Exploring the impacts of government programs on households in Amazon estuary region of Brazil--an Agent-based simulation

Yue Dou, Peter Deadman, Derek Robinson

Department of Geography and Environmental Management, University of Waterloo

Oriana Almeida, Sérgio Rivero
Universidade Federal do Pará, Brazil

Nathan Vogt
National Institution for Space Research

UNIVERSITY OF WATERLOO

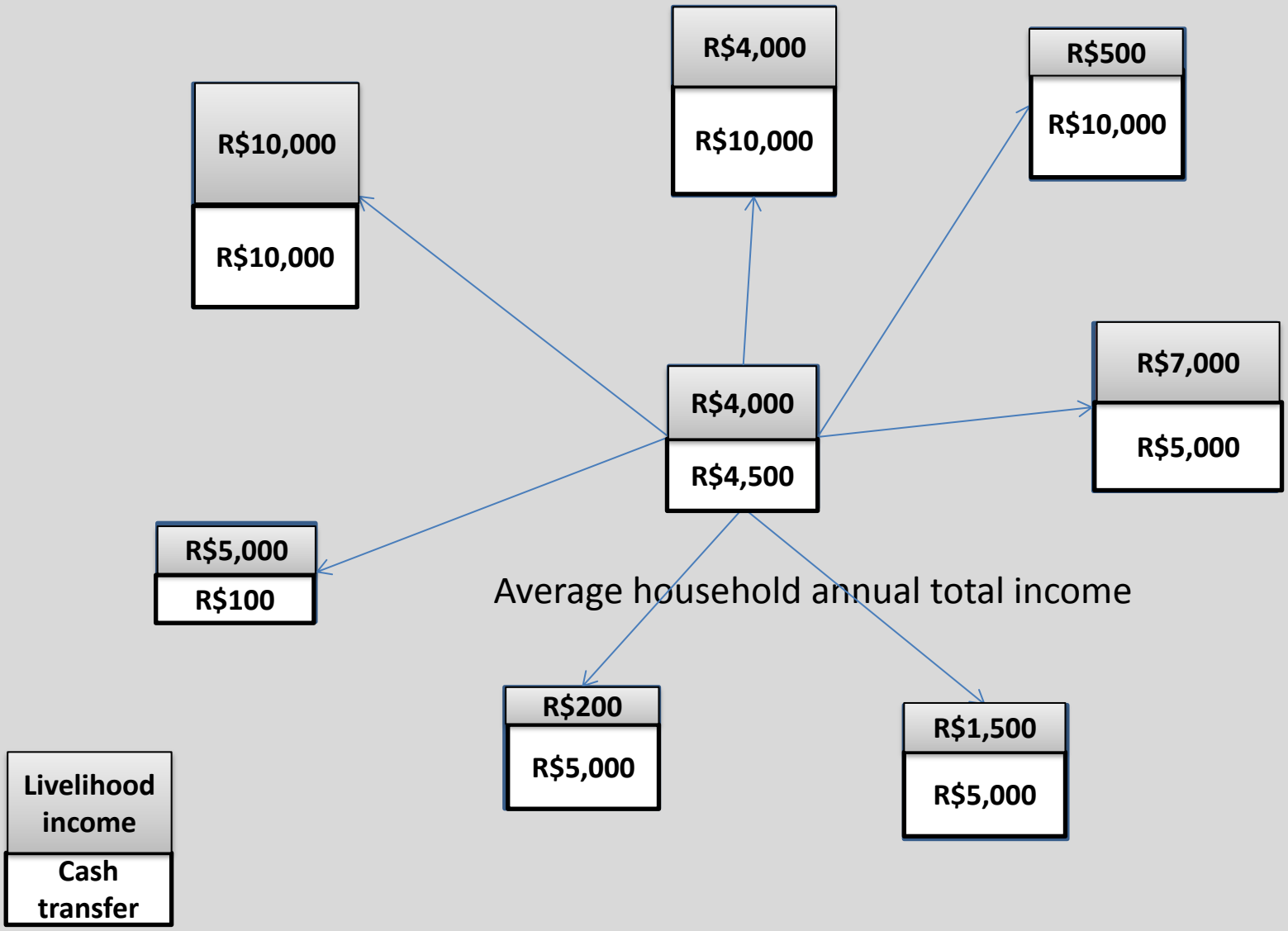
OUTLINE

- Background of Caboclos and cash transfer programs
- Research questions and methodology
- Experiment and scenario design
- Results analysis
- Discussion and policy aspects

