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**Imperfections in the  
Economics of Public Policy,  
Imperfections in Markets, and  
Climate Change**

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By **Nicholas Stern**, IG Patel Professor  
of Economics and Government at the  
LSE and Chairman of the Grantham  
Research Institute on Climate Change  
and the Environment

## SUSTAINABLE DEVELOPMENT Series

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### Imperfections in the Economics of Public Policy, Imperfections in Markets, and Climate Change

By Nicholas Stern, IG Patel Professor of Economics and Government at the LSE and Chairman of the Grantham Research Institute on Climate Change and the Environment

#### Summary

In the last twenty years economics has created much of lasting value and real potential: it has been a very fertile period. But economics has also suffered from what I shall term „collective amnesia“ covering whole areas of public policy. And on policy and the role of government it has, embarrassingly in my view, swayed with the political winds to the detriment of both our profession and to outcomes. Both the amnesia and the political bending have contributed to the economic crisis of the last year or two and to hostility towards the profession. My purpose here is first to lament the amnesia on theories of public policy in imperfect economies, in short the subject of public economics, to describe the bending of public policy analysis to political vogue, and to indicate some of the consequences. I then describe some of the mechanics of the processes described, in terms of choice of models and patterns of teaching. Finally, I use the example of climate change to illustrate some of the consequences of the amnesia, as well as of the political influence.

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Imperfections in the economics of public policy,  
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London School of Economics

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## **1. Introduction**

In the last twenty years economics has created much of lasting value and real potential: it has been a very fertile period. But economics has also suffered from what I shall term 'collective amnesia' covering whole areas of public policy. And on policy and the role of government it has, embarrassingly in my view, swayed with the political winds to the detriment of both our profession and to outcomes. Both the amnesia and the political bending have contributed to the economic crisis of the last year or two and to hostility towards the profession. Further, and amplifying our problems, the subject has also been compartmentalised in a way which implies we are all too often less than the sum of our parts. A narrow focus and specialised tools can be of great value in clearing the way for theoretical analysis but can be very damaging if carried forward unthinkingly into policy.

My purpose here is first, in section 2, following this introduction, to lament the amnesia on theories of public policy in imperfect economies, in short the subject of public economics, to describe the bending of public policy analysis to political vogue, and to indicate some of the consequences. Thus it both suggests a chain of causation opposite, and additional, to that of Keynes (General Theory, last chapter) when he famously pointed to politicians being the 'slaves' of economists and it argues that the consequences have been severe. In section 3, I describe some of the mechanics of the processes described, in terms of choice of models, patterns of teaching and what Tony Atkinson has called the increasing 'compartmentalisation' of our subject (Atkinson, 2009).

In section 4, I use the example of climate change to illustrate some of the consequences of the amnesia, as well as of the political influence. Climate change also shows some of the consequences of our 'addiction' to analysis in terms of marginal change. On the principle that a presidential lecture should contain a theorem or two, I have three. The first refers to the joint roles of discounting and of the magnitude of consequences in evaluating the impacts of climate change. The second is fairly traditional in showing how the

inefficiency of a climate externality implies scope for Pareto improvement (here, across generations) and thus what future generations might 'expect' of us if we act on their behalf. There are interesting analogies, as we shall see, with 'internalities' in the modern theory of behavioural economics. The third shows the relation between taxing an externality, and public discussion of policy, in the tradition of John Stuart Mill: such discussion could reduce the need for taxation.

The final section is cheerful and forward looking. I speculate on how we can combine some of the perspectives of public economics with some of the great progress we have made in our subject on, for example, individual behaviour, the analysis of institutions, game theory and theories of justice. This last section is speculative but I hope that it makes the case that the potential is immense, in terms of interesting theory, fascinating empirical analysis, and real impact on public policy.

## **2. Bending to political winds?**

The story I want to tell here, of profound changes in political perspectives playing a powerful role in what economists did and said, is inevitably big picture and broad-brush. This is not a statement which admits of unambiguous demonstration. But it poses major and controversial questions about how we do our work. And I believe strongly these are questions we have to ask ourselves if we are to maintain the integrity of our profession and of our analyses.

We like to think that our ideas are powerful. Indeed one of the most commonly quoted parts of Keynes' General Theory is, "the ideas of economists and political philosophers, both when they are right and they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be exempt from any intellectual influences, are usually the slaves of some

defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler<sup>1</sup> of a few years back.” (Keynes, 1936, p.383). We have to ask ourselves, however, how powerful are the forces in the opposite direction. There is, of course, a major identification problem. But let me tell the story of some of our ideas in a way that suggests the chain of causation from politics to economics may be strong. As argued in the following section, the details of the economic modelling I think are also suggestive on causation: chosen models embodied assumptions guaranteed to give the ‘required’ policy implications. This story, necessarily involving substantial and subjective interpretations of events, is offered from someone who has been studying public policy since the late 1960s and who has been intimately involved in the processes of making it for much of the past two decades.

During the 1940s, 1950s and 1960s there was confidence in what governments could do and a powerful sense of purpose in terms of reconstruction from the Second World War and in building new and more cohesive societies as empires crumbled and countries became newly independent. The experiences of the Great Depression, and living the consequences of weak policies and unmanaged market economies were still raw and bitter. In the decade after the Second World War, governments in Europe, the USA and Japan played a powerful role in the process of reconstruction. The Bretton Woods institutions were established. Independent India and the new People’s Republic of China set off on their five-year plans. The planning systems in the Soviet Union and Eastern Europe appeared strong. Of course, ideas and governments were far from uniform, indeed there were Conservative governments in the UK and Republican administrations in the USA for most of the 1950s, yet there was a broadly shared view that the appropriate responsibilities of the state were much larger than those seen before the Second World War. And levels of taxation and public expenditure grew strongly.

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<sup>1</sup> The ‘scribblers’ themselves are no doubt often strongly influenced by the political and economic environment in which they live – that is indeed a key point of this lecture.

The growth in the size of the state in most countries continued during the 1970s and 1980s but by the end of the 1960s, both the questioning of the expanding state<sup>2</sup> and the political opposition were growing. President Lyndon Johnson left office early in 1969 to be replaced by Richard Nixon and the 'can do' spirit and visions of the 'Great Society' began to wane. India's planning fell into disarray in the 1960s with its own heaviness and stresses compounded by wars against China (1962) and Pakistan (1965), the death of Nehru (1964) and some bad harvests. Following the disastrous Great Leap Forward of 1958-60, and the devastating famines that followed, the Cultural Revolution broke out in China in 1966 and continued for almost a decade. The international economy was battered in the 1970s by the collapse of the Bretton Woods monetary system and two oil crises.

By the end of the 1970s, the politics of economic policy was about to undergo a sea change. Margaret Thatcher was elected Prime Minister of the UK in 1979 and Ronald Reagan President of the USA in 1980, on platforms of radical reduction in the role of government, including in regulation and expenditure, and of the promotion of 'supply-side' economics<sup>3</sup>. Deng Xiao Ping launched his reforms<sup>3</sup> in China in 1979, with the household responsibility system in agriculture, soon to be followed by the expansion of township and village enterprises. This introduction of incentive structures and an expanded scope for entrepreneurship in China marked the beginning of what is the most remarkable 30 years of transformation in economic history.

During the 1980s, Rajiv Gandhi became involved in politics and after the assassination of his mother Indira in 1984, became Prime Minister of India. The 1980s brought a changed perspective on economic policy, which was accelerated from 1991, after the assassination of Rajiv, by the Government of PM Narasimha Rao and Finance Minister Manmohan Singh. Mikhail Gorbachev became General Secretary of the Communist Party of

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<sup>2</sup> Clement Atlee and the Labour Government of 1945-1951 lost office partly as a result of similar sentiment, although the Conservative governments of the next 13 years kept most of the Labour measures in place and continued the programme of council house building.

<sup>3</sup> An early voice in economics was Peter Bauer. Indeed, I must confess that as a young lecturer, I did not appreciate fully the strength and relevance of the arguments he was putting.

the Soviet Union in 1985 and launched Perestroika a few months later with its emphasis on overcoming economic stagnation by introducing incentives, with a focus on raising productivity. The Berlin Wall fell in 1989 in large measure as a result of the inherent weaknesses, contradictions and decrepitude of the system and with it economic planning across Central and Eastern Europe and the former Soviet Union. The European Bank for Reconstruction and Development (EBRD), of which I was Chief Economist for most of the 1990s, was formed to foster the transition to the market economy. Thus the 1980s and 1990s saw a very powerful move towards the market economy across the globe.

These dramatic changes in policy produced spectacular results in many places, not only in China as already noted, but also in India and much of Central Europe formerly under Communist rule. It is interesting, however, that the heart of the European Union, France and Germany, moved more cautiously. The 1980s and 1990s in Europe were led by François Mitterand in France, President 1981-95, and Helmut Kohl in Germany, Chancellor 1982-98: the former was from the Socialist Party. The latter, whilst from the Christian Democrats and declaring a wish to follow the lead of Reagan and Thatcher, was, in fact, cautious on reform and movement was small. For Kohl, a major priority for much of his long tenure was the reunification of Germany. Kohl and Mitterand were very focused on bringing Europe closer together and the introduction of the Euro, which took place at the end of the 1990s.

