Decision Making

Modeling human behaviors/Bounded rationality/Drug War♪

401.661 Advanced Construction Technology

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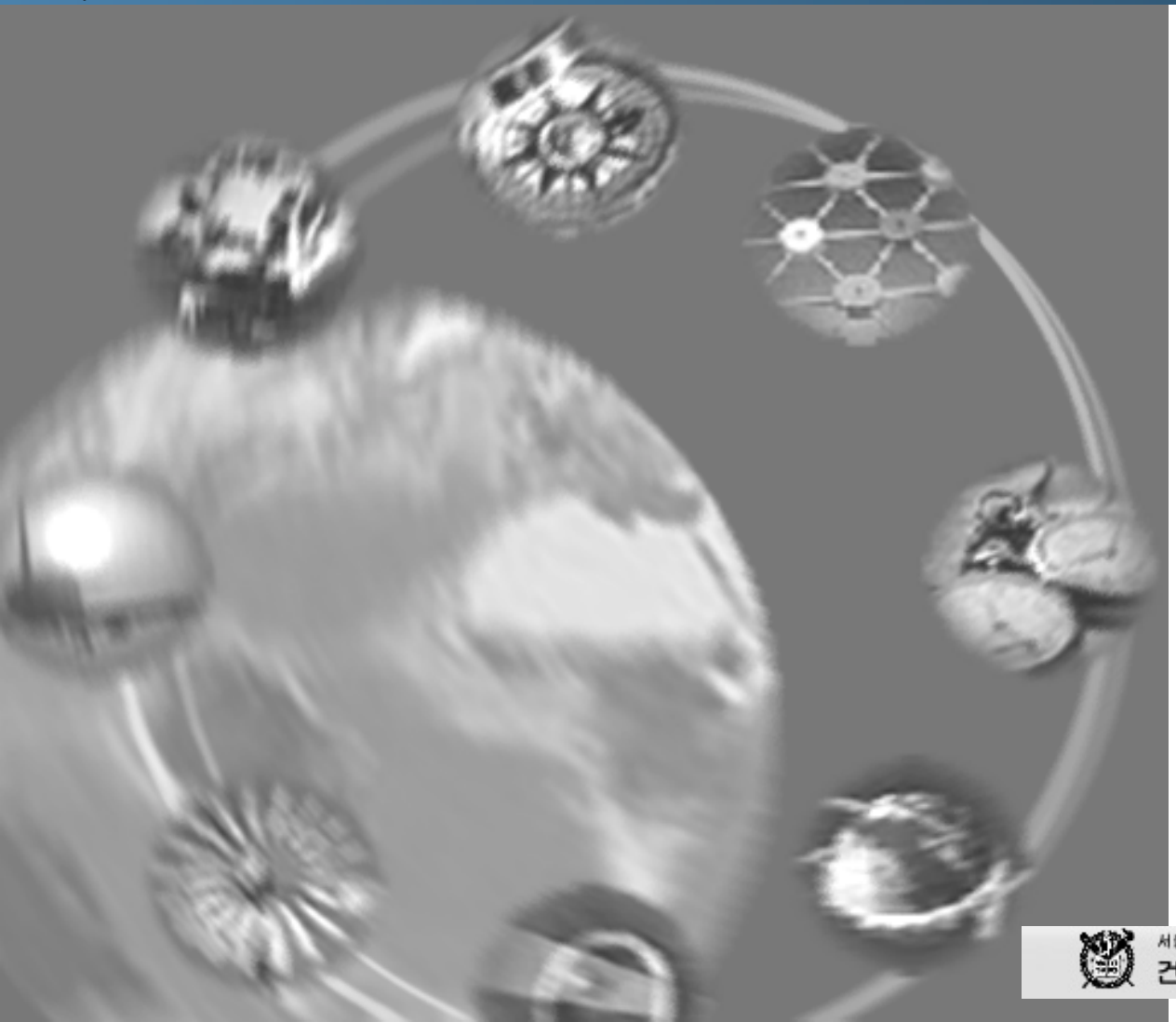

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Bounded Rationality

- Must capture decision making *as it is*, NOT as it should be.
- Rationality of human decision making is *bounded*.
- *Bounded rationality* results from limitations on our knowledge, cognitive capabilities, and time.
- Cognitive limitations: perception of information is not comprehensive but *selective"* (Hogarth 1987)

Individual & Organizational Responses to Bounded Rationality

People and organizations have developed a number of ways to simplify the task of decision making.

- Habit, Routines, and Rules of Thumb
- Goal Formation and Satisficing
- Problem Decomposition

Intended Rationality

- Decision makers are irrational or just plain stupid?
- NOT at all
- Human behavior is usually purposeful and motivated by *a certain logic*.
- A decision rule is intendedly (=locally) rational if it would produce reasonable and sensible results if the actual environment were as simple as the decision maker presumes it to be.

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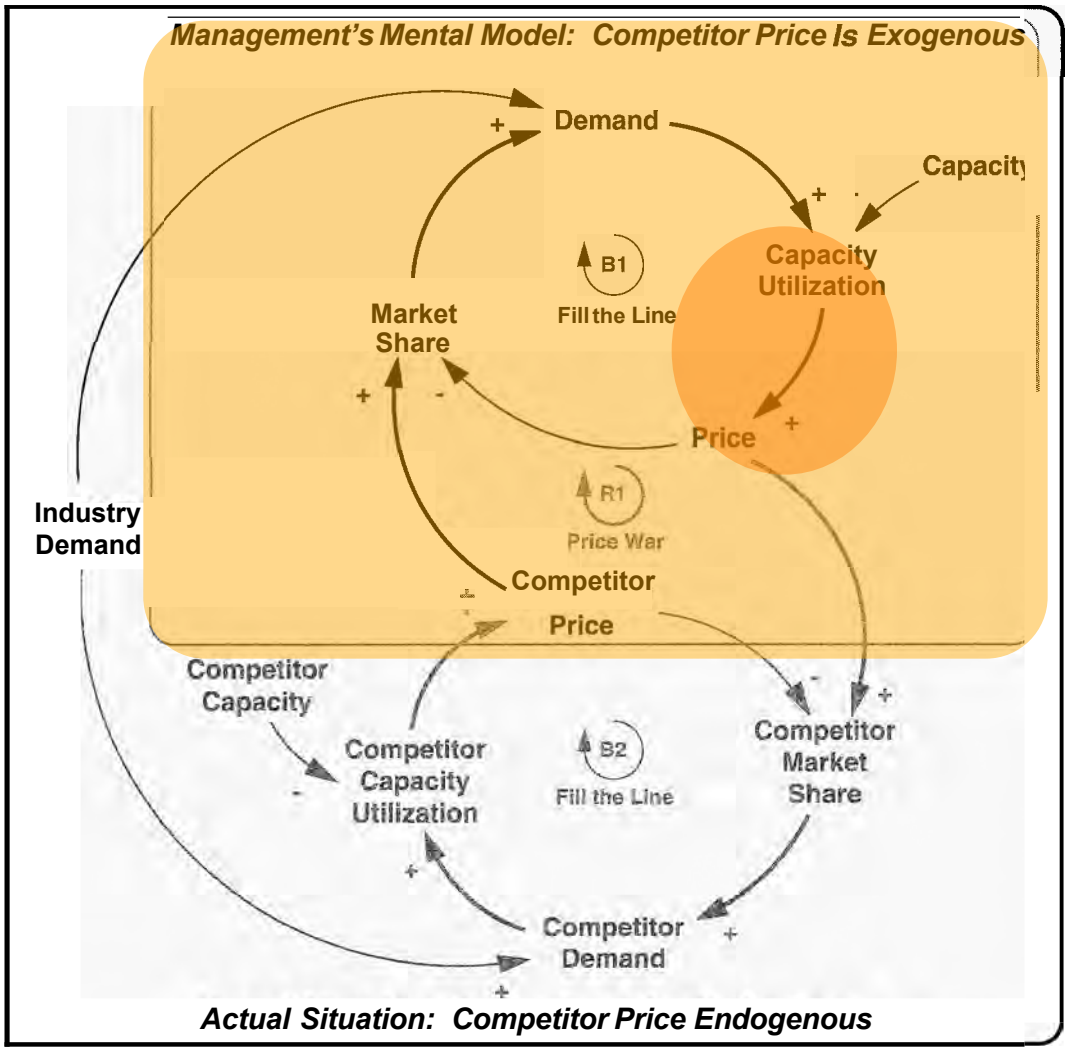


