Econometric Contributions to Public Policy

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Introduction

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I ECONOMETRICS

Econometrics, as an organised discipline within the wider field of economics, has not yet celebrated its fiftieth anniversary: the Econometric Society was established at the end of 1930 and its journal *Econometrica* began publication in 1933. The aim of the Society, as stated in its constitution, is to advance economic theory in its relation to statistics and mathematics. The meaning of this phrase was elaborated by the editor, Ragnar Frisch, in the first issue of *Econometrica*. He pointed out that 'Experience has shown that each of these three view-points, that of statistics, economic theory, and mathematics, is a necessary, but not by itself a sufficient, condition for a real understanding of the quantitative relations in modern economic life. It is the *unification* of all three that is powerful. And it is this unification that constitutes econometrics.'

A similar point of view was expressed by the Evaluative Committee for Econometrica (Paul Samuelson, chairman, Tjalling Koopmans and the present writer) whose report was published in *Econometrica* for April 1954. This committee was concerned with the kind of journal that *Econometrica* should be, its size and the kind of editorial organisation it should have. As a prelude to making recommendations on these issues the committee defined econometrics as 'the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference.' The committee went on to suggest that 'editorial policy should be aimed even more, and by additional means, at increasing the proportion of space devoted to empirical studies meeting a high standard of quality and relevance.'

I have not made a detailed study of the matter but, from reading econometric journals and from attending econometric meetings, my impression is that econometrics proper, in the sense of Frisch and the Evaluative Committee, has not been gaining ground. Indeed, I should say that thirty or forty years ago, given all the limitations of the period, it stood higher in relation to theoretical and methodological contributions than it does today. I am not

very clear why this should be so. Is it because in a young and growing subject theoretical and methodological issues inevitably loom large: what can you really do until you have solved them? Or is it because of some quirk in our educational institutions which tend to laud the pure and to denigrate the applied? However this may be, it is nothing new. As Marshall said in a letter to Edgeworth at the beginning of this century: 'The key-note of my *Plea* is that the work of the economist is "to disentangle the interwoven effects of complex causes"; and that for this, general reasoning is essential, but a wide and thorough study of facts is equally essential, and that a combination of the two sides of the work is *alone* economics *proper*. Economic theory is, in my opinion as mischievous an imposter when it claims to be economics *proper* as is mere crude unanalysed history. Six of ye one, ½ dozen of ye other!'

II THE IDEAS BEHIND THE CONFERENCE

It was largely the desire to promote a discussion of the application of econometric techniques to problems of practical importance that led to the decision to hold a conference on econometric contributions to public policy. There was, however, a second strand of thought which helped to determine the topics to be included, namely a wish not to restrict the discussion to traditional areas such as consumers' behaviour or models of the economy, where one can perhaps talk of experience and achievement, but to deal also with newer fields such as optimal taxation or environmental and social questions where, in the absence of much experience, one can talk only of promise. In this way we hoped to provide some indication of the strengths, limitations, achievements and potentialities of econometrics when applied to the problems of the world we live in.

In a single week it is clearly impossible to cover all possible fields of the application of econometric techniques. The papers included in the final programme and, therefore, in this volume, can be grouped under three broad headings: econometric models and economic policy; income distribution, welfare and taxation; and regional, environmental and social policy. This grouping is followed here although it does not accord with the precise order in which the papers were presented at the conference.

III ECONOMETRIC MODELS AND ECONOMIC POLICY

The first paper I shall consider under this heading was given by Professor Malinvaud, the President of our Association. It dealt with three examples of issues which had arisen in France in the early 1970s in connection with prices and incomes policy. These were all issues requiring decision and raised a

question which recurred at other points in the course of the conference, namely how far it had proved possible to make economic relationships sufficiently precise and quantitative to provide a basis for practical advice to policy makers. In each case Professor Malinvaud discussed the uses and limitations of econometric methods and showed that, in general, some formalisation was needed to indicate which variables had to be measured and which parameters estimated. He also brought out the interaction between the adviser and the policy-maker; understandably, advice correct on economic grounds might not be followed for political or other reasons.

Professor Ashenfelter's paper was mainly concerned with the effect of unionisation on relative wages for several industrial, occupational and race-sex groups in the United States. Again, the need was shown for careful theorising before statistical measurement could usefully proceed; and it provided an example of the contribution of econometrics to public policy through the testing of hypotheses.

In the discussion of these papers a general feeling was expressed that, as regards inflation and the question of regulating prices and incomes, the absence of a generally accepted theoretical framework was a much more serious obstacle to the formulation of a satisfactory policy than the absence of attempts at econometric estimation.

The remaining papers in this section provide four contrasting examples of achievement in large-scale econometric modelling.

Professor Aukrust described the development of the MODIS series of models which have been used since 1960 in Norway for planning purposes. From the outset, MODIS has been highly disaggregated on the production side but, though it has tended to become somewhat more complex through time, it still has a comparatively simple structure with a large number of exogenous variables. Great efforts have been made to render it easy to use, for instance by presenting the results in the familiar form of the national accounts, until by now it has become fully integrated into the administration.

A somewhat different kind of planning model was presented by Dr Barker, who described the latest developments of the model built by the Cambridge Growth Project, work on which also started around 1960. It, too, had gone through several stages but, until recently, had been of the medium-term, static type. The new version was dynamic in form, designed to estimate the values of the 2500 or so endogenous variables through the projection period. This version, in contrast with its static counterpart, requires that more attention be given to relationships, such as stock-building equations, which mainly contribute transient components to the movements of other variables. The new model, which was barely operational at the time of the Conference, has since gone into a

second version and shortly, it is hoped, will go into a third embodying Tinbergen's 'targets and instruments' approach to economic control which formed a feature of the final development of the static model.

