

Economic Dynamics

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The Modeling Process

Specify Dynamic Behavior of Problem

Formulate, Simulate, & Communicate Model Structure

Analyze & Test the Model

 Design & Test Policies



Don't confuse these two activities:

- (a) building a model to explain the past; *“explanatory model”*
- (b) modifying a model to improve the future. *“policy model”*

Explanatory model

- should include policies that operating in the past and present;
- should not include new policy structure.

Policy model

- includes new policy structure for the future
- add it after you have built a model that explains the past.



Two different meanings of Policy Design

Explanatory Modeling



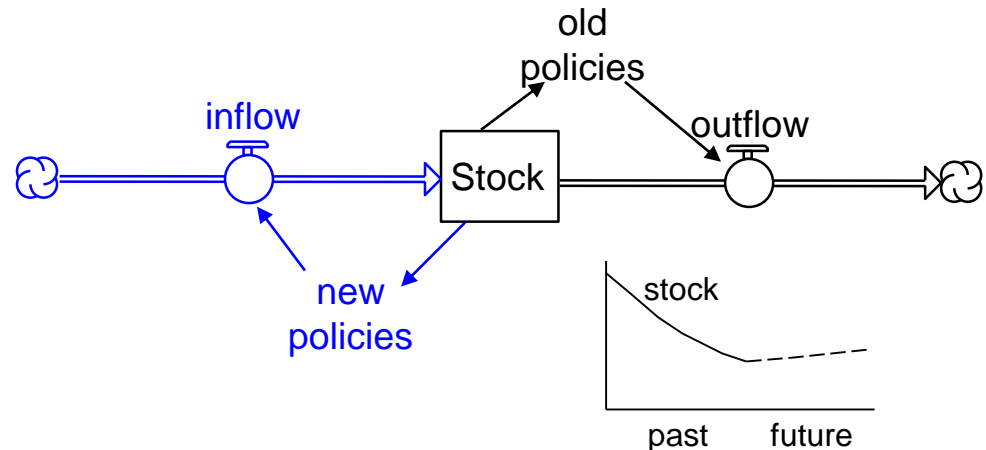
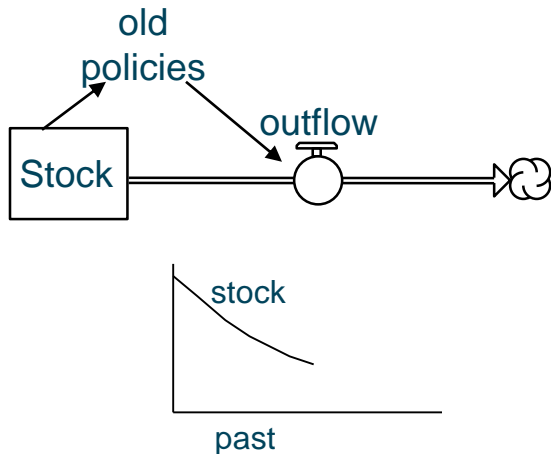
Policy Design Modeling

We formulate decision rules for flows that reflect our understanding of policies “designed” by others.

They are part of a structure that explains problematic behavior.

In the policy modeling stage, we become the designer.

We modify, add, or delete decision rules in the explanatory model in ways designed to alleviate the model’s problematic behavior.





“First . . . generate a model that creates the problem. Only if we understand the processes leading to the difficulties can we hope to restructure the system so that the internal processes lead in a different direction.”

Forrester, *Urban Dynamics* 1969

“A model should demonstrate how the symptoms are being generated. . . Only by clearly understanding what is causing the problem can one begin to see where [policy] attention should be focused.”