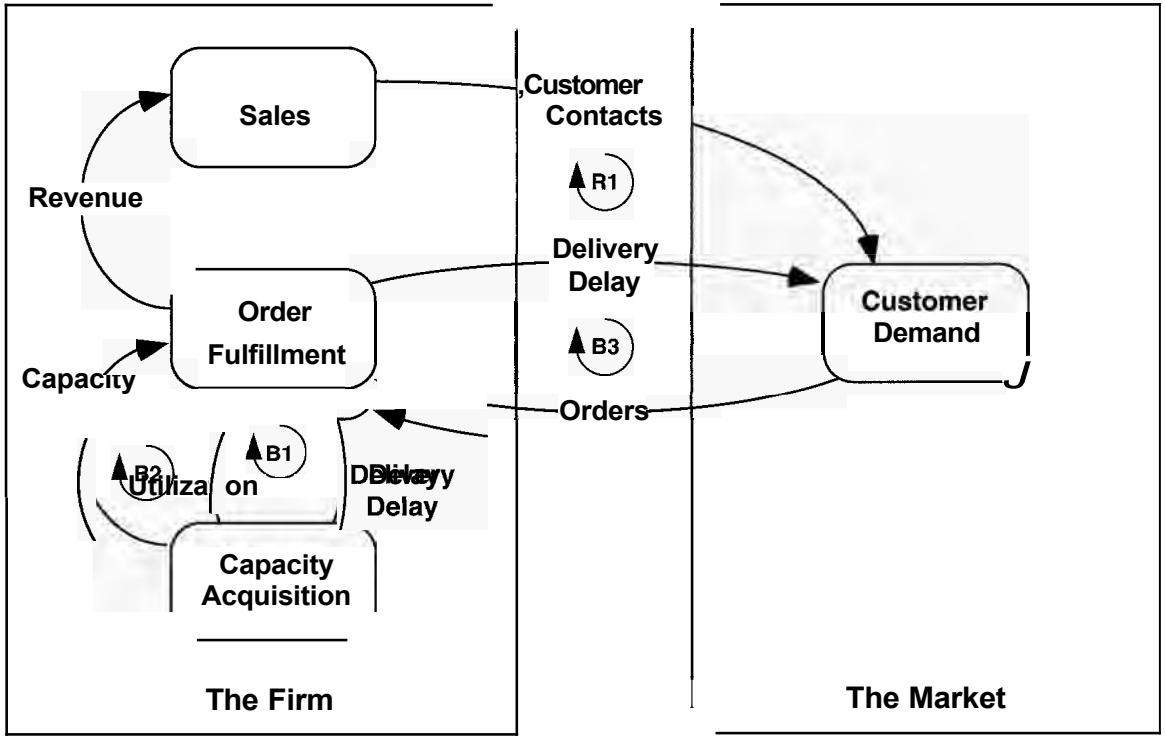
- An intendedly rational pricing policy can lead to an inadvertent price war.
- *Top:* Mental model of a firm in which competitor prices are believed to be exogenous. Cutting prices to Fill the Line (B l) when capacity utilization falls is locally rational if the boundary of management's mental model cuts the feedbacks to competitor prices.
- *Bottom:* When competitor firms behave the same way and also cut prices to boost their own capacity utilization (B2), then the intendedly rational decision to lower prices in the hope of stimulating demand creates the reinforcing feedback R1 (shown by the thick lines) and a price war ensues whenever industry demand drops below capacity.

Case Study: Modeling High-Tech Growth Firms

- Only a very small number seem able to grow rapidly and steadily
- No obvious differences between the successes and failures in fundamentals found
- May caused by the *different decision rules* used to manage the enterprise and the unanticipated side effects of policies that appeared to be rational and well-intentioned when viewed in isolation

Sectors of the market growth model

The model divides the firm into distinct organizational subunits. Each function operates on the basis of different information.



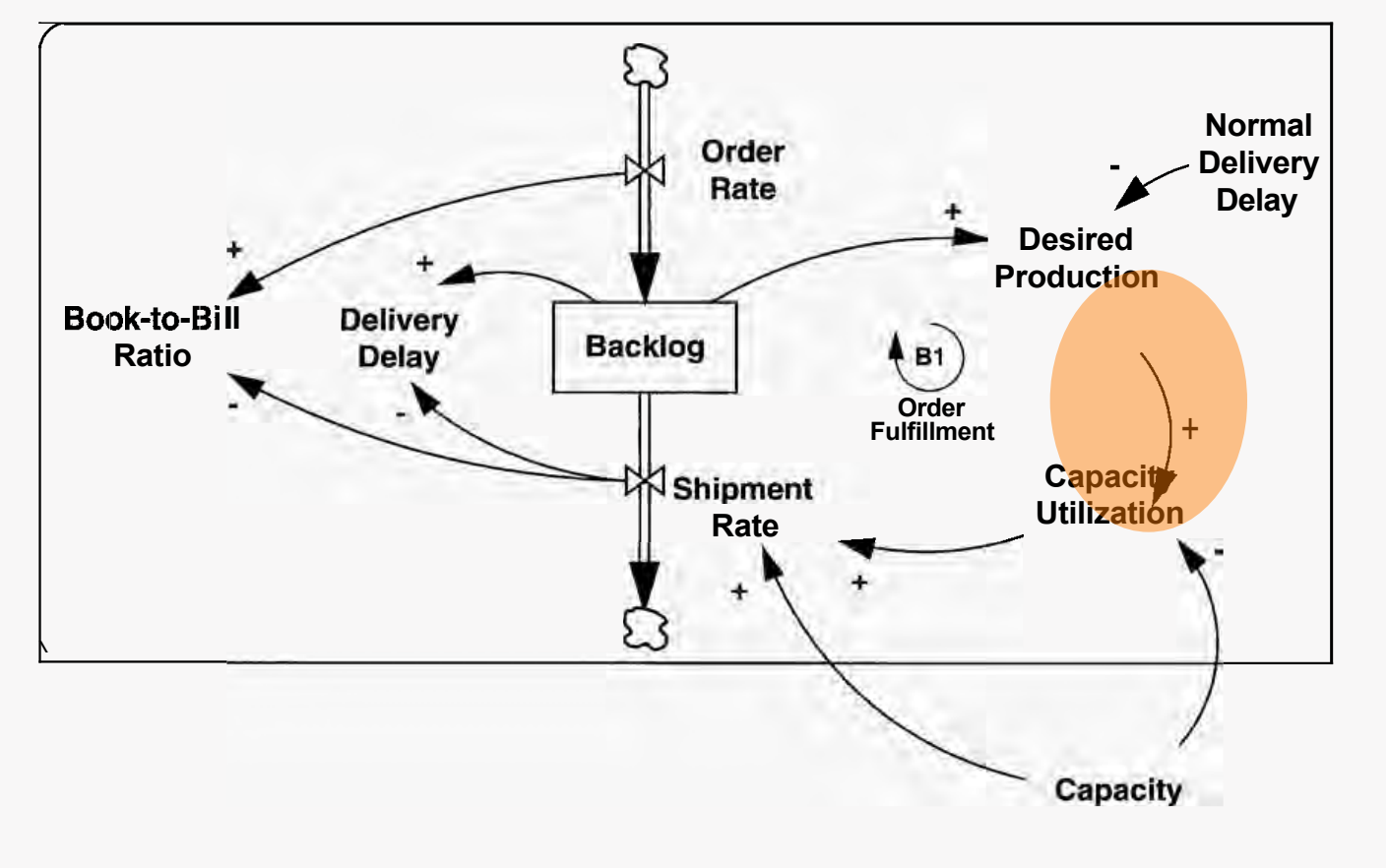
Source: Adapted from Morecroft (1983).