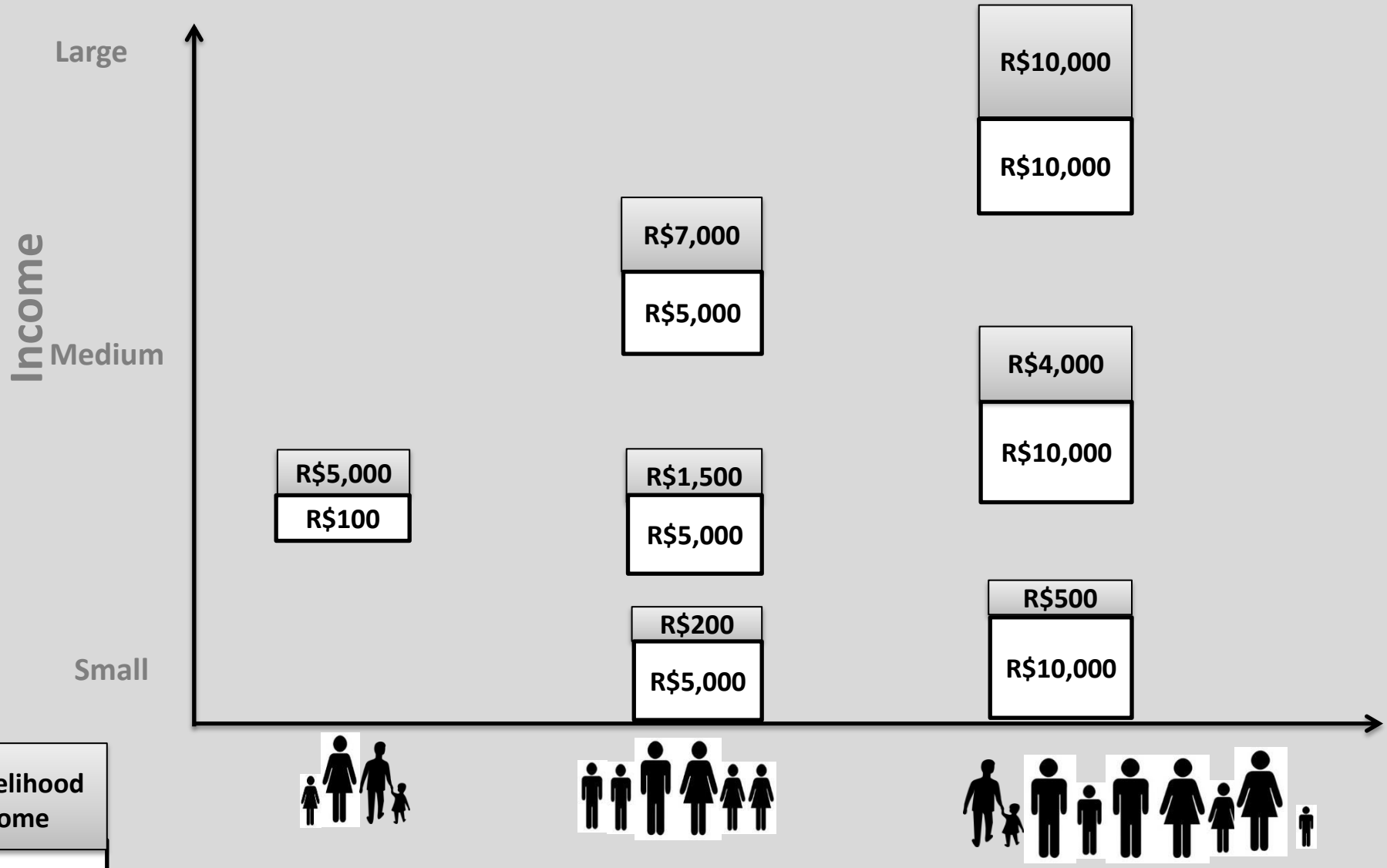
Introduction: Caboclos

- Small farming households who live in the Brazilian Amazon estuary region;
- Facing multiple stressors from both climate change and economic and social changes;
- A few government cash transfer programs, which become a significant income source
  - Bolsa Familia
  - Pension.

