

High-Level Causal Loop Diagram for Federal Student Financial Aid System

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and Modeling Network

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Agenda

- Overview of system dynamics (SD) approach
- Results from proof-of-concept project
- Current causal loop diagram (CLD)

Overview of Systems

- EVERY organizational system seeks balance and equilibrium, similar to an ecosystem
 - Typical driving force is to balance supply and demand
- Feedback loops are the building blocks of complex systems:
 - Positive (reinforcing) feedback loop
 - Negative (balancing) feedback loop
- Feedback loops differ in strength and time span
- Dominance of feedback loops can shift over time
 - Example: “S” curve

Tasks In Typical Simulation Project

1. Interview subject matter experts (SMEs):
 - No one sees the entire system. We all see parts.
2. Develop causal loop diagram (CLD) with interconnected feedback loops:
 - Determines scope of simulation model.
3. Develop baseline simulation:
 - Captures only a portion of the overall CLD.
 - Provides initial starting point and major “plumbing”.
 - Data embedded in model at an aggregate summary level
4. Revise baseline simulation:
 - Review with SME’s for validation.
 - Collect additional information to fill gaps and assist validation.
5. Extend and expand baseline simulation:
 - Capture the entire CLD as well as any additional scope desired.
 - Review with SME’s and known information for validation.
6. Develop desktop application for decision support:
 - Use primarily to assist policy development and deployment.
 - Do not typically use for detailed budgeting purposes.

Proof-of-Concept Project

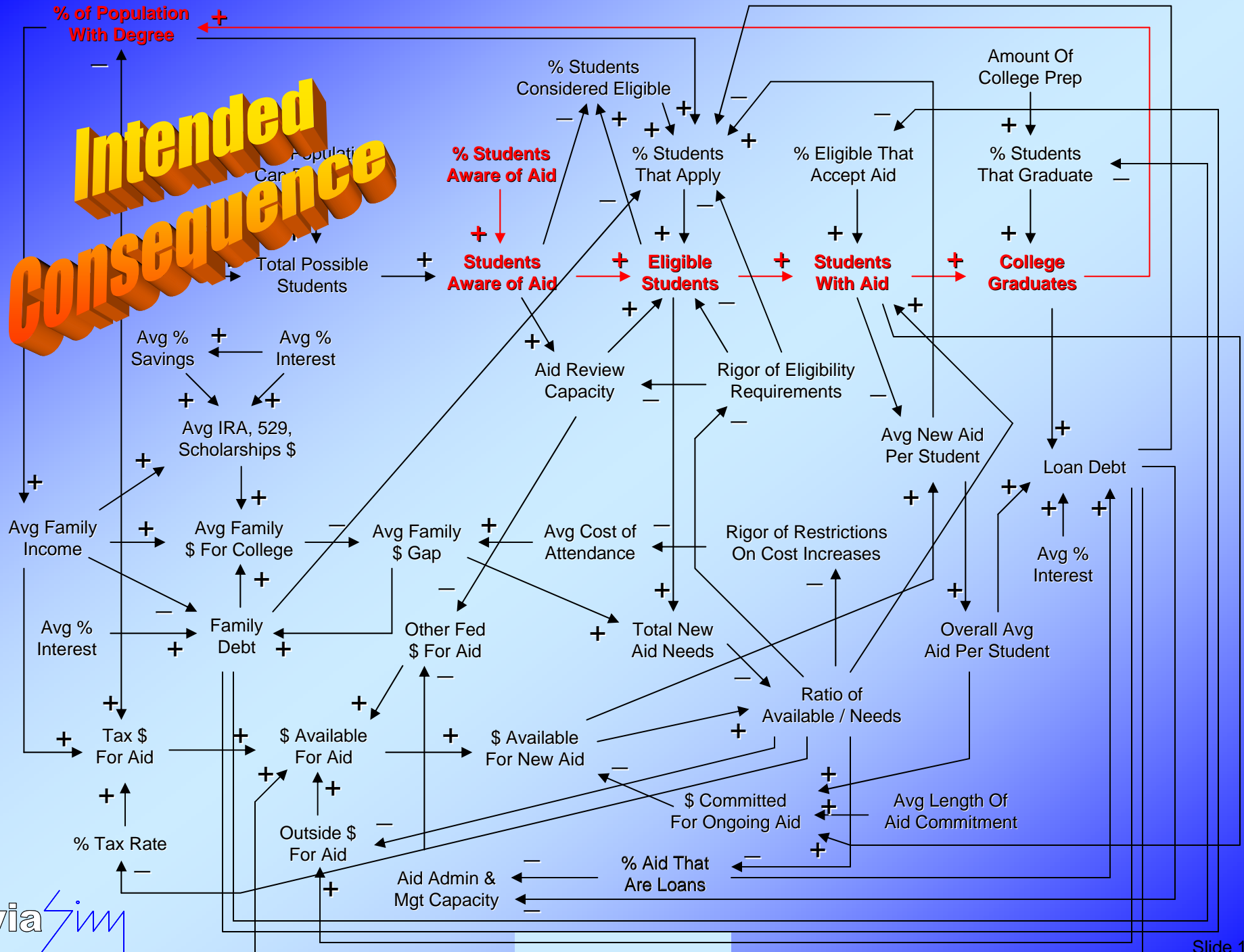
- Introduce ED to SD modeling for financial aid policy development and management by:
 - Developing baseline model of financial aid system using SD methodology.
 - Providing high-level, integrated, view of entire financial aid “ecosystem,” including major model entities and their relationships.
 - Demonstrating a SD simulation of the financial aid model.