The remaining two papers in this section described attempts to model econometrically the international linkages between national macroeconomic models. There was a general feeling that, for the present, these models offered little as a direct guide to policy, but it must be said that they are no more ahead of their time now than were national models two decades ago.

Mr Lee Samuelson described a model concerned with OECD short-term economic prospects which was designed to simulate the interaction of the OECD countries, linking them together with the non-OECD area through international trade flows. This model has two main aims: to ensure the consistency of initially independent national projections; and to model the international transmission of fluctuations.

The model of foreign trade described by Professor Nyhus forms part of a system of models being developed at the University of Maryland under the general title of INFORUM. The original model in this system relates to the United States but recently work has been proceeding on similar models for a number of other countries. In principle the trade model draws estimates of imports and domestic prices from individual country models and, in turn, produces forecasts of exports and world prices for use in the country models. The model distinguishes 119 commodity groups and nine developed countries plus a tenth 'country', the rest of the world; and it is based on annual data for the period 1962–72. Professor Nyhus described the methods used to project export shares and carried out simulations with the model on alternative assumptions about foreign exchange rates. The whole model system is not yet operational since many of the country models have not yet been completed.

IV INCOME DISTRIBUTION, WELFARE AND TAXATION

The second set of six papers deals with various aspects of welfare economics. What is nowadays regarded as the 'old' welfare economics, with its unwillingness to make interpersonal comparisons, is being strongly challenged by new lines of research directly concerned with issues of equity and inequality. At the present time, efforts are being made to base calculations on the concept of optimal taxation, an idea which not so very long ago formed a small and largely neglected part of economic theory. Cost-benefit analysis, which attempts an evaluation of schemes and projects more comprehensive than can be obtained from records directly expressible in money terms, has come a long way since its inception, which might be traced back to the American Flood Control Act of 1936.

Dr Muellbauer's paper on the distributional aspects of price comparisons attempted to express the distribution of income in real rather than in money terms. On this basis he compared the price structures of Britain, Hungary and the United States and found that, for consumers with British tastes, the British price structure was more egalitarian than either the American or the Hungarian. Dr Muellbauer also analysed inequality in Britain with the aid of a social welfare function which enabled his measure of welfare to be decomposed into the product of three terms representing the level of average income, the price structure and an index of inequality. Thus the conclusions come to depend on the subjective weight to be attached to the inequality component.

Professor Boskin provided a survey of recent literature on the theory of taxation, more specifically on optimal income and commodity taxes. The aim of these theories is to derive rules which a tax system should follow in order in some sense to maximise social welfare. These rules depend on several key parameters, such as price and income elasticities of demand, the elasticity of labour supply with respect to the wage rate and the elasticity of saving with respect to the rate of interest. The econometric evidence available on the magnitude of these elasticities throws doubt on several propositions of conventional wisdom and has implications for a number of aspects of tax policy.

After linking contemporary writings in the field to the pioneering papers of such writers as Dupuit, Ramsey and Colson, Professor Bronsard developed the theory of optimal commodity taxes with a view to making econometric estimates. This he did with the help of data on consumers' expenditure in Canada divided into eight broad categories. The ad valorem tolls (a concept more extended than that of taxes) vary, according to these calculations, from –19 per cent in the case of food to 50 per cent in the case of rent and recreation. No doubt these results would be modified if it were possible to work with a finer disaggregation of consumers' goods and services.

We now leave the subject of optimal taxation and come to quite a different aspect of welfare economics. In their paper on policies to improve the income distribution in Iran, Dr Pesaran and Mr Gahvary endeavoured to show how economic growth is related to the distribution of income. Their object in doing this was to indicate policies to increase equality which could be incorporated in the country's development plans without unduly jeopardising its potential for economic growth. The authors were able to offer some suggestions on this question while recognising that their study was of a preliminary nature because of imperfections in the data and a lack of earlier studies of factors affecting the distribution of income in Iran.

The last two papers in this section are devoted to cost-benefit analysis. Dr Dasgupta discussed methods of project appraisal, paying particular attention to the stages of the work and the information required at each stage.

Much of this information is more or less objective: data on household consumption patterns; a listing of instruments available to the government; a statement of information flows within the planning system. But it is not necessarily available or easy to obtain. The remaining information is more or less subjective, consisting above all of a formulation of the government's utility function but including, too, an assessment of the limitations on the use of instruments which the government considers acceptable. In spite of these rather heavy requirements, the literature on project appraisal suggests that in a number of cases it is possible to gain considerable insight with data which are either available or can be collected without too much difficulty. But whether or not these insights will in fact lead to improvements in policy depends to a large extent on the capacity of politicians and administrators to communicate with their economic advisers.

Professor Dorfman reviewed the evolution of cost-benefit analysis since its inception in the United States forty years ago. In its original application to the appraisal of flood-control projects, the criterion that 'the benefits to whomsoever they may accrue are in excess of the estimated costs' sounds simple and, indeed, many such calculations have been made. But the evaluation becomes more difficult if the purpose served by the project is not wholly or mainly economic, if the appraisers are explicitly required to take account of environmental considerations and if it is recognised that different groups in society are likely to have different and in many cases conflicting attitudes to the project. In these circumstances either the notion of what is measurable must be stretched out of all recognition or the simple benefit-cost ratio must be demoted from its position as the sole criterion for acceptance or rejection. There was a good deal of agreement with Professor Dorfman's view that the aim of summarising the total effects of a project in a single number was basically mistaken.

V REGIONAL, ENVIRONMENTAL AND SOCIAL POLICY

In this final section, papers were presented on regional policy and urban planning, environmental issues, the evaluation of applied social research and social programmes and the recent history of internal migration in Japan. Despite differences of terminology, methods of analysis and viewpoint, a considerable amount of common ground emerged in the course of the discussions.