- Managers operating in the individual subunits are not assumed to understand the overall feedback structure.

  For example, the capacity expansion decision is based on product availability as measured by the delivery delay and does not depend on forecasts of future sales generated by the marketing organization, which were generally distrusted and ignored by senior management.

Order Fulfillment

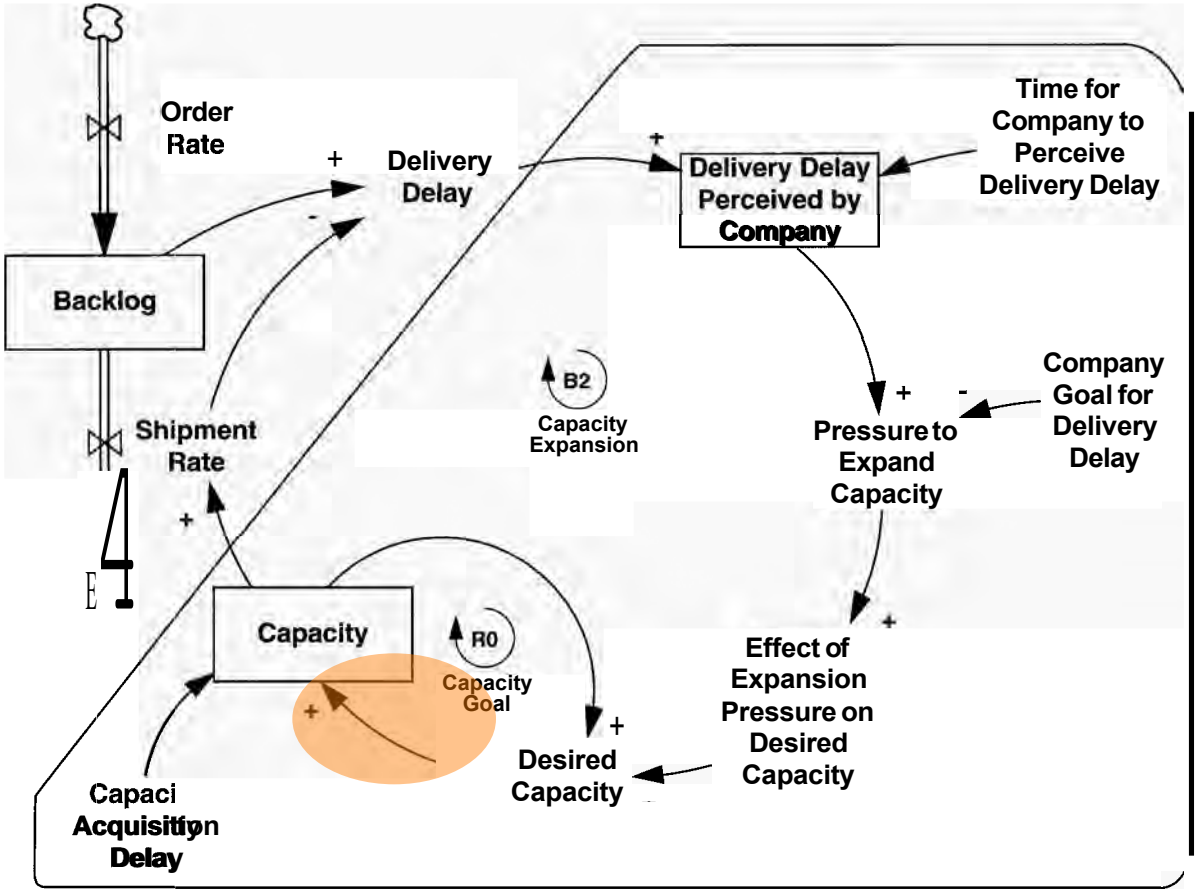
Variables outside the boundary are determined in other subsystems. Often the members of the subunit view these inputs as exogenous givens. Here, production capacity is taken to be outside the control of the order fulfillment organization



