5. Economic Growth: Is it Worth Having?[1]

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Foreword

This paper re-assesses economic growth in the light of questions that have been raised about its desirability in recent years. It pursues five main themes.

First, the paper recognises that economic growth is not to be pursued for its own sake. It is best conceived of not as an objective in its own right but as the likely *result* of policies directed to improving the welfare of the community without using resources wastefully. Secondly, and that observation notwithstanding, it suggests that those who question economic growth on the grounds that it means increasing pollution are attacking growth rather than pollution itself. Thirdly, and generalising that particular theme, the paper suggests that much of the debate on the relationships between growth and the environment originates in a confusion between economic growth and its conventional statistical indicator – the increase in gross domestic product at constant prices. Fourthly, the paper takes issue with the view put forward by some commentators that economic growth should be slowed or brought to a halt because, in their opinion, the world is running out of resources. Finally, the paper suggests that some of the objections which are said to be to 'growth' are, in fact, objections to the prevailing pattern of growth – that is, they are really arguments over priorities.

The paper, in concluding, puts forward the view that if what 'economic growth' is all about is carefully examined, it seems to constitute the key to achieving many of the things going to make up the national wellbeing.

Part 1: Growth under challenge

> No one can doubt that there are differences in social attitudes among countries – in the relative value placed on work and leisure, on money making, on duty and discipline – which cannot help but affect the rate

1 First published in June 1973 as Treasury Economic Paper 2. The editors of this volume have taken the liberty of re-publishing the paper with Castles identified as the main author as Ian Castles is known to have led the Australian Treasury team which prepared it. Except where otherwise indicated, all figures and tables in this chapter are Castles' own.

> of economic growth. Australians, though no more consistent in their demands on life than other people, have for long leaned towards the view which has recently found increasing favour also in other countries, that economic growth is not everything. (OECD Economic Surveys: Australia, December 1972: 28.)

I

All over the world, in developed and developing countries, alike, there was by the middle of the 1960s an intensive concern with rates of increase in the gross national product at constant prices. Differences in this measure, over time and between countries, were subject to the most minute examination.

No single statistic had ever claimed such attention. It became a standard against which almost all aspects of economic performance were judged. A low ranking on the international growth 'league ladder' was regarded as a sign of national failure, reflecting not only upon the performance of a country's economy but on the whole condition of its society. A high place, by contrast, connoted not merely enlightened economic management and a rapid rate of improvement in overall efficiency; it demonstrated a progress towards a higher destiny. It was the heyday of what came to be called 'growthmanship'.

In the 1970s a different view has increasingly been heard. Though economic growth remains an important object of concern of national governments in all countries, and in its broadest sense retains much of its 'grass roots' support among people generally, it is under increasingly strong attack by articulate and influential minorities. It is held to be responsible for many of the ills of modern industrial society – for the increasing pace and pressure of urban living and for the co-existence of 'private affluence and public squalor'; for the creation of 'imagined' wants rather than the satisfaction of 'real' needs; for the relentless exploitation of the earth's non-renewable resources; for poisoning of the air and waters; for despoliation of the environment and threats to the biosphere; for ugliness, materialism and acquisitiveness; for crime, violence and drug addiction; and for a variety of other problems and failings.

As discussion has proceeded those who see problems (and solutions) in over-simple terms have gained a good deal of attention. The persuasive effect of such opinions is magnified by the dire consequences that are foretold if they are not heeded. There is irony in the fact that a decade ago a very different viewpoint held sway.

Ten years ago there was a view that if a country failed to keep up with the international Jones' in the growth league tables, there was clearly something amiss. 'Projections showed' that by the end of the century – perhaps earlier – it would be an object of international derision, dependent on the favours of the

pace-maker countries which would increasingly dominate the world economy. To avoid such humiliation, it was necessary to push up savings, force-feed investment, subsidise exports and steer resources towards those industries in which statistically measured productivity growth was higher.

Now, however, measures to the contrary are urged by many. Their claim is that the rations on 'spaceship Earth' will soon be running low and that only urgent and drastic action can avert ecological catastrophe. Internationally, the most widely publicised of such predictions have been those contained in '*The Limits to Growth*', a study sponsored by the Club of Rome and conducted by a team at the Massachusetts Institute of Technology which was published in March 1972.[2] This concluded that there was an urgent need to bring about a deliberate, controlled end to growth; the Executive Committee of the Club of Rome commented that '...only the conviction that there is no other avenue to survival can liberate the moral, intellectual, and creative forces required to initiate this unprecedented human undertaking'.[3]

'*The Limits to Growth*' has aroused widespread controversy and many aspects of the study and, more importantly, its basic thesis have been subjected to exceedingly damaging criticism.[4] But that criticism has been little publicised. Certainly, it has received nothing like the attention that was aroused in the dramatic predictions and prescriptions of the original study, or by other writings claiming that an early end to growth is imperative if mankind is to survive.[5]

The purpose of this paper is to reassess the objective of economic growth in the light of these changes in attitudes. Eight years ago, an earlier Treasury paper discussed the meaning and measurement of economic growth and, in the process of doing so, sought to point out some of the cruder fallacies of the 'growthmanship' school with a view to clarifying debate.[6] Now that the intellectual pendulum has swung so far in the other direction, it may be no more than timely to examine whether indeed the swing may not have carried too far.

Accordingly, this paper is primarily concerned with the worth of growth. It discusses such questions as: Is continuing economic growth a curse rather than a blessing, as the more extreme of its latter-day critics would claim? Would some cutback in the growth in output per head be desirable? Is there a necessary conflict between increases in output and improvements in what is often termed

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2 DH Meadows and others, *The Limits to Growth*: *A Report for the Club of Rome's Project on the Predicament of Mankind*, (New York, 1972).

3 *Ibid*: 196.

4 See, for example, Report on *The Limits to Growth*: *A Study by a Special Task Force of the World Bank* (Washington, September 1972) and W Beckerman 'Economists, Scientists and Environmental Catastrophe' *Oxford Economic Papers*, November 1972: 327-344.

5 For example, 'A Blueprint for Survival', the *Ecologist*, London, January 1972, now available in paperback, has also attracted great attention.

6 *Supplement to the Treasury Information Bulletin: the Meaning and Measurement of Economic Growth*, (November 1964).

the 'quality of life'? Does *measured* economic growth (output at constant prices) provide a policy guide to increased efficiency in meeting the wants of the community? Given that the world's resources are finite, is not the real question one of the practicability of continued growth, rather than of its desirability? To the extent that the pursuit of growth conflicts with other national goals, what should guide decisions involving priorities between competing goals, and by whom should such decisions be made?

II

If the extreme differences in attitude commented on in the preceding pages resulted entirely from differing value judgements about the end purposes of society, the prospects of achieving consensus on community goals would appear slim. The very thing which to many represents 'progress' would be contested by many others as 'regress'.[7]

Fortunately there is a less depressing possibility. The differing attitudes to growth may arise in part – perhaps in large part – from differing beliefs or judgements on matters of *fact*, including the casual relationships which exist between economic growth and the results which it is desired either to avoid or achieve. If so, there is scope for discussion of the kind attempted here.

In short, there will always be differences of opinion on such basic questions as the emphasis to be assigned to economic growth; but it is worthwhile seeking to narrow the areas of disagreement to those that necessarily arise from fundamental differences of philosophical outlook about the proper pursuits of society.

III

The overall growth in economic activity is, of course, the compounded outcome of growth in population and the growth of economic activity *per capita*. This paper is concerned with economic growth as a *per capita* concept. Growth in total is a related concern to the degree that it may affect *per capita* output, directly or indirectly.[8]

Policies antagonistic to *per capita* economic growth are often linked with policies of population control. For an advanced economy such as Australia, the relationship of population growth to growth in output *per capita* is complex and

7 'Consensus' can never be more than approximate, and opinions will inevitably differ as to the desirability of particular objectives and courses of action. But the difficulties are moderated in most areas by the fact that disagreements are relative rather than absolute – e.g. should *more* or *fewer* resources be devoted to defence, education, environmental protection, etc?

8 Economic activities, whether industrial or social (e.g. engineering or education), may gain economies from the expansion of the domestic market and, thereby, tend to raise living standards.

by no means clear. For the 'third world', by contrast, the relevant relationship is all too simple; declining death rates are an almost certain consequence of growth, but corresponding declines in birth rates are far from certain and in any case tend to occur after a long time lag. Experience in the advanced economies does suggest that eventually the processes of industrialisation, organisation and education that are associated with growth tend to bring reproduction rates down to (or close to) replacement levels.[9] But even if this were certain to happen ultimately in the developing countries, their populations would continue to increase rapidly for many decades. Those governments in the 'third world' who strongly favour positive population policies also strongly favour *per capita* economic growth. Indeed the rationale of the first is to assist in the achievement of the second. It is only in some advanced economies that both population growth *and* economic growth *per capita* are under challenge.

In some advanced economies which (unlike Australia) have very high population densities, there is rising concern about rates of increase in population which are in reality quite slow. Other natural resources can be imported, and even water can be obtained (at an extra cost) from the sea. But *space* is a resource which many see as ultimately imposing limits on more intensive use. 'Crowding' comes not only from increased numbers but also from increased mobility and the use of space that goes with that. In these countries, policies of zero population growth are attracting increasing attention, and are sometimes supplemented by proposals to restrict 'economic growth' *per capita* because of the space-consuming pattern of growth.[10]

But what has changed the flavour of debate of these matters is the series of predictions of global disaster, of which last year's report for the Club of Rome has merely been the most conspicuous example. These predictions see continuing economic growth (whether from population growth or growth in output *per capita*) coming up against constraints such as an inexorable increase in pollution or rapid depletion of non-renewable resources.

Such views implicitly involve assumptions about the capacity of communities to change the pattern of economic growth and about the predictability of resource availability and technology.[11] It is to the substance of these assumptions that this paper addresses itself.

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9 For example, reproduction rates are at present roughly equivalent to replacement levels in the United States, Britain and a number of countries in Western Europe. If the current rates were to be sustained over a prolonged period, natural increase in these countries would ultimately decline to zero.

10 The relationship between economic growth and the consumption of space is a flexible one. However, the assumption that it cannot be flexible sometimes appears to underlie discussion and is analogous to an assumption about the relationship between economic growth and pollution which is considered in Part 2. Various interest groups have very different views about the way in which space should be utilised, and these differences in desired purposes have a large bearing on the relative 'supply' of space.

11 Predictability of resource availability and technology must underlie questions about the possibility of determining an 'optimum' population.

The first subject considered is the relationship between economic growth and environmental problems. It is often supposed that there is an inexorable connection between growth in economic activity and in environmental pollution. On this view, further economic growth will necessarily lead to more and more pollution and, eventually, to environmental catastrophe. Even some of those who take a less apocalyptic view have real doubts whether further rises in *per capita* output of goods and services will improve the community's wellbeing. Is there any point, they ask, in winning more goods and services when the process which makes this possible destroys the pleasant conditions of life which are essential for their enjoyment?

It will be suggested in Part 2 that the premise that increases in output of goods and services must *necessarily* be accompanied by corresponding increases in pollution is mistaken. Relationships between output and pollution can readily be changed if society has the will to do so. Such changes can make a far greater contribution to reducing pollution than measures designed to halt or slow down the rate of economic growth.

Part 3 explores the relationships between economic growth and national 'wellbeing'. It points out that the most commonly used indicator of economic growth – the rate of increase in the gross domestic product (GDP) at constant prices[12] – is not a comprehensive measure of changes in the welfare or wellbeing of the community. Hence, some of the alleged conflicts between economic growth and other goals only arise if the substance of growth is identified with its conventional statistical shadow. The fact that such an identification has frequently been made has confused discussion.

Part 3 suggests that economic and social policies should not be directed towards achieving any particular statistical rate of growth in the longer-run, but rather to the efficient use of available resources to establish and maintain those patterns of production and distribution which conform most closely to the preferences of the community. This is a simple statement which begs some important questions; and, however carefully the objective is defined, it could never be achieved except in the most approximate and by and large fashion. But the important point in the present context is that to set up a longer-term target rate of growth in GDP – whether that rate be a high one or, as some are now advocating, a 'zero' rate – is to miss the point. The criteria for decision-making must be related not to the achievement of a pre-ordained statistical result but to the desires of the community, as expressed by people in their capacities as consumers, workers and electors.

12 The more familiar term, which has been used until recently in the Australian National Accounts, is the gross national product (GNP) at constant prices. The change in terminology is part of a restructuring by the Commonwealth Statistician to place the Australian national accounting system on a broadly similar basis to the United Nations System of National Accounts (SNA).

The third and last of the particular problems to be discussed is that of the depletion of non-renewable (i.e. mineral) resources. The report for the Club of Rome, to which reference has already been made, has intensified concern about this topic. Predictions that the availability of mineral resources to sustain growth is limited to a few decades are being made with increasing frequency. If there were strong grounds for believing such predictions, many would doubtless agree that the present generation should put a stop to growth and delay a global crisis as long as possible. Again, the main dispute is not on the value judgement about what should be done if resources are running out, but on the question of fact. Is there a danger that non-renewable resources will be seriously depleted in the foreseeable future?

It will be suggested in Part 4 that there is no way of defining practicable physical limits to non-renewable resources. Availability of resources in the long-term future depends rather on the overall *demands* on resources and the technical responses induced by those demands. Such responses are an integral part of the growth process. In a real sense, technical progress 'creates' resources, so that the faster and further growth continues, the greater the availability of resources (at a given real cost) will be. If this overall view were accepted, it would obviously be wrong to advocate checking economic growth in order to conserve resources for future generations.

The concluding Part reflects on certain fundamental issues, such as the social forces underpinning economic growth, which are suggested by the more technical discussions earlier in the paper. Its purpose is to shed light on certain basic national questions, not to attempt definitive answers to those questions.

IV

Before turning to the specific growth-related issues to be discussed in the succeeding Parts of this paper, it may be useful to make some preliminary observations about the place of economic growth in relation to the objectives of society generally.

Economic growth is a stated objective of national policy in most countries. But, there are dangers of misinterpretation in the description of growth as an 'objective' or a 'goal'.