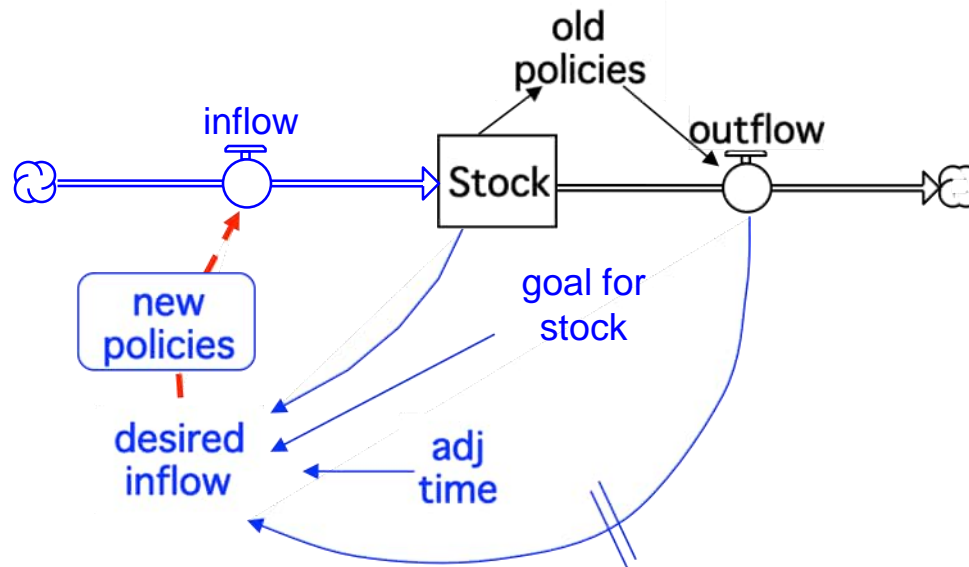
Forrester, email, 2009

Overview of Policy Modeling



General procedure (after Explanatory Model is built and tested):

- Identify desired outcome;
- Choose a policy strategy to analyze;
- Formulate information feedback structure.



- Identify “wishful thinking” links (**—→**)
... where implementation planning is necessary.



Build & test the Explanatory Model.

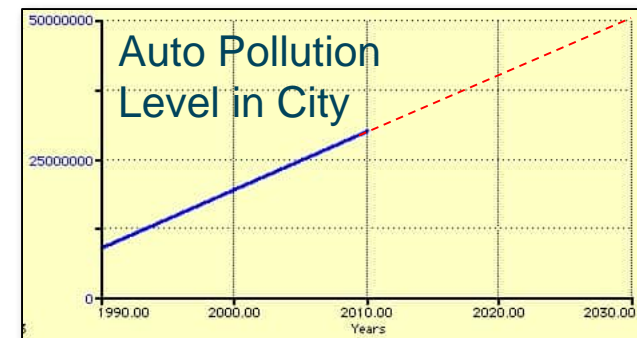
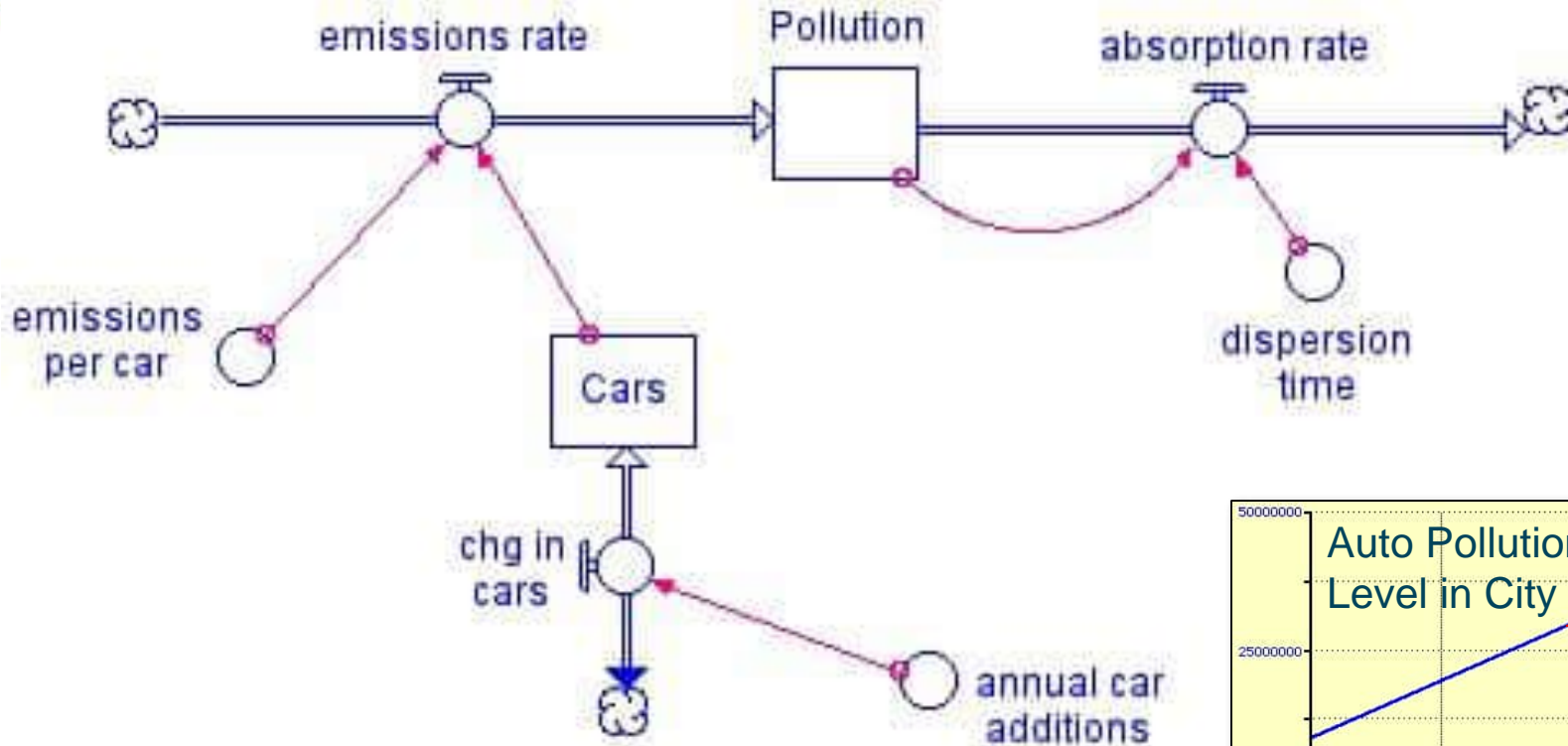
➔ Design a Policy with Wishful Thinking Links