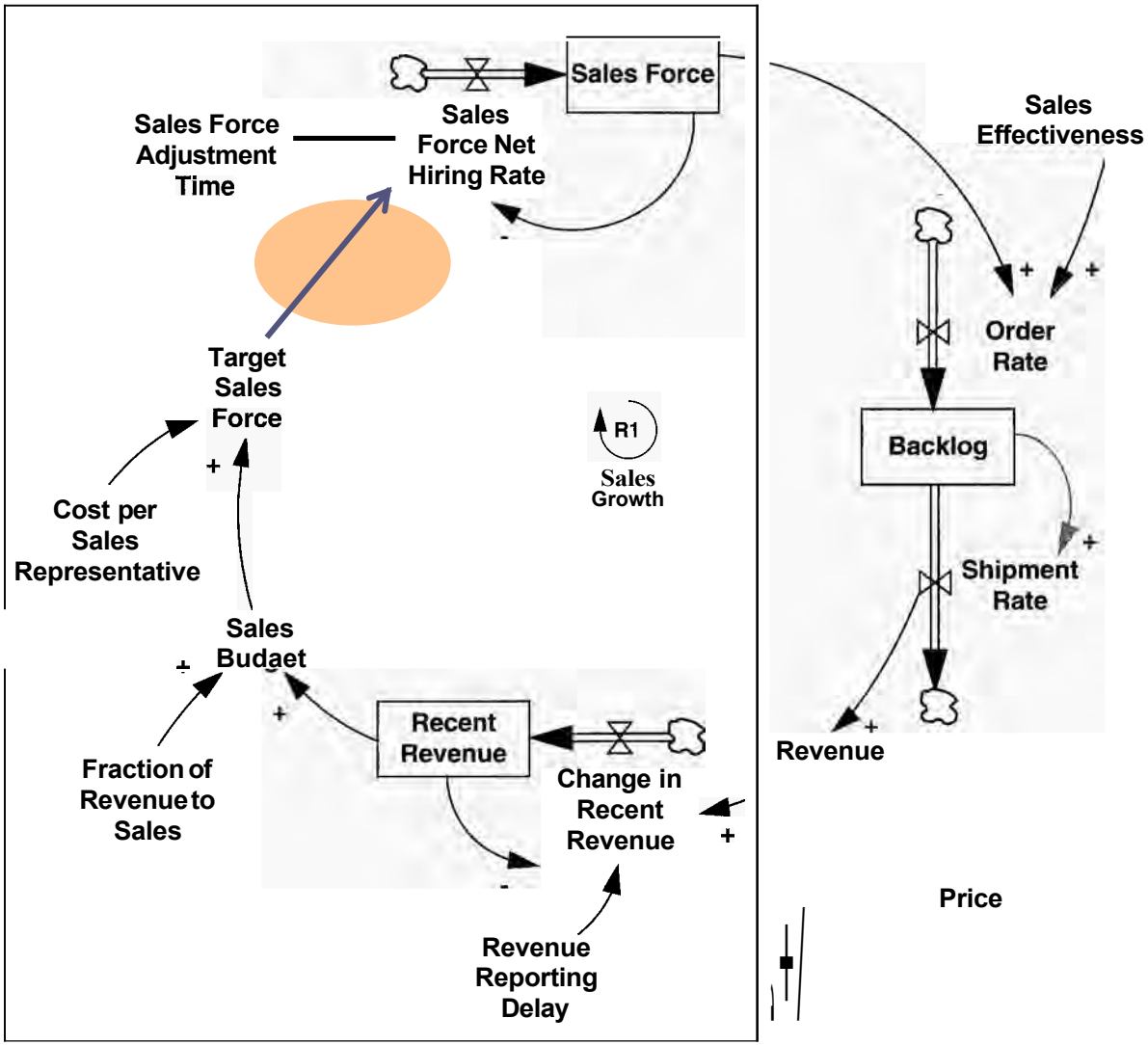
Capacity Acquisition

- Senior managers tend to be reluctant to invest until there is clear evidence of need.

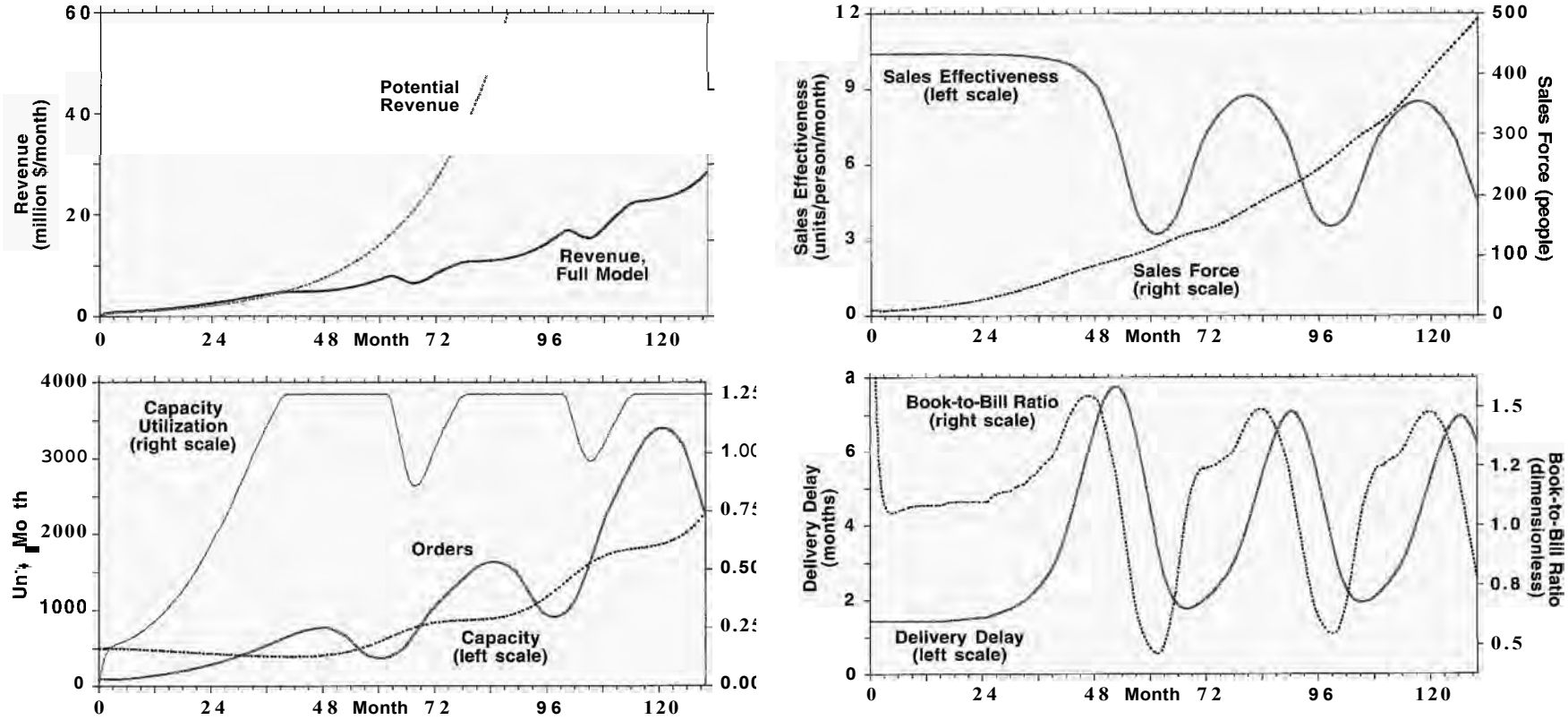
- The only reliable evidence that we need more capacity comes when we start missing delivery dates



Sales Force


Sales Force
Sales Force Adjustment Time
Sales Force Net Hiring Rate
Target Sales Force
R1
Sales Growth
Cost per Sales Representative
Sales Budget
Recent Revenue
Fraction of Revenue to Sales
Change in Recent Revenue
Revenue Reporting Delay
Sales Effectiveness
Order Rate
Backlog
Shipment Rate
Revenue
Price

Behavior of the Full System



*The potential revenue curve shows what revenue would be if the firm always had enough capacity to fill orders on time.

Overconfidence

- Overconfidence: the confidence bounds people provide around their estimate of an unknown quantity are too narrow.
- More information, more confident, while accuracy did not improve.
- Thousands of repetitions provide feedbacks enabling to learn from experience (weather forecast, gambling) but there is little chance to learn from experience in most social/business situations.

