

Markets for Public Goods

Kirit S Parikh

Director, Indira Gandhi Institute of Development Research

The development of capital markets in the recent years opens up a whole new set of opportunities to develop new markets for public goods.

The development of market mechanisms on financial markets, and the advent of the computerised “open electronic limit order book market”, have yielded markets which are close to the economists’ ideal of competitive markets. The ideal competitive market has many players, none of whom can affect the price significantly, one price prevails at any time, all the players know the price, and transaction costs are negligible. The modern automated trading practices have brought us close to fulfilling these conditions.

The availability of technological and human skills that have gone into these markets opens up the possibility of using economic incentives for efficient use of public goods such as environmental resources, road space, etc. Some of these markets could have trading volumes which are extremely large.

AIR QUALITY MARKETS

The quality of air in the Indian metropolises – Delhi, Mumbai and Calcutta – is very poor and is deteriorating rapidly. The level of suspended particulate matter (SPM) in Delhi is eight times the standards specified by the World Health Organisation (WHO). What is worse, the concentration level has increased by 40% in the last two years.

How can we control these in a cost-efficient way? The normal response of regulators is to impose emission standards on various polluters: factories, vehicles and commercial establishments. Yet, how does one fix these standards for different users?

A common practice is to use the standard that corresponds to the best available technology (BAT). There are many problems with this approach:

1. Even when every polluter meets the emission standard, if the number of polluters is large enough, ambient air quality may be inadequate.
2. Industry would always challenge the assumed BAT standards. Industry always knows more than regulators about technology, but it would never reveal what it knows.
3. Even if full information on BAT is available, it is not cost effective for all companies to follow it. A cost-effective solution, from the viewpoint of society at large, is one where the marginal cost of reducing emission by one unit is the same for all emitters.

An example will illustrate matters. Suppose there are two industries A and B. A emits 100 tonnes of pollution per year, and faces a cost of Rs 1 crore per ton in order to obtain reductions. B emits 200 tonnes of pollution a year, but faces a cost of Rs. 5 crore per ton to obtain reductions. In this

situation, it is best for society (which ultimately pays for pollution control) if A first implements pollution control.

USING TRADABLE PERMITS

A system of tradable emission rights would accomplish the task in a cost – efficient way, without the need for regulators to know the technical options available to various industries and the associated costs. Such a system would also reliably accomplish the desired ambient air quality. Suppose we know that Mumbai air can absorb or dissipate 100 tonnes of a particular pollutant per year. The government would make a public issue of 100,000 permits, the ownership of each of which entitles the holder to issue 1 kg of pollutant in the year. These permits would trade on the secondary market just like shares.

The secondary market trading for the permits would make the prices sensitive to information about the industry in real-time in a way which does not take place with fixed regulations.

Such schemes have been tried in some cities in the West, but with limited success. The main problem has been that secondary-market trading was not well developed, and transaction costs were large. The institutional arrangements which are used on stock markets in India can be easily redeployed into these areas.

Monitoring and enforcement are the prerequisites for tradable permits to work. However, it should be pointed out that monitoring and enforcement are also required if any kind of pollution control is to work. The only difference, with tradable permits, is that prices are more flexible, the total cost to society is lower, and adherence is obtained for scientific standards about the total quantity of pollution that is tolerable.

POLLUTION CONTROL AT THE COMPANY LEVEL

Regulators would no longer need to become knowledgeable about pollution control technology in different industries. These decisions would be made in a decentralised way by each company which is a polluter.

Each company would face a choice of (a) buying permits from the market and / or (b) installing pollution control equipment in order to avoid buying the permits. When it makes these choices, based on its own self-interest, it would compare (it's own) marginal cost of pollution control against the (common) price of the permits. On the margin these would be equal, thus ensuring economic efficiency. The total cost to society of obtaining the desired level of air quality would be minimised.

THE ROLE FOR DERIVATIVES

Since pollution control equipment is long-lived, the companies making decisions about permits vs. equipment would be greatly assisted in their work by the existence of futures and options markets in the permits.

In markets with storable goods (e.g., wheat), futures markets assist market efficiency, but they do not completely reveal new information (the futures price is linked to the spot price by cost of carry). In contrast, pollution permits cannot be stored, and a market which trades pollution permits for the coming year reveals information to the economy which is just not revealed in the spot market for the permits.

The futures market would also convey the future possibilities for permit prices to companies involved in research and production of pollution control equipment. If futures prices of permits were high, then the market would be sending out signals for enhanced research and manufacture of pollution control equipment.

Derivatives would also help in risk management. A company which makes the bet of not installing pollution control equipment is at risk that the price of the permits may flare up next year. By purchasing the permits on a future date on the futures market. Or by purchasing options to buy these permits, the company can protect itself against surprises. Conversely, a company which makes a bet by spending on research in pollution control suffers from the risk that permit prices might be lower in the future: it would benefit by being able to sell permits on the futures market, or by buying options to sell these permits on the options market.

A GLOBAL MARKET FOR GREENHOUSE PERMITS

This idea can be logically extended to the most serious global environmental problem facing us, namely that of climate change. A globally cost-effective way to deal with this is to issue each human being his share of the emission quota.

The global environment can absorb 5 billion tonnes of CO₂ in the atmosphere. Hence each individual on earth should be given a quota of 1 tonne of CO₂ per year. These permits can be made tradable.

The trading volume is expected to be very large, given the basic fact that individuals in the US emit more than 5 tonnes per person per year while those in India emit less than 0.3 tonnes per year. The global carbon emission market would have permits for 5 billion tonnes of emission per year. The permits are estimated to cost between \$20 to \$200 per tonne. The capitalisation is expected to be between \$100 to \$1000 billion per year.