- Specify a desired outcome(s)
 - *the goal(s) for key stock(s)*
- Choose a policy strategy to analyze
 - *the flow(s) that will be regulated*
- Formulate feedback structure to achieve desired outcome(s)
- Identify “wishful thinking” links that require implementation
- Repeat, as necessary, for other goals & other strategies

➔ Design a Policy with Implementation Structure

- Replace “wishful thinking” links with stock & flow structure that represents “operational thinking”

Identifying Options: Specify a Policy Goal

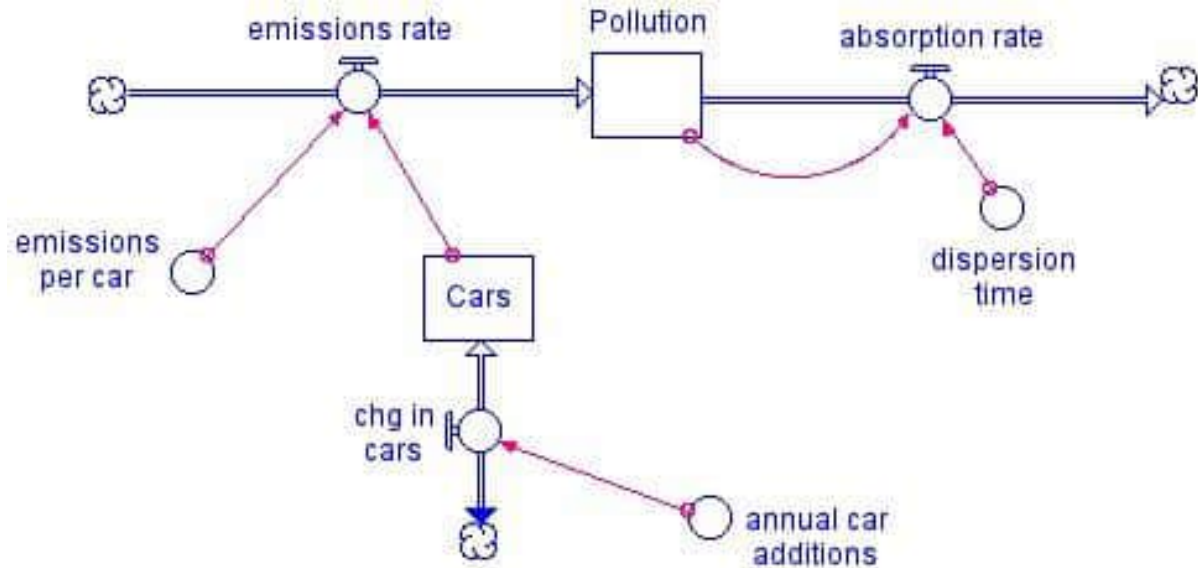
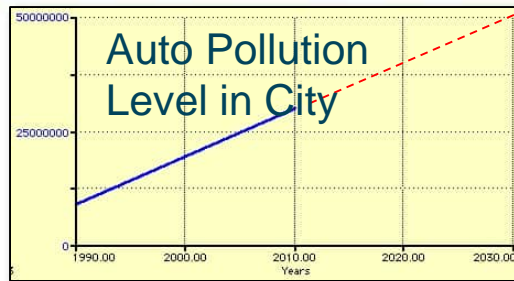