Causal Loop Diagrams

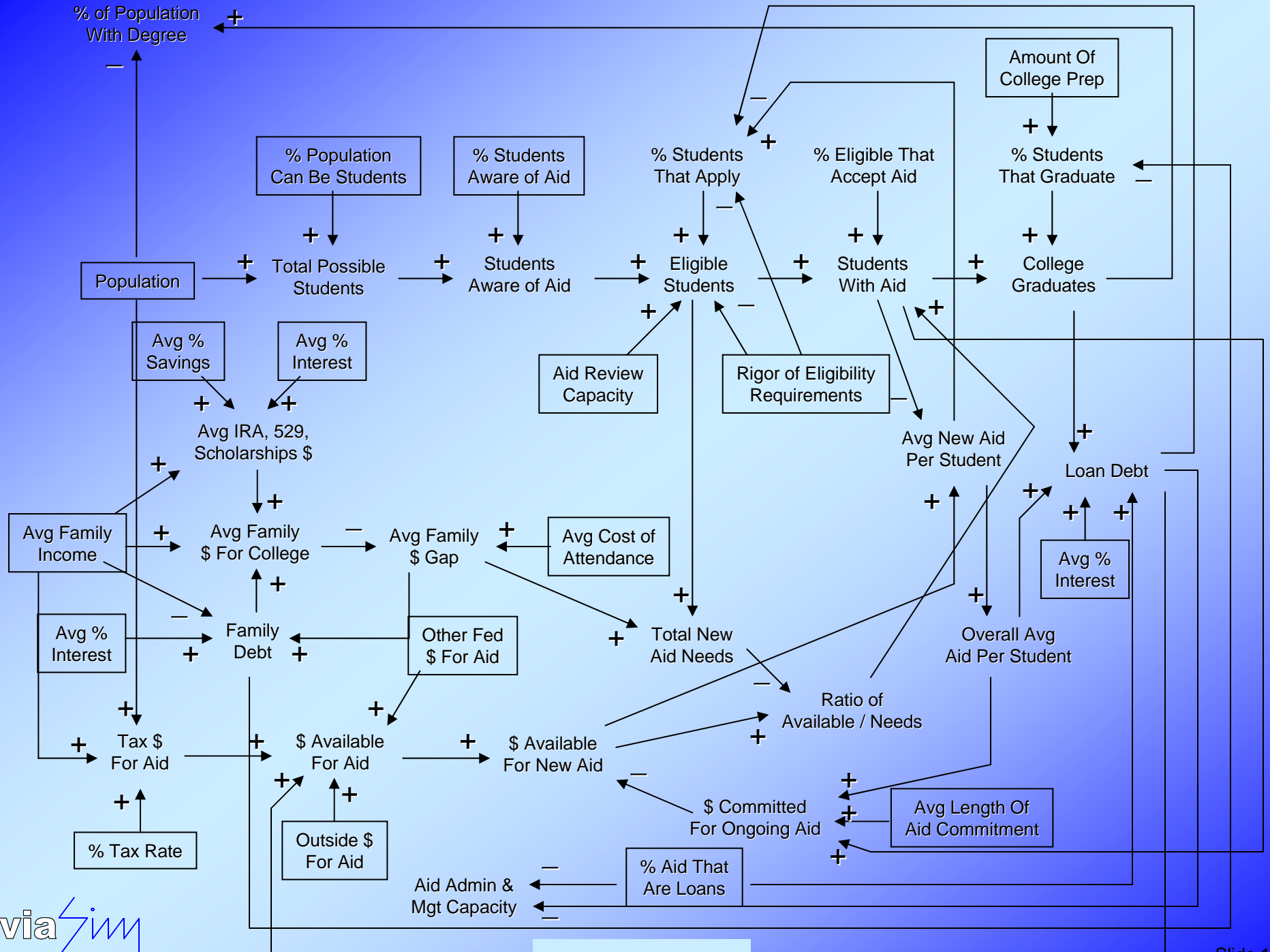
- Purpose:
 - Show interconnections of multiple feedback loops.
 - Provide common “big picture” for all participants to trace actions and their various consequences.
 - Form foundation for analysis with simulation model.
- Methods:
 - Arrows indicate direction of causality.
 - “+” sign indicates changes of variables move in same direction.
 - “-” sign indicates changes of variables move in opposite direction.