  Examples:
  - The Challenger explosion estimated 1 in 100,000.
  - Underestimating the likelihood of declining share price during 1920s and 1980s-90s

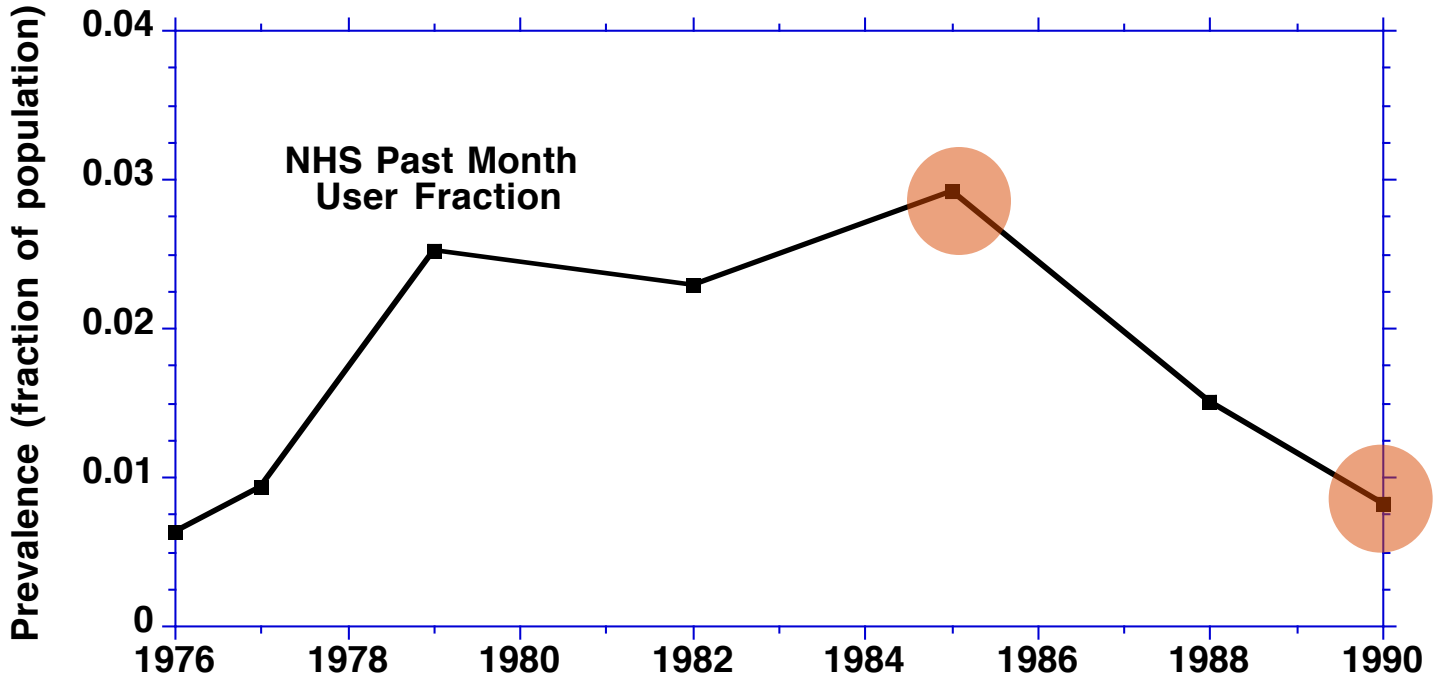
Overcoming Overconfidence

- List all the reasons your opinion could be wrong.
- Solicit the opinions of a diverse group especially those with opposite views.
- Suspect statements that something is absolutely certain, inevitable or a one in million chance.
- **When formal models are available, conduct extensive sensitivity tests.**

The War on Drugs

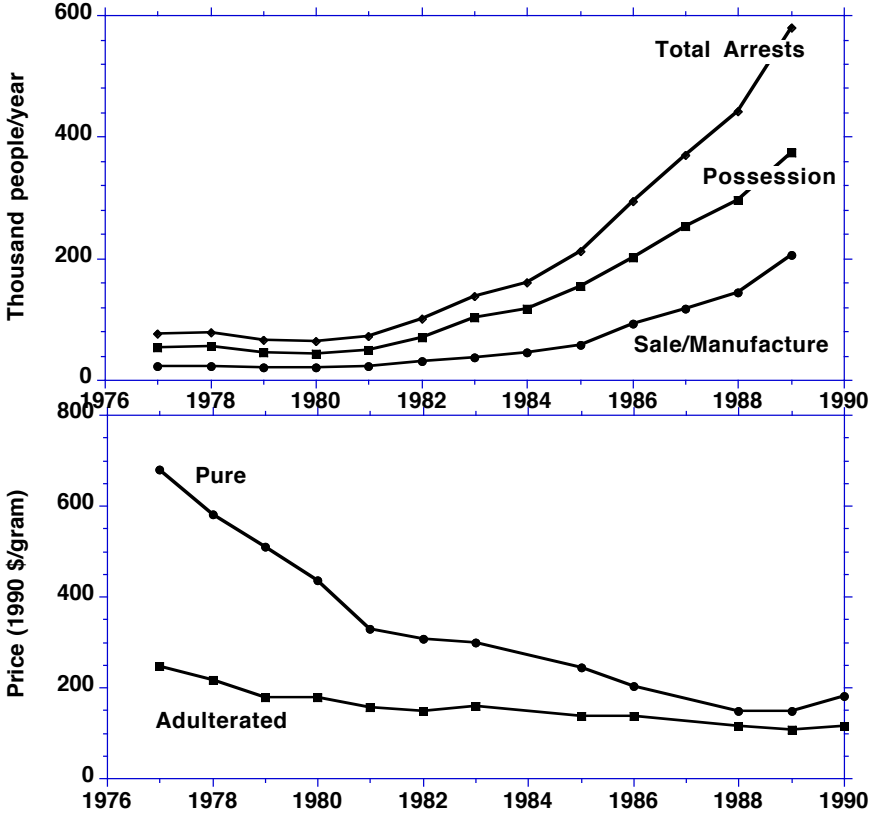
- Use of Cocaine dramatically increased in 1980s
- Billions spent to increase enforcement, focusing on the supply side
- On demand side: “Just say NO”
- Did it work?

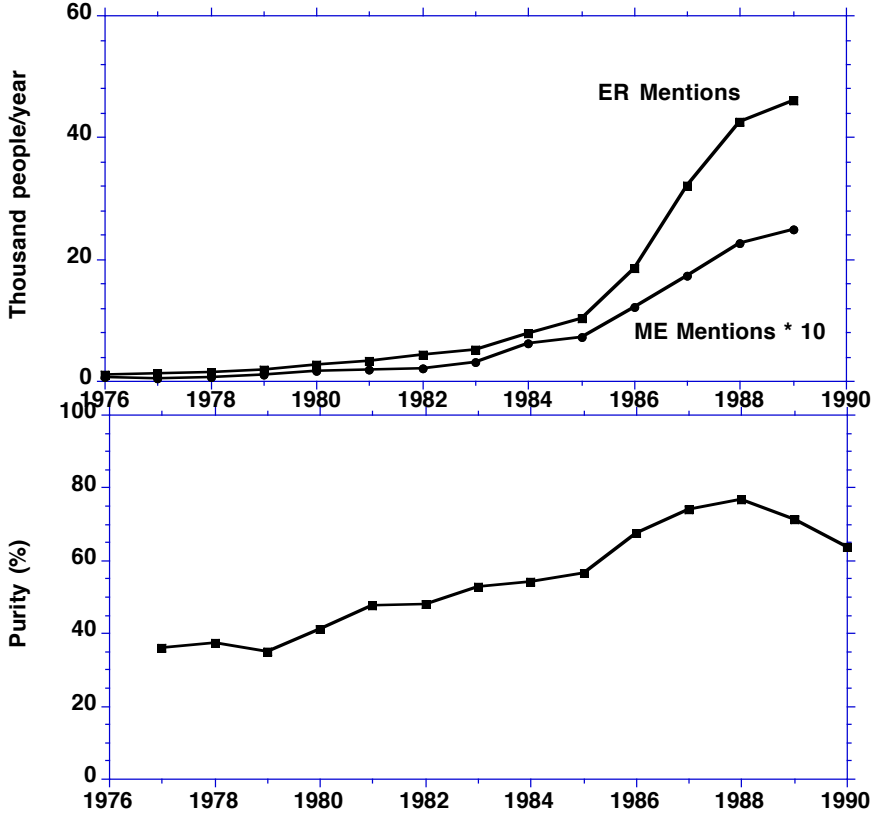
It seemed to be working…



Down from 3% in 1985 to 1% in 1990

But, the problem was getting worse…





***Source*: Homer (1993, 1997).**

As a result,..