Futures markets are also needed in order to help firms and individuals plan for the future.

TRADING FOR ELECTRICITY

Endemic and widespread shortages of power is a major problem for the economy. Our one great hope to get out of this mess is large scale involvement of private power producers. Some 240 MOUs have been signed, but only 3 have been cleared.

In the short run, captive plants and co-generation are attractive options. A captive plant is one which is owned by industry. Usually the industry does not need power round the clock and over parts of the day, and on many days of the year, it has idle capacity to generate power. It would like to do this and sell the power to the grid or to other users.

Co-generation is a slightly different process. Many factories require heat or steam for their process. If a power plant is attached to such a factory, it can use the heat which is currently wasted; it can thus generate electricity at a lower marginal cost.

Once we have a rich set of private producers, captive power plants, and co-generation, a question arises; who will the buyers and sellers be, and at what price will they trade electricity? There are large amounts of money involved in these decisions, and if regulators are required to set these prices and contractual arrangements, the pressures to favour one or the other can be large.

Markets are an ideal way to resolve this problem. Potential suppliers of electricity would convey their intentions by bidding prices and quantities for each half-hour slot in the day. Consumers would bid prices and quantities at which they are willing to purchase electricity.

Such a market would provide power at the least cost to consumers, it spontaneously generates the economically efficient time-of-day pricing, and it will bring enormous efficiency gains to the economy. The controversies about the load factor guaranteed to Enron would be side-stepped: indeed, in such an environment, there would be no PPA to be signed by each independent power producer. In an environment where signing of Power Purchase Agreements (PPA) is time-consuming and fraught with political complexities, the market approach appears to be a dramatically simpler way of reaching for economic efficiency.

The prices discovered by this market would be used as a "reference rate" for contracts with producers who have no control over their production, like wind power producers.

The trading volume expected in a market like this is enormous. A 100 MW unit generating at Rs. 3 per KWH has an output of Rs. 200 crore per year. India's power system is expected to be about 100,000 MW in 2000 AD, which yields a daily delivery volume of Rs. 600 crore / day. Futures and options markets are required in assisting production planning given the price volatility which such a system entails. As is the case with pollution permits, the lack of storage facilities of electricity means that the futures market reveals information to the economy which is just not revealed in the spot market for the permits. The futures prices would give signals to both, the producers and consumers of electricity and guide their future investments in generation, electricity conservation, choice of alternative technologies, etc.

The approach proposed here is not without precedent. Spot and futures markets for electricity exist in UK, Finland and in some parts of the US.

USING MARKETS FOR SUSTAINABLE FORESTRY

Another example where financial markets can play an allocative role is in sustainable exploitation of forests. Today, a forest contractor has no incentives to nurture the forests assigned to him. He would like to clear fell it. The forest department of forced to micro-manage his actions, but the *forest department* officials are only human. Over the last 50 years, the area under the forest department has risen, but the area under forests has gone down.

The problem arises from the fact that ownership of the forest is not with the contractor. If forests were privatised, however, there is no guarantee that they would be maintained as forests. Even if the land contained trees, the private owner may prefer a commercial plantation with inferior bio-diversity.

One can think of giving our forests on long-lease to private firms with a stipulation that a forest of the same quality (as defined by some objective metrics about biomass, bio-diversity, etc.) will be returned in 15 years. The failure to do so would evoke substantial penalties. However, how would we ensure that the terminal conditions generate altered behaviour today? One way is to require that these leases are only given to joint-stock companies with shares which are meaningfully traded on the stock market.

The stock market would know that a large penalty awaits the company if the forest is not maintained in adherence of certain minimal standards. Security analysts today visit the plants of companies that they cover; it is not unreasonable to think that they would visit the forests which are comparable productive assets. The stock market would do this monitoring in a more efficient and corruption-free fashion as compared with any bureaucratic organisation.

Similarly, it is feasible for voluntary environmental groups to visit a given forest once in 15 years and verify the correct calculation of penalties. In contrast, it is infeasible for them to ensure the honest day to day micro-management by the forest department which is required to produce good behaviour on the part of forest contractors.

MARKETS FOR URBAN ROAD SPACE

Traffic congestion in Mumbai worsens every day. City administrators have tried various ways to discourage cars. One approach is to use administrative fiat: e.g. use of cars on only alternate days (which generates incentives to own two cars, to switch license plates, etc.). Entry permits are used in downtown Singapore with some success. However, the question of what is the fair price of these permits remains unanswered.

Using modern electronics on the car coupled with the open electronic limit order book market, a superior market-based solution can be visualized:

Permits would exist for each four-hour slot of the day and would be valid for a month.

Each car would have a plastic card which obtains access at the few entry points into South Mumbai. A few minutes would be lost to each motorist in inserting the card and typing in a password, but many hours would be saved in the decongested city.

The government would do a primary market issue of the permits six months in the future. The permits would trade on the stock market. Car owners could either buy permits at the primary market or (through brokerage firms) on the secondary market. When a person “takes delivery” of the permit (whether on the primary or secondary market) his card would get replenished with the required permissions. This not unlike the electronic settlement which takes place with the depository.

If a person appears at the gate with a plastic card which has not been enabled with a permit, the human attendant at the gate would require him to pay cash equivalent to 50% or more than the current secondary market price of the permit.

More automated systems can simplify and streamline the operations of the car at the gate; however the main point here is that such a system is remarkably simple in implementation and yield the most economically efficient solution to congestion in cities.

The revenues thus raised would yield data to the government about the extent to which citizens value road transport. This information, coupled with futures prices, would guide future investments into roadways. The role for regulation in such a system would be to ensure that government does not auction ‘too few’ permits in an attempt to maximize revenues: the number of permits sold should be consistent with an engineering understanding of how much traffic the city can bear.