Example Cause-and-Effect Linkages and Feedback Loops

Intended Consequence



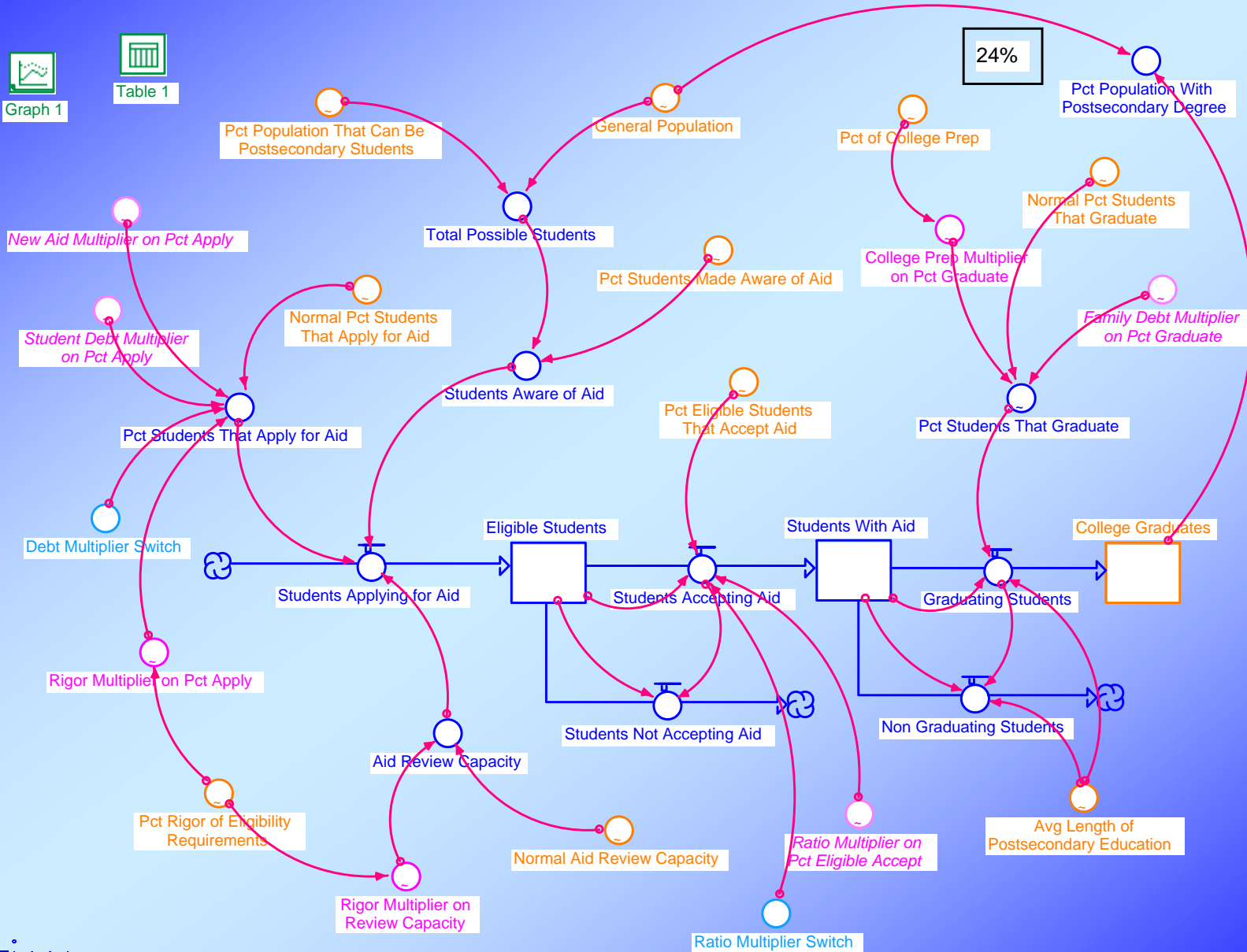
Baseline Simulation Model Scope



Purpose of Simulation

- CLD is good tool to discuss ideas and trace logic, but doesn't quantify impacts.
- Simulation model is used to:
 - Convert CLD into mechanism for quantification.
 - Provide a logically consistent framework for testing the interactions of several hypotheses and/or assumptions.
 - Example: What are the enrollment effects of simplified needs analysis?
 - Understand data gaps and data sensitivity.
 - Used NCES, Census, and College Board summary data.

