

# Spirals and Solutions:

## Thinking Systematically about Textbook Costs, Sex Selection, and Global Warming

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# Textbook Prices

- Problem: cost of textbooks for typical college student @ \$800-900 per semester
- Solution # 1: Buy new, use, resell
- Immediate effect: cuts the net cost of textbooks 10-25%
- Solution #2: Buy used, use, resell
- Immediate effect: cuts the net cost of textbooks 25% + 19%

# Publisher's problem

- First year sales of a new text are  $X$  \$
- Second year sales of a new text are  $.3X$  \$
- Third year sales of a new text are  $.05 X$  \$
- Solution #1: reissue text every 3 years in order to maintain income
- Solution #2: raise price of text by bundling with ancillary materials
- Effect: student's next year's text costs go up 2-4 times inflation rate, or 6-12%

# Analysis

- Student engages in short term reasoning, seizing on the most immediate way of cutting costs
- Used book sellers seize upon opportunity to get great return on investment: buy at 5-25% of resale value and gross 67+% on resell.
- Publisher loses many potential sales, adds to the price spiral.

# Analysis cont.

- Used book sellers make out very well: students and publishers (and authors) continue to lose
- Publishers seek to cut costs by merging with other publishers
- Mergers create monopolies; monopolies undermine competition; less competition means higher prices; prices spiral at an increasing rate.

# General solution #1

- Students keep their textbooks.
  - Hypothesis: this will, if wide enough, permit publishers to keep texts in print longer, have more sales, lower prices
  - Rationale: it is students selling their texts that drives the spiraling cost of textbooks
  - Reality: students won't change behavior enough to make a difference, and publishers will not lower prices

# General Solution # 2

- Some student groups have called for textbooks to be provided for free.
  - But production of texts is expensive, and authors of them do so in hopes of some royalties in return for their efforts.
  - The “let government pay” attitude that underlies this solution reflects students’ experience in public elementary and some secondary school settings. The rationale there is that attendance is compulsory, so that education is seen as a public good, to be paid for by public means. College is non-compulsory.

# Further analysis

- A solution has to satisfy students' need to control costs and publishers' need to earn on each transaction involving a given text
- Book resellers are making the greatest profits in the transactions of buying texts and reselling them.



# General solution #3

- Publishers contract with bookstores to lease, or rent, texts to students. A text is leased to a given student, who returns the text after the lease expires.
- The text is then re-leased repeatedly as long as the information in it is current.

- Lease costs run about 25% of current costs.
- A text that is re-leased for each semester of 5 years earns enough additional income to pay for the cost of record-keeping by the bookstore and to provide publisher and author with a reasonable return.
- Various technological means can be employed to insure that copies of the text remain in the possession of the lessee.

- What's striking about this solution is that it addresses all the interests of all essentially involved parties and seeks a simultaneous solution to them all.
- It would not be reached readily from the perspective of any one interested party.
- It requires viewing the problem as a manifestation of a system of interests and practices.

# Problems with General Solution 3

- Does not avoid costs of paper, printing, binding, shipping, all of which steadily increase
- Results in used copies of decreasing quality
- Involves security deposits, record-keeping, etc. that may diminish cost-lowering effect

# General Solution #4

- Publish texts in electronic format, to be purchased from the publisher (who may be the author) and downloaded onto a computer or electronic book reader
- Costs can be a fraction of those of printed books
- Updates, corrections can be made without loss of stock

- Avoids costs of paper, binding; limits costs to those for website, electronic transactions, marketing
- Can cut cost of a text 78-80%
- Student-to-student resale can be discouraged by treating as lease, embedding self destruct feature, or using a unique password for each download
- Negatives: requires changes in student behavior, publisher behavior; portable reading device

# India's Experiment

- Female infanticide was long a problem in countries with dowry traditions, other forms of devaluing females
- Widespread violation of anti-infanticide laws led to corruption, general decline in respect for law

- Emergence of amniocentesis, in vitro fertilization and other reproductive technologies permitted couples to select the sex of their offspring through selective abortion or other techniques
- Technology embraced by families desiring to avoid expense of dowry payments and to have sons suitable for family labor



# Effects

- Appropriation of these technologies for non-medical purposes led to strong shift in newborns toward mostly male babies
- In 1-2 generations, numerous villages found ratio of males to females of marriageable age was as high as 25 to 1
- A large number of males with no hope for marriage and families, prime candidates for conscription into military, paramilitary, terrorist organizations

# Analysis

- Social and legal structures fostered appropriation of reproductive technologies
- Short term result was solution of legal problem of infanticide, social problem of unwanted girl babies
- Permitted technology, approved to curb female infanticide, enabled the bias against females to become legal and effective

- But failure to view systematically has led to the new problem of an undersupply of potential wives for a large segment of the male population
- Result in turn is a growing class of frustrated males without prospects of marriage and families

# Possible Alternative Solution

- Result of systems analysis by policymakers might have been a more rapid move toward valuing women equally, control of access to reproductive technologies, elimination of the dowry tradition, and education of women to their potential