Alongside and intertwined with these dramatic political changes of the 1970s, 1980s, and 1990s, the analytics of the economics of public policy was moving strongly. Let me identify two key strands in the 1970s. The first is the public economics of imperfect economies, which I shall summarise as the advancement of the Meadean tradition (after James Meade and his seminal 'Trade and Welfare', 1955, Oxford University Press and the much-cherished Mathematical Supplement) and public choice theory, as developed by James Buchanan, working with Brennan, Tullock, Wagner and others (see, for example, 'The Calculus of Consent', 1962, with Tullock, and 'Democracy in Deficit', 1977, with



Wagner). Both strands produced insights and methods of great value, but with very different, and sometimes conflicting perspectives. Both Meade (1977) and Buchanan (1986), quite justifiably, received Nobel prizes<sup>4</sup>. There is no doubt both traditions were embraced by the profession. Both traditions are ‘market friendly’ and co-existed with the ever-present Chicago perspective, splendidly summarised by Bob Solow (oral tradition) “All that exists is efficient, because were it not efficient it could not exist”; except of course when government messes up. My argument here focuses more on Meade than Buchanan.

The Meadean tradition explores the question of the design of policy in the context of economies which are imperfect in some way – information problems, constraints on taxation, fixed prices – and where an objective can be specified in terms of a social welfare function whose arguments are individual utilities. James Meade investigated not only optimality but also reform, i.e. ‘how do we identify improvements?’ Meade’s theoretical analysis of reform (which contains optimality as a special case from which no improvement can be made) was taken forward in, for example, Guesnerie (1977), Guesnerie and Roberts (1987), Ahmad and Stern (1984), and Drèze and Stern (1987 and 1990). Looking back, I think that the value of the Meadean tradition should not be seen in terms of some naïve calculation of optimality relative to a social welfare function using, probably shaky, estimates of consumer supply and demand functions. It lies much more in the intuition that comes from an explicit and rigorous analysis of the logic of reform in a set of simple models.

We can mark a revival of the Meadean tradition with the important papers by Diamond and Mirrlees on “Optimal Taxation and Public Production” in the *American Economic Review* of 1971 and the paper by Mirrlees “An Exploration in the Theory of Optimum Income Taxation” in the *Review of Economic Studies*, 1971. The *Journal of Public Economics*, in which much of this analysis was published, was launched in 1972 with Tony Atkinson as editor – he continued in that position until 1997 (I joined him as editor from

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<sup>4</sup> Meade’s prize was for international economics: much of his achievement in this area was its integration with public economics as the title of ‘Trade and Welfare’ makes clear.

1981-97). This literature can be seen as starting from an Arrow-Debreu first best in an economy with a full set of markets, perfect information, and unconstrained tax tools, where a competitive equilibrium is Pareto-efficient and any Pareto-efficient allocation can be decentralised as a competitive equilibrium. It then asks what policy might look like if one or some of the basic assumptions are jettisoned. Arrow himself set a wonderful example in relation to information and medical care in his paper 'Uncertainty and The Welfare Economics of Medical Care' in the American Economic Review of 1963.

The Buchanan public choice tradition, on the other hand, asks what happens if self-seeking individuals or coalitions try to manage or manipulate the formation of policy for their own benefit. Rent-seeking and log-rolling are essential to their story, as are the potential incoherencies of policy if disciplines of balanced budgets are abandoned. In retrospect, whilst Buchanan's perspective on government failure has real substance, his positions and definitions were sometimes extreme. The more measured positions of, for example, Harberger, Bhagwati and Krueger, whilst showing a strong focus on the failures of government, were probably more influential<sup>5</sup>.

These two traditions are not necessarily in logical contradiction. Indeed if we embrace one to the exclusion of the other we risk being dogmatic or naïve. The former is providing a benchmark for the analysis of policy, guidance on necessary information, and techniques such as cost-benefit analysis for assessing reform. The latter is warning that institutions, regulation and policy frameworks must be closely examined to see whether they are likely to be corrupted, manipulated or lead to outcomes unforeseen by policy makers but potentially foreseen by economic analysis.

Together with these theoretical investigations, and motivated by and motivating them, was much empirical work. For example, Little, Scitovsky and Scott (1970) charted the untoward consequences, in terms of unproductive projects, programmes and economies of

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<sup>5</sup> And see Besley's 2007 book, 'Principled Agents? The Political Economy of Good Government'.

much of the policies of import substitution and planning. There were important contributions too from Balassa, Bhagwati, Corden and Krueger. Little and Mirrlees (1969, 1974) produced an approach to project appraisal and planning motivated by both the empirical work of Little, Scitovsky and Scott and the theories of Diamond and Mirrlees in the Meadean tradition.<sup>6</sup> Much of this empirical work directly embraced both the Meade and the Buchanan approaches. In this period, the two approaches, both theoretically and empirically, were working in harness and pulling in the same direction, specifically against policies of physical controls and import substitution.

Whilst in principle complementary, and whilst some of the reforms they identified were similar for the 1970s and 1980s, the two traditions suggested, over the medium term, different magnitudes of reform or different directions. The public choice literature pointed to a drastic reduction in the role of the state whereas the Meadean tradition pointed to its reform. The reform which followed from the Meadean tradition highlighted the importance both of public policy in setting incentives and of careful appraisal of programmes, but not necessarily a major reduction in public expenditure. Indeed, many in the Meadean tradition, such as Atkinson (1989), offered a very careful empirical and theoretical analysis of arguments for stronger social support.

Looking back over the two decades since 1990, it would seem that, during the later 1980s, the 1990s, and much of the last decade, the cry of 'get the government out' drowned out the Meadean approach. There is no doubt that the analysis of government failure must be set alongside that of market failure. That is, indeed, exactly what I tried to do in my Economic Journal Survey of 1989 on the economics of development where I set out the key sources of each in matching tables. But, and I caricature only a little, what happened was that an analysis of 'market failure with little emphasis on government failure', which had been

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<sup>6</sup> An important and contemporaneous work on project appraisal, similar to that of Little and Mirrlees, originally prompted by the OECD, was by Dasgupta, Marglin and Sen for UNIDO (Dasgupta et al, 1972).

very strong, perhaps dominant in some places, in the 1950s and 1960s, was replaced during the 1980s, and ruled the roost in the 1990s, by an emphasis on ‘government failure with only a minor role for market failure’<sup>7</sup>. We can restate the latter: ‘there may be some market failures, but governments can do little constructive and the more they try to do, the worse the outcomes’. In macro it was argued that all relevant information was ‘in the markets’ and it was dangerous, for example, to attempt to deflate bubbles, however irrational they might look. For example, speaking to the American Economic Association in 2004, and after the collapse of the dot.com bubble, Alan Greenspan said, “Instead of trying to contain a putative bubble by drastic actions with largely unpredictable consequences...” (Greenspan, 2004). Ten years earlier when addressing Representative Markey’s House Subcommittee he said “Risks in financial markets, including derivatives markets, are being regulated by private parties”... “There is nothing involved in federal regulation per se which makes it superior to market regulation.” Greenspan, during his long tenure from 1987 to 2006 as Chairman of the USA Federal Reserve Board, embodied this dominant perspective and bestrode the landscape of economic policy.

Good policy towards industry, it was argued, consisted of government retreat and de-regulation. Indeed de-regulation was the mantra: ‘the less regulation the better’, ‘how many regulations can we get rid of?’ A discerning policy maker should surely be looking to reduce bad or incoherent regulation whilst allowing for the possibility of more good regulation. Economists should be avoiding slogans and helping to identify the difference between good and bad regulations, and how regulations interact with each other and with economic policies more generally.

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<sup>7</sup> The move coincided with a further shift in the centre of gravity of the academic economics profession from Europe to the USA during that period.

There are good economic arguments for privatising the coal, oil, car and steel industries with little regulation beyond safety, environment and competition.<sup>8</sup> But the privatisation of rail is much less clear cut, and in the UK was a shambles. And industries with strong elements of natural monopoly like electricity require much greater care with regulation than was experienced in the UK (particularly, for example, concerning the regulation and pricing of capacity). De-regulation of electricity in California led to large and damaging market manipulation. The way that the financial sector was de-regulated in the USA, the UK and elsewhere in the 1980s and 1990s has come back to bite us with a vengeance (see, for example, the Report of the High Level Group on Financial Supervision in the European Union chaired by Jacques de Larosière, February 2009). Joe Stiglitz gives a lively and penetrating account of the USA experience of de-regulation in his chapter 'Deregulation run amok' in his 2003 book 'The Roaring Nineties'. And he reminds us (p.89) "The Democrats had always provided a check on the merciless pursuit of deregulation. Now, we joined the group – sometimes pushing things even further than under the Reagan administration".

The analysis of finance is an area where the simplistic assumptions of complete and perfect markets with full information were particularly prominent. Indeed, the pervasive Black-Scholes valuation of options, for example, requires exactly these assumptions. And many of the newly created instruments were welcomed by policymakers: Greenspan again in 2003 to the Senate Banking Committee... "derivatives have been an extraordinarily useful vehicle to transfer risk...". Meanwhile the sophisticated instruments were applied to more and more naïve and correlated bets on the housing markets. Focus on the analysis of technicalities of the specific prices and markets contributed to an absence of questioning of both underlying assumptions and systemic stability. At the time, a long period of growth, relative stability and modest inflation generated a complacency about fundamental macro

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<sup>8</sup> Even in these cases minority ownership may provide a sensible source of public revenue (when compared to the welfare costs of other sources) and royalty taxes on resource extraction may be relevant too.

imbalances: large persistent balance of payments deficits in the USA, for example, funded by large surpluses in some oil-rich countries and in East Asia. These imbalances and the credit they allowed in the USA contributed to the housing bubble and its funding by sophisticated, yet flawed, financial instruments. Thus mistakes in the analysis, combined with a presumption that 'markets know best' on both the micro and macro fronts, led to an inability to see the scale of the potential systematic instability<sup>9</sup>. For an interesting, clear and brief discussion, see my LSE colleague Tim Besley's letter of 22 July to Her Majesty the Queen in response to her, very reasonable, question as to why the economics profession had not foreseen that the credit crunch was on its way.