What do we want to accomplish?

In this example, what are some possible goals?

... stop the growth in pollution? ... reduce the level of pollution?

Identifying Options: Choose a Strategy



A “broad strategy” requires choosing which flow to regulate.

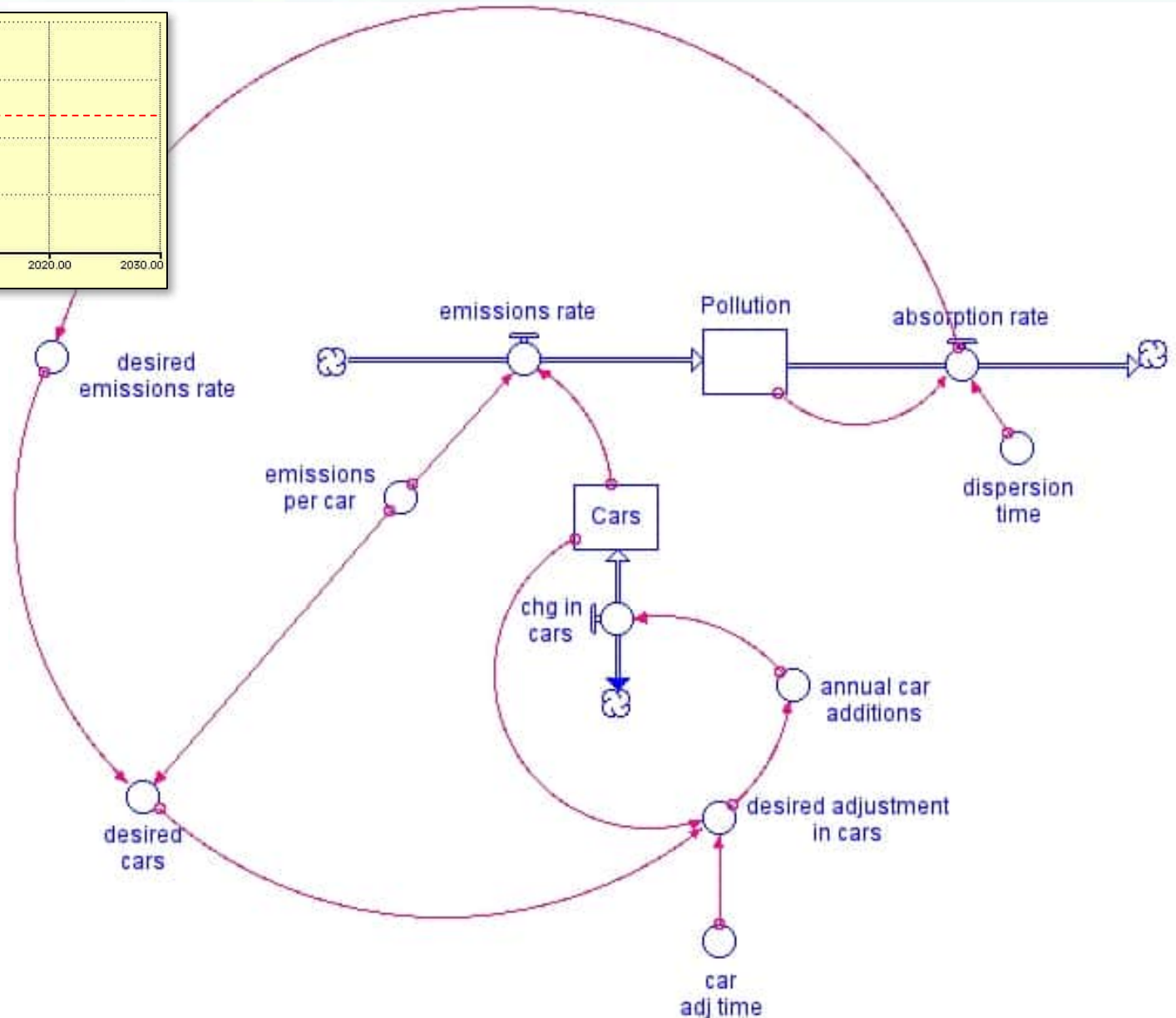
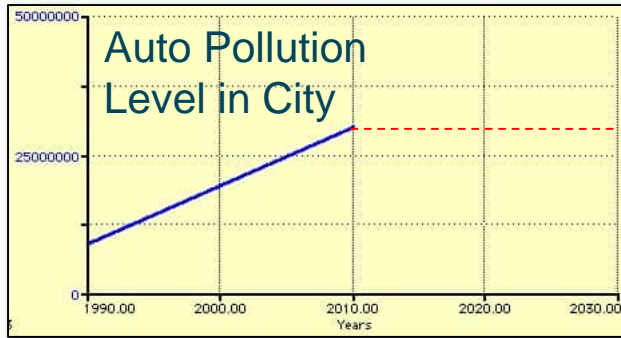
A “specific strategy” requires specifying which influence(s) on that flow to regulate.