> ...we might go so far as to suggest that economic growth *per se* should be jettisoned as an independent goal of policy. For if we are concerned primarily with social welfare, those forms of economic growth that meet our welfare criteria will in any case be approved and adopted, the remainder being rejected: thus, sources of worthwhile economic growth will continue to be sought after.[13]

13 EJ Misham, *The Costs of Economic Growth*, (London 1969) paperback edition: 65.

Whether economic growth should properly be described as a goal appears to be basically a question of presentation rather than of substance. To describe growth in this way can often be a convenient abstraction, an aid to exposition. Nevertheless, what ought to be an intellectual tool can sometimes become identified with reality in the course of debate. In the process, there is a risk that the *interdependence* of economic, social and technological goals will be disregarded.

Obviously the pursuit of growth for its own sake misses the point: the aim must be to improve the welfare of the community. Policies directed to this latter end are likely in fact to lead to increases in the real output of the economic system per head of population and can thus fairly be described – without abuse of language – as policies for economic growth. But there are obvious possibilities for confusion and misunderstanding here, particularly when economic growth is identified with growth in statistical measures of output such as the gross domestic product at constant prices. More will be said about this in Part 3.

V

This leads to another important distinction which should be made at this stage, though its full significance will only become apparent later. This is that the boundaries of the 'economic problem' – the problem of allocating scarce means to plentiful but competing ends – coincide neither with the market economy nor with that part of the output of the economic system which GDP seeks to measure. Economic decisions cover a wider area than either.

The truth of this has been obscured for various reasons. Not least of these has been the tendency for the phrase 'quality of life' to be used very loosely.[14] In current usage the phrase appears to cover a miscellany of desirable things not recognised, or not adequately recognised, in the marketplace. It compounds at least two sorts of things. First, there are such things as personal and family relationships, civil liberties, compassion, justice, freedom, fair play – all the qualities of a civilised society which cannot readily be valued or measured. Secondly, there are such things as the enjoyment of wilderness, wildlife, clean air and water, recreation, health and education – desirable 'goods' which are the resources of the community. Often the term 'quality of life' gives to the second category of things an aura that more properly belongs to the first.

The discussion which follows will emphasise the importance of evaluating environmental and other social 'goods' so that they can be properly related to other goods and services which make demands upon resources. To attempt to

14 The same thing had, of course, happened to the term 'economic growth'. Professor James Tobin wrote in 1964: 'Growth has become a good word. And the better a word becomes, the more it is invoked to bless a variety of causes and the more it loses specific meaning'. 'Economic Growth as an Objective of Government Policy', *American Economic Review, Papers and Proceedings (1964): 1.*

quantify the worth of social goods in this way is not to 'commercialise' them or to scrutinise them by the standards of a 'production ethic'. It is simply to acknowledge that there are competing ends for resources, and that some way has to be found of sorting out how worthwhile any one aim is in terms of its competitors.

VI

Assessment of the feasibility and desirability of public projects or programs, or government decisions following such assessments should, in principle, take into account the whole spectrum of effects on the community. Individuals do not, of course, only look to income return on their work efforts but to such things as personal security, work satisfaction, good health, pleasant surroundings recreational opportunities, and so on. In a similar way governments will attempt to take social valuations into account in the appraisal of projects. The effects of some of these things are difficult to quantify or incorporate formally in analyses, though there is no dispute about the desirability of doing so to the greatest extent possible. 'Environmental impact' statements have an important potential role to play in this respect.[15] Much of the effort being made in many countries to develop and refine techniques to aid the decision-making process in the public sector (cost-benefit analysis, cost effectiveness evaluations, etc.) is directed to devising means of bringing into account *all* of the costs and benefits of decisions – whether economic or non-economic, tangible or intangible, social, strategic, aesthetic or environmental.

> ...there will be some cases in which non-economic considerations are indisputably relevant, in which case, however, the weight to be attached to them is a matter for the decision-maker. To take a highly simplified example, it would obviously be difficult in a benefit-cost study to weight the marring of a scenic reserve, an increase in national product by a given amount, and a reduction of two road deaths per year, all of which are expected to result from the construction of a highway. The function of benefit-cost studies in such circumstances is to illuminate the choices underlying the decisions to be taken, by highlighting the cost of one objective in terms of others or possibly, in some cases, pointing towards the desirability of redesigning the projects.[16]

The key point is that all decisions *imply* a valuation of those effects which are difficult to quantify. If such effects have been ignored entirely, their implied

15 The Australian Government has decided that such statements will be mandatory from 1 January 1974 in respect of proposals having significant environmental consequences and where Commonwealth funds are involved and/or where Commonwealth constitutional power is involved.

16 *Supplement to the Treasury Information Bulletin: Investment Analysis*, (July 1966): 16.

value is nil (which would almost certainly be wrong). If a decision is made to proceed with a project which would not otherwise be regarded as viable because, for example, there are strategic benefits, a value has been placed – explicitly or implicitly – on those benefits. Conversely, if a decision is made *not* to proceed with a project because of its undesirable environmental effects, a judgement has been made – explicitly or implicitly – *about* the value to be gained from avoiding those effects. The greater the effort to quantify and to make such judgements explicit, the more rational and consistent will the decision-making process become.[17] The same broad approach is required when the object of investigation is a private sector activity which is imposing costs upon others, through pollution for example.

In short, the level, pattern and rate of growth of national economic activity reflect the outcome of decisions, by individuals and by governments which take into account a great variety of goals. Of course, depending on the prevailing national ethos, some objectives will be pursued more actively and visibly than others. As the ethos changes so will the various valuations – the weight which is effectively given to each of the objectives. In particular, as levels of income rise beyond that needed to satisfy basic needs such as food, clothing and shelter, attention turns increasingly towards less immediately material components of human wants.

An obvious example of this phenomenon is the current concern with the effect of pollution in its various forms on human life and on the environment. It is to this subject that we now turn.

Part 2: Growth and the environment

> …and most importantly, the elimination of 'bads' contributes to economic growth just as does the production of goods, and both activities require the utilization of human and material resources. The choice is not between economic growth and a pleasant environment, but between the various ends to which economic growth – which, fundamentally, means greater capacity to do what we would wish to do – can be directed.[18]

17 The criticism is sometimes made – and not without justification – that there is a tendency in analytical evaluation to give too much weight to those effects that are more easily quantified. On the other hand inability or failure to quantify some effects at the analytical stage can often mean that those effects are *over*-weighted in the decision-making process. These are not so much criticisms of the techniques themselves, but rather of how they may be applied in practice.

18 RM Parish: 'Economic Aspects of Pollution Control', 1971 Autumn Forum, Economic Society of Australia and New Zealand, Reprinted in *The Australian Economy*, HW Arndt and AH Boxer, (eds), (Melbourne 1972): 535.

I

Pollution and environmental damage are seen by many as a relentless consequence of economic growth. Though material progress has brought improvements in standards of hygiene and the removal of pollution in its grosser and more obvious forms, it has also been associated with subtler and more insidious types of environmental damage. In the most advanced economies, the engines of industrialism fog the air with irritant gases, and make lakes moribund with decaying wastes; ears are assaulted by lawnmowers, cars, motor cycles, aeroplanes and construction equipment; and farmers may disperse poisons which cumulate potently in the bodies of animals, including Man. It is scarcely a matter for surprise that there is increasing support for action to proscribe activities that degrade the environment and – at the extreme – for action to put a stop to the process of growth that some see as the root cause of the damage.

Yet most people still want to be better off, even in relatively wealthy countries such as Australia. They have many pressing wants, of which the desire for a cleaner and quieter environment is only one, and one the relative importance of which differs greatly from one person to another. It would be a grim choice if hopes for improvement in all other directions had to be sacrificed to this one end – especially as a complete halt to growth would not itself be a remedy for pollution, but at best a palliative that might prevent the problem getting any worse.[19] But is the demand for a better environment necessarily in conflict with continuing economic growth? Or can further growth play a part in satisfying the totality of the material desires of society, including the desire for a healthier and more pleasing environment in which people can live, work and play?

II

It was mentioned in the first Part that the goals of an advancing community are not solely pecuniary. This is shown in such historical trends as the taking out of some part of the benefits of rising productivity in increased leisure. Why then, it may be asked, has there been so little apparent interest – at least until very recently – in taking out more of the benefits of economic growth in environmental improvement or, at the least, in minimising the environmental damage attributable to economic activity?

This is a difficult question to answer fully but some contributory factors can be identified readily enough.

First, there has been a lack of knowledge and appreciation of the complexity and seriousness of environmental problems. Few have recognised the intricacies

19 Some problems would in fact continue to grow even if output remained constant, because of the long-delayed cumulative effects of many pollutants.

of ecological balance: for example, that bacteria which decompose sewage disposed into rivers may make such demands on available oxygen as to kill off their aquatic life. With greater knowledge of such problems has come a widespread belief that they cannot be ignored.

Secondly, it is only the increasing scale and concentration of economic activity that make some types of pollution a matter for concern. The assimilative capacity of the environment is not taxed by sparse development over large areas, but by intensive and concentrated development. That is why the most acute problems have arisen in and around the huge 'megalopolises' of Europe, North America and Japan; and why Australia's pollution problems have first shown up around our largest cities.

Thirdly, the quality of the environment naturally acquires a higher priority as a society becomes more affluent. It still has a low place in most developing countries, where resources for pollution abatement could only be found at the expense of people's most basic needs for food, clothing and shelter. Moreover, in those countries the grosser and more direct forms of pollution which material progress has removed in the more affluent countries, persist in some degree and it is to material progress that such countries have to look for improvement.

Finally, there is a key point which largely follows from the three already mentioned. The lack of knowledge of many environmental problems in the past, the relatively limited adverse impact of pollutant emissions when they were within the environment's assimilative capacity and the pre-occupation of governments with more pressing economic and social problems, have meant that most governments have not created the conditions in which community preferences for a clean environment could be properly taken into account when consumers and producers were making decisions affecting the composition of output and the techniques of production. Polluters 'use up' the community's resources of pure air, clean water, etc., but in general they have not had to pay for these resources. Unless polluters are induced to take into account the harm they do to society by being obliged to bear the *full* costs of their actions and not just the 'private' costs, insufficient resources will continue to be devoted to avoiding or remedying pollution.[20]

This is a matter of central significance to the argument of this Part of the paper and, indeed, to the subject of this paper as a whole. Efficient economic growth requires that available resources, which include air, water and the natural environment generally, be put to their 'best' use, which means - to anticipate discussion - the use which enables people to have most of what they want.

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20 This is not of course, a proposition that economists have suddenly discovered in an effort to rationalise pursuit of economic growth. The approach briefly outlined here (including its application to pollution problems) was outlined by AC Pigou in *The Economics of Welfare,* first published in 1920. A basic thesis of that book was that the private and social costs of any productive process may differ and that, where this is so, they should be brought into equality by Government action (e.g. taxation).

Since resources are not unlimited, their use must be regulated either by the resource-user paying a price or by direct regulation. The services of labour, for example, are not available to employers except at costs which reflect both market conditions and the regulatory activities of governments and their authorities. Similarly, the services of land and other productive facilities must be bought from those in whom the property rights are vested by law. But no charge is customarily made for the use of environmental resources - of the air and of rivers, lakes and oceans. Wastes can be ejected into the environment at no cost to the waste-maker. It is hardly to be wondered at that the result has been escessive levels of pollution. *Any resource will be grossly over-used if its use is unrestricted and no charge is made for it*.[21]

This is the crux of the matter. Pollution problems are mainly attributable not to economic growth *per se*, but to the economic conditions under which growth has been allowed to take place. It follows that the proper *remedy for pollution problems is not to halt growth or slow it down, but to change the conditions under which producers and consumers are allowed free and unrestricted use of the 'shared resources' of the environment*. It will be shown that this is by no means a simple matter, either in principle or in application. But first it is necessary to consider the alternative prescription for environment problems - to curb future rises in output, or at the least to prevent rises in output having anything like the composition that has prevailed in the past.

III

Probably the most extreme opponents of growth are those who accept the tentative suggestions by some scientists that certain almost inescapable by–products of economic activity – notably heat and carbon dioxide – have pollutive effects that could wreak death and destruction on a global scale. There is, for example, the possible 'greenhouse' effect of increased carbon dioxide in the atmosphere: the sun's rays penetrate such a polluted atmosphere, but heat radiation from the earth is less able to. The theory is that as the volume of fossil fuels consumed goes up and deforestation spreads, by the early decades of next century there might be such a rise in world temperature as to melt the polar ice caps and inundate the world's great coastal cities. In the past thirty years the world's temperature has been falling but this appears to be due to other atmospheric pollutants – dust, soot and gas: and it is argued that in certain circumstances this thickening of the atmosphere could reinforce the 'greenhouse' effect.

21 Unless the resources concerned are available in virtually unlimited quantities. This is not true of environmental resources, though it could be said to have been approximately true when the total use of such resources did not tax assimilative capacities.

These theories and predictions cannot be evaluated here; they are a subject of uncertainty and dissension amongst scientists.[22] Probably the main point to be made is that the prospective scale of man's economic activities is so great that the atmosphere might some day be polluted sufficiently to produce major climatic changes. But until the relationship between pollution and climates can be further clarified, there can scarcely be said to be a case for checking economic growth on these uncertain grounds. Moreover, were the 'greenhouse' or some other effect found to be established, the change in temperature would presumably be slow enough to enable a major switch in resources – for example, from the combustion of fossil fuels to the use of nuclear or solar energy – without undue disruption to the path of growth. It is possible or even likely, in fact, that changes of the kind required will be made in any case, for other reasons than the need to avoid the possibility of global climatic disruption.[23]

Scientific speculations of this kind about possible distant catastrophes do however appear to reinforce viewpoints already hostile to continued growth on other grounds relating to its alleged pollutive effects. A number of arguments are advanced for such views.