The damaging consequences of an ideological approach to policy were not confined to macro stability in rich countries, railways in the UK and electricity in California. The World Bank in the 1990s succumbed to the notion that infrastructure was now largely for the private sector, when in most countries it was very difficult to see how the bulk of infrastructure could effectively be supplied in this way (see chapter 12 of Stern, Dethier and Rogers, 2005). Similar propositions were advanced for pensions. One result was a retreat from infrastructure financing and a formulaic approach to the privatisation of pensions (see Barr and Diamond, 2009). The Bank in the 1980s had a strong group on public economics but this was dispersed across the Bank during the 1990s.<sup>10</sup> In my view growth was slowed and individual insecurity amplified in a number of countries.

The consequences of an ideological approach to transition from command to market economies in central and eastern Europe and the former Soviet Union was catastrophic in some countries, particularly in Russia in the 1990s, as I witnessed closely whilst Chief Economist of the EBRD from 1994-1999. The extraordinarily rapid and corrupt privatisation process in Russia led to the destruction of livelihoods and to the insecurity of tens of millions.

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<sup>9</sup> The academic subject of finance looked to be particularly at fault here during this period.

<sup>10</sup> See, for example, the book by Newbery and Stern (1987) and the 2006 review of Bank research led by Angus Deaton.

Age-specific death rates accelerated dramatically and excess mortality in the region (extra deaths relative to those arising from constant age-specific death rates) were probably in the millions in the 1990s. And most of the extra deaths were, it seems, stress-related: accidents, suicide, alcohol, heart disease, strokes, etc.) For valuable discussions of what happened on the demographic front, see Stuckler et al, *Lancet*, January 2009.

For financial deregulation in rich countries, for infrastructure and pension policy in developing countries, and for the process of transition in Eastern Europe and the former Soviet Union, the consequences of failing to apply circumspection and basic economic principles on market imperfections have not been small. Of course, that is not to argue for nationalisation of banks or telecoms or for a very slow dismantling of controls in a planned economy; far from it. What I am saying is that, during the last 25 years, questions which challenged the ideology should have been asked, and relevant analysis pursued, much more strongly<sup>11</sup>. And we should have been using the tools of modern public economics. Thus our questions should have been: ‘how can we use what we know about information, market imperfections, the theory of contracts, the theory of institutions and economic history to make the markets work much better?’<sup>12</sup> The kind of theory I am suggesting is firmly pro-market. On the other hand, it is the ideology that governments always and everywhere serve markets best by leaving them alone that went so badly wrong: this ideology ultimately damages the prospects for markets working well.<sup>13</sup>

The story I have told in this section is one of ideology taking over as an approach to policy during a crucial period when economics had the tools to provide a framework, and a

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<sup>11</sup> Just as there should have been stronger challenges to the planning approaches of the 1950s and 1960s (Peter Bauer was a notable exception at that time).

<sup>12</sup> Interestingly and without prior discussion, Charles Bean argued in his Schumpeter lecture at the same EEA gathering in Barcelona (this issue), from his perspective at the Bank of England, that prior to the crisis we failed to apply this type of analysis.

<sup>13</sup> That outcomes follow from theories was neatly summarised by Helen Bosanquet, writing in the *Economic Journal* in 1920 “It has been said that in the sphere of economics, theory is only the outcome of the economic conditions of the moment; it is quite as true to say that the economic conditions of one day are mainly the outcome of the economic theory of the day before” (p. 308). I am grateful to Tony Atkinson for this reference.

collection of perspectives, to better inform judgments on policy. What happened was that one perspective on policy dominated others.<sup>14</sup> Those who tried to suggest a combination of perspectives and theories were jeered at or dismissed as planners, social engineers, or philosopher-kings.<sup>15</sup> As Isaiah Berlin saw so clearly in political philosophy, we must have a plurality of perspectives. We must articulate each perspective as clearly and logically as we can. And we must form a judgment of how best to combine analyses and perspectives in the context of a considered examination of the circumstances, time and country of their application. Thus my argument is for a collection of principles and approaches, well-informed empirically, and carefully applied to inform judgments of policy, in contrast to a single over-riding simple-minded approach which dominated for a decade or so in our subject, at least in a number of important countries.

### **3. Theories and mechanisms**

The story told so far is of politics, ideology, policies and consequences. It has inevitably been big picture and broad brush. Let me now try to be a little more specific on some of the mechanisms by which the ideological approach came to dominate too much of the discussion of policy. I will illustrate through: specific approaches to modelling; the way we have been teaching; and the 'compartmentalisation of our subject'. I will conclude this section by drawing attention to how some, including my illustrious predecessors as Presidents of the EEA, Tony Atkinson, Roger Guesnerie, Jean-Jacques Laffont, and Agnar Sandmo recognised and called attention at an early stage to the potential problems of ignoring public economics and succumbing to a single dominant approach to policy. Indeed I was struck on looking through the list of 23 past presidents to see that over a half, even on a

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<sup>14</sup> Mrs Thatcher famously invoked TINA, 'there is no alternative'. For much of the 1980s in the UK government this applied to perspectives and ideas as well as to policies.

<sup>15</sup> When planning approaches were predominant in the 1950s and 1960s there was similar jeering the other way.



narrow definition, have written directly in the Meadean tradition of public economics<sup>16</sup>. The phenomenon that I have been identifying whilst dominant was far from universal: but not many past presidents of the EEA have been directly involved in making policy.

By what mechanisms did policy models come to embody such a narrow approach to policy? I focus here first on macroeconomic policy and the use of a representative infinitely-lived optimising consumer with perfect foresight/rational expectations (Lucas, 1977; Prescott, 1986) – representative consumer, for brevity – and second on the efficient markets hypothesis (EMH). It seems obvious to me that to start with the representative consumer model is to embody colossal bias when it comes to policy. As Bob Solow put it, “but in my more pessimistic moments, I think that the only reason to insist on optimising behaviour is to get welfare conclusions that no one believes anyway, the most spectacularly implausible one being that the observed business cycle is really an optimal adjustment to unexpected shocks to technology” (p.152, *Journal of Economic Perspectives*, Vol.14, 2000, pp.151-158).

In this kind of economy with the assumptions of perfect markets and a single or representative consumer, so that there are no distributional issues, there is no serious role for policy.<sup>17</sup> Any revenue that may be necessary, say for a public good serving the many identical consumers, should be raised by a simple lump-sum tax. Apart from this the government has no role to play. But this is not policy by analysis, this is essentially policy by assumption. This has been perhaps the most striking example of how an overall presumption against government action gets embodied in a discussion of a key set of policy issues. I do not speculate on the empirical success of this approach: it has not been an area of research for me. Let me, however, merely quote again from my teacher on macro, Bob Solow, commenting in 1997 on this type of supply-driven analysis in relation to ‘short-run motions of the economy’: “But my view is that this explanation has been an empirical failure, or at best, a non-success” (*AER Papers and Proceedings*, May 1997, p.230). I doubt

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<sup>16</sup> There is no doubt a cohort effect here and the next 23 will probably look somewhat different. And the problems I am describing were more prominent in the USA than in Europe.

<sup>17</sup> In a model with infinite horizons the long-run budget constraint, or optimality efficiency condition associated with ‘transversality’, does have a role to play.

whether the experience of the world's economies over the last two years would lead Bob Solow to change that view. It may well be the case, of course, that alternatives to this supply-side, representative consumer, rational expectations model do not do very well either and make assumptions which are deemed to be 'ad hoc'. That is not my point: my argument is that, once you have made the representative consumer and related assumptions, you have assumed the basic results on policy and then the empirics have only a minor role.

Historically, as someone whose first research was on optimal growth theory, and growth theory more generally, in the late 1960s and early 1970s, I should note that most of us were clear that we were doing planning models. We were concerned with developing general techniques, thinking about sufficient as well as necessary conditions for inter-temporal optimisation and worrying about issues like convexity.<sup>18</sup> Teaching in Oxford, Warwick and LSE in the 1970s and 1980s, I presented techniques of inter-temporal optimisation as part of development planning. I later found that a very simplistic version was appearing, by the early 1980s, as a model of consumer behaviour in macro courses. That might be all fine as a teaching device but what was astounding was that this was being used as a serious model for inter-temporal tax and debt policy.

Simple cases generally make natural starting points for focused theory. They isolate some key issues. They constitute a natural way to proceed. Basic welfare economics, for example, uses the theorems linking competitive equilibrium and Pareto efficiency as a springboard. We can then look at some market imperfections or tax constraints one-by-one. And we can then go on to ask about how interactions between some imperfections make a difference to tax policy. Thus in Diamond and Mirrlees type models, in evaluating the marginal impact of a public good, we have to take into account, in assessing benefits, the effect of an extra unit of the public good on tax revenue via cross-elasticities of demands with other goods that are subject to taxation. A similar phenomenon is important in more

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<sup>18</sup> See, for example, Stern (1972a), where I set out as an appendix to a paper on a growth and planning model, sufficient conditions for optimality (many current applications take only necessary conditions) for a fairly general class of models.

complex models with some fixed prices, where it is the shadow tax revenue that becomes important (some of this type of theory is reflected in the analysis of discounting in section 4 below). This is how we build an analysis of policy. But if we stop at stage one, i.e. the theorems on competitive equilibrium and Pareto efficiency, then there is nothing very interesting to say about tax policy. Everything is determined directly by the basic assumptions: raise all revenue via lump-sum taxation and leave all other prices and markets alone.

