

Agent-Based Model and System Dynamics Model for Peacekeeping Operations

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"All models are wrong, but some are useful" – George Box

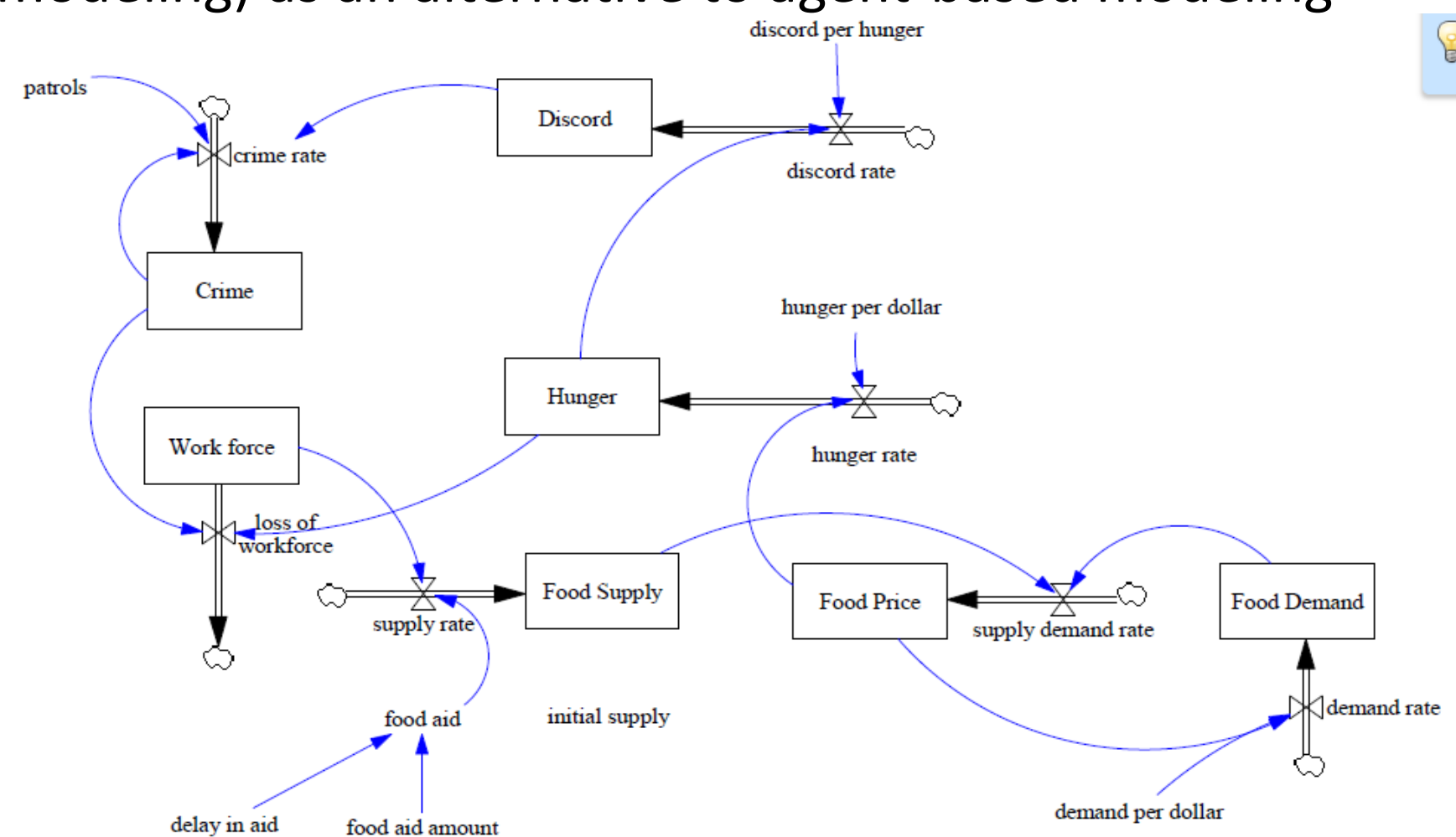
"Make everything as simple as possible, but not simpler" – Albert Einstein

Objectives:

- To model the early stage of peacekeeping, humanitarian assistance, and disaster relief (HADR)
- To explore the use of system dynamics (equation-based modeling) as an alternative to agent-based modeling

Conceptual Model:

- *Self-sustaining*
→ Supply = Demand in the absence of crimes
- *Economy*
→ Food price, supply, demand
- *Social*
→ Income disparity, relative deprivation
- *Security*
→ Crime driven by hunger, arrest of criminals