First, it is said that higher levels of economic activity might transform an otherwise controllable problem into one that is quite unmanageable. If increased economic activity increases the concentration of pollutants within a given space, higher pollution control standards may be required and at more than proportional cost. There is an implicit assumption that technical advances will not counter any such trend. Secondly, there is the idea that the inter-relations of events (particularly organic events) is such that the 'solution' of one problem only leads on to the generation of another. For example, mercurial compounds were developed to protect seed from fungi, and were thought to be disposable into rivers and lakes without harm but mud bacteria unexpectedly converted the supposedly inert compounds to lethal and persistent methyl mercury, which increases in concentration as it passes up the food chain to man. Such examples can lead to a distrust of technical progress and the growth in output which such progress makes possible. Thirdly, there is the belief that nothing effective

22 The United Kingdom Royal Commission on Environmental Pollution, in its *First Report* (HMSO, February 1971) considered that, on plausible assumptions, the 'greenhouse effect' might cause a warming of the atmosphere at the earth's surface by about 0.1 to 0.2 degrees centigrade in thirty years time. The Commission added 'such a rise in temperature is unlikely to be significant. These figures are tentative, and cannot become more precise until more advanced mathematical models of the problem have been developed' (37).

23 There is a further side-effect of energy use which arises from the fact that all energy generated must ultimately be dissipated as heat. If the source is something other than solar energy – potentially an important qualification in the very long-run – that heat will warm the atmosphere, directly or indirectly. But the *global* effect is very slight indeed, and the *First Report of the (UK) Royal Commission on Environmental Pollution* stated that 'it seems clear that it will be a very long time before direct thermal pollution of the environment reaches the point at which it could have a detectable effect on world climate' *(op cit*.: 41). Local climatic effects would be more significant, a factor that might eventually need to be taken into account in decisions affecting industrial location.

will be done about pollution – that industrialists will resist the imposition by governments of effective standards, and that the man in the street is not prepared to pay up either as consumer or taxpayer. Fourthly, there is an attitude that seems to be merely a semantic confusion, but is influential nevertheless; it identifies 'economic growth' with the growth of the composite measure known as Gross Domestic Product (GDP). Because environmental quality does not enter into the calculation of that composite – as to the significance of which, see the next Part – it is supposed that there is an inevitable conflict between the two.

These views on the environment are often associated with a more fundamental attitude: that which puts a low value on the products of an industrial society as such. Industrial society is seen not only as satisfying man's wants but also as shaping them. Defenders of industrialisation have seen economic advancement as the means whereby men may escape from the thrall of a life 'nasty, brutish and short', and as holding out the possibility of a high civilisation participated in by all. But the more critical view referred to sees the process of advancement as forever frustrating such an achievement by becoming an end in itself and leading onto the compulsive acquisition of 'things' –fanciful substitutes and elaborate junk that are usually trivial and often ludicrous. Whatever the validity of this view more will be said about it later – it would explain why some critics are undismayed by the costs of slowing or halting economic growth as methods of checking pollution or preserving natural features.

This radical revaluation of industrial society aside, it is important to see that there is no logical inevitability about the connection between continued economic growth and the effects that the opponents of further growth are seeking to avoid. Implicit in the other views noted are all kinds of challengeable judgements. Does pollution abatement require that cars need to be equipped with several hundred dollars worth of extra equipment or abolished altogether? Are the risks of *possible* unanticipated consequences arising from particular technical advances significant enough to justify forgoing the *certain* benefits? Would the large-scale re-organisation of society required to curb growth encounter less resistance than specific measures to counter pollution?

These are large questions, and there are (and will continue to be) differing opinions about the answers. For the present purpose it is sufficient to note that it is possible to take up a position – which is the position of this paper – that fully acknowledges the technical relations between events (for example, inorganic fertilisers boosting productivity on farms, but running off into rivers and atrophying them), but which sees pollution abatement as involving a modest – even small – redistribution of resources, and relatively minor changes in the prevailing pattern of production. It is to the means of achieving these required changes that we now turn.

IV

Contemporary environmental deterioration takes a bewildering variety of forms, but noise may be taken – for various reasons – as symbolic of the problem as a whole. It has required high technological advance in order to produce it on the current scale; its effects on hearing, nervous tension and physical vigour, especially over a long period, have only recently come to be appreciated; it is pervasive and difficult to escape; and its creators, whether they be operators of jet airliners or jackhammers, will not take on the extra cost of suppressing their screechings and bangings as long as there is no charge for perpetrating them.

Let us assume, for the sake of illustration, that the noise of compressors used in construction can be reduced to about one per cent of its present intensity by the use of equipment that costs about ten to 15 per cent more.[24] It will be assumed that there are not laws governing permissible levels of noise from construction equipment. Then a normally profit conscious operator, confronted with the choice between two compressors of equal specifications except that one is noisier but cheaper than the other, will obviously buy the equipment that costs him less. He will not take into his reckoning the cost which the noisier compressor imposes, on others, but only the costs which he must bear. He will justify his decision by pointing to the lower cost (of the work involved) which his decision has made possible and, of course, his need to match the tender prices of his competitors who are making their decisions on the same basis.

This is the key point for those who do not see growth of output, of itself, as the cause of pollution problems. Individual decision-makers, be they producers or consumers, do not necessarily have to pay a price for what they buy which reflects the full costs (the costs to society) of the action they have taken. The market prices are 'wrong'. Moreover the deficiency, being inherent in the unregulated working of the market system itself, *occurs independently of the rate at which the economy which that system regulates is growing*.[25]

Thus the cure to the conflict which some see between growth and pollution control lies not in restricting growth but in eliminating divergences between the private costs and full (i.e. social) costs arising from particular decisions. This may not be easy – indeed it may not be possible in any precise way – but it is clearly the right approach.

If laws (with appropriate penalties) are introduced regulating levels of noise from construction equipment, the operator of a compressor would have to take

24 This is stated to be the case in the *Second Annual Report* of the (US) *Council on Environmental Quality* (Washington 1971): 102.

25 That is, a stationary or 'no growth' economy will generate excessive pollution just as a growing economy will, unless action has been taken to eliminate divergences between private and social costs. The proportion of resources devoted to pollution control will be too small in both cases.

account of those laws in the choice of his equipment.[26] The 'right' level of noise pollution to be permitted would of course be a matter of `judgement', to be based on study of the social costs involved at various levels. Depending upon the level chosen and the additional cost of providing equipment to conform to that specification, there would, of course, be a rise in building costs and probably a slowing effect on economic growth as conventionally conceived. The rate of improvement in welfare, however, would not be slowed – the increased cost of building would be offset by the decreased 'cost' of noise. Note, however, that had the attack been on economic growth as such rather than its pollution effects, the noise would have been done away with only by not constructing the building at all – a classic example of throwing out the baby with the bathwater.

V

To some the notion that there is a 'right' level of pollution other than zero may seem repugnant. Should not the aim be the *elimination* of pollution, rather than its controlled reduction?

Superficially, such an objective may appear attractive. In fact, it involves the implicit assumption that the most productive use of resources for any purpose other than pollution reduction could never yield as great a return as the least productive use of resources in reducing pollution. Such an assumption needs only to be spelled out for its unacceptability to be clearly evident. The problem of applying available resources to best meet society's needs cannot be avoided by setting up absolutes to which unlimited resources must be directed irrespective of the return on those resources.

To return to the compressor illustration, it might be technically possible to develop a machine that reduced the noise level further – from one per cent of the present level to one-hundredth of one per cent. But the additional cost of compressors, and therefore of construction activities, would be substantial, while the additional benefits of being closer to total silence would be negligible. The community would be better off if resources were applied to some other purpose than the replacement of very quiet compressors by silent ones.

The point still applies even to those forms of pollution which more obviously affect human health. In such cases governments have been more active over a long period, and have understandably insisted that no one has the right to take actions which impose *undue* risks on the health (sometimes the lives) of others. Yet the very presence of the word 'undue' exposes the fact that the problem is still implicitly a cost/benefit one – the balancing of risks against the costs of reducing or eliminating them. There is always a gap between what is desirable

26 Regulation is not the only form of pollution control, nor is it necessarily preferable to measures which utilise the market. See pages 126-128.

and what is possible, and it arises because, at any point in time, resources are not unlimited. There must be some limitation since damage to life and health from other causes can also be reduced (at cost), and there is also the alternative of using the resources to provide a more satisfying existence in other ways. It may not, of course, be human life itself that is at stake but the refreshment of the human spirit that comes from close contact with nature. However, the preservation of a piece of woodland of moving natural beauty, 'priceless' though it appears, must contend for its claim on resources with alternative uses: on hospitals, schools or even less honorific avenues. Skies unsmudged by smoke and waters sparklingly pure are desiderata but their achievement may frustrate other aims.[27]

If degradation of the environment is to be prevented some of society's resources must be diverted from other tasks. Whether these resources are applied in ways known under existing technology or to solve hitherto unsolved problems, they could have been used for some other purpose. In the language of economics, their use to improve the environment incurs a cost to society which is equal to the good which those same resources could have achieved in their most beneficial alternative employment; but there is also, of course, a *benefit* to society represented by the greater enjoyment which people will derive from an environment of higher quality. The principles of resource allocation are no less applicable to environmental improvement than to any other aspect of the economic problem. Those principles decree that society will be best served if resources are applied to pollution abatement to, but not beyond, the point where the costs of doing so are covered by the benefits derived.

That is a technical and very general proposition, and it is scarcely necessary to add that, like most sound advice, it is more easily stated than applied. In fact, the application is so much more difficult than the theory that some might doubt whether the theory has any practical value at all.

It may therefore be worth recalling what was said in the previous Part I about the proper basis of decision-making: all decisions imply a valuation of those effects which are difficult to quantify, so that there is point in exposing implicit valuations and distinguishing objective factors from value judgements. It is true that many of the benefits to be derived from devoting more resources to environmental improvement defy valuation at all, let alone any precise measurement. How can a value be placed upon clean air and streams, upon unspoiled countryside and the preservation of natural systems? The problems

27 'To listen to some scientists on the question of water pollution, for example, one gets the firm impression that they regard the proper object of policy as being to eliminate pollution entirely, and the costs side of the story enters into it only in so far as it means that they have difficulty in achieving this objective. But even if the funds were to be made available, I, for one, have no wish to spend thousands of millions of pounds on what would be, in effect, the conversion of all our rivers into beautiful open-air swimming pools for fish. I live in a town where there are not even adequate swimming pool facilities for humans' Beckerman, *op cit*: 331.

are compounded by other facts: that individual valuations will differ greatly,[28] that the effects of many actions only come to light after a long time lag, and that many decisions once made are irrevocable – what is lost is lost for all time.

Yet, for all that, the difficulties are not obviously more daunting than those which face governments in other areas. What values are to be placed on improving preschool education, seeking a cure for cancer, developing the national opera? Decisions must be made, however arguable their basis may be; and, having been made, there is much to be gained from ensuring that resources are not used wastefully for the achievement of these purposes. In the use of resources there can be no absolutes: e*very purpose, no matter how over-riding it may appear to be, is ultimately in competition with every othe*r.

VI

The question of how the use of resources to protect and improve the environment is to be reconciled with the competing demands on resources to satisfy people's other desires – for food, clothing, entertainment, defence, health services and so on – raises complex technical issues. The general nature of these issues will be indicated briefly in this section, but it is worth mentioning at the outset that the discussion is concerned essentially with matters of *technique*. Those who are content to accept that there are devices to facilitate decision-making processes in this area may prefer to move straight on to the next section.

So far as public sector projects are concerned, the key point is that the framework of evaluation of such projects or programs must incorporate environmental factors, whether or not it is possible to quantify these factors and charge or credit them to the project. Reference has already been made to the role of 'environmental impact' statements in this respect. There are many non-environmental considerations entering into the assessment of public expenditure proposals which involve large subjective judgements – judgements about relative prices in the long-term future, about the directions of technological change, or about the value to be placed on leisure time or on reducing accidents.[29] That there are formidable problems in measuring or quantifying environmental factors is not a reason for abandoning or ignoring the techniques which have been developed to evaluate public sector decisions.[30]

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28 There are clean air, clear streams and unspoiled natural environment to be found in Australia – most people, however, prefer to live in urban areas. That is, they value the higher incomes and social amenities to be found in those areas above the life of 'the noble savage'.

29 This arises in the evaluation of road projects, for example.

30 '…the difficulties of obtaining precise scientific measures of the relationship between the costs and the benefits must not provide a pretext for failure to analyse individual pollution problems as carefully and quantitatively as possible. The fact that no simple or mechanical cost-benefit exercise will provide all the answers does not mean that such analysis is not an important ingredient in the decision-making process. It is often the only way to ensure that all the main relevant variables are brought to light and to demonstrate the consequences, both direct and indirect, of alternative measures to deal with pollution. Moreover, the

In the private sector of the economy the objective should also be to ensure that decision-makers take into account all of the costs (i.e. the costs to society) of their decisions.

In general, this already happens with respect to most non-environmental aspects of proposed actions: prices charged for using resources reflect (or should reflect) the costs of using them. A 'go ahead' decision by a producer implies that his assessment of the benefits (or revenue) from the use of these resources exceeds costs. As previously noted, the cause of excessive pollution has been that the price charged for using environmental resources (water, landscape, air) has been too low – in many cases zero. What is needed, therefore, is to equate the price charged for use of environmental resources with the cost of damage inflicted on society by using them.

This approach via the price structure may be applied in any of a number of ways, with implications for the ultimate bearer of such costs. The price charged might be levied directly – for example, as taxes on the process which generates pollution or as the purchase price of licences which entitle the holder to generate specific quantities of pollutants. Such charges make it more expensive to produce (and therefore, indirectly, to consume) a polluting good than before. If a producer or consumer can avoid the extra expense, he will tend to do so: there is, therefore, an incentive to refrain from using the polluting good or to change consumption patterns or production processes in ways which mitigate pollution.[31]

In contrast to measures of this kind in which the 'polluter pays' principle applies, are measures in the form of direct payments from the 'public purse', most notably in the form of subsidies to polluters not to pollute. Such subsidies have the pattern of final demand unchanged – that is, the same as it would have been in the absence of pollution abatement measures. The act of pollution entails a cost to the producer only as much as the subsidy must be foregone.

The difficulty with market procedures lies in deciding the 'right' price to charge for those uses of environmental resources that generate pollution, or the 'right' subsidy to pay for not polluting. For most other resources prices can be ascertained or inferred from market behaviour. But as the 'market' for a clean

difficulties, formidable as they are, should not prevent us from reaching decisions about the scale of abatement of pollution which is socially desirable.' *First Report of (UK) Royal Commission on Environmental Pollution, op cit*: 7-8.