No doubt in an inter-temporal world, modelling becomes more complex and we try to keep it as simple as we can. A model with rational expectations and a representative consumer is one natural analytic and pedagogical starting point precisely because it does keep things simple and uses basic theory. But what happened was ‘the simple case for focused learning’ became elevated into the central case for policy. It is in this last step of the process that we were producing something that clearly served a prevailing antipathy to government action and it is hard to avoid the question as to whether the assumptions were made to get specific policy answers as well as to keep things simple.

No doubt some of the macro literature has moved on with now, in some models, more than one type of consumer and missing markets, see for example, Gali et al, (2007). But my point here concerns the type of models being constructed, and their normative indicators, at the times when the ideology was the strongest. And with perfect foresight and infinite horizons, assumptions which are generally retained, many policy results, questionable in their plausibility, follow directly from assumptions.

A second, and more micro, area where policy assumptions flowed directly from assumptions was the efficient markets hypothesis (EMH), particularly as applied to financial markets. The assumption denies both the possibility of irrational<sup>19</sup> bubbles and of market manipulation: all information that is relevant is already embodied in the market. If someone learns something then, via competition and arbitrage, this knowledge is immediately

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<sup>19</sup> It may be rational to participate in short-run forward speculation whilst the ‘bubble music is still playing’, but the bubble phenomenon itself generally has little rational basis over the medium term.

embodied in the relevant prices.<sup>20</sup> With these assumptions there is no need for micro regulation and no need for macro policies on bubbles.

After the experience of the last decade with the collapse of the dot.com bubble, Enron, a huge housing bubble, and the biggest financial crisis since the Great Depression, it is astonishing that an assumption about markets which is so obviously<sup>21</sup> flawed as a generalisation, yet has such powerful implications for policy, should have carried such sway.

We should note, however, that the EMH example of 'getting policy directly from assumptions' is rather different from the representative consumer macro case. No-one would claim that the evidence in favour of a representative consumer was ever overwhelming: it was presented as an abstraction which was good enough for some purposes and then its implications were mistakenly elevated into crucial policy insights. On the other hand, there were many who claimed that the EMH was indeed powerfully supported by the evidence: in 1978, Michael Jensen said "I believe there is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Market Hypothesis" (p.95, *Journal of Financial Economics*, Vol. 6, 1978, pp.95-101). It may well be a good enough theory for some financial markets, in some circumstances, some of the time, particularly if loosely enough defined. But much of policy in financial markets is to guard against times and circumstances when things go badly wrong. How could the evidence ever have been regarded as sufficiently powerful to say that the strong forms of the EMH were so well founded that policy to cover cases when the EMH might go wrong is unnecessary? There were no doubt voices raised against the prevailing dominance of the strong form of the EMH, see for example, Shiller (1981, 2000), but they were largely drowned out.

We cannot regard the experience of the crisis of the last few years as such a long shot that the meteor is most unlikely to strike again. The probability that bubbles burst when they build is high. The probability that there will be crooks and swindlers who wish to take

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<sup>20</sup> As Grossman and Stiglitz (1980) show, this demonstrates the impossibility of the EMH, since no-one would have an incentive to produce or seek out information.

<sup>21</sup> At least in the (strong) form used so often.

advantage of naivety and misfortune and to manipulate firms and markets is not small. Surely basic principles and common sense teach us this? So does economic history: “Extraordinary Popular Delusions and the Madness of Crowds” by Charles Mackay, first published in 1841, covers many examples, including Tulipomania in the 1630s, the South Sea Bubble early in the 1710s and the Mississippi scheme at the end of that decade.<sup>22</sup> His story of bubbles and rip-off artists ranges over the millennium preceding the 19<sup>th</sup> century. He begins his chapter on the Crusades (p.354): “Every age has its peculiar folly; some scheme, project or fantasy into which it plunges, spurred on either by the love of gain, the necessity of excitement, or the mere force of imitation”. He would have been astonished by the efficient markets hypothesis as a basis for policy.<sup>23</sup>

When policy in this area is in large measure to guard against the follies of which Mackay speaks, how could it be that we let the EMH be presented as sufficiently strong to brook little exception? We surely should have known that it could not be that strong and we should have spoken as a profession more strongly on its mis-application. One plausible explanation as to why we did not is a bending to the political winds. In the words of Jeremy Grantham<sup>24</sup> a few months ago, a very successful fund manager who has ridden the storm of the last two years much better than most, “The incredibly inaccurate efficient market theory was believed in totality by many of our financial leaders and believed in part by almost all. It left our economic and governmental establishment sitting by confidently, even as a lethally dangerous combination of asset bubbles, lax controls, pernicious incentives, and wickedly complicated instruments led to our current plight.” (GMO Quarterly Letter, January 2009).

The structure of teaching in the leading universities of the world has changed in ways that have seen public economics and the theory of policy and of reform move down the

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<sup>22</sup> More examples are given in the splendid book by Carmen Reinhart and Ken Rogoff ‘This Time is Different’ (Princeton, 2009), published after this lecture was given.

<sup>23</sup> This is not to say that Mackay would have seen no regulations in the financial markets of the late 20<sup>th</sup> and early 21<sup>st</sup> centuries. But he surely would have been surprised to see some of the arguments for dismantling them.

<sup>24</sup> Jeremy Grantham is a major donor to the London School of Economics and Political Science and funded the establishment of the Grantham Research Institute which I chair.

agenda. It is not easy to plot empirically the pattern of teaching. Course descriptions in the programmes of economics departments are inevitably sketchy and do not give a full story on content. And 20 or 30 years ago, they were not on the internet. An internet trawl of graduate and undergraduate courses of the top 20 economic departments suggests that, with some notable exceptions,<sup>25</sup> the analysis of policy in imperfect economies is some way down the pecking order in both undergraduate and graduate courses. It is usually, if it is available, at best an option (see, Table 1: 'Teaching of Policy in Imperfect Economies'). Our economics undergraduates and graduates can go through their university lives without really studying the basic principles of economic policy in imperfect economics. A number of friends teaching in the USA during the relevant periods have suggested that the rise of game theory (clearly a subject of real value) partially displaced consumer theory and welfare economics. The more ideological approaches of the 1980s and 1990s also went with a lack of emphasis on income distribution at a time when inequality was rising in a number of rich countries. Do not get me wrong; in my view most of what our students do study is valuable. But something crucial is missing.

One feature of our subject that has been developing relentlessly, and with a number of negative consequences for the analysis of public policy, is its compartmentalisation. The consequence is a reduced ability to transfer insights from one area to another and to fail to see crucial relationships. This can lead not only to the kinds of simplistic views on policy that I have described but also to the missing of systemic effects. We may make assumptions that the area we are studying is only weakly related to other things because we want to make abstractions that allow us to focus. Or we may wish to avoid wandering into issues about which we know little. But for the making of policy compartmentalisation can be dangerous. Examples in the next section relate to climate change and discount rates.

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<sup>25</sup> In my view the exceptions are some of the stronger departments – perhaps for this reason they have the confidence to buck popular trends.

**Table 1: Teaching of Policy in Imperfect Economies**

<b>Top 20 Economics Departments<sup>1</sup></b>	<b>Welfare Economics</b>		
	<b>First best covered in core subjects?<sup>2</sup></b>	<b>Policy in imperfect economies covered in core subjects?<sup>3</sup></b>	<b>First best and/or policy in imperfect economies covered in optional subjects<sup>4</sup></b>
<b>Undergraduate courses</b>			
Harvard University	Yes	Yes	Yes
University of Chicago	-	-	-
University of California, Berkeley	Yes	-	Yes
MIT	Yes	Yes	Yes
Princeton University	Yes	Yes	Yes
University of Oxford	Yes	-	Yes
New York University	-	No	Yes
London School of Economics	Yes	Yes	Yes
Stanford University	Yes	No	Yes
Columbia University	Yes	No	Yes
Boston University	Yes	No	Yes
University of Pennsylvania	Yes	No	Yes
University of California, San Diego	-	-	-
Brown University	Yes	-	Yes
Graduate School of Business Columbia	N/A	N/A	N/A
Northwestern University	Yes	Yes	Yes
UCLA	Yes	No	Yes
University of Michigan	Yes	No	Yes
University of Warwick	Yes	Yes*	Yes
Toulouse School of Economics	-	-	-
<b>Graduate courses</b>			
	<b>First best covered in core subjects?<sup>2</sup></b>	<b>Policy in imperfect economies covered in core subjects?<sup>3</sup></b>	<b>First best and/or policy in imperfect economies covered in optional subjects<sup>4</sup></b>
Harvard University	Yes	Yes	Yes
University of Chicago	-	-	-
University of California, Berkeley	Yes	-	Yes
MIT	Yes	Yes	Yes
Princeton University	Yes	Yes	Yes
University of Oxford	Yes	-	Yes
New York University	-	-	No
London School of Economics	Yes	Yes	Yes
Stanford University	Yes	No	Yes
Columbia University	Yes	No	Yes
Boston University	Yes	No	Yes
University of Pennsylvania	Yes	No	Yes
University of California, San Diego	-	-	-
Brown University	Yes	-	Yes
Graduate School of Business Columbia	No	No	Yes
Northwestern University	Yes	No	Yes
UCLA	Yes	No	Yes
University of Michigan	Yes	No	Yes
University of Warwick	Yes	Yes*	Yes
Toulouse School of Economics	Yes	Yes	Yes

<sup>1</sup>Source: <http://ideas.repec.org/top/top.econdept.html>

Information obtained from economics department websites. Only LSE, Harvard, Princeton, Warwick, Boston, MIT and Northwestern University responded to attempts to verify information obtained from their websites. Information was often unavailable due to insufficient information on the website and no response received from attempts to contact the department.

