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MEDIUM-TERM ANALYSIS OF FISCAL POLICY IN IRELAND: A MACROECONOMETRIC STUDY OF THE PERIOD   1967-1980

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and MARK WYNNE

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GENERAL SUMMARY

The decade of the 1970s was characterised by fluctuations in the world economy of a kind which had not been experienced in peacetime since the 1930s. Even with the wisest and most prudent fiscal and monetary policies it would have been impossible to protect the Irish economy fully from the world-wide recession. Our objective in this paper is to investigate what effect fiscal policies had on the evolution of the Irish economy over the period 1967 to 1980 and, with the benefit of hindsight, to attempt to formulate a judgement as to the manner in which fiscal policy was planned and executed. The "hindsight" from which we benefit has two major components: first our access to data which are at once more detailed and accurate than those available to successive Ministers of Finance at the time when they planned their budget strategies and second our use of a formal model of how the various sectors and agents in the economy interact with each other and evolve over time. While the first component (more accurate data) is an unqualified benefit, the second component (the model) is much more controversial since there is no absolute consensus in the economics profession on broad areas of macroeconomic theory and modelling practice. We are fully conscious of this problem and hope that the reader will not interpret our formal and detailed quantitative analysis as implying either ignorance or arrogance on our part in respect of the current very active international research into the foundations of macroeconomic theory and practice. It remains, of course, for the reader to decide whether our judgement, in relation to the gross simplifications needed in order to construct an operational model of the economy, has been good or bad.

In Chapter 2 of our paper we describe in detail the structure of our macromodel of the Irish economy. Details of the exact formulation of all the individual equations and statistical results are contained in Appendix 2, with a full dictionary of the variables used given in Appendix 1. A view of how an economy functions does not emerge *after* one constructs a formal model. Rather, one must have a fairly clear idea on how the economy works *before* expressing this view through the medium of mathematical/statistical equations. The objective of Chapter 2 is to convey to the reader our conception of the structure of the Irish economy. We divide our description into three main "blocks": supply, absorption and income distribution. To talk in any meaningful way about the supply side of the Irish economy requires separate consideration, at the very least, of industry, agriculture and services. The core of the industry sector involves the determination of industrial

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capacity output, the related long-run demands for labour and capital, the short-run (or actual) labour and capital inputs, and the rate of capacity utilisation. The concept of "export-led" growth motivates the determination of capacity, and the determination of factor inputs is along fairly standard neo-classical lines (meaning that, for example, employment and investment are sensitive to relative factor prices as well as to output). The behaviour of the agricultural sector is considerably more simple and is heavily influenced by institutional, governmental and demographic forces. The service sector has three subcomponents; a marketed services component (responsive to demand and prices), a non-marketed component (consisting of non-public authorities elements such as teachers, hospitals, etc.), which is almost entirely state funded, and a public authorities component (public administration and defence), which is considered as largely instrumental in nature. Two further parts of the supply block deal with the determination of imports and labour supply.

The second main block deals with the determination of domestic and foreign absorption (i.e., consumption, investment, stock changes and exports) and is of fairly standard form. The third and final block of the model translates the factor-based modelling of supply into the pattern of income distribution which results from the interaction of production and demand activities, and yields the prices and incomes accruing to the sectoral and expenditure categories used in the model. The basic inspiration for the determination of prices and wages comes from the "Scandinavian" model. We identify our industry sector with the "tradables" sector and the services sector with the "non-tradables" sector. In the main variant of the model, the price of tradables is determined on world markets. Wage inflation in both tradable and non-tradable sectors adjusts to the "room" for wage increases in the *tradables* sector, i.e., an increase which is consistent with a "normal" profit share. Price inflation of non-tradables is determined by cost-push forces and overall price inflation is a weighted average of both the tradable and non-tradable elements. In addition, wage determination can be influenced by deviations of the unemployment rate from its trend value (i.e., a Phillips curve). The second component of the income distribution block deals with state expenditure and revenue and with the financing of the resulting deficit. The monetary environment is modelled using a conventional small-open-economy (SOE) fixed exchange rate approach.

In Chapter 3 we describe tests we have carried out to examine the performance of the model as a system representing the actual economy. Such tests consist of various types of simulations and involve the calculation of model "multipliers", where policy or exogenous variables are altered and the impact on the model relative to some control solution is examined.

Such testing complements a study of the individual equations of the model (Chapter 2), but does not constitute a "validation" of the model in any formal or rigorous sense.

Chapter 4 deals with the methodology we have used to investigate the detailed impact and delayed effects of fiscal policy actions. Basically we wish to compare the effects of *actual* fiscal policy actions (which, of course, yielded the *historical* outturn) with some idealised, or benchmark, fiscal policy (which would yield a *hypothetical* outturn when simulated with the model). The benchmark policy we choose attempts to pin down the concept of "fiscal neutrality" or "fiscal indexation", concepts which, in one form or another, are used in official publications dealing with fiscal policy. By look-ing at the difference between the *hypothetical* outturn and the *actual* out-turn we can attempt to quantify the extent to which *actual* fiscal actions differed from "fiscal neutrality", defined in a specific way. This allows us quantify the "discretionary" element of policy. These ideas are illustrated in Chapter 4 using the year 1967 (the first year in our sample), and show the impact (or immediate) effects of discretionary policy and the manner in which these effects change over time as the economy evolves in response to discretionary policy changes.

Chapters 5 and 6 represent the empirical core of our study. In them we examine how the exercise of fiscal "discretion" (by our definition) has influenced major economic indicators such as gross domestic product, real personal disposable income, the balance of payments and the borrowing requirement, unemployment, employment in the market sector of the economy, consumption prices and wages. The period being examined (1967 to 1980) includes the run-up to the world economic crisis associated with the first OPEC oil price rises. It also includes the full duration of the Fianna Fáil administration of 1969/73, the Fine Gael-Labour Coalition of 1973/77 and all but six months of the succeeding Fianna Fáil administration which remained in office until June 1981. Two of Whitaker's "financial turning points" also fall in our period, namely the introduction of current budget deficits as *explicit* policy measures from 1972 and the very "expansionary" budgets of 1978/79 (Whitaker, 1983).

Our analysis of fiscal policy is presented under two headings: "incremental" analysis, which attempts to isolate effects of discretionary policy changes specific to each individual year of our sample, and "integral" analysis, which attempts to quantify the effects of pursuing a policy of continual strict fiscal indexation from an initial year (1967) to a terminal year (1980).

In the case of "incremental" analysis, we present our results in a tabular form which permits the identification of the impact effects of each year's specific discretionary fiscal changes and the delayed effects of these changes.

the wage equation, i.e., unemployment does not *directly* influence wage bargaining. Third, a variant of the standard model where a crucial parameter (the elasticity of the "target" wage with respect to the income retentions ratio) is changed from unity to 0.5. Finally, a variant where the above parameter is set to zero, i.e., direct tax rates do not affect wage bargaining directly. Of interest in our analysis are both the results for the standard model variant and the extent to which such results are sensitive to each of the other three model variants. Some broad results for the standard model are as follows:

(i)   The cumulative effect of fiscal discretion on the growth rate of GDP was positive for all years except 1968, 1974 and 1976-1978. For example, by 1980 the growth rate was 1.7 percentage points higher than would have been the case under policies of strict indexation from a 1967 base. The largest negative effect was in the year 1977, when actual policies *reduced* growth by 3.7 points relative to indexed policies, largely as a result of the negative delayed effect from the 1976 budget.

(ii)   The cumulative effect of fiscal discretion on the level of real personal disposable income was positive for all years except 1971 and 1977. In both of these years the negative effect was very minor.

(iii)   Fiscal discretion led to a massive deterioration in both the balance of payments and the borrowing requirement. Under strict indexation of policy since 1967, there would have been a balance of payments surplus of 10 per cent of GDP by 1980. The mechanisms which caused such extraordinary behaviour related mainly to the export-led orientation of the industrial sector, the accumulation of foreign assets as the borrowing requirement would have been reduced (the domestic financing component being exogenous in the model) and the massive gains in competitiveness. Needless to say it does not need the "Lucas" critique of policy analysis to warn us that such an extraordinary economic configuration would have caused shifts in many of the parameters of the model (even if we grant that it would have been politically feasible) and the assumption of a fixed exchange rate would appear implausible in such a context.

(iv)   The cumulative effects on unemployment numbers were rather small. Only for the years 1977 and 1978 is the effect positive, largely as a result of the deflationary budget of 1976, followed by relatively neutral fiscal policy over the whole of 1977.

(v)   A basic trade-off in the model is between market sector and non-market sector employment. In all years since 1969 the cumulative

effect of fiscal discretion on market sector employment was negative. By 1980, this loss amounted to 20,800 jobs. Between 1967 and 1980, on the other hand, about 94,400 jobs were "created" in the non-market sector.

Turning to the second aspect, i.e., the sensitivity of our results to certain key model properties, the GDP growth rate and the level of real personal disposable income are relatively insensitive to changes in the model variants. In the case of the balance of payments deficit and the borrowing requirement, our use of an elasticity of unity on the income retentions ratio in the standard model wage equation has exaggerated the discretionary effects, relative to the lower values of 0.5 and zero. This aspect of the model also proves to be important in determining the unemployment and employment effects of policy. Our inclusion of *ten* possible variants of the wage equation in the model is a measure of our uncertainty regarding this vital aspect of the economy and the central role played by wage determination in solving the model.

In Chapter 7, we provide an overview of the effects of fiscal policy over the 1967 to 1980 period. Based on the results of Chapters 5 and 6, we suggest that the effectiveness of fiscal policy in attaining long-term growth goals (as distinct from changing short-term standards of living) has fallen well below that which was expected of it by policy makers. Two types of budgets are distinguished which appear to characterise the fiscal stance of the 'seventies — namely, those aimed at the immediate expansion of activity and those aimed at the correction of high inflation rates or balance of payments deficits. We conclude that neither type of policy has stimulated sustainable long-term growth. Our analysis suggests that this results from an apparent failure by policy makers to comprehend the mechanisms of inflation and/or the level of leakages from the economy via imports and savings. Specifically, the potential relationship between wage inflation and rates of taxation, where gross wages may adjust after tax changes to maintain net wages, was poorly understood in many of the budget speeches. This mechanism, plus that of the Phillips curve, has resulted in fiscal policy during the 'seventies hampering the industrial sector through disimproved competitiveness *vis-à-vis* our trading partners rather than stimulating its growth via a buoyant domestic economy. A consequence of this is that fiscal policy has induced a shift of resources from the private marketed sectors (notably the industrial sector) to the public non-marketed sectors, leaving the domestic economy in a weaker position to take advantage of an upturning world economy than it otherwise might have been with indexed fiscal policy.

Areas of further research are also identified in Chapter 7. We distinguish

between areas where our model could be improved and areas where our method of policy evaluation might be inadequate. We discuss the crudeness of the industrial sector, where the level of domestic demand does not influence long-run output and where the Public Capital Programme may not have been adequately treated. Doubts are also raised as to our failure to link agricultural output to material inputs in a consistent framework. The poor quality of data used in the market services sector is also seen as a barrier preventing a more adequate representation of the economy. Finally, we admit the short-comings of a fixed-exchange rate SOE monetary sector and the method of debt financing used in the model. The paper is concluded by describing some problems with our method of policy evaluation, notably the assumptions of temporal policy independence and perfect foresight, and potential problems caused by the Lucas critique, i.e., policy-induced changes in the model parameters due to rational expectations formation by agents.

A full dictionary of definitions of all the exogenous and endogenous variables used in the model is given in Appendix 1 and Appendix 2 presents a complete listing of all the equations of the model, together with statistical estimation results. A note on the relationship between "discretionary" and "integral" fiscal analysis is contained in Appendix 3.

Chapter 1

INTRODUCTION

Our objective in this paper is to present a quantitative analysis of fiscal policy in Ireland over the period 1967 to 1980. In order to place this analysis on a firm basis we have constructed an operational macroeconometric model of the economy which has a medium-term orientation and we test this model in terms of its ability to assist in explaining and interpreting economic behaviour during the 1967-1980 period.

To carry out quantitative economic analysis requires a formal economic model. However, to present analysis and draw conclusions on the basis of computations carried out using a model presents conceptual and practical difficulties. To the recipients of the proffered economic advice, the "model" may be the subject of controversy. Such an audience will wish to know how sensitive is the advice to the particular form chosen for the model. Alternatively the model may appear as a mysterious "black box" and be liable to be misunderstood or abused by becoming, for example, a tool in a debate where sides are chosen according to the extent that the structure of the model has certain theoretical properties and the "results" from the model agree with predetermined views.

It was in the hope of isolating such potential problems that we have carried out, in a previous paper, a fairly formal and exhaustive investigation into some of the economic underpinnings of quantitative analysis of the economy (Bradley and Fanning, 1984). The fact that some of the empirical results in that study were of limited use in choosing between competing economic hypotheses and paradigms, and of mixed quality, should serve as a caution against a hasty or inflexible selection of results for incorporation into any interpretation or quantification of the Irish economy. Faced with poor empirical results, reactions by aspiring model builders tend to fall into one of the following three categories. Formal mathematical-quantitative models may be left aside in favour of a verbal or informal approach. In this way many economic subleties of behaviour can be encompassed. However, there is the danger that crucial assumptions may not always be made explicit and indeed may be made in an inconsistent fashion. Furthermore, it is difficult to draw quantitative conclusions using an informal approach. A second possible reaction could be to select the best available empirical equations from the statistical analysis and to use them in a model, even if these are not based on, or derived from, theoretically firm foundations. The tracking

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performance of such models is often quite impressive, at least for the historical, or within sample, period. However, it may be less easy to evaluate the usefulness of the model's policy advice. In addition, "empirical" equations, with their many parameters and variables, often become subject to structural instability when data revisions are made or when new data observations are added. A final approach could be to use a judicious mixture of an imposed theoretical structure and of empirical investigation to produce equations that have both reasonable (or at the least, understandable) theoretical underpinnings and acceptably accurate tracking performance. Such an approach attempts to use the best elements of both previous attitudes. Ideally the entire model should be derivable from an integrated set of chosen theoretical postulates but in practice this is often unattainable ·and an operational model represents an uneasy compromise between theoretical rigour and empirical findings. The model used in this study is an example of just such a compromise.

There has been extensive previous empirical analysis of the macroeconomy in Ireland. Some of this has been at a sectoral level, while many previous attempts have been made to construct and use operational macroeconometric models of the economy.[1] One previous model is being used extensively for policy analysis and forecasting and has been updated and maintained on a regular basis (FitzGerald and Keegan, 1982). This model, MODEL-80, has been used by the Department of Finance, the Central Bank of Ireland, the ESRI and the National Planning Board. However, there are features of MODEL-80 which make it unsuitable for use in medium-term policy analysis. In its orientation MODEL-80 is a short-run demand management model with detailed modelling of the expenditure and income side of the national accounts but with less attention given to the problem of modelling the supply of output and factor inputs on a sectoral basis. Its basic assumption, common to all models of its type, is that the supply side will accommodate any increases in demand with little complication. The major portion of MODEL-80 is given over to a very detailed modelling of the fiscal instruments available for use by the government and the manner in which these instruments can be brought to bear to influence demand. In deciding to construct a new model for use in the analysis of medium-term economic policy issues we have been influenced by the necessity to incorporate supply side features in a fundamental way. As Lawrence Klein has suggested in a recent book, it is only by constructing a model which brings together the total forces of supply and demand that we can understand, and then derive policies to affect, the economic issues of modern society (Klein, 1983).

1. Examination of this work is contained in Bradley and Fanning, 1984 and a detailed examination and comparison of previous macromodels is contained in Bradley and Fanning, 1985.

The conventional use of simultaneous equation econometric models for policy analysis has been the subject of much criticism by the economics profession. A succinct summary of major areas of contention was provided by Geary (1982) in his reply to the FitzGerald and Keegan (1982) paper on MODEL-80. Although raised in the context of a critical evaluation of MODEL-80, these points have more universal application to all macromodels. We summarise Geary's views below.

First, it was claimed that macroeconometric models performed badly in dealing with the economic upheavals of the 1970s and that the "Keynesian orthodoxy", widely regarded as providing the theoretical underpinnings of empirical models, had broken down. As a statement of fact, one could hardly dispute this point.[2] However, the macromodels of the late 1970s and early 1980s are very different entities from those of the earlier period. As put by Helliwell and McRae (1981), "any model structure that was chosen . . . a decade ago is sure to be the wrong structure now that energy price changes and other events have posed new and largely unforeseen problems of adjustment". The inference to draw from Geary's point is that Irish applied economists must face up to these new challenges in a constructive way, be it through neo-Keynesian or new classical frameworks (Klamer, 1984).

Geary's second point concerned issues of econometrics and their relationship to empirical models; that models are cavalier on the issue of stochastic specification and require identification restrictions which, in the terminology of Sims (1980), are simply incredible. On the issue of stochastic specification it is, indeed, the case that the imperatives of making a model operational result in gross simplifications both in the error structures used and in the estimation techniques applied. Also, the identifying restrictions are mainly simplifications, chosen empirically so that they do not conflict with the data.

The third point was essentially the "Lucas critique" of the use of macromodels for policy analysis, which holds that the parameters of the model may not remain fixed but may vary with each alternative policy. This critique, by using examples generated with the rational expectations assumption,[3] shows what serious errors can be made in econometric policy analysis if the response of expectation formation mechanisms to policy is ignored. In the words of Sims (1982), "As in most revolutions, the old regime toppled by the rational expectations revolution was corrupt and in some sense deserved

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2. Although Alan Blinder (1979) held that the neo-Keynesian approach provided a quite adequate interpretation of the stagflation of 1972-1976.

3. The rational expectations assumption is that the public behaves optimally, given its own objectives and the information available to it, and that the public understands precisely what contingency plans have been chosen for future policy.

its fate. However, as is often the case, the revolution itself has had its excesses, *destroying or discarding much that was valuable in the name of utopian ideology*". Sims argues that the explicit identification of expectation-formation mechanisms is not necessary for policy analysis and that the rational expectations critique is only a special case of the more general cautionary note – statistical models are likely to become unreliable when extrapolated to make predictions for conditions far outside the range experienced in the data sample used for estimation (Sims, 1982, p. 122).

In a final point, Geary argued that if the specification of a model is *ad hoc*, there can be no presumption of the internal consistency often claimed for models. He suggested that a more aggressively experimental approach with smaller models might be useful either in the direction of extensive parametrisation using information from tightly specified sectoral models or a less structured time-series approach using quarterly data. Our approach leans towards the first suggestion (in particular our industrial and service sectors are tightly specified with an imposed technology) while recent applications of the new quarterly national accounts derived by O'Reilly (1982) has developed the second line of research. O'Reilly's analysis, using a pure multivariate time-series technique, indicated that issues of lag structures and stochastic error specification may usefully be explored but that the imposition of strong theoretical priors is needed to resolve problems such as multicollinearity.

These and other related issues have been recently explored in a stimulating and novel way by Smith and Pesaran (1984). They hold that the usual applied econometric procedure is by and large an efficient goal-oriented activity and that many of the criticisms made of it reflect a misunderstanding both of the context in which applied econometricians operate and of the multiple criteria their work must satisfy. Three such criteria are identified: models must be *relevant* to the purpose for which they are designed; they should be internally *consistent* (in the sense that they do not generate self-contradictory answers to the questions posed and should also be consistent with more general theories); and models need to be *adequate* representations of the phenomena of interest. The final criterion of adequacy covers the statistical criteria to which most of econometric theory is devoted. Smith and Pesaran interpret the wave of criticism of econometric models in terms of the above three criteria: clients see models as being insufficiently *relevant* to their problems of forecasting and policy; economic theorists see models as being *inconsistent* with their knowledge of the economy; theoretical econometricians see models as being *inadequately* estimated and tested. A balanced approach is desirable but a completely formal structure within which to trade-off the three criteria does not seem feasible since model

construction and use are organic social processes and not mechanical activities.

The remainder of our paper is structured as follows. In Chapter 2 we describe the structure of our model and highlight some of the key numerical magnitudes that serve to characterise it. Detailed technical equations and statistical estimation results are presented in Appendix 2. Extensive background material has been given in a previous paper, Bradley and Fanning (1984), so our presentation is fairly concise.

In Chapter 3, we describe the tests we have carried out to examine the performance of the model as a mathematical-statistical system representing the real economy. Such tests consist of various types of model simulations and involve the calculation of model "multipliers", where policy or exogenous variables are altered and the impact on the model relative to some control solution is examined. Such testing complements a study of the individual equations of the model in the sense that while individually the equations of the model make good sense as an integrated system they might have undesirable properties.

In Chapter 4 we describe briefly the methodology of policy analysis. Techniques available for use can range from fairly simple simulation experiments to sophisticated use of optimal control techniques. We restrict ourselves to the simpler simulation techniques, and make use of an approach developed by Blinder and Goldfeld (1976) which permits investigation of the detailed impact and delayed effects of policy actions. This approach is model based and, hence, the results are only as credible as the underlying model. We hope that our results will encourage others to attempt to encapsulate their views on the workings of the macroeconomy within their own quantitative frameworks and thus provide alternative policy analysis for comparison and public discussion.

In Chapter 5 we undertake a retrospective analysis of fiscal policy over the period 1967 to 1980. This period covers approximately the terms of four different political administrations, the last two being characterised by vigorous fiscal policies designed to insulate the economy from the ravages of the post-OPEC world recession. Our methodology does not permit us to enquire into the reasons *why* various policy decisions were taken, but merely permits us to attempt to quantify the effects of *what* was done, be it intentionally or otherwise. However, a recent article by Whitaker (1983) on "Financial Turning Points" provides interesting interpretations of the motives of, and political constraints facing, the governments of the period being studied.

In Chapter 6 we examine the individual budgets that implemented fiscal policy over the 1970-1980 period. This presentation is designed to illustrate some of the practical and political issues that underlie the more formal

analysis contained in Chapter 5 and to compare, where possible, the contemporaneous *"ex-ante"* projected budget effects with our *"ex-post"* analysis.

Finally, in Chapter 7 we conclude our study with a review of our main results and an account of areas of further research prompted by the weaknesses and flaws that emerged in our applications of this first version of the model.

Chapter 2

THE MODELLING FRAMEWORK

INTRODUCTION

To construct a model of an economy is essentially to have a view of how that economy works and to incorporate that view into a set of mathematical equations. Some of these equations will have a "behavioural" content in the sense that they describe directly the behaviour of agents in the economy (e.g., the consumption function for households or the demand for labour by industry). Other equations will have no behavioural content but will simply link variables together (i.e., the *ex-post* identities of the model). In addition, the behavioural equations invariably contain parameters or coefficients whose specific numerical values are assigned using statistical estimation techniques with time-series data.

As a result of its technical and mathematical nature, any thorough description of a macroeconometric model must, of necessity, be a complex affair. In order to make this task more digestible we have split it into three separate, but obviously interrelated, parts. In this chapter we give a mainly verbal description of the behavioural structure of the model and highlight some of the most important empirical findings from the statistical estimation. In Appendix 2 we present a purely technical summary of the model equations and the complete statistical results of the estimation. In Chapter 3 we describe some of the ways in which the model performs as an integrated system, how it stands up to the standard tests of within-sample tracking performance and how it reacts to perturbations or shocks to its exogenous variables and to its coefficients.

In this chapter our description is organised around a three-block framework comprising a supply block, an absorption block and an income distribution block. The main components of each block are shown in Figure 2.1. The reasons for choosing this method of organising the model structure have been discussed at length in a previous publication (Bradley and Fanning, 1984) and while the actual nomenclature should not be taken too seriously, this approach does serve to highlight the main behavioural components of the model and is useful for expositional purposes. Figure 2.1 also provides the linear sequence which we follow in our exposition of the model.

Figure 2.1: *Block structure of the model*

Supply Block	● Industry
	● Agriculture, Forestry and Fishing
	● Services
	● Imports
	● Labour Supply
	● National Aggregates: Supply and Income
Absorption Block	● Consumption
	● Investment
	● Exports and the Balance of Payments
	● Inventory Changes
	● National Aggregates: Demand
Income Distribution Block	● Producer Prices
	● Expenditure Prices
	● Wages
	● Fiscal Activities
	● National Debt Interest Payments
	● Monetary Activities

THE SUPPLY BLOCK

Introductory Remarks

In the treatment of domestic supply of goods and services in the model we use a major division into three production branches — industry, agriculture and services. The agriculture branch includes forestry and fishing while the services branch includes marketed services, non-marketed services and public administration. Completing the supply block are two sections concerned with imports and the balance of payments and with the issue of labour supply.

In the case of industry we attempt to implement a theoretically coherent behavioural model. The core of the industry sub-model involves the determination of industrial capacity output and the related long-run factor demands for labour and capital. Our approach to the determination of capacity out-output is in the spirit of the model of export-led growth (Caves, 1970; Dixon and Thirlwall, 1975; Thirlwall, 1980; Kennedy and Dowling, 1975). Because the simulation results of the model can be very sensitive to particular assumptions made by the modellers, we have set up multiple options in the case of various key equations. Three versions of the capacity output relationship are available in the model. In the first the determinants are simply expected world demand (proxied by a trade-weighted world GDP variable) and a measure of the relative competitiveness of production in Ireland and else-where. An autonomous growth in capacity was also found, which could not be explained by other than a time trend. In the second we have included a disequilibrium term in expected domestic absorption which modifies the previous formulation. In the third version we have included both world activity and domestic absorption together with relative competitiveness. This last version cannot be interpreted within the export-led growth framework since it requires both expected world demand and domestic absorption to be autonomous.

Our interpretation of the technology of the industry sector is along standard neo-classical lines. Capacity output together with measures of expected relative factor prices are used to determine the cost minimising long-run demands for labour and capital. An important aspect of our approach is the imposition of a specific technology on the relationship between capacity output and long-run factor inputs. As a consequence, labour and capital requirements cannot become inconsistent with the underlying technology of the model, a very desirable property for medium-term analysis. The translation of the long-run to the actual factor inputs is by means of adjustment mechanisms which attempt to capture the processes which prevent instant adjustment. Hence, in the short run the national industrial "firm"

need not be on its long-run production function. Finally, actual output in industry is determined primarily by the capacity output measure, but is affected by abnormal changes in final sales of industrial goods and by the profitability of production (Helliwell, Boothe and McRae, 1982, p. 265).

In the case of agriculture, forestry and fishing (AFF), it was recognised that employment and investment decisions were unlikely to derive from neo-classical optimising paradigms which are more appropriate to an industrial sector exposed to international competitive forces and relatively capital intensive. In Irish agriculture, institutional, government and demographic forces become dominant and any realistic model must recognise this. Given the importance of the agricultural component of AFF, and the ready availability of data on gross output and material inputs, we attempt to model gross agricultural output by means of a simple supply function making output sensitive to capacity, relative prices of output and inputs, and weather conditions. A separate equation explains the demand for material inputs and permits the derivation of added-value in agriculture. Added-value in forestry and fishing, a very small element of total AFF, is left exogenous. Employment in AFF is modelled as a labour-release or migration-out process in that agents who do not leave are employed. The long-term factors permitting and encouraging the release of labour from AFF are the growth of labour productivity, the relative earnings differential *vis-à-vis* the non-agricultural sector and the availability of work elsewhere in the economy. The total investment process in AFF is particularly difficult to specify behaviourally due both to the importance of investment in cattle stocks (which may be subject to substantial variation over a fairly short period) and to the complex system of grants, subsidies and other incentives available to farmers. Consequently, we consider only a subset of the investment process — machinery and buildings — and use a simple flexible accelerator model which links the capital stock to output and the real cost of capital. Agricultural stock changes are left exogenous in the model.

The complex heterogeneity of the service sector makes it difficult to justify implementation of a comprehensive decision-based factor demand system. For example, the inclusion of large non-commercial and self-employment components is likely to affect the sensitivity of employment and investment to a relative factor price measure. Also, the distinction between capacity output and actual output is less clear since there are shorter production processes involved, a more simplified technology and a less structured labour force. In this version of the model we have attempted to "purge" the total services sector of the non-marketed element. Public administration and defence are isolated clearly in the national accounts and thus provide little difficulty (ignoring, of course, the underlying difficult measurement pro-

blems and the somewhat suspect national accounting conventions involved). The isolation of other non-marketed services is a more difficult problem and our attempts represent a very crude first effort.

Output in the marketed services sector (MS) is determined by a weighted measure of final demand and by profitability. The factor demand system for capital and labour is derived by cost minimisation subject to a flexible functional form technology. This imposes a certain consistency of behaviour (perhaps unwarranted) on the MS sector and while such assumptions are perhaps unrealistic, they seem preferable to an approach based on unrelated employment and investment equations. They also permit us to make stylised comparisons between industry and marketed services.

Output of the non-marketed services sector (NMS), which excludes public administration, is determined by the level of NMS employment. The wage bill in NMS is determined by nominal government expenditure on goods and services (excluding public administration wages), and NMS employment is obtained by dividing the wage bill by average annual earnings in NMS (determined in the income distribution block of the model). An alternative approach treats NMS employment as a policy instrument and derives the wage bill endogenously in an identity. In the case of public administration output is actually *measured* in the national accounts by labour inputs with essentially no productivity or capital stock corrections. Public administration employment and investment decisions are regarded as discretionary policy instruments.

In modelling imports we distinguish five broad economic categories: imports of investment goods (related to total investment); consumption goods (related to total private consumption); materials for further production in agriculture (related to agricultural output); and imports of services (related to a broad measure of total activity in the economy). Imports of inter-mediate industrial goods, which constitute some 65 per cent of total imports, are derived residually in an expenditure-output identity.

Finally, in the labour supply sector we distinguish, in an integrated (albeit simple) schema, population growth, education participation, labour force participation and migration abroad. Unemployment is determined as the difference between labour supply and labour demand (determined in the industry, agriculture and services sectors of the supply block).

Industry

The outline schema for the industry sector is shown in Figure 2.2. The key empirical concept, capacity output, is of course unobservable and we use a linked-peaks measure as a proxy. In fact the empirical results proved quite robust to a wide range of alternative measures (Bradley and Fanning,

1984, Chapter 3). We provide three choices of model for the determination of capacity output. In the first (illustrated in Figure 2.2), capacity output is determined by expected world demand (elasticity 1.3) and competitiveness as measured by Irish total unit factor costs relative to world unit labour costs (elasticity -1.2). The generation of a trade-weighted competitor cost of capital index will certainly be considered for future work to improve our measure of competitiveness. In addition, a secular growth in capacity was detected which could not be explained by other than a time trend (3.9 per cent per annum). In the second variant we have made the world demand elasticity parametric in the rate of change of expected domestic absorption, thus introducing a feedback between domestic real activity and capacity output. The "equilibrium" world activity elasticity falls to 1.1 while every 1 per cent rise in expected domestic absorption raises this by 0.04. In the third variant we have included a geometric average of expected world and domestic activities. Such a model requires the very strong assumption that variations in expected domestic activity are regarded as autonomous in the same way as for world activity. Estimation results indicated a total activity elasticity of 2.0, with a weight of 0.6 on world activity and 0.4 on domestic activity.

Even though we have included three variants of the capacity output equation, there remain many reasons for using any or all of them with caution. For example, the concentration of all industrial incentive effects into the Irish total unit factor cost measure may be quite inadequate and ignores any beneficial effects due to public funding of improved infrastructure. The trade weighting used to derive the world activity measure is by no means comprehensive or unambiguous. The fact that almost four percentage points of growth on average are not accounted for by economic variables should serve as a warning that the equation may require further development. Some aspects of this rich agenda of research have been explored by FitzGerald (1984a) in his study of multinational investment location. In addition, the choice of capacity model is central to the overall properties of the model. In the first variant (the "pure" export-led growth model), industrialists perceive domestic market growth as being transient or insignificant and do not modify their capacity as a consequence. They do, however, modify their rate of capacity utilisation (see below) in response to domestic sales and profitability conditions. In the other two variants industrialists assign non-zero weights to the growth of domestic absorption. Consequently, fiscally stimulated real growth will have a positive effect on capacity and on exporting potential which may partially offset any loss in competitiveness due to Phillips curve effects.

Given capacity output and a relative factor price ratio which is exogenous

Figure 2.2: *Schema for industry sector*
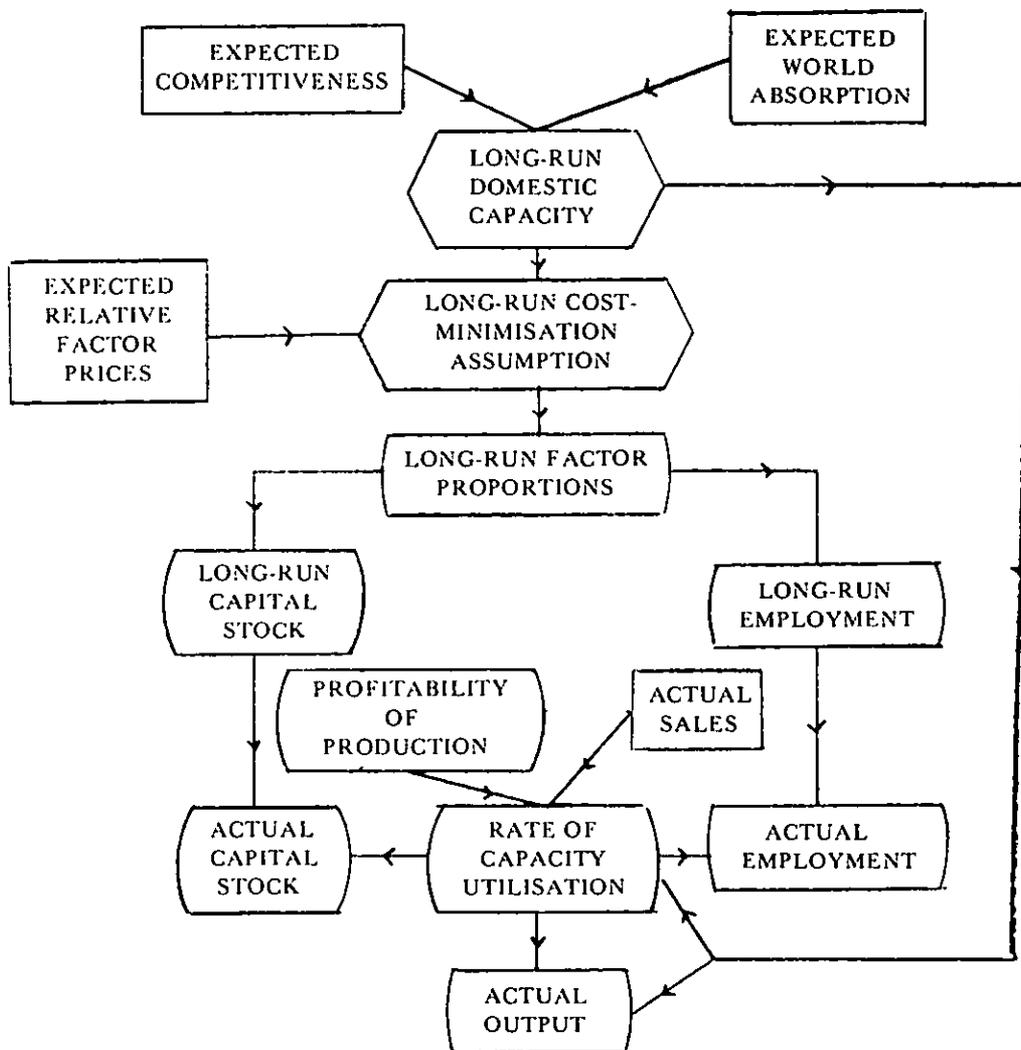
to the industry sector, the assumption of cost minimisation subject to a specific technology yields the demand for labour and capital at full capacity. In other words, the chain of causation runs from capacity output to long-run factor inputs. An implicit assumption being made is that there can be no "shortage" of fixed capital in Ireland, i.e., that it simply accommodates to the required level of capacity output for given relative factor prices. Given

the high international mobility of industrial capital, this seems a relatively plausible assumption (McAleese, 1983). The complete system of equations derived using the well-known CES production function is given in Appendix 2. Briefly, the technology of the industry sector is characterised by its approximately Leontief nature (with an elasticity of substitution between labour and capital of 0.29) and by technical progress which is capital using and labour saving. Both constant and increasing returns to scale versions were estimated. However, the well-known difficulties in separating technical progress and returns to scale prevented satisfactory free estimates (Berndt and Khaled, 1979; Bradley and Fanning, 1984, Chapter 4). In the model constant returns to scale (CRS) and increasing returns of 1.3 are included as options. The statistical fits are quite good given the "parsimonious" nature of the model. The large errors which arise about the time of the first OPEC price shocks may be partially explained by the fixed exponential decay rate assumed in generating the rather artificial capital stock measures and by the putty-putty model of capital being used. However, as a first approximation the long-run factor demand model may provide a useful framework on which future refinements can be made.

In the model the long-run factor demands are converted to actual factor inputs by means of a two-tier adjustment mechanism. The passage from the desired level of factor inputs to the inputs needed at long-run capacity output is assumed to be influenced by the rate of capacity utilisation in industry. Furthermore, the passage of the actual inputs to the desired level depends on the extent to which agents can, and will, adjust their actual behaviour towards desired levels. Combining both mechanisms leads to employment and capital demand equations which are dynamic functions of the long-run demands and the rate of capacity utilisation. The empirical results indicate that the process of adjustment of the actual capital stock to its long-run optimal value is slightly faster than the corresponding adjustment of employment and that this adjustment is quite insensitive to variations in capacity utilisation. Labour inputs, on the other hand, proved to be very sensitive to variations in capacity utilisation.

Having determined the actual capital input, K, the gross investment flow, I, is obtained by means of the identity which was originally used to generate the capital stock measure, i.e.,

$$I_t = K_t - (1 - d)K_{t-1}$$

where d, the depreciation rate, is set at 5 per cent (Bradley and Fanning, 1984, pp. 64-65).

The final, and crucial, behavioural equation in the industry sector concerns the manner in which the capacity utilisation rate is determined. The

production decision is represented in the model as a choice of the operating rate of capacity and is determined by the deviations of final sales from planned capacity and by the profitability of production. Since the capacity utilisation decision is essentially a short-run phenomenon, profitability is measured by the ratio of short-run costs (taken as unit labour costs) to the added value price (i.e., labour's share of added-value), no consideration being given to the user cost of capital. The empirical results show that if sales relative to capacity rise by 1 per cent then the rate of capacity utilisation rises by about 0.6 per cent. The remaining 0.4 per cent will be imported. On the other hand, a 1 per cent rise in labour's share of added-value leads to a 0.3 per cent fall in utilisation. With capacity fixed in the short run, this will translate into a 0.3 per cent fall in actual output.