31 In the nature of things some techniques to avoid pollution will be readily at hand, others will have to be searched out. If the decision-maker concludes that it would be more expensive to employ known or new procedures to avoid pollution than to bear the pollution expenses himself, then, provided the charge equals society's valuation of damage suffered (a big proviso), the cost-benefit calculation has come down against pollution abatement with respect to this activity. Other uses of available resources would yield greater benefit to the community than this act of pollution abatement.

environment is yet to be established, this approach is not available. Inevitably indirect means of assessment must be used (such as seeking to identify the extra price that people appear to be prepared to pay to live in a clean environment). It is this difficulty of obtaining or interpreting necessary information that often prompts the exploration of an alternative group of direct measures – namely, non-market techniques.[32]

Non-market techniques of pollution control may also be differentiated according to whether the polluter or the public purse pays. Under the 'polluter pays' principle, non-market measures encompass the promulgation of regulations governing the permissible emission of pollution (such as the maximum noise regulations referred to earlier).

Regulations to curb pollution tend to lead to rigidities and inefficiencies. For example, depending upon how such regulations are framed, they may stifle research into cheaper forms of total pollution control and mitigate against efforts to do better than the regulations stipulate. But the regulatory approach also has some advantages over market approaches to pollution control. Provided that achieving the improved environmental quality is not more costly than the benefits from doing so, and that the regulations can be closely attuned to the community's own assessment of tolerable pollution levels, regulations eliminate some of the uncertainty which is inherent in market approaches.

Non-market intervention may also be undertaken directly by government; such intervention often involves cleaning up pollution which has been generated, rather than changing the form of production and consumption in the first place.[33] Under this approach society may sacrifice more than is necessary for the sake of a given improvement in wellbeing due to pollution control.

Whether the best approach to pollution control is via market measures, non market measures or some combination of the two is thus essentially a question

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32 There are market and non-market approaches to indirect measures also. The difference between direct and indirect lies not with the instruments employed (taxes, regulations, etc) but with the point at which they are applied. Direct measures are those applied to the *actual* pollution generated; for example, a charge per unit of sulphur dioxide emitted from a plant. Indirect measures are those applied to the *potential* for consumption or production to cause pollution; for example, inputs which might be highly pollutive are discouraged, or certain methods of production or consumption are prohibited or particular goods banned outright. Because indirect measures will apply regardless of whether this potential pollution occurs or not, they provide no incentive to find other ways of reducing the actual level of pollution. There will be occasions when these other means of curbing pollution are cheaper than those encouraged by the indirect measures. But if indirect measures are employed, the cheaper alternatives will be overlooked and the community will incur a higher cost for pollution control than necessary. Since direct measures operate on actual pollution generated they provide the needed incentive and avoid this problem.

33 By contrast, application of the 'polluter pays' principle means that less pollution is generated, either because the prices of products of industries which have to spend most on pollution control will be relatively higher (and the size of those industries therefore smaller) than if there are no pollution controls, or because regulations directly stipulate a lower level of pollution emission.

about the *efficiency* of such approaches. But, since any new measures to control pollution will involve new costs to someone, it is also necessary to consider their equity aspects. These crystallise around the two polar approaches of 'polluter pays' or 'public purse pays'. Advocates of the former argue that (social) costs incurred in using the environment should be treated no differently from costs incurred in using any other resources. In essence this viewpoint holds that society 'owns' the clean environment and therefore has a right to expect individual users of it to pay. That is, those who benefit from goods produced at a cost to the environment should have to meet that cost. The expense of pollution control is borne in the first instance by would-be polluters, but ultimately it will be passed onto the users of the products.

The 'public purse pays' viewpoint accepts that individual decision-makers are generating the wrong combination of physical commodities and clean environment. However, it sees the more appropriate cure as being for collective decision-makers to correct the result of inappropriate individual decisions. Adherents to this viewpoint justify their stand on the grounds that since society as a whole benefits from the cleaner environment, society as a whole should meet the costs incurred. In effect, a clean environment becomes a privilege to be paid for rather than a right to be expected.

The 'polluter pays' principle appears to be the sounder on grounds both of equity and efficiency, and an inter-governmental consensus appears to have been reached in its favour. As a member of the Organisation for Economic Co-Operation and Development, Australia adopted in1972 that Organisation's guiding principles governing the international economic aspects of environmental policies, including the 'polluter pays' principle.

VII

The preservation and, still more, improvement of the environment obviously requires the use of more resources for that purpose. As more resources are devoted to those ends, fewer resources than would otherwise have been available can be applied to other purposes. Using resources for pollution control conflicts with other uses of resources – with traffic control, school buildings, dry cleaning or TV sets – but this conflict is not specifically a growth problem: there is no reason for thinking that directing resources to pollution control will be *particularly* at the expense of growth-producing investment in physical equipment and human skills.

Wealthy countries will probably take out more of their growth in the form of pollution abatement than poor countries, but growing economies will also probably accommodate the required diversion of resources more readily than 'stationary' ones. It is easier to modernise plant and equipment (e.g. to incorporate pollution control mechanisms) and to engineer structural readjustments to the

changing pattern of economic activity in a growth context than otherwise. More fundamentally, economic growth implies that the stock of resources (including technology), which the community has at its disposal, is continually expanding. This expansion enables people – either through their own choice or through decisions made by their governments – to exercise an option to improve their welfare in one of a number of ways. In the past this option has been exercised in favour of increasing consumption of services rather than goods, and in favour of more leisure rather than still more goods and services. Nowadays we have the opportunity that comes with growth to opt for a more pleasing environment. If that opportunity occurs in an expanding economy, opting for it need not involve an absolute reduction in presently enjoyed standards in other respects. In short, 'growth' entails a positive contribution to pollution control in a way which a 'stationary state' cannot.

VIII

The discussion so far in this Part has suggested that pollution amounts to hidden costs of production, and that when these costs are properly charged for, the output of goods and services will achieve a pattern more in keeping with the preservation of a clean environment. But how different would that pattern be? What is the extent of the change required? Will the rate of improvement in other directions be seriously retarded?

It will be clear from what has been said that the answers to these questions depend upon the priority attached to a cleaner and quieter environment. Since all human activity pollutes in some respects, the continued existence of the human species depends upon a compromise with the environment. The real issues turn upon the terms of that compromise – that is, upon the consensus reached as to the magnitude of the costs imposed by specific environmental ills, and therefore of the resources that should properly be devoted to curing them. It is clear, however, that some types of pollution can be reduced quite dramatically at relatively modest cost. The reduction in various forms of air and water pollution in London over recent years is perhaps the most widely known example of this.

The pollution control proposals being implemented in the United States today are more ambitious than in most countries, yet it is evident from estimates of the costs involved that the required redistribution of resources is not radical. The 'annualised cost' of pollution control expenditures, including measures to counter air and water pollution and to dispose of solid wastes, is estimated to rise from $10 billion in 1970 to $33 billion in 1980[34] (both totals expressed in

34 Of the *increase of $23 billion*, $9 billion relates to the estimated costs of regulating motor vehicle emissions. The estimates are given in the *Third Annual Report of the (US) Council on Environmental Quality*, (August 1972).

1971 prices). Large as these figures may appear, they represent an increase from just below one per cent to a little over two per cent of actual and prospective GNP, respectively.[35]

A diversion of an additional one per cent or so of a country's GDP to a particular use is not negligible, but a growing economy can clearly take such a diversion in its stride. Even in the period of adjustment to higher standards of environmental quality, only a small proportion of the increase in available output would need to be devoted to pollution control expenditures.

The United States' pollution control measures are expected to bring about very substantial reductions in emissions of pollutants:

> (In the US), for 1976, without new controls, iron and steel would produce over one million tons of particulates per year. Pollution controls would reduce this to 93,000 tons per year. Similarly, for kraft pulp, from 561,000 to 120,000; for grey iron foundries, from 166,000 to 29,000. Carbon monoxide emissions from the latter would be reduced from 2,220,000 tons per year to 210,000 per year. Crudely speaking, it appears that industrial pollutants can be reduced by 80 to 90 per cent through annual expenditures of the order of 5 per cent or less of the total value of the particular industrial output. For electric power generation, similar reductions can be effected at roughly 2 per cent of total power costs.[36]

There will be some industries in which large changes, and therefore large increases in costs, may be needed to counter pollution. But a few cases of spectacular cost increases would not much alter the overall proportion of resources devoted to pollution control, moderated as it would be by the numerous run-of-the-mill decisions which achieve large results for modest cost.

It is true, of course, that increasing recognition of pollution problems combined with further improvements in living standards could raise the question of even more ambitious anti-pollution objectives – and these could certainly be achieved though at increasing cost.[37]

It is also true that overall welfare may be reduced below what might have been achieved if pollution control becomes an over-riding objective regardless of the totality of considerations, or if recourse to legal restraints holds up or leads to

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35 Overall figures for costs of pollution control program are available for five other countries for the period 1971-1975. (See the *OECD Observer*, February 1973: 9.) These costs, expressed as a percentage of GNP, for the five countries are as follows: Germany, 1.8 per cent; Italy, 0.4 per cent; Japan, 2.2 per cent; Netherlands, 1.0-1.5 per cent; and Sweden, 0.7 per cent. These figures will not be comparable as an index of effort because environmental problems will differ as will appropriate techniques; moreover, past attention or neglect will influence current requirements.

36 *IBRD*, *op cit*: 51.

37 It is likely, however, that technological advance will also reduce the real costs of pollution control over time, so that some improvements in standards may be possible in the future without increases in real costs.

the abandonment of important projects over issues where benefits of proceeding outweigh the costs. If pollution control standards are set so high that the costs of control clearly exceed the resulting benefits, resources will be wastefully diverted from other purposes – including perhaps other forms of environmental improvement. Moreover, it is already apparent – with the technology of pollution control only beginning to develop – that even modest expenditure can have large effects in reducing pollution.

In summary *the damage from environmental pollution in a large and growing economy with effective pollution control standards certainly need be no greater and in practice is likely to be far less than the damage in a small and slower-growing economy operating in the same area without effective pollution control measures.* The quality of the environment can be improved much more – and more quickly – by measures to counter pollution than by steps to contain economic growth. It is doubtful in any case whether action of the latter kind will be deliberately attempted; and if it were, and the improvement in living standards were slowed down as a result, the resistance to applying resources to control pollution would be so much the greater.

Part 3: Growth and its measurement

> ...with contemporary technologies and living standards, it is doubtful how far the growth of marketable output, as defined in national income statistics, is an adequate measure of the growth that is important for society... The problems of social choice, the assessment of costs and benefits of possible developments, and the selection of policy goals may therefore need to be looked at in a wider context than conventionally measured growth rates. (*OECD: The Growth of Output 1960-1980*, December 1970.)

I

Some of the confusion over the relationship between pollution and economic growth seems to stem from an over-reliance on the significance of conventional growth measures. In particular, Part I referred to the practice – more prevalent some years ago than now – of using the growth rate in 'real' GDP as an 'all purpose guide' to a country's economic performance.

The basic error here is the failure to pay heed to the *objectives* of economic activity. Just as measurements of a machine's performance are meaningless unless they bear upon the efficiency with which it performs the tasks for which it is designed, so measurements of economic performance must be related to the

purpose of the economic machine. This was stated as follows in the *Supplement to the Treasury Information Bulletin: the Meaning and Measurement of Economic Growth*:

> The object of all economic activity, in the long run at least, is the satisfaction of people's demands, whether for goods and services that can be purchased in the market or for other things, tangible or intangible, that cannot.[38]

By definition things, tangible and intangible, that cannot be purchased in the market are excluded from GDP, although the output of many government services (for example, national defence), which do not have market equivalents but loom large in the economy, are represented by proxy – the cost of their purchases. Where market equivalents are available, it does not follow that the output of the relevant goods and services which are not marketed will be included – the difficulties of imputation may be too great. In the private sector, for example the services of a TV set are marketed (and therefore included) if the set is hired, but if the viewer buys a set the market equivalent of those services is excluded from GDP.[39] In the public sector the services of, for example, a government-owned school building are excluded although market equivalents exist. Again, some activities will confer benefits or impose penalties on other activities, and these effects will not necessarily be captured by GDP statistics. For example, public expenditure to relieve traffic congestion provides a future return which is included in GDP insofar as it reduces business costs, but not to the extent that it adds to the real leisure time of commuters. The latter benefits are also related to satisfying people's demands: but the ways in which they are reflected or not reflected in GDP are such that supplementary measures may also be needed.[40]

These are examples that illustrate the significance of the fact that GDP is confined, broadly speaking, to the output of goods and services that enters the market. Serious difficulties also arise in seeking to estimate changes in market output over time. Whilst this can be done with reasonable precision in terms of c*urrent* prices – that is, the prices actually prevailing from time to time – such movements cannot indicate the 'real' growth in output because they are much influenced by changes in those prices over time. In an attempt to overcome this problem and confine the measure of growth in output as far as possible

38 *Op cit*: 5.

39 Expenditure on the *purchase* of durable goods, such as television sets is included in GDP whether the purchaser is a final consumer or a business enterprise: but only in the latter case are the services subsequently provided included in GDP. The domestic services of a housewife are an important activity which is excluded. The British economist AC Pigou once remarked that if a widower vicar paid his housekeeper a weekly wage this would represent an addition to the national income; if he married her it would be a subtraction!

40 Also, as noted earlier, the effect of pollutants on the natural environment itself is not brought into GDP. However, the use of resources to control pollution is reflected, at least in part, in GDP.

to changes in 'quantum', statisticians have developed the measure of GDP *at constant prices* by revaluing the goods and services included with a view to removing the direct effects of changes in prices.

II

Estimates of expenditure at constant prices, and the corresponding estimates of 'real' GDP as a whole which may be built up from them, are valuable – and indeed essential for some types of economic analysis. They are however very frequently misused because their inherent limitations are insufficiently recognised.

In essence, these limitations arise from the fact that relative prices of goods and services entering the computation are used as weights; and the comparisons between periods which are necessary for growth estimates involve the application of a *constant* set of weights – that is, it must be implicitly assumed, contrary to the facts, that *relative* prices or valuations remain unchanged.[41]

> In certain circumstances we may be justified in assuming that the relative values of the goods and services produced have remained constant over a period of time. If in fact the relative values have changed considerably, we may not be justified in making this assumption... In proportion as we are not so justified, the more difficult it becomes to make numerical summaries which are at all significant; and the more seriously are the changes in physical quantities resulting from changes in the 'efficiency' of the productive processes overshadowed by changes in the estimation in which the final product is held.[42]

This may appear abstract and theoretical, but an understanding of it is basic to anyone wishing to draw conclusions from constant price data.