“Tactics” refer to implementation of the strategy—how to do it.

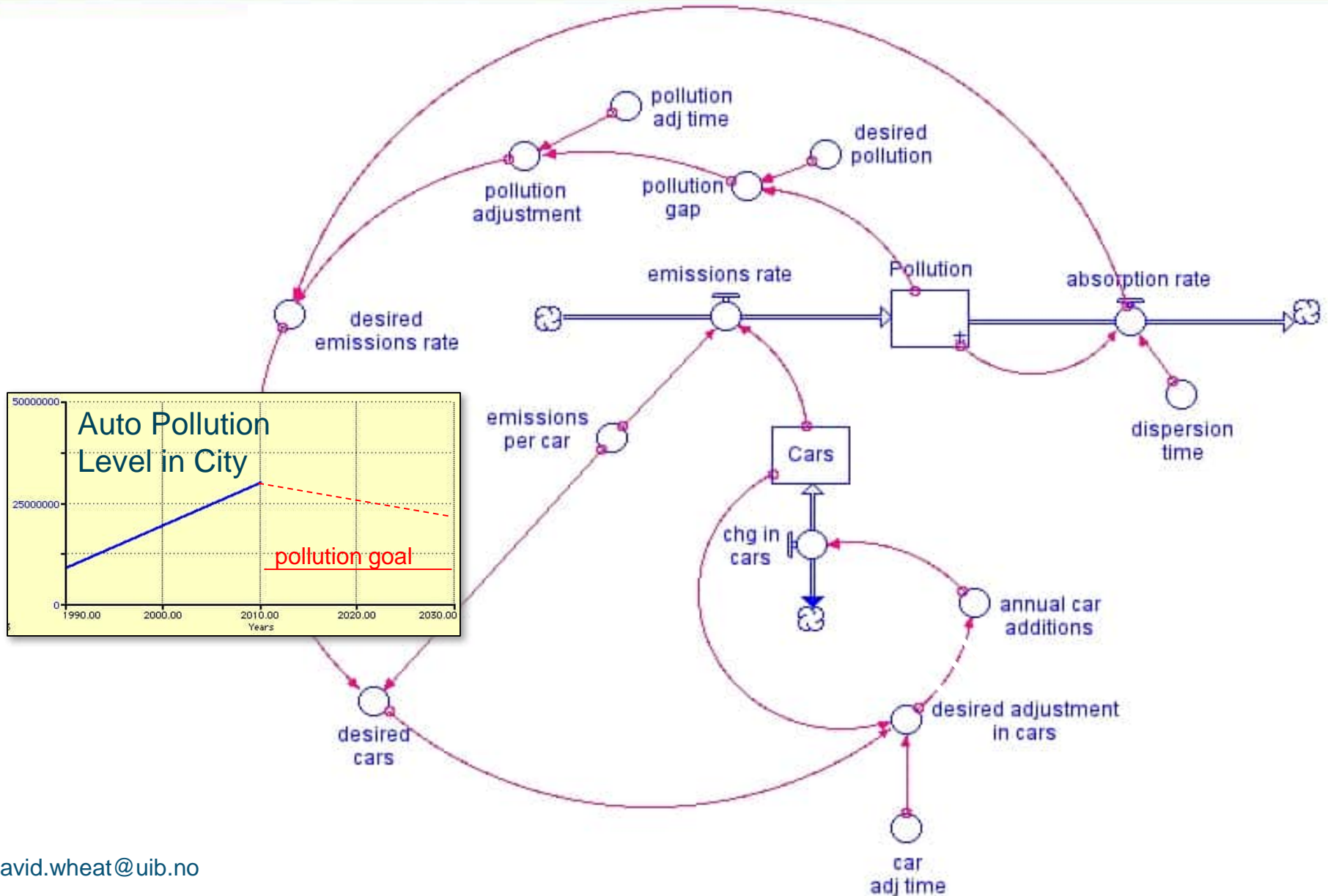
Here, we plan to *regulate the emissions rate* and, specifically, to *regulate the number of active cars*.