Agriculture, Forestry and Fishing

The schema for the AFF sector is shown in Figure 2.3. Our approach is to consider agriculture separately from forestry and fishing since the annual Census of Agricultural Production gives comprehensive details of gross output and limited information on material inputs in agriculture, the major component of the sector. A measure of capacity output in agriculture is defined as a five-year moving average, and actual output is made a linear function of capacity output, the real price of material inputs and a variable which captures weather effects. The signs of all coefficients are in accordance with *a priori* expectations; a fall in the real price of inputs or an improvement in the "weather" both lead to increased output (the real price elasticity is - 0.36 evaluated in 1975).

Attempts to specify and estimate an interrelated output and material input system failed to yield plausible empirical magnitudes. In this version of the model we explain the ratio of material inputs to gross output by a time trend and the data indicate that this ratio has been growing steadily at about 2.7 per cent per annum. The equation residuals for the 1973-75 period are rather large, indicating the inadequacy of this simple approach. Total employment in AFF is determined by a time-trend (as a proxy for long-run labour productivity), a measure of the expected AFF/non-AFF relative earnings and the overall rate of unemployment. The empirical results indicate employment falling at a rate of 2.9 per cent per annum, a relative earnings ratio elasticity of 0.07 per cent and a small positive sensitivity to the general level of unemployment. The stock of machinery and buildings is determined by output and by the real cost of capital in a simple flexible accelerator model. Changes in the capital stock proved rather sluggish with respect to changes in output and the cost of capital, only about 10 per cent of the desired change occurring in the first year.

Figure 2.3: *Schema for agriculture, forestry and fishing sector*
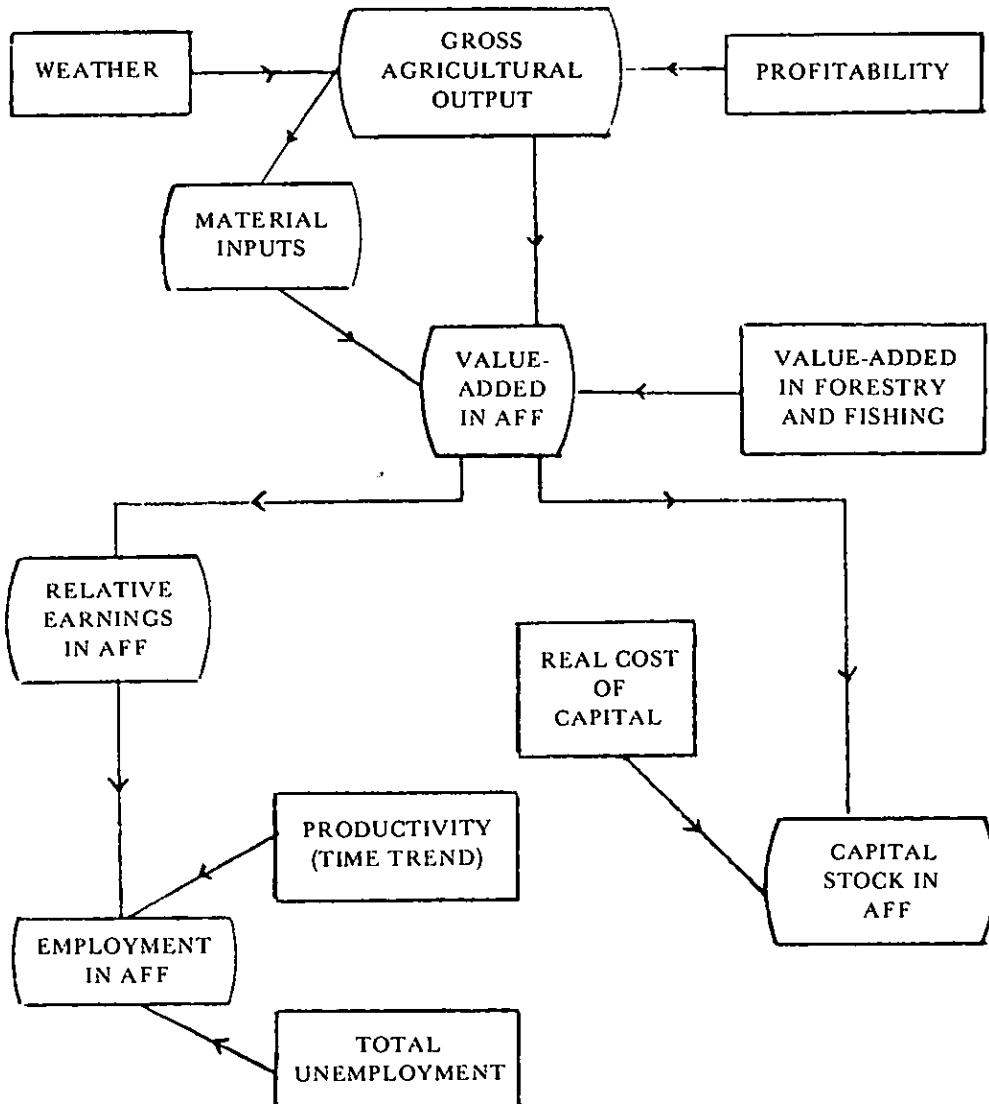
The final behavioural element in the AFF sector concerns the allocation of gross agricultural output between its three final uses: domestic absorption, inventory changes and exports. The separate determination of any two elements means that the third can be derived from an identity. In this version of the model we have chosen to leave inventory changes exogenous mainly due to the intractability of modelling their behaviour. The domestic absorp-

tion element is a rather stable fraction of gross output, a fact noted in a slightly different context by Kennedy and Dowling (1975, pp. 115-118). Agricultural exports are derived by an identity as gross output less domestic absorption and inventory changes.

The AFF specification as discussed above is rather unsatisfactory. Given that a theoretically consistent neo-classical framework could not be estimated empirically, one is reduced to explaining key variables by simple time trends. While such equations often track extremely well, they impart autonomous properties to the sector which may be misleading when the model is shocked.

Services

Having considered industrial and agricultural supply, the rest of the economy is divided into three broad categories of services-producing subsectors. The first subsector consists of marketed services, an outline schema of which is provided in Figure 2.4. Output in the marketed services sector is determined by a weighted measure of final demand (where the weights are taken from the 1969 I/O table and measure the service sector output content of final demand) and a measure of profitability. The elasticity with respect to final demand is 0.9 and with respect to profitability is 0.3. Factor inputs are determined by assuming cost minimisation in the production of output where the technology is assumed to be of generalised Leontief form with constant returns to scale. Estimation indicated that the "technology" of the marketed services sector was characterised by an Allen elasticity of substitution of about 0.6 and technical progress was found to be neutral with respect to labour and capital saving (at a rate of some 5 per cent per annum).

A simpler model of the non-marketed services sector (NMS) was specified. Output is essentially determined by labour inputs, corrected for a trend in productivity. The wage bill in NMS is determined by government purchases of services from this sector. We proxy this by the value of total government consumption expenditures net of the public administration wage bill. Hence in one variant we view government as imposing a cash limit on the NMS wage bill, with actual numbers employed in NMS being determined as the ratio of the wage bill to average annual earnings in NMS (determined in the income distribution block). A second variant takes NMS employment as a policy instrument.

Finally, public administration output is determined by labour inputs, the numbers employed being a discretionary policy instrument. In both non-marketed services and in public administration gross fixed capital formation is a discretionary policy instrument.

Figure 2.4: *Schema for the marketed services subsector of the model*
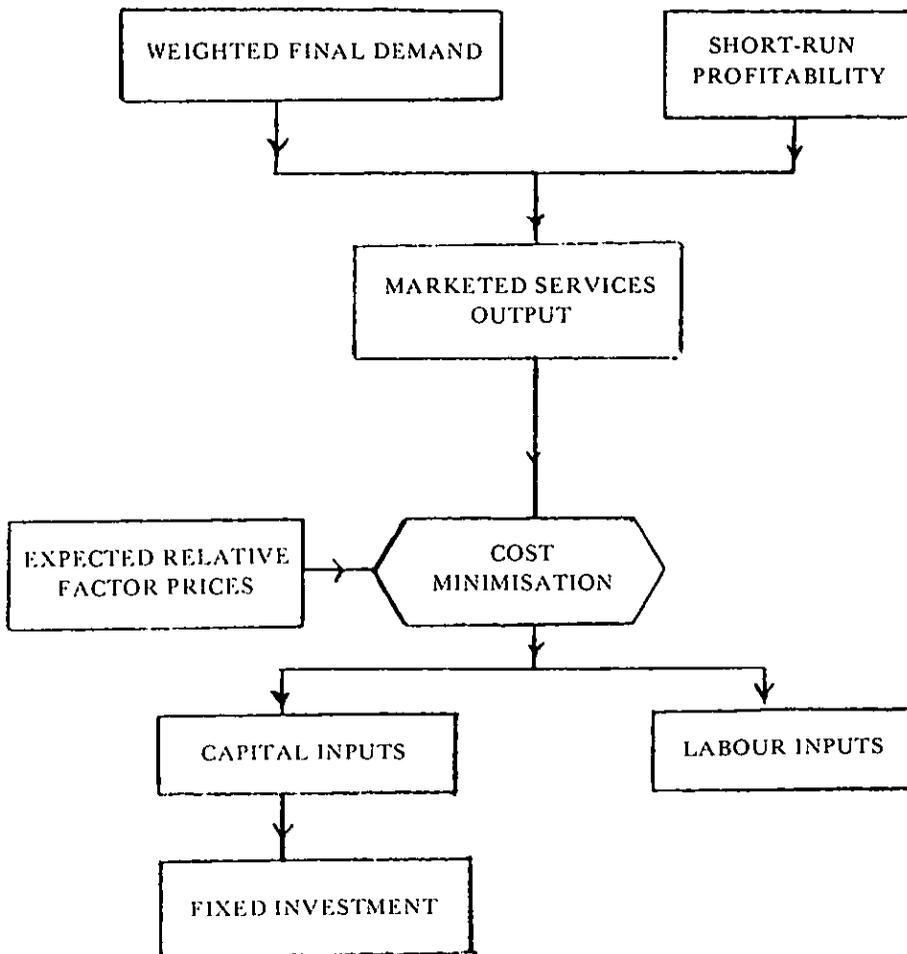
Imports

Our determination of imports uses a breakdown of imports by five economic categories. Even though there are very serious reservations about these data, nevertheless, we feel that this classification is more satisfactory from an analytic point of view than the alternative more accurate SITC breakdown. Four categories of imports are determined in separate behavioural equations. Imports of producers' capital goods are determined by total fixed investment expenditures (elasticity 1.2) and industrial capacity utilisation (elasticity 0.7). For imports of consumption goods an elasticity of unity with respect to total household consumption is imposed. The average propen-

sity to import grew at a fixed rate of 4 per cent per annum and the relative domestic-import price elasticity was - 0.6. Imports of agricultural raw materials were similarly treated with an imposed elasticity of unity with respect to gross agricultural output, a trend growth of 3.6 per cent and a relative price elasticity of - 0.5. Finally, imports of services are determined by a broad measure of GNP with an impact elasticity of 0.4 and a long-run elasticity of 1.3.

The important category of imports of industrial goods for further production is determined residually in the expenditure-output identity. Consequently, this category of imports, constituting some 65 per cent of total imports, acts as a buffer which resolves any imbalances between domestic supply and domestic demand. An alternative approach would, of course, be to model this category of imports behaviourally and regard any resulting imbalance between supply and demand as indicating errors in the model.

Labour Supply

It is well established that migration abroad has played a very important role in Irish population adjustments in the past. To the extent that migration is caused by domestic economic conditions relative to economic conditions in destination countries, it is necessary to model population growth rather than include population as an exogenous variable uninfluenced by economic conditions. The schema for modelling demographic and labour supply issues is given in Figure 2.5. We consider the demographic structure in terms of three major age groupings: under 15 years; between 15 and 64 years; and over 64 years. The first and last groupings constitute the "dependent" population while the middle group constitutes the working age population. Changes in the total population are related to total migration and a "natural" population growth rate (which is assumed constant for the entire 1961-80 period). Statistical estimation yielded a "natural" growth rate of 1.1 per cent. Two similar equations are used to determine the changes in population aged under 15 and between 15 and 64. In the latter two cases the fraction of migrants in these age groups was empirically determined (21 per cent and 67 per cent, respectively). The final population grouping — those aged over 64 — is determined as a residual to ensure "adding-up". Clearly the model is highly simplistic and ignores the important question of inter-cohort movements over time. Improvements to this model would be possible but we feel they would require a complexity out of keeping with any conceivable additional accuracy obtainable.

Net migration abroad is determined using an approach developed in Bradley and Fanning (1984) which is related to the standard approaches in the literature. Net migration is a linear function of the population group

Figure 2.5: *Schema for labour supply sector*
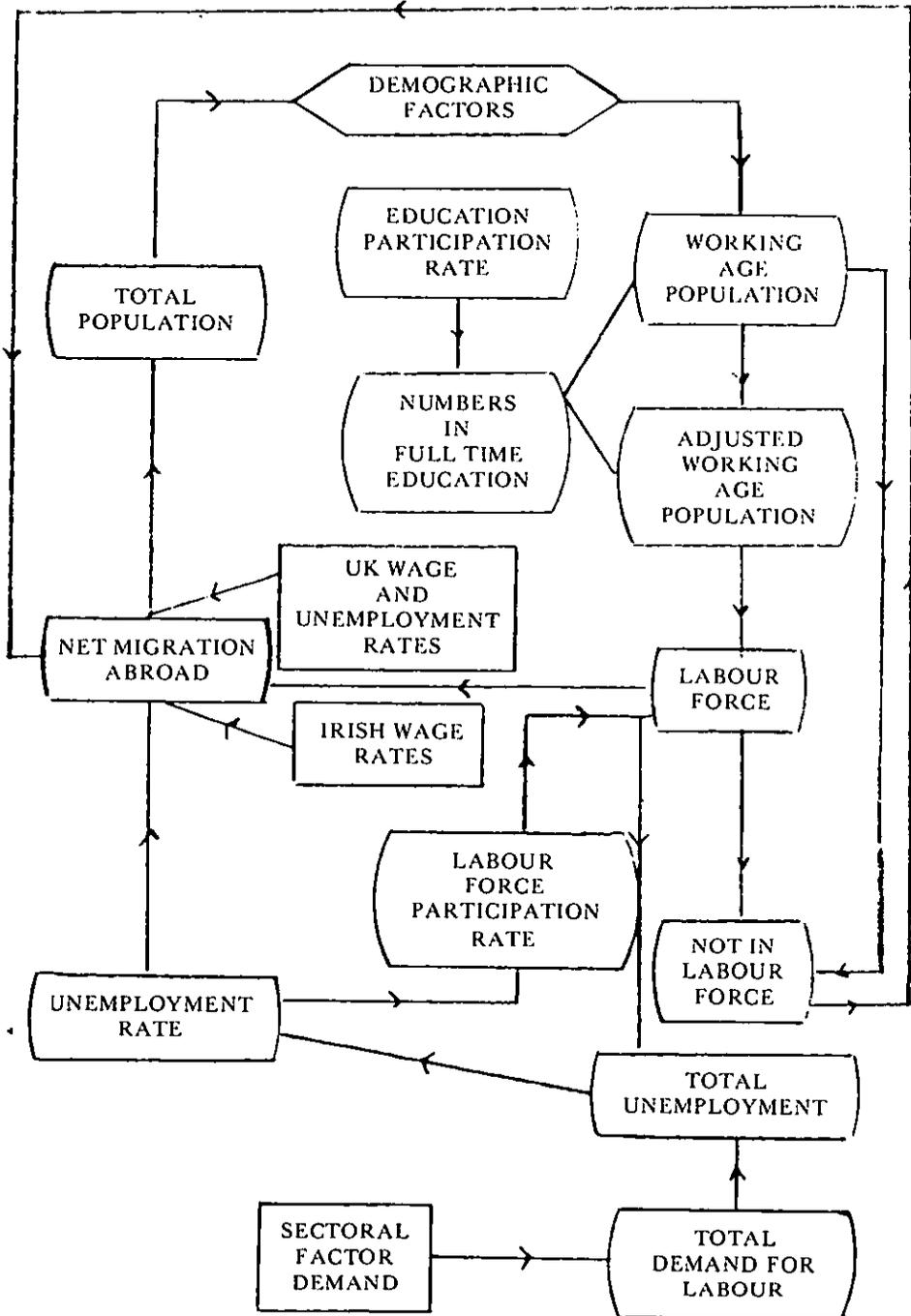
exposed to migration (i.e., those aged between 15 and 64). The coefficient
in the equation is sensitive to the relative attractiveness of working in Ireland
vis-à-vis working abroad, measured by the product of the relative employ-
ment probability between Ireland and the United Kingdom, and an Irish-UK
relative earnings measure. Such an approach derives from the well-known
Harris-Todaro models of urban-rural migration (Harris and Todaro, 1970).
Recent work by Kirwan and Nairn (1983) indicates that the position of Irish
labour in Britain has been more adversely affected by the present recession
than other classes of labour. For this reason, and also the exclusion of factors
such as unemployment benefits and tax rates, the migration equation should
be used with caution.

It is assumed that the dependent population groups do not participate in
the labour force. Furthermore, since education beyond the statutory limit
of 15 years has become progressively more common (particularly since the
extension of state funding in secondary education in 1968), an education
participation rate is determined as a function of a policy dummy variable
and a time trend to capture slowly changing attitudes to education. Attempts
to find real wage, unemployment and other economic influences failed. In
the actual model simulations this participation rate is exogenised and the
equation is retained merely to facilitate future extensions. Using the education
participation rate, two identities determine the population of working age
which is in full-time education and an adjusted measure of working age
population, i.e., the total less those in education. Labour force participation
is explained in terms of a discouraged-worker model. Estimation showed
that a rise of 1 per cent in the unemployment rate results in a fall of 0.015
per cent in the participation rate. Extensive investigation failed to yield
any sensible wage, price or social welfare influences. Unemployment is deter-
mined residually by subtracting the labour supply (determined above) from
the total demand for labour (determined in the industry, agriculture and
services sectors). The manner in which labour demand, supply and unemploy-
ment interact with each other and with the process of wage determination is
of central and crucial importance to the overall properties of the model. We
take up these issues in the income distribution block below and in the next
chapter, where we examine the performance of the model as a system.

National Aggregates: Supply and Income
This section of the model brings together, in aggregate summary accounts,
the supply implications of the previous sectors. The starting point for the
summary macroeconomic pattern of income distribution is the organisation
of sectoral supply information so as to obtain a definition of overall incomes
earned from production activity. The basic accounting identity adds up

the value of output produced by the three domestic sectors, adjusted for financial services. This is the total domestically earned income at factor costs. Net indirect taxes have to be added in order to value it at market prices. Gross national product is obtained by adding to GDP an estimate of net factor income from abroad.

Taking the value of GDP at factor cost as a starting point, we can follow through the distribution of aggregate income as it is affected by fiscal redistribution and its distribution between labour and capital. Identities are used to determine net domestic product at factor cost, net national income, the adjustment for stock appreciation, private income, personal income, personal disposable income and real personal disposable income. Company profits are determined residually from the output-income identity in rather the same way as imports of industrial raw materials were determined residually from the output-expenditure identity. The complex issue of what determines profit retention within the company sector is not addressed directly. Instead a simple linear relationship is assumed linking undistributed profits to total profits.

THE ABSORPTION BLOCK

Introductory Remarks

Our treatment of the second main block of the model involves the determination of domestic and foreign absorption. Domestic absorption is defined as the sum of consumption expenditures (by households and government), fixed investment expenditures (by industry, agriculture and services), housing investment (by households and government), and expenditures on inventory investment. Foreign absorption consists of exports of goods and services.

Our consumption function is an aggregate one and is of the conventional permanent income type. Experiments with other consumption functions surveyed elsewhere (Bradley and Fanning, 1984, pp. 175-184) indicated that our simple approach was not dominated by any other and, in addition, has the desirable virtue of stability. Government consumption is treated as a policy instrument, the components of which are the wage bill in public administration and other purchases, mainly from the non-marketed service sector. Our approach to modelling private housing investment attempts to cut through the complex details of the functioning of the housing market. We use an expenditure-type relation driven by real personal disposable income, but influenced by government housing transfers, interest rates and inflation. Government housing investment is treated as a discretionary policy instrument. The remaining investment categories have already been treated in the supply block, namely fixed investment by industry, agriculture and

services. Agricultural and intervention inventory changes are left exogenous. Non-agricultural inventory changes are determined in a simple stock adjustment model. Concerning exports, the component of gross agricultural output which is exported abroad has already been determined in the supply block. The determination of non-agricultural exports has been the subject of much controversy in Ireland and in the international literature. The choice of approach lies between supply driven, demand driven or hybrid models, and has been analysed in Bradley and Fanning (1984, pp. 196-202). In the model we implement both an export supply equation and a hybrid export function in order to study the robustness of our analysis to the choice of export model.

Consumption

Private consumption expenditures are determined by real personal disposable income. The impact marginal propensity to consume was estimated as 0.42, with a long-run value of 0.62. The long-run average propensity to consume (measured in 1970) is 0.86. A data dummy variable was included in the consumption function, essentially eliminating the year 1975. Government consumption is composed of two elements: a wages and salaries element for public administration employees and a residual element which covers other government consumption (mainly the wage bill of the non-marketed service sector).

Investment

Private housing investment is determined mainly as a function of real personal disposable income. Additional explanatory variables include real housing transfers (positive effect) and a real interest rate (negative effect). The real income elasticity was estimated as 1.8. Government housing investment is left as a discretionary policy variable. The remaining elements of total investment are determined in the supply block. It should be noted that we do not disaggregate fixed non-housing investment into its building and non-building components. Such a disaggregation could be made (using unpublished CSO data) and would greatly improve the specification of the various weighted final demand variables in the model.

Exports and the Balance of Payments

We treat exports in the model at a fairly aggregate level in keeping with the aggregate structure of the supply block. In the agriculture sector exports were determined residually by subtracting the fairly stable domestic absorption from total agricultural output. However, given the theoretical and empirical controversy that surrounds the determination of non-agricultural

exports in a small and open economy (Honohan, 1982), we have included stylised supply and demand interpretations. Underlying both models is the assumption that export prices are determined on world markets. In the first variant, exports are a function of world demand (proxied by a trade-weighted GDP measure) and the profitability of exporting (the export price relative to the Irish unit labour costs). The demand elasticity is 1.03 and the profitability elasticity is 1.4. In addition, a secular export growth of 7 per cent per annum could not be accounted for by economic variables but is probably capturing such phenomena as the progressive "opening up" of the economy to world trade and the difference between the gross measure of exports and the added value measures of world activity. In the second variant the ratio of exports to industrial capacity output is determined by export profitability (elasticity 1.13) and a secular growth (3.7 per cent per annum). A consequence of this formulation is that world demand has no contemporaneous effect on exports (industrial capacity is a very sluggish function of world activity and domestic absorption is only indirectly affected by world activity). In a third variant we make the stylised export supply function parametric in disequilibrium growth in world demand.

Within our overall model system the controversy over export determination becomes less important than the key issue of the determination of industrial capacity. In the case where industrial capacity is uninfluenced by domestic absorption (i.e., the "pure" export-led growth model), both demand and supply export functions yield similar results. However, allowing domestic absorption to influence industrial capacity (i.e., the "generalised" export-led growth model), introduces a wedge between the supply and demand export functions. For example, hiring an extra 1,000 civil servants will boost domestic absorption and, using the generalised export-led growth model, will raise industrial capacity. However, the circumstances under which this would lead to increased export growth would have to be examined very critically.

National Aggregates: Demand

In the model we must establish a series of identities which determine various expenditure aggregates: domestic absorption, domestic expenditure, final demand and the necessary weighted expenditure aggregates. The historical "statistical discrepancy" that emerges is the excess of gross domestic expenditure over output at constant prices. This discrepancy arises due to incompatible deflation procedures on the output and expenditure sides of the national accounts, a process which is mirrored within the model by including the *historical* value of STATDIS as an exogenous variable. In carrying out simulations in the out of sample period we set STATDIS to zero or

to some average value if the historical discrepancy displays a systematic component.

THE INCOME DISTRIBUTION BLOCK

Introductory Remarks

The third and final block of the model translates the factor based modelling of supply into the pattern of income distribution which results from the interaction of production and demand activities. Our usage of the term "income distribution" is a rather limited one and is taken to mean the prices and incomes accruing according to the sectoral and expenditure categories used in the model. We do not consider the important issue of the distribution of personal incomes *within* these sectoral categories, a question which would require considerably more detail than is available in the present model.

The basic inspiration for the determination of prices and wages comes from the Scandinavian model (Lindbeck, 1979), the details of which are briefly summarised below. We identify our industry sector with the "tradables" sector and the services sector with the "non-tradables" sector. In the main variant of our model, the price of tradables is determined on world markets. Wage inflation in both the tradables and the non-tradables sectors adjusts to the "room" for wage increases in the tradables sector, i.e., an increase which is consistent with a "normal" profit share. Price inflation of non-tradables is determined by cost-push forces and the overall price inflation is a weighted average of both tradable and non-tradable inflation.

The number of expenditure categories distinguished in the model is quite large. Each of these categories (eight in all) requires its separate price. The basic approach to modelling the expenditure deflators is quite uniform in that they are "explained" in terms of their component prices. In other words, any such deflator simply incorporates the prices of all goods and services which go to make them up, and includes any tax effects. The weights, which are assumed constant, can be obtained by statistical estimation — the approach we have used — or from Input-Output tables.

The bargaining process which underlies the Scandinavian wages model for the tradables sector can be interpreted in different ways. Our model implementation reflects this ambiguity in that various choices are offered for the tradables wage equation, e.g., for the role of direct taxation and its incidence, for the price index used in evaluating labour's share of added-value, and for the role of the Phillips curve in modifying bargaining strengths (Lindbeck, 1979). Wages in the services sectors adjust to those in industry, i.e., the labour market is assumed to be fairly homogeneous.

The fiscal and monetary aspects of the model are concerned with three issues:

  (i)   Income redistribution via taxes and expenditures
  (ii) Derivation of the government's budget constraint
  (iii) Monetary consequences of financing the borrowing requirement.

Consequently, the fiscal sector is concerned with modelling of direct and indirect tax revenues, subsidies, personal transfers, interest payments on national debt, etc., and with the isolation of the instruments of fiscal policy. The monetary environment is modelled using a conventional SOE fixed exchange approach. This has important long-term consequences which must be clearly understood if one is to interpret the policy simulations correctly. We return to this point in Chapter 4 below.

Producer (Added-Value) Prices

The deflator of industrial added-value plays an important role in the model as a major component of the deflator of overall GDP at factor cost. Assuming perfect commodity arbitrage in the long run for a homogeneous aggregate tradable commodity, we determine industrial producer prices as a distributed lag over world prices of manufactured exports. In estimation we force full adjustment within two years, 40 per cent of the adjustment coming through in the first year. In a second variant of the industrial price equation we modify the external determination of prices by adding as an additional explanatory variable, abnormal changes in Irish unit labour costs in industry. Empirically, a 1 per cent rise in unit labour costs above their expected value causes a 0.6 per cent rise in price. In a third variant we determine industrial prices by a simple mark-up on unit labour costs, i.e., a model which would be relevant to a price-making economy.

The nearest proxy to the price of gross industrial output is the price of gross output of the transportable goods industries. This gross output price is determined in the model as a function of the added-value price (determined above), and the price of material inputs (proxied by import prices and agricultural output prices). In estimation a homogeneity constraint was not rejected by the data. The elasticities with respect to added-value, imports and agricultural output prices were, respectively, 0.18, 0.53 and 0.29. The output of the services sector is largely non-traded and a cost mark-up model of added-value prices yielded an adequate statistical fit. The price of material inputs in agriculture is explained in terms of its component prices, i.e., agricultural output prices and industrial output prices, the first as a proxy for farm-type inputs and the second as a proxy for other inputs. The dominant explanatory variable proved to be the industrial price. Two identities complete this section: the first determines the deflator of added-value in agriculture; the second determines the overall deflator of GDP at factor cost.

Expenditure Prices

The deflators of the expenditure categories used in the model (other than non-agricultural exports) are explained in terms of their components in an equation of the general form

$$\log \text{PEX} = a_0 + a_1 \log \text{PGDPFC} + a_2 \log \text{PMGS} + a_3 \log (1 + \text{TINC})$$

where PEX is any expenditure deflator, PGDPFC is the deflator of GDP at factor cost, PMGS is the deflator of total imports and TINC is an index of indirect taxes net of subsidies. The tax variable was found to be of statistical significance only in the case of the private consumption deflator. Hence, for simplicity, we regard *all* indirect taxes and subsidies as bearing on private consumption and estimate the consumption price equation with the coefficient on the net indirect tax rate constrained to unity. The complete estimation results are given in Appendix 2. Briefly, the split between the GDP price component and the import price component broadly mirrors the import content of the expenditure category in question. Finally, the price of non-agricultural exports is determined by world prices of manufactured exports.

The deflator of inventory changes proved particularly difficult to model. The deflator of inventory stock levels was determined in an equation of standard form with a GDP price elasticity of 0.37 and an import price elasticity of 0.63. The inventory change price deflator was related to the average of the contemporaneous and lagged stock level deflator with an imposed elasticity of unity. In addition, any price disequilibrium between import prices and industrial output prices is allowed to influence the inventory change price with an elasticity determined by estimation. A 1 per cent increase in the price of imports relative to the price of industrial output results in a 0.5 per cent increase in stock change prices.

Three further deflators are needed for the model. The first concerns the deflation of the item "adjustment for financial services" in the national accounts, an item which refers to the excess of interest and dividends received by financial institutions over payments to depositors. The necessary deflator is simply linked to the overall GDP deflator. In order to derive GDP at constant market prices it is necessary to value taxes on expenditure and subsidies at base year prices. The description of the official process of deflation reads as follows:

> Where taxes on expenditure and subsidies relate to particular goods
> the rate or subsidy per unit quantity of the item taxed or subsidised,
> if available, is used to derive an index to deflate current values. In
> the case of "ad valorem" duties both the rate of duty and an
> appropriate price index are used to compile constant price data.

If neither of these methods of deflation can be used the estimation of a constant price series is made by using volume indicators appertaining to the relevant industry or by deflating by a suitable price index.

In the spirit of this rather vague description, the deflator of taxes on expenditure and the subsidies deflator are simply linked to the overall GDP deflator.

Wages

The basic idea of the Scandinavian model, when used as a positive theory of inflation, is the assertion that the rate of wage inflation tends to adjust to the "room" for wage increases in the tradable sector, as defined by the sum of the (exogenous) increase in world market prices for tradables and the rate of productivity increase in the tradable sector. A second key assumption is that the labour market is homogeneous and that the wage increase determined in the tradable sector is "inherited" by the non-tradable sector. After extensive empirical experimentation with a wide range of alternative models (bargaining models, expectations-augmented Phillips curves, etc.), we choose to implement a very simple version of the Scandinavian model based on the observed regularity in labour's share of added value in industry over the period 1960 to 1980. Five different measures of labour's "share" were defined as follows:

$$SHR1 = LI*WI*RETRAT/(POI*OI)$$
$$SHR2 = LI*WI/(POI*OI)$$
$$SHR3 = LI*WI*RETRAT/(PCPER*OI)$$
$$SHR4 = LI*WI/(PCPER*OI)$$
$$SHR5 = LI*WI*(RETRAT)^{0.5}/(PCPER*OI)$$

where LI denotes employment in industry, WI denotes average annual earnings, RETRAT denotes the average retentions ratio, OI denotes added-value in constant prices, POI is the added value deflator of industrial output and PCPER is the deflator of private consumption expenditures. The sample period averages were as follows (for 1962 to 1980):

	Mean	*Standard Deviation*
SHR1	0.61	0.023
SHR2	0.72	0.034
SHR3	0.58	0.025
SHR4	0.69	0.030
SHR5	0.63	0.019

For example, the statistics for SHR1 show that labour's share of added-

value, net of all direct taxes, averaged 61 per cent. However, if labour evaluated its share by using the consumption deflator (SHR3), its average share falls to 58 per cent. The formula for SHR5 uses the elasticity of 0.5 on the retentions ratio, found by Hughes (1985).

We regard each measure of labour's share as the basis for a possible target nominal wage; e.g., using the above mean value of SHR1 we obtain

$$WIT1 = SHR1 * POI * OPRI / RETRAT$$

where OPRI denotes labour productivity. Actual wages, WI, adjust to the target wage by means of an error-correction mechanism:

$$\Delta \log WI = a_1 * \Delta \log WIT1 + a_2 * \log(WIT1/WI)_{-1}$$

The wage bargaining process can also be influenced by deviations of the unemployment rate from its trend. This was the only form of the Phillips curve that proved statistically significant and has obvious interpretations in terms of the "natural rate" hypothesis. The empirical results showed very quick adjustments to the target wage. Where a Phillips curve was included, a one percentage point rise in the unemployment rate above its trend causes a two percentage point fall in the rate of wage inflation. In all we have available ten variants of the industrial wage equation corresponding to the five measures of labour's "normal" share including and excluding the Phillips curve effect. These variants permit us to examine the macro consequences of the following issues:

(i)   Direct tax incidence: who pays the extra direct tax?
(ii) Is the process of wage bargaining dominated from the supply side or the demand side?
(iii) How important a role does the Phillips curve play?

The fact that we have felt obliged to include so many polar choices in the wage equation should serve as a measure of our relative ignorance of this whole area and may be preferable to "plumping" for a particular single formulation (Hersong, 1984, provides a theoretical analysis of the links between points (i) and (ii) above). Indeed, the almost universal absence of direct taxation effects in wage equations is one of the more curious features of macroeconometric models (Britton, 1983, on the NIESR model of the United Kingdom is a recent example) and serves to introduce a serious asymmetry between, say, the employment effects of direct and indirect taxation policy changes.

In conclusion, wage inflation in the marketed, non-marketed and public administration service sectors is simply linked to the industrial (or tradable) sector by means of error-correction mechanisms. The speed of adjustment in

every case is extremely rapid. Such a linkage does not imply that any wage inflation spiral must *initiate* within the industry sector. It does, however, imply that in the long-run maintenance of industrial sector competitiveness acts as a constraint on intersectoral wage differences.

Fiscal Activities: General Remarks

The purpose of the fiscal sector of the model is relatively straightforward. Equations are provided to endogenise the main indirect tax revenues (excise duties, VAT, motor vehicle duties, customs duties and a residual category), direct tax revenues (income tax, social insurance contributions and corporation tax), and income transfers (unemployment transfers, social welfare transfers and national debt interest payments). The main current expenditures on goods and services and the entire capital budget are treated as discretionary policy instruments. We have no doubt but that this approach to expenditure is a gross simplification of the true state of affairs and some alternative approaches are outlined in Bradley and Fanning (1984, Chapter 8). We return to the question of the exogeneity assumption for government expenditures in Chapter 4 below.

The tax revenue equations in the model are based on the following underlying identity:

$$T = \sum_{i=1}^{n} t_i TB_i$$

where T denotes revenue from any of the range of direct and indirect taxes; t_i denotes statutory tax rates, where i indicates a specific income bracket or expenditure category; TB_i denotes the tax base, distributed by tax bracket or expenditure category and measured net of deductions and exemptions; n denotes the number of tax brackets or expenditure categories. With a sufficiently detailed disaggregation of TB, in principle it would be possible to reproduce the above identity in the model and no statistical estimation would be required. However, in almost all cases such a level of disaggregation would be impracticable and the identity is usually replaced by an approximation of the form

$$T = tr^a * TB^b$$

where tr is a representative or average tax rate and TB an aggregate proxy for the tax base. The rate elasticity, a, gives some indication of how representative tr is since values below unity would imply that only part of the tax base is "covered" by the chosen rate. The base elasticity, b, measures the progressivity of the rate schedule as well as the effect of changes in the distribution of income or in the composition of aggregate expenditure

occurring in response to tax base variations. A distinction between real and nominal changes can be introduced as follows, where P is a price index:

$$\log T = \alpha \log tr + \beta \log(TB/P) + \gamma \log P$$

where β measures the revenue effect of real income or expenditure changes and γ gives an indication of inflation-induced fiscal drag.

In order to link tax revenue equations with the rest of the model, the tax bases, TB, need to be defined in terms of income and expenditure concepts which are at once appropriate and available. For example, for excise duties TB is taken as total household consumption. A highly disaggregated study of taxation has been carried out by Keegan (1984) where the tax bases are determined in a consumer demand system. While such a level of detail is necessary for preparation of individual budgets, we feel that our broad aggregate approach is quite adequate for a study of medium-term policy issues.

For administrative reasons fiscal activities are classified as current account and capital account. The current account activities (both expenditure and taxation) are the subject of annual review in the Budget, while activities on the capital account are the subject of the annual Public Capital Programme (PCP). However, these are by no means self-contained categories and are subject to frequent cross-classification and re-definitions. On the capital expenditure side, there are three items which represent direct government investment in housing and in other fixed assets and that part of fixed investment by the non-marketed services sector which is part of the PCP. Capital transfers are made to industry, the rest of the company sector, to the personal sector for housing and for other purposes and a residual category. All of the above capital expenditure items together with the small capital revenue side are treated as discretionary policy instruments.

Fiscal Activities: Details

Four major types of indirect taxation are considered: a large grouping of excise taxes, the value-added tax, motor vehicle duties and a residual class of indirect taxes. The equations follow the general schema discussed above. The rate, base and price elasticities are indicated below:

	Rate	Base	Price
Excise duties	0.77	0.88	0.33
Value-Added Tax	1.08	1.38	1.00
Motor vehicle duties	0.93	1.53	—
Residual category	1.43	1.08	1.02

The low value of the price elasticity for excise duties is to be expected given the specific nature of excise duties. The rate elasticities for excise duties and for the residual category give some cause for concern, as do the base elasticities for VAT and motor vehicle duties.

Three types of direct taxation are considered: direct income tax, social insurance contributions (the sum of flat rate contributions, discontinued in 1979, and pay-related contributions, introduced in 1974) and company taxation. Given the great complexity of the income taxation system, we use a very simple approach based on an assumed exogenous average tax rate with tax revenue determined by an identity. This approach, although crude, seems preferable for our purposes to the approach of Dowling (1975) who modelled income tax revenues as a function of a complex measure of allowances claimable, but did not include explicit tax rates. Our approach ignores the progressivity of the tax system at any point in time but it could be generalised to take account of this. A very detailed sub-model of the income tax system has been developed by FitzGerald (1984b) and could be incorporated into later versions of our model. The social insurance system is modelled in a similar way with the average rate of contribution exogenous. Finally, no attempt was made to grapple with the complexities of the corporate tax system. A simple equation is used to link revenue with company profits, the profit elasticity being 0.84.