Take, for example, the practice of quoting estimates of trends in GDP at constant prices as evidence bearing upon the effectiveness or otherwise of those policies that influence the allocation of resources between industries by affecting market prices, e.g. tariff policies. Since it is precisely through their influence on relative prices that such policies have their effects on the pattern of economic activity, measures of output that *assume* the structure of relative prices remains constant are of very qualified relevance in this context.[43]

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41 Implicit assumptions which are contrary to the facts are not made by those who *produce* statistics at constant prices, but by those who make indiscriminating use of such statistics to measure economic growth.

42 Dr (now Sir) Roland Wilson, *Facts and Fancies of Productivity* paper read before Section G of ANZAAS at its Adelaide Meeting, August 1946: 28.

43 The higher the proportion of GDP represented by the output of industries in which productivity is growing rapidly, the more rapidly will total GDP at constant prices tend to grow: but rapid growth in productivity is not the same thing as a high l*evel* of productivity. There is no necessary correlation between

Another common misuse of constant price estimates arises from what they appear to show about the services sector of the economy. Services are typically less standardised than manufactured goods, and the problem of differentiating between the volume and price components of the overall change in expenditure is therefore more formidable in their case. It is generally accepted that some (net) improvements in the quality of many services are not captured by constant price estimates – that is, that apparent price increases are overstated (and output growth correspondingly understated) in this area.

Compounding the problem arising from these difficulties of measurement of the output of services is the more fundamental 'index number' problem. Even if quality improvements in services could be fully identified, it is probable that rises in their prices would be shown to be faster than rises in prices of goods. But, to the extent that this is true, the *relative* prices of services have increased. Measures such as GDP at constant prices necessarily disregard such relative changes. Those who use such measures uncritically therefore implicitly assume[44] – contrary to the fact – that the output of one unit of 'services' is no more valuable, by comparison with the output of one unit of goods, than it was at the base date.

These statistical illusions are not always appreciated. The misunderstanding shows up from time to time in suggestion that the goods-producing industries be specially encouraged and the service-producing industries discouraged[45] so as to raise the apparent rate of economic growth. The notion was referred to in *The Meaning and Measurement of Economic Growth*.

> If it were desired solely to achieve a high rate of overall productivity increase as measured statistically by figures of GNP at constant prices, efforts might be directed towards inducing the community to buy more and more of the kinds of output that appear to enhance the growth performance most – cars and other products of highly mechanised operations, for example. If, however, it were thought desirable instead to increase the proportion of national expenditure devoted to education, health and the like, or to travel or the patronage of the arts, the statistical growth in 'productivity' would be very much lower even though, in the view of many, the quality of life might thereby be much improved.[46]

The conclusion is, of course, that to seek to maximise the statistical *measure* of growth, rather than the real welfare of the community, is to miss the point.

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the industries which are most competitive internationally and industries in which technical progress is proceeding most rapidly. Nor are industries experiencing rapid technological progress necessarily becoming more competitive: the rate of progress may be equally fast or faster in other countries.

44 See footnote 41 above.

45 The suggestion was more common in the heyday of 'growthmanship'. These days the opposite proposal is sometimes made on the grounds that goods-producing industries tend to use more mineral resources and produce more pollution per dollar of output than the services industries.

46 *Op cit*: 17.

III

In *The Meaning and Measurement of Economic Growth* it was pointed out that no one familiar with the construction of estimates of what was then called the GNP would think of attaching the significance that was being attached to them by many users.[47] The reasons for this will be apparent from the preceding section. The simple truth is that measures of trends in the market value of output, whether revalued to remove the direct effects of price changes or not, cannot be taken as comprehensive and unambiguous measures of changes in total welfare.

It is unnecessary to repeat the whole catalogue of pitfalls detailed in the earlier publication, which are illustrated by the examples cited above. It is sufficient to note that attention was drawn to problems of concept, problems of estimation and problems arising out of the necessity to tailor concepts used to the availability of data. Some of the key conclusions were:

> Like all tools of trade, estimates of GNP are meant for a particular job and they do it as well as can be expected. Difficulties arise only where they are used for jobs for which they are less well suited.[48]
>
> The particular job for which GNP figures are best suited is the description, analysis and forecasting of economic trends. `They represent a convenient ''short hand'' means of roughly appraising what is happening to the economy, or analysing the requirements of policy from time to time, and of portraying the inter-relationships between incomes and expenditures of the different sectors of the economy.'[49]
>
> In this context, 'constant price estimates (of GNP) indicate, over comparatively short periods free from substantial institutional change, whether economic growth appears to be taking place and whether it appears to be accelerating or slowing down. It is but a broad indicator; it certainly is not intended to be interpreted in any precise quantitative sense.'[50]

In summary, it was suggested that the attempt to identify economic growth with the growth in output at constant prices is misleading. The distinction between the two is important because certain criticisms of 'economic growth' appear to result from misinterpretation: movements in the statistic are taken as closely representing movements in economic growth.

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47 *Op cit*: 13.
48 *Loc cit*.
49 *Loc cit*.
50 *Op cit*: 12.

IV

People are presumably interested in making 'right' decisions in the sense that these decisions directly or indirectly, give them what they want. A 'wrong' decision is one that leads to a different outcome from that which the decision-maker would have preferred and which could have been achieved had he decided otherwise. In the case of government decisions on behalf of the community the principles are the same – though the difficulties of making 'right' decisions are greater for many reasons: because the values that people place on many government services are not readily ascertained, because they vary greatly between individuals and because of the practical problems of assessing the full consequences of decisions even when priorities and relative valuations are known.

It will be clear from what has been said, however, that the 'rightness' of decisions cannot be judged solely by reference to their effects on GDP. People make their decisions in accordance with their own assessment of the costs and returns involved.[51] The results of particular individual decisions may or may not be registered in the national accounts; that is something which – quite rightly – is not taken into consideration by those making the decisions.

The same is true of government decisions. It was noted earlier that the process of appraisal of public sector projects and programs should not discriminate between costs and benefits that enter the GDP calculus and those that do not. The objective of general government activities is to maximise the 'output' (in terms of community welfare) for any given input of resources. The effects on national accounting aggregates are an inadequate guide in this respect because such activities are conventionally measured in the national accounts only by their cost or input, and not by their output. The rise in 'output' of the health industry cannot be adequately measured by what is spent on health services; other, and probably broad, indicators of that output have to be sought.

Because output is not an end in itself, but a means to promote the welfare of the community, it is only sensible that national policies be designed to create conditions which will enable available supplies of labour, capital and natural resources to be efficiently applied for the purposes which the community values most highly. This is not to suggest, of course that it is easy to determine what values to assign to various forms of production – and hence to the return from

51 The returns may, of course, be of many kinds and may include altruistic considerations as well as the range of other non-material values mentioned in Part I. Decisions may also be influenced by the circumstance – increasingly present in the case of the well-to-do – of not having to weigh up too carefully the pros and cons, especially on minor matters. Even those on modest incomes make many decisions, out of habit or otherwise, with little or no conscious considerations of how to get the most for their money. Nevertheless, the process involved in reaching any rational decision is essentially a benefit/cost calculus; and, although the reasoning process is expressed in many different ways, it tends to become increasingly conscious and articulated as decisions become more important.

resources in various forms. On the contrary, it can often be extremely difficult, as was shown in the discussion on environmental valuations in Part II. But it is the meeting of people's demands and preferences – individually and collectively – which constitutes the criterion. The real objective of putting available resources to their best use would not be achieved by maximising measured growth.

V

Nothing that has been said should be taken to imply that GDP and the structure of national accounts of which it forms part are not valuable tools of analysis. They are of great value in showing how the economy works and in illuminating many of the key relationships which are relevant to the formulation of policies – with respect both to the management of the economy to maintain a sound balance between available supplies and the calls upon them, and to problems of the longer term. In fact, GDP and other key aggregates provide points of reference against which may be measured not only those items of income, expenditure and product forming part of the market economy, but also the implications of using resources to provide goods and services not exchanged in the market place.

The trend in GDP at constant prices is not, however, a comprehensive measure of changes in the national wellbeing, or in the progress (if any) towards the 'good life'. Recognition of these limitations has led to two distinct strands of development directed towards their remedy.

One school advocates that additional components of human wellbeing be built into the GDP measure itself. GDP could – so it is claimed – be modified so as to take into the reckoning such negative effects as pollution, congestion and environmental degradation. Thus the measure would approach what has been called 'net economic welfare' (NEW).[52] Whilst admitting that the necessary adjustments would be relatively primitive, proponents of such a measure argue that it is better to have an inaccurate sense of what is wanted than an accurate sense of what, for some purposes, is not wanted.

As an alternative to proposals to modify the GDP concept to include 'quality of life' considerations, another school favours the development of a system of social indicators to *supplement* the conventional GDP. Their proposals do not envisage the development of a single aggregative index of human wellbeing but rather the social demands and problems which are or are likely to become major concerns of policy. It is claimed that measurement of changes in the various indicators will assist and enlighten public discussion and the decision-making processes. Considerable conceptual and methodological problems arise and it is too early to say how far this approach can successfully be developed.

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52 The American economists, Professors William Nordhaus and James Tobin formulated this concept and it has been popularised by Professor Paul Samuelson.

VI

The conclusions of this Part so far might perhaps be summarised as follows.

The test of the success with which a country such as Australia uses its resources cannot be discerned by examining the trend in output at constant prices or any other indicator. It depends partly, but by no means wholly, on whether market prices and the implicit or explicit valuations assigned to activities outside the market reflect the preferences of its citizens. Those preferences may call for an increasing or decreasing proportion of resources to be allocated to items included in GDP. There is no basis for suggesting that arrangements which favour the provision of items which society wants but which are partly or entirely excluded from GDP are less 'material' or less 'growth-oriented' than an economic system which is designed to achieve growth only in supplies of products included in GDP.

If economic and social policies are directed to meeting the preferences of a country's citizens without using resources wastefully, the rate of growth in GDP is best regarded not as a goal or a target but rather as a result. It is the outcome of the pattern of preferences, of the efficiency of the arrangements to give effect to those preferences, and of the factors influencing the rate at which productive efficiency increases in individual productive units. A high rate of growth in the conventional statistical measure of output may be a likely result of well-directed policies: it is certainly not a necessary result. Other measures may be used to shed light on various aspects of national performance; but they cannot do so comprehensively and unambiguously, and assessments of many matters affecting national welfare must include a large subjective element.

An important factor influencing a country's rate of economic growth which has not been mentioned so far is the allocation of resources between production for current uses and for investment – that is, 'production' whether of physical equipment or human skills which adds to the economy's capacity to produce in future years. The rate of future economic growth can be increased by using fewer resources for current uses and more resources to produce items that will yield some of or all of their services in future years. But there is obviously a limit to the present sacrifices which it is sensible to make in order that one (and others) may be better-off in the future. Individuals make their own evaluations in deciding how much they will spend out of their incomes. The nation's choice is a compound not only of individual decisions but also of the decisions and policies of firms and governments.

A widely held view is that the decisions of individual consumers and enterprises will result in too little consideration of the future. This view arises in a number of contexts and it is not possible to explore all of them here. It is sufficient

to say that it is not easy to find a logical chain of reasoning which leads to the conclusion that there is a general tendency for present decision-makers to neglect the interests of future generations.

The real problem, which will be considered in greater detail in the concluding chapter, is that of knowing how to take those interests into due and proper account. This can be strikingly illustrated by the wide differences in attitude between the 'growthmanship' and anti-growth schools referred to at the beginning of this paper. Both have the interests of the future at heart. Among the growthmen there is or was a view that governments should provide special encouragement to investment. This would involve some cost in present living standards, but growth would be stimulated and future living standards would therefore be higher than they would otherwise have been.

An opposite viewpoint is held by those most unequivocally in the anti-growth school. Investment in their view should not be stimulated but choked back. Far from being grateful to the present generation for sacrificing its welfare in their interest, they assert that our children and our grandchildren will curse us for condoning growth, let alone encouraging it.

One of the reasons for this latter view is the conflict that is seen between growth and the care of the environment, which was discussed in Part 2. It was suggested in that Part that the way to attack this problem was not in attempting to frustrate growth *per se* but in a proper ordering of priorities between environmental improvement and other uses of resources.

> To have growth, that is, to have more consumption tomorrow, what has to be sacrificed today is not the environment today, or even the environment tomorrow, but consumption today; for growth requires investment. How that sacrifice of consumption is to be allocated amongst various component items of consumption is a problem of the allocation of resources at any one moment of time, not a problem of the allocation of resources over time.[53]

Another argument for the view that the interests of the future require a curb on economic growth is that the physical resources are not available to sustain indefinite expansion. There is particular concern about the continued availability of non-renewable mineral resources. The next Part examines whether this concern is justified.

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53 Beckerman, *op cit*: 342.

Part 4: Growth and mineral supplies

> Resources are highly dynamic functional concepts; they *are not*, *they become*, they evolve out of the truine interaction of nature, man, and culture. The command over energy, especially inanimate energy is the key to resource availability. And, finally, the works is not 'a bundle of hay' but a living growing complex of matter and energy, *a process rather than a thing*... the problem of resources adequacy for the ages to come will involve human wisdom more than limits set by nature. (Eric W Zimmermann, *World Resources and Industries*. (New York 1951): 814-815, 818.)

I

The economic growth of modern times has depended heavily on the use of minerals as raw materials and to provide energy. The discovery of methods of using coal rather than charcoal in forges and blast furnaces, and the subsequent application of steam power in place of water power, were critical events in the rise of industrialism in eighteenth century England.

Fears of early exhaustion are as old as the large-scale exploitation of minerals. The degree of concern has ebbed and flowed over the years, the peaks usually coinciding with periods of high prices and supply shortages that proved, with hindsight, to be temporary.