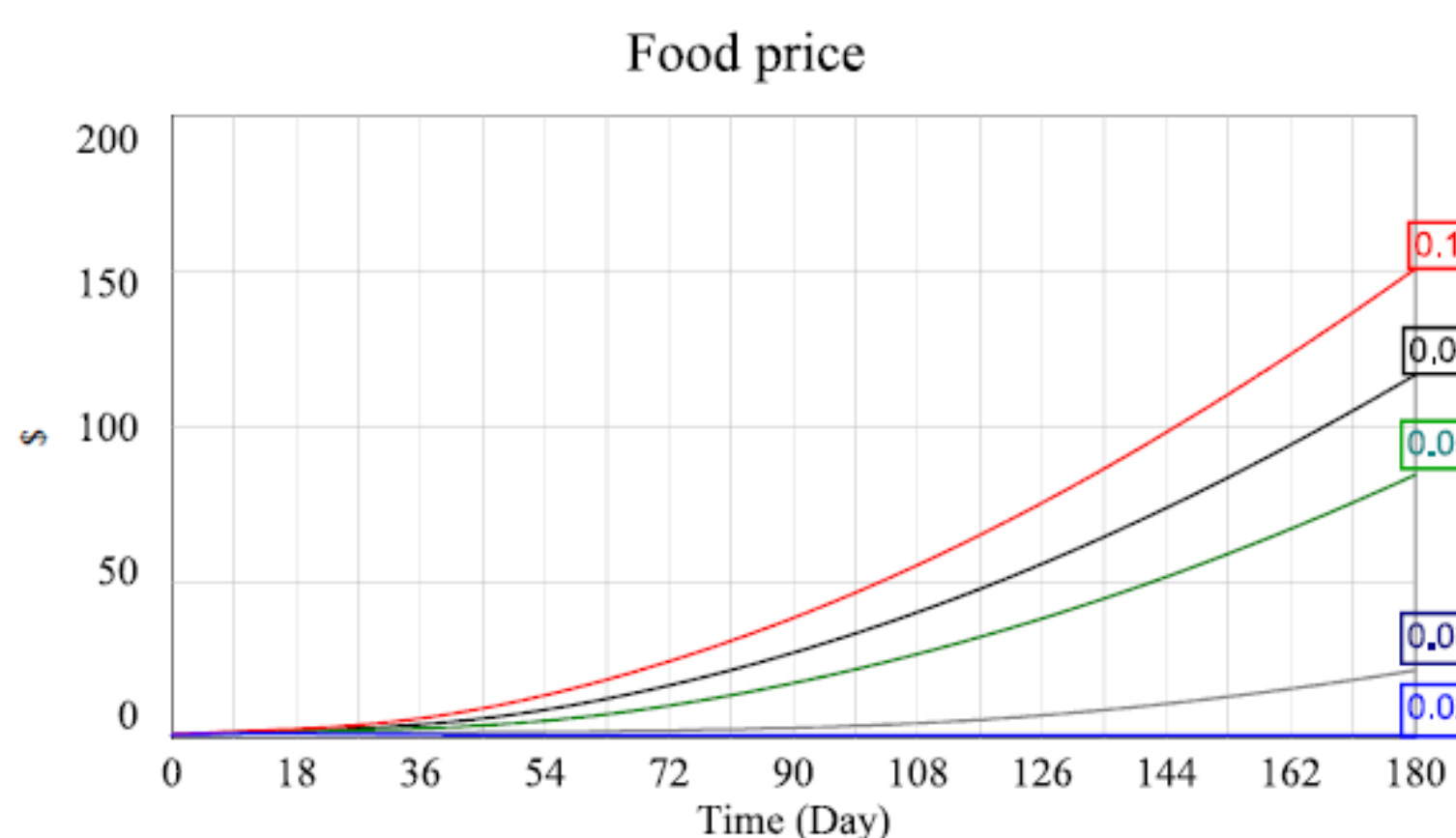
System Dynamics Model:

- Top-down approach, models system-level behavior
- Expanded version of the conceptual model
- *Discord*, i.e., % of discriminated population within households that are hungry used to model relative deprivation