Subsidies in the model are of three types: subsidies on personal consumption, EEC subsidies and a residual category. The latter two are left exogenous while the consumption subsidy is handled by defining an explicit subsidy "rate" which is regarded as a discretionary policy instrument.

Three categories of personal income transfers are modelled: unemployment assistance and benefit, pay-related unemployment benefit, and a residual (but very large) category of mainly social welfare transfers (i.e., pensions, sickness benefit, etc.). Unemployment assistance and benefit payments are related to a payment rate and total numbers unemployed. Only a short data sample is available for pay-related unemployment benefit and a simple equation links expenditure with a lagged wage rate and numbers unemployed. Finally, the residual category of social welfare transfers covers a wide and heterogeneous mixture of payments ranging from old age pensions, health benefits and children's allowances, to secondary school teachers' salaries. An explanation along standard lines — i.e., expenditure related to a rate of payment and a base — proved impossible at an aggregate level. In the present version of the model they are left as discretionary policy instruments.

National Debt Interest Payments

National debt is considered in two parts: debt denominated in Irish pounds

and debt denominated in foreign currency. Interest payments on the first component are explained in terms of a rate of interest and changes in National Loans outstanding. The actual stock of debt outstanding is exogenous. In this version of the model we determine interest payments on foreign debt as if all foreign debt was of infinite maturity. We also permit a simple revaluation option for the stock of foreign debt outstanding when exchange rates change. The details of this area are probably best handled in satellite sub-models by analysts with particular concern for the composition of the foreign debt and the debt maturity structure.

Identities are used to determine total current expenditure by government, total capital expenditure, total revenue and the resulting borrowing requirement. This borrowing requirement can be financed by either monetary or non-monetary means. Monetary financing consists of money creation by the Central Bank or of foreign borrowing. Non-monetary financing consists of borrowing from domestic commercial banks and the non-bank public. Foreign borrowing is determined in the model as the residual financing element.

Monetary Activities

As explained in the introduction, an SOE, fixed exchange rate monetary sector is included in the model. The first element consists of a demand for money equation which determines the broad money aggregate, M3, in constant prices as a function of real GNP, the inflation rate and the ratio of the deposit rate to the lending rate. Estimation yielded a GNP elasticity of approximately unity, an inflation elasticity of -0.5 and a small positive, but statistically insignificant, interest rate differential elasticity. The existence and stability of the demand for money equation is important for the monetary authorities irrespective of whether policy is conducted within a closed economy or within an open economy with a fixed exchange rate and dominated by external financial markets. With perfect capital mobility there is no scope for altering the domestic interest rate since any attempt to do so will be frustrated by capital flows. A stable demand for money function in this case implies that if the monetary authority carries out policy actions designed to change the domestic component of the money stock (i.e., domestic credit), there will be equal and offsetting changes in the foreign component. Hence, in an open economy with virtually perfect capital mobility, a stable demand for money equation enables the Central Bank to adapt domestic credit policy to attain an external reserves target.

The second element of the monetary sector, the financing of the public authorities borrowing requirement, has been included in the fiscal sector where the foreign element is determined residually. The empirical assumption being made is that the borrowing requirement can be financed domestically

or abroad by changes in interest rates which are small enough that their effects on domestic spending can be ignored (Helliwell *et al.*, 1982). In using such a model over a period of sustained deficits by the public sector, the implications of this assumption must be closely monitored, particularly aspects related to debt accumulation and resulting debt service payments problems and the exogeneity of the exchange rate.

The third element of the monetary sector links the balance of payments with changes in the official external reserves. This relation is used to endogenise the net capital inflow of the non-bank private sector and is at the core of the perfect capital mobility assumption. The final identity concerns the sources of the money supply and simply states the two sources involved — domestic credit and the external reserves. The entire specification of the monetary sector is highly recursive. Gross National Product and its deflator are determined in the real sector and are used to determine money demand. Given a level of domestic credit the level of external reserves are determined. Given the level of reserves and the balance of payments, the private net capital inflow is determined.

Chapter 3

EMPIRICAL TESTING OF THE MODEL

In Chapter 2 we presented and discussed the structure of the model on an equation, sectoral and block basis. In this chapter we examine the model as a complete system. We simulate it through the within sample data period (1966 to 1980) in order to examine its tracking performance. We also subject the model to exogenous "shocks" and examine how the model reacts to them. Here, of course, we have nothing but intuition and common sense to guide us in our evaluation. Through execution of such tests we are better able to pass a rough judgement upon the validity and applicability of the model as a tool for policy analysis.

Our general philosophy of model construction should be clear from Chapter 2. We feel that it is necessary to impose as rigorous a macro-theoretical structure as possible on a macroeconometric model since it is only through such a perspective that policy analysis can be adequately rationalised. Given this objective, it became clear that one must trade off theoretical rigor against tracking performance. If one adds enough explanatory variables it is usually possible to account for the twists and turns of even the most obstinate dependant variable! Because of this we felt that the analysis of multipliers should be used as the predominant criterion for model testing with the requirement of "reasonable" tracking performance being a necessary, but not sufficient, condition for model acceptability. To adopt this attitude does, however, require the theoretical underpinnings to be subjected to very close scutiny.

Before turning to the empirical analysis we give a brief outline of the manner in which the different sectors of the model operate and of some of the main linkages between sectors when the model is operated as an integrated system. The model has a strong supply orientation in its concern with the determination of output in industry, agriculture and services. In industry, capacity output is determined by long-run demand and by competitiveness. There is great difficulty in specifying the industry sector given that it is composed of both traded and non-traded components. Our standard model variant treats the entire industrial sector as potentially tradable and determines capacity as a function of world demand and competitiveness. Complementary to this, in the price sector we determine the industrial output price purely in terms of world prices. Such a stylised approach serves to play down the influence of any potential domestic effects on industrial capacity and in

different variants we examine the effect of relaxing this restrictive formulation. Conversely, the marketed services sector has been treated as a non-traded sector with output determined by domestic demand and price determined as a mark-up on unit labour costs. The non-marketed services sector and the public administration sector are driven by policy instruments, expenditure or employment. In the agricultural sector, capacity output displays great inertia and is only influenced by profitability and the weather to a slight degree. Consequently, it is relative impervious to changes in the other sectors since it is driven more by exogenous factors and demographic forces than by economic circumstances.

The manner in which the model framework is specified conditions the way in which shocks feed through the economy. For example, the demand effect of a fiscal expenditure stimulus will initially influence the public administration or the NMS sectors with the demand expansion effect spilling over into the marketed services sector and, depending on the choice of industrial capacity output model, possibly into the industry sector. On the other hand, the effect of an increase in world demand will result in increased exports and industrial output, which then filters through over time to the MS sector through increased disposable income. The NMS and public authority sectors are unaffected.

The price and competitiveness effects of exogenous shocks are also of great importance. In the industrial sector, competitiveness is measured by the ratio of a weighted sum of Irish unit capital and labour costs to "world" unit labour costs. Clearly Irish competitiveness will depend upon the manner in which wages and productivity are determined in the model. The well-known Scandinavian model of SOE wage-price determination has been used but differs from the "text-book" version in that productivity is endogenously determined in our model and the wage determination process can be modified by a short-run Phillips curve. The role played by returns to scale in industry also generates links between supply and price/competitiveness aspects of the model particularly since the positive relationship between output and productivity implicit in increasing returns, *ceteris paribus*, is not evident under constant returns to scale. The implications of various different maintained hypotheses are explored below.

The government borrowing requirement is derived residually as the difference between expenditure and revenue. The component of the borrowing requirement which is financed domestically is exogenous and net foreign borrowing is ultimately the residual. If unadapted, this has the implication that when the model is perturbed by a fiscal expansion not only is the policy financed by foreign borrowing but all interest payments on the increased foreign debt are also financed by further foreign borrowing. As a result,

foreign debt interest payments do not act as a leakage upon domestic demand but rather debt is simply accumulated. To rectify this problem it has been assumed in all fiscal multiplier analysis in this chapter that any increase in interest payments on foreign debt above its historical value is financed by increased taxation. In our multiplier calculations we use direct income tax as the source of this extra finance but any other tax or selection of taxes could be used. The effect of introducing this mechanism is that, subsequent to the initial demand stimulus, increased interest payments act as a leakage on aggregate demand which serve to negate any expansionary effect of the fiscal stimulus, a process which is exacerbated if target wage growth is determined net of direct taxes.

The process whereby fiscal expansion (and contraction) affects the economy is quite complicated. Such expansion, presumed to be financed by foreign borrowing, might initially stimulate public administration employment, with demand spill-over into the market services sector and, possibly, the industrial sector. The unemployment rate is reduced so that unemployment transfers fall, at fixed transfer rates. Tax revenue also initially rises since disposable income and expenditure rises. On the other hand, a fall in the unemployment rate induces wage inflation via the Phillips curve (if selected), thus disimproving international competitiveness at fixed output prices. Furthermore, increased gross wages and/or reduced unemployment will induce net inward migration via the Harris-Todaro migration model. These mechanisms will work towards offsetting the initial beneficial effect on the unemployment rate. Finally, the initial expansionary effects on demand are further offset by increased imports (since disposable income has increased) and by increased interest payments on the foreign debt (at fixed interest rates). The complex combination of these and other factors determines the eventual outcome of the fiscal stimulus.

Before examining the multiplier properties of the model and its sensitivity to various possible equation variants, we now turn to the tracking performance of the model.

TRACKING PERFORMANCE OF THE MODEL

Errors enter the model system through the stochastic errors in the behavioural equations. If all the behavioural equations fitted perfectly within sample, the model, when simulated as a system, would reproduce the entire set of endogenous variables exactly. In practice, of course, this is never the case. Intuitively one feels that the within-sample tracking errors of the individual behavioural equations will represent a lower bound of error when compared with the errors of the model simulated as an integrated system. In Appendix 2 the behavioural equations are presented, along with a selection

of summary statistics that describe the "goodness of fit" of the equations considered in isolation. However, to examine the performance of the model as a system we must simulate it in various ways and test its tracking ability. For reasons of space it is clearly impossible to provide analysis of tracking performance for all variants of the model. Instead, we have defined a "standard" model as a basis for tracking and multiplier analysis. With reference to the discussion of Chapter 2, this "standard" version has the following features:

(i) Increasing returns to scale in the industry sector
(ii) Industrial capacity determined by world demand and competitiveness
(iii) Industrial exports determined by demand and profitability
(iv) Industrial prices determined by world prices
(v) Target industrial wage determined in terms of consumption prices and net of direct taxation
(vi) Industrial wage determination characterised by a short-run Phillips curve.

In Table 3.1 we present summary statistics for a subset of the endogenous variables in the model. We examine three different types of simulation; a single-equation simulation where each equation is considered in isolation; a static simulation where the model is treated as a complete system but is "restarted" every year; and a full dynamic simulation where the model is started in a specific year and allowed to run on to a terminal year. Each of these simulations constitutes a progressively more stringent test of the model's performance as a system. The summary statistics used to compare the three simulations are the root mean square error (RMSE) and the root mean square percentage error (RMSPE) which are defined as

$$RMSE = \frac{1}{T}\sqrt{\sum_{t=1}^{T} (Y_{it}^{*} - Y_{it})^2}$$

$$RMSPE = \frac{1}{T}\sqrt{\sum_{t=1}^{T} [(Y_{it}^{*} - Y_{it})/Y_{it}]^2}$$

where Y_{it}^{*} is the simulated value of the ith endogenous variable at time t, Y_{it} is its historical value and T is the number of time periods in the simulation. No statistics are presented under the single equation forecast for industrial output, and fixed investment in industry, private services or agriculture as these variables are generated by identities in the model. The same is also true of total imports, employment, the balance of payments, various demand aggregates and the government borrowing requirement as

Table 3.1: *Simulation results for 1966 to 1980*

Variable:	Single equation static forecast		Static simulation of the model		Dynamic simulation of the model	
	RMSE	RMSPE	RMSE	RMSPE	RMSE	RMSPE
Industry						
Capacity[1]	23.8	2.0	23.8	2.0	39.9	3.1
Output[1]	—	—	36.5	3.1	34.3	2.8
Capital stock[1]	8.6	0.3	36.1	1.6	54.9	2.1
Fixed investment[1]	—	—	22.3	8.8	24.8	9.4
Employment[2]	—	—	5.5	1.7	7.2	2.2
Agriculture						
Output[1]	—	—	32.4	7.5	31.3	7.2
Capital stock[1]	8.0	0.7	8.6	0.8	22.6	2.0
Investment[1]	—	—	8.6	7.0	12.2	9.4
Employment[2]	2.6	1.0	2.6	1.0	3.0	1.1
Private services						
Output[1]	28.5	2.7	30.2	3.0	30.4	3.0
Capital stock[1]	69.0	5.0	69.6	5.1	100.4	6.0
Investment[1]	—	—	69.6	38.6	58.6	40.0
Employment[2]	11.0	3.5	6.7	2.1	6.6.	2.1
Public services						
Output[1]	16.1	3.6	25.7	5.9	22.1	5.2
Employment[2]	—	—	5.2	4.4	5.2	4.4
Public administration						
Output[1]	4.3	1.8	4.3	1.8	4.3	1.8
Trade						
Total imports of goods and services[1]	—	—	137.5	6.9	81.3	4.2
Materials for further pro-duction industry[1]	—	—	116.3	9.8	77.1	6.3
Non-agricultural exports[1]	36.6	2.9	36.6	2.9	72.7	5.8
Balance of payments rate[3]*	—	—	3.3	245.5	2.7	97.4
Supply and demand aggregates						
Employment[2]	—	—	11.4	1.1	12.1	1.1
GDP at market prices[1]	—	—	61.5	1.8	68.3	2.0
Personal consumption[1]	28.1	1.3	39.1	1.7	33.3	1.5
Gross domestic expenditure[1]	—	—	61.5	1.8	68.2	2.0
Total fixed investment[1]	—	—	78.7	11.2	68.8	9.8
Disposable income[1]	—	—	66.5	2.2	55.0	1.8
*Net migration abroad[2]**	6.5	117.4	6.5	118.0	10.9	144.5
Wages and prices						
Industrial wages[4]	0.08	2.7	0.094	3.7	0.085	3.0
Private service wages[4]	0.09	5.2	0.09	4.8	0.08	3.2
Public sector wages[4]	0.08	1.7	0.17	4.5	0.16	4.3
Industrial output deflator[5]	0.05	4.8	0.05	4.8	0.05	4.8
Service sector output deflator[5]	0.017	1.7	0.019	2.2	0.026	2.3
Consumption deflator[5]	0.012	1.3	0.019	1.6	0.016	1.4

Superscripts refer to units of measurements as follows:

1. £m, 1975
2. 000s
3. ratio to GDP at market prices
4. £000s, 1975
5. index, 1975 = 1.

they are identities comprising of the relevant components determined endogenously elsewhere in the model.

Our prior expectation as we move to the right across Table 3.1 is that the tracking performance as measured by RMSE and RMSPE will deteriorate. We find that, for a number of variables examined, the fit does not deteriorate between the static and dynamic simulation. In fact it improves. The results presented in Table 3.1 seem reasonably satisfactory given the rapidly changing structure of the Irish economy over the 1966 to 1980 period. The only serious anomalies which exist are our failure to estimate adequately net migration abroad or investment in private services. Our failure to capture the movements in these variables and its implications are returned to in the next section where similar results are plotted against their historical equivalents.

Those variables against which an asterisk have been placed consist of economic factors which have changed sign throughout the 1966 to 1980 period. For example, net migration may be +500 one year and –100 the next. As a result, the historical level of any of these variables may often be very close to zero. Therefore any errors which occur at these points will be magnified if presented in percentage error form as the base (i.e., the historical level of the variable) is very low. For instance, a 1,000 error when the base is 200 will appear very much larger than when the base is 20,000. As a result we would suggest that the RMSE be used as the relevant validation criterion as it gets over this problem.

In Figures 3.1 to 3.6 we present plots over time of the actual and dynamically simulated values of a number of key economic indicators. These historical values are given by the continuous line and the simulated values by the broken line. In Figure 3.1 we present a number of variables characterising demand in the economy — personal consumption, gross domestic expenditure, disposable income, non-agricultural exports and total fixed investment. We see that household consumption tracks well with the only significant errors occurring in 1968 and 1980. Gross domestic expenditure also tracks well, any errors being both small and non-systematic (meaning that there is no long-run deviation above or below the historical solution). Disposable income is captured quite well with the only serious errors occurring in 1979 and 1980, as a result of the failure of the model to adequately quantify tax revenue in those years. Non-agricultural exports do not track as well as the other variables mentioned above after 1972 though this is hardly surprising given the growing export-orientation of the Irish economy in a period, of depressed world demand. Finally, total investment is captured quite well with the exception of a huge under-prediction in 1975 and 1976 (7% and 25%, respectively).

In order to find the source of the large error in total investment we plot

Figure 3.1: *Within-sample tracking: selected demand variables*
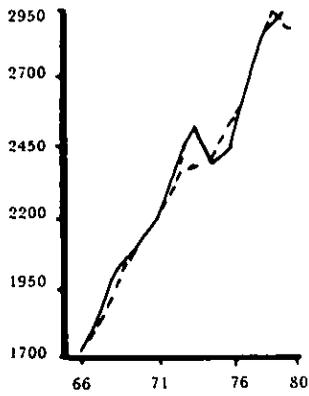
Personal Consumption (£m, 1975)
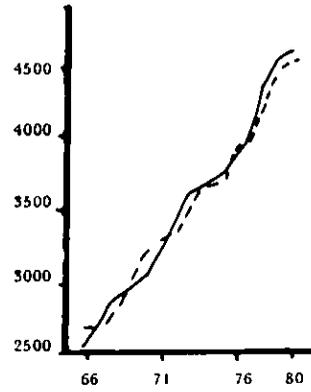
Gross Domestic Expenditure (£m, 1975)
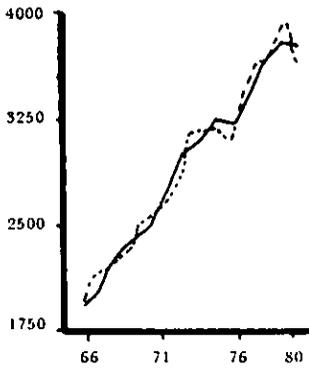
Disposable Income (£m, 1975)

Gross Non-agricultural Exports (£m, 1975)
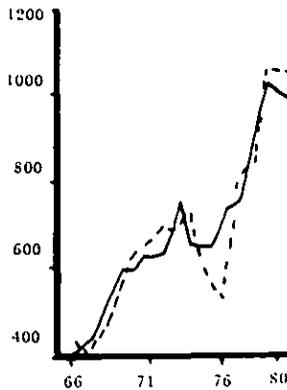
Total Fixed Investment (£m, 1975)

Figure 3.2: *Within-sample tracking: sectoral investment*

Industrial Investment (£m, 1975)

Market Services Investment (£m, 1975)

Government Investment (£m, 1975)

Agricultural Investment (£m, 1975)
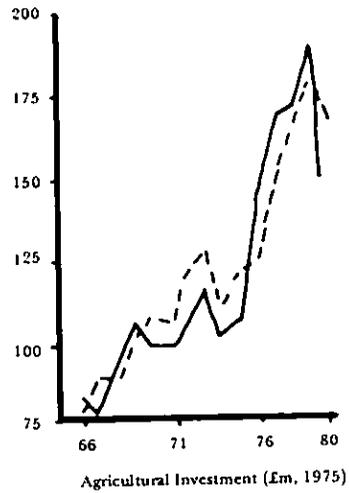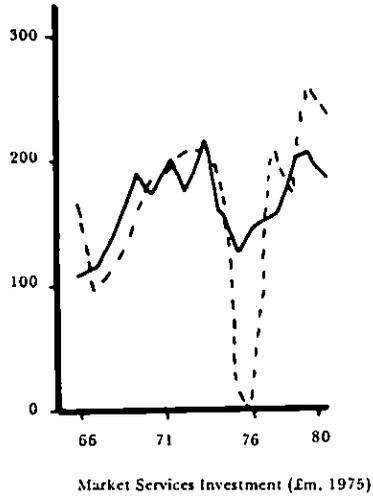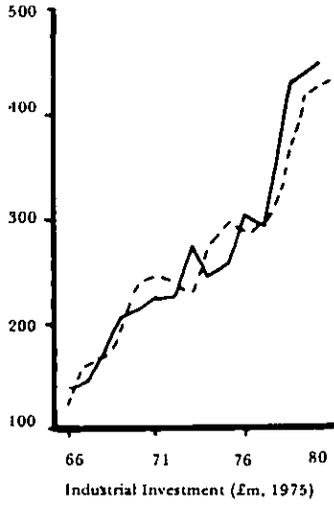
investment at a sectoral level in Figure 3.2. Of the £200m error in total investment in 1976, 75 per cent is explained by under-prediction in the private service sector. Further examination suggests that this problem has been caused by a failure both to estimate output and to capture relative capital-labour prices in private services in those years. This problem is returned to below in a discussion of sectoral employment (see Figure 3.3). Investment in the other sectors shows an adequate tracking performance. In the case of government investment, since the value of investment is a policy instrument (and hence exogenous), errors can only arise through the price system.

In Figures 3.3 and 3.4 we present a graphical analysis of the model's performance in tracking sectoral supply. Value-added output in industry is captured satisfactorily though is over-predicted in 1974-75 and under-predicted in 1980, the latter case probably explicable by the impressive export performance during that year given falling world demand (see Figure 3.1). Value-added in the private service sector is again tracked reasonably though there is a large over-prediction of output in 1976 and 1980. This is possibly explained by the rather long lags which have been imposed upon the variable explaining output in private services. Value-added in agriculture is poorly tracked due both to the complex nature of this sector and the fact that value-added output is derived residually from gross output and material inputs, both larger than value-added output. Value-added in this sector moved rather erratically over the 1966 to 1980 period. As with other sectors, there appears to be a certain inertia in the modelling of the agricultural sector so that changes which vary both in sign and magnitude are not reflected over a single year but are rather averaged over a 2-3 year period picking up an underlying trend.

Output in the non-market service sector also tracks well up to 1975 but performance after that is rather poor. This problem is possibly due to the determination of output in this sector by a single instrument, government consumption, which was relatively stable in real terms in the 1975-1977 period while historical non-market services output fell. This problem could possibly be solved by the inclusion of total government investment variable as a secondary explanatory variable in which case the historical fall in government investment would most likely result in a sharp down-turn in predicted non-market services output.

Errors in tracking employment appear to follow the pattern of errors in output described above for all sectors except private services. In the private service sector there is a systematic over-estimation of employment after 1970 even though output is reasonably well captured (with the exception of 1975). This is due to systematic errors in the measurement of relative capital-labour costs which, coupled with a high Allen elasticity of sub-

Figure 3.3: *Within-sample tracking: selected supply variables (a)*

Industrial Output (£m, 1975)

Industrial Employment (000's)

Market Services Output (£m, 1975)

Market Services Employment (000's)
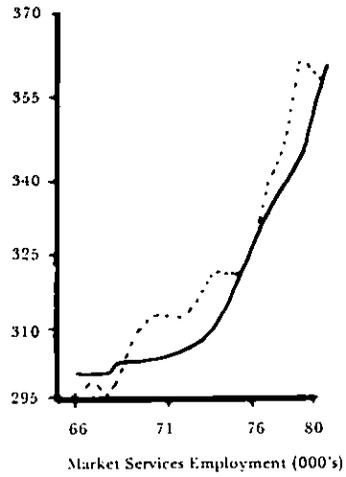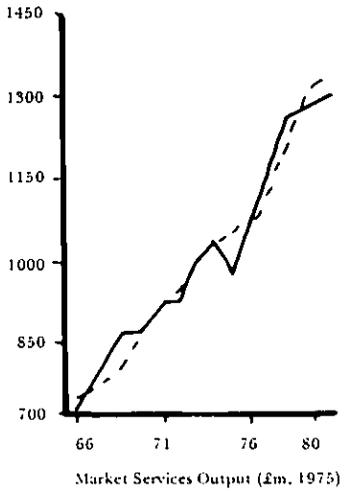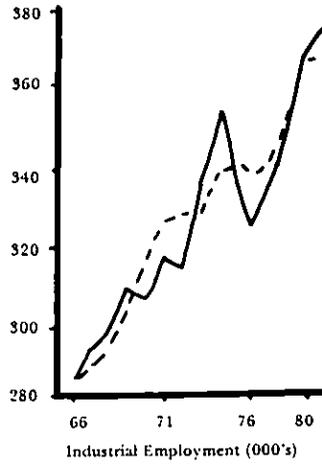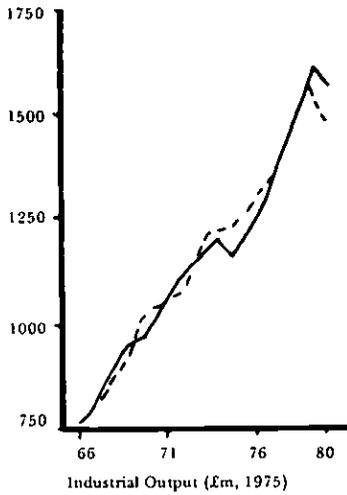
Figure 3.4: *Within-sample tracking: selected supply variables (b)*

Non-market Services Output (£m, 1975)

Non-market Services Employment (000's)

Agricultural Output (£m, 1975)

Agricultural Employment (000's)
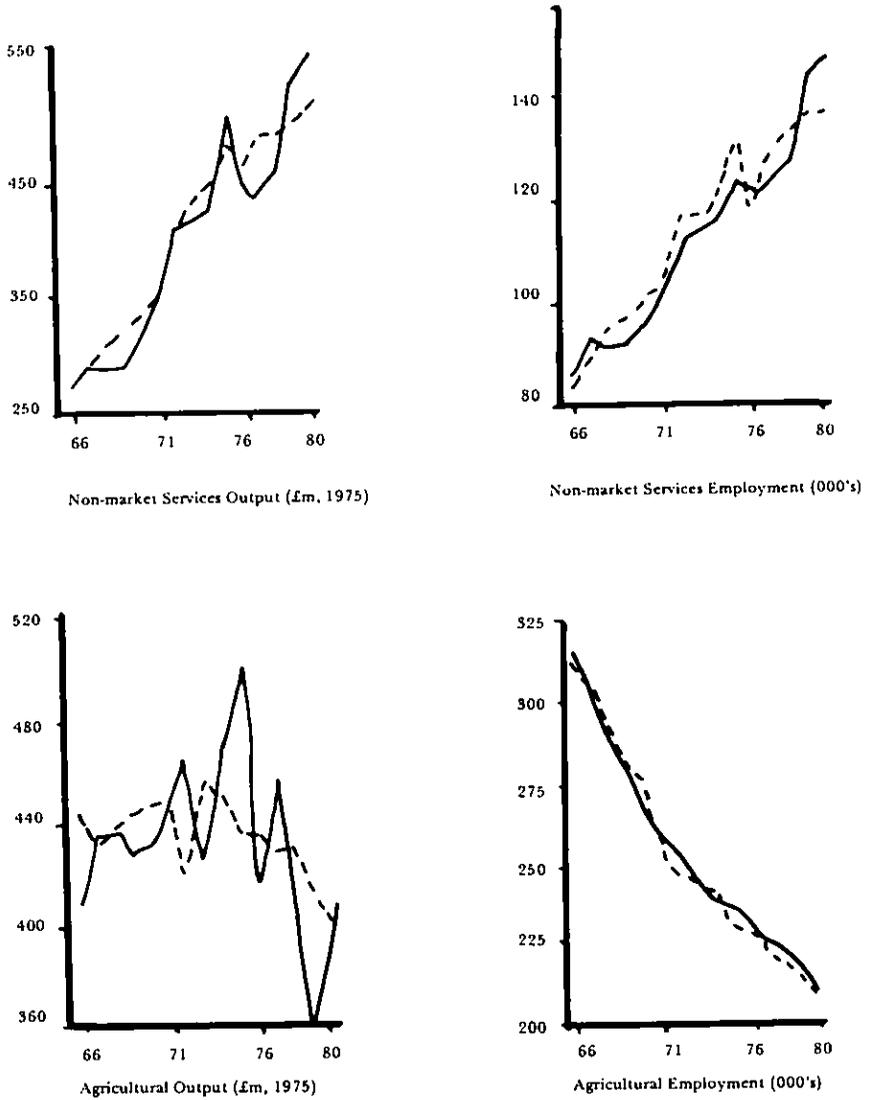
stitution between capital and labour (0.6), results in over-estimation of employment at the expense of under-estimated investment (see Figure 3.2). This problem is difficult to rectify given the poor quality of data on wages and capital costs for private services. The tracking performance of industrial employment is, again, reasonable if a little sluggish. The major problems occur from 1971 to 1977 where large short-run changes in productivity are not well captured in a single year but are rather averaged over a two to three year period, picking up an underlying trend.

In Figure 3.5 we examine the performance of a number of important aggregates. Gross Domestic product at market prices is well estimated with the only noticeable errors occurring in 1966 and 1970. It is worth noting however that errors would be magnified if they had been graphed in terms of growth rates. Total employment is reasonably well represented given the problems of measuring productivity and relative factor prices and their high variance over the post-1970 period. The estimation of the deterioration of the public authorities borrowing requirement is moderately satisfactory with significant errors in 1976-1977 and 1980. Further examination of this problem suggested that this resulted from errors in estimating tax revenue rather than expenditure.

Net migration abroad is badly predicted with large under-estimates of emigration from 1972 to 1978, a maximum error of 11,500 occurring in 1978. We feel that while migration has traditionally proved even a difficult variable to measure, a better representation might be obtained if migration flows were induced by differences between net wages in Ireland and the UK rather than by gross wages differentials as in the present model. In terms of its seriousness for the entire model's performance, an alternative dynamic simulation where migration was set at its historical level showed little differences from these results presented here so the effect of these errors appears quite slight.

In Figure 3.5 we also examine the ability of the model to estimate gross imports and the balance of payments rate. Imports are relatively well estimated, the only serious problems occurring with over-estimation in 1975 and under-estimation in 1980, as with industrial output. That gross imports would mirror industrial output is hardly surprising given that 70 per cent of gross imports is accounted for by imported materials for the industrial sector. The balance of payments rate[4] is reasonably well measured given that the balance of payments is derived residually from gross imports and gross exports. The most serious errors occur in 1976 when non-agricultural exports were seriously over-estimated and 1979-80 when they were under-estimated.

4. Measured by the balance of payments as a proportion of GDP.

Figure 3.5: *Within-sample tracking: selected aggregates*

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Rate (% of GDP)

Net Migration Abroad (000's)

Gross Imports (£m, 1975)

Balance of Payments Rate (% of GDP)
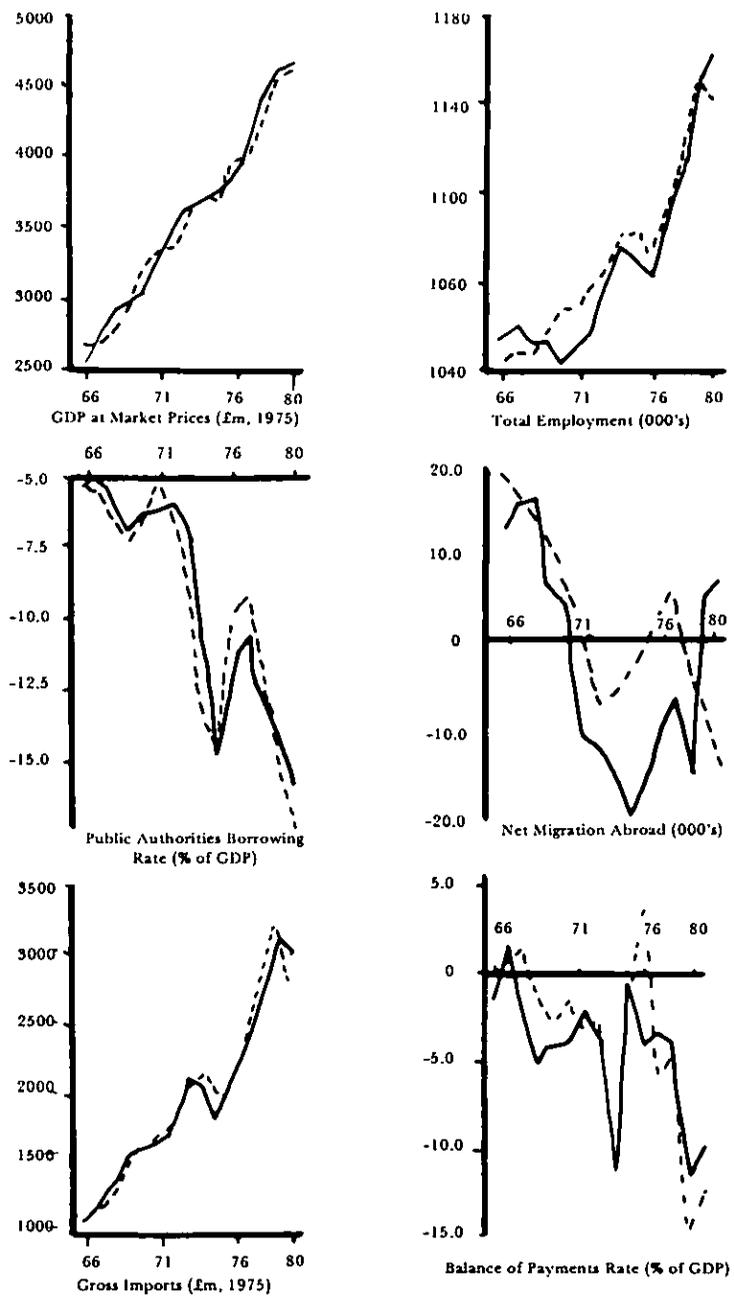
Finally, in Figure 3.6 we examine the performance of our model in estimating rates of inflation for key wage and price aggregates. This section of the model appears to suffer from the inertia of the other sectors so that a single year lag is generally required to pick up wage increases, particularly wage inflation which deviates much from the average. This is particularly evident for the high wage and price increases of 1975 which are not reflected by the tracking simulation until 1976 (for example, see public administration wage inflation). Our general impression of the six wage and price variables given in Figure 3.6 is that while the model may not capture single year changes in a particular wage or price, over a two year period the errors tend to average out (see the rate of inflation for industrial price deflator in 1975-76 for the most obvious example).

MULTIPLIER ANALYSIS: INTRODUCTION

The examination of the results of perturbing a selection of exogenous variables and coefficients furthers our understanding of the model's structure and the linkages between sectors. Furthermore, it provides a rough quantification of the relative importance, not only of the exogenous variable(s) in question, but also of the sensitivity of the model to the choice of equation variants. In this section we present the results of a number of multiplier calculations where exogenous variables have been perturbed, by specific amounts, above or below their historical values at some point in time, usually the year 1967. Graphs are then presented to illustrate the effects of the perturbations on a range of key endogenous variables. These graphs plot the deviation of an endogenous variable from the historical baseline value.

For the purposes of multiplier analysis the model has been "corrected" so that a dynamic tracking simulation reproduces exactly the historical data. This is done by adding the vector of single-equation estimation errors to each behavioural equation in the model. This operation has been carried out so as to be able to present results in a form where they may be easily compared with the historical data rather than with first differences of a hypothetical simulated solution. Furthermore, it allows us carry out more complex multipliers where *marginal* effects can differ from historically average values, e.g., where the rate of interest of any increased debt may differ from the historical average rate. From a more practical point of view, it also permits us to have a single baseline simulation for *all* variants of the model. However, if the model were significantly non-linear such a procedure would be difficult to defend since the multipliers would be sensitive to the particular correction method used. However, quite extensive examination of the "corrected" versus "uncorrected" versions of the model showed negligible difference in their multiplier properties.

Figure 3.6: *Within-sample tracking: inflation rates of selected wages and prices*

Industrial Wages (%)

Market Services Wages (%)

Public Administration Wages (%)

Industrial Value-added Deflator (%)

Services Value-added Deflator (%)

Consumption Deflator (%)
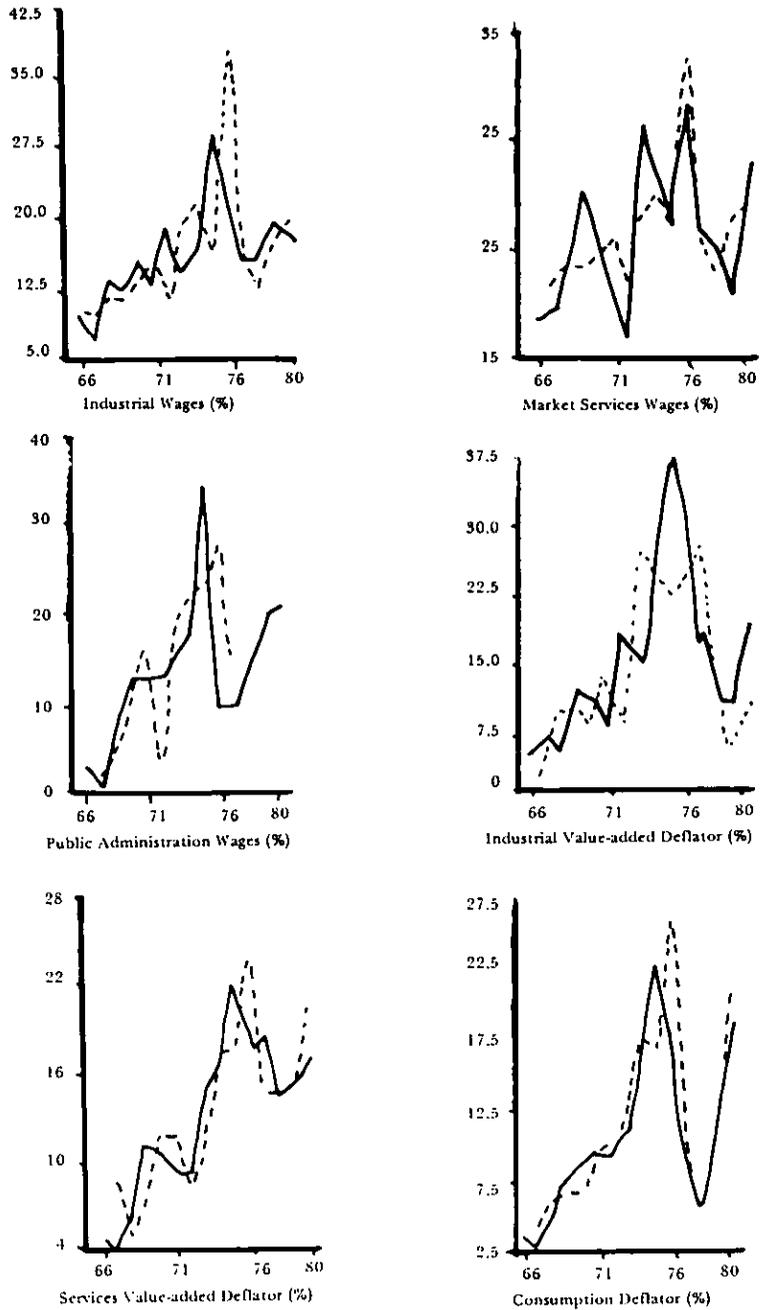
It would be impracticable to present multipliers for all the exogenous variables using all possible variants of the model. Instead, we examine a single perturbation at length using different variants of the model. We then present results for a wider range of exogenous variables using only a "standard" version of the model with perhaps minor variants. The policy variable we have selected for detailed treatment is government current expenditure on goods and services net of the public administration wage bill (CGOV). This is denominated in current prices and represents essentially purchases by government of the output of the non-marketed services sector (NMS sector).