Exactly a century ago, such a temporary 'dearness and scarcity of coal' in Britain led to predictions that supplies would run out in the not-so-distant future if the exponential growth of the preceding thirty years continued, and to the appointment of a Select Committee of the House of Commons to examine the problem. In the United States fears about the long-term adequacy of non-renewable resources reached a peak in the years before World War I and again at the time of the Korean War boom, when it led to the setting up of the Paley Commission.[54] Now in the 1970s there has been a new wave of concern, not only in the United States but in many of the developed countries, that growing scarcity of non-renewable resources may pose an early threat to the continued growth of the world economy.

54 See footnote 74.

II

Many of these fears spring from comparisons of the known reserves of minerals with their present and prospective rate of use. Such comparisons appear to 'show' that many of this planet's mineral resources will be exhausted in a few decades if economic growth is maintained.[55]

It is therefore crucial to recognise that *known* reserves, or even multiples of those known reserves, are no more a guide to what ultimately usable reserves might be than they were 25, 100, 200 or 1,000 years ago. To match an extrapolated rate of consumption against the reserves which are known to exist at a particular point of time is simply to express those reserves – as defined by current technology and commercial values – in another way. A time-flow is substituted for volume. *The real question is not how known reserves compare with the prospective calls upon them, but why total known reserves are what they are*. Surprisingly, the authors of the report for the Club of Rome[56] and many others who fear that resources will be inadequate to sustain continued growth have not addressed themselves to the highly relevant question: if resources are insufficient to assure long-term adequacy, why has exploration not been stepped up so that more reserves will be found?

When the question is posed this way, the answer is obvious. There are two reasons why no one knows the extent of ultimately recoverable mineral resources. First, the search for minerals is undertaken mainly by mining companies and their efforts are directed to a specific and sensible goal: the 'proving up' of a stock of raw materials which will suffice to ensure that their decisions to spend much larger amounts on working the deposits are safely based. Secondly, the very definition of 'reserve' depends on economics and technology.

Rising demands for a mineral (as long as its price is free to move in line with that rising demand) will lead to investment in new extraction facilities and treatment plants, and to a sufficient exploration effort to satisfy the producers concerned that reserves exist to employ the facilities and feed the plants during their economic life. It will *not* lead to any interest in finding deposits that will lie idle for thirty years. That would be little more sensible than installing treatment facilities that will not be used for many years ahead.

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55 The report for the Club of Rome already cited is the most conspicuous recent example; but fears on this score are very widely held.

56 For detailed commentary on the resource depletion aspects of this report, see *IBRD* and Beckerman, cited on page 109 above. For comprehensive data relating to United States and world reserves of individual minerals, discussion of the interpretation to be placed upon such data and an approach to the forecasting of supply and demand for minerals in the long-term, see *Mineral Facts and Problems,* 1970 (Washington, DC, Government Printing Office, 1970).

It follows that statements about the number of years' supply that known reserves represent give no reliable guide to the possible scale of ultimately usable reserves. At most, such statements might provide a guide to the commercial practices and motivations of mineral producers – though not as sound a guide as could be obtained from other evidence. Among the factors influencing the reserves/annual consumption ratio for a particular mineral, both globally and in particular countries, are the cost of exploration, the capital costs of mining plant and equipment, the apparent prospects for growth in demand for the mineral concerned, changes in transport costs or techniques of extraction and treatment, national security considerations and the prospects of reducing costs by discovering new reserves which are superior to existing known reserves in point of quality, accessibility or other characteristics. It is impossible to interpret statistics of known reserves without taking such factors into account. *The notion that such figures can provide evidence of impending scarcity of particular minerals is a fallacy of the crudest kind*[57] (though the abundance of known reserves of some minerals provides evidence *against* the proposition that scarcities will soon arise in those cases).

III

The conclusions of the preceding section do not depend on whether or not the proving of mineral resources is carried out entirely, or almost entirely, by business enterprises. The desirability or otherwise of governments engaging in the search for minerals need not be pursued here. It is however relevant in the present context to consider one of the reasons sometimes given for that course – that governments, which have wider responsibilities than mining companies, should seek to remove 'uncertainty' about the long term availability of minerals by engaging in comprehensive programs of exploration directed not towards discovering reserves for early use but towards compiling global inventories of available resources.

The first and obvious objection is that 'taking stock' of the world's minerals in that way would be extremely costly. That is, it would involve the use of substantial resources which might have been used for other purposes. There is a real question whether progress in raising living standards (or building up capacity to raise living standards in the future) should be retarded in the interests of seeking a greater degree of 'certainty' about the very long-term future. The answer to the question partly depends on the likelihood and consequences of a general scarcity of resources, a subject which will be taken up shortly. But there

57 Ironically, it happens that the reserves/annual consumption ratios for most key minerals have *increased* over time – that is, the exponential growth in known reserves has tended to outpace the exponential growth in consumption. If those who have taken such ratios as evidence of impending scarcity took their logic to its proper conclusion, they would have *fewer* grounds for concern now than twenty years ago.

is a much more fundamental difficulty: is the removal of uncertainty – desirable as that might be – in fact possible? The main point to have in mind in answering that question is that no one can predict, for decades into the future, the form which technical and economic progress will take.

An example may help to illustrate the point. An inventory of the world's iron ore resources in 1938 would not have included any reserves in the Pilbara region of Western Australia. Contrary to popular present-day belief, however, massive ore bodies were known to exist there. They were, in fact, mentioned in the report which led the Australian government of the day to impose its embargo on exports. The point, however, is that they were not then *economic* resources. To know that they would become so within the short space of thirty years, it would have been necessary to foresee such developments as the post-war economic growth of Japan and the slashing of real transport costs through the development of bulk materials handling equipment and the advent of giant ore carriers. Uncertainty as to the future global availability of iron ore would not have been removed by assembling data about the size and physical characteristics of ore bodies in the Pilbara or elsewhere.

Examples of this kind show that questions about the availability of raw materials to sustain continued economic growth in the long-term future cannot be answered by reference to the stock of 'reserves', and could not be even if we knew the entire stock which would be available for development in the future, given the maintenance of *present* economic and technical conditions. This is because those conditions will inevitably change quite radically as the decades pass, and in ways that defy prediction.

It is therefore not possible to ascertain the supplies of particular minerals which will ultimately be available — or, for that matter, the supplies which will be *required* in the far-distant future.[58] There are however grounds for confidence that the continued pursuit of economic growth will not leave future generations without the physical wherewithal to maintain living standards. The subject is too large to cover comprehensively within the confines of a single chapter, but there is space to explain briefly what these grounds for confidence are.

58 Although there are fears that specific minerals will be exhausted, it is hard to think of examples of exhaustion which have occurred in the past, even among the minor minerals. Moreover, it is difficult to forecast what the consequences of exhausting particular resources would be. For any particular mineral it would happen only gradually, by a process which involved a steady rise in its price. Presumably patterns of production and consumption would gradually adapt towards what they would have been had the mineral never existed in the first place. Moreover, developments in substitute materials and processes and in the pattern of demand can mean that an 'indispensable' mineral at one time might become redundant at another.

IV

As an historical fact, the long-term trend has been for the cost of mineral inputs to *decline* as a proportion of total production costs. Numerous studies of the available statistical data, spanning more than a century, have demonstrated that the tendency during this phase of unprecedented growth in the world economy and in the use of minerals has not been towards scarcity but towards abundance. In the United States the real cost per unit of minerals output was less than one-half the average 1870—1900 level by 1929; and by 1957 it was less than one-half the 1929 level.[59] Not only have there been reductions in the real cost per unit of output of most minerals, but there have also been declines in the input of minerals per unit of final output. 'Increasing costs for particular extractive products, therefore, do not signify increasing costs for extractive output as a whole, let alone for the aggregate of all goods and services.'[60]

These are points which may not have been sufficiently noted by those who take a pessimistic view about depletion of non-renewable resources. True, they relate to the past and cannot be guaranteed to continue into the future – though there is as yet no sign that they will not. But in any case the question is not of great importance for the overall scale of future growth.[61] The argument against those who fear scarcities and shortages of minerals in the future is not just that they are pessimistic about the possibilities of maintaining rapid progress in the development of new techniques and the application of presently known techniques, to the finding, extracting, processing, transporting and using of minerals. *It is rather that they are not consistent in their pessimism*. Forecasts of an indefinite exponential growth in the demand for minerals are the source of their concern; yet it is inconceivable that the development and application of new technology – which is implicitly assumed in expectations of exponentially expanding demand – could somehow pass the minerals and mineral-using industries by. It is not enough to say that sooner or later predictions that mineral supplies essential to the economy will run out must be fulfilled. Such predictions have been regularly made ever since the rise of industrialism. Past fears have proved unfounded and it is appropriate here to ask why.

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59 HJ Barnett and C Morse, *Scarcity and Growth; The Economics of Natural Resource Availability,* (Resources for the Future, Washington, 1963): 8. This study examined the quantitative importance of various influences contributing to those results. It was shown that substitution of commodities with relatively lower or declining costs and growth in imports both contributed to the reduction in costs *but* that much the greater part of that reduction would still have occurred in the absence of either of these influences.

60 *Ibid:* 9.

61 It does of course have significant implications for the *pattern* of growth, and therefore for the future of individual industries.

V

Perhaps the basic flaw is in conceiving of the long-term availability of a particular 'resource' as an *end* in itself, rather than as an ingredient of one of the *means* of progress. The impression sometimes given that the availability of a particular mineral might give out suddenly rather than gradually is itself mistaken; and there is an associated notion that particular minerals will always be utterly indispensable for certain processes or end-uses. The latter concept may be true of the short-term but it is of the very essence of technological change that alternative methods or substitute products are invariably available in the longer-term.

Nor is it true that the need, if it were to develop, to replace increasingly scarce materials by the cheapest available alternative would necessarily impose huge and indigestible increases in costs. Fears that this may happen ignore the tendency for the elasticity of supply of resources, and the degree of substitutability between them, to increase as time goes by.

The economists' concepts of 'alternatives' and 'substitutes' may convey an impression of something less satisfactory than the original. This is not the sense in which these terms are here used. Alternative resources may be

> ...not only equal in economic quality but often superior to those replaced. Few components of the earth's crust including farm land, are so specific as to defy economic replacement, or so resistant to technological advance as to be incapable of eventually yielding extractive products at constant or declining cost. When coal, petroleum, hydro-electric power, and the atomic nucleus replace wood, peat and dung as sources of energy; when aluminium yields its secrets to technology and is made to exist, as never before, in the form of metal; when the iron in tacomite, once held there inseparably, becomes competitive with that in traditional ores – when all this happens, can we say that we have been forced to shift from resources of higher to those of lower economic quality?[62]

Implicit in fears of exhaustion of non-renewable resources is the notion that the stock of such resources can, in principle, be counted up like the stock on a shopkeeper's shelves – so many tons of iron, so many barrels of oil and so on. In fact, the level of reserves is constantly influenced, both in the short-term and the long-term, by a whole complex of ever-changing factors. There is no firm dividing line, at any point of time, between what is part of the stock and what *is* not: for reasons already indicated, statements about supplies available cannot be divorced from the current state of technology and commercial values. Scarcity does not exist as an absolute: it has to be thought of in terms of cost.

62 Barnett and Morse, *op cit*: 10.

This key point may be illustrated by a few examples. Thus, the United States Bureau of Mines has estimated that an increase of 35-40 per cent in the price of iron ore could double world reserves; a 50 per cent increase in the price of tin would raise reserves by 80 per cent; and a trebling in the price of copper would raise reserves to about 2.5 times their present level.[63] These estimates relate only to known reserves but of course, increases in prices not only lead to 'overnight' growth in the level of economically mineable ore, but also to larger *additions* to reserves. Exploration becomes more attractive, techniques of exploration and treatment which would not have been feasible at the earlier level of prices become so, recycling and reclamation of scrap and residues are encouraged, alternative materials and processes become increasingly attractive, technical methods which enable greater economy in use become more profitable, and so on.

This process of substitution and expansion in the range of alternate materials, sources and processes is going on all the time. As it continues, the possibility of large discrete leaps upward in final costs arising from growing scarcity of particular minerals is steadily receding. Numerous illustrations could be given of the increasing range of alternatives available. Aluminium has displaced or become more competitive with steel in some uses, with copper in others. As a result, bauxite has become a 'resource'.[64] Synthetic materials have displaced or become more competitive with minerals –for example, plastic piping has replaced lead in some plumbing uses.[65] Half a century ago the air was for breathing and burning; now it is also a natural resource of the chemical industry.[66] As time goes by the quality of ores becomes a less critical component in the price of many metals, while treatment and transport costs become more important.[67]

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63 IBRD, *op cit*: 37-39. *By definition*, such estimates will necessarily show that ore bodies not now regarded as part of reserves are inferior in economic quality to those that are – in the sense that it would add to costs if these reserves, rather than as-yet undiscovered reserves, had to be used with *presently known* techniques to produce products *now known*, in the proportions required to meet *present* demands reflecting the tastes and preferences of the *existing* population in the places in which they *now* live and work. Since there will be large changes in these and other ways, estimates of what would happen if there were not are entirely hypothetical. But they do illustrate the point that scarcity is not an absolute, even for a particular commodity.

64 Bauxite is the main raw material used in aluminium production at present, though alternative aluminous materials – virtually unlimited in quantity – are also available and will probably be increasingly exploited in the long-run.

65 '...more and more of the materials input used in manufacturing plants is coming from other factories instead of from farms, mines and forests. To be sure the crude materials from which synthetics are made must still come from farms, mines, forests, or the sea, but such materials are generally worth much less than the natural materials they replace and they may be abundant rather than scarce materials.' US Bureau of the Census and US Bureau of Mines, *Raw Materials in the United States Economy 1900-1966*, (Working Paper No. 30, 1969): 11.

66 Barnett and Morse, *op cit*: 7.

67 It was stated some years ago by Mr. RT Madigan, then Managing Director of Hamersley Iron Ltd, that the low-grade iron deposits in the Pilbara region of Western Australia could amount to *100 million million tons*. On that basis the iron content of these deposits would be hundreds of times greater than the known reserves of the entire world, as estimated in the study for the Club of Rome. Similar low-grade material is exploited in North America and Europe, but there will be no need in the foreseeable future to mine low-grade ore in locations where treatment and transport costs are relatively high.

Is there any foreseeable end to this process of technological change, which is constantly 'creating' resources and opportunities for substitution?