Model Sector – Student Flow



Model Sector – Student Debt

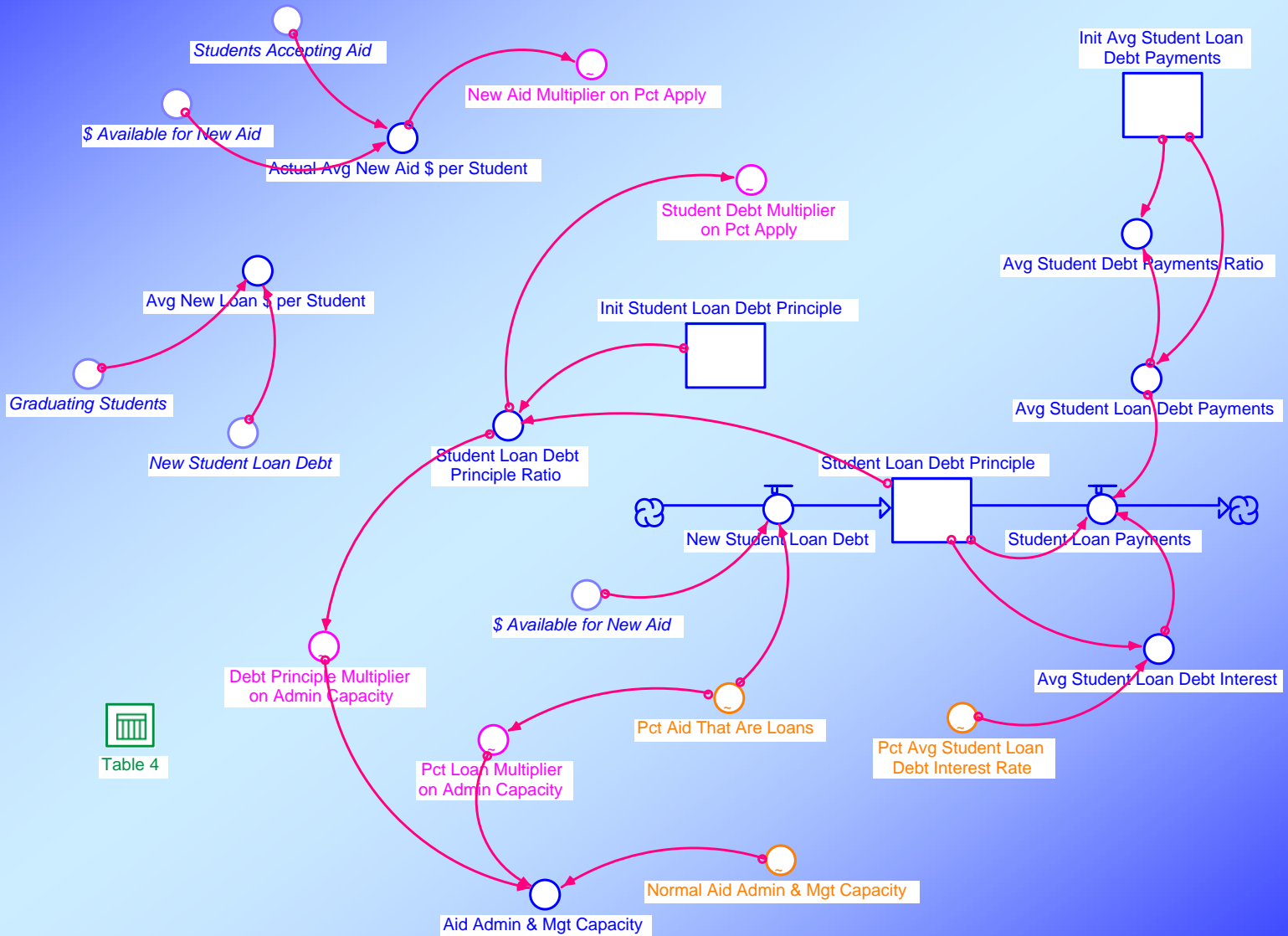
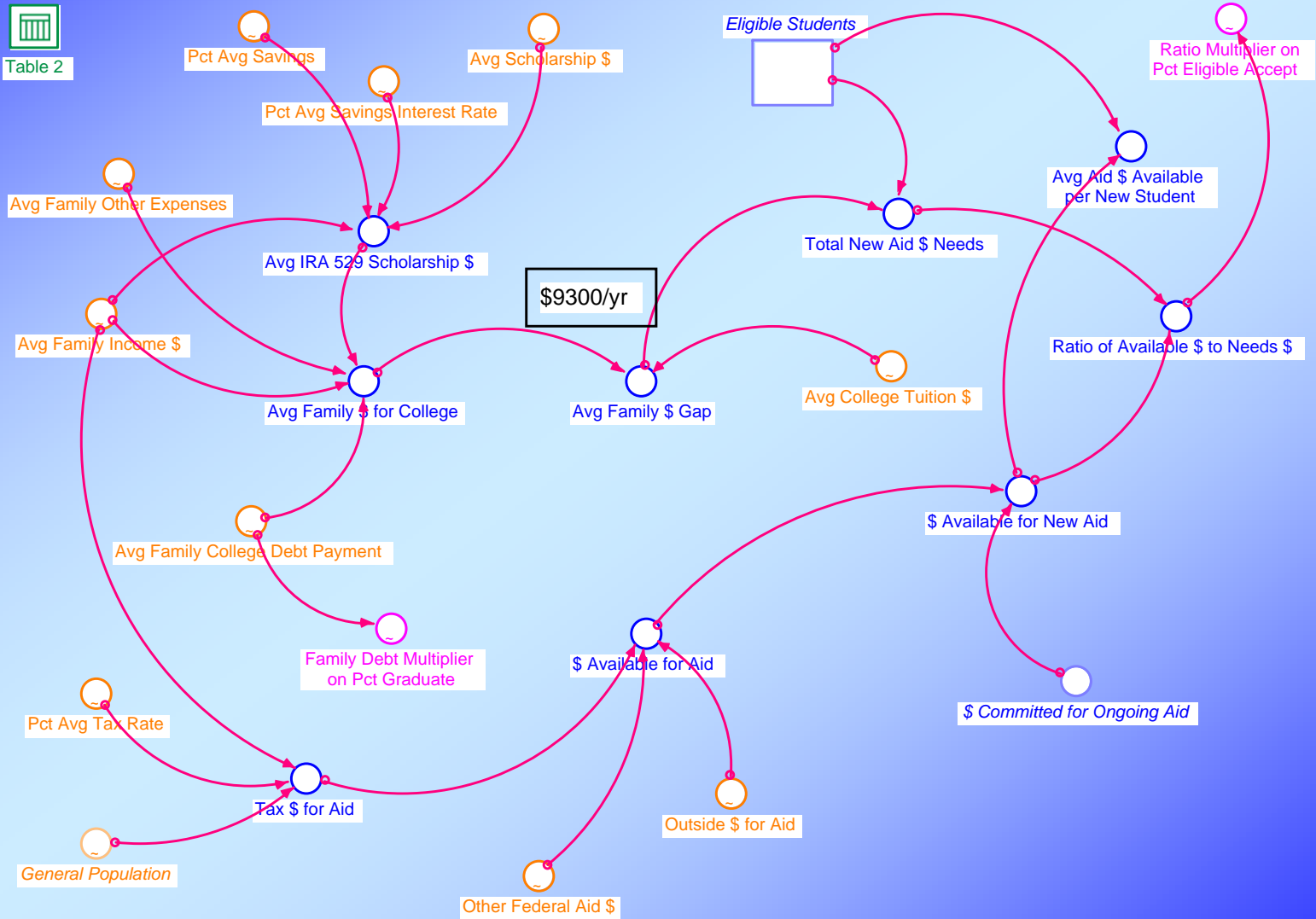


