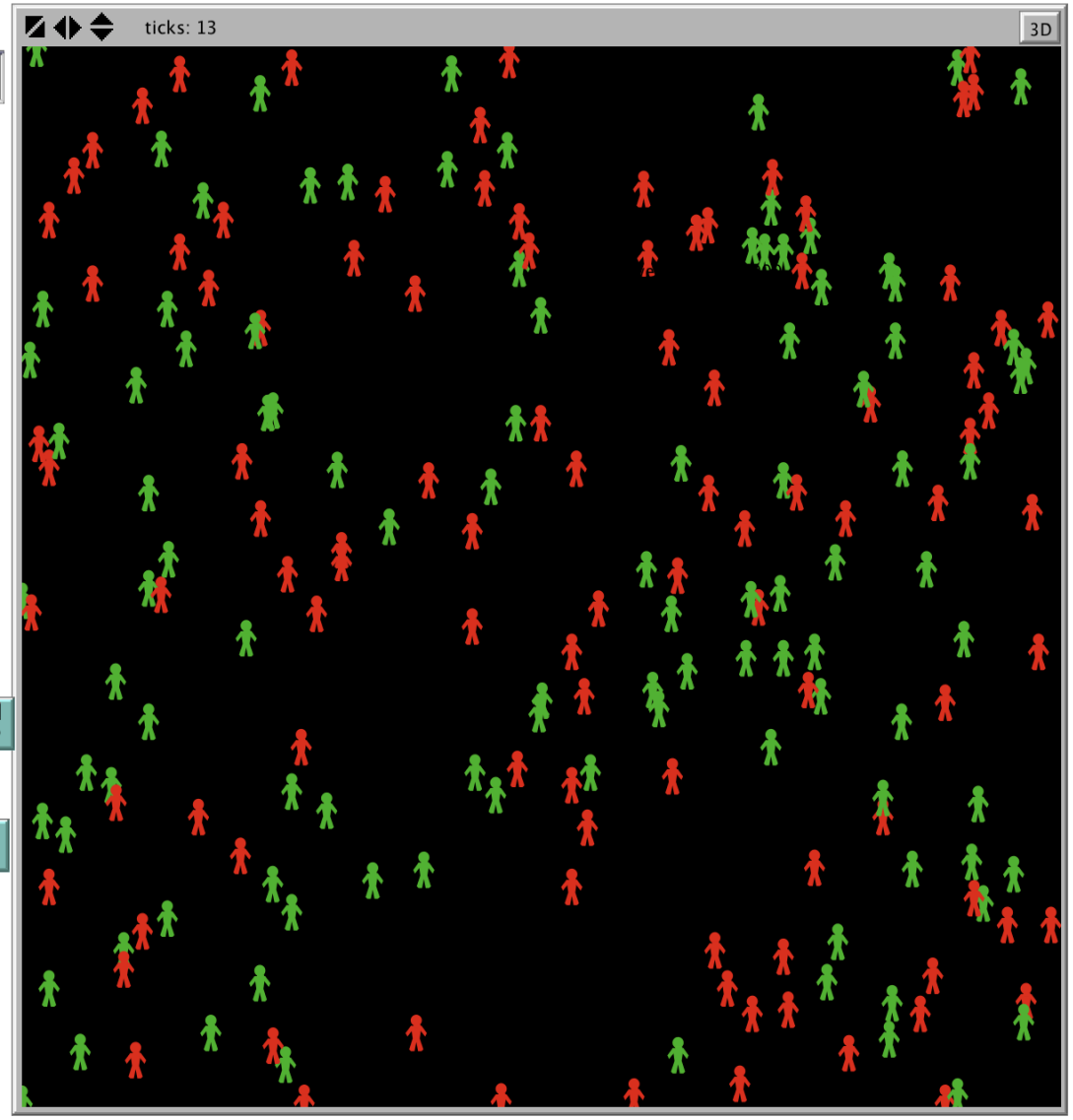
- Why ABM Model ?
  - Make predictions using validated theories of agent behaviors
    - Use micro-known to produce macro-unknown
  - Explore and develop new explanations of empirically observed phenomena
    - Use micro-unknown to reproduce macro-known