- Cocaine use was up sharply and availability was growing.
- The same failure of prohibition in 1920s and 1930s.
- Critics argue “ interdiction could never work and call for stronger demand-side measure (MacCoun and Reuter, 1997)”

How to explain?

Supporters

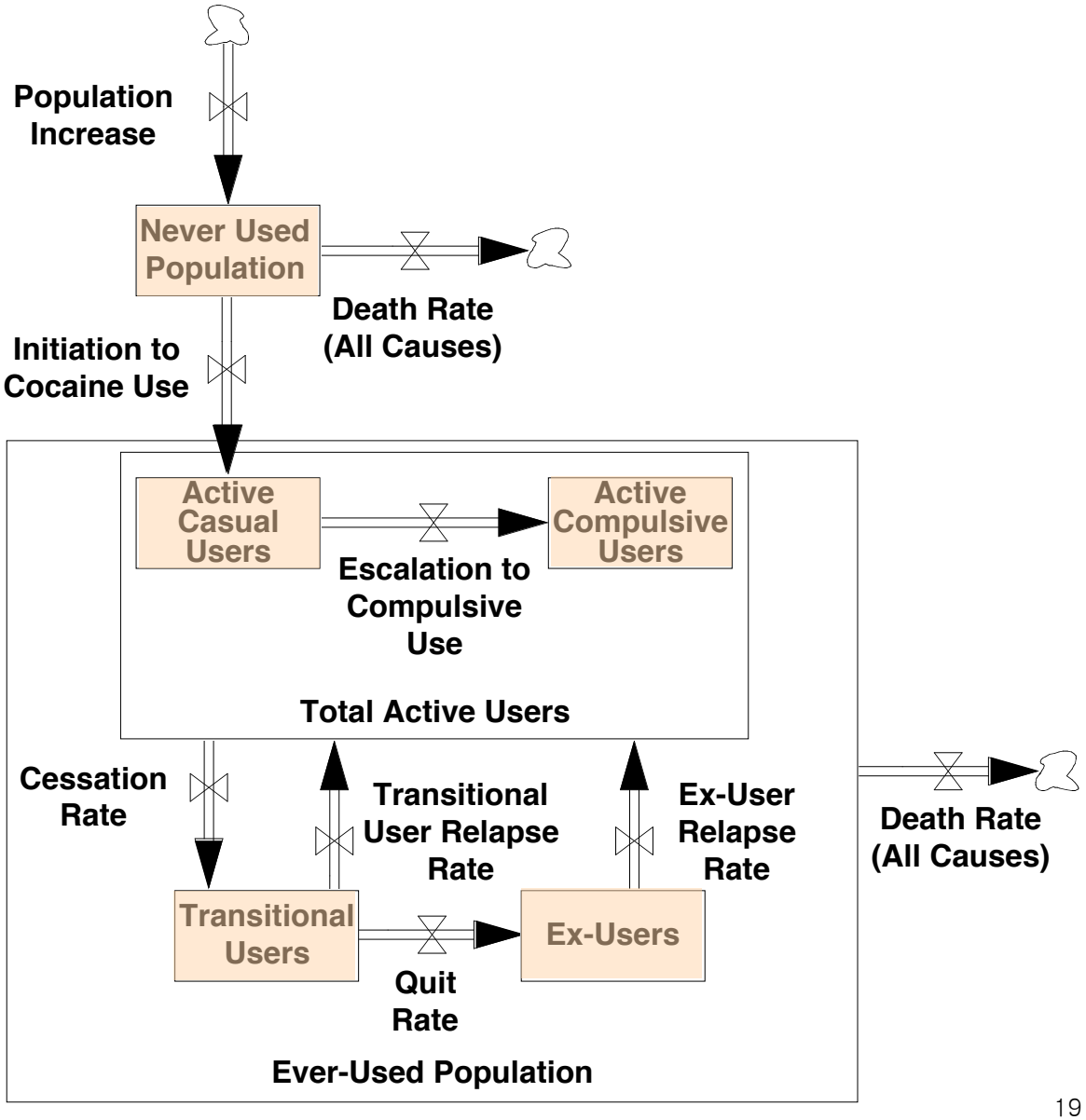
- Rising arrest rates by greater enforcement, not by greater drug use
- Falling prices, rising purity, surge in ER by substitution of more potent crack for the less pure power form

Critics

- Cocaine users are less likely than law-abiding citizens to be selected for the survey. Thus,
- They are likely deny they use drugs.