<sup>2</sup>First best: topics include marginal cost pricing, financing through lump-sum transfers, taxing for externalities. Yes indicates that first best topics are covered in core Microeconomics and/or Macroeconomics courses (extent of coverage varies by course, year and lecturer).

<sup>3</sup>Policy in imperfect economies: topics include limits on taxation, optimal indirect taxation, imperfect information, theory of regulation, CBA. Yes indicates that policy in imperfect economies is covered in core Microeconomics and/or Macroeconomics courses (extent of coverage varies by course, year and lecturer). No indicates that, given the information available, it is not covered in core subjects. \*The department indicated that topics have been reduced in recent years.

<sup>4</sup>Optional graduate and undergraduate courses that cover first best and/or policy in imperfect economies (topics may be covered in more than one optional course and extent of coverage varies by course, year and lecturer).

As Atkinson (2009) argues, if you have been brought up on policy in supply-side macro models you may not be sufficiently aware of or attach sufficient weight to what used to be standard in macro policy, automatic stabilisers. These matter greatly in assessing fiscal stance and policy in a recession. A second example he gives concerns pensions policy: the privatisation of state pensions has contributed strongly to the growth of the financial services industry and thus probably to our economic and financial vulnerability in the last few years.

My own experience in a Ministry of Finance (as Head of the Government Economic Service in the UK, 2003-2007) and as someone offering external advice to senior ministers (as Chief Economist of the European Bank for Reconstruction and Development between 1994-1999 and of the World Bank between 2000-2003) taught me the importance, in the making of policy, of judgement in putting together insights from different parts of economics, political economy and politics. But to do this you need both grounding across the key relevant analytical areas and skills in combining them. Although some of the very best graduate students choose to do a range of courses, it would surely be very rare for these 'combination' skills to be covered in graduate courses in economics (and many graduate students remain very specialised). I do not think these skills are impossible to teach. Indeed, at present we are probably losing much from having one set of skills (the intensely formal analysis) being learnt at graduate school and the others, putting insights together, being taught on the job. The greater the 'compartmentalisation' the bigger the problem. If we have both narrow knowledge and are not taught enough about the way different parts of complex systems may interact, we are less likely to develop the necessary judgemental skills and more likely to overlook key effects of relevance to the policy making in question.

The rise of empirical economics, and the focus on the workings of particular institutions and market structures, has been a very positive development in our profession, but may have limited the range of individual economists, since, given the required investment in learning about the relevant institutions and context for the issue being examined, it becomes more difficult to 'dip into' a subject. One way to broaden insight would



be to strengthen our understanding of economic history, but many graduate schools no longer have economic history as a requirement.

If we look back to some of the giants of our profession we see people who straddled many areas of our subject. As such, their judgments were founded on a range of insights and observations. That did not, of course, prevent some of them from doing intense and focused work or from taking very particular and strong positions. My point is that when they discussed policy their views were founded on a broad range of theoretical and empirical experience: examples are Keynes, Meade, Samuelson, Friedman, Modigliani, Tobin and Solow.

In order to explore whether there were disadvantages to compartmentalisation in other subjects, I went back to the person, Bill Saslaw, who had taught me special relativity and quantum mechanics in the senior year of my mathematics degree in Cambridge UK in the 1960s. He gave the following examples, all related to quantum mechanics, of giants of the physics profession who had made great leaps by showing or using links across different areas of enquiry.

The most outstanding is surely Albert Einstein (1879-1955). His Wikipedia entry has sixteen bullet points of ideas and theories of fundamental import and these are just examples. The applications range from the cosmic, astrophysics, to the ultra-micro nuclear physics. The theories include special relativity, general relativity, gravity in relation to distortions of space and time (which led to the idea of an expanding universe), and a definitive proof of the existence of atoms. His range came from his desire to unify and to set out a 'grammar for physics' to use his own words.

Linus Pauling was probably the greatest chemist of the 20th century. He applied quantum mechanics to produce fundamental explanations of a whole range of chemical phenomena, including chemical bonds. He showed the way to investigate the structure of DNA, a path which Watson and Crick followed. He pointed to the chemical nature of some mental illness and the possibility of a genetic element in disease. And he pioneered the

examination of key aspects of the role of vitamins. One basic feature of his work was the taking of a fundamental set of ideas across disciplines, from physics, particularly quantum mechanics, into chemistry.

Richard Feynman (1918-1988) unified quantum theory, special relativity and the theory of radiation. A key element in his approach was the development of simple methods of doing complex calculations. Thus his route across areas of enquiry was via a particular technique. And he had other skills too: as a safe-breaker and lock-picker; juggler; painter; and bongo player.

One could go on, but these illustrations from physics and chemistry show that, in other subjects too, great insights can come from people who can see across their broad discipline, and indeed link with others. In economics great mistakes can come from failing to see across our subject.

There is a tradition, I hope a good one, of Presidents of the EEA reminding the profession of the importance of public economics. I think that the reminder is more important now than it has ever been. In his Presidential lecture in Augsburg in 1989, Tony Atkinson spoke on "Public Economics and the Economic Public". He asked explicitly how we could communicate better to those making policy. He was concerned in particular, and this was his main example, that so much of the making of tax policy was divorced from economic principles. He explicitly did not argue for a single perspective on those principles and emphasised strongly a plurality of objectives. He was also concerned (he was speaking after Mrs Thatcher had been in power for 10 years) of a narrowing of the debate and the elimination of many fora for public discussions. This narrowing of debate went side-by-side with a narrow and formulaic approach to the making of policy.

Agnar Sandmo, the next year in Lisbon, spoke on 'Economists and the Welfare State'. He asked why discussion in economics in Scandinavian countries (Denmark, Norway, Sweden) had shifted so strongly against the welfare state.

"While in the first decades of the post-war period economists as a profession used to be considered as policy activists and spokesmen for a deeper

involvement of government in economic affairs, in recent years their public image has been more coloured by their scepticism with respect to the efficacy of public policies and advocacy of tax reductions and privatisation. I believe myself that there is little doubt that our public image here reflects the underlying reality.”

He offered three reasons but investigated only the first two, leaving the third for speculation.

The first was that the public sector had in fact grown, and arguably there was no further reason to push further growth. Second, that evidence from the experience of a large welfare state, plus changing theories, may have altered the views of the profession. The third is ‘simply that economists are moving with the current of political opinion and providing the arguments that those in power tend to favour’. I have tried to press this argument that Agnar Sandmo only hinted: the intervening two decades have in my view strengthened the grounds for this view. This is not an area where we can establish direction and strength of causation with great confidence. But I do think that the evidence points to this conclusion.

I myself raised related concerns in my Economic Journal survey on development economics published in 1989, where I emphasised the importance in making policy of the balancing of arguments concerning market and government failure.<sup>26</sup> I developed some of these points in my Walras-Pareto lectures given in Lausanne in May 1991 (published only in French as ‘Le Rôle de L’Etat dans le Développement Économique’, Payot, 1992). I suggested in my Marshall lecture in the same conference as Agnar’s Presidential lecture that we may be in danger of forgetting some of these lessons concerning market failure and government failure in our headlong rush to establish the market economy in those countries behind the then just-fallen Berlin wall<sup>27</sup>. This was before I became Chief Economist of the EBRD for the period 1994-99, although I think, on the basis of that experience, that some of the fears I raised in 1991 had foundation.

In his review of these Walras-Pareto lectures in late 1992 in *Le Monde* (3<sup>rd</sup> November) Jean-Jacques Laffont (President of the EEA in 1998), whilst raising concerns

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<sup>26</sup> I was not alone. Joe Stiglitz adopted, also in 1989, a similar approach in his book “The Economic Role of the State” (Stiglitz, 1989).

<sup>27</sup> Just as in the 1950s and 1960s the profession may have placed insufficient emphasis on government failure.

about how much we could expect the state to deliver, argued that modern public economics showed clearly how many issues were not treated well by “une économie de marché laissée à elle-même”. Interestingly he spoke of “l’heure du libéralisme triomphant”. When he died in 2004, we lost one of the finest economists of our generation. He was one of those who strode across our profession from econometrics, to game theory, to public economics, to macro. He was the opposite of compartmentalised.

#### **4. Public economics and climate change<sup>28</sup>**

This is not the place to rehearse the economics of climate change in detail. My purpose here is to link it to the story of public economics I have been trying to tell. Thus, first I will emphasise how the economics of climate change fell into error by ignoring much of the theory of public economics. It went back to the narrowest of starting points, the simple theory of externalities in an otherwise perfect economy, it focused mainly on marginal changes and it did not take the scale of risk sufficiently seriously, and it largely ignored the theory of inter-temporal evaluation that arose from the public economics of the 1960s and 1970s.

The scale of possible damage is fundamental to the whole argument: failing to recognise it was the most fundamental reason why many early studies of the economics of climate change went so badly wrong. Business-as-usual would with probability of around 50% take us to temperature increases of 5°C or higher by the early part of next century. The world has not seen 5°C for 30 million years, we humans have been around for just 100,000-200,000 years. Such temperature change would re-write the physical geography and thus the human geography of the planet. Hundreds of thousands, probably billions, would have to move and there would be extended, severe and global conflict.