How to model it?
Agent Based Model

- Design
  - Consumer agents
  - Producer agents
  - Interactions based on transfers
  - Some functions such as saving, reproduction, revenue, and consumption
  - Interact within an environment

Interface Info Code

Edit Delete Add Plot slower view updates continuous Settings...



setup go

Population 121

consojeune 0.29

augmentation 0.42

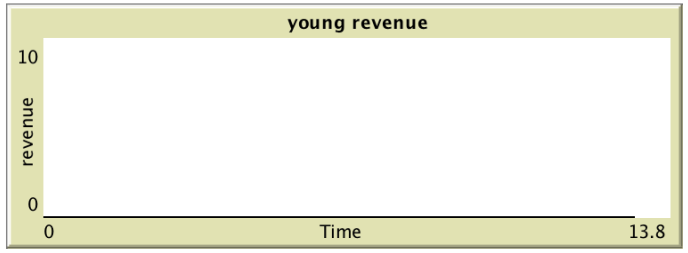
Time 13

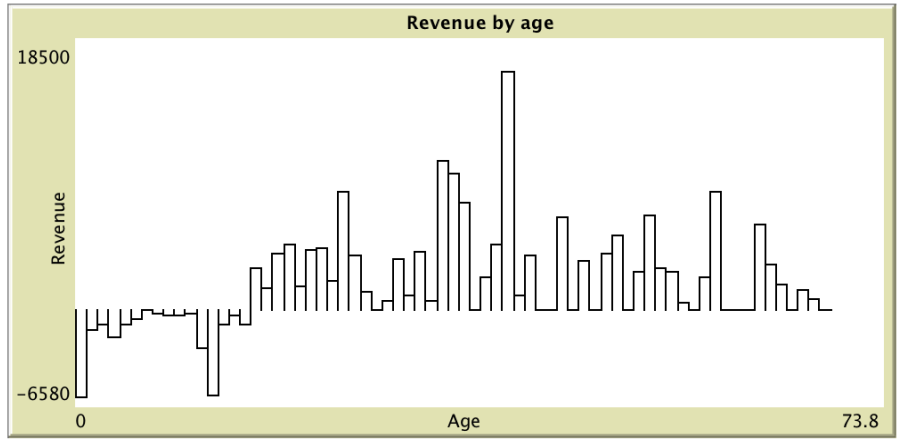
max_child 3

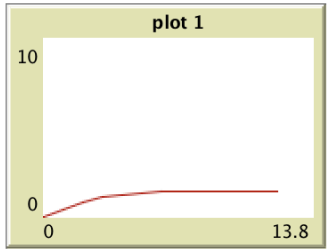
life-expectancy-max 69

consumption-max 624

life-expectancy-min 10







Command Center Clear

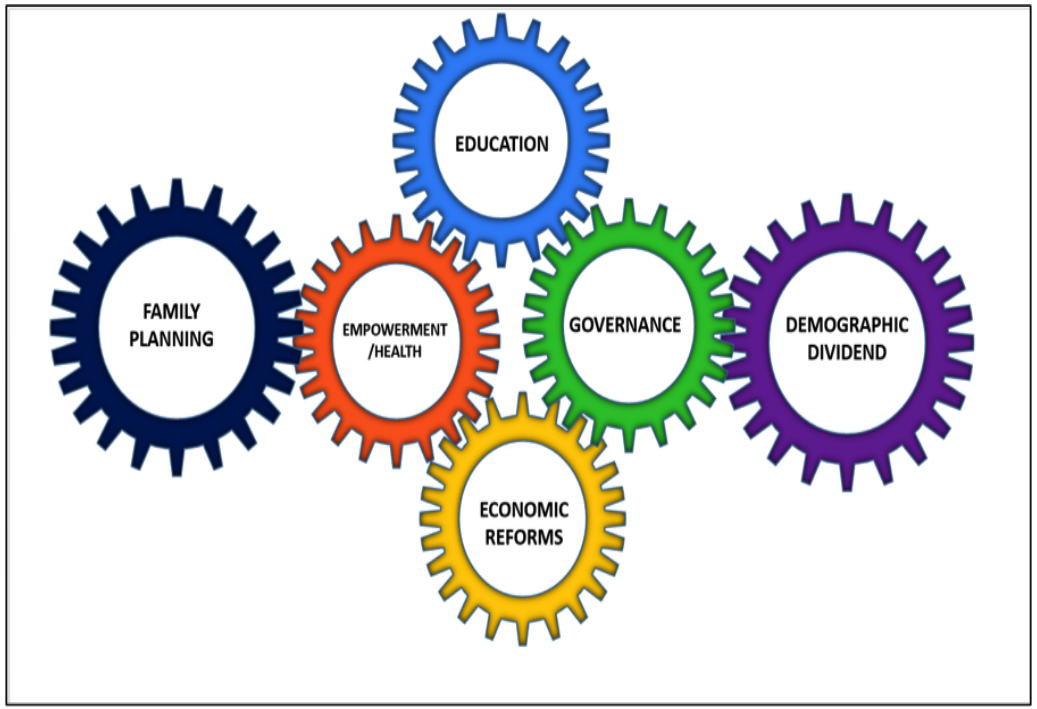
observer: 1839.7007999999998

observer>

How to model it?
Gaming Model

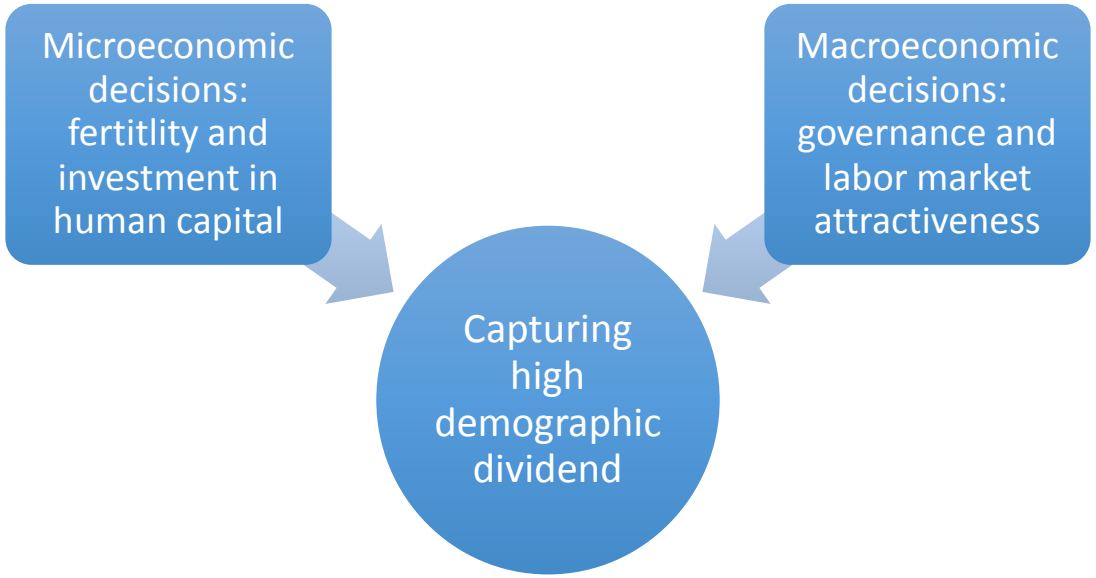
- Why Gaming Model?