In its original form the French Plan had no regional dimension and this was introduced only partially in the 1960s. In 1972 work was started on a regional-national model, REGINA. This model became operational in 1975 and the first quantitative results were available for the second stage of the preparatory

work on the VIIth Plan. In his paper Professor Courbis described the characteristics and structure of the model and presented the first results obtained from using it.

Professor Lombardini's paper on econometric methods in regional and urban planning is largely theoretical in character. He sought to clarify the role of econometric analysis in this context and to give reasons for his opinion that equilibrium models are not well adapted to spatial analysis. In this area, perhaps more than in most others, it is necessary for the decision-maker and the model-builder to work closely together, and what is wanted is a model which would: (a) bring out the various assumptions about national and world develop-ments; and (b) facilitate calculations of the consequences of trying to bring about any particular structure. Professor Lombardini set out models which he thought would be suitable for these purposes.

In their paper on the optimal allocation of economic activities under environmental constraints in the Frankfurt Metropolitan Area, Professor Thoss and Mr Wiik provided an example of the contribution of econometrics to the best ways of dealing with water pollution. Apart from the possibility of prohibiting the use of certain processes, it is usually possible, at a cost, to treat pollutants. Thus the question arises: how far should we engage in treatment and by what means in order that the supply of regular goods and services on the one hand and the cleanliness of the environment on the other should most nearly meet the wishes of the community? If the model has a regional dimension, as in the present case, there is also the possibility of relocating certain activities since the opportunity costs of hitting targets may vary from region to region. From their programming model the authors were able to derive many results of value to policy makers.

Dr Ayres began his paper by pointing out the departures from optimality that arise in the world we live in because most markets are not free and competitive, many services, such as environmental services, are not priced and externalities are fairly common. In these circumstances it is desirable to measure the welfare losses involved and, since it is clearly difficult to do this in monetary units, it seemed worth exploring the possibilities of physical measures, for instance 'second law' energy efficiency. As was pointed out in the discussion the suitability of this measure depended on the availability of energy being the sole limiting factor for the economy. Dr Ayres then went on to discuss the problems of measuring energy balances and of setting up stock-flow matrices for physical materials and forms of energy of a kind that would be needed in a System of Environmental Statistics such as is now being designed under the auspices of the United Nations.

Dr Abt's paper is concerned with the evaluation of the applied social

research and social programmes undertaken by the American government in the past decade. Although a great deal has been written on the subject, it is clearly very difficult to carry out cost-benefit analyses in these areas. In spite of this, Dr Abt managed to reach some tentative conclusions. For instance: the benefit-cost ratios of social programmes as a whole in different social fields are highly variable, but on the whole greater than one; applied social research seems likely to be extremely profitable, though it would be possible to be more certain about this if it had been practicable to study individual programmes within social fields; it appears that a field may be over-researched as well as under-researched.

The last paper in this section was given by Professor Shishido and dealt with recent internal migration patterns in Japan and their implications for social policy. Since the mid-1950s at any rate there has been a persistent migration from predominantly rural areas to the main metropolitan centres. In recent years migration patterns have changed, some of the migrants returning to the region from which they came and others spilling over into less densely populated areas closer to the metropolitan centres. With the wealth of demographic statistics available in Japan, it is possible to trace, year by year, not only the regional population stocks but also the interregional flows which, together with births, deaths and international migratory movements account for the difference between the opening and closing stocks. From these stock-flow matrices transition proportions can be calculated and, as we have seen, these proportions have recently been changing. By pooling the data and using regression methods it is possible to try to account for these changes and it turns out that this can be done in a highly satisfactory way which has a number of implications for social and regional development policies.

VI SOME LESSONS OF THE CONFERENCE

By way of conclusion I shall try to draw some general lessons from the discussions that took place at the Conference. Most of the issues mentioned were discussed explicitly though a few were only implicit in the papers that were presented.

(a) *Facts and theories.* It is the essence of econometrics that facts and theories are combined by suitable methods of inference. It does not, therefore, matter from which pole we take off provided that subsequently we are prepared to go backwards and forwards between the two.

(b) *Causality and association.* It would be nice to think that the behavioural relationships in econometric models could always be given a causal interpretation. Unfortunately this is not the case; frequently they reflect only associa-

tions present in a particular data set. This may not matter if the relevant structure does not change, since in that case the associations may be expected to persist. Otherwise, relationships based on associations may be extremely misleading.

(c) *'Traditional' and 'controversial' relationships.* One reason for treating certain variables as exogenous is that the relationships that could be used to make them endogenous are 'controversial'. By contrast, some other relationships are 'traditional', that is generally accepted and therefore 'safe'. This distinction must be viewed with some care, as is illustrated by the general acceptance of various systems of demand equations all of which, being based on additive preferences, imply a rigid and, in general, implausible connection between income and price elasticities.

(d) *Stochastic modelling.* Econometric equations contain disturbance terms but forecasts made with them are almost always deterministic, being based only on the systematic components of these equations. Stochastic modelling is now attracting some attention and in the future it may prove as important in economics as it has shown itself to be in epidemiology.

(e) *Forecasts and structural analysis.* It is sometimes suggested that the main purpose of building econometric models is to enable forecasts to be made. This use was amply illustrated at the Conference and no one would wish to deny its importance. It is, however, difficult largely because of uncertainties about the future which are particularly marked in unsettled periods when economic variables respond to changing non-economic factors which are rarely included in econometric models. It should be remembered, therefore, that for policy purposes much insight can often be gained from structural analysis, that is the estimation of the consequences of hypothetical changes when they have been allowed to work their way through the system. This use was also illustrated at the Conference.

(f) *The weak links.* Econometric modelling depends on data, economic theory and methods of estimation and inference. The most frequently mentioned weak link was traceable to the unsatisfactory state of certain branches of economic theory which encouraged model builders *faute de mieux* to treat as exogenous variables which ought to be treated as endogenous.