It has been estimated, on the evidence of a large number of random samples, that the total natural occurrence of most metals in the top mile of the earth's crust is about *a million times* as great as present known reserves.[68] In purely physical terms the basic ingredients of the environment – air and water, iron and aluminium, stone and sand – are available without practical limit, and there is a constant expansion in the technical possibilities for using them to meet human needs.

The economic feasibility of many of the more radical techniques – both known and yet to be developed – is, of course, another matter; but that is because of the rapid pace of progress in extracting and using established materials in orthodox ways. If scarcities were to begin to develop, all past experience suggests that revolutionary new approaches would rapidly become practicable.

VI

It is true that the economic development of processes to use lower-grade sources of minerals and to extract raw materials from the air and the sea depends in turn upon the availability of energy supplies, and in much larger quantities than are used at present. Many see this as the key constraint. Are we not already reading of an energy crisis? What of the future, if the world economy continues to grow and the input of energy required to produce a given amount of final output becomes even greater than at present?

It is necessary to consider first the nature of the 'energy crisis':

> Much has been heard recently of an energy crisis in the developed countries, particularly the United States. This is not, of course, an ultimate crisis for the availability of sufficient resources to meet demand, but is more a crisis of *policy* on what sources of energy those countries should be reliant on, at which prices, and from where these sources should be obtained. There is still a vast potential of energy which could be tapped with changed economic circumstances or technological advance.[69]

In short, the prospect for energy supplies is no different from that for metal supplies in this respect: that there need not be *physical* shortages in total,

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68 Estimate made by Commodities Research Unit, London, quoted by Beckerman, *op cit*: 338. Although statements about natural occurrences of minerals have no economic meaning, they dramatically emphasise the truth that constraints on the future availability of resources *are* economic, not physical. It is thus not valid to take known reserves and to forecast future availability on what is said to be the generous assumption that they might be capable of being doubled or even increased ten-fold. That sort of figuring misses the point.

69 IBRD, *op cit*: 9.

whatever might be the position with respect to particular fuels, or of fuels in particular countries.[70] There would be an enormous increase in available oil supplies if the world's shale oil deposits were ultimately to be developed.[71] It has been estimated that only two per cent of the world's known coal reserves will have been consumed by the year 2000.[72]

It remains to be seen how much of each of the fossil fuels are used to produce energy in the future, and by what means, in what places and on what scale. In general, energy sources are more readily substitutable for one another than raw materials; and there are also considerable possibilities for the conversion of one form of fuel into another:

> Coal can also be liquefied and refined to substitute directly for gasoline or fuel oil. It can also be gasified to substitute for natural gas. Liquefaction and gasification of coal are both approaching the margin of economic feasibility. The production of oil from oil shale is another marginal economic proposition, and it is expected that with production experience costs will be reduced further.[73]

The large-scale development of some of these processes may be accelerated by the desire of some countries to avoid excessive dependence on imported energy sources. That consideration aside, the rate of development of new processes will depend on whether (and where) they are less costly than traditional sources. If the commercial exploitation of techniques for the liquefaction and gasification of coal and the production of oil from tar sands or shale has not proceeded as

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70 Authorities in the United States attribute current shortages of various forms of energy in that country to a large number of contributing influences. Most observers agree that concern for the environment has been of major importance – for example, there have been delays in the construction of pipelines and in the licensing of nuclear power plants, increasing difficulties in securing acceptable sizes for oil refineries, and rapid growth in petroleum usage because of the heavier fuel consumption of vehicles equipped with emission-control devices. Construction of oil refineries within the US is also believed to have been discouraged by uncertainty as to the ready availability of inputs, under the system of year-by-year or month-by-month setting of import quotas on crude supplies which was discontinued in April 1973. Demand for natural gas was stimulated, and the growth of the capacity of the industry retarded, by regulations which were designed to keep prices to users low. Without entering here into the validity or relative importance of these explanations – the issues are complex and controversial – it can be said that most observers agree that the origin of the 'energy crisis' cannot be traced primarily or largely to the depletion of mineral resources.

71 Known crude oil reserves, as given in the *Limits to Growth*, *op cit*: 58, are equivalent to 31 years' usage at current rates and 20 years' usage assuming that the past rate of exponential growth is maintained. *Mineral Facts and Problems* (1970), *op cit*: 190, quotes estimates by the US Geological Survey that shale oil resources in place in the land areas of the world, in shales as rich as 10 gallons to the ton or richer, may be in excess of 300 million million barrels, which is about *700 times* as great as known crude oil reserves. It is unlikely that more than a tiny fraction of these resources will ever be used, because new crude discoveries, the liquefaction of coal and the production of oil from other synthetic sources are likely to provide less costly supplies on a vast scale.

72 Quoted by Sir John Hill, chairman of the United Kingdom Atomic Energy Authority, in 'The Role of Nuclear Energy in the Total Energy Mix' *(Atom,* December 1972: 210).

73 *Economic Report of the (US) President*, *Annual Report of the Council of Economic Advisers*, (Washington 1971): 132.

the Paley Commission in the United States expected twenty years ago,[74] that is not because technical progress in reducing the costs of these processes has been slower than expected. *It is because progress in reducing the real costs of using conventional fuel sources in conventional ways has been faster than was then expected*.[75]

The same can be said of the development of nuclear power. Thirty years after the first controlled fission chain reaction, nuclear fission reactors are not making a large contribution to world energy supply, but they would undoubtedly have made a much larger contribution if power from conventional sources had become more expensive. In fact, the real price of conventional power has declined steeply. As nuclear technology develops, fuel costs are becoming a progressively smaller component of the cost of nuclear energy. They will soon be an insignificant component. Even if uranium had to be extracted from the sea, which is unlikely to be necessary in the foreseeable future, the additional cost would not be substantial.[76] The source of the fuel consumed in power stations will not be an important determinant of the cost of electricity used in houses in thirty years time; nor will the relative cost of operating a car depend to any significant extent on the cost of crude oil or whatever other materials may then be being processed into the fuel that cars will then be using.[77] In the decades ahead, society may face important decisions about the role of the motor vehicle, especially in the cities: but the belief that the long-term availability of fuel will be a critical consideration in those decisions can only serve to confuse the issues.

It is not possible to predict movements in the relative costs of the major energy sources several decades ahead. Nor is it possible to predict what new sources may be developed. There is the possibility of eventually producing power from controlled fusion reactions, in which case virtually limitless energy could be

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74 The President's Materials Policy Commission (Paley Commission) submitted its five-volume analysis of the past, present and probable future of US mineral supply industries in June 1952. The Commission 'concluded that domestic crude oil production would not be able to meet domestic demand at constant costs, and anticipated supplementary supplies from oil shale and coal liquefaction by 1970. It also felt that unrestrained crude imports would be necessary to keep costs and prices from rising. What actually happened is that petroleum prices declined. Oil from shale and coal is not yet profitable, and petroleum imports are restricted under a national control program'. (*Mineral Facts and Problems*, 1970, *op cit*: 1.)

75 Statements that new means of producing energy would be 'too expensive' will usually be found on examination to depend on a comparison with costs of energy produced by 'old' means. Some of the more alarming forecasts of energy scarcity appear to rest on two assumptions that are mutually inconsistent: that supplies of traditional fuel will be inadequate; and that alternative sources cannot be developed because costs will be higher than for energy produced from traditional fuels.

76 TN Marsham and RS Pease, 'Nuclear Power – The Future' (*Atom*, February 1973: 46).

77 Even today a doubling in the cost of crude oil in Australia would add only a relatively small percentage – less than 10 per cent – to the total average cost of owning and operating a motor vehicle.

produced.[78] The sun or the tides may be harnessed. Such developments are not impossible or even highly unlikely. The question is not so much whether new developments can be effected, but when and at what cost.

If the world gradually shifts from using fossil fuels to other forms of energy in the future, it will be because those other forms become – in given locations and conditions – competitive with traditional sources in terms of cost, convenience and cleanliness. It cannot be inferred from the fact that supplies of fossil fuels are finite that the prices of such fuels must necessarily rise in the decades ahead; but it *can* be inferred that as alternative energy forms are developed, it will become increasingly necessary for fossil fuel supplies to be cheap if they are to be used at all. It is conceivable that the great bulk of the world's store of these fuels will remain in the ground (or under the sea) forever.

VII

A ton of coal once consumed is gone forever; and the same is true of a ton of iron or of other metals, with the qualification that these may be recovered in due course if resources are used for the purpose. These facts, and the common sense view that there must be a physical limit to the number of tons of coal or iron or copper in the world, are the main supports for the belief that the present generation must conserve mineral resources for its successors.

The preceding sections have however drawn attention to other important facts: that inexhaustible energy sources can be substituted for exhaustible ones, and that the eventual availability of metals is, for the future so far as it is worth talking about even in the most speculative terms, infinitely large. It follows that there is no blanket argument for physical conservation – each conservation proposal must be put to the test in terms of what is foregone to achieve its benefits.

It may, for example, be technically feasible to recycle a very large proportion of a given metal, but it would be pointless to do so if the metal can be produced more cheaply from new ore.[79] The 'waste' conserved by recycling would be offset by other 'wastes'; the ore left un-mined in the ground plus whatever other resources are involved including, directly or indirectly, other minerals and hydrocarbons.

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78 For example, if the controlled fusion of two deuterium atoms were accomplished, it has been calculated that the energy released by the withdrawal of *one per cent of* the initial concentration of deuterium in sea water would be equivalent to *500,000 times* the world's estimated ultimate reserves of fossil fuels. *(*See *Resources and Man,* US National Academy of Science, Washington 1969: 230.)

79 There are, of course, other factors to be taken into account than minimising the cost of producing metal. For example, recycling may yield social benefits (e.g. cans) voluntary labour might sometimes carry out the task for nominal payment (e.g. boy scouts) but, of course, such voluntary organisations may find more attractive fund-raising activities.

It is sometimes suggested that the expectations about the future demand for a mineral which producers take into account in making their decisions about whether or not to work a deposit do not extend sufficiently far into the future, and that governments therefore have a duty to conserve mineral supplies for future generations. There will be occasions when governments accept such obligations – for example, in the interests of national security. Proposals to reserve known mineral deposits for future use require careful assessment in each case, having regard both to the possibility of safeguarding the interests of future generations and the costs of doing so. The basic problem in preventing current exploitation in order to facilitate future development is that *possible* future gains are being weighed against *certain* current losses: those in whose interests it is suggested that a certain mineral should be conserved might not turn out to want it at all, or might want it only at a fraction of its current real price.[80] Even if it could be known – and clearly it cannot be – that at a certain time in the distant future the real price of the mineral concerned would be several times the current price, there would still be no clear-cut answers to the question whether production of the mineral should be limited now in order to reduce real costs in the future. A multiple increase in the real price of one mineral or even of most minerals, would not seriously inhibit future economic growth, or change the expectation that future generations will be much better off materially than our own. Such threats as there are to these prospects do not come from the depletion of what lies in the ground.

VIII

The key conclusion of this chapter is that the effects of continuing economic growth on the availability of non-renewable resources are much more complex than is sometimes supposed. Such resources may be being 'used up', but they are also – *as an integral part of the same process* – being 'created'. It is in the twentieth century that the essential uniformity of energy and matter has been discovered, that the development of new synthetic materials has become almost commonplace, and that technological advance has become virtually continuous, each improvement creating new opportunities for further advance. The extension of knowledge about the world has not only confounded past predictions of resource scarcity but has been in directions which make such predictions less and less defensible as time goes by.

The current wave of concern about the rate of depletion of the earth's 'capital stock' of minerals sometimes appears to result in a loss in perspective. Of the legacy of capital which each generation passes on, mineral resources in

80 There is an *ad infinitum* aspect here. If the current generation arbitrarily sacrifices current ore consumption for the sake of a future generation, the future generation could logically do the same for a more future generation and so on.

the ground are only a tiny part. Far more important is the growing stock of productive and social capital in use – equipment and buildings, knowledge and technology, human skills and institutions. It is the quantity and quality of their inheritance of these things that our descendants will care about. If real minerals and energy costs were to be higher, and even much higher than at present, that would be a matter of relatively small concern to them.[81]

There is, however, in any case, no sign that real mineral and energy costs *will* be higher. Even those predicting 'Doomsday' agree that it will not arrive overnight. On their view of things, scarcities will gradually develop, driving up prices and creating increasingly difficult and eventually intolerable problems. If this is indeed the outlook for the decades ahead, however, the process should already be apparent, at least in some degree. It is not: on the contrary, the fastest rising prices in advanced economies continue to be those in the services sector. Prices in the industrial sector – the major user of energy and minerals – continue right up to the present to rise at below average rates.

There are, of course, many circumstances in which intervention by governments and supervision of private sector operations in the mining industry are essential – not only to correct disparities between private and social costs of which pollution and environmental damage are the obvious symptoms, but also to safeguard the general interest (including the interests of future generations) against wasteful and short-sighted techniques which result in ore which is or may be economic to remove now or at a future date ceasing to be so.

But conservation policy which takes the sensible form of enforcing 'best practice' is very different from that which pursues conservation on the basis of physical criteria, vaguely backed by the notion that all mineral deposits represent a 'limited' resource and are thereby 'valuable'. It is not really true that the mineral deposits our ancestors worked were 'richer' than those now exploited; some of the physical ore grades may have been higher then, but technological advance means that present-day reserves are richer in the only sense that counts: their effectiveness in achieving a given result at least real costs.

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81 Typically an advanced economy devotes only a small proportion of its total productive effort to the winning or importation of minerals (directly or indirectly). Australia is a substantial net exporter of minerals, but even so its mineral output only represented 3.2 per cent of GDP in 1970-71. Of course the fact that a group of products are a small proportion of total output does not mean to say that they are not of critical importance: however, it is the theme of this Part of the paper that the supply of minerals as a group will not become critical. Again, the fact that an activity absorbs a small proportion of available capacity does not mean that increases in that proportion are of no importance – far from it: the total economy is the sum of activities which could be classified into small industry groups. If incomes (in the broadest sense) are to advance, there is a need to seek efficiency in *every* branch of activity. Governments will manoeuvre to the best advantage in an endeavour to obtain cheap and secure supplies of raw materials and energy for industrial and domestic use. Nevertheless, increases in the small proportion of productive effort devoted to mineral supplies would not be crippling to economic growth in the longer-term.