  - Put the wheels together in a dynamic and strategic way
  - Simulate the effects of microeconomic decisions and public policy decisions on capturing the DD
  - Understanding the concept of surplus, deficit, and lifecycle deficit



How to model it?
Gaming Model at macro level

- Why Gaming Model?
  - Four assumptions on:
    - Fertility
    - Labor market
    - Human capital
    - Governance



Why modelling?
Gaming Model at macro level

- Three states for each assumption: giving 81 different cases; illustrating different trajectories; having different meanings in dividend capture

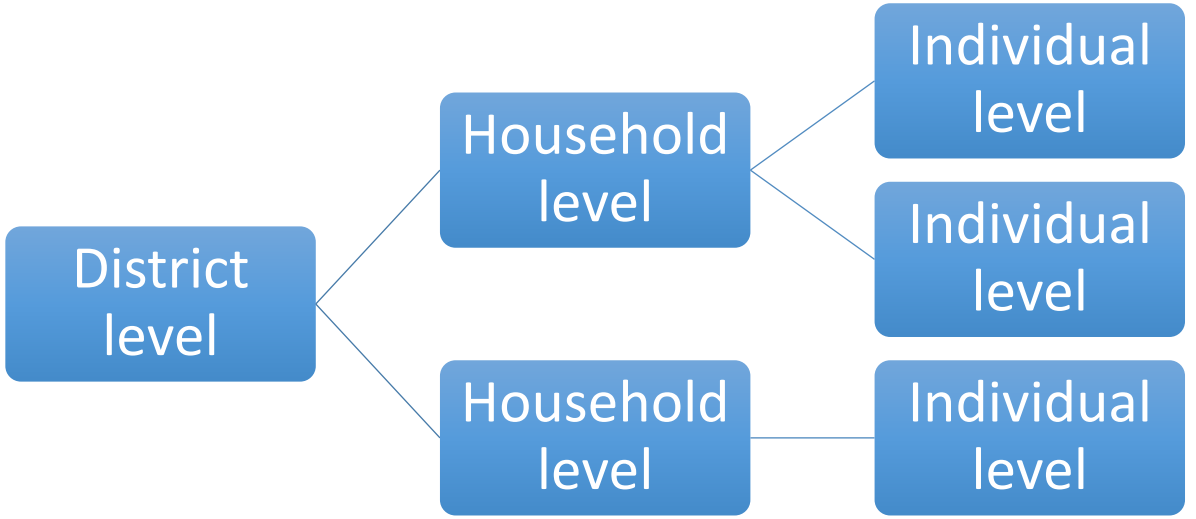
States	F	H	G	E
Very Good	1	1	1	1
Medium	2	2	2	2
Weak	3	3	3	3

STATE 1		STATE 2		STATE 3	
1111		2111		3111	
1112		2112		3112	
1113		2113		3113	
1121		2121		3121	
1122		2122		3122	
1123		2123		3123	
1131		2131		3131	
1132		2132		3132	
1133		2133		3133	
1211		2211		3211	
1212		2212		3212	
1213		2213		3213	
1221		2221		3221	
1222		2222		3222	
1223		2223		3223	
1231		2231		3231	
1232		2232		3232	
1233		2233		3233	
1311		2311		3311	
1312		2312		3312	
1313		2313		3313	
1321		2321		3321	
1322		2322		3322	
1323		2323		3323	
1331		2331		3331	
1332		2332		3332	
1333		2333		3333	

Why modelling?
Gaming Model at macro level

How to model it?
Gaming Model at micro level

- A networking game based on the fact that the lifecycle deficit is a scaling problem at:
  - the individual level
  - The household level
  - The district level
  - The country level



How to model it?
Gaming Model at micro level

- Each player chooses randomly a family and follows the life trajectory of this family: For each event in the family (baby born, death, ...)
    - Consumption, revenue, lifecycle deficit, saving, debts are updated
    - Families are supposed to be in the same district
    - The chief of the district follows economic indicators of the district and takes political decisions

Gaming model at the macro and micro level

- Dissemination:
  - Cards
  - Web platform
  - Mobile platform

Visualization

- Objectives:
  - Visualize evidence obtained from NTA Data
  - Monitor lifecycle deficit evolution on time
  - Open NTA results to a larger public
  - Link for Senegal: https://crefat.univ-thies.sn/crefatdataviz/

Perspectives

- Use genetic algorithm in order to select best variables for capturing a high demographic dividend

- Model demographic dividend capture as a dynamic system or a fractal model

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