The "standard" version of the model is defined, in slightly more detail than previously, as having the following features:

(i)   Industrial capacity determined by world demand and competitiveness
(ii) Increasing returns to scale in the industrial sector
(iii) Non-agricultural exports determined by world demand and profitability
(iv) Target industrial wage denominated in consumer prices and net of tax
(v)   Short-run Phillips curve in the wage equation
(vi) Interest payments on changed foreign debt financed by extra direct taxation
(vii) The non-market service sector driven by a single government instrument, employment.

Variants of the "standard" model include:

(i)   Domestic demand is allowed play a role in industrial capacity determination
(ii) Constant and increasing returns to scale in industry are examined
(iii) Exports are determined by a supply equation as well as a demand equation
(iv) Different forms of the industrial wage equation are examined, e.g., with and without a Phillips curve, in terms of consumer and producer prices, gross and net of direction taxation
(v)   Output in the non-market service sector is driven by nominal expenditure rather than employment.

The many variants on the standard model have been included for two reasons. First, there may be disagreement among economists about the nature of the Irish economy and we felt it desirable to allow certain options to give us alternative frameworks within which to examine fiscal policy.

Second, it is doubtful whether a single model can analyse an economy adequately over a long period. Circumstances change and agents act differently in some periods compared with others. For instance, the issue of direct tax incidence is one which can vary, with direct tax awareness perhaps more acute during the latter part of the sample period (e.g., PAYE marches) than during the 1960s or early 1970s. As such we felt it desirable to include the relevant option if required.

The variant of the model used in this chapter as the "standard" model includes one distinction from that defined above. Output in the non-market service sector is driven by nominal government consumption expenditure rather than by employment. This specification has been substituted in Chapter 5 by an employment-driven non-market service sector as it was felt that when a shock introduced serious changes to the rate of inflation (as in Chapter 5), a real instrument such as employment seems more in line with government action over the 1960s and 1970s rather than the idea of cash limits imposed by a nominal instrument.

For the standard model, multipliers were calculated with respect to the following exogenous variables:

(i)   A sustained increase in the value of government consumption expenditure, net of public administration wages, of 10 per cent of its 1967 value, i.e., £9.2 million
(ii)   A sustained increase in public administration employment of 10 per cent of its 1967 value, i.e., 4,300 extra jobs
(iii)   A sustained increase in real world GDP of 1 per cent of its 1967 value
(iv)   A sustained increase in the level of all exogenous prices and in world unit labour costs of 10 per cent of their 1967 values
(v)   A once-off increase in the rates of excise tax, income tax and VAT of 10 per cent of their 1967 values
(vi)   A sustained decrease in "world" unit labour costs of 5 per cent of its 1967 value.

In Figure 3.7 we present the effect of increasing the value of government consumption, net of public administration wages, (CGOV) by 10 per cent of its 1967 value, i.e., a sustained increase of £9.2 million. Since CGOV is measured in nominal rather than real terms, the real magnitude of the sustained nominal shock decays over time due to the underlying high rate of price inflation. The increase in CGOV initially boosts nominal aggregate demand which translates into an increase in real GDP measured in 1975 prices of £30 million in 1967, with total employment increases of 9,600, of which 7,600 occur in the NMS sector (directly affected by CGOV), 1,700 in the MS sector and 300 in the industrial sector. After the initial stimulus to

demand, the boost to disposable income is then eroded over time by inflation and by the increased taxation needed to finance extra interest payments. Furthermore, the Phillips curve forces wages to rise above their historical value since unemployment has fallen, thus causing a loss in competitiveness and a fall in industrial output. By 1980 employment has returned to its historical level though the unemployment rate is higher and the borrowing requirement rate, though improving, is still greater than its historical value. The initial deterioration in the balance of payments rate, due to increased imports (via disposable income) and reduced exports (via loss in competitiveness) is also gradually eroded over time by inflation. We now consider the effects of varying some of the assumptions used in the determination of a "standard model".

ALTERNATIVE VARIANTS OF THE MODEL UNDER A SINGLE PERTURBATION

In Figure 3.8 we explore the role of the Phillips curve in the model. The Phillips curve plays an equilibriating role in the model, moving wage rates inversely with the unemployment rate. The increase in labour's share of added-value in industry after the CGOV stimulus, exacerbated by the low elasticity of substitution between labour and capital, reduced profitability and, consequently, industrial capacity. As capacity output falls so also does industrial employment, thus directing the system back towards its "natural" rate of unemployment. This pattern is evident from Figure 3.8, where the continuous line refers to the standard model and the dotted line refers to the model without a Phillips curve (but otherwise identical to the standard model). In the standard model industrial output falls quite sharply due to the loss in competitiveness. Without the Phillips curve the fall is not as severe. However, due to the absence of any equilibriating tendency, this fall is sustained and total employment and output in industry remain below that recorded for the standard model. Total employment settles at approximately 1,200 below the standard model solution, the loss being equally divided between the industrial and marketed service sectors. Similar trends are evident in the other aggregate variables such as disposable income borrowing requirement and GDP.

In Figure 3.9 we examine the effects of a CGOV perturbation where changes in direct taxation rates have no effects on industrial wage formation, i.e., workers are indifferent to direct tax rates. In this variant the increase in the direct tax rate necessary to finance increased payments has no direct effect on the target industrial wage rate. This results in an improvement in competitiveness and increased industrial output above the standard model case with spin-offs into other sectors. This pattern continues so that by

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Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages
(£000, 1975)

Competitiveness
(Index, 1975 = 1)

Figure 3.7: *Multipliers for standard model: change in public expenditure*
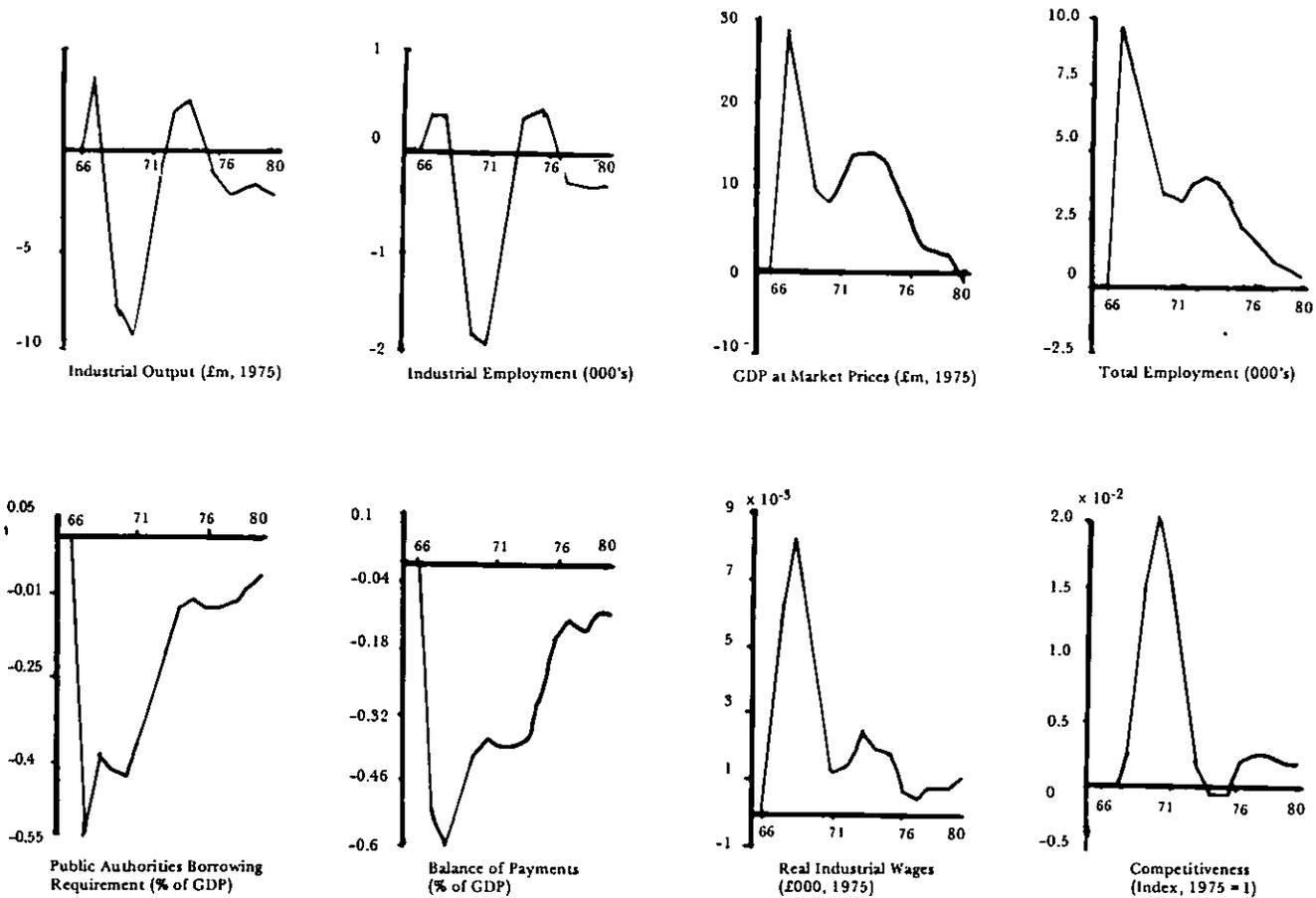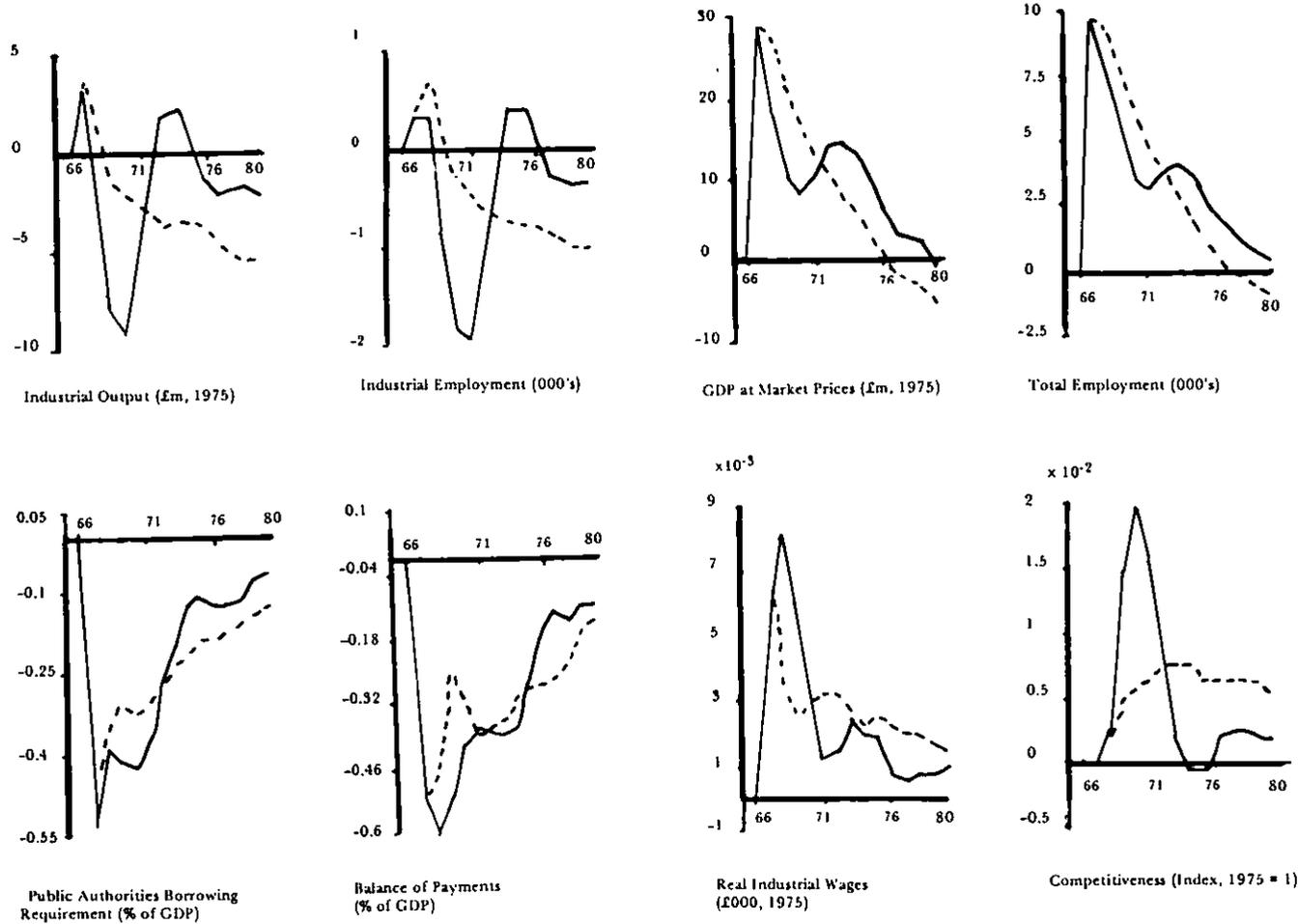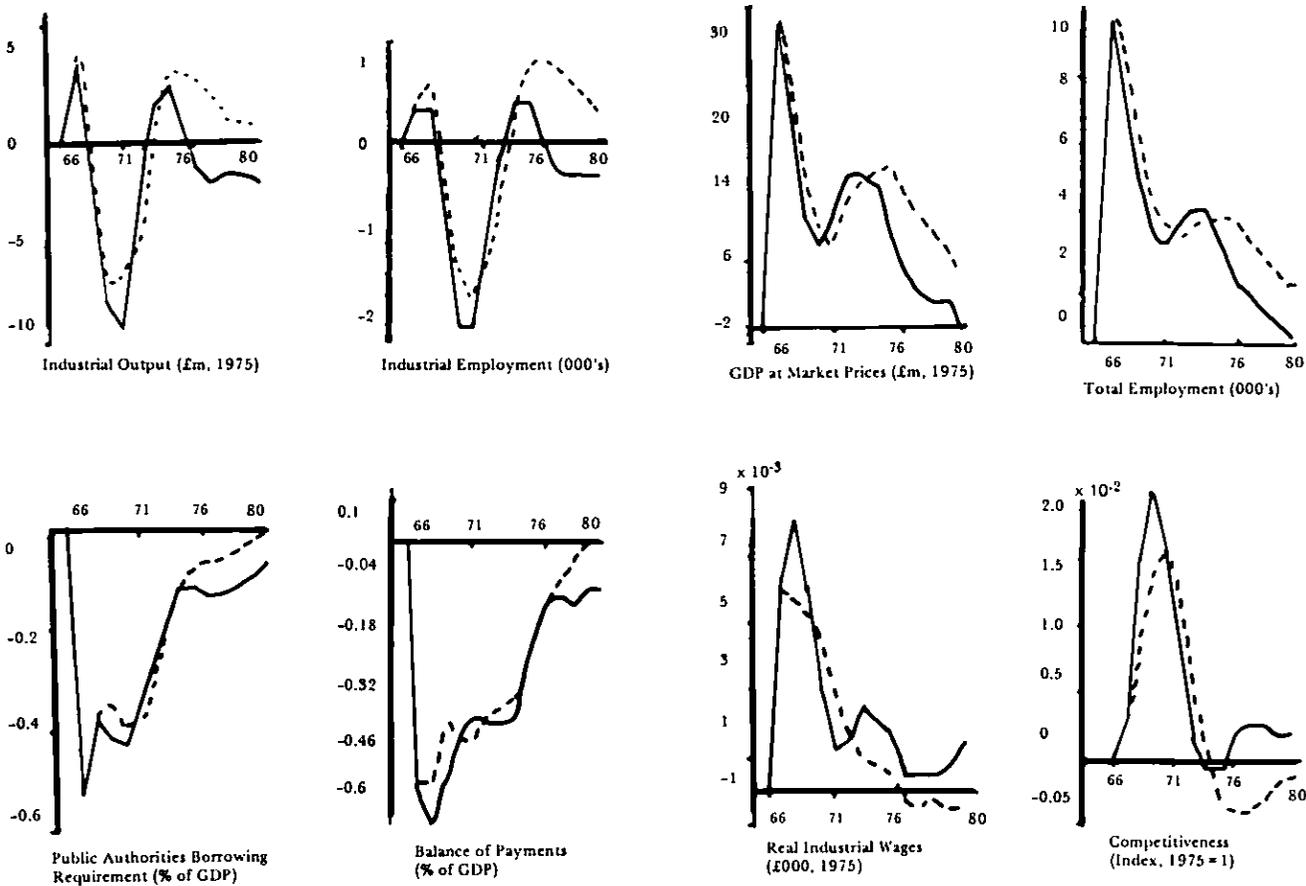
Figure 3.9: *Multipliers: role of direct taxation in wage bargaining*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages
(£000, 1975)

Competitiveness
(Index, 1975 = 1)

1980 total employment is approximately 1,500 higher than with the standard model, with similar effects on the other macro aggregates. Gross wage rates are, of course, lower than for the standard model. However, since the borrowing required has improved (due to reduced unemployment, etc.), the taxation requirement to finance increased interest repayments has fallen. The difference between the take-home wages in both simulations is negligible.

The model framework provides three choices of industrial capacity output equations. The standard version uses an export-led growth approach where the level of domestic demand plays no direct role. The alternatives provided include a short-run disequilibrium effect in domestic absorption (option 2) and a permanent domestic absorption effect where a geometric average of world and domestic absorption drives industrial capacity output (with weights of 0.60 and 0.40 respectively — option 3). The use of the export-led growth model does not imply that domestic absorption plays no role in the determination of industrial capacity; rather, world demand may act as a proxy for domestic absorption, and any increase in domestic absorption brought about by domestic fiscal stimulation is felt by industrialists to be unsustainable and, consequently, does not enter into their long-run capacity plans. Rather, capacity utilisation in industry rises. Options 2 and 3 highlight a more important role for domestic absorption, in ascending order. However, the statistical estimation involved in option 3 may be somewhat dubious due to strong multicollinearity between world and domestic absorption. Figure 3.10 illustrates the effect which the choice of industrial capacity option has for the CGOV perturbation. Any divergences of option 2 from the standard model are negligible. The effect of imposing option 3 has the expected result. Increased domestic absorption, with no change in world activity, results in higher industrial output and employment compared with the standard model. This pattern continues until 1976, after which point the effects of inflation and the Phillips curve guide the system back towards the standard model solution.

Thus far, industrial wage rates have been determined using industrial labour productivity as a key explanatory factor. Since industrial wage rates determine wage rates in all other sectors, it is clear that the wage rates in other sectors also depend on industrial productivity. The standard model wage equation plays down the role which industrial productivity can potentially play in the determination of competitiveness, namely, if changes in productivity are not assumed to be fully recouped in increased wages, unit labour costs will move in the opposite direction. To examine such a possibility, we present in Figure 3.11 results for the CGOV perturbation where industrial wages are no longer dependent on productivity. The effects of this

Figure 3.10: *Multipliers: role of industrial capacity determination*
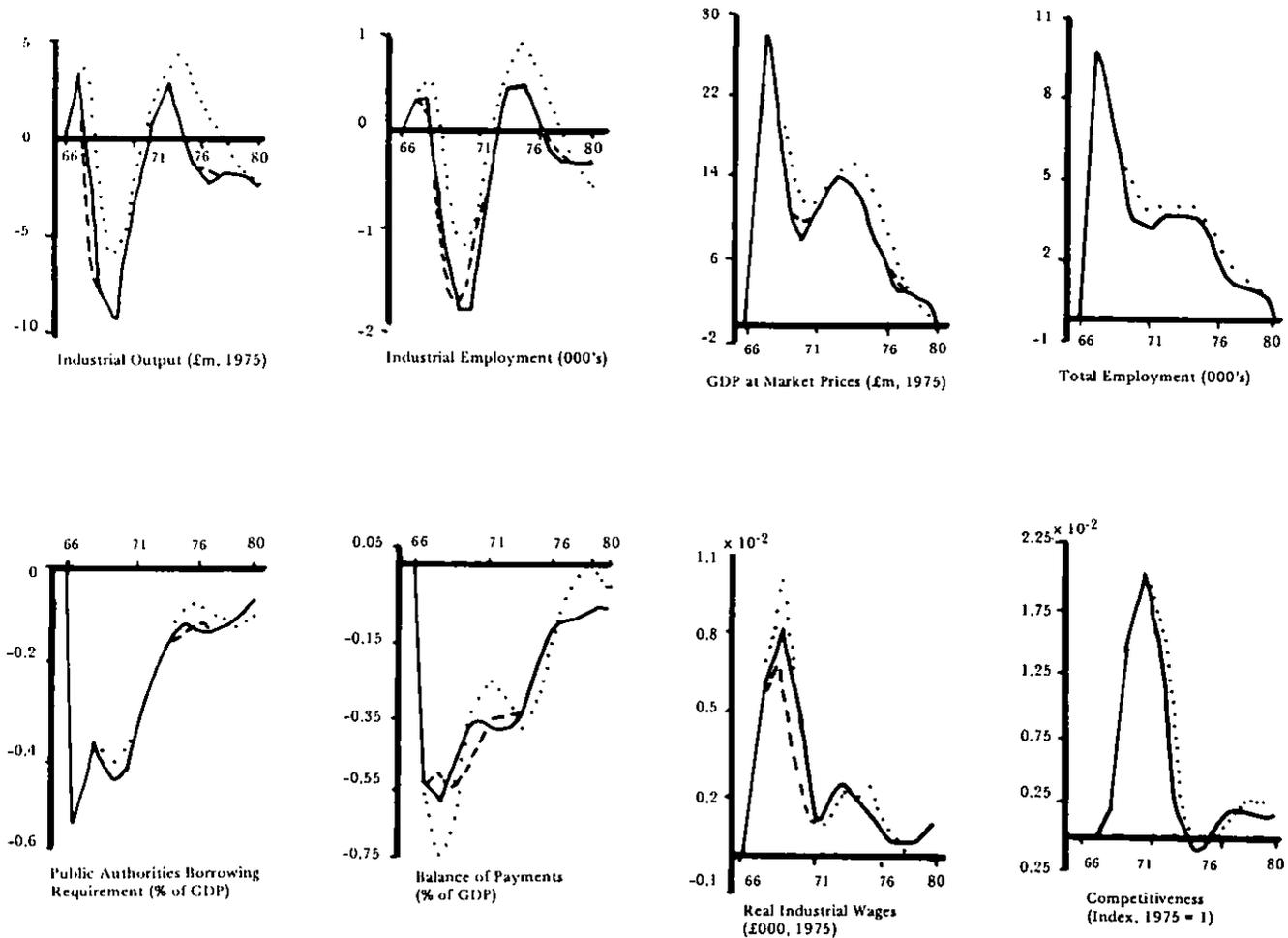
change on output and employment are twofold. First, industrial wage rates no longer respond to productivity changes so movements in competitiveness will be more marked than with the standard model, where only lags of adjustment to the target wage apply. Second, for the standard model increased industrial productivity with no change in the other sectoral productivities will result in increased unit labour costs in the MS sector, leading to price rises for GDP and its expenditure components. The resulting effects on industrial wages and competitiveness constrain the growth stimulus via profitability. This second situation will no longer hold if the link between industrial productivity and industrial wages is broken. Hence, we expect movements in productivity to have more exaggerated effects in the modified version of the model when compared with the standard version, largely through changes in competitiveness and profitability. Such a pattern is evident in Figure 3.11 where both models are subjected to the usual CGOV shock. The oscillations about the standard version continue until the end of the simulation period.

Another variant on the standard model which we now examine is the substitution of the industrial wage equation by one where the target wage is denominated in producer prices rather than consumer prices. This shifts the emphasis in wage bargaining from the employee to the employer and corresponds to the version of the Scandinavian model usually considered in the literature (Lindbeck, 1979). Results for this variation are shown in Figure 3.12. In the standard version of the model, the Phillips curve and the increased direct tax rates required to finance interest repayments on foreign debt both serve to increase industrial wage rates and, ultimately, consumer prices. The industrial producer price, however, is exogenously determined. Hence, whereas for the standard model increased consumer prices will increase wages further, with resulting loss in competitiveness, for the producer-price wage variant this chain of causation is missing from the model. The effect of this for the CGOV perturbation is to give a lasting improvement in competitiveness over the standard model simulation, with consequent increases in output and employment, though at the expense of lower real take-home wages. The effects endure over a long period, with the difference between the two simulations settling down after 1975 at an employment gain of 1,000, a real GDP gain of £4 million in 1975 prices and a drop in annual average earnings in industry of £25 in 1975 prices.

The standard version of the model imposes increased returns to scale (IRS) of 1.3 upon the industrial sector. We now examine the effect of imposing constant returns to scale (CRS). Autonomous output increases in industry induce productivity and wage increases under IRS but have no effect with CRS. Therefore, we expect higher wages under IRS than for CRS after any

Figure 3.11: *Multipliers: role of productivity*
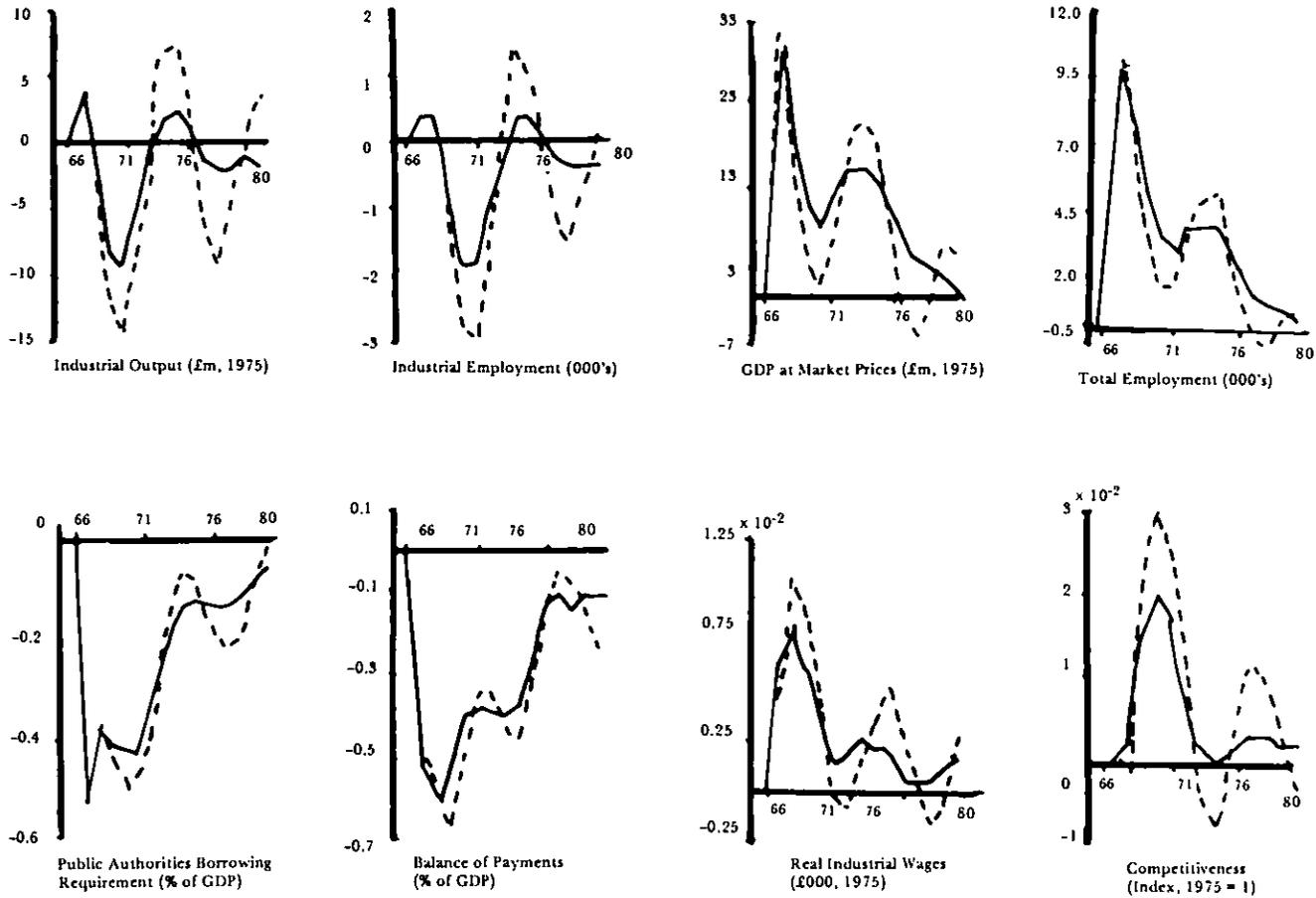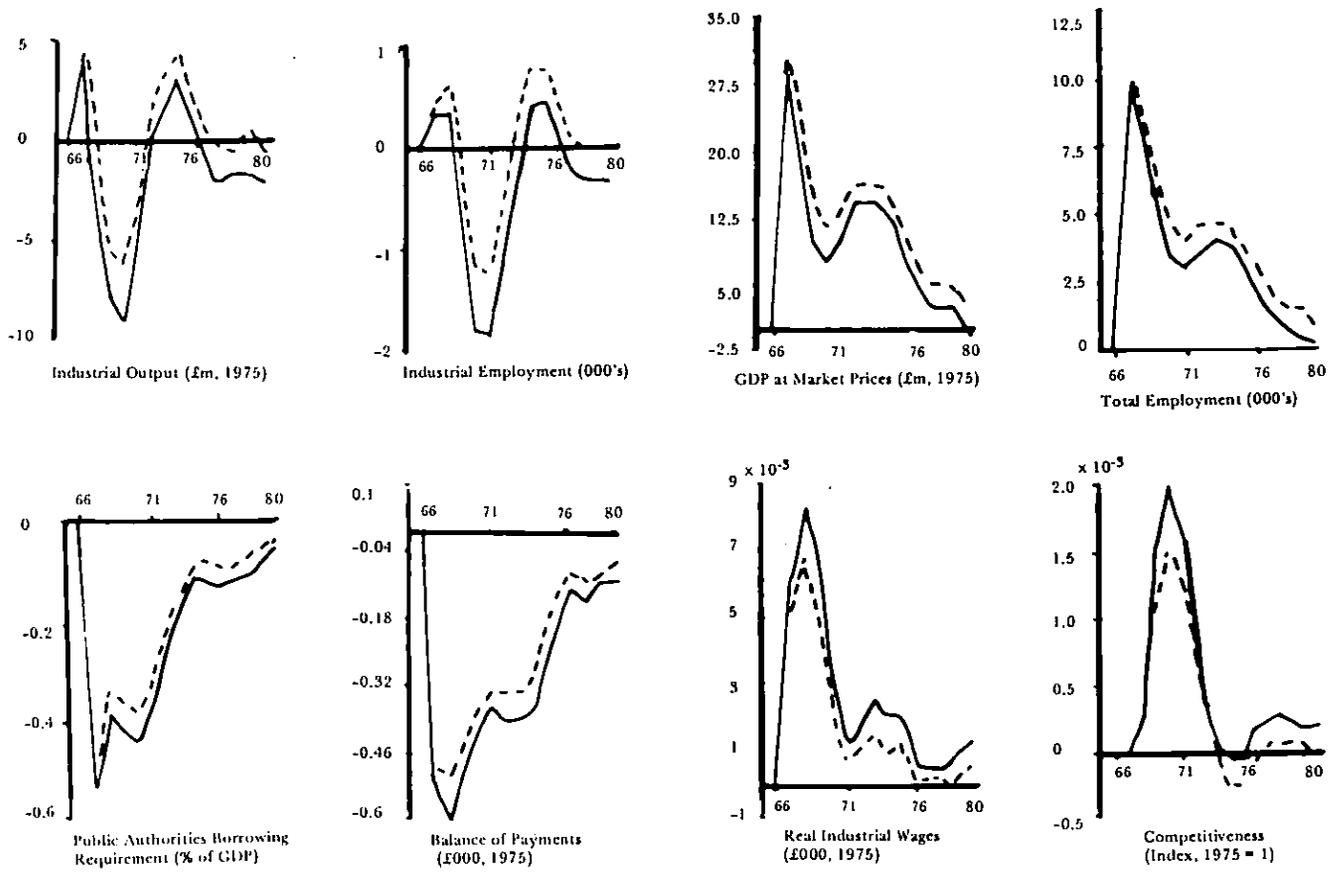
Figure 3.12: *Multipliers: role of prices in wage determination*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing Requirement (% of GDP)

Balance of Payments (£000, 1975)

Real Industrial Wages (£000, 1975)

Competitiveness (Index, 1975 = 1)

expansionary perturbation. Since MS sector wages are determined by those in industry, this results in higher unit labour costs, and hence prices, under IRS compared with CRS. Increased service sector prices eventually have knock-on effects on other sectors so that competitiveness is eventually lost in industry. At the same time, employment increases will be attenuated under IRS compared with CRS since less factor inputs are required to produce a given output increase. The converse of these effects are initially evident in Figure 3.13 since industrial output actually *falls* after the CGOV perturbation for reasons that have been examined in previous cases. Reduced industrial output results in wages which are higher under CRS than under IRS (productivity has fallen), employment which is lower and consumer price increases which are lower. The trade-off between these related effects, plus the fact that the Phillips curve plays a stronger role in this perturbation than under CRS, eventually results in no long-run deviation between the two cases.

The effect of using a selection of taxes to finance the increased interest payments on foreign borrowing consequent on the CGOV perturbation, rather than financing it by direct income tax alone, is examined in Figure 3.14. The rates of excise tax (TEDR), value-added tax (TAVR), motor vehicle duty (TCARR), other indirect tax (TIOR) and income tax (TYRA) have been increased to produce the necessary extra finance, using their relative revenue shares as weights. The standard model raises finance by direct taxation alone, i.e., its base is the wage bill. The selection of taxes mentioned above apply to both expenditure bases (mainly proxied by household consumption) and the wage bill. The fact that the industrial target wage is formulated in net of (direct) tax form means that the gross wage increase under the broader financing variant is less than under the narrower (direct taxation) standard variant. Of course, the broader financing variant now imposes a direct inflation effect through its influence on consumer prices (in the model all indirect taxes are assumed to bear on consumption and not on any other expenditure component). Overall, the broader financing variant is more expansionary than the narrower one, but the effects very slight.

Having examined the effect of different variants of the model on a single expenditure shock, we now look at how the standard version of the model defined above reacts to other perturbations.

