Lecture 4 (AO, March 12)

Environmental Policy in the Central European Context

Time: Thursdays 3 p.m. – 6 p.m.
Location: at CERGE-EI, Room # 7

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Undergraduate Program in Central European Studies

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WEEK: TOPICS: DATE: INSTRUCTOR

1 Introduction (history/outline) Feb 19 JK/AO
2 Market failures: externalities, tragedy of the commons, enforcement as public good, also, (rise and fall) of the environmental Kuznets Curve February 26 AO
3 Interventionalist solutions to the Externality problem – Pigouvian taxes and standards and charges, also environmental labeling and incomplete consumer information in laboratory markets March 5 JK
4 Interventionalist solutions to the Externality problem – Marketable pollution permits March 12 AO

Need to leave earlier today …
Lunch or brunch Saturday or Sunday? Or coffee one of these days? (We could discuss David's Zetland's proposal – see the bottom of these lecture notes)

5 Non-Interventionalist solutions to the Externality problem – The Coasian solution March 19 JK
6 Non-interventionalist solutions to the Externality problem – Self-regulation March 26 AO

7 *Mid-term exam April 2*
8 Environmental Policy in the Czech Republic – History and current issues April 9 JK
9 Environmental Policy in the EU – History and current problems April 23 (April 16 falls into Semester break and on Easter Holiday) AO
10 Environmental Policy in the world context – History and Current problems April 30 JK/AO
11 Contingent valuation and related issues May 7 AO
12 To be determined by the interests of the class

Final exam: to be determined (according to schedule May 18 – 21)

Readings for Lecture 3/brief review in reverse order:

PART I - Interventionalist solutions to the Externality problem – Pigouvian taxes and standards and charges
Schotter, Microeconomics, A Modern Approach (2nd edition), Chapter 17, Sections 17.3 & 17.4
Plott, Externalities and Corrective Policies in Experimental Markets

PART II - Environmental labeling and incomplete consumer information in laboratory markets

- Cason, Gangadharan, Environmental labelling and incomplete consumer information in laboratory markets

- (hypothetical) survey evidence exists suggesting that the consumers care for the environment and are willing to pay the higher a price the more friendly to the environment a products is
- they study a market with incomplete information – prior to purchase the consumer is unaware of the product (environment-related) quality (moral hazard problem)
- no signaling, no reputational concerns => market failure
- various treatments to remedy the market failure: **cheap talk signals**, **seller reputation**, (costly) **certification** ("eco-label")

TABLE I

Experimental Design

Treatment	Features	Number of sessions
Baseline	Seller identification not revealed, no product claims allowed	3 inexperienced (UM1[a], UM3, PU1)
Reputations only	Seller identification revealed, but no product claims allowed	4 inexperienced (PU2, PU3, UM4, UM10) 1 experienced (PU4x)
Cheap talk signaling	Seller identification revealed, unregulated product claims allowed	4 inexperienced (UM7, UM8, PU7, PU8) 1 experienced (UM9x)
Certification	Seller identification revealed, binding ("certified") product claims and unregulated product claims allowed	4 inexperienced (PU5, PU6, UM5, PU9) 1 experienced (UM6x)
Reputations only with outside option	Seller identification revealed, but no product claims allowed; buyers received ten francs for "no-purchase" option	2 inexperienced (PU10, PU11) 1 experienced (PU12)

Note. A PU in the session name denotes Purdue University, and a UM in the session name denotes University of Melbourne. An x in the session name denotes experienced subjects.

[a] Session UM1 lasted 16 periods. All other sessions lasted 20 periods.

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CONCLUSION

1) Seller reputations increase the number of high-quality goods delivered relative to the no-reputation baseline.
2) Unverified claims are not sufficient to improve market outcomes.
3) Although certification is costly, sellers usually opt to certify; consequently, the number of high-quality units increases, even though efficiency does not significantly increase due to the certification costs. Certification appears sufficient to overcome the moral hazard problem.
4) Seller reputations modestly influence prices in some conditions, and signals and certification have a significant impact on transaction prices.
5) Buyers are willing to forgive sellers quickly who previously deliver Regulars at Supers prices it is explained at least in part by the absence of a profitably exit from the market.
6) laboratory results suggest that government regulators or non-governmental organizations can improve environmental performance by providing the option of certified green labeling. (only a single dimension of the product studied here)

Experimental Evidence on Corrective Policies in Experimental Markets

Plott, Externalities and Corrective Policies in Experimental Markets, also Schotter, Section **17.4**

A series of experiments to evaluate how the interventionist solutions work

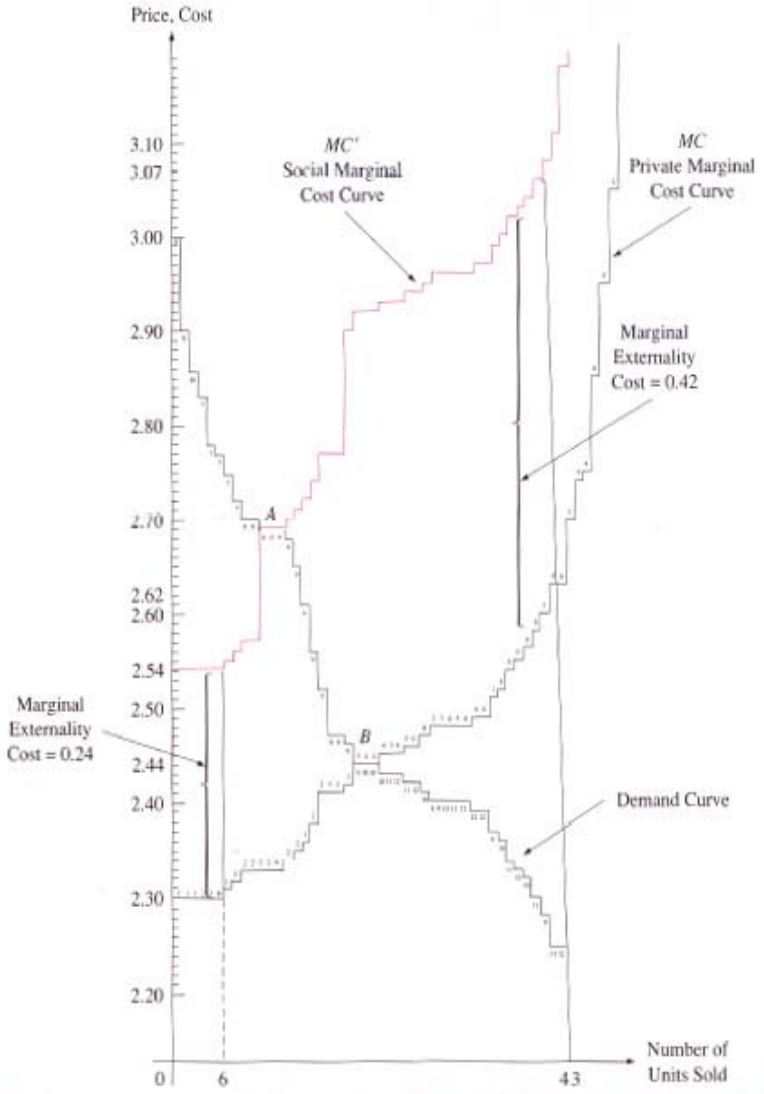
- market participants buy and sell units of a fictitious good using a double oral auction (*In such a **double oral auction** any potential buyer (seller) can make a verbal bid (offer) to buy (sell) a unit of the good at a specified price. Any seller (buyer) can accept a bid (offer). If a bid (offer) is accepted a binding contract is closed for a single unit at the specified price. Any ties are resolved randomly. Remember that's what we did at the end of L2.*
- each buyer is paid a redemption value for every purchased unit according to a predetermined redemption schedule ⇔ induced demand curve
- each seller must pay a premium for each unit he sells according to a predetermined cost schedule ⇔ private marginal cost curve
- every completed transaction imposes an additional cost in all subsequent transactions ; the cost increases with the number of units sold ⇔ externality => social marginal cost curve

