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Reducing the healthcare costs of urban air pollution: The South African experience

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Abstract

Air pollutants often have adverse effects on human health. This paper investigates and ranks a set of policy and technological interventions intended to reduce such health costs in the high population density areas of South Africa. It initially uses a simple benefit–cost rule, later extended to capture sectoral employment impacts. Although the focus of state air quality legislation is on industrial pollutants, the most efficient interventions were found to be at household level. These included such low-cost interventions as training householders to place kindling above rather than below the coal in a fireplace and insulating roofs. The first non-household policies to emerge involved vehicle fuels and technologies. Most proposed industrial interventions failed a simple cost–benefit test. The paper's policy messages are that interventions should begin with households and that further industry controls are not yet justifiable in their present forms as these relate to the health care costs of such interventions.

Keywords: Air pollution; Economic efficiency; Marginal abatement cost; Cost-effectiveness; South Africa; Health care costs

1. Introduction

This paper emerged from a document presented to South Africa's Nedlac policy forum.[1] The occasion of the discussion was a proposed new air quality bill. Members of the forum were concerned about the broad economic implications of more stringent air quality control measures.

South Africa has an urbanising population, many of whom live in the high-density townships that surround the major centres. In these areas both industry and households are responsible for air emissions that may be locally severe. A number of initiatives are underway to reduce levels of harmful air pollutants. These include a new Air Quality bill before Parliament, a draft report on possibilities for environmental taxation and the review of existing emissions standards.

"Dirty fuels" are major contributors to urban air pollution in South Africa, and a local debate has developed about the relative merits of alternative approaches to the problem: regulating their use; phasing them out; cleaning their emissions; and intervening to reduce their impacts.

The theory of environmental externalities describes a single 'pollutant' whose effects can be abated (Baumol and Oates, 1988; Cropper and Oates, 1992). Each successive attempt to cut the emission is more expensive than the preceding one, and there are assumed to be diminishing returns to the benefits of abatement. Reality is however often more challenging than theory. In reality geography, demography and chemistry all play their parts. The damage done by a given atmospheric emission will typically be influenced by the smoke stack height, wind direction and wind velocity, amongst others. The implications from a policy perspective are profound: the "ideal" air quality targets, and the interventions needed to attain

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[1]Nedlac is a forum where government, business, labour and community organisations meet to discuss social and economic policy.

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them, are likely to be far more elusive goals in the real world than naive theory implies. In this study the problem was circumvented by identifying a set of pollution-abating activities and ranking these in order of the present value of the marginal net benefit (MNB) each offered. The study was bounded by focussing only on the associated health care costs of air pollution in urban areas.

Section 2 of the paper presents the economic background to the problem and discusses the South African Clean Air Initiatives. Section 3 describes the methodology of the study and Section 4 presents its results. The paper also points out some surprising findings of the study that may be of policy relevance elsewhere in the developing world.

2. Economic issues in pollution reduction and The South African clean air initiative

The environmental externalities approaches to pollution control describe an optimal level of abatement. This optimum is reached when the private cost of abating an incremental unit of the pollutant equals the incremental damage done by it (see Fig. 1). Marginal abatement cost is typically shown as an increasing function of the emissions level; the first unit is the cheapest to abate and costs per unit of abatement increase thereafter. Uncertainty about the optimal policy response is often presented as the consequence of strategic incentives that induce polluters to overstate the costs of abatement (Pearce and Turner, 1990, pp. 89–91; Perman et al., 1999, pp. 217–219).

The result is a simple and clear cut optimal level of abatement (or if preferred, optimal level of pollution). Fig. 1 presents an example of the standard diagrammatic presentation.

As abatement (which commences from the right of the diagram) proceeds, its MNB falls, reaching zero when total emissions have been driven down to level E^*. Marginal abatement benefits (MAB) reflect the external (and private) health costs avoided when emissions are reduced. When emissions have fallen to E^*, abating emissions by one unit adds as much to costs as it yields in private and social benefits (i.e. MAB = MAC). Abatement expenditures are therefore justifiable economically whenever the ambient level of pollution (or the emission from a point source) exceeds E^*. In reality policy makers are unlikely to target an optimal ambient pollutant level immediately, but to initiate iteratively those actions or technologies expected to reduce emissions towards the ideal. Their decision concerns the order in which these initiatives are to be adopted.

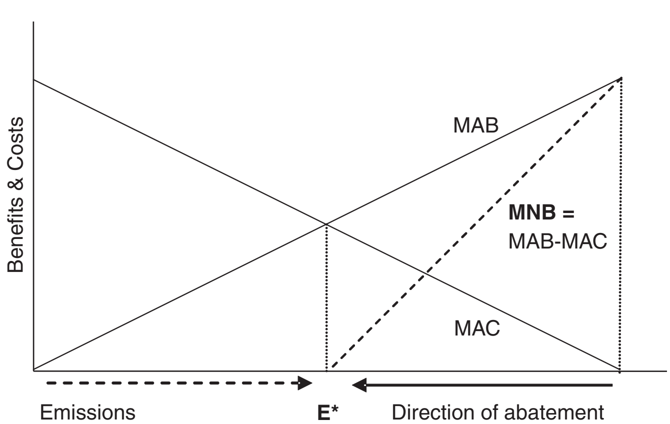

Fig. 1.

Both costs and benefits present measurement difficulties. Each emission reduction measure has its own costs, which in turn are likely to vary across firms, industries, households and locations.

On the benefits side, MAB are even more problematic. The impacts of pollutants range from damage suffered by engineering structures to increased health costs and lost labour productivity. Despite the existence of well-researched dose–response functions, the physical effects of pollution remain difficult to assess. Even more difficult is their reduction to financial terms, needed to calculate a pollutant's marginal damage function.

From a policy perspective, the notion of "optimal" emissions levels can have little relevance at a national level: such optima necessarily vary with location. Local factors like topography, population level and density, and prevailing wind direction, can influence both abatement costs and benefits. Consequently such optima are of little value when national or regional pollution standards are being determined.

Regulation, which sets uniform national standards for polluters, can impose unnecessarily high reduction costs. It is, however, often the most expedient measure; politically superior, quick to initiate and showing the authorities 'getting something done'. Visible official pollution controls can also offer benefits to polluters: these include efficiency related savings and access to markets where high environmental standards are required. On the other hand, measures that do not use legal coercion (such as self-regulation by industry, electrification of cities and encouraging insulation of houses) might achieve the same emissions reduction benefits while saving the administrative costs of regulation.

The new South African Clean Air legislation addresses some of these problems by using three levels of implementation. The weakest standards are national, and apply even in sparsely settled rural areas. The second level is set by provincial authorities who have the option to impose tighter regulations. Finally, at an individual city level, municipalities can opt for even more stringent standards.

While this makes the new act a more efficient system of regulation, it remains unclear that its implementation is the most cost-efficient way to address the air pollution problems faced by the public. The state has a variety of alternatives to coercive regulation: these include education, peer pressure, public disclosure programmes and economic instruments. The socio-economic impacts of a given level of abatement will naturally vary considerably with the tool (and timing) chosen.