Table 4

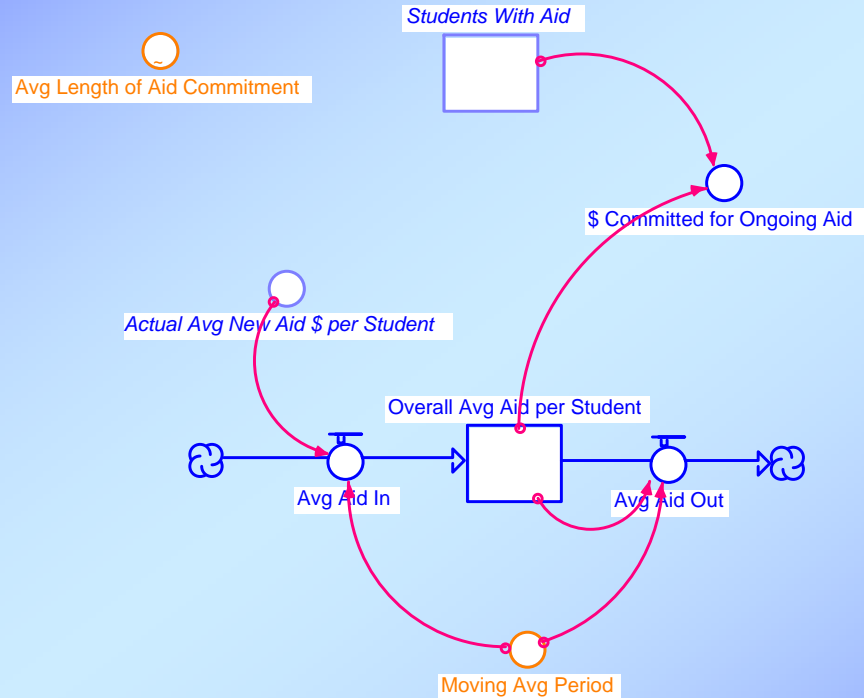
Model Sector – Family Gap



Table 2



Model Sector – Student Aid



Example Scenarios to Demonstrate:

- Adding/increasing IRA, 529, etc.
- Increasing aid awareness
- Increasing Pell grants

- Major assumptions:
 - Constant population (300M)
 - Estimates for current sources of aid funding
 - Aid committed for duration of education

Simulation Demonstration

Updated CLD

Next Steps

- **Socialize CLD with experts outside ED to:**
 - Clarify purpose of model:
 - What questions do we want answered, which policies, etc.
 - Validate scope of model:
 - Relevant entities, relationships, feedback loops, etc.
 - Verify details of model:
 - Flows of students, flow of money/loans, etc.
- **Finalize CLD:**
 - Develop list of scenarios that will be explored.
- **Develop simulation model based on CLD**