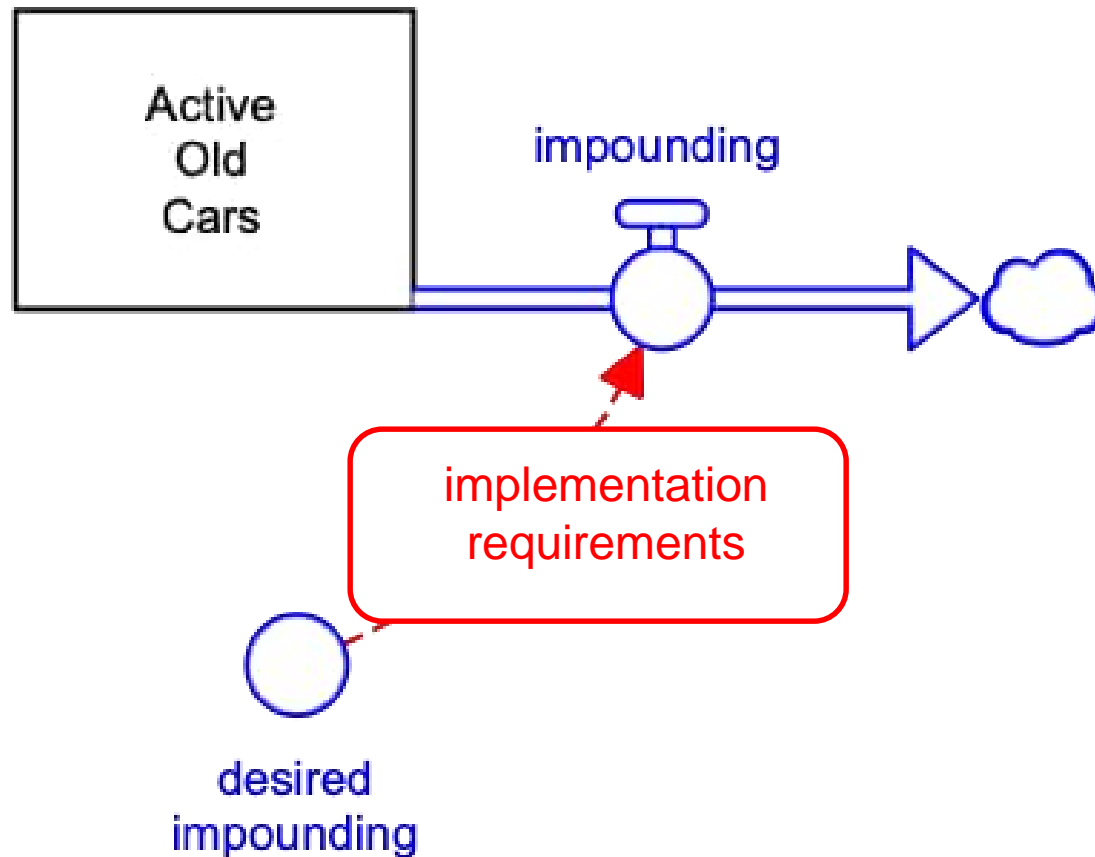
Regulate Inflow to Stop Pollution Growth