INTRODUCTION: SIZE AND DEPENDENCE OF CASH TRANSFER

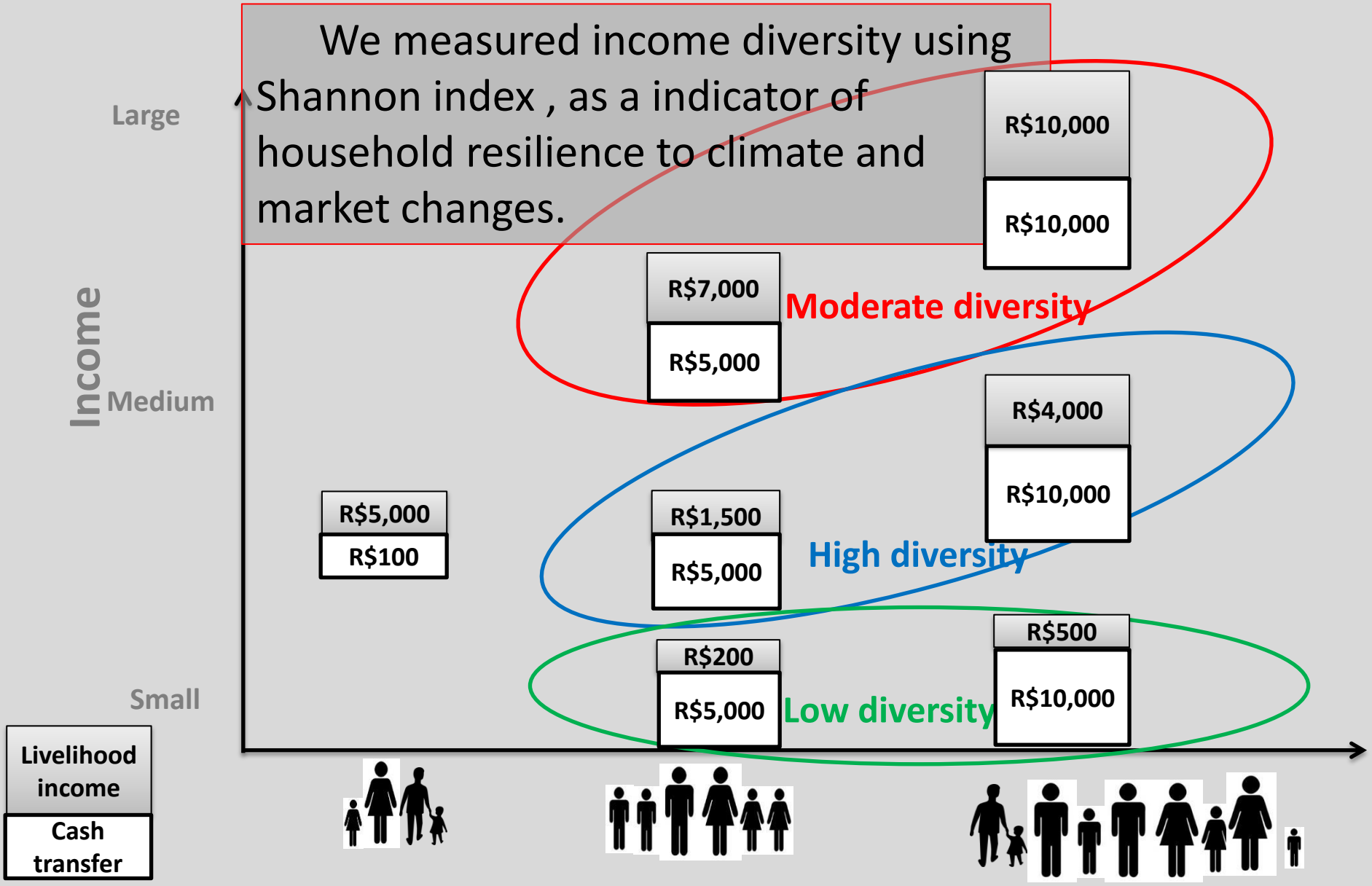


HOUSEHOLDS ARE HETEROGENEOUS



HOUSEHOLDS ARE HETEROGENEOUS

We measured income diversity using Shannon index , as a indicator of household resilience to climate and market changes.



RESEARCH QUESTIONS

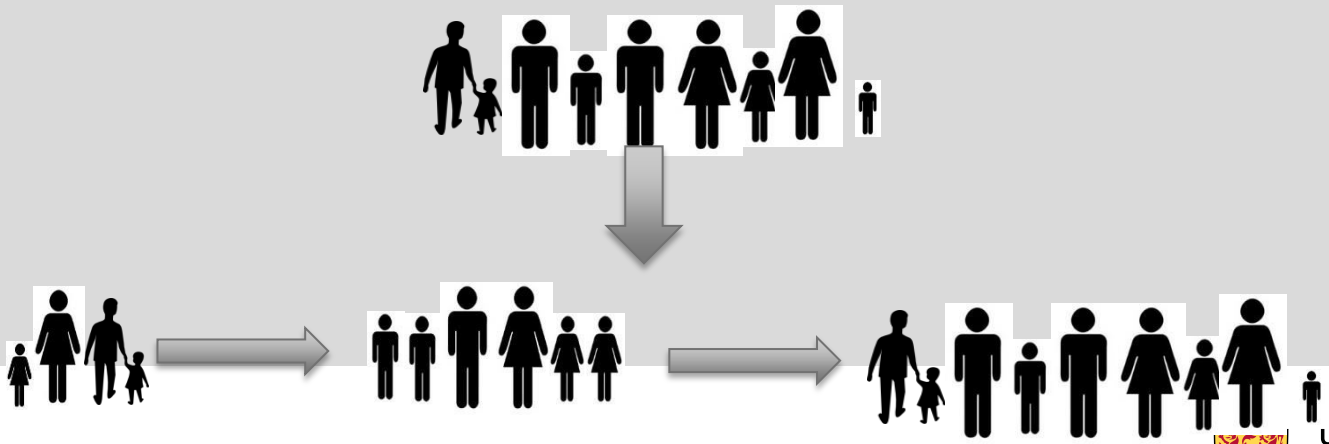
- What differentiate household agents and cause such diverging livelihoods if they are statistically similar?
- What are the impacts of cash transfer programs on household livelihood? How do different agents benefit and react to these policies?