ALTERNATIVE PERTURBATIONS TO A SINGLE VERSION OF THE MODEL

Figure 3.15 examines the implications of increasing public administration employment by 10 per cent of its level in 1967 on the standard model. This

Figure 3.13: *Multipliers: role of returns to scale in industry*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages (£000, 1975)

Competitiveness
(Index, 1975 = 1)
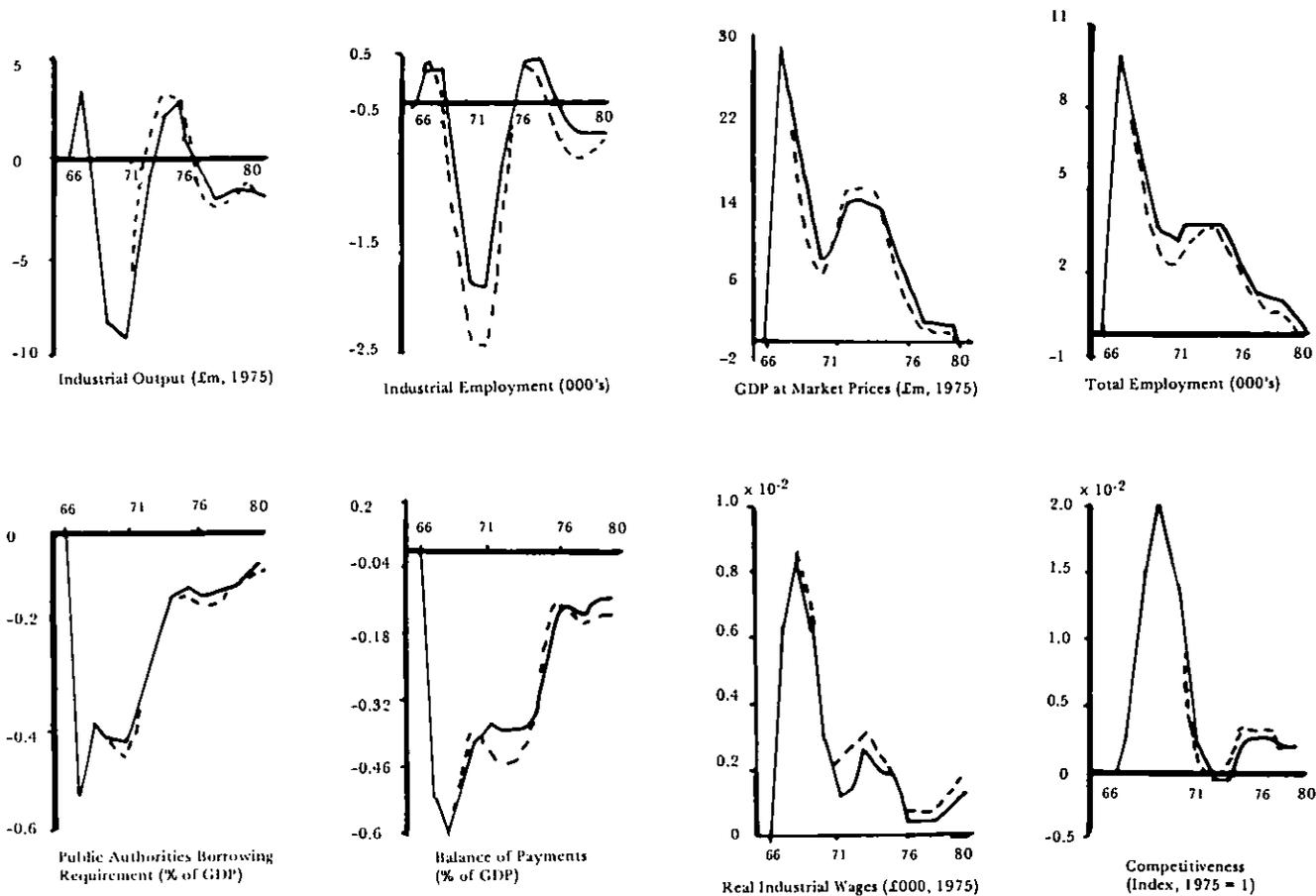
Figure 3.14: *Multipliers: alternative financing of the borrowing requirement*
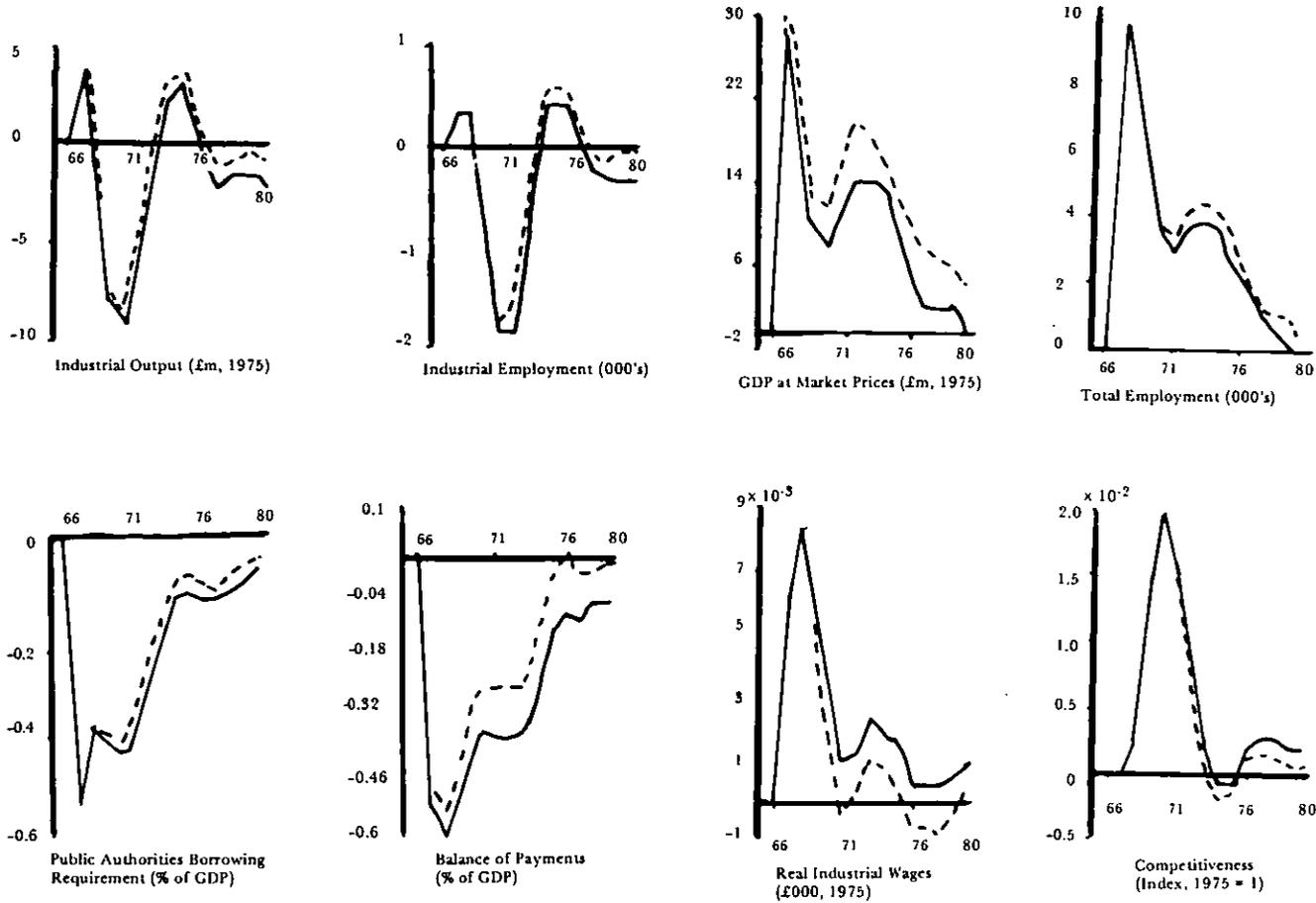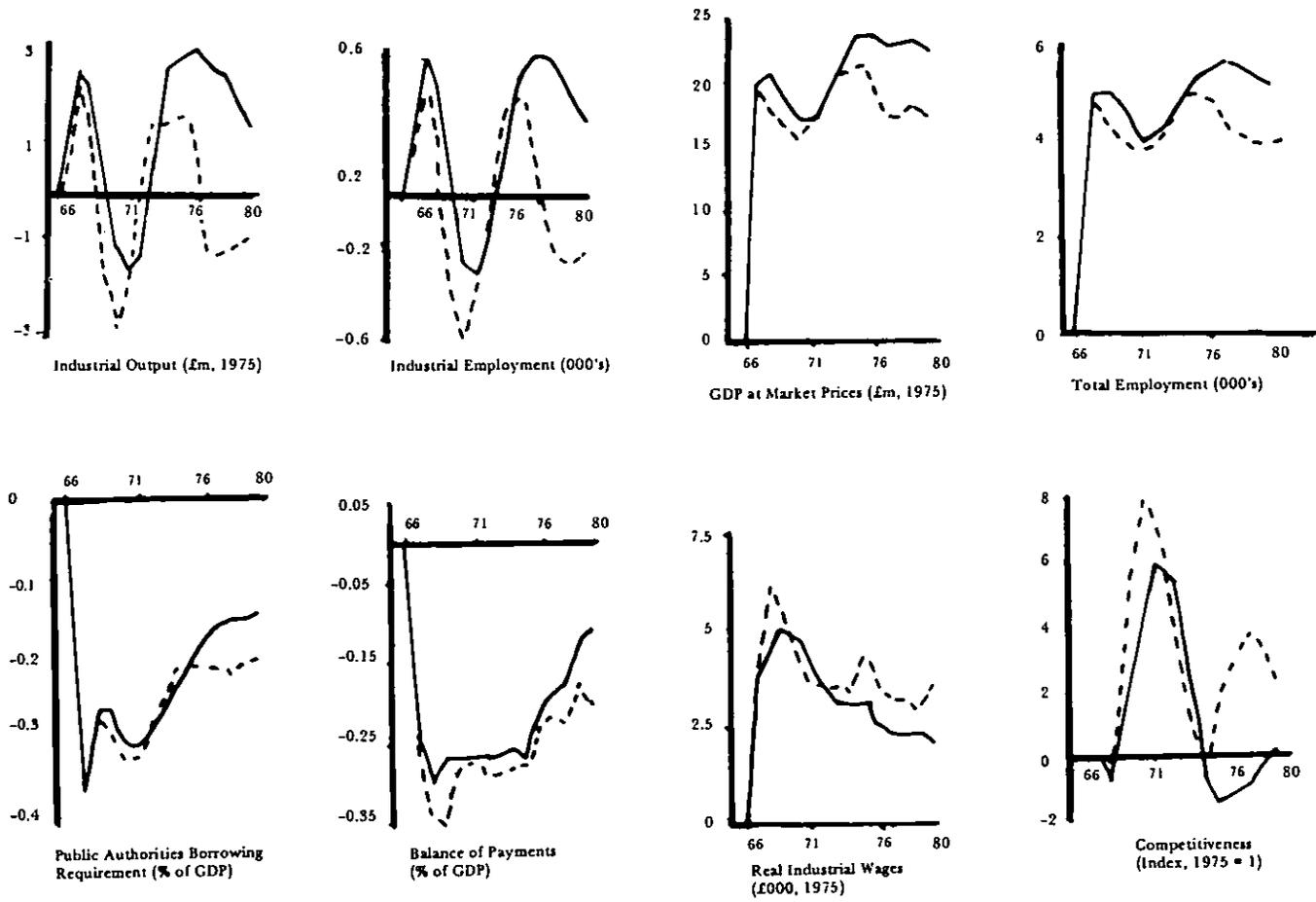
Figure 3.15: *Multipliers for standard model: increased public employment*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages
(£000, 1975)

Competitiveness
(Index, 1975 = 1)

involves a *sustained* increase in public administration employment of 4,300 above historical levels, a perturbation which intuitively will have greater long-run effects on the economy than the previous *nominal* government stimulus since its effects will not be eroded over time by inflation given that public sector employment must be paid the going wage. As before, results for the standard model are given by the full line. Employment initially rises by 5,000 suggesting slight spin-off effects to the other sectors of the economy. Real GDP increases by £18m though is then eroded by a loss in competitiveness induced by the Phillips curve since wages increase after the drop in the unemployment rate and by the increased taxation required to finance foreign debt repayments. While GDP remains approximately £17m above its base value, disposable income falls rapidly over time since the average rate of direct taxation has risen, with the result that it is only £8m above its historical value by 1980. At the same time, the government borrowing requirement has stabilised at approximately 0.2 per cent above its baseline historical equivalent, as the increased public administration wage bill and debt repayments outweighs increased taxation at fixed rates (since domestic absorption rises) and reduces unemployment benefit bill.

A similar perturbation on the standard model without a Phillips curve is given by the broken line on Figure 3.15. This shows a slight initial improvement in competitiveness (since a reduced unemployment rate no longer induces wage increases) and similar effects on industrial and market services sector output. However, like the nominal government expenditure perturbation (discussed at length above), though there is an initial improvement in aggregate demand and supply the omission of a Phillips curve removes an equilibriating mechanism from the model there being no tendency to move back towards historical levels via competitiveness after increases in taxation. The effect on this simulation is to reduce industrial output below historical levels by 1979 since the tax rates necessary to finance public administration employment squeeze industrial competitiveness. Similar patterns are evident in other major aggregates such as GDP, personal consumption, etc.

Figure 3.16 plots the likely effect of a simultaneous once-off one-year increase in the rates of VAT, income tax and excise tax of 10 per cent of their value in 1967. This once-off increase in taxation reduces the borrowing requirement. Domestic competitiveness disimproves since wages are linked to both direct and indirect taxation and disposable income falls. There is a resulting loss in total employment of 2,000 and a reduction in real GDP of £9m. The reduction in demand and output quickly dies off as tax rates are returned to their historical level so losses in competitiveness are short-lived. After a period of approximately 3 years, there seems to be no significant net gain or loss to the economy suggesting that the initial beneficial effect on
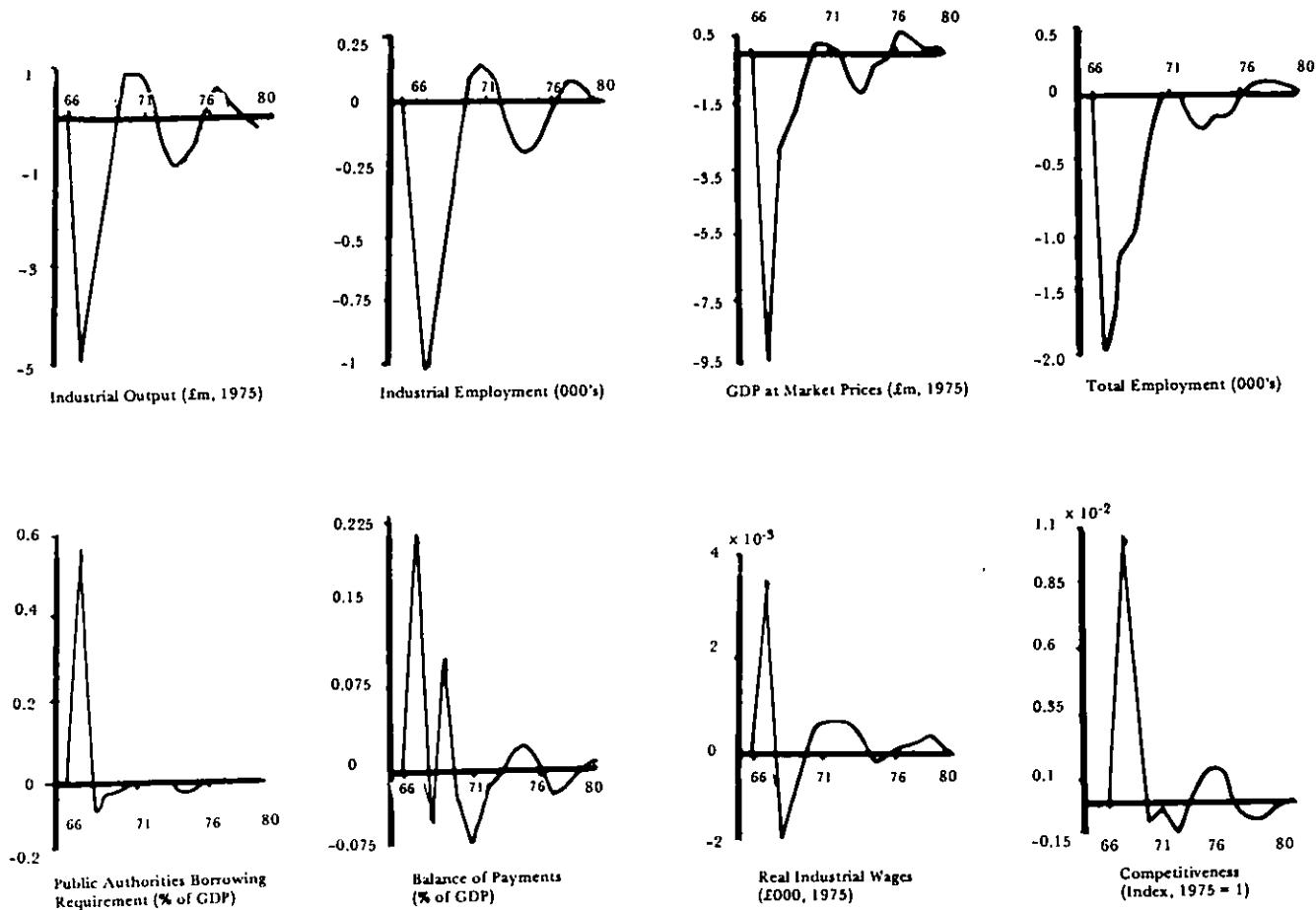
Figure 3.16: *Multipliers for standard model: one year indirect tax increases*

the reduced foreign debt seem to be offset by increased unemployment transfers, an obvious consquence of reduced output.

In Figure 3.17 we examine the effects on the standard model of increasing real world demand, trade weighted, by 1 per cent of its 1967 value. The increase in world demand increases output initially in the industrial sector. Gross Domestic Product increases cumulatively so that by 1980 it is £16m above its historical level, and total employment rises by 3,000, 75 per cent of which occurs in the industrial sector. The borrowing requirement rate has fallen by 0.2 per cent in 1980, presumably as a result of reduced unemployment transfers. Similar improvements are evident in other major indicators such as the balance of payments, personal consumption and market service sector output.

The distinction between the results of this perturbation and that where public administration employment is increased (Figure 3.15) lies in the manner in which government expenditure is handled. A consequence of any demand expansion is an initial increase in tax revenue and reduction in unemployment transfers (assuming constant tax and expenditure rates) so that the government borrowing requirement initially improves. This means that under a world-induced demand expansion the borrowing requirement improves *vis-à-vis* a situation where no account is taken of the public finances, so that rates of direct taxation can fall (while still providing the same government service domestically) with a resulting improvement in competitiveness via wage bargaining. On the other hand, the borrowing requirement increases when public administration employment increases (Figure 3.15), so that, by the same reasoning as above, competitiveness is lost with depressing effects upon the economy.

To take account of the possibility that the rate of interest in which government debt is denominated could be dependent upon the level of debt, we have introduced a variant to the model where a profile has been set on the interest rate charged on marginal government debt above or below its historical level. In other words, the marginal rate of interest is greater than the average rate of interest on foreign government debt. We presume that the relevant rate of interest is fixed at 2 per cent in real terms, i.e., world inflation plus 2 per cent. This compares with a period during the 1970s when real interest rates were significantly negative so that the constraining effects upon the model after fiscal stimulation will be greater under this variant than under the standard model. In order to show the importance of this variable in examining the desirability of fiscal stimulus, we have set the required interest rate at its hypothetical level only after 1973 when historically it became negative in real terms. This simulation has the further aim of giving some crude idea of the implications for the model of fiscal
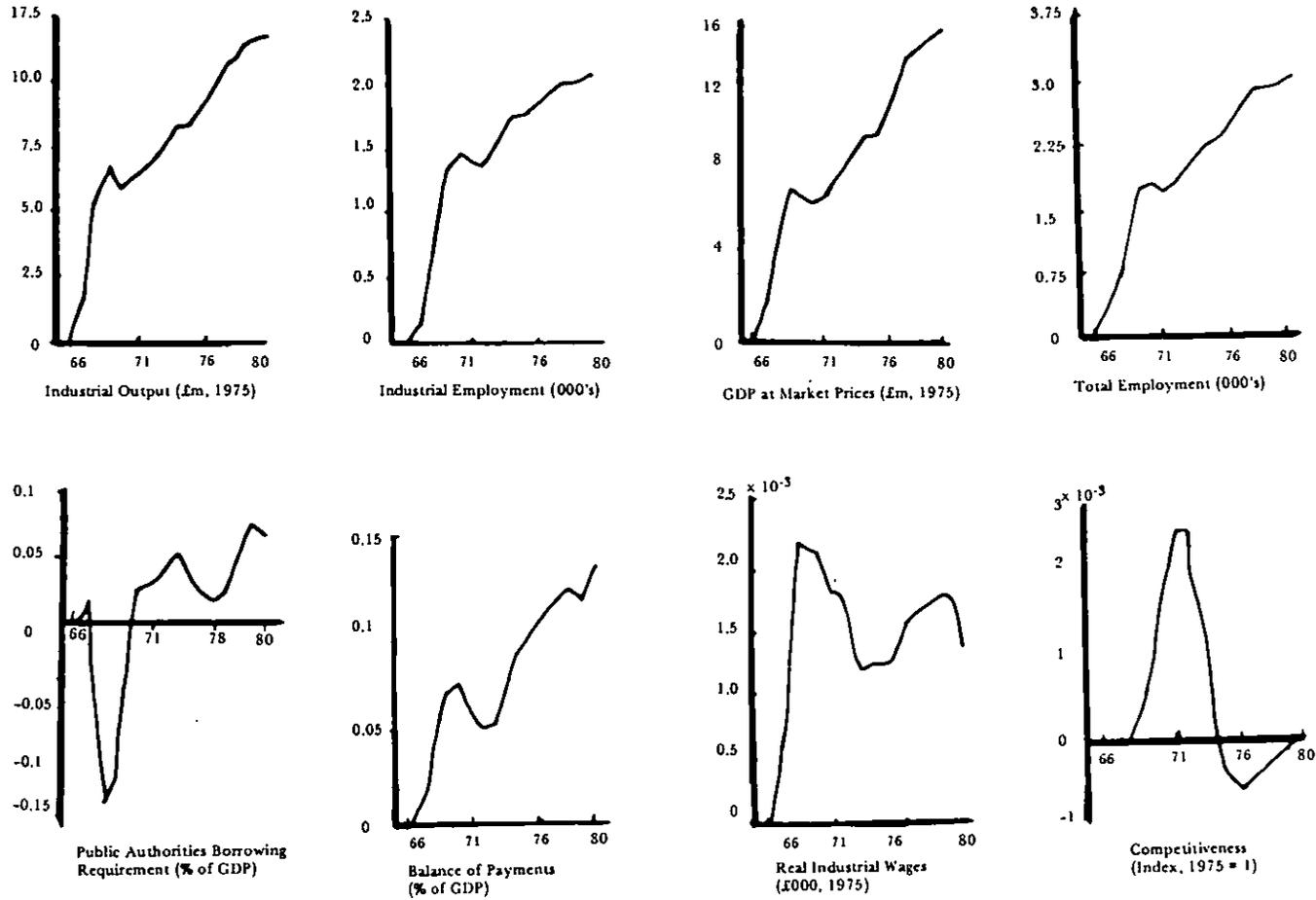
Figure 3.17: *Multipliers for standard model: increased world demand*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages
(£000, 1975)

Competitiveness
(Index, 1975 = 1)

expansion in a period of positive real interest rates given that all other exogenous variables take on their historical levels. The perturbation used to change the stock of debt is the standard CGOV perturbation considered at length in the first part of this section.

For a given stock of foreign-held debt, an increase in the relevant interest rates will increase interest repayments thus requiring increased taxation over the standard model perturbation. Since wages are determined net of taxes, this implies wage increases and, consequently, lost competitiveness over the historical equivalent. Such patterns are evident in Figure 3.18 where the full line refers to the standard model and the dotted line to the variant considered here. The loss in competitiveness mentioned above results in reduced real industrial output of £6m and total employment losses by 2,000 over the standard model stimulation, both in 1977. After 1977, the convergence between hypothetical and historical foreign interest rates on government debt and the effect of the Phillips curve directs the major indicators (output, employment, consumption) back towards their standard model equivalents, though at reduced wage rates.

The penultimate "shock" which we consider is to use the same hypothetical real interest rate of 2 per cent but to subject the entire stock of debt to this rate rather than the marginal effects considered in Figure 3.18 above. The standard model is then simulated over time to examine the magnitude of the role which the rate of interest on foreign government debt can play upon the model. An important caveat must be mentioned here, namely, that this simulation can be seen as realistic only with the accompanying assumption that government would have employed the historical number of public administration employees and spent the historical nominal amount of the non-market service sector, unlikely perhaps given the increased cost of foreign borrowing.

Results of this perturbation are presented in Figure 3.19 by the full line where, as we might expect, the additional leakage from the economy via interest repayments on government debt has a depressing effect, total employment falling cumulatively until 1977 where it is 25,000 below its historical level (with similar effects on other indicators) before a reduction in the difference between the hypothetical and historical interest rates and the Phillips curve return the system towards its historical level. An additional simulation, where the Phillips curve has been dropped, is given by the broken line in Figure 3.19. This perturbation shows even more severe effects on output and employment since there is now no downward pressure on wages once the unemployment rate rises so that competitiveness is lost. In this scenario, employment falls by 34,000 in 1977 and only slightly returns towards its historical solution by 1980 by reduced discrepancies between

Figure 3.18: Multipliers for standard model: marginal changes in foreign interest rate

Figure 3.19: Multipliers for standard model: major changes in foreign interest rate
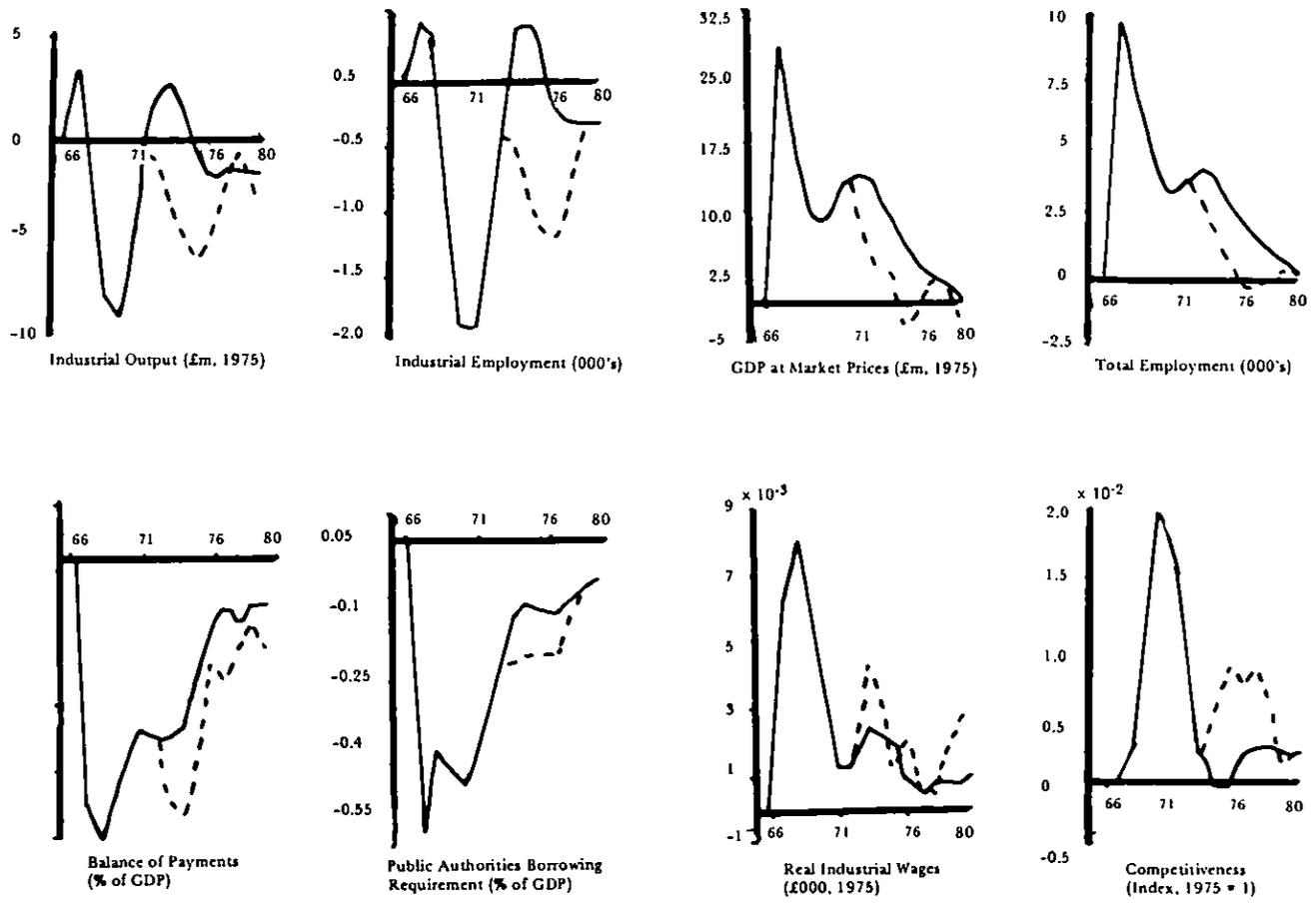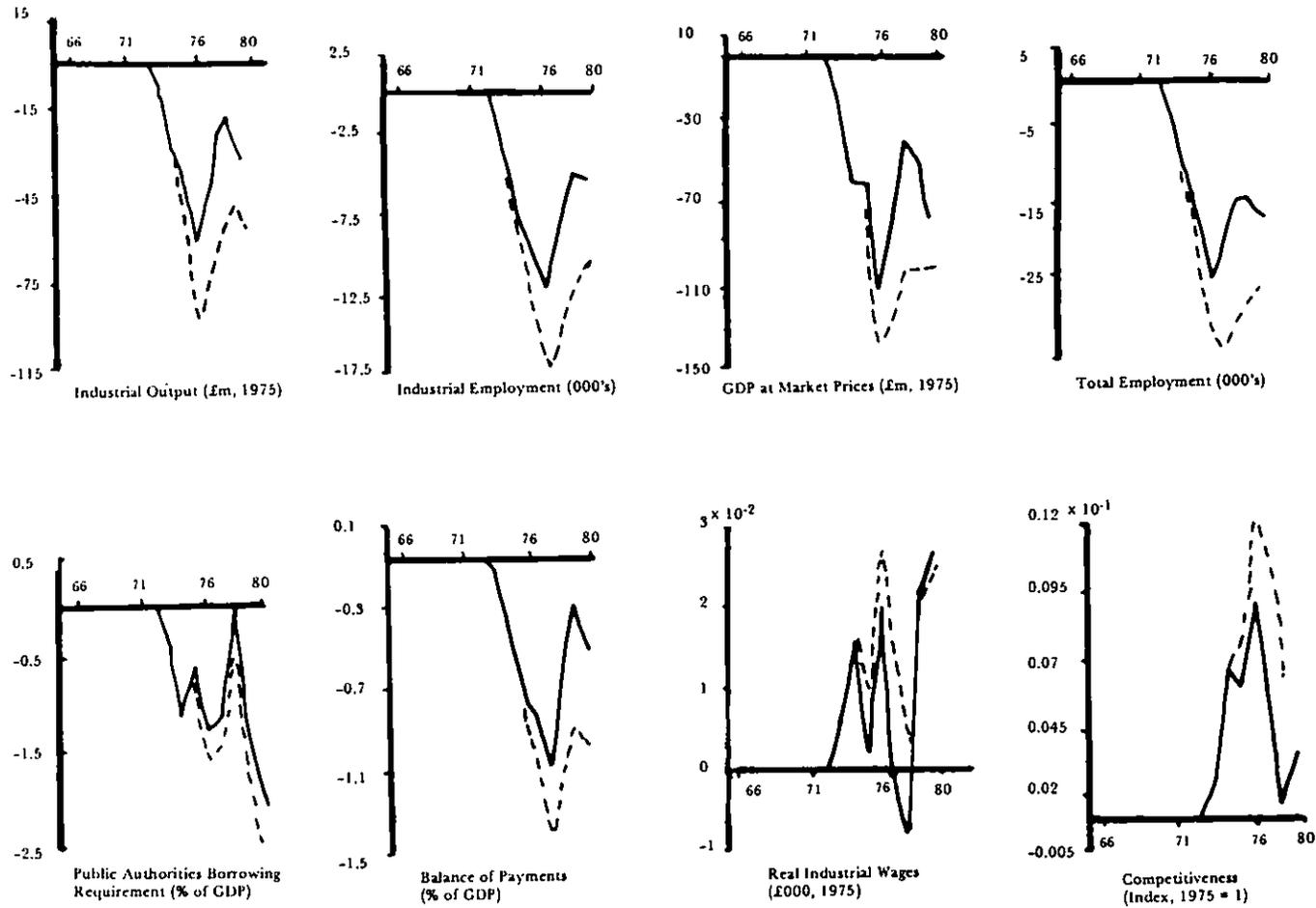
hypothetical and actual interest rates.

In order to examine the importance of competitiveness on the Irish economy we now consider a situation where world unit labour costs fall by 5 per cent of their value in 1967. The results are presented in Figure 3.20. Being an external influence which enters the model through industrial competitiveness, reduced world unit labour costs initially affect the economy through reduced industrial output, employment and investment. By 1970 the output fall is £27m, with a decline of 6,000 in industrial employment. There follows a slow cyclical return to the historical values, though by 1980 industrial output is still £17m, and employment 3,600, below the historical level. Total employment falls by approximately 5,000 from 1970 to 1978, which reduces wage rates via the Phillips curve, thus partially offsetting the loss in competitiveness. The borrowing requirement rate also rises, remaining approximately 0.2 per cent above historical levels after 1970. These results would suggest that even though a nominal exogenous variable may have changed for only one year, there can be very long-tailed implications. It is certainly not sufficient to suggest that any nominal shock hits the model, works its way through, and disappears via inflation erosion. While inflation certainly does play an important role, there are other influences to consider. The effect of a change in any variable on the model depends not only on its effects on expenditure but also on supply considerations such as profitability, unit labour costs and competitiveness. It can have indirect effects as well, via the Phillips curve or the manner in which the borrowing requirement affects the real side of the economy. It is a far more complex situation than inflation erosion.

Care must be exercised if these multiplier results are to be used to justify policy during the sample period or if they are to be extrapolated into the 1980s. Aside from the Lucas argument that the coefficients estimated in the behavioural equations may depend on the level of the exogenous policy variable(s) we shock, there is also the further problem of relating one exogenous variable to another, no account of which is taken here. For instance, in Figure 3.17 we consider the effect of increasing real world demand ignoring the potential relationship between world demand, world prices and world competitiveness. There is a similar problem where certain government instruments have been exogenised at their historical nominal levels so that movements in the economy, induced by imposed shocks, do not affect these variables in any way. In an attempt to overcome this problem, we are currently examining methods whereby, within a multiplier analysis, government expendiure may be related to growth in the economy, or changes in tax revenues with some correction for the stock of debt. One further constraint, imposed by the simplicity of the monetary sector, is the lack of a relationship where-
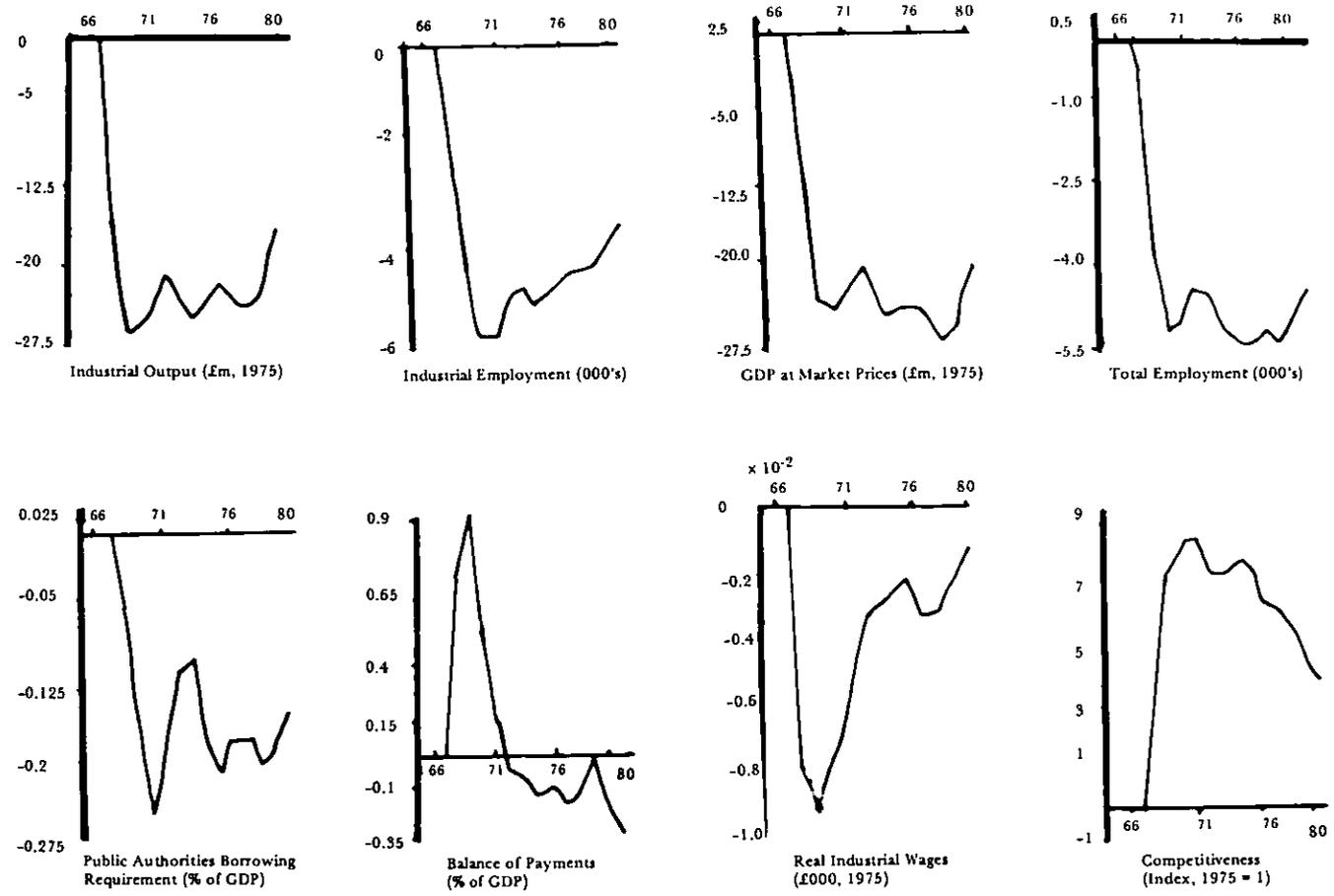
Figure 3.20: *Multipliers for standard model: changes in world unit labour costs*

Industrial Output (£m, 1975)

Industrial Employment (000's)

GDP at Market Prices (£m, 1975)

Total Employment (000's)

Public Authorities Borrowing
Requirement (% of GDP)

Balance of Payments
(% of GDP)

Real Industrial Wages
(£000, 1975)

Competitiveness
(Index, 1975 = 1)

by the exchange rate, always assumed fixed during the above perturbations, could be related to certain indicators in the domestic and world economy.

It is particularly difficult to deduce policy implications from the above results for the present. While demand conditions during the 1970s might be likened to the present depression there are two crucial differences between the 1970s and early 1980s for analysis of fiscal stimulation. First, the inflation rates experienced during the mid-1970s were far in excess of those being presently experienced so the effect of a nominal shock such as the CGOV perturbation considered above, which disappear quickly in a high inflation environment, may linger in a low-inflation era. Second, and perhaps more importantly, fiscal expansion financed by foreign borrowing must now be repaid at significantly positive real interest rates rather than the negative real rates which persisted for long periods during the 1970s. As a result, the demand depressing effects of interest repayments will presumably be that much greater now than during the period studied above.

Chapter 4

POLICY ANALYSIS WITH MACROMODELS

INTRODUCTION

Operational macromodels of an economy are constructed mainly to provide tools to assist in historical appraisals of the role and impact of economic policy decisions, and to provide guidance in evaluating stabilisation policies for the present and future. With a model one can begin to attempt to answer the counter-factual question: what would have been the state of the economy in the absence of particular policies?

Two broad methodological approaches to policy analysis are available for use with macromodels. The first approach originated with the work of Hansen and his collaborators and has come to be known as the "Hansen" methodology.[5] An early application of this approach using an Irish econometric model was due to Norton (1975). In the Hansen approach, an attempt is made to isolate the component of the economic outturn which can be attributed to fiscal and monetary policy changes and to categorise this component in terms of "discretionary" and "automatic" effects. The procedure used involves only standard simulation techniques to carry out counter-factual experiments. The results of such exercises are, of course, specific to the particular model used. Although the overall methodology is the subject of continuing but, as yet, unresolved controversy,[6] nevertheless the proper focus of debate over the results and conclusions of its use is most fruitfully directed at the underlying model, its structure and its assumptions.

The second broad approach to policy analysis involves the use of optimal control theory with economic models. Here one seeks to establish not what the *ex-post* policy impacts turned out to be but rather what was the *ex-ante* policy "criterion" function that guided policy makers in formulating their policy decisions and in settling on trade-off measures between different desirable economic objectives.[7] In addition one can explore "optimal" policy decisions using specific *ex-ante* criterion functions and arrive at the "best" policy prescriptions to attain given objectives.