⇨ Figure 17.6 Schotter (Figure 3 in Plott)

- Note that after 6 units sold, the marginal externality cost is $.24, after 43 transactions (if they ever happened), it would be $.42
- Pareto optimal solution -- **point A** (13 units at price $2.69)
- without intervention -> theory predicts the competitive outcome "as with no externality" -> **point B** (24 units at price $2.44)
- Charles Plott (p. 106):
    - ⇨ "Do markets with externalities behave in accordance with the law of supply and demand?" [Economists say, yes; policy makers say, no: "Why should the price and volume of a market be independent of the existence of externalities? … People are aware, sensitive, and concerned about others so why should they behave in such atomistic fashion? Intuitions, customs, ethics, and a host of instincts might guide us individually and as groups to behaviour other than that suggested by the model."
    - ⇨ "How do pollution tax, pollution standard and pollution licenses compare as methods for correcting the externality?"

FIGURE 17.6 Plott's laboratory model of a market with an externality.

Economic theory predicts that the market, if left alone, will ignore the externality and will reach its equilibrium at point *B*, where the private marginal cost curve *MC* and the demand curve intersect. Point *A*, where the social marginal cost curve *MC'* and the demand curve intersect, is the optimal solution for society.



- 4 treatments (one baseline; one for each of the corrective policies)
- 2 sessions (markets) for each treatment, 6 buyers and 6 sellers in each market
- individual demands and costs are assumed to be unknown, only the optimum level of pollution and marginal social cost at the (social) optimum are known for the license and the tax policy

Social cost supply

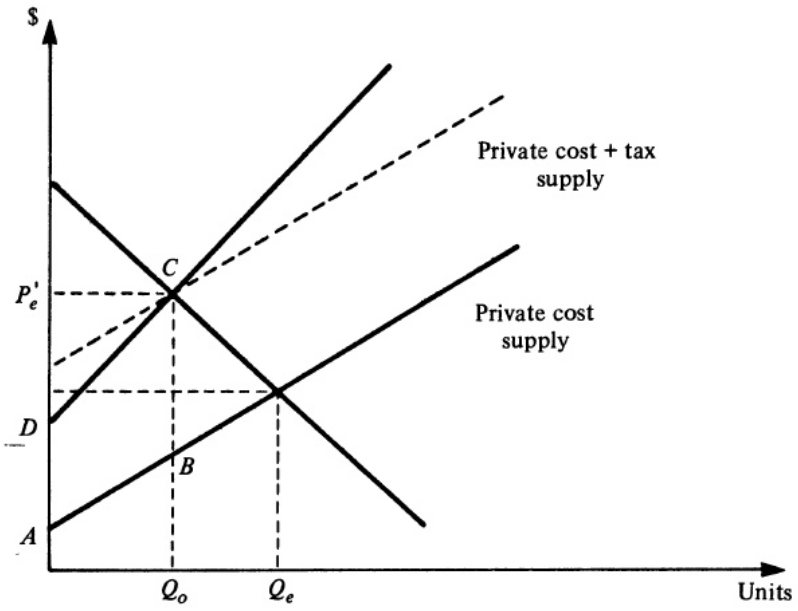


Fig. 2

1. **Market with externality** (no policy, 5 periods in each)
    - Baseline or benchmark, to see the market solution
2. **Pigouvian Tax policy** (6+7 periods)
    - the amount of marginal social cost is calculated at the optimum quantity Q_0, and is imposed as a per unit tax. Tax revenues are then redistributed back.
3. **Standards policy** (9+7 periods)
    - the ABCD area (welfare economics argument) is the amount of admissible pollution => STANDARD
4. **Permits policy** (10+12 periods)
    - only Q_0 permits exist and only licensed units can be produced
    - EQ: price of license = BC; market price of the good = P_e'; quantity = Q_0; licenses should be held by the low cost sellers

3. **Standards policy (Jana used graphs from Schotter's book; here are the graphs from Plott's article)**

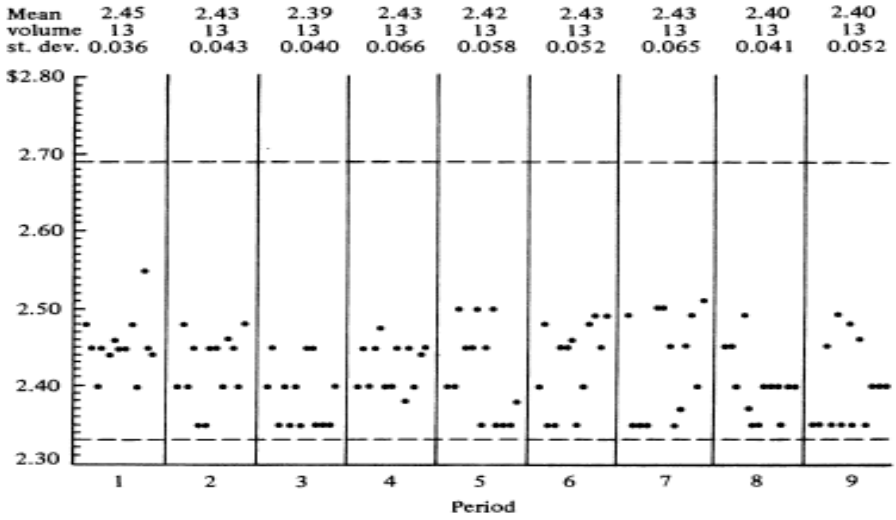


Fig. 8. Session 5, time series of contract prices.