HOW?--MODELING

- From questionnaire to modeling

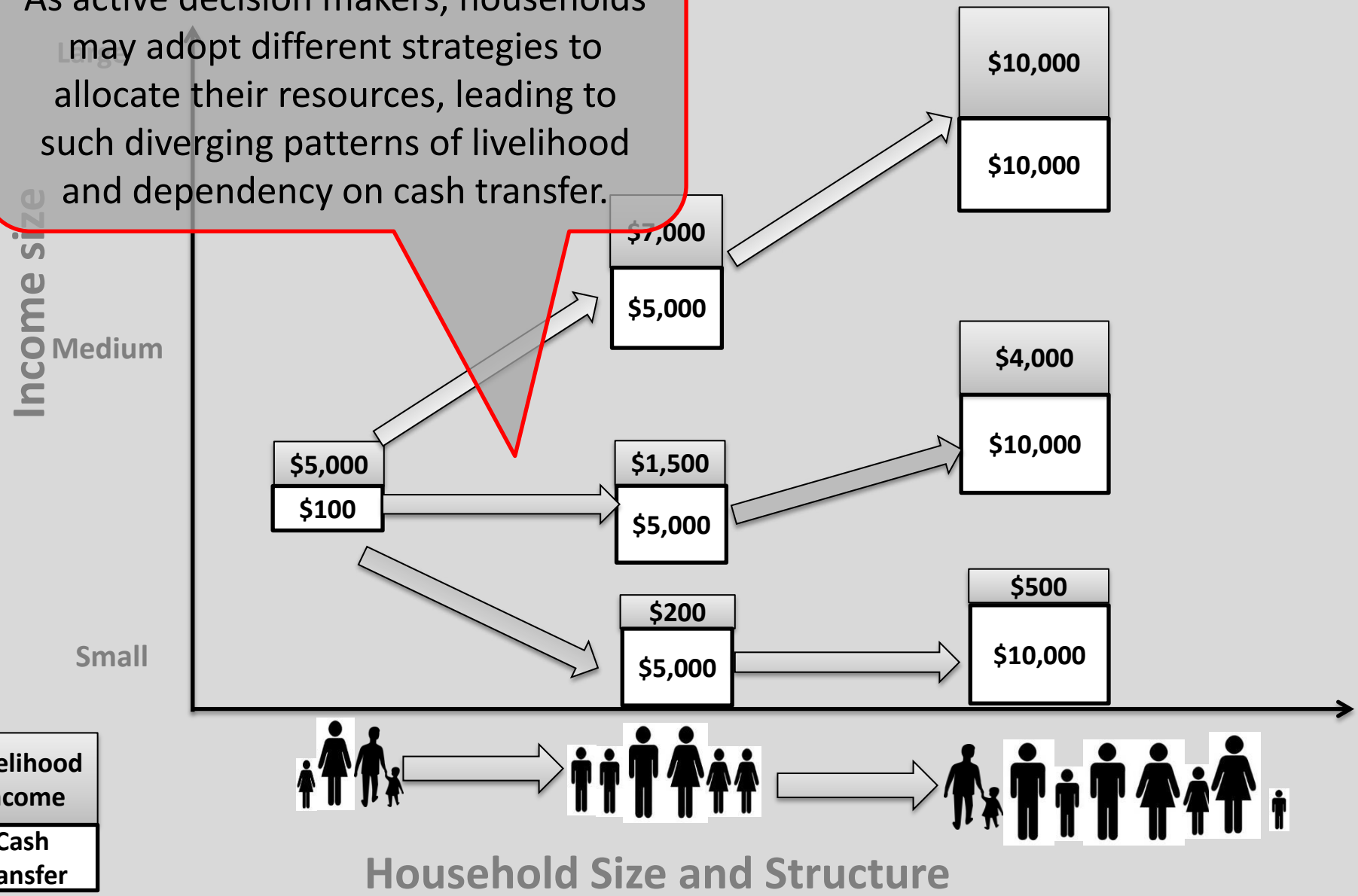
	dependency cluster	livelihood income	Total Income	dependency	Livelihood diversity
YOUNG		4713	4738	0.005	0.244
MIDDLE	Low	7012	7921	0.115	0.471
	Moderate	1290	3112	0.585	0.522
	High	162	2035	0.920	0.104
MULTIGENERATION	Low	10988	21471	0.488	0.44
	Moderate	4056	15376	0.736	0.55
	High	446	12140	0.963	0.176

- From static snapshot to time clapes



HYPOTHESIS

As active decision makers, households may adopt different strategies to allocate their resources, leading to such diverging patterns of livelihood and dependency on cash transfer.