(g) *Non-economic factors.* Changes in social and political attitudes, increased emphasis on equity, concern for the environment and the growing importance of non-market activities introduce new features in many branches of econometric modelling. An attempt was made to take some account of these developments in the formulation of the programme.

(h) *Difficulties of communication.* If econometrics is to contribute to public
policy, econometricians, administrators and politicians must learn to work
together. Typically, members of the three groups bring very different attitudes
and experience to the common task. As a consequence there is in many
countries at the present time a serious difficulty of communication. In this
connection the effort made by the model builders in Norway to make their
model as easy as possible for the non-specialist to understand and use is of
general interest. The problem, being rooted in educational formations, is likely
to be with us for some time to come and all efforts to shorten this period are
much to be welcomed.

It can fairly be said that the Conference came up to the expectations of
those who had initiated it and confirmed the fact that econometrics, although
it has a vast programme ahead of it, has also substantial contributions to public
policy to its credit.

Part One

Econometric Models and Economic Policy

1 Some Problems of Prices and Incomes Policy in France[1]

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INTRODUCTION

When econometrics first emerged in the inter-war period, one of its earliest concerns was to help improve economic policy. Now, almost fifty years later, econometricians can take pride in the success of their subject, which no economist worthy of the name can overlook today. But they have to admit that the impact of their work upon the conduct of economic policy is still somewhat limited. This is one of the reasons why the programme of this conference is of such particular interest.

Like most econometricians, I am anxious to form a clear picture in my own mind of what exactly we contribute to the preparation of economic policy. I have always worked in the French civil service or at its fringes, and for three years I was policy adviser to the Minister of the Economy and Finance. Consequently, my view of the subject under discussion rests upon a wealth of examples. Before taking up particular questions of prices and incomes policy, I should like to outline very briefly the general conclusions to which I have been led.

I ECONOMETRICIANS, ECONOMISTS AND POLITICIANS

The contribution of econometricians to policy-making can be evaluated only in the broader context of the contribution of economists generally. These, to be sure, play only a limited part in the determination of economic policy; their recommendations, however, nearly always rest upon the results of certain econometric studies.

Neither public opinion nor politicians are very receptive to the views of economists. It would be wrong to imagine that Ministers are always waiting

[1] Translation by Elizabeth Henderson.

for the economists' advice before taking any particular decision, let alone following that advice. At best, such a recommendation is only one among several elements considered at the moment when a decision is taken, as will be quite clear from the three examples I propose to discuss.

But this state of affairs need not cause undue concern. As time goes on, politicians and economists learn from each other. The same sort of advice proffered in the same sort of situations eventually makes its mark. The con- sequences of past decisions are, of course, hard to identify objectively, but there are cases in which they are clear enough and subsequent decisions may then be more soundly based. Observing current business conditions an eco- nomist may indeed be glad sometimes that his previous advice has not been followed, for it may have rested upon an inaccurate prediction of certain important factors.

What matters ultimately is that economic science should prove itself reason- ably relevant to impending policy decisions, that those who have to take such decisions should know it and solicit the views of economists fairly regularly, and that public opinion in its turn should become increasingly aware of the economic aspects of current problems.

When economists are asked to give advice, they can seldom do so without reference to econometric studies. There was a time when an economist called upon to advise the government could feel he had done his duty with a qualita- tive explanation of the effects of the price mechanism, that is, of the recipro- cal relations between the system of prices and the system of quantities produced, consumed or exchanged with other countries (and even then a con- scientious economist should have consulted econometric studies to make sure that the prevailing situation was not one of those paradoxical cases which theory has shown to be possible). This will no longer do. Nowadays an econo- mist is often expected to produce quantitative answers, or he may be consulted about phenomena subject to conflicting influences of which econometrics alone can assess the relative strength. In my personal experience I have found few examples in which no quantification at all was necessary.

For each of the broad sectors of economic policy the problem to be dis- cussed at the present conference seems to me to involve two questions, namely

(1) Does economic science correctly understand the relevant phenomena and know their causal factors?
(2) Does econometrics quantify the effects of these factors with sufficient precision for economists to be able to give sensible advice?

It is to the second of these questions that I shall address myself more particul- arly in this paper. But the first must not be passed over in silence, except in fields where the answer is clearly in the affirmative — in fields, that is, where

we have a theory commanding unanimous acceptance (e.g. regarding the role of public finance in stimulating an economy suffering temporarily from serious underemployment and not subject to any risk of inflation).

But since I am to discuss prices and incomes policy, I find myself in one of those rather unfortunate fields where any economic theory we can apply is either desperately negative, or else quite unrefined.

The most contested aspect of neoclassical theory is its implications for income distribution. The relative shares of wages and profits are supposed to result from (1) the long-term trend of capital accumulation per unit of labour, (2) the nature of technical progress, and (3) the elasticity of substitution be- tween capital and labour. Changes in the wage structure are supposed to derive from shifts in the relative scarcities of different skills. There is little scope, then, for any quick-acting economic policy. But the opponents of this theory have no fully worked-out alternative theory to put in its place, except in so far as they uphold Marxism in its most unsophisticated form, where only political power has any influence on the distribution of incomes.

When it comes to inflation, the quantity theory of money is even more controversial. This theory denies any effectiveness at all to direct action upon prices and incomes, and attributes omnipotence to indirect control via regula- tion of the money supply. Most economists nowadays take the view that direct government action does have a part to play, by accelerating or retarding certain developments and by altering the public's expectations, which are increasingly regarded as of prime importance. But this approach, which has its implications for incomes policy too, is not as yet integrated into a fully explicit and generally accepted theory.