Second, climate change illustrates another of my themes which is the danger of compartmentalisation. The principles and practice of policy on climate change should

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<sup>28</sup> For references and further discussion of some of the material of this section, see Stern 2008 and 2009.

incorporate an unusually rich and fascinating blend of the broadest of economics, of science, of politics, history and so on. It is unavoidably on a grand scale, involving as it does both potentially enormous impacts 100 years in the future, and the requirement to look back over millennia to understand the types of phenomenon that could occur and the magnitude of potential risks. Within economics the study of climate change must involve growth and development, international economics, political economy, game theory, research and development, regulation, institutions, economic history and many other major parts of our discipline, as well as the obvious subjects of public economics and environmental economics. I hope that this is clear and will not dwell on it further.

Third, there are very natural links to the topic of the next section, on future possibilities in public economics, which I will flag here and then take up in that section.

The simple Pigovian theory of externalities is a natural starting point for a policy analysis of the damages associated with the emissions of greenhouse gases. Environmental economics has indeed done a great service over the years in emphasising policy based on the taxes or prices associated with the marginal cost of an externality; but it has sometimes done a disservice by implying that this is all that is involved. The economics of climate change has to go way beyond this basic, if important, insight.

Let me illustrate by pointing to the problem of calculating the social marginal cost of an externality in this context. It is important to recognise that an emission of carbon dioxide now increases the concentration of stock of greenhouse gases for a very long period into the future. Thus the social marginal cost will depend very sensitively on: (i) assumed further growth paths of the economy and of emissions, both of which are highly endogenous in the sense that they are strongly influenced by current and future decisions and cannot be seen as an 'external' input into current policy; (ii) distributional values both within and across generations (iii) assumptions on the nature and magnitude of, and presumed attitudes towards, risk and uncertainty. The result is that it is possible to construct a variety of assumptions, all with some plausibility, representing different possible behaviour and

scenarios, that could give a very large range of possibilities for the social marginal cost of emissions. Such calculations can therefore give only a very weak guide to policy. Taxes on, or a price for, emissions will be key elements of policy; but they cannot be the only platform for policy otherwise we would be completely at sea. But it is not simply that the price or tax is so difficult to identify or calculate; there are also fundamental analytical flaws in confining policy formation to this perspective.

Most importantly our choice here is not a marginal one. We are choosing between very different paths of growth or decline that will take us in very different directions. The science tells us that a failure to act on climate change would be likely to wreak serious damage within a few decades and extraordinary destruction towards the end of this century.<sup>29</sup> Prices of greenhouse gases are one feature of an overall strategy: we cannot discuss the appropriate prices without identifying that strategy.

Many of the likely consequences are uncertain and thus public policy is in large measure about risk management. Such analysis must inevitably involve a careful assessment of a range of policy tools, including regulation and standards (see, e.g., Weitzman 1974; Stern 2008).

Further, in trying to implement price or tax-based policies, we must recognise that investment decisions will be shaped by the assumptions of private agents about future tax policy, to which it is impossible for governments to commit. Thus price policy alone could not be credible and would be seen by investors as discouragingly uncertain. That is a major reason why it is important to promote research, development and deployment directly (see Stern Review Chapter 16 and, e.g. Ulph and Ulph, 2009).

There are strong further externalities or market failures associated with learning-by-doing in key areas of implementation; for example, costs of electricity generation for a given technology decrease, often sharply, with collective experience in that technology. Thus the act of investing in new technologies carries strong benefits for others. And there are other

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<sup>29</sup> We are already seeing serious problems from past emissions at temperature increases of around 0.8°C.

market failures too, for example concerning property markets, where it seems difficult to capture through market rents the full value of energy savings resulting from investments in construction of low-energy buildings. This may be an important example of the short-sightedness in decision-making that has received great attention in the literature on psychology and economics (see next section).

All of this points clearly to two conclusions. First, the simple Pigovian tax/price approach is too simplistic. Indeed, I have argued in the Stern Review and the Ely lecture (Stern, 2008) that as a result we will require a strong element of emissions quotas and trading of quotas; the latter can give, relative to taxes, more confidence on quantities, allow for flows between rich and poor countries, and provide a direct route to price determination. No doubt, a combination of tax policies and quotas should be used and, if they are co-ordinated and revised appropriately, could be coherent. But we know enough to be very clear that a simple approach confined to price equals marginal social cost will not be good enough. And an analysis of the complications beyond the emissions externality, including policy credibility and other market failures, points to the importance of, and can help identify, further policies, including for technology. But straddling all this must be a strategic approach to a fundamental non-marginality.

A further range of policies relevant to climate change, which I will reflect on again in the next section, concerns the shaping of preferences. Let me give the example of alcohol and driving. In the 1960s in the UK, when I was a student, laws were introduced (in 1966) limiting the permitted levels of alcohol in the blood while driving. From many there was uproar and the shouts were of limitations of freedom, particularly for the 'working man to go to the pub'. It seems strange to reflect on these attitudes now, when there is surely near-universal recognition that some limit on alcohol and driving makes obvious sense.<sup>30</sup> Attitudes have changed as a result of public discussion, education in schools, experience and evidence. The notion of what is responsible has changed. There are, of course, penalties for

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<sup>30</sup> And I trust that we do, or soon will, take a similar view of sending emails or SMS (text) messages whilst driving.

the offences of drink-driving, these are the economists' sticks and carrots, but they have not been the whole story of public policy. Related public discussions around what is responsible are already taking place on climate change.

The neglect of theories of public economics was particularly marked in the discussion in the climate change literature on discounting. Let me illustrate by the deeply flawed attempt (see e.g. Nordhaus, 2007 and Weitzman, 2007) to 'read off' rates for discounting or inter-temporal values<sup>31</sup> directly from market interest rates: surely an example of the perils of the idea that 'all relevant information is in the market price'.

This attempt has involved a whole series of basic mistakes. First, the scale of impacts from ignoring, or applying weak policy to, climate change is such that future consumption and output levels will depend greatly on decisions on emissions between now and then. In other words, consumption and output, however measured, and thus marginal valuations of goods are highly endogenous to the decisions at hand. Second, there are no markets with relevant interest rates or rates of return for collective decisions over a hundred or more years.<sup>32</sup> Current markets for individuals and firms are generally for far shorter periods.

Third, if we do look at actual long-run rates of interest or return they vary greatly. Indeed for the more secure assets, e.g. long-term government bonds, they are (real) around 1.5%, far lower than many have suggested (5-7%) as 'the market rate' appropriate for discounting. And the discount rates under examination here are those to be applied before allowing for the approach to risk and uncertainty embodied in taking expected utilities (if that is the approach to risk and uncertainty which is followed), thus it is the risk-less rate that is relevant.

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<sup>31</sup> For the moment, in this part of the argument, we do not need to refer to any decomposition of an overall discount rate into a 'pure time discount' rate – meaning that there is discounting purely for the passage of time independent of the circumstances ruling at the time (consumption, environment, etc.) – and a remainder which relates to the circumstances at the given point in time. We return to this issue in Theorem 1 below.

<sup>32</sup> The infinite-horizon 'consols' seem to have been a product of war time and 'patriotic' saving.



Fourth, the approach generally ignores all the distinctions between social and private rates of return, and consumption discount rates versus rates of return on investment, which were rightly so important to the cost-benefit literature of the 1960s and 1970s<sup>33</sup>. The differences between social and private and between consumption and investment are often crucial in economies with externalities, uncertainties and limitations on taxes, i.e. the economies we study.

Fifth, the 'read-it-from-the-market' approach, generally ignores that we are unavoidably in a multi-good framework. Relative prices between environmental and other goods are likely to change sharply. If the environment is deteriorating on key dimensions and for some aspects of consumption we have growth, then discounting with an environmental good as numéraire will give us a negative discount rate, whereas with some consumption good or numéraire the associated discount rate might be positive (assuming utility functions are concave). Recall that, in a cost-benefit framework, the discount rate is the rate of fall of the present value of the numéraire good. If we switch from one numéraire to another, then the difference between the two associated discount rates is the rate of change of the relative price of the two goods. All this should be well known, at least since Malinvaud's seminal *Econometrica* 1953 article on capital theory. This is not a minor wrinkle here but a large element of the whole point.

That is five major common errors and a number of authors make all five of them; I could go on. But I hope I have said enough to illustrate the futility of the 'read-it-from-the-market' approach to discounting when applied to the problem of climate change. It was very striking to see the extent to which the lessons of public economics were forgotten; but I suspect that in some cases it was not forgetting but 'never knowing'. This lack of knowledge

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<sup>33</sup> See, for example Little and Mirrlees (1969 and 1974), Dasgupta, Marglin and Sen (1972), and Stern (1972b).

of our subject comes, in part, from its compartmentalisation. Many of those who built the 'Integrated Assessment Models' appeared to know little about public economics.<sup>34</sup>

Let me finish this section with three theorems; I suppose a Presidential address should have at least one theorem. The purpose is to show that many of our standard approaches are useful, as starting points and in the posing of questions. The theorems will be framed in a way that also provides a link with the next section on ways forward in public economics. The theorems will be set out in simple language and the proofs referenced or sketched. It is straightforward to make them more formal.

The first theorem clarifies the relationship between inter-temporal values and the probability distribution of the damages from climate change in shaping assessments of damages from climate change. The first part of theorem 1 takes a given strategy or future path, and the second part a given set of values (terms are defined immediately after stating the theorem). For a more formal statement see Box 1, p20, Stern 2008.

Theorem 1: (i) For any specification of probability distributions of future damages, there is a set of pure-time discount factors which makes the expectation of the inter-temporal integral of discounted damages less than any given number. In other words we can make (expected total discounted) damages as small as we please by choosing sufficiently heavy pure-time discounting.

(ii) For any given set of pure-time discount factors, there is a probability distribution of damages, which makes the expectation of the inter-temporal integral of discounted damages larger than any given number. Thus, we can make (expected total discounted) damages as large as we please with a sufficiently severe set of damages.