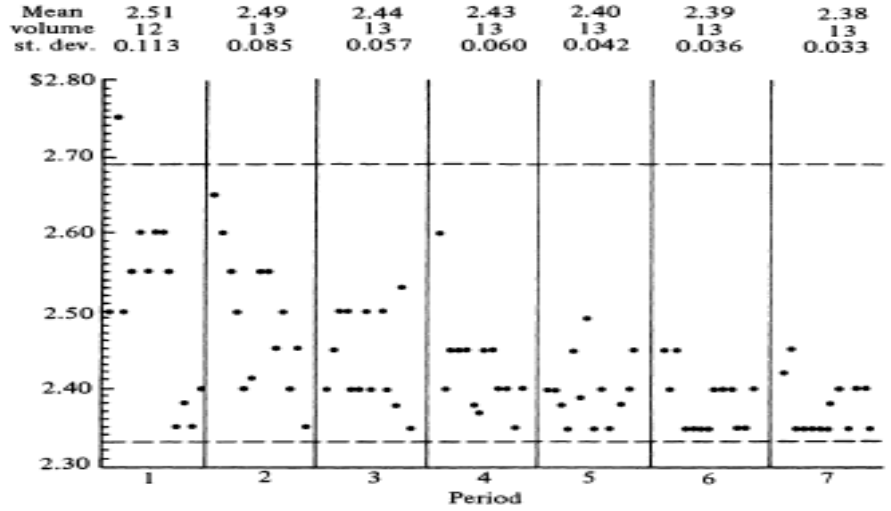


Fig. 9. Session 6, time series of contract prices.

- at the top of each graph, see the mean price and the number of units sold in each period
- the least efficient way of intervention
- because the total number of permits was limited to 13, the subjects rushed into concluding the deals => low prices, close to the levels with no intervention

4. **Permits policy (Jana used graphs from Schotter's book; here are the graphs from Plott's article)**

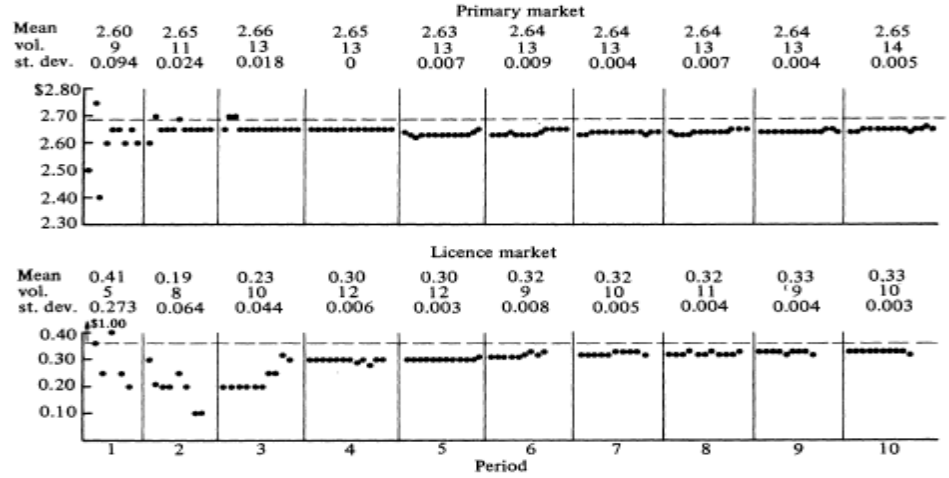


Fig. 10. Session 7, time series of contract prices.

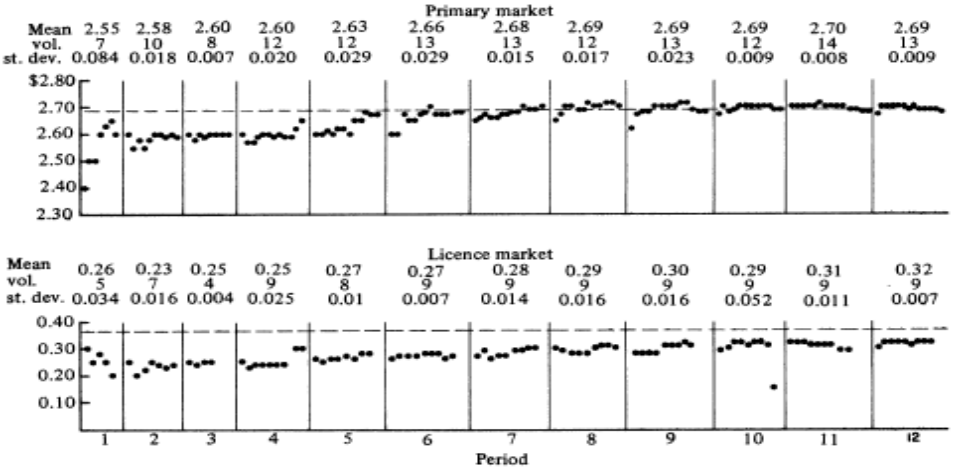


Fig. 11. Session 8, time series of contract prices.

- at the top of each Figure, see the mean price and the number of units sold in each period
- PERMITS effective in pushing the volume down to the Pareto optimal level of 13, and price up to eq. level of 2.69
- ALSO the price per permit converged to the equilibrium level of $.36 ($2.69=$2.33+$.36)
- Session 8 convergence more obvious, session 7 series more stable, close to eq. levels
- more efficient than TAXES in terms of the surplus captured by subjects

CONCLUSION:

- the LEAST efficient is the unregulated market
- the MOST efficient is the license policy (which is only slightly better than Pigouvian taxes
- [efficiency here measured in fraction of joint surplus implemented]
- the standards policy is in the middle and all over the place
- [how can that be? "The standards approach is the one found most frequently in application. The current air pollution are a good case in point." (Plott 1982, p. 107)]
- Say Porter et al (2009, p. 190) "Among economists at least, the use of tradable emission allowances under an aggregate emission cap is generally considered a mature policy technology. It has become the default policy option in controlling a variety of large scale air emissions and is being increasingly considered for replacing inefficient source-specific regulation of water pollutants (Tietenberg, 2002). The same policy technology is also being used in fisheries regulation and elsewhere (National Academy of Sciences, 1999). In a competitive emissions market with low transaction costs, the initial allocation of rights will not affect the final use of the allowances. However, how the rights are allocated can have significant economic consequences through their effect on the entry and exit decisions and marginal tax rates (Goulder et all 1999)."