5. Hansen (1968; 1973), Hansen and Snyder (1968), Snyder and Tanaka (1972), Blinder and Goldfeld (1976), Artis and Green (1982).

6. Lucas (1976), Lucas and Sargent (1981), Simms (1982), Begg (1982).

7. The international literature in this area is immense. Standard works include Chow (1975; 1981), Pindyck (1973), Aoki (1975). An application to Dutch stabilisation policy has been described by Buiter and Owen (1981). The technique has been the subject of a Parliamentary report in the UK (Ball, 1978). The only application to an Irish model appears to be Bradley and Ó Raifeartaigh (1982).

The control-theoretic framework is useful for formulating policy decisions and is considerably more subtle than the simpler Hansen methodology. However, it suffers from three major drawbacks. First, the computational burdens are very heavy since complex non-linear optimisation algorithms are required to solve optimal control problems.[8] Second, the optimal control analysis often forces one into policy configurations which are very different from those which characterised the period over which the model behavioural equations were estimated. Hence, before embarking on the application of control techniques to economic problems, one must be sure that the model being used is robust, stable and appropriate over a wide range of policy configurations. Few economists can honestly say that they have such confidence in their macromodels. Finally, the Lucas critique, allied to problems with the time inconsistency of optimal plans (Kydland and Prescott, 1977), means that optimal control calculations must be interpreted with great care.

In this paper we restrict ourselves to the Hansen methodology, particularly in the sophisticated form developed by Blinder and Goldfeld (1976). We feel that only when a model has been fully exposed to these simpler methods of analysis should one turn to applications of control theory. In the next section we describe the methodology we propose to use and how it is to be implemented using a macromodel of an economy. In the following section we illustrate the Blinder and Goldfeld methodology for a specific year (1967) using the model described in Chapter 2 and discuss practical problems of implementation. Having explored how policy effects can be quantified in an experimental framework, in Chapter 5 we apply the method to an examination of the historical fiscal policy effects over the period 1967 to 1980.

THE METHODOLOGY OF POLICY EVALUATION

In its very simplest form, the Hansen methodology for policy evaluation can be presented using the rudimentary model shown in Figure 4.1. If we ignore the unrealistic nature of this model for the moment, we can say that it is characterised by three endogenous variables (consumption (C), tax revenue (T) and income (Y)), two policy instruments (expenditure (G) and the tax rate (t)), one exogenous variable (investment (I)) and two behavioural coefficients (α and β). Solving for Y (income) in terms of the exogenous and policy variables yields

$$Y = \frac{1}{1 - \beta(1-t)} (\alpha + I + G) \tag{4.1}$$

8. Typically, the computer time required to calculate an optimal policy decision over a single time period could be one hundred times as long as the time required to carry out a single simulation experiment.

Figure 4.1: *A simple macromodel*

$$
\begin{aligned}
(1) \quad & C = \alpha + \beta\,(Y - T) \\
(2) \quad & T = tY \\
(3) \quad & Y = C + \overline{I} + G
\end{aligned}
$$

Notation

Y	=	Real National Income
C	=	Real Private Consumption
I	=	Real Total Investment
G	=	Real Public Expenditure
T	=	Real Tax Receipts
α	=	Intercept
β	=	Marginal Propensity to Consume
t	=	Marginal Tax Rate

Hence, for any given time period, and given fixed values of the behavioural coefficients (α, β) we obtain the value of Y by simply inserting the values of the exogenous variable (I) and the policy instruments (G and t).

Consider now differential changes to the exogenous variable (ΔI) and the policy instruments $(\Delta G$ and $\Delta t)$. Using (4.1) this yields

$$
\Delta Y = \left(\frac{1}{1 - \beta(1-t)}\right)(\Delta I + \Delta G) - \frac{\beta \Delta t}{(1 - \beta(1-t))^2}\,(\alpha + I + G) \quad (4.2)
$$

This change in income (ΔY), brought about by changes in investment (I), government expenditure (G) and the tax rate (t), is called the *total* change.

If we assume that policy makers have discretion over whether or not to make changes in the policy instruments G and t, then if no such discretionary changes are made, any change in income must arise as a result of changes in the purely exogenous variable I, i.e.,

$$
\Delta Y = \left(\frac{1}{1 - \beta(1-t)}\right)\Delta I \quad (4.3)
$$

In the complete absence of government taxation activities (i.e., t = 0), then the income change reduces to

$$
\Delta Y = \left(\frac{1}{1 - \beta}\right)\Delta I \quad (4.4)
$$

In practice, of course, t is positive and the income change in the presence of

taxation is less than the change in the absence of taxation, i.e., the taxation system acts as a stabiliser.

Since (4.2) represents the total change in income (due to combined exogenous and policy variable alterations) and (4.3) represents the change when the policy variables are not altered from their base values, then the income change attributable purely to the discretionary fiscal policy is simply the difference of (4.2) and (4.3), i.e.,

$$\Delta Y_{disc} = (\frac{1}{1 - \beta(1-t)})\Delta G - \frac{\beta \Delta t}{(1 - \beta(1-t))^2} \cdot (\alpha + I + G) \qquad (4.5)$$

where, of course, $dY_{disc} = 0$ if $dG = dt = 0$.

The above simple model serves to isolate three important concepts:

(i) The *total* change in policy targets brought about by changes in both the purely exogenous variables and in the policy variables;

(ii) The change in policy targets resulting from changes only in exogenous (non-policy) variables. This change is, of course, influenced by the existence of a fiscal structure and incorporates aspects of *automatic* stabilisation effects;

(iii) The change in policy targets resulting from changes only in the policy variables which are subject to *discretionary* variation.

For practical analysis of actual policy decisions it is necessary to generalise this simple model of Figure 4.1 in two directions: to formulate the analysis in terms of a general macromodel (usually large and highly non-linear), and to deal with dynamic effects.[9]

Consider a single target variable Y whose behaviour is governed by the non-linear dynamic reduced form equation

$$Y_t = f(X_t, Y_{t-1}, G_t) \qquad (4.6)$$

where X is a vector of exogenous variables and G is a vector of policy instruments.[10] Suppose we now create a hypothetical series $G(t, t_0)$ which follows the historical path of $G(t)$ up to the period $t_0 - 1$; remains unchanged (at value $G(t_0 - 1)$) during period t_0; and replicates all subsequent policy *changes* exactly as found in the historical record $G(t)$.

Since the hypothetical policy path $G(t,t_0)$ removes only the policy *changes* of period t_0, it enables us to isolate the influence of period t_0's policy on any future value of the target variable Y. The methodology for

---

9. Blinder and Goldfeld (1976), Artis and Green (1982).

10. It is not necessary to assume that f(.) can be written analytically. It is sufficient to be able to solve the underlying structure model by numerical techniques, and such techniques.are always used in practice. There is no loss in generality in assuming lags of only one period.

doing so is as follows:

(i)   Derive a baseline path for Y by simulating the model dynamically using the historical values of all policy variables (yielding $\hat{Y}(t)$);

(ii) Construct a hypothetical path, denoted by $\hat{Y}(t, t_0)$, by simulating the model using policy $G(t, t_0)$ instead of $G(t)$;

(iii) Calculate the difference (D) between the two paths $\hat{Y}(t)$ and $\hat{Y}(t, t_0)$ as a measure of the policy influence, i.e., $D(t, t_0) = \hat{Y}(t) - \hat{Y}(t, t_0)$.

This describes the impact of policy changes, made in period t_0, on the target variable Y at any subsequent period t.

However, because of lags in the model structure, past policy actions will have effects on future values of target variables, Y. This requires us to distinguish between the effects of a particular policy action taken at time t_0 on subsequent levels of the target Y, and the total effect on Y of *all* past actions. In any period, t, the total effect of policy may be defined as

$$D(t) = \sum_{i=0}^{n} D(t, t-i) \tag{4.7}$$

where n is, in theory, infinite, but in practice is truncated to a finite number.[11] The first difference of this series, i.e.,

$$\Delta D(t) = D(t) - D(t-1)$$

quantifies the net change in effect of policy between two periods.

The benefits of such measures are clear: the effects are precisely dated; one can examine a range of target variables; initial conditions are taken into account; the full non-linearities of the model are used. However, there are the following reservations about the methodology. Any results are specific to the model used: change the model and the results will be different. This reservation should serve, not merely to call into question any analysis, but more importantly to focus attention on the model as a good economy representation. Second, it makes the assumption of the independence of policies. In practice, certain policies (e.g., fiscal expansion) might only have been undertaken if other policies (e.g., wage and price controls) were in force. Third, the method requires a baseline (or indexed) policy to be defined, deviations from which are used to quantify the discretion exercised in policy making. It is to this important aspect that we now turn.

The fiscal instruments in our model can be classified into three types:

(i)   Instruments expressed in nominal (or money) terms. Examples of this type include government investment expenditures, certain tax

11. A "well-behaved" model should "settle down" after a policy shock in the sense that
    $D(t, t_0) = D(t + 1, t_0)$ for $t > n$ if n is large enough.

revenues (such as rates and wealth tax) and the rate of specific excise taxes. Of the 27 fiscal instruments used in the model, 19 fall into this category.

(ii) Instruments expressed in real or quantity terms. The only such instruments in our model are employment in public administration and non-marketed service sector employment (expressed in thousands).

(iii) Tax rates expressed in percentage form. Examples are the average direct income tax rate, the VAT rate, the social insurance rate, etc. In all there are six such instruments in our model.

Two possible definitions of a "indexed" or "baseline" fiscal policy suggest themselves.

(a) No change in any of the three types of instruments listed above, i.e., all nominal magnitudes remain unchanged, employment in public administration and public services is fixed at its previous year's level, as also are all tax rates which are expressed in percentage terms. We refer, subsequently, to such a policy baseline as "nominal", or:

(b) All nominal instruments are *indexed* to a suitable price or value index, with no changes in other instruments. We refer, subsequently, to such a policy baseline as "real".

Neither of these definitions is without its limitations. The "real" baseline definition attempts to get at a concept of fiscal policy that is neutral in its effects on the real economy in the sense of maintaining government's share of activity in the economy. The "nominal" baseline involves a definition meaning literally no change in the variables the government actually controls.[12] The real baseline definition only considers deviations from full indexation of all nominal instruments in line with inflation as policy: it implicitly assumes, therefore, that the decision to index is not a policy option. The nominal baseline definition, on the other hand, sees any change in the value of the nominal instruments as a policy decision. In reality, of course, it is about the current value of its expenditure and revenue instruments that the government makes decisions, and not about their value in 1975 prices. However, among the disadvantages of the nominal baseline definition is that it will give different values for the effects of a given set of policy changes according as inflation rates differ. Also the measured effects of fiscal policy in an inflationary period will be very high using this definition if some of the items of government expenditure and taxation designated as being exogenous

12. Artis and Green adopt the "no-change" in nominal magnitudes definition since whatever the reason for changes from the chosen baseline, such changes must be financed, and hence the zero change assumption is preferred. Bacon *et al.* (1982) adopt the indexation approach in a study of Irish fiscal effects using MODEL-80. Artis (1984) has switched to the indexation approach.

policy variables are not, in fact, exogenous but have been increased in line with inflation. This problem derives less from focusing on nominal instruments than from a failure to model properly all of the components of the government accounts and exogenising items that should in fact be endogenous. While we do not believe that looking only at "real" changes gets around this problem (what in fact is needed is better modelling of the government sector), in this study we have opted for the real baseline definition. While not perfect, we feel that it maintains a closer consistency with the actual budgetary procedures used in the Department of Finance than the nominal baseline policy.[13]

The Blinder-Goldfeld method can also be used to examine the balance between taxation and expenditure policies in the overall outturn for, say, GDP by quantifying the effects of taxation and expenditure policies together, and then each separately. A simple diagram can be used to illustrate the results (Figure 4.2), where the output effects of tax changes are shown along the vertical axis, and output effects of expenditure changes along the horizontal axis. The dotted line represents the locus of policy configurations where any tax increases (with a negative effect on output) are balanced by expenditure increases (with a positive effect on output). In a specific sense, such policies are "neutral". The information shown in Figure 4.2 relates to the duration of the UK labour administration of the years 1974-1979. It shows, for example, the shift from tax financed expenditure stimulations in 1974 and 1975 to expenditure cuts whose deflationary impacts were partially offset by tax cuts in 1976 and 1977. In 1978 the role of fiscal policy was very minor. In addition, at no time were both arms of fiscal policy pulling in the same direction (i.e.,there are no policy configurations in the north-east or south-west quadrants of the diagram). In the diagram, policy configurations in the north-east quadrant are expansionary both in terms of taxation and expenditure policy, while points in the south-west quadrant are contractionary in terms of both. Points in the south-east quadrant are expansionary in terms of expenditure policies and contractionary in terms of taxation policy. The reverse holds in the north-west quadrant.

POLICY ANALYSIS WITH A SPECIFIC MODEL

In the previous two sections we have described the methodology of policy analysis in general terms. In this section we examine how this general

13. "It is customary to assess economic prospects before the Budget on the assumption of Budget neutrality (i.e., no change in the real level of public expenditure and no alteration in the tax code). The assumption is purely technical and has no implications for policy intentions"(Economic Background to the Budget, 1981, Department of Finance, 1981). It should be noted, however, that the spirit of the above scheme has been interpreted and implemented in differing ways over the period 1960 to 1980 by the Department of Finance.

Figure 4.2: *The output effects of taxation (ΔT) and expenditure (ΔG) changes: UK, 1974-1979*
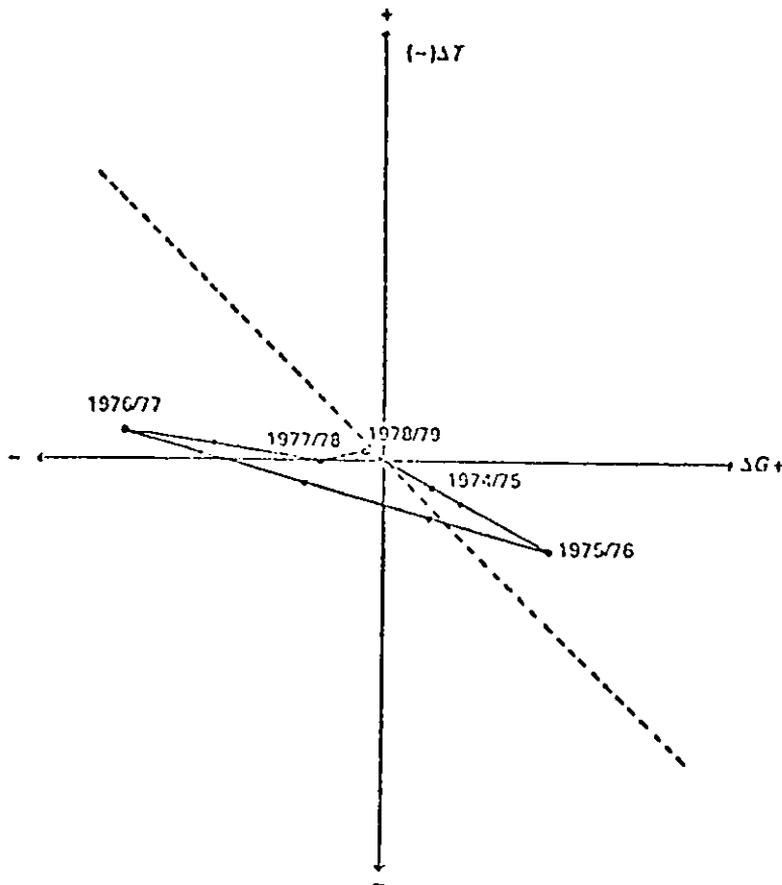
methodology can be implemented with the model described in Chapter 2. Our purpose is to illustrate the Blinder-Goldfeld approach for a single year, 1967, in order to lay the ground work for the analysis of fiscal policy effects over the period 1967 to 1980, which is carried out in the next chapter.

The first task to be performed is to classify the exogenous variables into policy variables (which, to a greater or a lesser extent, are under the control of the public authorities) and purely exogenous variables (e.g., world prices, etc). Within the class of policy variables we make a further distinction between the fiscal authorities, the monetary authorities and the European Commis-

sion. Finally, within the class of fiscal policy instruments we make the distinction between taxation instruments and expenditure instruments.

In all there are 77 exogenous variables of all types in the model. A complete listing, by the above classification is given in Appendix 1. Briefly, they split into the following groups:

Fiscal Policy: Expenditure	= 12	
Fiscal Policy: Revenue	= 15	Policy variables
Financial and Monetary Policy	= 21	
European Commission	= 7	
Agricultural	= 7	
World	= 8	Purely exogenous variables
Other (including dummy variables) =	7	

In what follows we regard the European Commission variables as being purely exogenous to the domestic economy. Financial and monetary policy instruments are considerably more difficult to handle within the model. Given the fixed link with sterling prior to 1979 and membership of the EMS subsequently, it may not strain credulity if the exchange rate is regarded as purely exogenous in what follows. A somewhat similar argument will also serve to justify exogenous interest rates.

In relation to the financing of the government borrowing requirement, we have made the assumption that the domestic uptake of government securities is exogenous. Hence, any rise in the borrowing requirement due to variations in the settings of fiscal instruments is assumed to be financed by foreign borrowing. Such an assumption is crude, but is made in order to avoid the very complex issues related to a more sophisticated monetary sector, within which the balance between domestic and foreign financing would be handled endogenously.

In Table 4.1 we list the fiscal policy instruments used in the model, together with the mnemonics used in Appendix 1. We also indicate how an "indexation" change for each instrument has been defined. Where "previous year" is shown, indexation policy is defined as involving no change from the previous years value. This is the case for tax rates expressed in percentage or fraction form and for employment numbers. Where "GNPV" is shown, the instrument is indexed to the *value* of GNP. The same holds for QAV (the value of gross agricultural output) and CPERV (the value of household consumption). Finally, PCPER indicates simple price indexation, using the consumption deflator.

In order to illustrate how the Blinder-Goldfeld method of fiscal analysis works, we take the first year in our period of study, 1967, and we examine

Table 4.1: *Fiscal policy instruments*

Taxation instruments		Indexed to
GREVK:	Total revenue on capital account (£m)	GNPV
SOCR:	Implicit average social insurance contribution rate (fraction)	Previous year
TAGLEV:	Revenue from agricultural levies (£m)	QAV
TAU:	Effective corporate tax rate (fraction)	Previous year
TAVR:	Effective VAT rate (fraction)	Previous year
TCARR:	Motor vehicle road tax rate (index)	PCPER
TCDR:	Implicit rate of customs duty (fraction)	Previous year
TEDR:	Rate of excise duty on alcohol, petrol, etc. (index)	PCPER
THE:	Rate of initial depreciation allowances on capital goods (fraction)	Previous year
TIOR:	Implicit rate of residual indirect taxation (index)	PCPER
TRATE:	Revenue from property taxes (£m)	GNPV
TYA:	Revenue from taxes on agricultural income (£m)	QAV
TYRA:	Implicit average rate of direct taxation (fraction)	Previous year
TYW:	Revenue from wealth taxes (£m)	CPERV
YGI:	Government trading and investment income (£m)	GNPV
Expenditure instruments		Indexed to
GEXPKO:	Residual capacity expenditure category (£m)	GNPV
IFGOV:	Other public sector direct fixed investment (£m)	GNPV
IFGV:	Fixed investment by public administration (£m)	GNPV
IHGV:	Public authorities housing investment (£m)	GNPV
LPA:	Employment in public administration and defence (thousands)	Previous year
LSNM:	Employment in non-marketed services (thousands)	Previous year
SUBCR:	Implicit rate of subsidy on private consumption (fraction)	PCPER
SUBO:	Residual category of subsidies (£m)	GNPV
TRKH:	Capital transfers to households for housing purposes (£m)	GNPV
TRKI:	Capital transfers to industry (£m)	GNPV
TRPO:	Residual category of personal transfers (£m)	CPERV
TRUR:	Unemployment transfer payment rate	PCPER

Note: In some variants of the model, the policy instrument LSNM can be replaced by CGOV: Public authorities non-wage current expenditure (£m).

how the actual changes in the fiscal instruments differed from the "indexed" changes. In Table 4.2 we list all the instruments, their actual values taken in 1967, the hypothetical "indexed" values, and the difference between the actual values and the indexed values. A brief examination of the taxation instruments in Table 4.2 (the first 15 listed) shows that in all but two cases the indexed value of the tax instrument was lower than the actual value.

Table 4.2: *Actual and hypothetical values of fiscal instruments in 1967*

Instrument	Actual value (1967)	Hypothetical value (1967)	Difference
GREVK	11.287	10.641	-0.64
SOCR	0.0335	0.0303	-0.0032
TAGLEV	0.0	0.0	0.0
TAU	0.1177	0.0974	-0.0203
TAVR	0.027	0.023	-0.004
TCARR	0.6613	0.6747	0.0134
TCDR	0.018	0.019	0.001
TEDR	0.5659	0.5478	-0.0181
THE	0.286	0.241	-0.045
TIOR	0.928	0.9173	-0.0107
TRATE	34.17	35.12	0.95
TYA	0.0	0.0	0.0
TYRA	0.085	0.078	-0.007
TYW	0.0	0.0	0.0
YGI	27.05	26.66	-0.39
GEXPKO	28.598	29.325	0.727
IFGOV	20.204	21.392	1.182
IFGV	11.50	11.47	-0.03
IHGV	14.176	11.895	-2.281
LPA	44.0	43.2	-0.8
LSNM	93.8	85.3	-8.5
SUBCR	0.0059	0.0058	-0.0001
SUBO	38.19	32.75	-5.44
TRKH	3.163	2.841	-0.322
TRKI	6.149	5.232	-0.917
TRPO	73.11	69.83	-3.28
TRUR	3.829	3.826	-0.003

The exceptions are TCARR (road tax) and TCDR (customs duty), and even in these cases the differences are very small. A similar picture holds with the expenditure instruments where all except two have negative differences, i.e., the indexed values are smaller than the actual values. The exceptions are GEXPKO (residual capital expenditure) and IFGOV (an element of public fixed capital formation). From the point of view of the settings of the fiscal instruments ("the fiscal stance"), the figures in Table 4.2 would lead us to expect that the fiscal actions taken in 1967 were expansionary relative to "indexed" changes in expenditure and contractionary for tax changes. In order to confirm this impression, and to quantify the magnitude of the fiscal stimulus, we need to stimulate the model replacing the actual 1967 fiscal

actions by the above hypothetical ones, and apply historical *changes* subsequent to 1967, as described in the methodology section above. The remainder of this chapter is devoted to a detailed examination of the results of this simulation in order to prepare for the more comprehensive analysis of the next chapter where the combined effects of many different budgets are examined.

FISCAL POLICY IN 1967

In this section we examine in detail the impact and delayed effects of the discretionary fiscal actions taken in 1967. We use 1967 to illustrate the Blinder-Goldfeld methodology and to prepare the way for the more concise treatment of Chapter 5, where we only present summary results for the period 1967 to 1980.

As an illustration of the actual and hypothetical time paths for the fiscal instruments, we show in Table 4.3 the values for the main excise duty tax rate (TEDR), the social welfare transfer instrument (TRPO) and numbers employed in non-marketed services (LSNM). In each case it is seen that, subsequent to 1967, the historical *change* in each instrument is reproduced in the hypothetical path of the instrument. Since both TEDR and TRPO are measured in money terms (TEDR is an index of nominal duty per physical unit of goods and TRPO is measured in millions of pounds), the sustained difference is eroded over time due to the high background inflation. The instrument LSNM is measured in thousands of employees. Hence, the sustained difference remains constant in real terms and is not eroded by inflation.

We turn now to the paths of the endogenous, or target, variables and the manner in which removal of the discretionary fiscal changes for 1967 affects the economy (as mirrored in the model) over time. This information is presented in a series of graphs which illustrate the differences between the evolution of a specific target variable under the hypothetical fiscal policy and its evolution under the actual fiscal policy.[14]

In Figure 4.3 we examine the effects on the most aggregate indicator of economic activity, real gross domestic product (GDPM) and the growth rate of gross domestic product (GDPMDOT). The data for 1966 are included for reference in order to define the base-line zero difference between the historical outturn and the "hypothetical" outturn due to indexed policies. Relative to the historical outturn fiscal indexation (as defined in Table 4.2) would have led to a lower value of GDP. In 1967, GDP would have been

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14. Since the within-sample stochastic errors have been added back to the behavioural equations, simulation of the model with actual fiscal instruments reproduces the historically observed values of *all* the endogenous variables (refer Chapter 3).

Table 4.3: *Examples of fiscal indexation for 1967*

TEDR — Index of excise duty rate (base 1975 = 1.0)			
Year	Actual	Indexation	Difference
1966	0.534537	0.534537	0.
1967	0.565947	0.547837	−0.018
1968	0.595015	0.576906	−0.018
1969	0.666844	0.648734	−0.018
1970	0.682131	0.664021	−0.018
1971	0.693827	0.675718	−0.018
1972	0.697422	0.679312	−0.018
1973	0.725802	0.707692	−0.018
1974	0.742615	0.724505	−0.018
1975	1.	0.98189	−0.018
1976	1.30622	1.28811	−0.018
1977	1.33076	1.31265	−0.018
1978	1.31819	1.30008	−0.018
1979	1.45024	1.43213	−0.018
1980	2.07639	2.05828	−0.018

TRPO — Social welfare income transfers (£ million)			
Year	Actual	Indexation	Difference
1966	65.9062	65.9062	0.
1967	73.1142	69.8322	−3.28
1968	85.019	81.737	−3.28
1969	103.054	99.7717	−3.28
1970	124.789	121.507	−3.28
1971	149.303	146.021	−3.28
1972	177.006	173.724	−3.28
1973	231.702	228.42	−3.28
1974	308.34	305.058	−3.28
1975	417.158	413.876	−3.28
1976	502.62	499.338	−3.28
1977	569.327	566.045	−3.28
1978	657.947	654.665	−3.28
1979	791.795	788.513	−3.28
1980	1004.48	1001.2	−3.28

LSNM — Employment in non-marketed services (thousands)			
Year	Actual	Indexation	Difference
1966	85.2998	85.2998	0.
1967	93.8	85.2998	−8.50
1968	92.4001	83.8999	−8.50
1969	91.1001	82.5999	−8.50
1970	96.2	87.6997	−8.50
1971	101.4	92.8997	−8.50
1972	114.	105.5	−8.50
1973	115.8	107.3	−8.50
1974	116.3	107.8	−8.50
1975	124.7	116.2	−8.50
1976	122.2	113.7	−8.50
1977	125.5	117.	−8.50
1978	130.8	122.3	−8.50
1979	145.2	136.7	−8.50
1980	148.9	140.4	−8.50

Figure 4.3: *The effects of fiscal indexation in 1967: Gross Domestic Product*

GDPM — Gross Domestic Product (£m, 1975)   *GDPMDOT — GDP growth rate (per cent)*

Year	Actual	Indexation	Difference	Year	Actual	Indexation	Difference
1966	2565.05	2565.05	0.00415	1966	1.25093	1.25113	0.000191
1967	2687.26	2657.14	-30.127	1967	4.76456	3.58982	-1.17474
1968	2857.48	2834.47	-23.0159	1968	6.3343	6.67372	0.339413
1969	2990.25	2981.19	-9.06836	1969	4.6463	4.17616	0.529861
1970	3080.72	3075.78	-4.93628	1970	3.02525	3.17297	0.147724
1971	3230.24	3222.85	-7.39453	1971	4.85353	4.78134	-0.072193
1972	3425.72	3409.59	-16.1274	1972	5.05154	5.79443	-0.257111
1973	3605.84	3581.55	-24.2907	1973	5.25789	5.04332	-0.214577
1974	3710.5	3687.49	-23.01	1974	2.90232	2.95782	0.055504
1975	3731.1	3709.42	-21.6787	1975	0.555134	0.594711	0.055504
1976	3851.6	3844.5	-7.09985	1976	3.22962	3.64151	0.411892
1977	4071.2	4072.01	0.814453	1977	5.70145	5.91784	0.216389
1978	4364.1	4364.68	0.578125	1978	7.19433	7.18708	-0.007248
1979	4536.	4538.95	2.95703	1979	3.93887	3.99284	0.053978
1980	4602.89	4611.02	8.12109	1980	1.47476	1.58758	0.11282

GDPM — Gross Domestic Product (£m, 1975)   *GDPMDOT — GDP growth rate (per cent)*
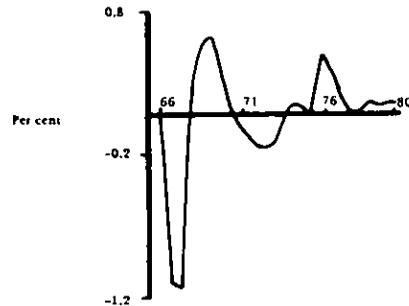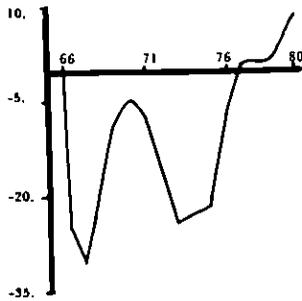
£30m lower (in 1975 prices) and the growth rate would have been 1.2 percentage points lower. The subsequent evolution of the economy is clear from Figure 4.3. A gradual convergence back to the historical level and growth rate of GDP is interrupted by a cycle, but by the last year in our sample (1980) adjustment is almost complete. Hence, in terms of its effect on GDP one would describe the actual fiscal policy of 1967 as fairly expansionary. However, the stimulatory effect of the expansion gradually dies away over time. The economic mechanisms by means of which this happens are explored below.

In Figure 4.4 we look at another aggregate economic indicator, the total number unemployed (U) and the unemployment rate (UR). For the three years after 1967 unemployment and the unemployment rate would have been higher than their historical values if the 1967 fiscal policies had been based on indexation, as defined by Table 4.2 above. In 1967, about 8,500 extra persons would have been unemployed and the unemployment rate would have been 0.8 percentage points higher. From 1970 to 1975 there are only very small differences between the actual and hypothetical outturns. After 1975 the earlier impact effects tend to be partially reversed and unemployment tends to fall below the historical level. Hence, in terms of its effect on unemployment, one would describe the actual fiscal policy of 1967 as initially expansionary but that this expansionary effect is lost within three years through mechanisms which we examine below.

A third aggregate indicator of the effect of policy changes is the balance of payments surplus (BPV) and the surplus expressed as a percentage of GDP (BPVR) and these effects are explored in Figure 4.5. In the year 1967 the actual balance of payments was mildly in surplus (to the extent of about 1.4 per cent of GDP). Not surprisingly (in view of the fiscal policy effects on GDP and unemployment above), fiscal indexation in 1967 would have further increased this surplus by about one percentage point of GDP in the first year. The delayed effects on the balance of payments endure and remain positive. However, the units of measurement for BPV are current prices. Expressed as a percentage of GDP the surplus peaks in the second year (at 1.1 percentage points extra) and gradually declines to zero change by 1976. In the sense that the actual 1967 fiscal policies relative to fiscal indexation in 1967 caused the balance of payments surplus to fall (or, equivalently, the deficit to rise), policy can be said to have been expansionary.

In Figure 4.6 we examine an aggregate indicator of the state of the public authorities finances: the public authorities surplus (GBR), and the surplus expressed as a percentage of GDP (GBRR). As expected, fiscal indexation in 1967 would have led to a smaller deficit. In 1967 the actual deficit was £55.8 million (or 5.1 per cent of GDP). Under fiscal indexation the deficit

Figure 4.4: *The effects of fiscal indexation in 1967: unemployment*

U — Total Numbers Unemployed (thousands)				UR — Unemployment Rate (per cent)			
Year	Actual	Indexation	Difference	Year	Actual	Indexation	Difference
1966	40.3003	40.2983	−0.001953	1966	3.74886	3.74968	−0.000179
1967	41.8	50.3003	8.50024	1967	3.86858	4.66811	0.799525
1968	46.2	53.4668	7.26685	1968	4.28253	4.97086	0.688327
1969	43.4001	46.4043	3.00415	1969	4.03347	4.32629	0.292817
1970	52.4004	52.0369	−0.363525	1970	4.86947	4.85284	−0.016626
1971	49.7002	47.9585	−1.7417	1971	4.6023	4.4602	−0.142096
1972	56.6001	55.4197	−1.18042	1972	5.16424	5.08313	−0.081115
1973	52.4004	52.0488	−0.351563	1973	4.71184	4.7075	−0.004336
1974	52.6003	52.1409	−0.459473	1974	4.65448	4.64141	−0.013078
1975	73.	71.5144	−1.4856	1975	6.36998	6.27689	−0.093084
1976	90.	86.6501	−3.34985	1976	7.79896	7.55019	−0.248773
1977	88.8999	84.0454	−4.85449	1977	7.58596	7.20739	−0.378567
1978	85.	79.9546	−5.04541	1978	7.11297	6.7201	−0.392866
1979	74.	69.6621	−4.33789	1979	6.07055	5.73592	−0.334628
1980	76.	71.8708	−4.12915	1980	6.13398	5.8187	−0.315274

U — Total Numbers Unemployed (thousands)   UR — Unemployment Rate (per cent)
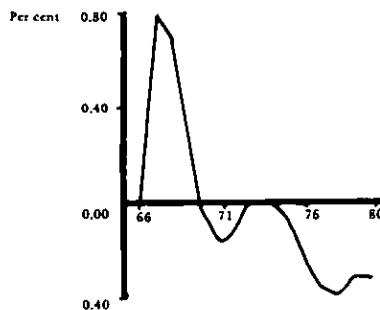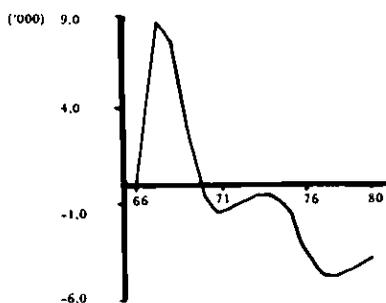
Figure 4.5: *The effects of fiscal indexation in 1967: balance of payments*

	BPV — Balance of Payments Surplus (£m)				BPVR — Balance of Payments Surplus as per cent of GDP		
Year	Actual	Indexation	Difference	Year	Actual	Indexation	Difference
1966	⁻15.8	⁻15.799	0.000977	1966	-1.57047	-1.57037	9.822845E-05
1967	14.9998	25.2852	10.2855	1967	1.36107	2.34549	0.984417
1968	-15.9002	⁻2.6551	13.2447	1968	-1.28298	-0.219685	1.0633
1969	-69.1002	-56.7561	12.3441	1969	-4.84031	-4.05033	0.78948
1970	-65.3004	-54.6505	10.6498	1970	-4.05685	-3,4446	0.612245
1971	-71.0003	-57.2871	13.7132	1971	-3.8549	-3.15042	0.704477
1972	-48.4004	-32.2849	16.1155	1972	-2.17797	-1.47351	0.704462
1973	-93.3003	-74.2857	19.0146	1973	-3.48874	-2.82507	0.66367
1974	-294.5	⁻276.157	18.3428	1974	-9.84716	-9.40799	0.439174
1975	-19.7	-9.62173	10.0783	1975	-0.528004	-0.262507	0.265496
1976	-180.2	-172.587	7.61328	1976	-3.93301	-3.81736	0.115648
1977	-191.3	-183.073	8.22705	1977	-3.47701	-3.35933	0.11768
1978	-256.3	-245.448	10.8519	1978	-3.99142	-3.86144	0.129988
1979	-843.701	-829.339	14.3628	1979	-11.2792	-11.2172	0.061996
1980	-881.897	-866.519	15.3784	1980	-9.94344	-9.89051	0.052929
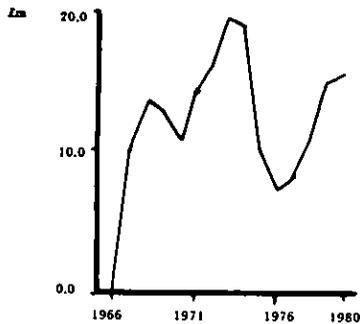
BPV — *Balance of Payments Surplus (£m)*   BPVR — *Balance of Payments Surplus as per cent of GDP*
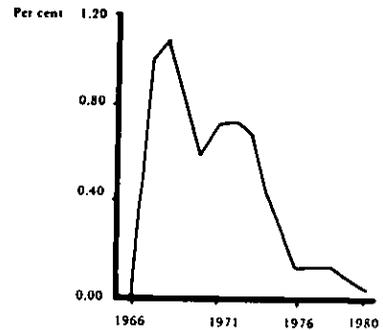
Figure 4.6: *The effects of fiscal indexation in 1967: public authorities surplus*

GBR – Public Authorities Surplus (£m)				GBRR – Public Authorities Surplus as per cent of GDP		
Year	Actual	Indexation	Difference	Year	Actual	Indexation	Difference
1966	−54.2347	−54.2347	0.	1966	5.39075	−5.39074	6.675720E-06
1967	−55.8125	−47.8807	7.93178	1967	−5.0644	−4.44147	0.622931
1968	−75.016	−67.5845	7.43155	1968	−6.05303	−5.59111	0.461917
1969	−99.8821	−91.1449	8.7372	1969	−6.99651	−6.50524	0.491261
1970	−102.163	−91.7377	10.4249	1970	−6.34695	−5.7822	0.564752
1971	−110.356	−98.6823	11.674	1971	· 5.99169	−5.42689	0.564802
1972	−132.818	−122.457	10.3612	1972	−5.9767	−5.58904	0.387656
1973	−188.595	−180.419	8.17592	1973	−7.05205	−6.8613	0.190747
1974	−395.74	−389.789	5.95117	1974	−13.2323	−13.2792	− 0.046825
1975	−543.366	−530.395	12.9719	1975	−14.5634	−14.4706	0.092811
1976	−510.604	−497.979	12.625	1976	−11.1443	−11.0146	0.129788
1977	−582.252	−565.969	16.2832	1977	−10.5828	−10.3853	0.197482
1978	−822.365	−806.569	15.7961	1978	−12.8069	−12.6891	0.117797
1979	−1094.32	−1077.6	16.7192	1979	−14.6296	−14.575	0.054581
1980	−1424.52	−1401.98	22.5425	1980	−16.0615	−16.0023	0.059265

GBR – Public Authorities Surplus (£m)   *GBRR – Public Authorities Surplus as per cent of GDP*
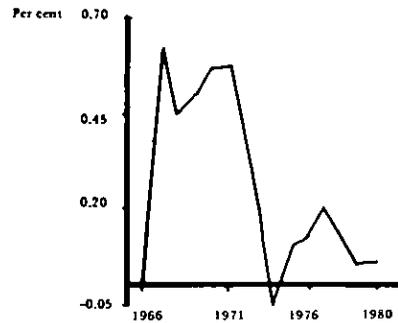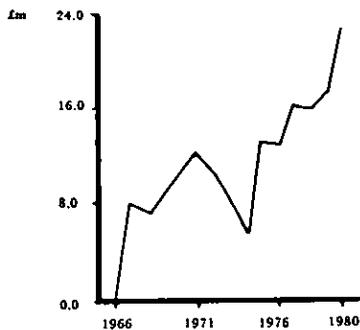
would have been reduced by £8 million (or 0.6 percentage points of GDP). As in the case of the balance of payments, this reduction (expressed as a percentage of GDP) eventually vanishes by 1973.