METHODOLOGY

- Definition of ABM
  - Decision makers (household actors)
  - An environment that decision makers interact with
  - Prescribed rules – decision making strategies
- Modeling complex socio-ecological environment
  - Capture emergent macro-level phenomena from the heterogeneous individual interactions;
  - Flexible to plug in ecological and/or social components, assumptions, and scenarios;
  - From heterogeneous to aggregate level

MODEL DESIGN

Household member

- **Age, Education, Labour**
- **Subsistence requirement**

Decision making unit
Household

- **Labour**
- **Capital**
- **Land**

Maximize profit (MP)

Maximize Leisure (ML)

Subsistence First (SF)

acai

agriculture

wage

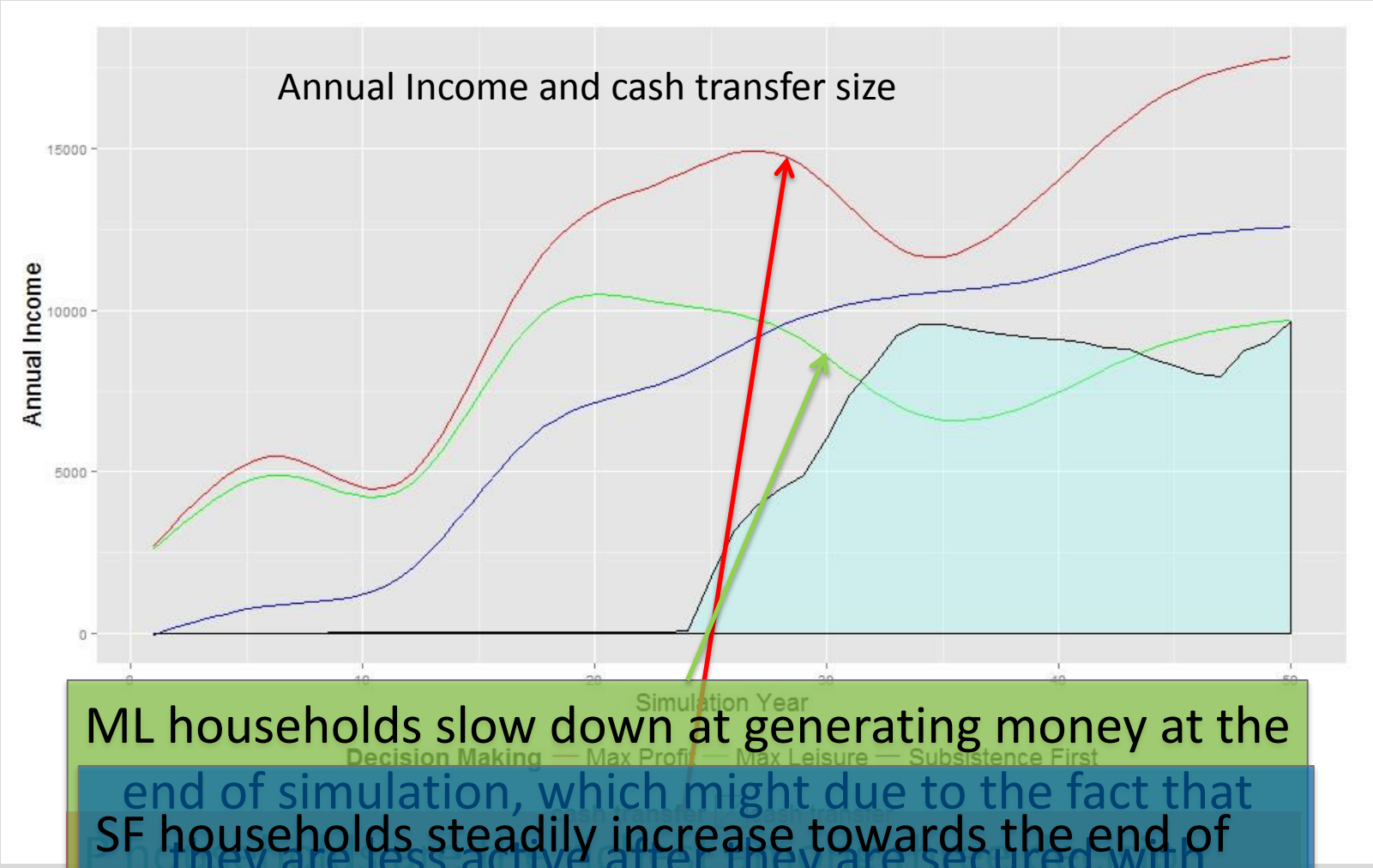
MODEL DESIGN

- Max Profit (MP)
  - Bring the households the highest net income measured in market prices
- Max Leisure (ML)
  - Maximize the leisure time as long as the subsistence requirement is met
- Subsistence First (SF)
  - Maintain their own domestic consumption (manioc) before they produce other market products (acai) for revenue