So there …

What are current problems? That's what some of the readings for today are about …

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Transactions Costs in Tradable Permit Markets: An Experimental Study of Pollution Market Designs*

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- Tradable emission permits ("allowances")
  - Polluters with high abatement costs have incentives to buy them
  - Polluters with low abatement costs have incentives to sell them
  - In the aggregate the number of permits is determined by a desirable standard of pollution (as in the standards policy)
  - Trading permits between polluters minimizes the cost of complying with the standard since (a well-functioning permit market with low transaction costs) equalizes the marginal cost of emissions abatement across firms (and all this without the informational requirements of the standards policy; that's because firms are forced to implicitly reveal their marginal cost)
  - Important design issues for such permit markets:
    - How to endow firms (consumers) with permits?
    - How to minimize the transaction costs?
      - in absence of transaction costs, no efficiency losses (see next lecture), "only" distributional concerns
      - in presence of transaction costs, "cost-effectiveness" is compromised
    - What are the consequences of particular transaction costs / endowments ???

- Transaction costs
  - can arise at various stages
    - firms have to make decision whether to go into the permits markets and what permits to buy (e.g., which vintage – see the article by Porter et al.)
    - firms have to identify firms that buy / sell permits
  - there is abundant anecdotal but little hard evidence about the importance of transaction costs (see pp. 146 - 147 for examples of too many bureaucratic layers – on the federal and state level -- that probably contributed to the low level of inter-firm trading in the EPA's early Emissions Trading Program to regulate air quality, etc.; see also pp. 147 – 148 on the RECLAIM market)
  - even in an apparently well-functioning permit market such as the lead permit market, efficiency losses have been estimated to be about 10%.)
  - the regulator can influence the magnitude and nature of transaction costs through choice of trading rules and the market design
    - should initial endowments be negotiated and "grandfathered" based on past emissions or capacities or outputs, or what (again, see the Porter et al. article assigned for today)?

- Cason and Gangadharan want to study the impact of transaction costs on market outcomes under different initial permit endowments
  - transaction cost regimes: zero, constant, declining
  - initial permit endowments: 20% and 60% of the cost-effective allocation
    - goal is to study how permits could be endowed to reduce the impact of transaction costs depending on the properties of the transaction costs
    - the experimental design is based on a theoretical model
    - the experimental design is not calibrated to any real-world scenario explicitly (in fact, the authors "abstract deliberately from any additional market characteristics that exist in the field" p. 149; this is in contrast to what Porter et al. do but their purpose is very different …)

- Details of the experimental design and implementation
  - 28 sessions with ten subjects each

Table 1. Experimental Design

Nature of Transaction Costs	Initial Endowment: 20% of the Cost-Effective Allocation	Initial Endowment: 60% of the Cost-Effective Allocation
Zero (z)	Four sessions: one experienced M420z20 (14 periods) M901z20 (14 periods) P906z20 (14 periods) P913z20x (14 periods)	Four sessions: one experienced P420z60 (15 periods) M830z60 (15 periods) M905z60x (15 periods) P906z60 (11 periods)
Constant marginal transaction costs (c)	Five sessions: two experienced P413c20 (15 periods) M504c20 (17 periods) M522c20x (15 periods) P628c20 (15 periods) P713c20x (15 periods)	Five sessions: two experienced P427c60x (15 periods) M508c60 (15 periods) M516c60 (13 periods) P628c60 (15 periods) P712c60x (14 periods)
Decreasing marginal transaction costs (d)	Five sessions: two experienced P424d20x (15 periods) M505d20 (13 periods) M516d20 (15 periods) M518d20x (10 periods) P712d20 (15 periods)	Five sessions: two experienced P417d60 (11 periods) M511d60 (9 periods) M515d60 (15 periods) M523d60x (14 periods) P720d60x (12 periods)

Notes. A P in the session name denotes Purdue University and M denotes Melbourne University. An x in the session name denotes subjects who were experienced in a previous session in this experiment. The z, c and d codes refer to the transaction costs treatment shown in the left column.

  - subjects were undergraduate students from Purdue U and U of Melbourne
  - subjects were randomly assigned as buyers or sellers (five of each)
  - subjects traded in experimental dollars that were multiplied by two In the USA and by three in Australia to generate about the same real level of (expected) earnings.
  - “subjects earned between US $25 and $40”, “sessions lasted between 90 and 120 minutes”

- computerized double auction (rather than the oral double auction in Plott 1982, or in class, but same logic)
- initial endowment treatments correspond to shifting the vertical axis between the Q = 10 and Q = 30 positions (note: Q (equilib) = 50):