System Dynamics Model

The national Institute of Justice commissioned a study, 1980s



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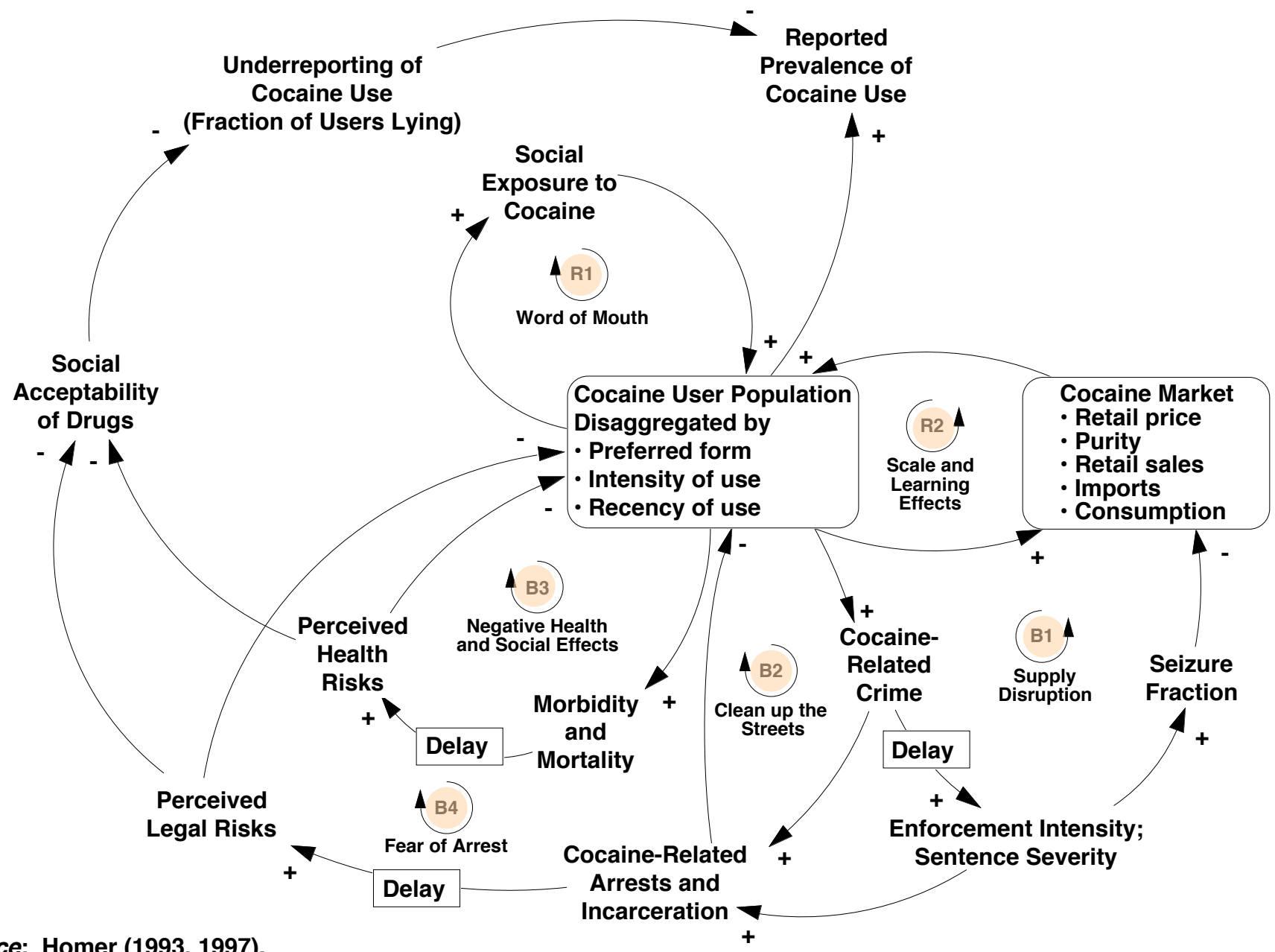
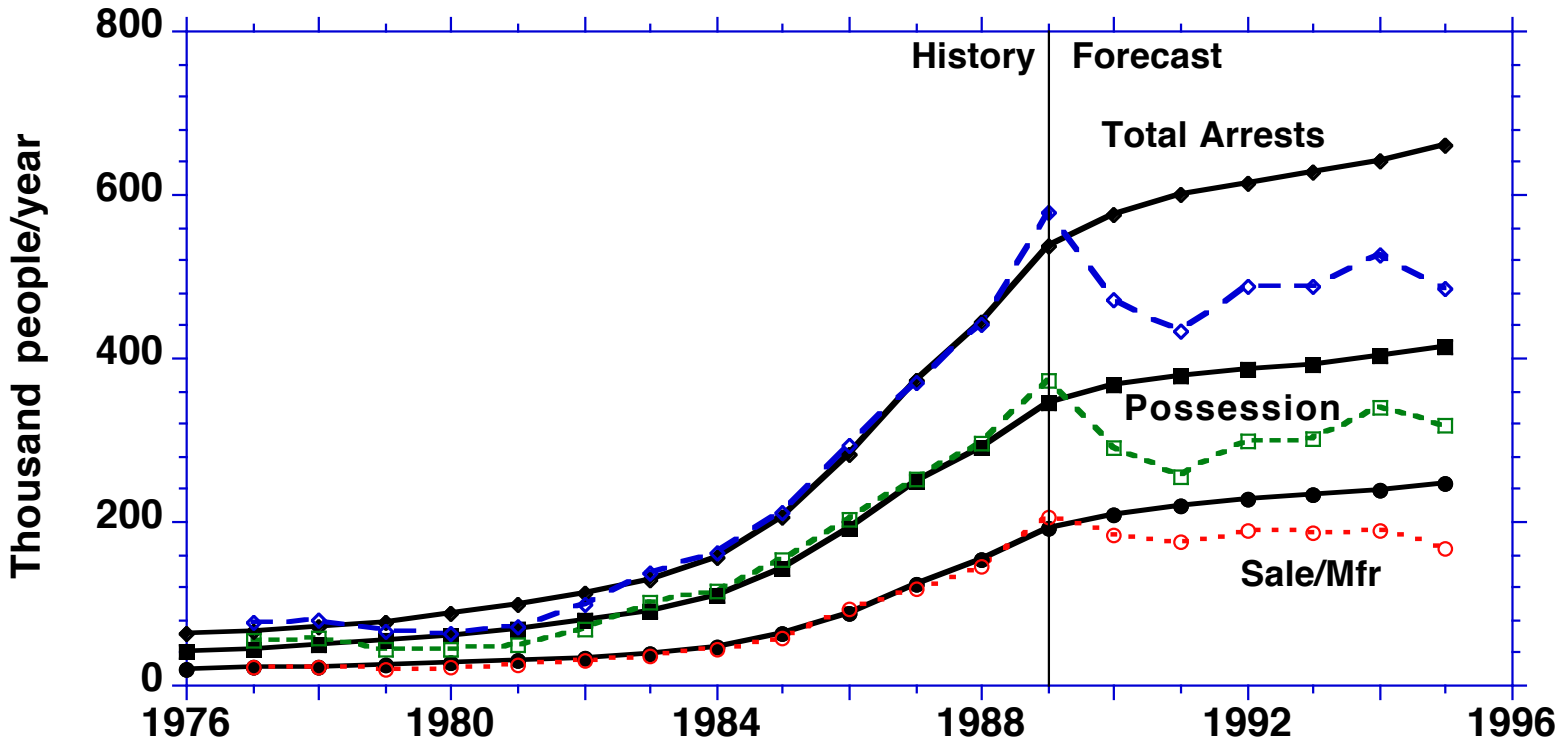
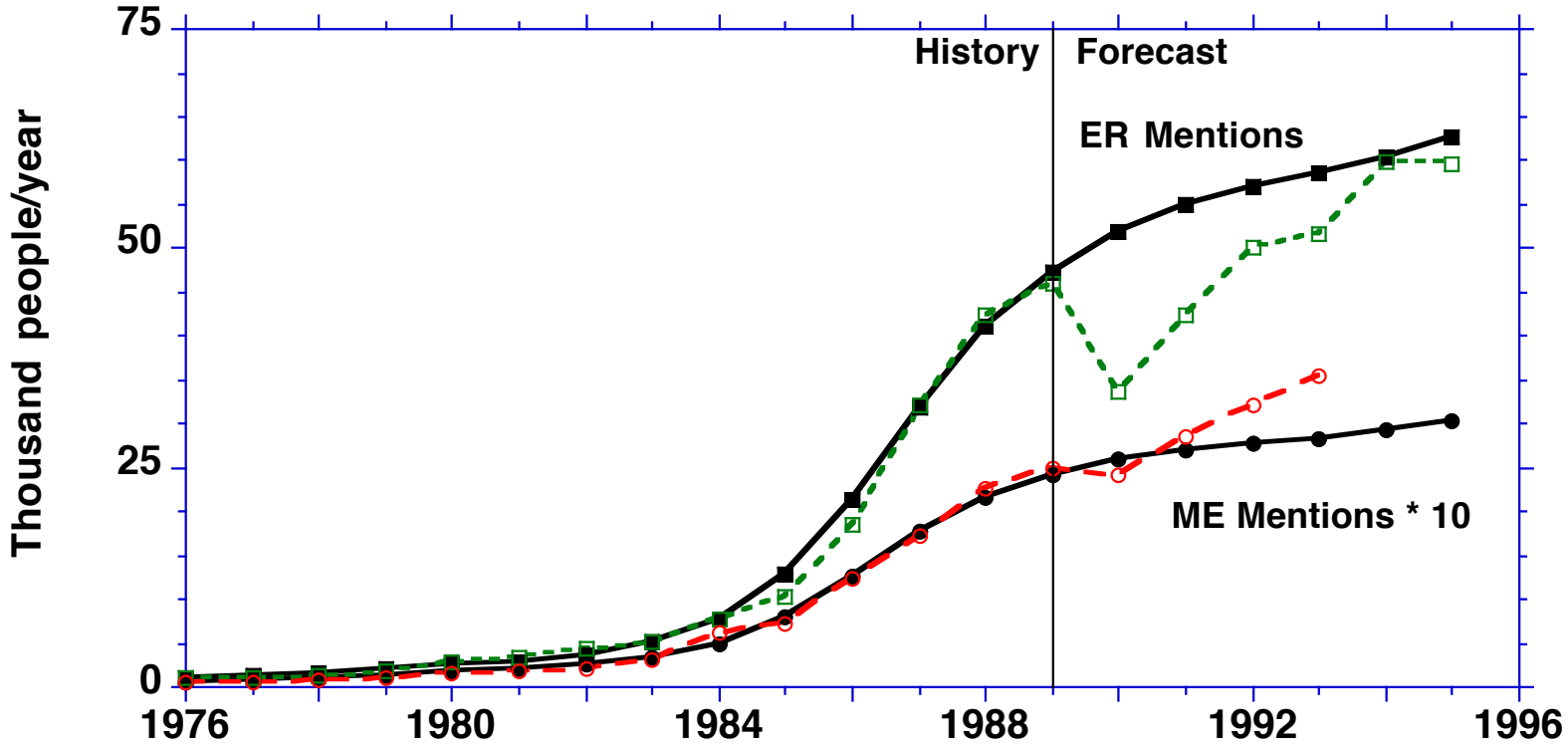
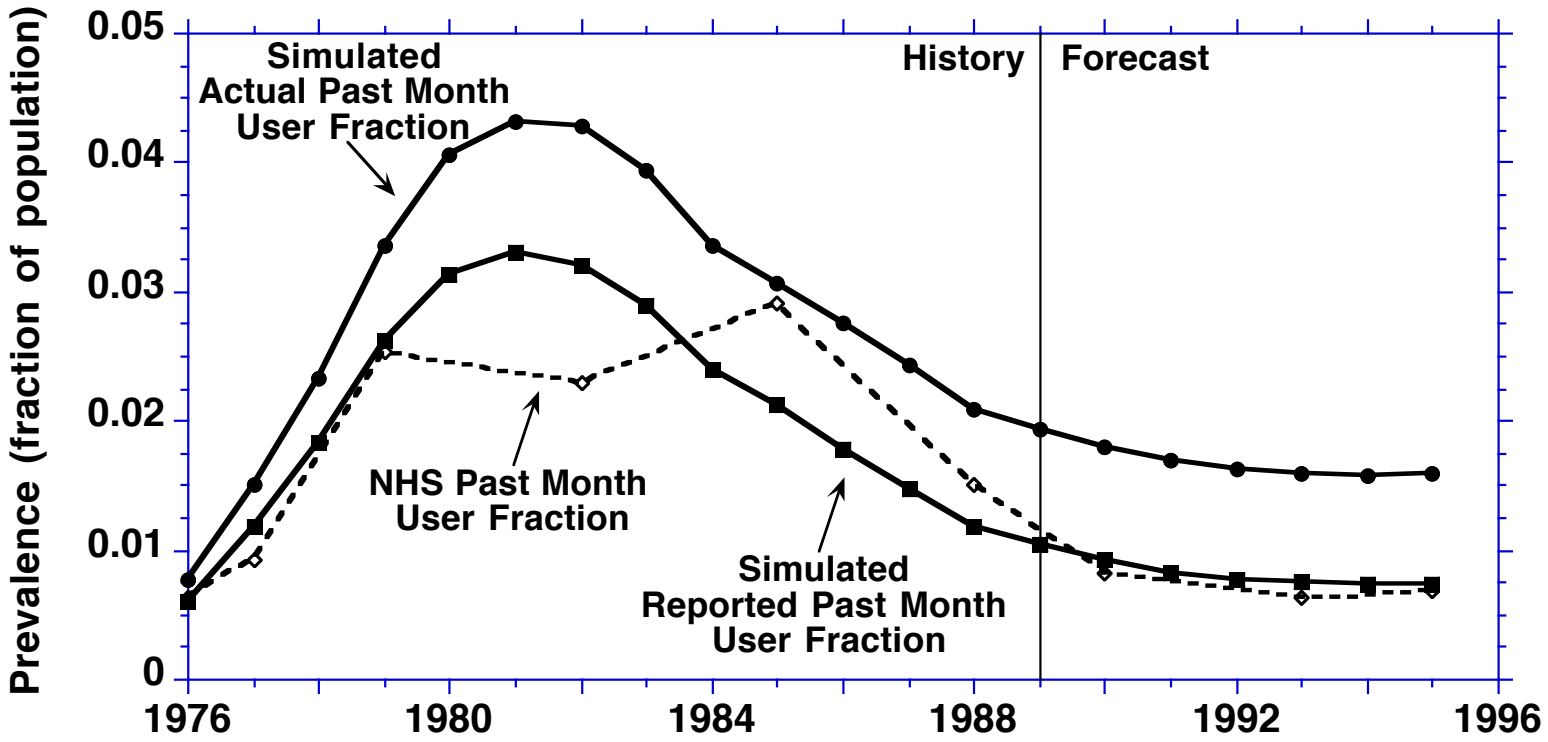