SCENARIO DESIGN

- Purpose: reproduce the empirical patterns
- Scenario settings:
  - No external factors– market and climatic conditions are static
  - Temporal scale: 50 years
  - 30% job probability
  - Three decision making strategies
  - BF and pension
- Initialization: homogeneous young households
- Indicators:
  - Income
  - Dependency on CT
  - Income diversity

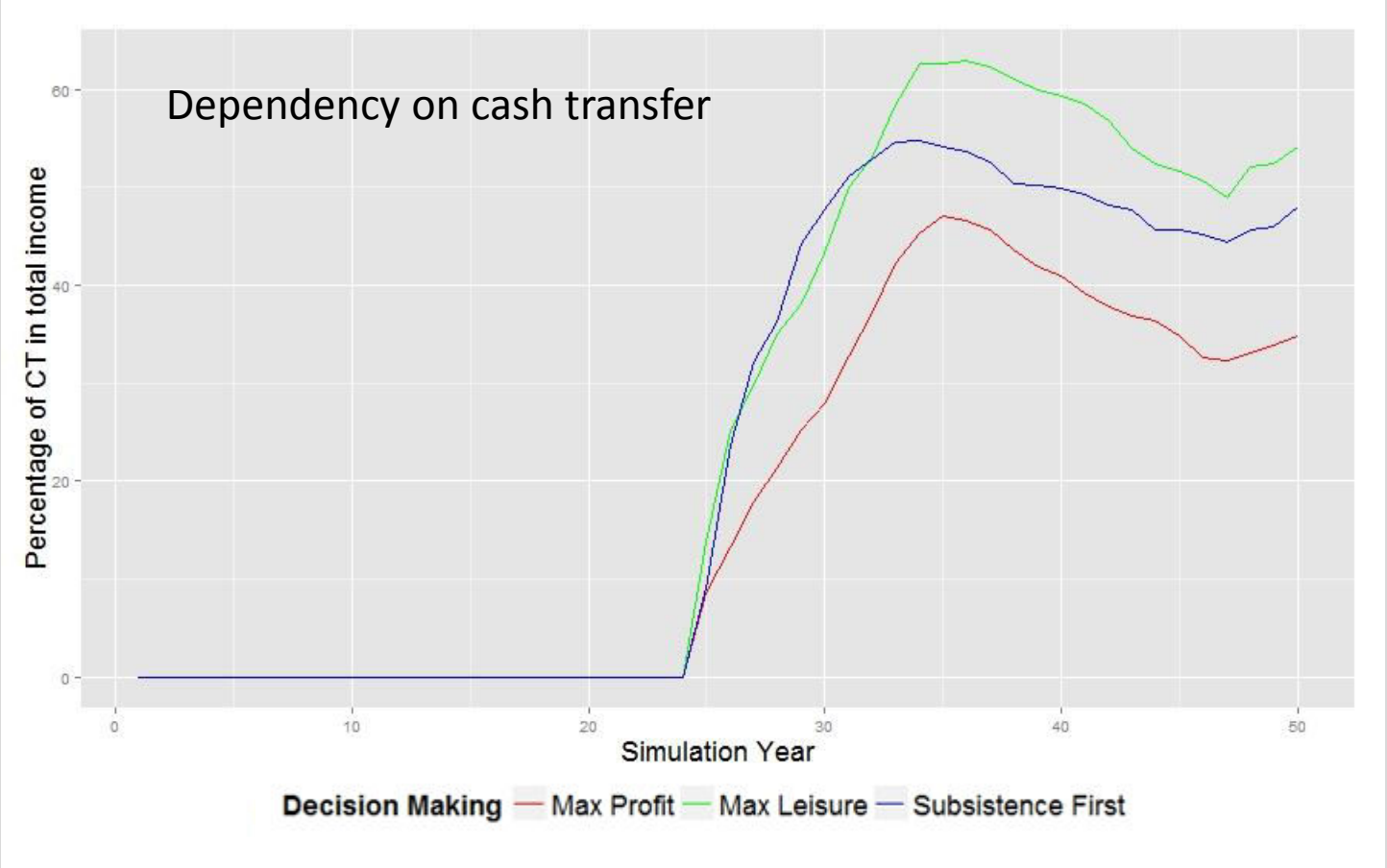
VALIDATE ALTERNATIVE DECISION MAKING



ML households slow down at generating money at the end of simulation, which might due to the fact that they are less active after they are secured with government pension program.