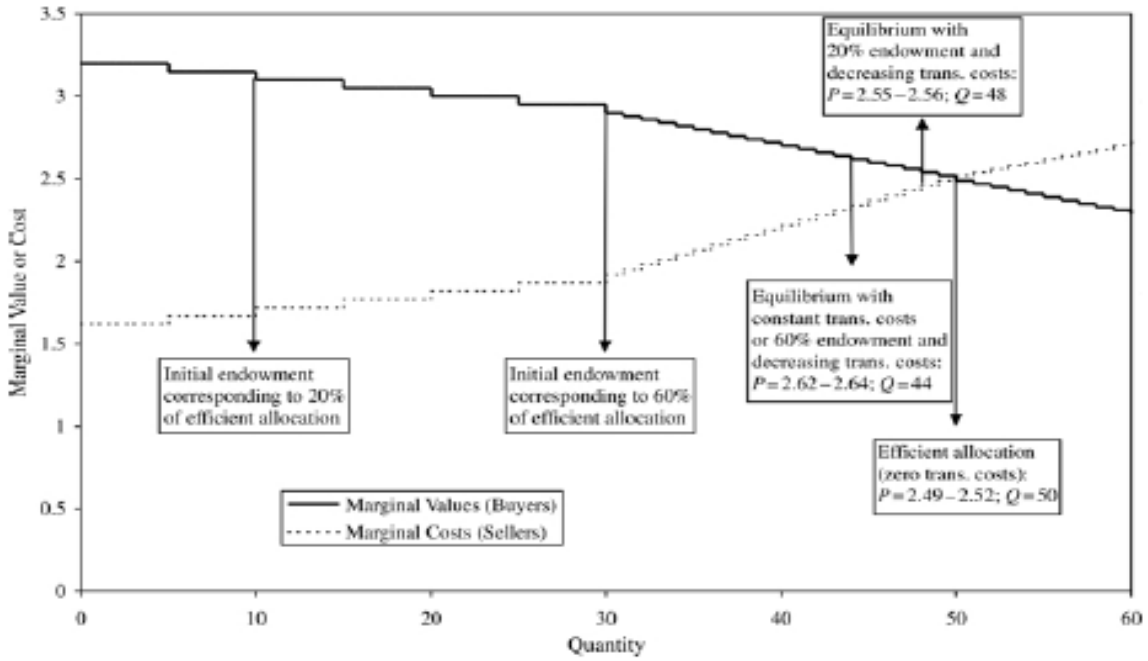

Figure 1. Induced marginal values and control costs for allowances.

- Theoretical predictions (derived from Stavins 1995)
  - hypotheses 1 – 3 (on transaction prices)
    - t–costs raise prices (h1)
    - with decreasing marginal t–costs, t–prices are lower the further the initial endowment of allowances is away from cost-effective allocation (h2)
    - with constant marginal t-costs, t–prices are independent of initial endowments of allowances (h3)
  - hypotheses 4 – 5 (on transaction quantities and final allowance distributions)
    - with decreasing marginal t–costs, normalized t-quantities are greater and closer to zero t–costs competitive equilibrium the further the initial endowment of allowances is away from cost-effective allocation (h4)
    - with constant marginal t-costs, … no impact on transaction quantity (h5)
  - hypotheses 6 – 7 (on cost-effectiveness of abatement)
    - with decreasing marginal t-costs, final cost-effectiveness greater the further the initial endowment of allowances is away from the cost-effective allocation (h6)
    - with constant marginal t-costs, … no impact on final cost-effectiveness (h7)

- Results

Table 2. Average Transaction Prices, Normalized Quantity Traded and Cost-Effectiveness for the 28 Individual Sessions

Session Name	Ave. Transaction Price (Final Five Periods)	Normalized Quantity (Final Five Periods)	Average Cost-Effectiveness (Final Five Periods)
Decreasing transaction costs, 20% endowment			
P424d20x	259.7	46.0	96.86
M505d20	250.5	49.2	99.56
M516d20	253.8	47.4	98.39
M518d20x	256.5	47.2	98.57
P712d20	254.9	47.0	98.73
Treatment Mean	255.1	47.4	98.42
Decreasing transaction costs, 60% endowment			
P417d60	263.5	44.4	97.33
M511d60	263.9	44.0	97.16
M515d60	261.3	44.2	97.30
M523d60x	264.1	43.8	97.04
P720d60x	264.3	43.8	96.88
Treatment Mean	263.4	44.0	97.14
Constant transaction costs, 20% endowment			
P413c20	260.2	45.0	97.78
M504c20	266.3	41.8	93.61
M522c20x	262.9	43.8	95.69
P628c20	264.8	42.4	94.83
P713c20x	265.6	42.0	93.18
Treatment Mean	263.9	43.0	95.02
Constant transaction costs, 60% endowment			
P427c60x	262.4	44.2	97.42
M508c60	262.0	44.4	97.44
M516c60	264.0	44.0	97.16
P628c60	265.0	43.2	96.32
P712c60x	263.1	44.2	97.45
Treatment Mean	263.3	44.0	97.16
Zero transaction costs, 20% endowment			
M420z20	251.1	50.8	99.02
M901z20	249.4	48.0	96.21
P906z20	249.6	48.6	98.14
P913z20x	248.8	49.4	99.65
Treatment Mean	249.7	49.2	98.26
Zero transaction costs, 60% endowment			
P420z60	251.0	50.0	99.82
M830z60	248.9	49.8	99.90
M905z60x	247.9	48.2	98.75
P906z60	249.0	50.0	99.58
Treatment Mean	249.2	49.5	99.51

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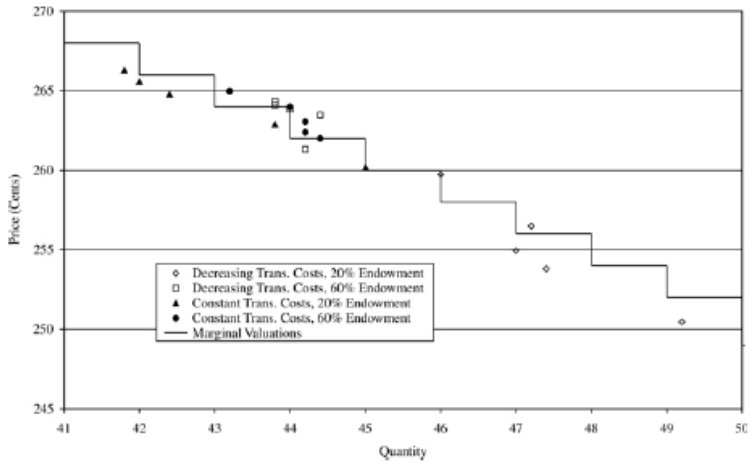

Figure 2. Mean transaction prices and quantities over final five periods of each session.

Conclusions?

By and far the theory (as reflected in the hypotheses) gets confirmed.