***Source*: Homer (1993, 1997).**

Simulated / Actual Data




75
50
25
0
Thousand people/year
1976
1980
1984
1988
1992
1996
History
Forecast
ER Mentions
ME Mentions * 10


Prevalence (fraction of population)
0.05
0.04
0.03
0.02
0.01
0
1976
1980
1984
1988
1992
1996
Simulated
Actual Past Month
User Fraction
History
Forecast
NHS Past Month
User Fraction
Simulated
Reported Past Month
User Fraction

Where did they go?

In 2004, The South Korean government passed an anti-prostitution law (Special Law on Sex Trade 2004) prohibiting the buying and selling of sex and shutting down brothels.

In 2007, the courts prosecuted 35,000 clients, 2.5 times higher than the number of those who were caught buying sex in 2003.

Meanwhile enforcement is weak and corruption problematic; there is little evidence that new legislation has made much difference, the trade simply finding other ways to carry on its business.

Despite legal sanctions and police crackdowns, prostitution continues to flourish in S Korea, while sex workers continue to actively resist the state's activities.

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Identify S&F….

A8: Suggest Policy Alternatives

- Build CLDs
- Combine them with S&F
- Test behaviors of your model with the empirical data
- Suggest policy alternatives based on the model behaviors
- Due next week

* Do not have to do site survey.

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