The costs of emissions abatement using command and control and market-based instruments

A substantial literature now exists on the comparative costs of attaining emissions abatement targets using traditional quantity or technology regulations – what we call command and control (CAC) instruments – and so-called market instruments (particularly emissions taxes, abatement subsidies and marketable/transferable emissions permits). Much of this literature derives from experience in the USA with these two categories of instrument. Tietenberg (1990) provides an admirable account of recent evidence on these costs. Table 7.8 reproduces one of Tietenberg's tables, showing the ratio of costs under CAC approaches to the least-cost controls (using market instruments) for air pollution control in the United States. We have examined one of these studies – that by Krupnick (1986) – in more detail in Box 7.9 (Box 6.6 in 4th edition).

Although they can be 'best' instruments in some circumstances, such direct controls are often extremely costly. Tietenberg (1984) finds that the CAC approach costs from twice to 22 times the least-cost alternative for given degrees of control. These ratios suggest that massive cost savings might be available if market instruments were to be used in place of CAC. In his 1990 paper, Tietenberg reports estimates that compliance with the US Clean Air Act through market instruments has led to accumulated capital savings of over $10 billion. It should be pointed out, however, that most studies compare actual CAC costs with those theoretically expected under least-cost market-based instruments. In practice, one would not expect market instruments to operate at these theoretical minimum costs, and so the ratios we quoted above overstate the cost savings that would be obtained in practice by switching from CAC techniques.

Three arguments underlie the tenet that market-based incentive approaches are likely to be more efficient than regulation and control. First, markets are effective in processing information; second, market instruments tend to result in pollution control being undertaken where that control is least costly in real terms; and third, market-based approaches generate dynamic gains through responses over time to their patterns of incentives.

However, stringent conditions are necessary for markets to guarantee efficient outcomes. Policy instrument choice takes place in a ‘second-best’ world, where results are much less clear. The absence of markets (including those for externalities and public goods), asymmetric information, moral hazard and other instances of market failure, all point to possible benefits of CAC-based public intervention or to the inappropriateness of complete reliance on markets and market instruments. (See Fisher and Rothkopf (1989) for an excellent survey.)

A European example is given in the file *Agriculture.doc* in the *Additional Materials* for Chapter 6. A study by Andreasson (1990) examines the real resource costs of three different policies for reducing nitrate fertiliser use on the Swedish island of Gotland: non-marketable quotas on fertiliser use, a tax on nitrogenous fertiliser and a marketable permit system. Some additional references to studies which attempt to quantify the costs of attaining pollution standards using various instruments are given in the recommendations for further reading.

Table 7.8 Empirical studies of air pollution control

Study	Pollutants covered	Geographic area	CAC benchmark	Ratio of CAC cost to least cost
Atkinson and Lewis	Particulates	St Louis	SIP regulations	6.00[a]
Roach *et al*.	Sulphur dioxide	Four corners in Utah	SIP regulations Colorado, Arizona, and New Mexico	4.25
Hahn and Noll	Sulphates standards	Los Angeles	California emission	1.07
Krupnick	Nitrogen dioxide regulations	Baltimore	Proposed RACT	5.96[b]
Seskin *et al*.	Nitrogen dioxide regulations	Chicago	Proposed RACT	14.40[b]
McGartland	Particulates	Baltimore	SIP regulations	4.18
Spofford	Sulphur dioxide	Lower Delaware	Uniform percentage	1.78

		Valley	regulations	
	Particulates	Lower Delaware Valley	Uniform percentage regulations	22.0
Harrison	Airport noise	United States	Mandatory retrofit	1.72[c]
Maloney and Yandle	Hydrocarbons	All domestic DuPont plants	Uniform percentage reduction	4.15[d]
Palmer *et al*.	CFC emissions from non-aerosol applications	United States	Proposed standards	1.96

Notes:

CAC = command and control, the traditional regulatory approach.

SIP = state implementation plan.

RACT = reasonably available control technologies, a set of standards imposed on existing sources in non-attainment areas.

[a] Based on a 40 $\mu g/m^3$ at worst receptor.

[b] Based on a short-term, one-hour average of 250 $\mu g/m^3$.

[c] Because it is a benefit–cost study instead of a cost-effectiveness study the Harrison comparison of the command and control approach with the least-cost allocation involves different benefit levels. Specifically, the benefit levels associated with the least-cost allocation are only 82% of those associated with the command-and-control allocation. To produce cost estimates based on more comparable benefits, as a first approximation the least-cost allocation was divided by 0.82 and the resulting number was compared with the command-and-control cost.

[d] Based on 85% reduction of emissions from all sources.

Source: Tietenberg (1990), Table 1