'Pure-time discounting' refers to discounting purely for the passage of time between  $0$  and  $t$  and is unrelated to circumstances (consumption, environment, etc.) ruling at time  $t$ . The 'total integral of damages' is the difference between the expectation of a utility integral in the presence of climate change (resulting from some given structure of policies) and a reference expectation of a utility integral where there is no climate change (with the same policies): in other words it measures how much welfare has been lowered by climate change (for marginal changes it would be the expected present value of the damages).

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<sup>34</sup> And those who knew something of public economics, such as Bill Nordhaus and Martin Weitzman, appeared at key points to overlook some of the key basics of discounting in distorted economies.

The point being made here is that any calculation of damages will be determined by the interaction of inter-temporal values and the scale of damages. We must take great care with each. They both matter. We can, by assumption, make either one dominate the calculation. I emphasise this because some earlier discussions focussed on the idea that the story is all about discounting or all about 'weight in the tails' of damages (see Nordhaus, 2007 or Weitzman, 2007).

A key mistake of much of the earlier work on the economics of climate change was to discount far too heavily by using overall discount rates of 5 or 6% derived unquestioningly from markets<sup>35</sup>, essentially making the mistakes just described, whilst at the same time choosing ludicrously small damage functions. For example, a 5°C temperature increase from pre-industrial times was deemed in many models to imply a loss of less than 5% of GDP (or even 1 or 2%, see, for example, Toll (2002), Mendelsohn et al, (1998) and Stern (2007) chapter 6). Nordhaus' model has temperature rising by an astonishing 19°C before the loss reaches 50% of GDP (see, for example, Ackerman et al, 2009). At 19°C the human race would very likely be extinct.

Thus it is crystal clear why much of the earlier work on this subject produced what now seem to be ridiculously small losses from business-as-usual and thus were taken to imply that the economics of climate change pointed to only modest policy action. Such work grossly underestimated the scale of damages and risk. Further, and partly as a result of the mistake of underestimating damages, it chose discount rates that were far too high in relation to the future outcomes to which they were applied. Indeed if we will be poorer as a result of climate change, there is a case for negative discounting (this is clearly a different issue from pure-time discounting): this simply refers to the idea that someone who is worse

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<sup>35</sup> Or where a separation into pure-time discounting and the remainder was made a pure-time discount rate of 2% was suggested (Weitzman 2007). This seems very high – a life lived in a given way, with the *same* consumption patterns, 50 years from now would have only 37% of the value of a life lived in the same way now. It represents a very strong discrimination by date of birth which many would regard as ethically peculiar and unacceptable.

off may be taken as having a higher marginal utility of income than someone who is better off.

The apparent sophistication of the Integrated Assessment Models counted for little. The results were clearly naïve in the assumptions about damages; naïve in relation to the science. For those outside economics, the profession appeared to be producing completely implausible answers. Sometimes the perception by non-economists of the implausibility of conclusions in economics flows from an inability to understand (or lack of clear explanation of) sound economic reasoning. In this case, the perception of implausibility came from common sense and the smell of implausible assumptions.

Theorem 2: In a two-person economy which is otherwise perfect, but which has an externality, a Pigovian tax can support a Pareto-efficient outcome; if the individual generating the externality regards some of the loss to others arising from the externality as diminishing her own utility then the appropriate tax will be lower.

Intuitively, if I care about my impact on others then, to that extent, I will reduce an activity which damages them; as a result there is less work for a tax to do or need for policy more generally.<sup>36</sup> If the externality is fully 'internalised' a tax is unnecessary: if I do not want to upset or damage others by smoking near to them, then policy to stop my smoking inside a restaurant will be unnecessary (of course, with many different types of people, the story becomes more complex).

A key implication of the theorem is to show that there is a public policy role, along the lines of John Stuart Mill, for public discussion (see Stern et al, 2005 chapter 9 for further argument and references). The more that people take on board damages to others, through discussion and information, and worry about them directly, the less the need for other public policy actions. This public discussion of what is responsible behaviour is an important

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<sup>36</sup> A formal argument can be constructed as follows. Consider a Pareto-efficient outcome at utility levels  $U_1^*$  and  $U_2^*$  where  $U_1$  and  $U_2$  are the utility functions of individual 1 and 2 and where there is an externality from individual 1 to individual 2. A Pigovian tax representing the marginal damage from 1 on 2 can support a competitive equilibrium which decentralises this outcome. If  $U_1$  is replaced by  $U_1 + \epsilon U_2$  where  $\epsilon$  is sufficiently small, then the same allocation will still be Pareto efficient (an increase in  $U_2$  from  $U_2^*$  must reduce  $U_1$  from  $U_1^*$  and will therefore also reduce  $U_1 + \epsilon U_2$  from  $U_1^* + \epsilon U_2^*$  if  $\epsilon$  is sufficiently small). The Pigovian tax is thus reduced as the first individual takes some account of (specifically  $\epsilon$  times) the marginal damage and the necessary Pigovian tax goes down by that amount.

element of policy. And such discussion will inform us not only about the consequences of our actions but help us to understand what we think about our own rights and responsibilities.

Theorem 3: If the climate change externality falls on future generations in the form of a deteriorated environment, and each generation cares only about its own consumption, then the current generation can shift the balance of its legacy from standard goods (e.g., capital or infrastructure) towards environmental goods and improve the welfare of future generations, without making the current generation worse off.

This is really an inter-temporal version of the standard Pareto efficiency theorem on externalities. This theorem will have a direct analogy in the next section, where we will refer to public policy to improve the welfare of an individual when his behaviour is inherently short-sighted – for example, he is being unkind to his future self by drinking or smoking ‘too much’.

All of these theorems show the power of our standard approach to public economics, provided we build in enough of the problem at hand to make policy analysis interesting. And if we do so we point directly to further policy questions; and usually we cannot make good policy without taking on these questions. On the other hand, if we force the problem into a narrow, perhaps familiar and tractable form, for example the simplest version of the Pigovian tax, we risk losing sight of the issues and pointing to bad policies. Let us make use of the fertile range of theories and perspectives our subject has generated.

The advance of our subject in the last 20 years outside public economics now offers us the chance not only to remember our public economics but to take it into a new and fascinating era. That is the subject of the next section, where we raise issues outside the standard Meade or Bergson-Samuelson framework and beyond the standard political economy approach. Most of them have strong relevance to climate change.

## **5. Recasting Theories of Policy**<sup>37</sup>

The last twenty years has seen great progress in our subject, many elements of which have strong implications for understanding public policy. They include: behavioural

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<sup>37</sup> I am particularly grateful to Doug Bernheim, Tim Besley, Angus Deaton, Peter Diamond, Greg Fischer, Alan Kirman and Matthew Rabin for discussions of this section.

economics; theories of justice, freedom and empowerment; institutions and game theory. I will focus mainly on the first two but the last two are, quite rightly, all pervasive and will have an increasingly profound influence on public economics. And so will other subjects such as theories of information and search, and endogenous growth theory. I will merely illustrate some future lines of enquiry by discussing the first two of these, with only occasional mention of the other two.

Theories of behavioural economics have recently begun to embrace the challenge of their relationship with policy. A key step has been that analyses of behavioural economics have moved beyond the demonstration of the manifest inconsistencies and instabilities of real choices and have been asking how what people actually do can be understood in terms of their objectives or motivations. This allows us to ask about the appropriate relationships between these objectives and motivations and public policy.

Recent work has shown that there is strong explanatory power in models where shorter-term considerations, instincts or motives dominate longer-term goal-orientated approaches. In the language used by Loewenstein and O'Donoghue (2004), people can be seen as behaving as if there are 'deliberative processes' that make assessments from a goal-orientated perspective, and 'affective processes' that are more emotionally driven. We can all recognise in the latter our weaknesses for instant gratification and the extra piece of cake or glass of wine right now.

Then in looking at policy one might give a superior status to the deliberative process and suggest that policy should be framed in a way that encourages people to move closer to the associated choices. We should not rush to adjudicate unambiguously in favour of the deliberative process. Indeed I might object if someone physically stopped me opening the second bottle. To insist that the deliberative process is superior might be seen by some people (in some circumstances) as paternalistic, arrogant, arbitrary or judgemental. And to enforce it could understandably be seen as trespassing on freedom. But, if someone I respected simply asked whether it was a good idea, or could not find the corkscrew, I might

not object too readily and would be grateful in the morning. Ideas of 'nudge' and 'libertarian paternalism', for example, Thaler and Sunstein (2003) and (2008), and others are at work here. There are many examples concerned with inter-temporal allocations, hyperbolic discounting, and the setting of default options for pension plans.

It is clear, however, that to make progress on policy in analyses that have as models of behaviour unstable, inconsistent, endogenous or changing preferences, then assumptions concerning which of the preferences are fundamental, underlying, superior or appropriate in some sense, or what weights to use in an averaging process across preferences, are very likely to be part of the story. An alternative, of which more later, is to ignore all of the 'preferences' and look to other perspectives. Making assumptions about weights on, or ranking of, sets of preferences will inevitably have an element of arbitrariness. Nevertheless, this is, I think, one fruitful way to proceed: indeed in many circumstances it seems to be unavoidable. And many would go further and welcome legislation to require the wearing of crash helmets on motor cycles, to add fluoride to water, to restrain the advertising of tobacco and to have compulsory health insurance or savings plans. The sensitivity in our profession to charges of 'paternalism' seems to me be grossly overdone. These new theories give us an opportunity to be more explicit, transparent and analytical in discussing policy on these issues.