# A Complex of Problems

- Several problems humanity will deal with in the next two decades
  - Have the potential to reach critical stages
  - Are interconnected, so that attempts to solve one may exacerbate others
  - Have potential to become self-sustaining
  - Have potential to be temporarily controlled
  - Will require long-term solutions involving technologies not yet invented

# Problem #1: Global Warming

- 2000-2004: average annual increase in CO<sub>2</sub> emissions of 3.2 percent—4 times that in the 1990s
- IPCC projects an increase in natural sources of greenhouse gases, e.g. permafrost thaw releasing CO<sub>2</sub> and methane

# Natural sources

- Despite its reducing its CO<sub>2</sub> output from manmade sources, soil released CO<sub>2</sub> in England in 2006 exceeded the total amount saved by all emissions cuts
- Methane hydrates lie on ocean floors: if ocean temperatures rise as a result of shrinking ice caps and bottom water temperature increases, the potential release of methane could be enormous

# Human sources

- Fossil fuels add carbon to biosphere:
  - Coal-fired generators
  - Petroleum-based transportation in autos, trucks, aircraft, trains, ocean vessels
  - Oil-fired generators, furnaces
  - Natural gas-fired furnaces, vehicles
- Production and refinement add carbon to biosphere



# Projections

- Recent evidence suggests the mass extinction 50 million years ago caused by release of ocean-bottom methane
- Uninterrupted continuation of the present rate of CO<sub>2</sub> and methane release can cause human extinction along with much of the biosphere
- IPCC projects global warming may become self-sustaining in 10 years

# Initial Conclusion

- Uninterrupted at its present rate of increase, atmospheric CO<sub>2</sub> and methane increase can cause human extinction along with much of the biosphere
- We must address manmade *and* natural sources of greenhouse gases *immediately*

# What's being done and proposed

- Corn ethanol
- Hydrogen as fuel
- Reduction of use of electricity with fluorescent light bulbs, energy star appliances
- Nuclear generation of electricity
- Hybrid and electric cars and transports

# Problems with these solutions

- Corn ethanol

- To replace foreign oil alone, 100% of arable land would be needed to grow sufficient corn
- Removes a major food source for humans and cattle
- Gives only 1.3 units of energy for each unit expended in its production
- Has already driven price of corn up to the point that corn ethanol plants are closing
- Removal as food source has increased price of wheat, milk, chicken, eggs

- Hydrogen as fuel
  - Produced from methane, coal, electrolysis
    - Methane and coal production gives CO<sub>2</sub> as a byproduct
    - Electrolysis requires electricity, currently mostly from fossil-fuel fired plants
  - Enormous cost to create production and distribution system, conversion of autos

# Reduction of energy use

- Replacement of light bulbs
  - Saves less than 4% of electricity use
  - Creates disposal problem (mercury)
- Appliance replacement
  - Replacing all with energy star equivalent to taking 3 million cars off the road
  - But number of cars produced annually = 500,000
  - Buys a bit of time at most

# Nuclear generation of energy

- Disposal problem of nuclear waste
- Highly dependent on reliable source of fresh water for cooling
  - Summer drought in Western Europe diminished water supply
  - Nuclear reactor power levels had to be reduced, limiting electricity available for air conditioning
  - Resulted in several thousand deaths

# Hybrid and electric cars

- Battery life still undetermined
- Hybrid cars currently reduce energy consumption to less than half of conventional autos
- Electric cars require energy, putting more generating capacity pressure on grid



# Intermediate conclusions

- Current measures are not adequate to avoid catastrophic global warming
- Insufficient attention has been played to systematic interrelationship of factors, causing loss of capital (corn ethanol plants) and time

- Any short-term solutions will have to
  - Use existing knowledge and technology
  - Be relatively inexpensive
  - Mesh with existing transportation, other technology
  - Reduce net carbon in the biosphere
  - Avoid massive conversion of agricultural land to energy production
  - Rely on current energy distribution systems
  - Produce substantially more energy than uses

# Cellulosic Ethanol

- We know how to make it using microorganisms
- Cost @ \$.70/gallon if from switch grass, old newspapers, any source of cellulose
- Most vehicles either will operate on it, or can be converted
- Mfg process, with blue-green algae, carbon negative

- 10% of arable US crop land all that's needed
- Can utilize currently existing gasoline distribution system
- Produces 11.5 units of energy for every unit employed
- Employs carbon already in the biosphere

# Analysis of solution

- Achieved by
  - Systems analysis of benefits and drawbacks of existing energy sources
  - Cross-disciplinary collaboration of biology, physics
  - Small company without vested interest in expensive solutions
  - Elevating simplicity over complexity

- These are characteristics of rational systems approach to other problems, such as need for fresh water, control of environmental degradation, need for population reduction, all discussed in the following sources.

- Stephen Paley, George Oister, Richard Hull, "Can We Survive? (Part 1): The Changes Required to Deal Effectively with Global Warming," *Free Inquiry*, Feb-Mar 2008, Vol. 228, no. 2: 44-47. Part 2 will be in the Apr/May issue.
- Paley, Oister, Hull, "Human Sustainability: Overview of Survival Technologies and Impediments to Their Development," in Randall Osbourne and Paul Kriese, eds., *Global Security and Global Community*. Amsterdam and New York: Editions Rodopi, 2007 (in press).