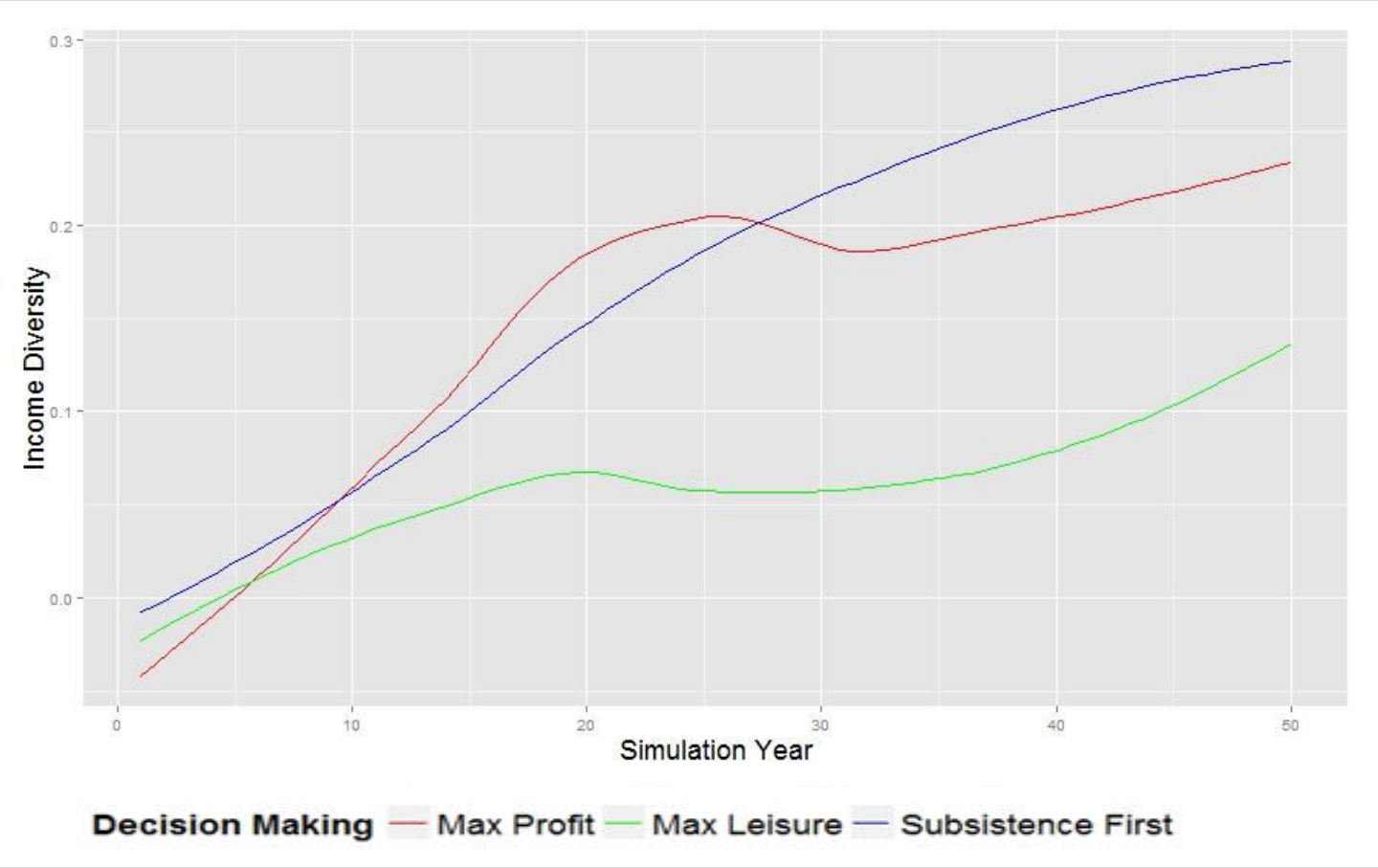
SF households steadily increase towards the end of simulation.

VALIDATE ALTERNATIVE DECISION MAKING



MP households always have the lowest dependency on cash transfer.
ML households rely on cash transfer most.

VALIDATE ALTERNATIVE DECISION MAKING



SF households have a increasing diversity trend, which exceeds MP households at the end of simulation.

while ML households have the lowest diversity.