It is against this background, and in the light of my own personal experience, that I propose to discuss three examples, all of them real cases that I encoun- tered in the years 1972 to 1974. For each of them, I shall begin with a brief historical sketch describing how the problem arose, what part was played by economists, and what decision was taken. I shall then outline my view of the underlying economic analysis, and finally examine the state of pertinent eco- nometric knowledge, together with its relevance to decision-making.

II REDUCTION OF INDIRECT TAXES AND CONTROL OF INFLATION

In 1972 the French government were thinking, reasonably enough, of reducing the rate of value-added tax (VAT). There were three main reasons for this. First, indirect taxes in France are heavy in comparison with direct ones, and it has long been established policy to move steadily, though slowly, towards substituting direct for indirect taxation. Secondly, VAT rates in France were very high, and would sooner or later have to be reduced in the course of fiscal

harmonisation in the European Economic Community. Thirdly, the French budget had a permanent bias towards surplus, since revenue from income tax was growing rapidly, and the Minister of the Economy and Finance felt it was inconvenient to have a budget surplus which weakened his position in refusing to sanction new government expenditure of a kind he regarded as unjustified.

The only question was exactly when to cut the VAT rates. The Minister's advisers knew that such a reduction might be a useful means of slowing down the pace of the then incipient price rise. Nevertheless they concluded, in October 1972, that the moment was not right for a cut in VAT rates to result in a lasting check to inflation. The pressure of demand was strong at the time, and any tax cut would give a further boost to demand, so that, even though costs would come down, prices would in the end rise even faster. The argument was that the first thing to do was to reduce global demand, and to cut VAT rates later, when it would become evident that the strain had eased.

This was the advice given to the Minister of the Economy and Finance. Nevertheless the government decided, in November, to cut VAT rates sharply as of 1 January 1973. I do not know what line of thought led to this decision; maybe the government had its eye on the parliamentary elections due in March 1973, or maybe they felt intuitively that our economic argument was too complicated and hence probably wrong. One day, perhaps, we shall be able to say which of these two interpretations is correct.

The way things went in the economy during the first half of 1973 fully vindicated our advice. Both foreign and domestic demand was even more buoyant than we had expected, and, once the purely mechanical effect of the VAT reduction had worn off, the pace of consumer price rises gathered speed: prices went up by 4·1 per cent from June to December 1972, and by 5·1 per cent during the same months of 1973.

But upon what precise economic analysis, and upon what econometric data, had we drawn for our recommendation? Did we have convincing evidence?

In any attempt to explain the rate of price increase, the formulations of modern economic theory are very close to those of econometrics. This is a case where theory seems to have followed rather than preceded econometric investigations. [2]

Current formulations make use of three main notions, namely

[2] The latter were obviously derived from prior theoretical considerations concerning the law of supply and demand. Similarly, future econometric work will no doubt be refined in the light of the now plentiful literature on the micro-economic foundations of macro-economic laws. The fact remains that econometrics has had a dominating influence on the macro-economic theory of inflation.

(a) costs, which, while following a partly autonomous course, are, via wages, also subject to induced effects of previous price rises

(b) the pressure of demand on the markets for goods and labour, which is partly autonomous and partly induced by variations in real wages

(c) lags connected both with the fact that price and wage changes are costly or inconvenient and with the formation of expectations which govern economic behaviour.

By way of example, equations (1) and (2) represent a view fairly generally held nowadays:

$$g_{pt} = P(L)g_{wt} + z_{pt} + \pi(d_t) \tag{1}$$

$$g_{wt} = W(L)g_{pt} + z_{wt} + \varphi(u_t) \tag{2}$$

where g_{pt} and g_{wt} are the rates of price and wage rises in period t; d_t is the pressure of demand for goods and u_t the unemployment rate, taken to be a measure of the slack on the labour market; z_{pt} and z_{wt} measure the effects of autonomous factors influencing costs and wages; and P(L) and W(L) express the time lags between g_{wt} and its effect on g_{pt} and between g_{pt} and its effect on g_{wt}.[3] The function π, which expresses the influence of the pressure of demand for goods upon price rises is increasing, and the function φ, relating to the influence of unemployment upon wage rises, is decreasing. The two equations (1) and (2) do not constitute a complete model for our purposes, since they do not make clear how d_t and u_t depend upon g_{pt} and g_{wt} with certain distributed lags; this would obviously have to be done in a complete theoretical formulation, but would lead me too far here.[4]

A reduction of indirect taxes causes z_{pt} to assume negative values for one, two or three months. The direct effect on g_{pt} is immediately apparent from equation (1). But the slow-down in the price rise raises the purchasing power of wages, which means an increase in d_t and consequently a diminution of u_t. Opposite indirect effects come into play in equation (1) both through the last term π and via the intermediary of g_{wt}, which itself is influenced by φ.

Our recommendation in October 1972 was based on the view that these indirect effects were large when the pressure of demand was initially strong (d_t high and u_t low), and that they were small in the contrary case. This means we believed the functions π and φ to be non-linear. In a situation of already buoyant demand, it seemed to us that a temporary increase in real incomes was likely to set off a cumulative process of price rises, which would be

[3] The mathematical economist recognises L as the lagging operator ($Lx_t = x_{t-1}$) and can easily find explicit solutions to equations (1) and (2) once P(L) and W(L) are specified as rational functions of L.

[4] I intend to do so on another occasion.

explosive and would eventually require very strong restrictive action. Contrariwise, we felt that if demand were reduced first, any price rises induced by an increase in purchasing power would be fairly slight and quickly absorbed.

Do existing econometric estimations prove that this is so? I think they do, though I have not explored this question fully and systematically.