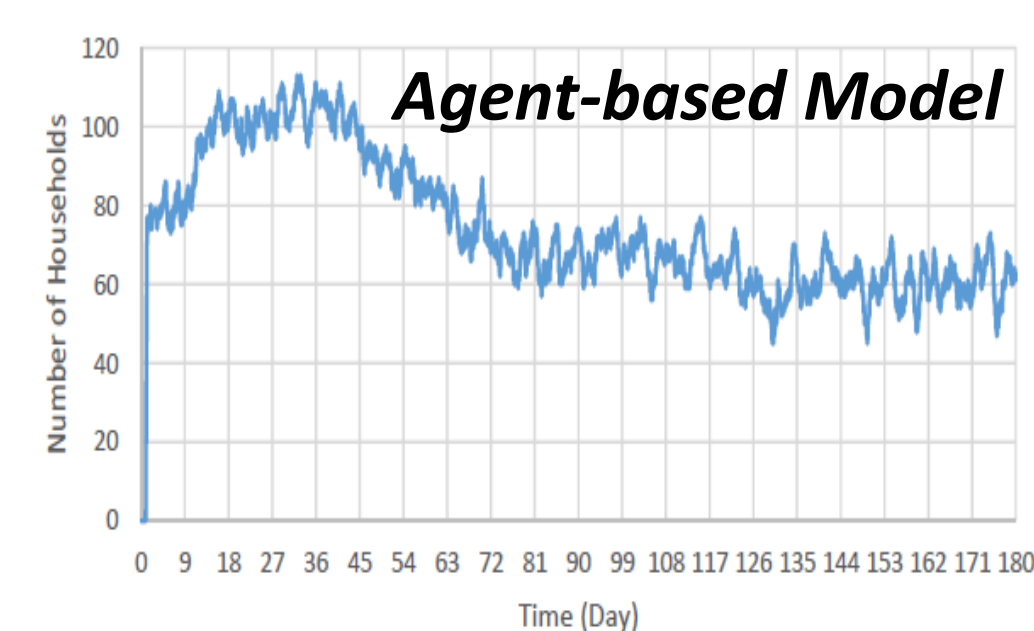
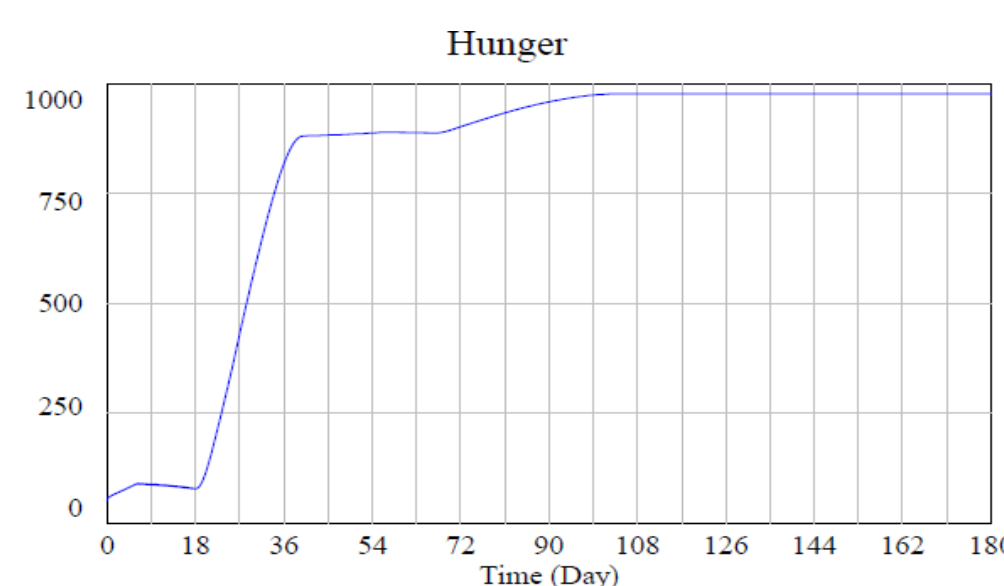
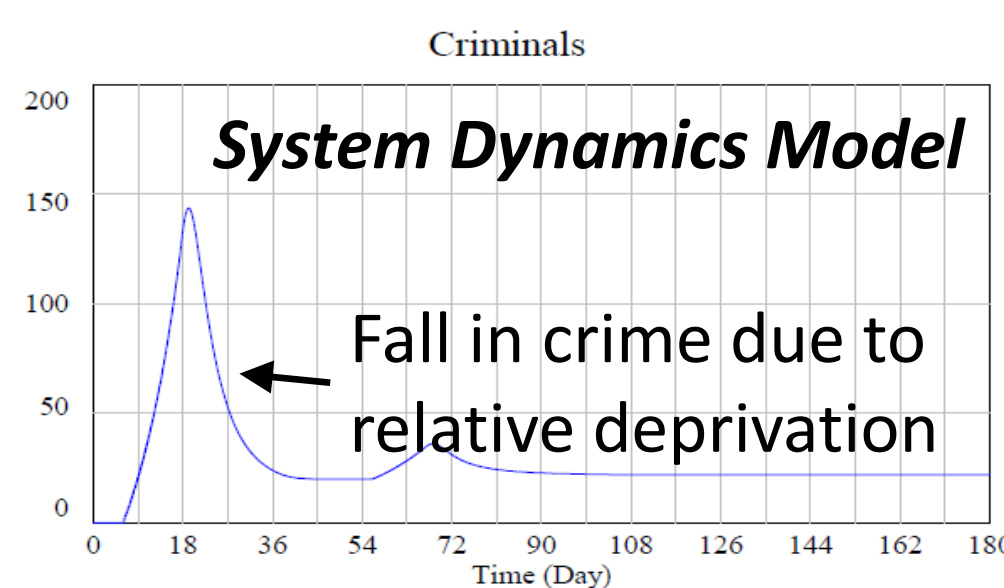
Agent-based Model:

- Bottom-up approach, models individual behavior
- Belief-desire-intention based
→ Buy food if possible, ask for food aid, turn to crime
→ Rob neighbors if much hungrier than neighbors
→ Continue to resort to crime until arrested

Results:



Large variation in food prices due to time step



Conclusions:

- Both the system dynamics model and the agent-based model displayed similar emergent behavior in terms of crimes that occurred due to relative deprivation within the population.
- Large variations in food prices were observed as the time step and the integration technique were varied for the system dynamics model.