Finally, in Figure 4.7 we examine policy effects on the inflation rates of consumption (PCPERDOT) and the industrial average earnings (WIDOT). In both cases we find that actual fiscal policy relative to fiscal indexation was inflationary. Consumption price inflation was approximately 0.6 percentage points higher due to a higher net indirect tax rate and industrial wage inflation was almost 2.1 percentage points higher in the first year due to a combination of higher prices, higher direct taxes and lower unemployment. In neither case is there any long-run effect.

To summarise the position, we examined the actual fiscal policy of 1967 and compared it to a hypothetical "indexed" fiscal policy. By looking at the effects of both policies on a range of aggregate economic indicators (GDP, unemployment, the balance of payments, the public authorities borrowing requirement and inflation) we found that the actual fiscal policy was expansionary relative to the "indexed" fiscal policy. In all cases the difference between the effects of both policies was eroded over time except in the case of unemployment, where there appeared to be a small long-run fall in unemployment in the case of "indexation" relative to the actual policies. We now turn to an examination of some more disaggregated economic indicators, particularly sectoral disaggregation, to gain further understanding of the economic processes involved.

In Figure 4.8 we examine some of the fiscal effects on the supply side of the economy. Four indicators are included: industrial capacity (OCI), industrial capacity utilisation (CURI), non-agricultural exports (XNA) and industrial competitiveness (ECOMP). As before, the graphs illustrate the differences between policy "indexation" and actual policy in 1967. Under policy indexation, industrial capacity would have been higher, utilisation would have fallen very slightly, non-agricultural exports would have been higher, and competitiveness would have improved.[15] The better performance of the industrial sector under fiscal indexation, particularly the gain in competitiveness, comes about through three mechanisms: the lower (indexed) direct tax rates, the lower indirect tax rates and the higher initial unemployment rate. These three mechanisms operate through the process of wage determination in industry and serve to offset the domestic deflationary effects of fiscal indexation, as already discussed in the presentation of model multipliers in Chapter 3 above.

The consequences for employment are examined in Figure 4.9 in terms of

15. Remember that competitiveness (ECOMP) is defined in the model in such a way that a fall in ECOMP represents a gain in competitiveness relative to the world.

Figure 4.7: *The effects of fiscal indexation in 1967: price and wage inflation*

PCPERDOT — Consumption Price Inflation (per cent)				WIDOT — Industrial Earnings Inflation (per cent)			
Year	Actual	Indexation	Difference	Year	Actual	Indexation	Difference
1966	3.72229	3.72229	0.	1966	10.0047	10.0048	9.536743E-05
1967	3.07217	2.48814	−0.58403	1967	6.61116	4.55818	−2.05297
1968	5.15537	4.64172	−0.513649	1968	13.211	12.3574	−0.853539
1969	7.33061	7.3844	0.053787	1969	12.1278	12.8052	0.677395
1970	8.22792	8.34837	0.120449	1970	15.5499	16.4959	0.946045
1971	9.44252	9.62276	0.180244	1971	12.603	13.2272	0.62418
1972	9.6261	9.64146	0.015354	1972	18.647	18.5067	−0.140289
1973	11.516	11.33	−0.185966	1973	14.2797	13.6618	−0.617981
1974	15.7072	15.47	−0.237179	1974	16.0401	15.6765	−0.363632
1975	22.3472	22.304	−0.043106	1975	28.3431	28.4632	0.120071
1976	18.8944	18.9774	0.082977	1976	22.963	23.2533	0.290298
1977	12.7666	12.865	0.098419	1977	15.4525	15.6925	0.24004
1978	7.03545	6.90918	−0.126266	1978	15.7624	15.6345	−0.127888
1979	13.4211	13.2778	−0.143242	1979	19.3828	19.1417	−0.241089
1980	18.5923	18.5334	−0.058929	1980	17.3212	17.0851	−0.23613

PCPERDOT — *Consumption Price Inflation*
(per cent)

WIDOT — *Industrial Earnings Inflation*
(per cent)

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OCI — Industrial Capacity

CURI — Industrial Capacity Utilisation Rate

XNA — Non-Agricultural Exports

ECOMP — Industrial Competitiveness (1975 = 1)
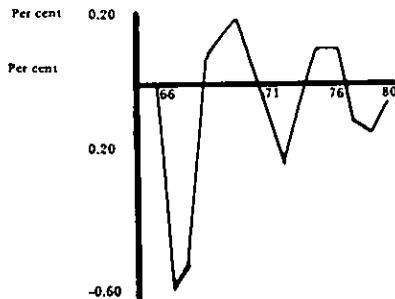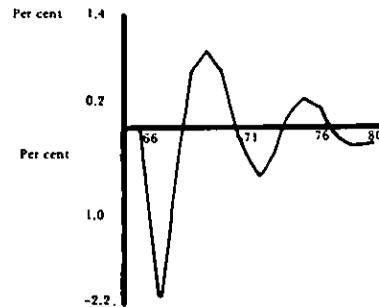
Figure 4.8: *The effects of fiscal indexation in 1967: supply side measures*
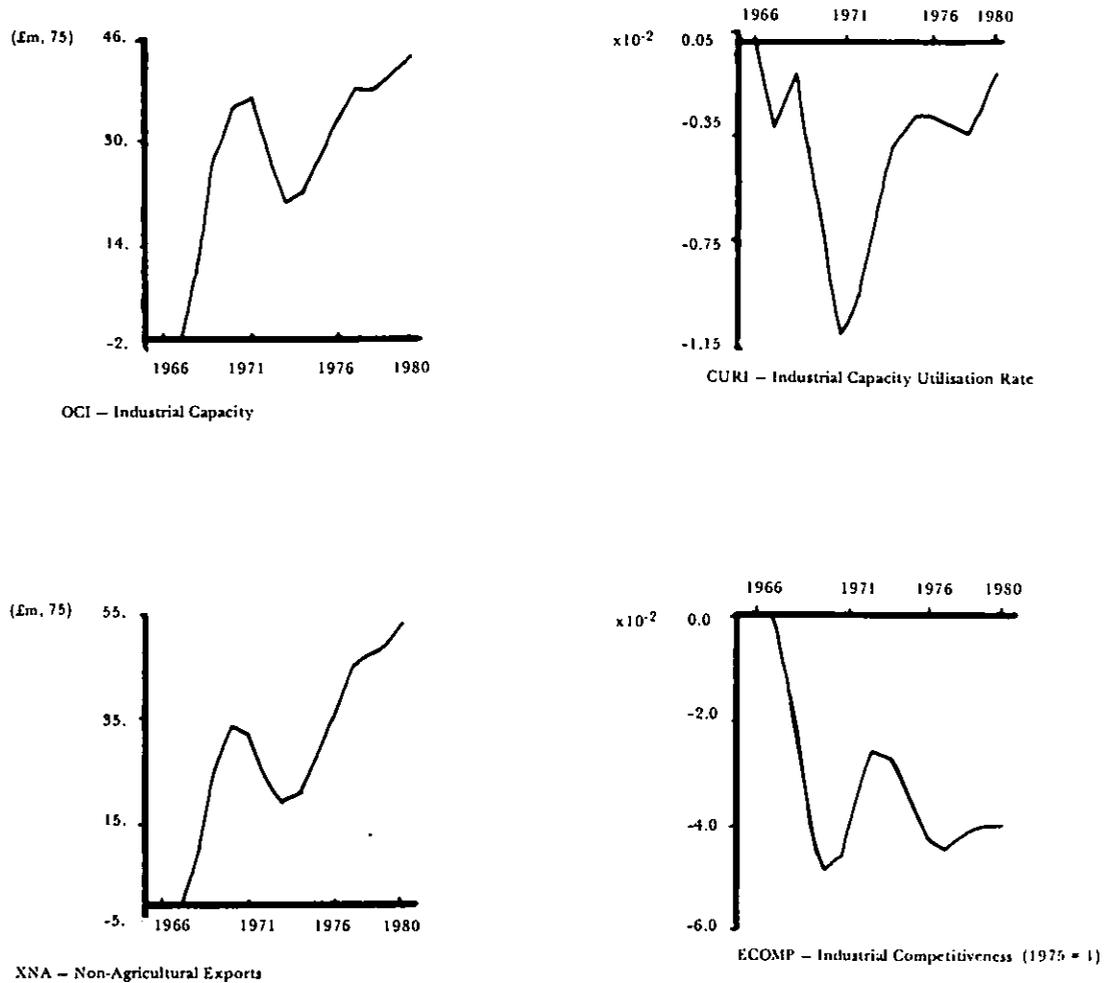
Figure 4.9: *The effects of fiscal indexation in 1967: employment*
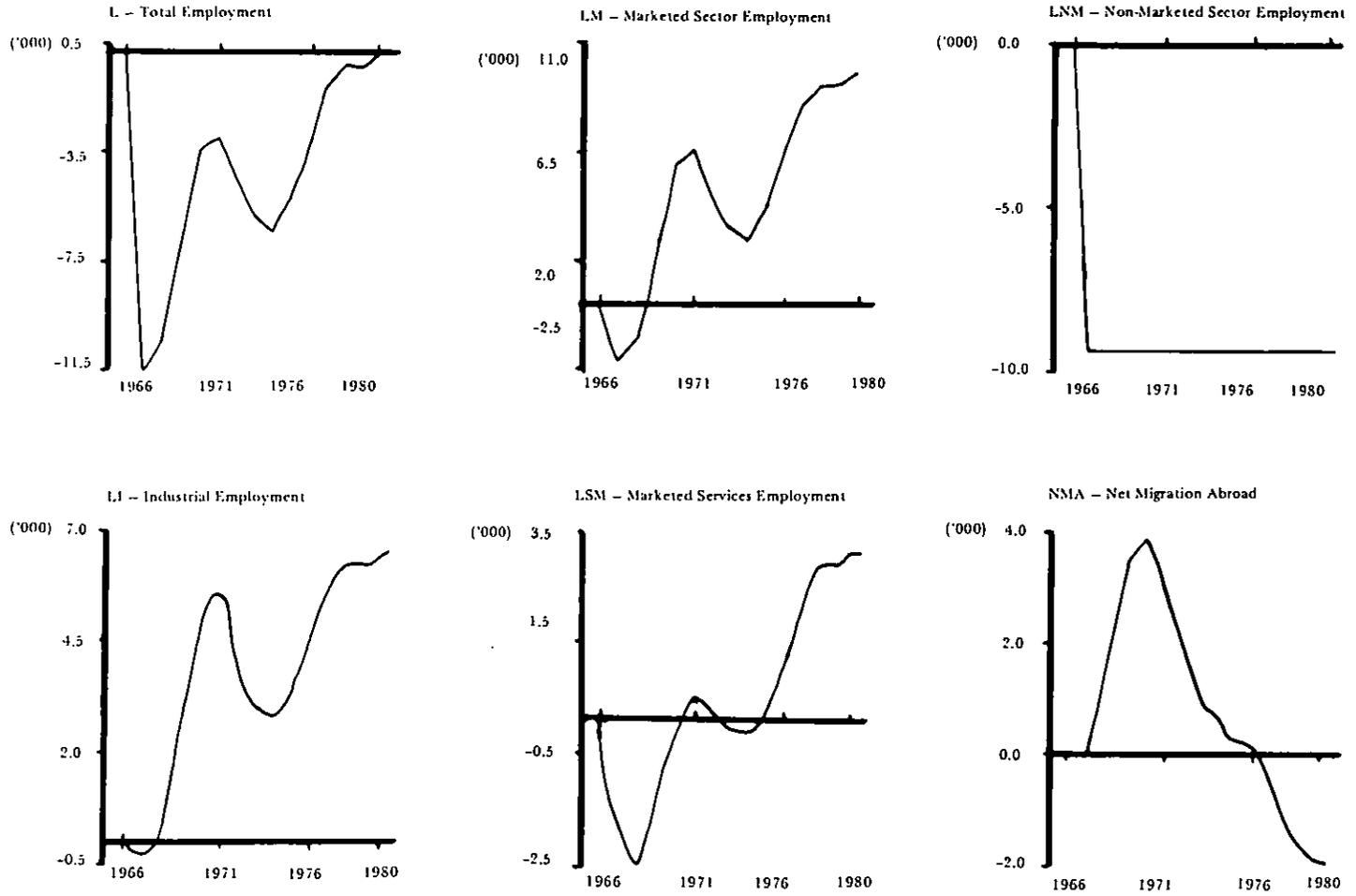
total employment (L), marketed sector employment (LM) and non-marketed sector employment (LNM). The marketed sector is further disaggregated into industry (LI) and marketed services (LSM). Finally, net migration abroad is shown (NMA). Relative to the case of the actual fiscal policies of 1967, fiscal indexation leads to a sharp drop in total employment of 11,500 in the first year. This fall is steadily eroded over time and, by 1978, the discrepancy has been removed. Total employment is decomposed into employment in the market sectors (LM) and the non-market sectors (LNM). In the case of LNM the two component parts (public administration employment (LPA) and employment in non-marketed services (LSNM)) are policy instruments. The removal of the employment changes in 1967 (using the Blinder-Goldfeld method), causes a permanent drop of about 9,300. For the first two years, employment in the market sector drops slightly with fiscal indexation (largely due to a fall in marketed services employment of 2,500). However, by 1969 a rise in LM is registered and, by 1978, a rise of 9,100 is registered, thus eliminating the discretionary cut in public employment. About two-thirds of the rise in market sector employment comes from industry, the remainder arising in marketed services. Finally, the graph for net migration abroad shows that, under fiscal indexation, outward migration flows are induced (largely due to the rise in unemployment). By 1976 these flows are eliminated and are reversed after 1976.

Finally, in Figure 4.10 we examine policy effects on household consumption (CPER) and total investment (IFT). Taking consumption first, in the short-run policy indexation results in a fall in real personal disposable income (YRPERD) and, consequently, in personal consumption. However, by 1973 disposable income is starting to rise and has stabilised at a gain of almost £39 million (in 1975 prices) by 1978. Turning to total investment (IFT), the dominant causal influence is the stimulation of industrial capacity (refer Figure 4.8). Fiscal indexation induces increased investment, which stabilises at an additional £14 million (in 1975 prices). The fluctuations already present in industrial capacity are further magnified by relative factor price fluctuations. Labour productivity in industry (OPRI) is also boosted in the long run by indexation, and reflects the investment fluctuations.

We have provided in this section an investigation into the nature of the fiscal policy changes carried out in the year 1967. Using aggregate economic indicators we have characterised the 1967 fiscal changes as expansionary, relative to a policy of fiscal indexation. Further understanding of the fiscal effects was obtained by looking at the sectoral effects, particularly the relationship between the market and non-market sectors. The purpose of the following chapter is to extend our analysis to the entire period 1967 to 1980 in order to study each individual year's policy stance and to look at how different "vintages" of fiscal policy interacted over time.

Figure 4.10: *The effects of fiscal indexation in 1967: consumption and investment*

CPER – Household Consumption (£m, 75)

YRPERD – Personal Disposable Income (£m, 75)

IFT – Total Fixed Investment (£m, 75)

OPRI – Labour Productivity
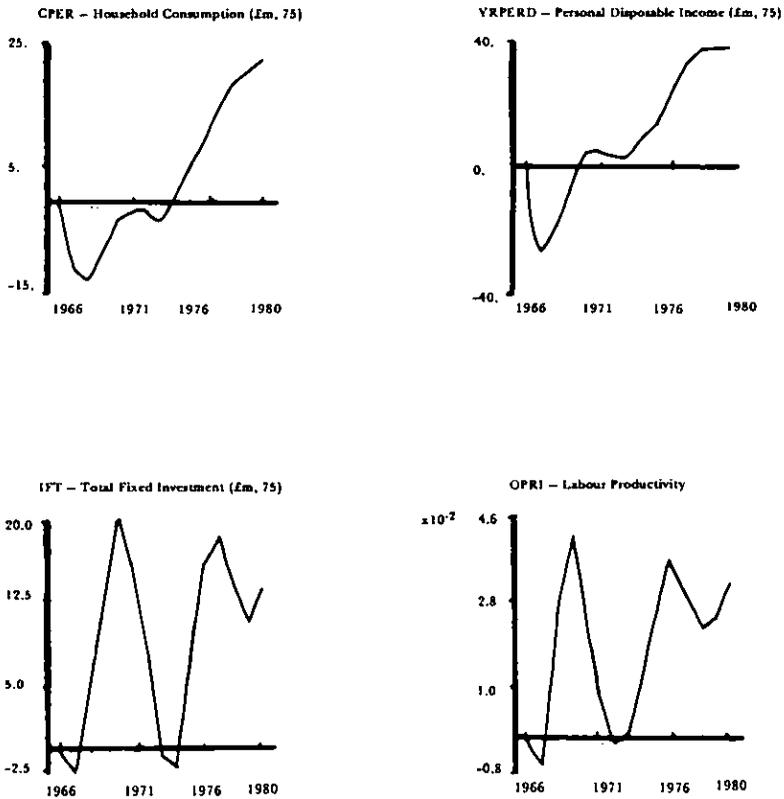
Chapter 5

FISCAL POLICY EFFECTS: 1967-1980

INTRODUCTION

In this chapter we present a preliminary analysis of the effect of fiscal policy on the economy over the 1967 to 1980 period. The particular period chosen was dictated by the available data since estimation and lag requirements used up the years from 1960 to 1966. However, the period includes the run-up to the economic crisis associated with the first OPEC oil price rises. The period also includes two of the "financial turning points" discussed by Whitaker, (1983, pp. 98-114), namely, the introduction of current budget deficits as an explicit policy measure in 1972 and the very expansionary budgets of 1978/1979. Over the period 1965 to the present there were seven changes of government. Summary details are given in Table 5.1 below. Hence, it can be seen that our 1967 to 1980 period includes the full duration of the Fianna Fail administration of 1969/73, the Fine Gael—Labour coalition of 1973/77 and all but six months of the succeeding Fianna Fail single party government which remained in office until June 1981.

In analysing the economic policy effects which characterise any administration, three aspects are of importance: first, the fiscal effects inherited from the previous administration, over which there is no control; second, the fiscal effects that take effect *within* the lifetime of that administration and finally the fiscal effects passed on to the succeeding administration. For our period of analysis we are forced to disregard the delayed effects of policies inherited by the Fianna Fail administration prior to 1967. However

Table 5.1: *Changes of government: 1965-1984*

Date of appointment	Government party	Nature of government	Duration
April 1965	Fianna Fáil	One Party: Majority	4 years 3 mts.
July 1969	Fianna Fáil	One Party: Majority	3 years 8 mts.
March 1973	Fine Gael/Labour	Coalition: Majority	4 years 3 mts.
June 1977	Fianna Fáil	One Party: Majority	4 years
June 1981	Fine Gael/Labour	Coalition: Minority	9 mts.
March 1982	Fianna Fáil	One Party: Minority	8 mts.
December 1982	Fine Gael/Labour	Coalition: Majority	Still in Office

we do consider the delayed effects of policies on later administrations. Clearly the analysis could be extended further back in time prior to 1966 and forward beyond 1980. However this is left to a future study. Furthermore, it must be understood that we are studying *annual* fiscal changes and do not consider the individual budgets, which sometimes occurred more than once per year. Material on the individual budgets is treated in Chapter 6.

Our objective in this chapter is to gain a thorough understanding of the role played by fiscal policy during the period 1967 to 1980. To this end, we apply the methodology of Blinder and Goldfeld (1976) with our medium-term model along the lines discussed in the previous chapter. This chapter is organised as follows. In the second section we apply the Blinder-Goldfeld method in its "incremental" form (to use the terminology of Artis *et al*, 1984), in order to examine the economic effects of fiscal policy specific to each individual year of our sample. For space reasons we restrict our comments to the fiscal effects on a range of eight major indicators: the real GDP growth rate, the level of real personal disposable income, the balance of payments surplus as a percentage of GDP, the public authorities surplus as a percentage of GDP, the numbers unemployed, the total employment in the market sector, price inflation and wage inflation. Using the table format developed by Artis *et al*, (1984), we present our results in a way which is reminiscent of a geological cross-section with the effects of current annual policies shown as being imposed on top of layers of policy effects stemming from actions taken in earlier years.

In the following section we look at the Blinder-Goldfeld method in its "integral" form. Here the analysis is started in 1967 and a process of continual fiscal indexation is followed through to 1980. The relationship between the "incremental" analysis and the "integral" analysis has been considered in Chapter 4 and in Appendix 3.

FISCAL POLICY EFFECTS 1967-1980: INCREMENTAL APPROACH

The tabular form of presentation to be used in this section is illustrated in Table 5.2. This table attempts to summarise the effects on the growth rate of GDP of all fiscal policy changes made over the period 1967 to 1980. In the methodology chapter (Chapter 4) we have already examined 1967 in detail and the 1967 results are shown in the top line of Table 5.2 (compare with the material in Figure 4.3). Consider the top left-hand-side entry: the number 1.17. This represents the difference between the actual growth rate and the growth rate which would have resulted if a process of policy indexation had been performed in 1967 (refer Table 4.3 also). The fact that the entry is positive means that actual policy in 1967 added to the growth rate

Table 5.2: *Fiscal policy effects, 1967-1980*

Effects on growth rate of real gross domestic product ("actual" minus "indexed")

	Cumulative effects by year (percentage points)													
Policy Actions Taken During Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	1.17	-0.34	-0.53	-0.15	0.07	0.26	0.21	-0.06	-0.04	-0.41	-0.22	0.01	-0.05	-0.11
1968		-0.42	0.00	-0.02	-0.01	-0.02	0.00	-0.02	-0.01	-0.02	-0.02	-0.03	-0.04	0.01
1969			0.77	-0.04	-0.24	-0.05	0.03	-0.03	-0.10	-0.15	-0.05	0.03	-0.06	-0.09
1970				1.14	-0.46	-0.44	-0.11	0.17	0.35	-0.07	-0.27	-0.27	-0.26	-0.09
1971					0.79	-0.73	-0.91	-0.26	0.31	0.01	-0.26	-0.41	-0.58	-0.26
1972						2.06	-0.52	-0.65	-0.11	0.20	0.37	0.29	-0.12	-0.38
1973							1.65	-0.25	-0.71	-0.25	-0.06	0.15	0.12	-0.03
1974								0.80	0.40	-0.21	-0.40	0.00	0.32	0.35
1975									0.38	-0.26	-0.57	-0.26	0.25	0.49
1976										-0.47	-1.58	-0.71	0.16	0.12
1977											-0.33	-0.33	-0.07	0.15
1978												0.36	0.68	0.05
1979													1.47	0.10
1980														1.29
Actual Growth Rate	4.76	6.33	4.65	3.03	4.85	6.05	5.26	2.90	0.56	3.23	5.70	7.19	3.94	1.47

which would have resulted from a hypothetical process of indexation. In what follows, we will say that this increment in growth of 1.17 per cent points resulted from "discretionary" fiscal action. Since the actual growth rate in 1967 was 4.76 per cent, almost one-quarter was accounted for by discretionary fiscal stimulation.

Two issues are of interest in relation to Table 5.2:

(i)   The nature of the impact, or first year, effects of fiscal policy changes in each year.
(ii) The nature of the delayed effects of fiscal policy changes for each specific year's policy.

If we denote each entry in Table 5.2 by

$$A_{ij} \ , \ \begin{array}{l} i = 1967 \ldots 1980 \\ j = 1967 \ldots 1980 \end{array}$$

then

Impact Effects	A_{ii} , $i = 1967 \ldots 1980$
Delayed Effects	A_{ij} , $j = i + 1 \ldots 1980$

Impact Effects: Growth Rate

Working down the diagonal of Table 5.2 we can read off the impact effects of each years fiscal changes. In only three cases were these effects negative, i.e., actual fiscal policies led to a lower growth rate than fiscal indexation. These were 1968 (-0.42%), 1976 (-0.47%) and 1977 (-0.33%). In all remaining years the discretionary fiscal impact was positive. Ranking the years in terms of the absolute addition to the growth rate yields the following:

Year	Additional growth (percentage points)	Historical growth (per cent)
1972	+2.06	6.05
1973	+1.65	5.26
1979	+1.47	3.94
1980	+1.29	1.47
1967	+1.17	4.76

Hence, in terms of its impact effect on the GDP growth rate, the discretionary fiscal policy of 1972 was the most expansionary, followed by the years 1973, 1979 and 1980.

Delayed Effects: Growth Rate

We have already examined the delayed effects of the 1967 fiscal policies. We saw, in Figure 4.3, that the impact effect of an additional 1.17 per cent points is quickly eroded over time and that there is no long-run change in the growth rate. A similar pattern is followed in all the other years. In the case of policy actions taken in 1976 and 1978 the second year effect is larger than the impact effect. Hence, the main *deflationary* effect of the 1976 budget does not come through until 1977, when it reduced the growth rate by over 1½ percentage points.

In Table 5.3 we examine the fiscal policy effects on real personal disposable income. In many ways this variable provides a key to understanding Irish budgetary policy since our range of fiscal instruments bears most heavily on it. Direct taxation and income transfers feed directly into nominal disposable income and the range of indirect taxes and subsidies influences real disposable income through its effects on the consumption deflator. Two points are immediately clear from Table 5.3. The budget of 1976 was massively deflationary (removing £204 million from disposable income relative to a policy of fiscal indexation), and the budgets of the years 1978 and 1979 were very expansionary (adding £143 million and £140 million, respectively, in the first year). In all cases there are very long-tailed effects, but it must be remembered that the effect on the absolute level of disposable income is being tabulated, not the effect on its growth rate.

In Table 5.4 we show the effects of fiscal policy on the balance of payments surplus.[16] Some characteristics stand out immediately. Prior to 1974 the first year effects of discretionary fiscal policy (i.e., policy which deviated from strict indexation) on the balance of payments surplus were relatively minor. The largest effect occurred in 1972 and represented an increase in the deficit of 1.16 percentage points of GDP. However, after 1973 the discretionary fiscal effects on the balance of payments were considerably larger than for the earlier period. In 1974 and 1975 the impact "discretionary" element in the deficit increased sharply (by 3.6 and 2.7 per cent of GDP, respectively). In 1976 a sharp correction to the deficit was made, to the

16. This unconventional use of terminology ("surplus" instead of "deficit") is forced on us by the data sign convention used in the computer data bank. A negative effect in the table represents a fall in the balance of payments surplus (or, equivalently, a rise in the deficit). Similar terminology is used to handle the public authorities "surplus".

Table 5.3: *Fiscal policy effects, 1967-1980*

Effects on real personal disposable (RPD) income ("actual" minus "indexed")

Cumulative effects by year (£ million, 1975)

Policy Actions Taken During Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	26.2	19.4	5.2	-4.2	-4.6	-2.5	-1.6	-7.6	-14.2	-22.8	-30.9	-36.3	-38.6	-38.5
1968		-1.4	-2.8	-4.9	-6.4	-7.1	-8.3	-10.2	-11.7	-11.8	-12.1	-13.0	-14.3	-15.0
1969			1.7	-4.1	-7.5	-15.1	-21.8	-25.5	-29.3	-28.1	-33.1	-44.3	-46.6	-38.4
1970				22.6	17.3	-0.1	-13.9	-20.9	-19.9	-21.6	-31.5	-48.5	-58.8	-53.1
1971					-34.7	-55.3	-97.7	-114.3	-110.9	-104.9	-116.0	-145.2	-167.9	-162.4
1972						63.8	59.4	35.1	22.5	22.5	33.3	48.4	48.8	28.8
1973							57.3	43.7	19.5	13.1	14.7	20.7	24.7	21.7
1974								113.2	105.1	84.1	73.6	80.8	87.8	88.1
1975									111.5	89.1	65.7	58.3	58.4	59.9
1976										-203.9	-229.2	-274.0	-270.7	-229.2
1977											-34.6	-31.6	-32.6	-32.8
1978												142.8	147.7	122.9
1979													140.4	114.5
1980														-67.5
Actual R.P.D. Income	2012	2172	2293	2420	2483	2739	3007	3066	3206	3116	3291	3630	3774	3656

Table 5.4: *Fiscal policy effects, 1967-1980*

Effects on balance of payments surplus as a percentage of gross domestic product ("actual" minus "indexed")

Policy Actions Taken During Year	Cumulative effects by year (percentage points)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	−0.98	−1.06	−0.79	−0.61	−0.70	−0.70	−0.66	−0.44	−0.27	−0.12	−0.12	−0.13	−0.06	−0.05
1968		−0.29	−0.42	−0.43	−0.47	−0.48	−0.48	−0.45	−0.46	−0.48	−0.55	−0.55	−0.52	−0.57
1969			0.43	0.32	0.28	0.37	0.47	0.94	0.77	0.66	0.72	0.89	0.95	0.75
1970				−0.20	−0.44	−0.16	0.08	0.40	0.41	0.29	0.45	0.75	0.98	0.81
1971					0.52	0.27	0.90	1.69	1.36	0.76	0.76	1.11	1.45	1.35
1972						−1.16	−1.44	−1.33	−0.89	−0.95	−1.47	−1.72	−1.24	−0.70
1973							−0.71	−0.93	−0.62	−0.51	−0.96	−1.08	−1.01	−0.96
1974								−3.59	−4.10	−3.17	−2.94	−2.85	−2.64	−2.80
1975									−2.66	−2.51	−2.00	−1.67	−1.71	−1.77
1976										4.81	4.65	4.82	4.05	2.62
1977											−0.04	0.08	0.00	0.09
1978												−3.69	−3.68	−3.19
1979													−3.71	−3.27
1980														1.20
Actual B.P. Rate	1.36	−1.28	−4.84	−4.06	−3.85	−2.18	−3.49	−9.85	−0.53	−3.93	−3.48	−3.99	−11.28	−9.94

extent of 4.8 per cent of GDP. Fiscal policy in 1977 left the deficit largely
unchanged while in 1978 and 1979 the discretionary element in the deficit
increased (by 3.7 per cent of GDP in both years). By the last year in our
sample, 1980, the discretionary impact effect had reversed and served to
reduce the deficit.

In Table 5.5 we show the effects of discretionary fiscal policy on the public
authorities surplus, expressed as a percentage of GDP. A negative value in
this table represents a situation where failure to follow policy indexation
resulted in a fall in the public authorities surplus (or, equivalently, a rise in
the deficit). For the years 1974 to 1979 an adjustment must be made to
this table to eliminate the effect of the timing of intervention transations on
the capital account. These were as follows:

Year	Net payments received from the intervention agency		Uncorrected impact effect on surplus rate	Corrected impact effect on surplus rate
	£m.	Per cent of GDP		
1974	−56.9	−1.90	−6.13	−4.23
1975	46.7	1.25	1.15	−0.10
1976	11.3	0.25	3.92	3.67
1977	−25.0	−0.45	0.95	1.40
1978	− 3.5	−0.05	−2.72	−2.67
1979	28.5	0.38	−2.26	−2.64

In terms of the discretionary impact effect on the adjusted public authori-
ties surplus, we can characterise the following budgets as contractionary
(in the sense of increasing the surplus, or equivalently, decreasing the deficit).

. 1970 (mildly contractionary, 0.56%)
. 1971 (contractionary, 1.09%)
. 1976 (strongly contractionary, 3.67%)
. 1977 (contractionary, 1.40%)

In all other years, discretionary fiscal policy impact was expansionary,
particularly so in the years 1974 (-4.23%), 1978 (-2.67%) and 1979 (-2.64%).
In Table 5.6 we tabulate the first year effects of discretionary policy on both
the balance of payments surplus and the public authorities surplus, showing
the close relationship between the two variables given that government

Table 5.5: *Fiscal policy effects, 1967-1980*

Effects on public authorities surplus as a percentage of gross domestic product ("actual" minus "indexed")

	Cumulative effects by year (percentage points)													
Policy Actions Taken During Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	-0.62	-0.46	-0.49	-0.56	-0.56	-0.39	-0.19	0.05	-0.09	-0.13	-0.20	-0.12	-0.05	-0.06
1968		-1.07	-1.00	-0.96	-0.93	-0.85	-0.73	-0.58	-0.59	-0.54	-0.53	-0.47	-0.40	-0.42
1969			-0.82	-0.68	-0.70	-0.54	-0.36	-0.18	-0.22	-0.14	-0.12	0.00	0.02	-0.04
1970				0.56	0.48	0.40	0.37	0.47	0.59	0.70	0.67	0.61	0.46	0.37
1971					1.09	0.97	0.96	0.88	1.05	1.19	1.32	1.28	1.01	0.80
1972						-0.87	-0.71	-0.69	-1.01	-0.91	-0.75	-0.48	-0.32	-0.42
1973							-1.66	-1.24	-1.27	-1.27	-1.27	-1.06	-0.85	-0.81
1974								-6.13	-5.14	-4.46	-4.44	-4.17	-3.58	-3.29
1975									1.15	1.13	0.75	0.36	0.26	0.46
1976										3.29	2.93	2.51	2.35	2.34
1977											0.95	0.69	0.55	0.50
1978												-2.72	-2.01	-1.71
1979													-2.26	-1.51
1980														-0.01
Actual P.A. Surplus	-5.06	-6.06	-7.00	-6.35	-5.99	-5.98	-7.05	-13.23	-14.56	-11.14	-10.58	-12.81	-14.63	-16.06

Table 5.6: *First year effects of discretionary fiscal policy on balance of payments and public authorities surplus*

Year	Balance of payments Surplus (% of GDP)	Public authorities surplus (% of GDP)
1967	-0.98	-0.62
1968	-0.29	-1.07
1969	+0.43	-0.82
1970	-0.20	+0.56
1971	+0.52	+1.09
1972	-1.16	-0.87
1973	-0.71	-1.66
1974	-3.51	-6.13 (-4.23)*
1975	-2.66	+1.15 (-0.10)*
1976	+4.81	+3.92 (+3.67)*
1977	-0.04	+0.95 (+1.40)*
1978	-3.69	-2.72 (-2.67)*
1979	-3.71	-2.26 (-2.64)*
1980	+1.20	-0.01

* denotes the corrected value to eliminate the intervention transactions.

intervention was mainly concerned with expanding demand rather than supply.

In Tables 5.7 and 5.8 we examine the effects of discretionary fiscal policy on the numbers unemployed and on employment in the market sectors (industry, agriculture and marketed services). In the unemployment table, a negative entry denotes the case where discretionary policy reduced numbers unemployed compared to a policy of indexation. In the employment table, a negative entry denotes the case where discretionary policy reduced numbers employed compared to a policy of indexation.

In only three years of the sample did discretionary fiscal policy have a positive impact effect on unemployment numbers, the most important case being 1976 when 6,600 additional workers were unemployed, relative to a policy of fiscal indexation. For the years 1972, 1975, 1978 and 1979 unemployment was greatly reduced by fiscal discretion (by 20,100 in the case of 1979). As we saw in Chapter 4 for the case of 1967, the lags in unemployment effects are quite long and complex. In the case of 1967, an

Table 5.7: *Fiscal policy effects, 1967-1980*

Effects on numbers unemployed ("actual" minus "indexed")

Policy Actions Taken During Year	Cumulative effects by year ('000s)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	-8.5	-7.3	-3.0	0.4	1.7	1.2	0.4	0.5	1.5	3.3	4.9	5.0	4.3	4.1
1968		0.7	1.2	1.7	2.1	2.5	2.7	3.0	3.5	4.0	4.2	4.4	4.4	4.5
1969			0.4	0.8	1.2	1.5	1.6	1.5	1.4	1.3	1.4	1.6	1.7	1.4
1970				-6.2	-4.5	-1.1	2.0	3.1	2.4	1.6	2.2	4.0	5.5	5.8
1971					-3.4	1.1	8.2	12.9	13.8	13.2	13.2	15.3	17.9	20.1
1972						-15.6	-14.3	-8.3	-3.1	-1.0	-2.5	-5.2	-5.4	-2.9
1973							-5.4	-5.3	-2.3	0.4	1.1	0.1	1.6	1.9
1974								-6.7	-10.3	-9.0	-5.2	-2.9	-3.1	-5.0
1975									-11.3	-10.4	-4.4	1.4	3.5	2.3
1976										6.6	18.2	25.9	25.2	21.5
1977											-3.2	-1.6	0.1	1.3
1978												-11.4	-15.6	-14.6
1979													-20.1	-21.9
1980														-4.2
Actual Unemployment	41.8	46.2	43.4	52.4	49.7	56.6	52.4	52.6	73.0	90.0	88.9	85.0	74.0	76.0

Table 5.8: *Fiscal policy effects, 1967-1980*

Effects on marketed sector employment (MS) (industry and marketed services) ("actual" minus "indexed")

	Cumulative effects by year ('000s)													
Policy Actions Taken During Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	2.17	1.16	-2.19	-5.86	-6.40	-4.75	-3.21	-3.04	-4.11	-6.31	-8.35	-9.13	-9.13	-9.60
1968		-0.54	-1.10	-1.42	-1.73	-1.89	-2.08	-2.24	-2.43	-2.78	-3.08	-3.30	-3.48	-3.60
1969			-0.3	-0.8	-1.8	-2.7	-3.4	-4.0	-4.4	-4.9	-5.5	-6.2	-6.8	-6.9
1970				0.9	-0.6	-4.1	-7.1	-7.9	-6.4	-5.4	-6.3	-8.6	-11.0	-12.1
1971					-1.6	-6.7	-15.1	-20.9	-20.5	-19.2	-19.7	-22.9	-27.4	-30.9
1972						3.8	4.0	-1.1	-5.2	-5.5	-2.1	2.3	3.7	1.3
1973							2.2	2.7	-0.4	-2.9	-3.2	-1.5	0.4	1.0
1974								5.2	9.9	9.6	7.1	6.1	7.7	10.7
1975									3.3	3.3	-1.1	-4.9	-4.9	-1.3
1976										-9.5	-23.7	-34.7	-37.0	-34.5
1977											-0.5	-1.9	-3.3	-3.9
1978												6.3	12.9	14.2
1979													7.0	10.9
1980														-2.4
Actual M.S. Employment	900.0	895.2	895.5	879.5	879.9	873.4	888.9	903.2	888.3	877.8	892.5	912.2	929.8	940.1

initial drop of 8,500 in numbers unemployed becomes a rise of 4,100 by 1980, on the basis of 1967 changes in isolation. For 1971, an initial drop of 3,400 becomes a rise of 20,100 by 1980. These effects appear to have been induced by a serious loss in industrial competitiveness, the reasons for which are further examined in Chapter 6. For 1976, the initial rise of 6,600 in numbers unemployed becomes a rise of 21,500 by 1980. We return to the particularly inflationary consequences of the 1971 and 1976 budgets below.