VALIDATE ALTERNATIVE DECISION MAKING

Table: empirical data of different groups of households

	dependency cluster	livelihood income	Total Income	dependency	Livelihood diversity
YOUNG		4713	4738	0.005	0.244
MIDDLE	Low	7012	7921	0.115	0.471
	Moderate	**1290**	**3112**	**0.585**	**0.522**
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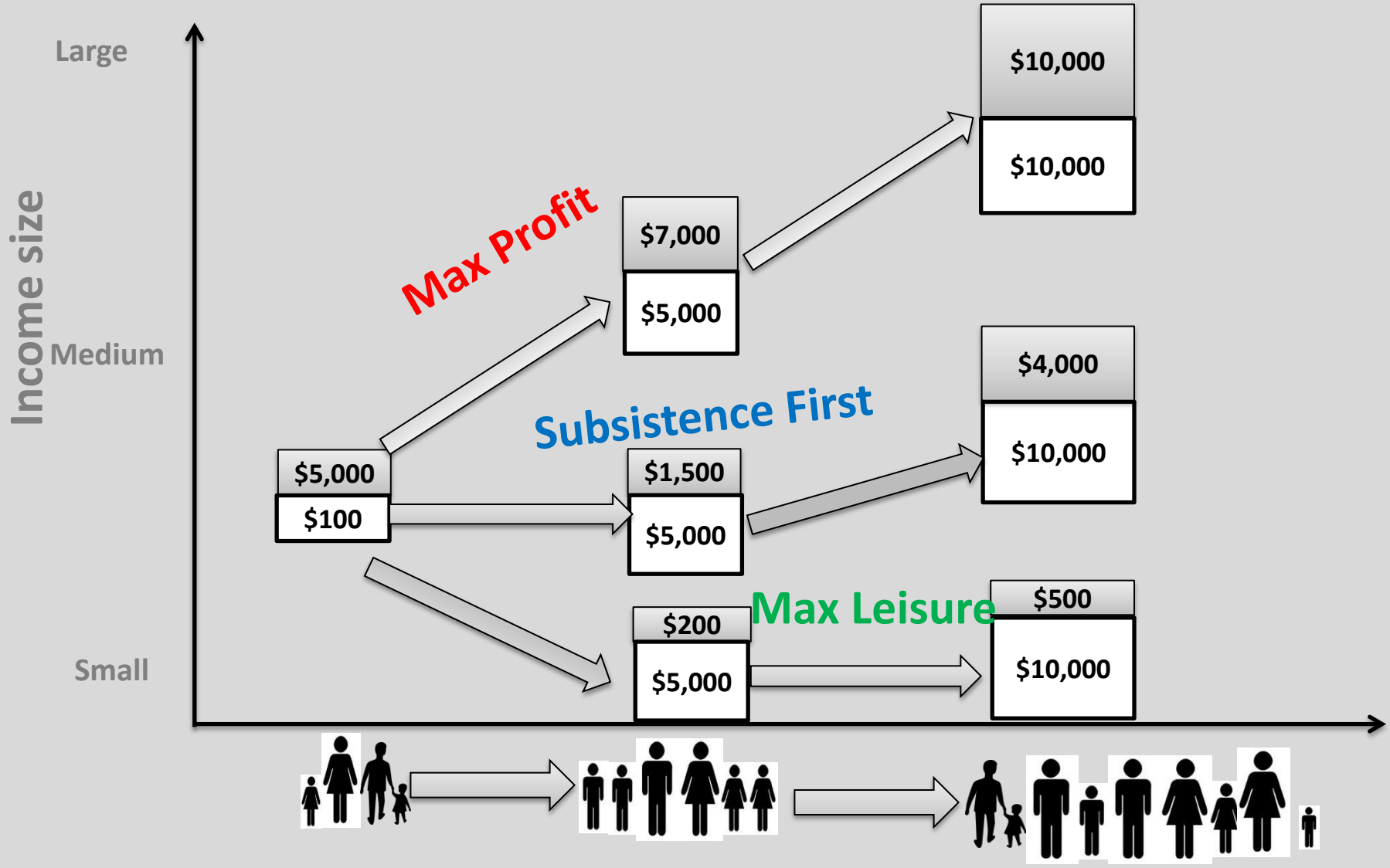
Based on the rank of four indicators, we could come to an conclusion (next slide) based on ***pattern-oriented validation.***

VALIDATE ALTERNATIVE DECISION MAKING



CONCLUSION

- The diverging patterns of household income and dependency on cash transfer programs can be reproduced by simulating different decision making strategies:
  - Households who aim to maximize their profit (MP) tend to have the highest income and lowest dependence on CT;
  - Households who aim to have most leisure time (ML) are more likely to generate the lowest income and highest dependence.
  - Households who produce their own subsistence crops (SF) have a steady increasing income, and highest income diversity.

POLICY ASPECTS

- Overall, with different resources and decision making strategies, households react and benefit differently to government cash transfer programs.
- When design cash transfer programs, side effects on different households, such as the growing dependency on cash transfer, should also be considered.

FUTURE RESEARCH

- As a calibrated ABM, it can be used to explore other scenarios and assumptions;
- To investigate the resilience of different decision making strategies under a changing environment setting, such as climate change scenarios and market boost and boom cycles.

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THANK YOU!

yue.dou@uwaterloo.ca,
pjdeadman@uwaterloo.ca