Hypotheses regarding transaction prices:

Hyp 1: Transaction costs raise prices compared to the zero transactions cost baseline.
Hyp 2: With decreasing marginal t–costs, t–prices are lower the further the initial endowment of allowances is away from cost-effective allocation
Hyp 3: With constant marginal t-costs, t–prices are independent of initial endowments of allowances

Hypotheses regarding transaction quantities and final allowance distributions:

Hyp 4: With decreasing marginal t–costs, normalized t-quantities are greater and closer to zero t–costs competitive equilibrium the further the initial endowment of allowances is away from cost-effective allocation
Hyp 5: With constant marginal t-costs, … no impact on transaction quantity

Hypotheses on cost-effectiveness of abatement:

Hyp 6: With decreasing marginal t-costs, final cost-effectiveness greater the further the initial endowment of allowances is away from the cost-effective allocation
Hyp 7: With constant marginal t-costs, … no impact on final cost-effectiveness

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The design, testing and implementation of Virginia's NOx allowance auction☆

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ABSTRACT

We report on the design and testing of three auction mechanisms to maximize revenue and efficiency in the sale of two vintages of nitrous oxide emission allowances by the Commonwealth of Virginia in 2004. The three mechanisms considered were a combinatorial sealed bid (CSB) auction, a sequential English clock (SEC) auction, and a combinatorial English clock (CEC) auction. We find the SEC and CEC mechanisms to be superior the CSB when demand is relatively elastic.

"Among economists at least, the use of tradable emission allowances under an aggregate emission gap is generally considered a mature policy technology. It has become the default policy in controlling a variety of large scale air emissions and is being increasingly considered for replacing inefficient source-specific regulation of water pollution (Tietenberg, 2002). The same policy technology is also being used in fisheries regulation elsewhere (National Academy of Sciences, 1999)."

Competitive emissions market with low transaction costs =>

- Initial allocation of rights will not affect the final use of the allowances
- Initial allocation of rights can have significant economic consequences through effect to entry and exit decisions

Aside [from wikipedia, retrieved 2009_03_12]

Health effects

NO_x react with ammonia, moisture, and other compounds to form nitric acid vapor and related particles. Small particles can penetrate deeply into sensitive lung tissue and damage it, causing premature death in extreme cases. Inhalation of such particles may cause or worsen respiratory diseases such as emphysema, bronchitis it may also aggravate existing heart disease.[4]

NO_x react with volatile organic compounds in the presence of heat and sunlight to form Ozone. Ozone can cause adverse effects such as damage to lung tissue and reduction in lung function mostly in susceptible populations (children, elderly, asthmatics). Ozone can be transported by

wind currents and cause health impacts far from the original sources. Millions of Americans live in areas that do not meet the health standards for ozone.

NO_x also readily react with common organic chemicals, and even ozone, to form a wide variety of toxic products: nitroarenes, nitrosamines and also the nitrate radical some of which may cause biological mutations.

[edit] Regulation and emission control technologies

The Kyoto Protocol, ratified by 54 nations in 1997, classifies N_2O as a greenhouse gas, and calls for substantial worldwide reductions in its emission.[5]

As discussed above, atmospheric NO_x eventually forms nitric acid, which contributes to acid rain.[6] NO_x emissions are regulated in the United States by the Environmental Protection Agency, and in the UK by the Department for Environment, Food and Rural Affairs.

Technologies such as flameless oxidation (FLOX) and staged combustion significantly reduce thermal NO_x in industrial processes. Bowin low NO_x technology is a hybrid of staged-premixed-radiant combustion technology with a major surface combustion preceded by a minor radiant combustion. In the Bowin burner, air and fuel gas are premixed at a ratio greater than or equal to the stoichiometric combustion requirement.[7] Water Injection technology, wherby water is introduced into the combustion chamber, is also becoming an important means of NO_x reduction through increased efficiency in the overall combustion process. Alternatively, the water (e.g. 10 to 50%) is emulsified into the fuel oil prior to the injection and combustion. This emulsification can either be made in-line (unstabilized) just before the injection or as a drop-in fuel with chemical additives for long term emulsion stability (stabilized). Other technologies, such as selective catalytic reduction (SCR) and selective non-catalytic reduction (SNCR) reduce post combustion NO_x.

The use of Exhaust gas recirculation and catalytic converters in motor vehicle engines have significantly reduced emissions.

Porter and colleagues (from here on: Porter+) study

- sale of 3710 allowances for emission of nitrogen oxides (NOx) in fiscal years 2004 (1,855) and 2005 (1,855) using a sequential English auction format (that's different from the DA that we discussed so far); 1,855 allowances account for about 8 percent of the annual total allotment. Where do the other allowances go? … to firms in recognition of their historical "rights to emit" … the 8 percent were set aside for distribution among new sources of NOx emissions .. originally meant to be handed out for free … but then budget crisis struck …
- part of a cap-and-trade system of pollution allowances that involves Virginia and 18 other states in the eastern U.S.; allowances are freely tradable throughout the 19-state region … there is an active private market …
- one of the first cases where emission allowances were auctioned to maximize government revenue
    - auction mechanism designed, tested, implemented by Porter+
    - brought DEQ/Commonwealth of Virginia $10.5 million, 19 percent above target revenue of $8.8 million
    - tight time constraint (from first time Porter+ were contacted to required delivery time, about two months)
    - transparency of the pricing rule critical
        - option 1: discriminatory (or "pay-as-you-bid")
            - this poses ex post problem to participants since nearly all participants included in final allocation realize that they could have had the licence to pollute for less …
        - option 2: uniform pricing
            - this might pose a problem to the government because public is likely to find out what bidding prices were and how much the government left on the table (keeping information secret not an option due to Virginia's Freedom of Information Act)
        - auction mechanism rules had to be simple since complicated bidding and allocation rules might scare potential buyers off (hence no combinatorial clock auction); one important complicating factor was the asymmetric substitutability of the two kinds of allowance involved
            - Emitters cannot borrow against future issuances of allowances
            - Allowances are "bankable", i.e., allowances used in 2004 can be used in 2005 but …
            - … use of banked allowances subject to restrictions meant to control the rate of their use in a given year (e.g., if region-wide carried-over licenses exceed 10 percent of the total regional budget – the "banking threshold" – then only a fraction of the carried-over licenses may be used, the remainder gets devalued (can be used for cover half of the emission amount in the issue year). See example on p. 192.

- in early March, local exchanges were trading 2004 allowances for about $2,000 and 2,005 allowances for about $3,500

- Which auction mechanism / pricing rule to use, that was the question:
"DEQ selected initially a combinatorial clock design, the complexity of the implementation proved prohibitive in the available timeframe, and ultimately a sequential clock was implemented instead." (p. 191) Why? (And why does it make the question of the pricing rule moot)?