We can, in the first place, turn to the work done on the rate of wage and price rises. The many studies which grew out of interest in the Phillips relation, that is equation (2), have shown that the derivative of the function φ is high in absolute value for low values of u_t, but low for high values of u_t. This fact is built into the specification by expressing φ as proportional sometimes to $1/u_t$, sometimes to log u_t, and sometimes to an expression containing magnitudes in non-linear relation with u_t, e.g. the ratio of applications for jobs to vacancies.[5] Existing estimations for the price equation, that is, equation (1), do not all assign a part to the pressure of demand and, when they do, the influence is rather weaker, so that the nature of the function π does not seem to me to be well established as yet.

Then there are macroeconometric models for a number of countries. With their help we can simulate policies very close to the one we were advocating in the autumn of 1972 and to the one adopted. Admittedly, some of these models, especially the earliest to be constructed, allow little room for the pressure of demand and do not make it clear just why this pressure matters. But other models yield results entirely in line with our expectations. For instance, the model constructed for the Netherlands and presented by P. de Wolff,[6] implies that an increase in global demand has a very considerable effect on consumer prices in the case of strong pressure of demand on the markets for goods and labour, but only a negligible effect in the case where the pressure of demand is slack.

III THE NATIONAL MINIMUM WAGE

The French government has for some years been working towards a gradual increase in the wages of the low-paid, with the aim of narrowing the differential between wages at the top and at the bottom of the scale. This can be done in a fairly direct way for those employed by government or public corporations. In the private sector, reference to public-sector wages may exert some influence, and so may the knowledge of a declared and oft-repeated political

[5] Studies for France have shown that the best indicator was the logarithm of this ratio. See D. Déruelle, 'Hausse à court terme du salaire nominal. Tension du marché du travail et mouvements des prix et du SMIC', Revue économique, May 1975.

[6] P. de Wolff, 'Macro-Economic Forecasting', in Forecasting on a Scientific Basis, Lisbon, Centro de Economia e Finanças, 1967 (especially p. 333).

intention. But the chief instrument remains the so-called SMIC, salaire minimum interprofessionel de croissance, for short, national minimum wage, which is fixed by the government and sets a legal minimum for hourly wage rates.

Every year in June, when the main decision is due,[7] the government's advisers have to think about the size of SMIC increase that they should recommend. Economists, in particular, are expected to say to what extent any SMIC rise will have repercussions on wages above the minimum as well as on consumer prices, for such repercussions clearly do exist.

When I had to give an opinion on this matter, I felt uneasy for two reasons. On the one hand, the government had carefully refrained from giving any guidance as to how we should arbitrate between the two declared purposes of raising low wages and containing inflation, and I felt ill-qualified to judge. On the other hand, as I shall explain presently, we knew little about how to evaluate the short-term and the long-term effects on wages as a whole and on prices. In the circumstances, all I felt I could do was to draft a few rather inconclusive notes in which I put forward some rough estimates of the short-term repercussions of alternative rates of SMIC increase. I made it clear that my estimates were uncertain. In each of the three years when I had to give an opinion, the government decided to raise the SMIC more than I expected. I may have misjudged the relative importance attached by the government to raising low wages and to checking inflation; or the Ministers may have thought that their economic experts were overestimating the repercussions on the whole system of wages and prices.

But why was our knowledge so uncertain in this matter?

As regards long-term effects, our first temptation was to say that if a national minimum wage were fixed in the absence of other measures to affect the determination of wages and prices, and indeed more generally the whole structure of the economy, this could not bring about any lasting change in wage differentials. With the 'market forces', or the 'power relationships',[8] otherwise remaining as they were, the respective positions of the various categories would soon be restored after a more or less sizeable rise in prices.

Unquestionably, this view is much more realistic than the belief that the wage structure established immediately after a SMIC increase will outlive its introduction for any length of time. Yet I feel it is not necessarily altogether correct; even if it is, it may be of less consequence than one might think.

First of all, one cannot dismiss out of hand the idea that income distribution depends to some extent upon social norms and conventions somewhat

[7] Automatic increases are triggered off in the course of the year by the rise in the consumer price index.

[8] Economists are free to choose whatever expression fits in best with their ideology.

different from those which would result solely from economic factors, including the effects of monopoly and domination. The fact that wage differentials are wider in Southern than in Northern Europe must surely be due to different social attitudes which are not wholly explainable by economic reasons, except perhaps by reference to a very distant past. To raise the national minimum wage in France may well be a means of altering social norms.

Secondly, even if only economic factors matter in the long run, in the medium-run government action to benefit the low-paid may accelerate a process which in any case is inevitable. In France, the early seventies have without doubt ushered in a new era in which the most highly skilled workers will command a much lower scarcity premium than in the past. Immigration is falling off fast, partly because many new workers are entering the labour force and partly because social reactions against foreigners are setting in, and this is bound to put a premium on manual labour, which is relatively low-paid in France. Government policy thus merely anticipates a development due to take place in any event.

At least in the medium run SMIC increases must have an effect on wage differentials. But who would presume to quantify this effect? When it comes to evaluating the short-term effects, the experts are not quite so helpless. The model set out in the preceding section may again serve as a reference for the average wage rate and the general level of prices. Whereas a tax reduction was previously shown to correspond to a diminution of z_{pt}, now a rise in the national minimum wage will show up in the model as an increase in z_{wt}. The reasoning in the present case is analogous to that outlined earlier, and it must take account of the pressure of demand.

But even to evaluate the short-term effects, it is necessary to know by how much a SMIC increase will raise z_{wt}. And since we are dealing with an effect on wage differentials, we have to disaggregate the analysis and consider wage rates at different levels of skill.