Regulate Inflow to Reduce Pollution

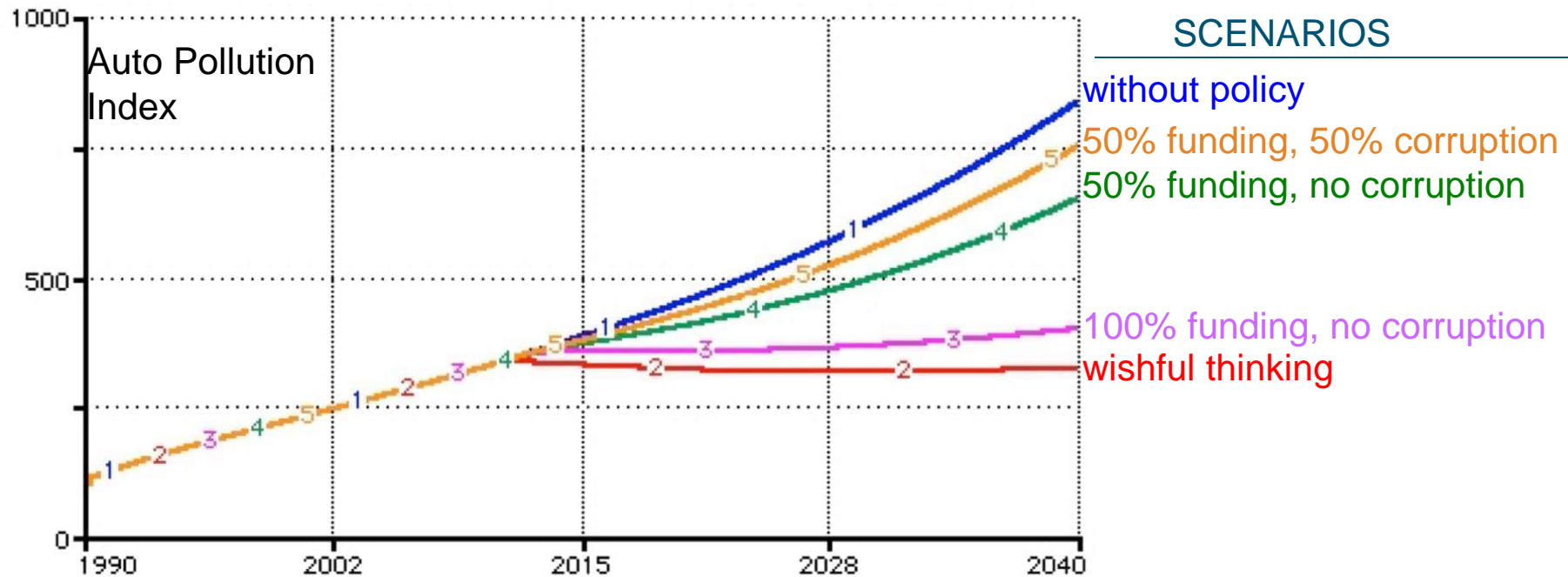


Strategy: Regulate Outflow*



* Auto Pollution in Zimbabwe
UiB thesis project of Linda Madoma (2010)

Simulation Results for Impoundment Policy



Simulation Results for Impoundment Policy Scenarios
Auto Pollution Index in Zimbabwe (1990 = 100)



(1) cost-benefit analysis

= *benefits – costs*

= *€ or \$ or NOK, etc.*

(2) cost-effectiveness analysis

= *costs / effect = € / effect or \$ / effect or NOK / effect*

€ / life saved \$ / child educated

NOK / emissions prevented

(3) discounting (relative weight on present vs. future)

Need a Debt Management Policy