If we exploit this planet's mineral resources now according to current economic and technological conditions, future generations will not necessarily be any less affluent than if we made a concentrated effort to conserve mineral resources for their use. Indeed, if conservation policy took the form of slowing or stopping economic growth, they would be much less well off than they would otherwise have been. It will be in the skills and technology of future generations that their fate will lie, and they are more likely to suffer than to benefit from any well-meant but almost inevitably misdirected efforts of the present generation to anticipate the specific constellation of technical conditions and opportunities with which they will be faced.

Part 5: A question of priorities

> ... since we must rely on governments for reform and since governments reflect fairly accurately the prejudices, hopes and intellectual pre-conceptions of the community generally, the broad requirements of policy suggested by theory must be thrashed about and mulled over in communication and controversy between academics, scientists, politicians and the community generally until they become, as did the objective of full employment, part of the ethos of the community. (Dr HC Coombs, ABC Boyer Lectures for 1970, *The Fragile Pattern: Institutions and Man*.)

I

In Part 1 it was noted that there is increasing (though still very much minority) support for the view that economic growth must be checked or even halted altogether. The succeeding discussion has suggested that such a view can scarcely base itself on inevitabilities. There is nothing inevitable about despoliation of the environment arising out of growth of output. Nor is there anything inevitable about exhaustion of needed mineral resources arising out of continued growth.

Though there have been some widely publicised claims that an early end to growth is a veritable condition for human survival, those claims have not been backed by the solid evidence and reasoning needed to support such a drastic prescription. Once the claim of technical inevitability is rejected it becomes plain that the debate about growth is really a debate about priorities: whether they are effective in decision-making. But here the debate encounters another inevitability argument – one not of technical but of social inevitability.

The view that relatively affluent communities place far too much emphasis upon production and its increase has more substance than the notion that physical constraints will impose early limits to global economic growth. There are many

strands to the argument. Some of the more important are that consumption of some products reflects status, not wants; that corporations manipulate 'wants' through advertising and other sales techniques; and that, driven on by the social compulsion of the 'rat 'race', each individual seeks to maintain or raise his *relative* position in the income structure so that the struggle to increase incomes overall is no more than a social treadmill.

Few would deny the existence of all of these phenomena, but views differ widely as to their significance, whether separately or in combination. In the final analysis a good deal obviously depends on differences in social philosophies. In this final chapter it is possible only to expose some of the issues on which judgements are likely to differ, and highlight the significance of some of the arguments for the debate about whether economic growth is worth having.

II

The ironic reflection that a major purpose of production might be to make possible socially acceptable forms of waste has cast doubt on the rationale of the process. 'Conspicuous consumption' is the term[82] adopted to describe this demand for allegedly useless goods (or aspects of goods) sought after as an outward testimony of 'pecuniary worth'. As the primitive Indian burned his pile of blankets as a token of his community standing, so, the argument goes, contemporary man encases himself in one and a half tons of metal to a similar effect.

It is one thing to acknowledge that conspicuous consumption constitutes an element in consumer behaviour. It is quite another to agree on its specific manifestations or on what to do about it. There is no more a consensus on what is 'useful' than on what is aesthetically fine. Functional engineering criteria cannot provide definitive answers. It is therefore incorrect to suppose that the concept of conspicuous consumption provides some *objective* measure of waste. It merely sets one group of values against another.[83]

Nor is the 'conspicuous consumption' thesis assisted by describing a particular valuation as involving a status symbol. Status or social acceptability in some form is important to people's participation in any society. Moreover, the suppression of one kind of pursuit of status does not necessarily mean its replacement by a kind more acceptable to the critic. Those who condemn increases in material standards of life which take the form of extra footage of car, 'useless' mechanical gadgets or modish garments are not obliged to devote any of their own expenditure to such fripperies; and they have the option, within

82 A term coined, incidentally, not in recent times but in the late nineteenth century by the American economist Thorstein Veblen.

83 Among the targets of Veblen's charges of 'conspicuous consumption' was the purchase of masterpieces of art.

limits, of seeking to persuade the purchasers of the foolishness of their actions. It is more difficult to see in such manifestations any justification for advocating a slow-down or a halt to growth.

Almost any non-subsistence purchases could be open to the charge of conspicuous consumption, but current criticism tends to concentrate on expenditure on cars and durable consumer goods. Spending on such items averages around 10 per cent of consumer spending in the advanced economies: rather more in some (including Australia) and less in others. The proportion does not appear to have increased much over time. Increased expenditure on new products tends to be offset by relatively less spending on items for which the phase of rapid growth in ownership has passed. Moreover, only extreme judgements would hold that more than a small proportion of expenditure on durable goods is of the 'conspicuous' variety. It is also at least arguable that the apparently lavish provision of these items in many households in the wealthier countries of the world should not be attributed to a misplaced ordering of priorities, but rather to a sensible response to their ready availability and low real price.[84]

The concept of conspicuous consumption has also figured in the contrast between 'private affluence' and 'public squalor'. Central to this contrast is the notion of an imbalance between the supply of those goods and services provided by the private sector and the supply of essentially complementary items by the public sector – for example, too many cars but not enough roads or parking space. Again the appropriate remedy lies in influencing priorities and the mechanisms for registering and giving effect to them, rather than in limiting the possibilities of implementing *any* set of priorities. Attitudes of sanctity towards private expenditure and parsimony towards public expenditure may properly be combatted, but there is a balance to be struck: governments may also engage in conspicuous consumption. Expansion of public spending *per se* will not rectify the supply imbalance; the real task is that of harmonising all spending, public and private, with a rational interpretation of the community's pattern of preferences (which is, of course, more easily said than done).

Personal consumer expenditures are also influenced, it is often claimed, by direct 'manipulation'. Advertising and other sales techniques frequently aim at heightening social pressures, to shame the consumer for his lack of the latest product. This is a complex issue. The point in the present context is, however, that although in the absence of persuasion techniques which contrive wants rather than inform, the pattern of consumption would doubtless be different, economic growth would not necessarily be any slower.[85] A policy of deliberately slowing or halting growth would be a costly and inefficient way of dealing with advertising: it would strike at the satisfying of wants whether contrived or not.

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84 This of course reflects in turn the relatively small input of total resources – including labour and capital as well as raw materials – devoted to their production.

85 It could be in terms of *measured* GDP.

III

Another aspect of social behaviour often seen as qualifying the advantages of economic growth is the observation that a person's relative 'income' (however interpreted) as distinct from his absolute 'income' may be of importance – perhaps even predominant importance – to him. He may, for example, prefer a one per cent increase in his own command over resources, other people's remaining constant, than a five per cent increase in line with everyone else.

This notion that people are concerned in some measure with their relative incomes is another variant of the conspicuous consumption thesis, and there can be no question that there is truth in it. Our concern here, however, is with its implications for questions about whether or not economic growth is worthwhile.

Measures of income redistribution, in the interests of equity and the relief of poverty, have been introduced in most countries; these aside, what courses of social policy will be appropriate in the face of the fact that people are to some degree concerned with their position in the income structure of society rather than with their absolute incomes? It is obviously a contradiction in terms to seek to improve total relative incomes: gains for some are necessarily offset by losses to others. In fact, short of seeking to change the mores of the society, there is no practical answer available unless the total 'cake' is also growing.

It follows that, as long as people are not indifferent to their absolute incomes, policies to promote a general increase in such incomes will be seen as enhancing welfare generally. To the extent that the cult of relative income rules a community, improvements in economic welfare may be hard to come by: but it remains sensible to pursue them.

This conclusion is reinforced by two further reflections.

First, even if concern for relative rather than absolute income were more intense in an affluent community than a poor one, it would not follow that it would be more powerful and persuasive in an expanding economy than in a stationary one. On the contrary, it may well be that it is in a stagnant economy that people or groups have the stronger expectations of retaining what they hold without the subversion of change and growth. In an expanding economy relative positions may be less entrenched and less apparent, and the assumption that improvement depends on disturbing them may have a lighter hold.

Secondly, the concern of individuals with their relative income is not restricted to their position *vis-a-vis* their compatriots. They are also concerned in some measure with how they fare compared with people in other countries. Their relative position would deteriorate imposing *decreases* in welfare, if their absolute

incomes remained constant while incomes in other countries increased. Even if it were the case, therefore, that people are entirely indifferent to their absolute incomes – which is very far from the truth – it would still not be sensible for one country to halt growth unless others did likewise. There is no sign of an international agreement to halt improvements in economic wellbeing.[86] Even in the developed countries it is easy for most people to think of good uses to which increased capacity can be put; elsewhere the notion of ceasing to strive for improvement would be dismissed as absurd.

IV

There is no doubt that different interpretations of social behaviour can lead to very different evaluations of the effectiveness of economic growth. Not only will there be disagreement over values – over how much emphasis to give to leisure, for example – but also the holders of a particular set of values may be accused by others of being caught up in a mindless 'rat race'. Their preference (say) for higher money income as against more leisure is the result – so it will be suggested – of the particular social context in which they pursue participation and acceptability. Those so criticised will tend to question whatever alternative is proposed. The resolution of such conflicts is a matter not for the economic but the political field.

It has been a theme of this paper that economic growth, properly interpreted, is neutral between objectives.[87] It simply expands the options. But the 'production' of the 'wrong' combination of things – for example, too many durable consumer goods and not enough government services or environmental 'goods' – can lead to the disparagement of economic growth itself by the particular groups who believe the combination is wrong.

Such disparagement has undoubtedly reinforced proposals that growth should be halted because of the alleged technical inevitabilities discussed – and rejected – in earlier Parts of this paper. Such policies are not a tenet of a widely supported political group; it is hard to envisage their operation without leading to some very unpalatable consequences such as the stifling of innovation; and they would be strongly opposed by those who see economic growth as the

86 There is the further aspect that a country taking measures to halt or drastically slow down its rate of growth could be faced with a 'brain drain' or similar consequences, and might eventually frustrate the very objectives that are held to justify action of that kind by those who advocate it.

87 That is between ultimate, long-term objectives. Policies directed towards ensuring that there is an adequate but not excessive growth in demand in the short-run, in line with the growth in capacity, must recognise the existence of 'trade-offs' between full employment, price stability, balance of payments viability and so on. But the outcome of the balancing of these aims need not involve any conflict with growth in the longer-term.

only way to improve human welfare both in its measurable and less measurable aspects. Such attitudes may, nevertheless, have their influence on decisions in a variety of fields – and in ways that may not be in the interests of anyone.

V

Time horizons are like geographical ones, so that generations in the distant future are akin to an alien people: they benefit in a general way – perhaps considerably – from the current following out of the economic calculus (as do foreigners from international trade), but their particular interests are not served. This is not surprising since those interests are not known. Were it possible to say that vital mineral deposits would be exhausted for them, or the air and water poisoned for them, these single technical absolutes would provide some guidance. But future generations are not likely to be presented with such absolutes. Whatever the present generation elects to do, there are no means of knowing what the *relative* availability of the various environmental and other resources will be in fifty or two hundred years' time; and such relativities will be worked on by an unknown technology for the purpose of meeting unknown wants. There have been many past predictions, implicit or explicit, that all of the important inventions have been made. Technology continues to grow exponentially for all that. The scientist in 1873, attempting to predict the supply of resources in 1973, would have seen as *impossible* the output of those resources which actually obtained. Yet because of the exponential nature of the growth of technology we are probably less fitted to pronounce on probabilities a hundred years hence than were our predecessors a hundred years ago.

Unborn generations cast no votes. Their political influence is by proxy, or through what there is of paternalistic foresight amongst the current generation. But if the collective frailties of present-day decision makers were to be replaced by a benign dictator 'above it all', what kinds of changes would he direct in the volume of investment and its composition? No clear-cut answer can be given, but it may be worthwhile drawing attention to some relevant points.

The projected net benefits flowing from any investment decision pass into shadow not too many years ahead. The present value of future net benefits is steadily reduced in weight through the process of discounting – that is, as preference for consumption now as against consumption at increasingly distant times is taken into account.[88] Moreover, the net benefits themselves become increasingly speculative.

Stepping up the proportion of production used for investment involves imposing a penalty on the present generation in order to make richer still those

88 See *Supplement to the Treasury Information Bulletin: Investment Analysis*, July 1966.

who through technical advance and compounding increases are likely to be richer anyway. The same is true of proposals that involve adding to the costs of investments made now for the sake of reducing the costs imposed upon, or increasing the benefits accruing to, future generations. There is no point of reference, other than the expected rate of social return criterion which guides public investment decisions generally, by which it can be shown that possible or even certain benefits for future citizens are worth the certain penalties imposed on present citizens.

The community might, of course, be ignorant and apathetic towards the welfare of future generations but it needs to be persuaded that it is so. Benefits in the remote future do not merely need to be *positive* to justify penalties on the present generation, they would need to be very large indeed in relation to current costs.

Whatever views might be held as to whether society's preferences as between present and future consumption show an excessive or deficient regard for our descendants – and there cannot be an objective answer – the 'policy' of anti-growth helps no one. It reduces the resources available to current and future generations alike.

VI

Perhaps the most important conclusion implied in what has been said in this paper is that statements 'for' or 'against' continuing economic growth abound in potential semantic tangles. Perhaps the most useful concept of 'growth' to have in mind is the process of expanding the options available to realise society's priorities.

The process of best achieving the welfare of society for the resources available will normally result in a net growth of the *per capita* output of the economic system as conventionally conceived. This growth will come from better resource allocation, improved management and skills, technological progress and net investment. It is an important *effect* because it adds to the resources of the community for meeting future social needs. But in essence the problem of providing more social (e.g. environmental) 'goods' as against more 'economic' goods is not a growth question at all. There are many problems in achieving satisfactory economic growth but the pattern of wants of the community, whether these wants are labelled economic or not, is not one of them.[89]

89 The discussion is concerned with economic growth in developed economies. In *primitive* societies the patterns of wants may be an important factor in inhibiting a people's control over their material environment.

Economic growth tends to facilitate the achievement of the community's priorities from time to time, and if that is accepted, growth cannot be the legitimate target for criticisms of those priorities.

Those who advocate checking growth or bringing it to a halt have an obligation to specify carefully what they have in mind: the danger is that the course they prescribe may reduce the options for attaining *any* commonly accepted set of priorities.