- Auction Design:
  - Coventional wisdom:
    i. The design of auctions matters (Klemperer JEP 2002, What Really Matters in Auction Design; Binmore & Klemperer EJ 2002, The Biggest Auction Ever: The Sale of the British 3G Telecom Licenses).
    ii. Substitute goods (such as the 2004 and 2005 allowances) ought to be offered simultaneously.
    iii. Auctions ought to be iterative so that the prices discovery process can work its magic.
  - Three auction mechnanisms (out of many, many) were investigated:
    i. Sealed bid (first-price auction) without iteration
    ii. Iterative English (second-price auction)
        1. simultaneously linked clocks
        2. sequential

Sneak preview of results:

Combinatorial pay-as-bid sealed bid auction would have captured 61 % of surplus

Assuming unitary elasticity:

Combinatorial or sequential clock option would generate about the same

Assuming higher degrees of elasticity:

Sequential and combinatorial clock option yield 71 % and 74 %, respectively

Interestingly, the allocative for all of them is 95 percent or better.

allocative efficiency (95 percent in al case

This result is interesting for the simple reason that the final recommendation of the report for the Regional Greenhouse Gas Initiative (RGGI) summarized in Burtraw and Palmer (see website) on auction design for selling CO_2 emissions allowances I 2009 suggest the implementation of uniform price sealed bid auction ! See the link in Burtraw and Palmer for lots of great material including an excellent example of experimental economics at work (Addendum [to the November 2007 report]: Response to Selected Comments April 2008)

Addendum: Response to Selected Comments

Charles Holt, William Shobe, Dallas Burtraw, Karen Palmer, Jacob Goeree, Erica Myers
April 8 2008

Summary: A final report summarizing research on auction design for RGGI was submitted to the New York State Energy Research and Development Authority (NYSERDA) in November 2007. Subsequently several constructive comments and suggestions have been made by interested parties. This addendum to the November 2007 report contains reactions to some of these comments, including some new findings based on research done subsequent to submission of the Final Report. The main issues addressed in this addendum are (1) the choice of auction design (clock versus sealed bid) and how this affects the efficiency of the auction and the ability of parties to collude, (2) variations on design for clock auctions, and (3) auctions that combine different vintages of allowances. To summarize the main results:

- In laboratory auctions with communication among participants, successful collusion is more effective in clock auctions than in discriminatory and uniform price auctions.

- An analysis of the 'chat' (instant message communications between bidders prior to submitting bids) indicates that clock auctions facilitate collusion by allowing bidders to focus on a single dimension (quantity reductions).

- The effects of this collusion are reflected in clock prices at or near reserve price levels, with subsequent trading at much higher prices in the spot markets.

- Results of our new experiments, conducted subsequent to the Final Report, indicate that the provision of information about the quantity of demand after *each round* of a clock auction does not improve price discovery of these auctions.

- This type of demand reduction in clock auctions echoes the striking results reported by Goeree, Offerman, and Sloof (2006) in a much simpler environment with full information provided about quantities demanded during the auction.

- The New England and New York ISO proposal that allowance owners be able to offer allowances for sale in the RGGI auction has definite advantages. We have different suggestions about how this might be implemented. The uncertainty of supply that results can help reduce the potential of collusion.

- Since RGGI allowances are bankable, a bid for a later vintage could be treated as a request to purchase *either* a later vintage *or* an earlier vintage, whichever is less expensive. Interpreting bids in this manner prevents a price inversion in which the uniform price for the later vintage is higher than the price for the earlier vintage, although theory suggests this price inversion is inefficient and would not occur in the secondary market. This addendum describes a simple procedure for combined vintage auctions that implements this idea.

Back to the Porter+ study

3.2.1. Sealed Bid auction (combinatorial), “CSB”

- allocation to the highest bidder on a pay-as-bid basis
- standard PQ bids replaced by “Any/Or” (AO) bids (which were of form (p04,Q04 |p05,Q05), meaning up to so many allowances of a particular vintage at maximally the given price as an either one or the other condition, or some linear combination of the two, as long as both Q04 and Q05 are mentioned as positive; a simple example is given on p. 193)
- solvable per mixed integer program for optimal quantities and proportions
- attractive format because known to potential bidders (although presents participants with ex-post explanatory problem, as mentioned)

3.2.2. Clock auctions (combinatorial and sequential) – “English” clock auction, “ECA”

- bidding process that gives feedback to bidders (about other bidders etc.)
- clock runs up prices, bidders just bid quantities (i.e., their right to make bids prices is taken away)
- note that this auction format determines the (uniform) pricing rule
    - believed to encourage greater revelation of bidders’ willingness to pay relative to pay-as-bid rule
    - solves the already mentioned ex-post predicament for bidders who realize that they could have had the license for less
    - also, since it stops revealing bidders’ demand at the market clearing price, it generates no information about true willingness to pay and therefore money left on the table.

Two way to do this:

- Sequential English (SEC) auctions
    - one vintage first, then the other second
    - no simultaneous price discovery process but simple
- Combinatorial English (CEC) auctions
    - simultaneous price discovery process but complex
    - both vintages at same time (two clocks running at same time)
    - as long as total quantity demanded for a vintage is greater than its supply, clock continues to increase
    - three modifications (of minor importance for us, …)

Experimental design

4.1 Demand configuration

- demand configuration apparently not well-known: is there a dominant auction mechanism (one that is the best across all environments – “elastic” and “ineleastic”, each with four “value environments”)
- if that not the case, then the DEQ has to make the “parallelism” call (i.e., it has to determine which of the investigated environments is closest to “real world”)

4.2. Experimental implementation

- 25 sessions with 11 – 12 volunteer subjects randomly selected from the George Mason University graduate and undergraduate population.
- usual procedure: subjects were randomly seated, given instructions [see fn 19 !!!], and all without reference to NOx, emissions, pollution or any other situation specific element
- Experiment was computerized
- Communication was forbidden “to prevent collusive behavior”
- Subjects received a “show-up fee” , remainder was based on decisions they made]
- Experiment took about two hours, average earnings were about $47.30

Table 2
Treatment design and summary of data collected.