By way of example, let us take a simple case. Consider the two equations below, fitted to French quarterly data:

$$g_1 = 0.3\,g_p + 1.4\,v \tag{3}$$

$$g_2 = 0.2\,g_p + 0.3\,z + 0.6\,v \tag{4}$$

where g_1 and g_2 are the rates of increase in wages for the most highly skilled men and for the least skilled women, respectively; z is the rate of SMIC increase; and v equals 10^{-2} times the logarithm of the ratio of applications for jobs to vacancies.[9]

[9] The results, rounded but significant, are taken from D. Dénuelle, op. cit., p. 382.

Equations (4) and (3) tell us that a SMIC increase has an immediate and very noticeable effect on the average wage of women in the least skilled category, but no immediate effect at all on the average wage of highly skilled men. Since the second of these wages is almost twice as high as the first, a SMIC increase has the immediate effect of narrowing the wage differential.

But equations (3) and (4) also suggest that after a few quarters the effect may well become much weaker. An increase in the wages at the bottom of the scale pushes up costs and boosts demand for goods, which means that the two variables g_p and v increase. Since both variables appear in equation (3) with higher coefficients than in equation (4), the indirect effect must be that the wages of highly skilled men go up faster than those of unskilled women.

One could try, of course, to calculate all the direct and indirect effects in a model which, in addition to equations of the type (3) and (4) for all categories of workers, contained also equations relating to the determination of prices and to the pressure of demand. But even with such a model one can hardly hope for more than mediocre precision, since inaccuracies in estimation (and especially specification errors) will greatly affect the results, some of which are differences: thus the narrowing of the wage differential is measured by $g_1 - g_2$.

While, therefore, we do possess a relevant econometric method as well as estimations enabling it to be applied, we cannot really hope to follow the effects of a SMIC increase beyond the first two or three quarters.

IV A LEVY TO CHECK INFLATIONARY BEHAVIOUR

In June 1974, when, after the election of President Giscard d'Estaing, the new government had to make up its mind about an economic policy to combat inflation, it put in hand, among other projects, a study of a novel tax, reputedly the invention of J. Sérisé, one of the President's advisers. The principle was simple: since inflation consists of unduly fast price rises, the thing to do is to penalise firms in which such rises have their origin. The disincentive effect of these penalties would alter the behaviour of firms in the direction of moderation.

In practice, the proposed levy was to apply to the increase in value added per unit of input employed. According to the simplest version then under consideration, the levy, T, would be

$$T = t\,V_0 \left[\frac{V_1}{V_0} - g\,\frac{f_1}{f_0} \right] \tag{5}$$

to the extent that this quantity was positive. In the formula, t is the percentage rate of levy, V_1 is value added during the period under consideration and V_0 value added during the preceding period, f_1 and f_0 are the quantities of

factors employed in the two periods, and g is the limit up to which the law considers an increase in the rate of money rewards admissible (e.g., if g = 1·15, penalisation sets in when value added per factor unit has risen more than 15 per cent).[10]

During the summer of 1974, a special commission and the advisers of the Minister of the Economy and Finance studied the host of problems connected with the proposed new levy: evaluation of V and f, selection of the base period, choice of g and t, the revenue to be expected from the new levy, and so on and so forth.[11] In my view this work was successful in so far as it (a) defined and explained the nature of the proposed levy, and (b) enabled us to put together for September a draft bill free at least of the crudest blunders that might have been committed in such a case of improvisation.

We took care to point out that, since the levy was to be calculated with reference to a base period necessarily having different characteristics for different firms, it was bound to be inequitable in a certain number of cases. The levy must be regarded only as an exceptional measure warranted by an emergency. This is why the law laid down that the levy was to be discontinued as soon as the rise in the price of manufactures stopped exceeding 1·5 per cent during three successive months.[12] In practice the law, which was to take effect with respect to the results of 1975 compared with those of 1974, was never applied at all, since price rises started slowing down in the winter of 1974/75.[13]

While we were busy studying the project all through the summer of 1974, nobody made any serious attempt to analyse just how the new levy was to achieve its purpose, namely, to slow down inflation. It was not until the end of September, when we had passed the project on to the parliamentary experts, that we devoted some attention to this matter. Perhaps I should be

[10] A similar idea was behind a tax proposed and studied in the United States by H. C. Wallich and S. Weintraub (see in particular H. C. Wallich and S. Weintraub, 'A Tax-based Income Policy', *Journal of Economic Issues*, June 1971). The suggestion was to increase the rate of the corporate income tax when the average wage paid by the corporation to its employees had grown by more than a national norm issued by the government.

[11] As a point of interest, I should mention that there were very few data from which to work out for any past year what would have been the direct incidence of the levy, had it existed. We had to compare, for each separate firm and for two successive years, both value added and the quantity of factors (labour and capital) employed. Then we had to look at the statistical distribution of magnitudes such as (5). We can say without exaggeration that our statistical studies on this occasion were 'a contribution of econometrics to public policy'.

[12] To mark the exceptional nature of the arrangement, it was deliberately called not a tax, but an 'anti-inflation levy on excessive increases in margins'.

[13] However, the levy is to be reactivated if prices again rise by 2 per cent for three months in succession.

ashamed of this, but then perhaps I need not be. We felt that the government were committed too far to this patently innovatory project to abandon it now, and we also realised that our economic analysis would be neither conclusive nor easy to explain, and so we just did what seemed most urgent.

Be that as it may, our economic analysis on this occasion was of some interest, because it showed that econometrics is ill-equipped to answer certain questions when economic theory itself is uncertain. Let us take a closer look at our problem.

Little needs to be said here about two aspects of the levy. First, it is conceivable that the coefficient g, fixed by law, be taken as a guideline which firms would follow as a matter of public spirit. The levy would then never have to be collected, since its very existence would express a generally accepted policy for controlling the growth of factor rewards. Whether or not the levy can really be expected to play this role is a matter for sociological analysis; for our part we assumed that it would not be so. Secondly, to the extent that the levy was paid, it would make inroads into the financial resources of firms, just like, say, a tax on corporate profits. The macroeconomic effect of this can be studied by well-known methods, which I need not discuss here. The argument will proceed on the assumption that the levy would be wholly offset by a reduction of other tax rates.