If we follow the route of shorter-term and longer-term preferences, there are some striking similarities with theorem 2 above. If we act in a way that damages our future selves, then that is analogous to ignoring an externality affecting future generations: indeed the formal argument is essentially identical. The language of 'internality' is sometimes used to capture this idea. In such a case there would be an action (or policy) which makes the short-term short-sighted self no worse off and improves the welfare of the future self. For example,

by smoking less and buying myself a lot more entertainment, I might be better off now and leave my future self better off, albeit with less money but with better health.<sup>38</sup>

A second route to behavioural public economics is that set out in the splendid Schumpeter lecture to the EEA last year by Doug Bernheim, drawing on his work with Antonio Rangel. He provides a very clear and valuable overview of the issues. Further, he argued that provided actual choices had some consistency to them, regardless of the underlying processes generating the choices, then we could base analyses on Pareto improvements defined relative to the actual choices. And we could retain the theorem that a competitive equilibrium was Pareto efficient. The consistency assumption is essentially acyclicity. Thus if  $X$  is chosen over  $Y$ , there is no circumstance that  $Y$  would be chosen if  $X$  were available. This implies that, at the prices of a competitive equilibrium,  $X$  must be more expensive than  $Y$ . This is enough to establish that a competitive equilibrium is Pareto efficient.<sup>39</sup> A stronger assumption would be the weak axiom of revealed preference (WARP). However, as we know from utility and preference theory, WARP is close (we need to add continuity of preferences) to assuming that there exists an underlying function the maximisation of which generates the preferences. And much of the empirical work shows that many choices violate WARP. Thus, the results using the acyclicity, or consistency, assumption provide valuable insights and the approach provides a useful benchmark. It is limited however, because, as Bernheim emphasises, the consistency assumption is often violated too. The cases where 'consistency of choice' applies but standard preference theory does not are likely to be fairly narrow.

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<sup>38</sup> Henry Sidgwick (1907, pp418-9) identified clearly the tension between short-run gratification and the future self "Grant that the Ego is merely a system of coherent phenomena, that the permanent identical 'I' is not a fact but a fiction, as Hume and his followers maintain; why, then, should one part of the series of feelings into which the Ego is resolved be concerned with another part of the same series, any more than with other series?". I am grateful to Alan Kirman for this reference.

<sup>39</sup> Under this consistency assumption a Pareto improving allocation must cost more at the prices associated with the competitive equilibrium; therefore, if it is feasible, producers could not have been producing the most valuable bundle, thus contradicting the assumptions of profit maximisation. Note that we do not need WARP to get this result; acyclicity, or the consistency assumptions, is enough.



A third route, however is to drop preferences, or actual choices, altogether. That is what Amartya Sen essentially does in his capability approach, developed over 20 years or so, and in his new book 'The Idea of Justice' (2009). Thus we ask about improvements (analogous to the reform versus optimality approach in public economics) and characterise them by the augmentation of capabilities or of empowerment, or by the removal of obvious injustices, like discrimination. Thus we do not go for Rousseau or Rawls in terms of defining just systems. We merely ask, "Can we make reasonably clear statements in some circumstances about a decrease in injustice or an increase in empowerment?" We can only ever expect statements analogous to partial orderings but on many key subjects such as education, health, or rights, we can say a great deal from this approach. Thus it does seem fruitful to me. I tried in my 2005 book 'Growth and Empowerment' in Chapter 9 to explore related ideas using the language of empowerment (Sen primarily uses the language of capability). Under these approaches we focus on what people are able to do rather than on what they actually do.<sup>40</sup>

Let me illustrate with two examples concerning constructive change by communities (taken from chapter 9 of Stern et al, 2005). Two men returned to a Moroccan village in the High Atlas Mountains, after some years working in cities. They helped organise collective construction of a well. Trust was built in the process and a collaborative approach emerged; a development association was formed. An access road was built, an ambulance bought and a school for girls was constructed. By the second year attendance at the school was 90%, and the success continued. These were processes involving knowledge, preferences and the spirit of collaboration. After a while people were behaving very differently from the beginning. The capabilities of many had been clearly enhanced. Most villagers were clear that there were major improvements but, at the start, many would have explicitly

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<sup>40</sup> The relevant objectives for policy action thus may be characterised by a different range of factors from those that determine behaviour and thus constraints on policy. This is in sharp contrast to the standard social welfare function (SWF) approach where individual utility functions both enter the SWF and determine behaviour.

disapproved of action to educate girls and would have gained little pleasure from the advancement of others.

A second example comes from anti-AIDS efforts in Sonagachi, a red-light district in Kolkata. An earlier policy by social workers had focused on trying to get women to leave the sex industry. It was unsuccessful as alternative options were limited, given the stigma from the previous activity, and the relatively high earnings from the sex industry. A new strategy was much more successful. A small group of sex workers were trained to educate their colleagues. These workers wore green medical coats, organised public events, and formed a union. Now almost all sex workers use condoms some of the time. The HIV incidence in Sonagachi was around 6% in 1999 compared with to 50% in corresponding areas in Mumbai. Building trust and working together changed the opportunities and capabilities for individuals; they felt empowered.

I have given the example of public discussion and policy yielding fundamental changes in attitudes to drinking and driving earlier in this lecture. There are many others and they are not minor or peripheral. They cover huge areas of public policy. We should therefore as a profession focus our attention more closely on investigating the logic of these behaviours, policies and public actions.

It is striking how quickly some of these ideas are translated into prominent political discussion. We are, in the UK, gearing up for an election in the first part of next year (i.e. 2010). Parties are looking for guiding principles and coherent philosophies. The Conservative Party, led by David Cameron, has embraced the ideas of 'nudge' from Thaler, Sunstein and others. Some parts of 'New Labour' (e.g., James Purnell) are focusing on Sen's work on capabilities and arguing that we should see issues of equity and re-distribution much more broadly than simply in terms of wealth. Others on the left of the Labour Party argue, in my view mistakenly (as a matter of logic, not necessarily policy), that empowerment is mostly about wealth and income. They slip quickly into the suggestion that this is a zero-sum game, and that the discussion of empowerment inevitably takes us to the

redistribution of assets.<sup>41</sup> The ideas that I have raised in this section are playing through into public discussion; they would benefit greatly from the still stronger involvement of the economics profession.

I have focused on how just two of the newer areas of theory can lead to a very fruitful contribution to public economics and public policy in action. There are many more. To go back to climate change, we have to see decision-making as building an international coalition; this is crucial. The stakes are huge, i.e. the future of the planet, and time is short. There is no time for many repeats of a bargaining game. We have to create an agreement that is effective (delivers reductions in emissions on the scale necessary), is efficient (keeps costs as low as possible) and is equitable. We will not be able to build and maintain agreement unless these three criteria are satisfied.

We have to recognise the great sense of injustice felt by developing countries. They will have to overcome poverty through low-carbon growth and development, whereas rich countries went the high-carbon route and 'filled the atmosphere' to close to capacity. There is an analogy with the 'ultimatum game'. A proposition from rich countries will not be accepted, if it is deemed to be unjust, even though as a result all will be worse off. The solution has to be collaboration. We have to work together to find mechanisms that are seen to be just. In my book, 'A Blueprint for a Safer Planet' ('The Global Deal' in the USA), without going into the game-theoretic issues in any detail, I discuss what might determine perceptions of justice and propose a global deal which might be seen as effective, efficient and equitable.

I am convinced that public economics has a rich and productive future of real relevance to policy making, particularly if we integrate the very productive developments across a broad range of our subject into public economics.

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<sup>41</sup> Some aspects of the empowerment of an individual or group may indeed damage others and reduce their empowerment such as the formation of gangs. But my ability to read does not necessarily diminish your empowerment and may well increase both yours and mine.

## **6. Concluding Remarks**

If we remember what we know, and apply a whole range of perspectives to the making of public policy, our subject can make a very powerful and constructive contribution to the making of policy. Without our involvement, or with our involvement only in a narrow and formulaic way, policy-making will be worse. I have argued that we have performed less well than we should as an economics profession by neglecting a very strong and clear perspective, one that I have called the Meadean public economics of imperfect economies. We would do badly if we confined ourselves only to that perspective, but we have done badly by downplaying or forgetting that perspective. That neglect contributed to the damaging consequences which arose from a blinkered and ideological approach that said 'de-regulate, get the government out; markets work well, everything relevant is in the prices, governments invariably make things worse'. There is no doubt that government failure is of profound importance and must be analysed alongside market failure. But we should never forget the importance of market failure as a key indicator for public action.

The economics of climate change, I argued, has been a crucial example of failing to go beyond the simplest case of externality; much of the early literature ignored the broader Meadean approach in its treatment of other externalities and of discounting. And fundamentally it failed to take on board the magnitude and basic non-marginality of this issue. The standard Pigovian analysis provides a constructive beginning but we must go way beyond this on climate change and take on board the analysis of changes which are highly non-marginal and the many other relevant market failures. And in thinking about the inter-temporal evaluations which are crucial to policy assessment, we have to remember all the problems and failures involved in inter-temporal markets. Indeed, there are so many that we have to go back to basic principles and ethics to think about inter-temporal valuations.

Finally, I have tried to argue that the very productive last two decades in our subject have created exciting and important opportunities for a revitalised public economics. It will have to go beyond simple maximising models of individual decisions and embrace

behavioural economics. It will have to go beyond simple social welfare functions and embrace theories of justice, empowerment, rights and responsibilities. And it will have to put game theory, growth theory, institutional economics and many other areas of our subject to good use. But in many parts of this fascinating and productive story, whilst we are only beginning, we are on our way.

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