Treatment	Sessions	Subjects	Observations
CSB (combinatorial sealed bid)	8	96	120
SEC (sequential English clock)	11	132	88
CEC (combinatorial English clock)	6	69	75
Total	25	297	283

- prior to each auction, subjects were assigned between 3 and 9 redemption values for one or both abstract goods … thereby being told at precise cash value they could redeem each unit purchased in each auction (each value was for exactly one allowance of one vintage)
- subjects had no information about others’ values (as probably true in the real-world)
- … imperfect substitutability …
- three treatments (corresponds to the three auction mechanisms tested), for all the same value environments

4.3. Treatment design

- each auction executed yielded one observation on the auction treatment being tested
- observations from first demand cycle (four auctions) excluded from data analysis because of likely effects of “learning of the first kind” (subjects understanding the laboratory setting rather than reacting to the given incentive)

Results

Aim was to estimate revenue and allocative efficiency under the three auction formats

- revenue measured as revenue in a given round normalized by the maximum possible surplus in that round
- efficiency measured as sum of values satisfied by the final allocation normalized by the sum of values that would be satisfied by the optimal allocation

Results come from random effects models which use revenue and efficiency data as dependent variables and as primary independent variables dummies indicating the auction mechanism used in a given observation (SEC, CEC, CSB is implicit) plus various controls … (not of importance for us right now)

5.1.2. Revenue results
5.1.2.1. The CSB outperformed both English clock designs in inelastic environments.
5.1.2.2. Elastic demand increased revenue in both English clock mechanisms, but not in the CSB.
5.1.2.3. Differences in CE prices between allowance vintages impact revenue generation in the CEC and SEC but not the CSB.
5.1.2.4. High minimum bids (reserve prices) increased revenues, but this was somewhat offset by unallocated units.
5.1.2.5 There was no learning from cycle to cycle.

5.1.3. Efficiency
5.1.3.1. Efficiency across mechanisms is comparable irrespective of the environment.
5.1.3.2. A high minimum bid rule slightly increases efficiency, but is quickly counteracted by unallocated units.
5.1.3.3. Learning occurred only in the SEC treatment.

Conclusions

- Experiments are being used (and that is probably for a good reason) to inform public policy decisions
- The Virginia NOx allowance auction had to be implemented on an extremely tight time line … three important effects:
    i. It forced state administrators to make very quick decisions
    ii. It forced selection of an easily implemented auction design that would be attractive to potential participants
    iii. Limited opportunities for involvement of outside parties in the process
- RFP for brokerage services to implement an auction was published May 17, for ten-day period; contract signed with the one firm that also recommended an English clock auction rather than all those (others) that proposed SB auction; see fn 26); it seems that the experimental results by Porter+ delivered in late April 2004 [which had not been published by May 17, swayed administrators].
- Auction held on June 24
    i. 2004 allowances sold in the morning at $2,325 (up from r-price of $1,900)
    ii. 2005 allowances sold in the afternoon at $ 3,425 (up from r-price of $2,900)

- The advantages of test-bedding a new application are:
    i. Exploration of parameter space when there are no empirical guidelines to identify the parameters (e.g., demand elasticity for allowances)
    ii. Comparing revenue and efficiency of auction formats makes for better informed decisions.
    iii. Increases confidence in process and outcome
    iv. Might facilitate the final choice of a contractor to run the auction
    v. All that at relatively low cost (less than 1 percent of the revenue, i.e., about $100,000)

And here is an excursion, from a blog that I have subscribed to. I hope you find it as interesting as it did!

Today at Aguanomics

Thursday, March 5, 2009 2:04 PM
From: "Aguanomics" <dzetland@gmail.com>
To: aortmann@yahoo.com
Today at Aguanomics

[As Reservoirs Fall, Prices Should Rise]

Posted: 05 Mar 2009 03:34 AM PST

...Says Harvard Professor Stavins [at the Huffington Post]. His op/ed continues:
Throughout the United States, water is under-priced. Efficient use of water will take place only when the price reflects the actual additional cost of making that water available. Lest one fear that higher water rates would mean that Americans would go thirsty, take note: On average, each of us uses 183 gallons of water a day for drinking, cooking, washing, flushing, cleaning, and watering, but less than 5% of that is for drinking and cooking combined. There is plenty of margin for change if people are given the right price signals.

Fifty years of economic analyses have demonstrated that water demand is responsive to price changes, both in the short term, as individuals and firms respond by making do with less, and in the long term, as they adopt more efficient devices in the home and workplace.
He goes on to give his version of my "some water for free, pay for more..."

Note: The story was picked up by DWR's clippers, which is funny, because they told ME that [my forbes.com piece] was too op/ed for them. Was it the message or the messenger? Perhaps the message, since I advocated higher water prices LAST July... OTOH, I am not a Harvard professor. So much for "the truth will set you free!"

Bottom Line: Now that we are all on the same page, can we get some [conservation pricing]? Everyone gets some cheap water but then pays a LOT if they want more.

thanks to TS for pushing me to post on this

Commentary

The Water Shortage Myth

David Zetland 07.15.08, 6:00 AM ET

California is perpetually portrayed as suffering from a shortage of water. Case in point: Gov. Arnold Schwarzenegger recently declared a statewide drought, telling citizens to prepare for rationing. But the state's problems are not a result of too little water.

The real problem is that the price of water in California, as in most of America, has virtually nothing to do with supply and demand. Although water is distributed by public and private monopolies that could easily charge high prices, municipalities and regulators set prices that are as low as possible. Underpriced water sends the wrong signal to the people using it: It tells them not to worry about how much they use.

Low prices lead to shortages. Water managers respond to them with calls for conservation. But this often fails. Residents in San Diego County, for example, were asked in June 2007 to cut their water use by 20 gallons a day. They used more. When voluntary conservation fails, water agencies impose mandatory rationing, which is unfair and inefficient because people who have historically been water misers are cut back by the same percentage as water hogs.

If water was priced to reflect scarcity, a decrease in supply would lead to an increase in price, and people would demand less. Consider another precious liquid: oil. Despite popular perception, there is no shortage of oil; supply does equal demand at the present price. It's just that supply meets demand at a higher price than it did a few years ago.

In a sensible water pricing system, everyone would be guaranteed a base quantity of water at a low price. Those who used more would face a steep price hike.

As it stands, Los Angeles households pay $2.80 for the first 885 gallons they use per day. That's enough water to fill 18 bathtubs. The next 18 tubs cost $3.40, which is only 20% more. Most L.A. households don't even see this price increase, since the average household of three uses just 350 gallons--about seven bathtubs--each day. For that water, the household pays only $35 a month. If they use twice the amount, the bill merely doubles.

I propose a system where every person gets the first 75 gallons, or 1.5 bathtubs, per day for free but pays $5.60 for each 75 gallons after that. Under my system, the monthly bill for the average household of three would come to $95.

My system is designed to reduce demand rather than cover costs. Revenue paid by guzzlers would cover the costs of those who use only a small amount of water. Any leftover profits could be refunded to consumers or used to enhance the quality or quantity of the water supply.