By hypothesis, the new levy was to act as an incentive for firms to be moderate in raising their prices, in other words, to keep down the wage increases and the widening of profit margins, both of w, ich lead to higher prices. We needed to know what such reactions would depend on. It was obviously no use relying on the competitive model in which prices and wages are the result of market equilibrium and are imposed upon firms acting as price takers. We had to turn to the theories of monopolistic competition, which, as we know, lack rigorous foundation.[14] For want of anything better, I proposed the following model.[15]

A 'representative firm' produces the quantity Y of goods with a quantity L

[14] See J.-J. Laffont and G. Laroque, 'Existence d'un équilibre général de concurrence imparfaite: une introduction', *Econometrica*, March 1976.

[15] The model is more integrated than the one used by P. Isard in his discussion of the Wallich–Weintraub proposal (see 'The Effectiveness of Using the Tax System to Curb Inflationary Collective Bargains: An Analysis of the Wallich–Weintraub Plan', *Journal of Political Economy*, May–June 1973). P. Isard considers successively the determination of prices and that of wages without taking their interdependence into account. The conclusions reached are, however, qualitatively similar to the ones proposed here, including the statement that it is difficult to set up a satisfactory theory for a complete analysis of the problem. I draw the same conclusion from a somewhat different attempt by Y. Kotowitz and R. Portes in 'The Tax on Wage Increases: A Theoretical Analysis', *Journal of Public Economics*, May 1974.

of labour. For the sake of simplicity, let us suppose that in the short run output depends on no other factor (which means, among other things, that capital is given for the period under consideration). Output is a function only of the amount of labour employed:

$$Y = f(L) \quad f' > 0 \quad f'' < 0 \qquad (6)$$

Two money variables depend upon the firm's decisions, namely, the price p of the product and the unit cost w of the labour employed. With the above simplifications, value added V equals receipts pY.

But Y is linked to p by a demand function for the product, and L to w by a labour supply function. Again, to keep the analysis simple, let us suppose that these two functions have constant elasticities $1/\alpha$ and $1/\beta$:

$$p = aY^{-\alpha} \qquad w = bL^{\beta} \qquad (7)$$

The second equation need not be interpreted as a labour supply function. Alternatively, it may represent the choice open to the firm in its wage negotiation: either to accept a high w or to run the risk of labour unrest which will reduce L.

Given the equations (6) and (7), the firm has only one independent decision variable, for instance L. The effect of the levy is the more favourable the more strongly it causes L to be revised downward, and with it w and Y. The firm would then have to worry less about finding outlets and could keep the price p higher.

The last point is paradoxical, but it applies only in a partial equilibrium analysis where the demand function for the product is assumed fixed. If firms cut the wages they pay, the demand functions will shift downward and prices will fall. This must surely be the dynamics of disinflation.

Before the new levy, profit

$$pY - wL = aY^{1-\alpha} - bL^{1+\beta} \qquad (8)$$

was maximised by the value of L as a solution of

$$(1-\alpha)pf'(L) = (1+\beta)w \qquad (9)$$

Applied in the context of our model, the expression for the levy T becomes

$$T = tpY - tgV_0\left(\frac{nL}{L_0} + m\right) \qquad (10)$$

to the extent that the right-hand side is positive (otherwise T = 0). In this expression n is the share of labour in the calculation of the factor index f_1/f_0 and m is the share of the complementary factors. In trying to find out how

the introduction of the levy alters the value of L, we limit ourselves here to the case where the optimal decision leads to a positive T. The value of L is then the solution of

$$(1 - t)(1 - \alpha)pf'(L) = (1 + \beta)w - tgw_0 \qquad (11)$$

(remembering that $nV_0 = w_0L_0$).

Comparing (9) and (11), we see that with the levy the equilibrium value of the left-hand side in (11) is higher, by $t[(1 + \beta)w - gw_0]$, than the equilibrium value without the levy. The levy does in fact depress both the demand for labour, L, and the wage rate, w. On closer examination we see that the relative fall in w is the larger,

(a) the higher is the tax rate t,
(b) the higher is the ratio w/gw_0 between the chosen wage and the wage resulting from the application of the legal norm,
(c) the lower is the elasticity of labour supply, $1/\beta$,
(d) the lower is the elasticity of the marginal productivity of labour.[16]

In spite of the well-known limitations of an argument based on the case of a representative firm, the four above conclusions are interesting. The first two could easily have been imagined, but the last two are less obvious. However, the model here discussed is really rather inadequate as a basis for quantification.

First of all, it merely explores the initial effect at the level of the firm, to wit, a fall in labour input and output, a slow-down of wage rises and an acceleration of price rises. It remains to place this initial effect in its macroeconomic context and to determine its consequences. We could, of course, again go back to equations (1) and (2), where we would see that z_w falls and z_p rises, while the rate of unemployment rises and the effect on d_t remains ambiguous.[17] We could even state that the fall in z_w will be larger than the increase in z_p, in so far as the labour supply available to a firm must in general be distinctly less elastic than the demand for its products.[18] All in all, after a brief transition period, inflation is bound to slow down. But to put numerical values on this

[16] The wage reduction δw is determined approximately by the formula
$$\frac{\delta w}{w} = \frac{-\beta t}{1-t} \cdot \frac{1 + \beta - gw_0/w}{(1+\beta)H}$$
where H is the absolute value of the elasticity (with respect to L) of the marginal productivity of labour.
[17] The lagging operator L in equations (1)–(2) must not be confused with the quantity of labour, also L, in the present model.
[18] The model in fact implies approximately that