Turning to Table 5.8 we see the effects of discretionary fiscal policy on total market sector employment (i.e., the sum of industrial, agricultural and marketed services employment). While employment in marketed services is sensitive to the level of domestic demand, industrial employment is mainly determined by capacity, which is sensitive to world demand and competitiveness. Agricultural employment is largely institutionally determined and is only subject to minor influences from outside agriculture. From Table 5.8 the impact and long-run deflationary effects of the 1976 budget are apparent. In Table 5.9, where we consider the total market

Table 5.9: *Impact and long-run employment effects of discretionary fiscal policy for industry and marketed services*

Year	Industry			Marketed services	
	Impact	*Long run*		*Impact*	*Long run*
('000s)					
1967	+0.28	-6.42		+1.89	-3.04
1968	-0.19	-2.00		-0.35	-1.67
1969	-0.09	-3.63		-0.19	-3.23
1970	-0.17	-7.67		+1.06	-4.36
1971	-1.09	-18.18		-0.52	-12.73
1972	+0.82	-0.93		+3.03	+2.74
1973	+0.73	+0.25		+1.46	+0.85
1974	+2.40	+5.79		+2.82	+4.94
1975	+0.66	-2.78		+2.64	+1.46
1976	-4.11	-18.91		-5.36	-16.29
1977	-0.27	-2.59		-0.19	-1.26
1978	+2.44	+7.43		+3.86	+7.22
1979	+2.40	+5.00		+4.60	+6.54
1980	-1.40	—		-1.05	—

sector components relating to industry and marketed services, we see that the bulk of the employment loss came in the service sector. The expansionary effects of the budgets of 1978 and 1979 are also apparent, where again the marketed services sector dominates. Of particular interest is the budget of 1971. In this year the rather small impact effect (a fall of 1,600 in total, of which 1,090 came in industry and 520 in services) resulted in a cumulative loss of 30,900 by 1980 (of which 18,180 were in industry and 12,730 in services). As we shall see in Tables 5.10 and 5.11, the inflationary effects of discretionary fiscal policy were greatest in the years 1971 and 1976.

Finally, in Tables 5.10 and 5.11 we examine the effects of discretionary fiscal policy on consumption price inflation (Table 5.10) and industrial wage inflation (Table 5.11). For all years except 1968, 1974-1975 and 1977-1979, discretionary policy was inflationary in its impact effect on the consumption price, resulting from either increases in taxation or wage increases induced through the Phillips curve. During 1974-1975 the wide extension of subsidies on consumption goods (bread, milk, etc.) was responsible. During 1977-1979 the drastic cutting and elimination of certain indirect taxes was responsible. The highly inflationary impact of the 1976 and 1979 budgets is apparent. In all cases the long-run effect tapers off to zero. The effects of policy on wage inflation are more complex, involving net indirect taxes (via the consumption, or cost-of-living price), direct taxes and the unemployment rate (i.e., the so-called Phillips curve effect). The impact effects for three years in particular stand out: 1971 (plus 3.9 percentage points), 1976 (plus 4.2%) and 1980 (plus 4.4%). Only for one year, 1978, was the discretionary impact fiscal effect on wage inflation negative (i.e., -1.15 percentage points).

FISCAL POLICY EFFECTS 1967-1980: INTEGRAL APPROACH

In this section we examine the effects of simulating the model, starting in 1967, and pursuing a policy of strict fiscal indexation through to 1980. We then isolate the difference between this simulation and the historical values of the key economic indicators. We call this method of analysis the "integral" or "cumulative" approach, to distinguish it from the "incremental" approach of the previous section.

If the "incremental" policy analysis is suitably defined, it is possible to sum the individual year's "incremental" policies to obtain an approximation to the "integral" policy. However, we have chosen a definition of fiscal indexation in order to gain as much insight as possible into the individual year's fiscal policy, given that a certain position has been inherited from the previous year. The technical issues involved are considered in detail in Appendix 3. The advantage of such an "incremental" approach is that it

Table 5.10: *Fiscal policy effects, 1967-1980*

Effects on consumption price inflation rate ("actual" minus "indexed")

| | *Cumulative effects by year (percentage points)* | | | | | | | | | | | | | |
Policy Actions Taken During Year	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	0.58	0.51	-0.05	-0.12	-0.18	-0.02	0.19	0.24	0.04	-0.08	-0.10	0.13	0.14	0.06
1968		-0.30	0.02	0.02	0.01	0.03	0.03	0.02	0.03	0.05	-0.03	-0.04	0.01	0.06
1969			1.11	0.12	-0.15	0.04	0.11	0.02	0.05	-0.06	0.01	0.15	-0.05	-0.21
1970				0.90	0.27	-0.05	-0.05	0.01	0.20	0.19	0.07	0.16	0.00	-0.18
1971					1.84	0.49	-0.07	-0.18	0.06	0.28	0.13	0.28	0.04	-0.24
1972						0.17	0.67	0.26	-0.42	-0.36	-0.10	0.27	0.39	0.11
1973							0.71	0.29	-0.10	-0.32	-0.23	-0.06	0.05	0.09
1974								-0.98	0.43	0.02	-0.20	-0.31	-0.17	0.15
1975									-1.26	0.67	-0.05	-0.30	-0.19	0.14
1976										3.41	-0.06	-0.35	-0.10	-0.02
1977											-0.56	0.12	0.16	0.11
1978												-2.47	0.71	0.85
1979													-1.32	1.33
1980														3.10
Actual Inflation Rate	3.07	5.16	7.33	8.23	9.44	9.63	11.52	15.71	22.35	18.89	12.77	7.04	13.42	18.59

Table 5.11: *Fiscal policy effects, 1967-1980*

Effects on industrial wage inflation rate ("actual" minus "indexed")

Policy Action Taken During Year	Cumulative effects by year (percentage points)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
1967	2.05	0.85	-0.68	-0.95	-0.62	0.14	0.62	0.36	-0.12	-0.29	-0.24	0.13	0.24	0.24
1968		0.35	-0.03	-0.06	0.01	0.05	0.08	0.02	0.05	0.07	-0.04	0.00	0.03	0.14
1969			0.75	-0.07	-0.29	0.00	0.15	0.03	0.11	0.01	-0.02	0.11	-0.07	-0.09
1970				1.76	0.66	-0.68	-0.63	-0.45	0.44	0.61	0.11	-0.04	-0.30	-0.14
1971					3.94	0.13	-1.24	-0.82	0.23	1.16	0.51	0.29	-0.30	-0.21
1972						1.88	1.87	-0.70	-2.08	-1.02	0.25	0.92	0.57	-0.27
1973							1.72	0.27	-0.94	-0.67	-0.39	0.09	0.40	0.29
1974								0.89	0.75	-0.72	-0.90	-0.84	-0.46	0.37
1975									1.84	1.40	-0.84	-1.29	-0.93	0.33
1976										4.21	-1.20	-1.24	0.54	1.57
1977											0.06	0.31	-0.04	-0.16
1978												-1.15	2.00	0.34
1979													0.59	2.67
1980														4.36
Actual Wage Inflation	6.61	13.21	12.13	15.55	12.60	18.65	14.28	16.04	28.34	22.96	15.45	15.76	19.38	17.32

allows one to study the effects of fiscal policy for each year in complete isolation from other years' fiscal actions. However, a disadvantage is the heavy computational burden (since fourteen separate simulations are needed to study 1967 to 1980) and our inability to cumulate the effects of all years. The computational burden of the "integral" approach is reduced to one simulation, but, of course, much interesting information is lost. However, the fact that only one simulation is involved permits us, at low cost, to examine the sensitivity of our results to some key assumptions in the model.

In addition to the "standard" model variant (for an exact definition refer to Chapter 3), i.e., the variant used in the "incremental" analysis of Tables 5.2 — 5.11, we have examined three other variants:

(i)   The Phillips curve relationship is dropped from the industrial wage equation.

(ii) The direct tax incidence elasticity in the wage equation is reduced from unity to 0.5, i.e., the value found by Hughes, (1985).

(iii) The direct tax incidence elasticity in the wage equation is set to zero.

In each of the three variants, only a specific single change is made to the standard model. All three changes deal with the question of wage formation which is probably the single most important mechanism in the model. The results for the integral fiscal policy analysis, using the "standard" model and the above three variants, are presented in Tables 5.12 to 5.16.

Turning to Table 5.12 first, we examine the effects of fiscal indexation on the growth rate of GDP and on the level of real personal disposable income. For the growth rate, only fairly minor differences between the four variants exist. Consider the first line of Table 5.12. This shows, for the standard model, the cumulative discretionary effects of fiscal policy since 1967 on the real growth rate. The first entry, 1.17, is identical to the first entry of the incremental analysis contained in Table 5.2. By the year 1968, the discretionary effect on growth amounted to -0.77, i.e., the difference between the actual growth rate and the growth rate which would have resulted if all fiscal instruments had been "indexed" *since 1967*, to a 1966 base, involved a drop of 0.77 points of growth. The last entry in this line, 1.74, has the following interpretation: the difference between the actual growth rate in 1980 and the growth rate which would have resulted if all fiscal instruments had been systematically indexed *since 1967*, is 1.74 points. It is of interest to compare the entry for the year 1978 in Table 5.12 and Table 5.2. The *impact* effect of 1978 discretionary fiscal policy *in 1978* was a rise of 0.38 points (Table 5.2). The cumulative effect of discretionary fiscal policy between 1967 and 1978 (inclusive) was a fall of 1.42 points. Hence, although

Table 5.12: *Integral fiscal policy analysis, 1967-1980*
GDPMDOT: Growth rate of real gross domestic product (per cent)

Model Variant	Cumulative discretionary effect by year (percentage points)
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	1.17	-0.77	0.22	0.90	0.13	1.24	0.56	-0.16	0.78	-1.19	-3.74	-1.42	2.75	1.74
No Phillips Curve	1.19	-0.58	0.34	0.97	0.06	1.06	0.70	-0.04	0.82	-1.30	-4.06	-1.96	1.73	1.45
Direct Tax Elasticity 0.5	1.24	-0.62	0.33	1.04	0.35	1.49	0.96	0.08	0.93	-0.67	-2.92	-0.79	2.92	1.57
Zero Direct Tax Elasticity	1.32	-0.45	0.44	1.12	0.50	1.68	1.35	0.24	0.97	-0.42	-2.49	-0.32	3.09	1.76

YRPERD: Real personal disposable income

	Cumulative discretionary effect by year (£ million, 1975)
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	26.2	21.5	12.3	24.0	-7.5	31.9	49.0	122.1	239.7	64.5	-2.5	131.7	333.4	378.5
No Phillips Curve	26.2	21.2	14.7	32.9	-0.4	33.4	50.2	128.3	251.6	69.8	-2.6	128.1	303.2	328.3
Direct Tax Elasticity 0.5	25.9	22.0	15.8	31.0	-0.5	45.0	73.7	151.8	268.3	99.7	55.6	216.1	420.7	447.6
Zero Direct Tax Elasticity	25.7	22.9	20.6	39.1	5.2	53.6	94.5	178.6	293.0	122.6	92.6	274.5	478.1	496.3

Table 5.13: *Integral fiscal policy analysis, 1967-1980*
BPVR: *Balance of payments surplus as per cent of GDP*

Cumulative discretionary effect by year (percentage points)

Model Variant	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	-0.98	-1.45	-1.04	-1.37	-1.61	-3.18	-3.55	-6.65	-11.26	-7.57	-9.13	-12.51	-17.74	-20.93
No Phillips Curve	-0.97	-1.26	-0.66	-1.27	-1.62	-2.94	-3.18	-6.21	-11.42	-7.45	-8.59	-12.73	-18.27	-20.46
Direct Tax Elasticity 0.5	-0.92	-1.22	-0.78	-1.18	-1.17	-2.47	-2.88	-5.92	-10.38	-5.94	-7.23	-11.10	-16.28	-18.66
Zero Direct Tax Elasticity	-0.82	-0.93	-0.50	-1.07	-0.77	-1.78	-2.24	-5.29	-9.84	-4.63	-5.53	-10.22	-15.27	-16.72

GBRR: *Public authorities surplus as per cent of GDP*

Cumulative discretionary effect by year (percentage points)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	-0.62	-1.69	-2.69	-2.37	-1.79	-2.91	-4.42	-10.54	-10.70	-6.91	-7.60	-10.97	-13.39	-15.52
No Phillips Curve	-0.61	-1.57	-2.51	-2.25	-1.67	-2.79	-4.25	-10.33	-10.54	-6.72	-7.47	-11.06	-13.76	-16.03
Direct Tax Elasticity 0.5	-0.58	-1.57	-2.54	-2.18	-1.45	-2.47	-3.91	-9.90	-9.84	-5.87	-6.40	-9.65	-11.96	-13.84
Zero Direct Tax Elasticity	-0.52	-1.42	-2.38	-2.02	-1.14	-2.06	-3.44	-9.36	-9.15	-5.05	-5.49	-8.70	-10.88	-12.47

Table 5.14: *Integral fiscal policy analysis, 1967-1980*
U: Numbers unemployed

	Cumulative discretionary effect by year ('000s)													
Model Variant	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	-8.5	-6.6	-1.7	-4.0	-4.0	-12.5	-7.7	-3.1	-11.2	-1.3	15.7	20.0	-2.3	-15.0
No Phillips Curve	-8.5	-7.2	-3.5	-7.1	-7.0	-14.6	-9.7	-6.2	-15.3	-4.7	13.8	21.1	5.6	-1.2
Direct Tax Elasticity 0.5	-8.7	-7.5	-3.7	-7.2	-8.4	-19.1	-17.4	-15.4	-25.6	-18.7	-7.4	-9.2	-34.5	-47.7
Zero Direct Tax Elasticity	-8.9	-8.6	-6.0	-10.5	-12.4	-24.7	-25.9	-26.4	-37.9	-32.2	-24.2	-30.3	-57.3	-72.2

LM: Numbers employed in market sector

	Cumulative discretionary effect by year ('000s)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	2.2	0.7	-3.8	-6.3	-10.5	-13.0	-19.7	-24.3	-19.8	-27.1	-44.9	-51.5	-35.6	-20.8
No Phillips Curve	2.2	1.5	-1.7	-3.1	-7.3	-11.0	-17.8	-21.1	-15.9	-23.7	-43.2	-53.2	-44.8	-35.7
Direct Tax Elasticity 0.5	2.4	1.8	-1.5	-2.9	-5.6	-6.2	-9.4	-11.0	-5.4	-9.6	-20.8	-20.1	-1.7	+13.3
Zero Direct Tax Elasticity	2.7	3.1	1.2	0.7	-1.3	-0.6	-0.6	0.4	6.5	3.5	-4.1	· 1.3	21.4	38.3

Table 5.15: *Integral fiscal policy analysis, 1967-1980*
PCPERDOT: *Consumption price inflation rate*

Model Variant	Cumulative discretionary effect by year (percentage points)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1978	1980
Standard Model	0.58	0.19	0.96	0.75	1.52	0.43	1.28	-0.65	-1.88	2.72	-2.18	-3.47	-0.77	2.31
No Phillips Curve	0.57	-0.05	0.88	1.03	1.61	0.35	0.99	-0.59	-1.46	2.53	-2.12	-2.77	-0.48	1.11
Direct Tax Elasticity 0.5	0.49	0.04	0.96	0.78	1.28	0.30	1.22	-0.59	-1.97	2.15	-2.39	-3.30	-0.56	1.89
Zero Direct Tax Elasticity	0.37	-0.13	1.03	0.90	0.99	0.14	1.12	-0.41	-1.88	1.52	-2.55	-3.00	-0.61	1.08

WIDOT: *Industrial wage inflation rate*

	Cumulative discretionary effects by year (percentage points)													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Standard Model	2.05	1.21	-0.01	0.58	3.53	1.54	2.53	-0.49	0.00	4.47	-3.60	-3.54	2.56	7.13
No Phillips Curve	1.97	-0.09	0.25	1.94	3.38	1.15	1.11	0.58	1.58	2.83	-2.39	-0.56	2.53	2.11
Direct Tax Elasticity 0.5	1.58	0.62	0.31	0.55	2.24	1.23	2.46	-0.17	-1.02	2.08	-3.49	-2.26	2.93	4.69
Zero Direct Tax Elasticity	0.94	-0.05	1.05	0.83	0.60	0.92	2.21	0.88	-1.37	-0.81	-2.74	-0.88	2.00	1.45

the discretionary stance of 1978 fiscal policy was mildly expansionary, the cumulative stance since 1967 in 1978 was deflationary, largely on account of the deflationary budget of 1976.

The differences between the four variants of the model can be more clearly seen in Figure 5.1 where we graph the differences between "integral" policy and actual policy for the *level* of GDP. The presence or absence of the Phillips curve is seen to make very little difference. However the progressive lowering of the direct tax elasticity in the wage equation is seen to greatly accentuate the discretionary fiscal effects. For example, by 1980, for a model with zero direct tax elasticity, a policy of integral fiscal indexation would have led to a fall of £400 million (in 1975 prices) relative to the actual (historical) outturn. We return to the trade-off with reduced wage inflation later in the section.

The second variable considered in Table 5.12 is real personal disposable income, also graphed in Figure 5.2. Two points stand out for all four model variants: the counter-cyclical effects on income during the recession of 1975-1976 when the cumulative fiscal stance was expansionary, and the much more vigorous expansionary effects over the years 1978 to 1980. By 1980, for the standard model, the cumulative effect of fiscal discretion added £378.5 million (in 1975 prices) to disposable income, i.e., disposable income was 11.5 per cent up from the level that would have applied if strict fiscal indexation had been imposed since 1967. The effects of introducing the other model variants is similar to the previous case of GDP.

In Table 5.13 we examine the integral policy effects on both the balance of payments rate and the borrowing requirement rate. In Figure 5.3 we graph the discretionary effects for the balance of payments for the four model variants and the actual and "indexed" balance of payments rate for the standard model. To take the most extreme result, for the standard model Table 5.13 shows that fiscal discretion over the 1967-1980 period resulted in a deterioration of the balance of payments by almost 21 per cent of GDP by 1980. Under a policy of strict fiscal indexation, there would have been a balance of payments surplus of 11 per cent of GDP by 1980, as against an actual balance of payments deficit of 10 per cent of GDP. The mechanisms causing such extraordinary behaviour relate mainly to the export-led orientation of the industrial sector, the accumulation of foreign assets as the borrowing requirement falls (the domestic financing component of the borrowing requirment being exogenous), and the massive gains in competitiveness. Needless to say it does not need the Lucas critique to warn us that such an extraordinary economic configuration would have caused shifts in many of the parameters of the model (even if we grant that it would have been politically feasible) and the assumption of a fixed exchange rate might not

Figure 5.1: *Cumulative discretionary fiscal effect on GDP (indexed minus actual)*

Figure 5.2: *Cumulative discretionary fiscal effect on real disposable income (indexed minus actual)*
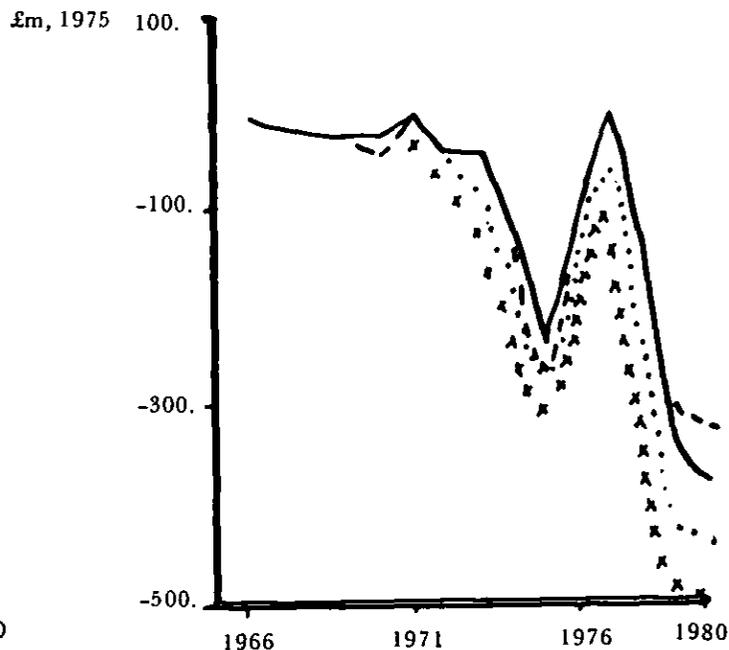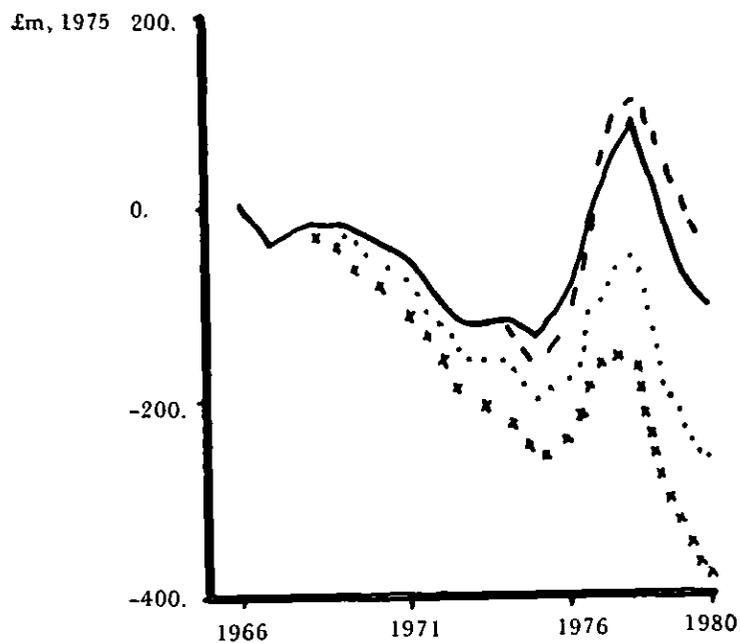
standard model
— — — no Phillips curve
. . . . . tax elasticity of 0.5
* * * * tax elasticity of 0.0

standard model
— — — no Phillips curve
. . . . . tax elasticity of 0.5
* * * * tax elasticity of 0.0

Figure 5.3:

Cumulative discretionary fiscal effect on the
balance of payments rate (indexed minus actual)

Actual and indexed balance of payments rate for
the standard model
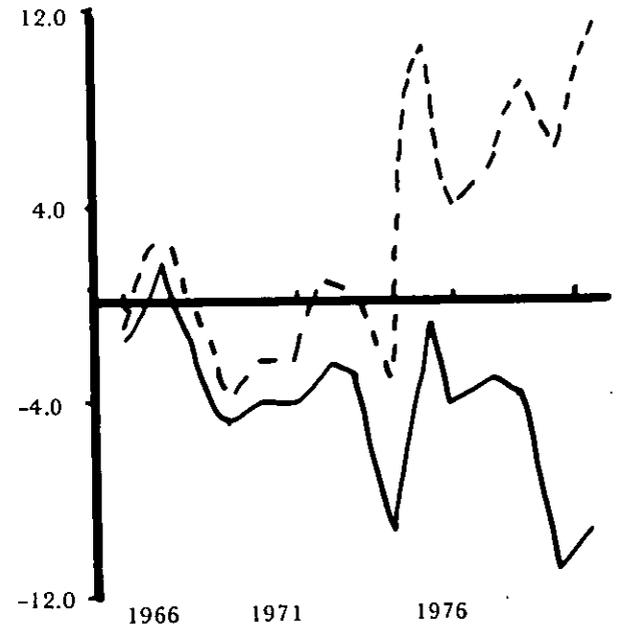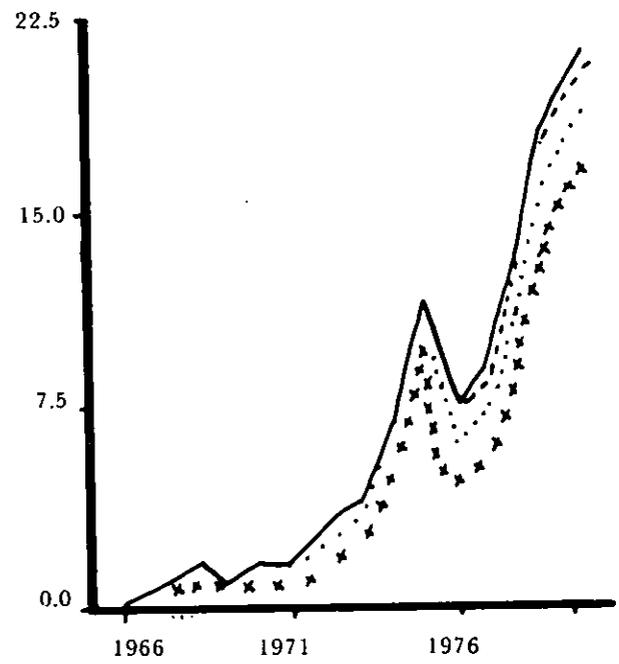
——— standard model
— — — no Phillips curve
. . . . . tax elasticity of 0.5
* * * * tax elasticity of 0.0

have been tenable.

The second variable examined in Table 5.13 is the borrowing requirement rate (GBRR) and in Figure 5.4 we graph the discretionary effects for the four model variants and the actual and "indexed" borrowing requirement rate for the standard model. The remarks made about the interpretation of the balance of payments effects apply equally to the borrowing requirement effects. Of interest, from a technical point of view, is the extent to which our process of fiscal "indexation" stabilised the borrowing requirement rate (GBRR) near its original 1967 level (-5.1% of GDP). From Figure 5.4 we see that for the standard model under fiscal indexation, GBRR takes the value of -0.5 per cent by 1980. Hence, over the years 1967 to 1980, fiscal indexation has induced an improvement of almost 4.5 percentage points in GBRR. The explanation for this lies mainly with the non-neutrality of the tax revenue with respect to GDP in the public authorities section of the model (refer Appendix 2) and the fact that our indexation rules apply to the fiscal instruments, not the fiscal constraints or budget constraints which are endogenous in the model. The effects of the counter-cyclical fiscal policy operated during the years 1974 and 1975 are clearly apparent from Figure 5.4: the cumulative discretionary effect of fiscal policy on GBRR rose from 4.4 per cent in 1973 to 10.5 per cent and 10.7 per cent of GDP in 1974 and 1975, respectively. The reversal of these policies in 1976 reduced the cumulative effect on GBRR to 6.9 per cent of GDP and, in a classical counter-cyclical pattern, the cumulative effect would have further reduced it between 1977 and 1979 during the world economy upswing, perhaps even going into surplus to balance out the large counter-cyclical deficits of the years 1974/75. Of course this did not happen. A policy of sustained fiscal expansion was embarked on in the second half of 1977, with the advent of the Fianna Fail administration which replaced the National Coalition in June 1977, leading to the massive deterioration apparent in Figure 5.4. This issue is further explored in Chapter 6, when we examine the individual budgets of the 1970 period and relate them to our more formal analysis.

In Table 5.14 we examine integral fiscal effects on numbers unemployed and on numbers employed in the market sector of the economy. Negative entries in the unemployment table represent situations where cumulative fiscal discretion has lowered unemployment relative to a situation of fiscal indexation. For the standard model, the cumulative effects of fiscal discretion were beneficial until the year 1976, and were particularly so in the years 1972 and 1975. However, the situation reversed in the years 1977 and 1978, but by 1980 the cumulative effect of fiscal discretion accounted for a fall of 15,000 in the numbers unemployed. The different implications of the four model variants are quite striking, particularly the effects of changing

Cumulative discretionary fiscal effect on the public authorities surplus rate (indexed minus actual)
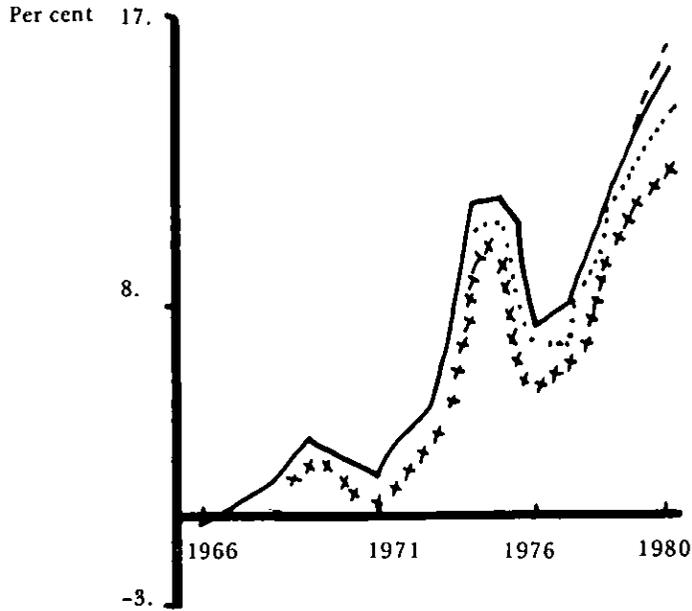
Actual and indexed public authorities surplus rate for the standard model

_____ standard model

— — — no Phillips curve

. . . . . tax elasticity of 0.5

* * * * tax elasticity of 0.0
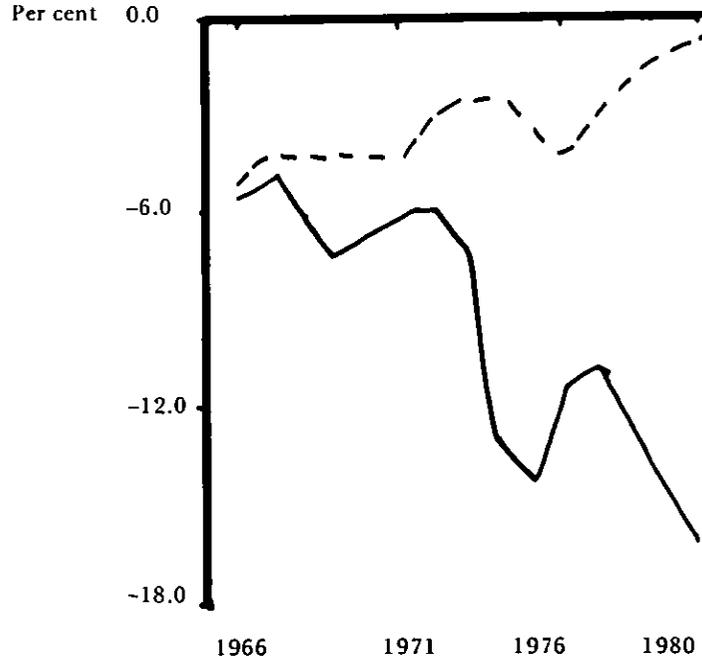
the direct tax elasticity from unity in the standard model to zero. Clearly, if
by lowering this tax elasticity we lessen the harmful effect of higher direct
taxation on wage inflation and competitiveness loss, we simultaneously
lessen the "beneficial" effects of fiscal indexation, i.e., the effects of lower
taxes on inflation and competitiveness. For example, by 1980 the model
variants with elasticities of 0.5 and zero show cumulative discretionary
effects of a lowering of unemployment by 48,000 and 72,200 respectively,
in stark contrast to the lowering of unemployment by only 15,000 in the
case of a unitary elasticity. In many ways the fiscal effects on market sector
employment are the mirror image of the unemployment effects. A negative
entry in this table represents a fall in employment due to fiscal discretion.
For the standard model, the fall in numbers by 1980 was 20,800. The
exclusion of the Phillips curve makes only minor changes, but the variation
of the size of the direct tax elasticity brings about large differences from the
"standard" case.

We can summarise the situation of the labour market in 1980 in terms of
the standard model and cumulative effects of fiscal discretion over the case
of indexed policies:

. Numbers unemployed (U)	−15,000
. Total labour force (LF)	+58,600
. Net migration abroad (NMA)	−15,700
. Total employment (L)	+73,600
. Non-agricultural employment (LNA)	+75,500
. Market sector employment (LM)	−20,800
. Non-market sector employment (LNM)	+94,400
. Non-agricultural market sector employment (LMNA)	−18,900
. Industrial sector employment (LI)	−22,100
. Marketed services sector employment (LSM)	+3,200
. Employment by public authorities (LPA)	+30,800
. Employment in non-market service sector (LSNM)	+63,600

In interpreting the above table it must be remembered that the migration
variable measures a flow (net migration abroad per annum) while all the
other variables measure stocks. Under a policy of strict indexation of fiscal
actions since 1967, a continual net outward flow of migrants would have
been induced, relative to the actual historical outturn (Figure 5.5). Hence,
the rise of 58,600 in the labour force induced by fiscal discretion is accounted

Figure 5.5: *Cumulative discretionary fiscal effect*
(indexed minus actual)

Numbers Unemployed

Employment in Marketed Sector

Net Migration Abroad

———— standard model
— — — no Phillips curve
. . . . . tax elasticity of 0.5
* * * * tax elasticity of 0.0
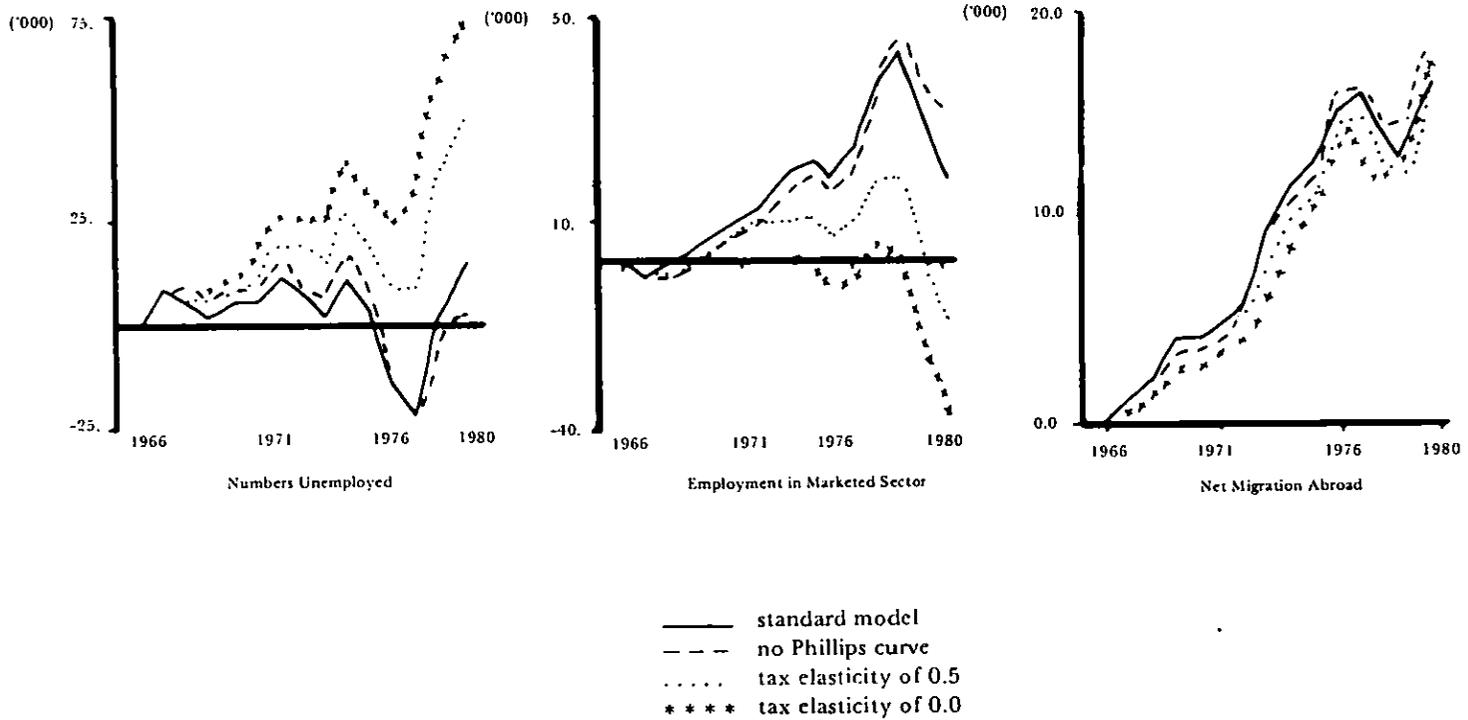
for largely by the induced net *inward* flow as the labour market responded
to expansionary policies. The bulk of the employment rise of 73,600 came
in the non-market (discretionary) sector (+94,400) with an offsetting loss of
20,800 jobs in the marketed sector. In the marketed sector, fiscal discretion
induced a loss of 22,000 jobs in industry, but a slight gain of 3,200 in mar-
keted services.

Finally, in Table 5.15 and Figure 5.6 we examine the cumulative effects of
fiscal policy on price inflation and wage inflation. The effects on price infla-
tion are characterised by the inflationary effects in the years 1971, 1976 and
1980, all years characterised by either explicit or implicit high taxation budgets
(we return to this point in the next chapter). However, the years 1975,
1977 and 1978 were (price) deflationary, mainly due to tax cuts and/or
subsidies. All four model variants yield broadly similar conclusions.

The results for wage inflation are rather larger and also differ between
model variants. The only years in which the cumulative discretionary effects
lowered wage inflation were 1977 and 1978 due to the very explicit policies
of cuts in both direct and indirect taxes. The Phillips curve introduces im-
portant changes in the wage effects, as a comparison of the first two rows
shows. The lowering of the direct tax elasticity dampens down the wage
effects since it progressively reduces the role of the direct tax rate on wage
formation (eliminating it entirely for a zero elasticity).

CONCLUSION

In this chapter we have provided basic tabular results showing the effect
discretionary fiscal policy has had on the economy over the period 1967 to
1980. We have looked at the effects of the fiscal changes introduced, in
isolation, in each individual year ("incremental" analysis) and the cumulative
effects of fiscal changes from all prior years ("integral" analysis). In the next
chapter we attempt to relate our formal analysis with the details of the in-
dividual budgets introduced to implement fiscal changes.

Figure 5.6: *Cumulative discretionary fiscal effect*
(indexed minus actual)

Inflation Rate of Consumption Deflator

Inflation Rate of Average Annual Earnings
in Industry

standard model
no Phillips curve
tax elasticity of 0.5
tax elasticity of 0.0
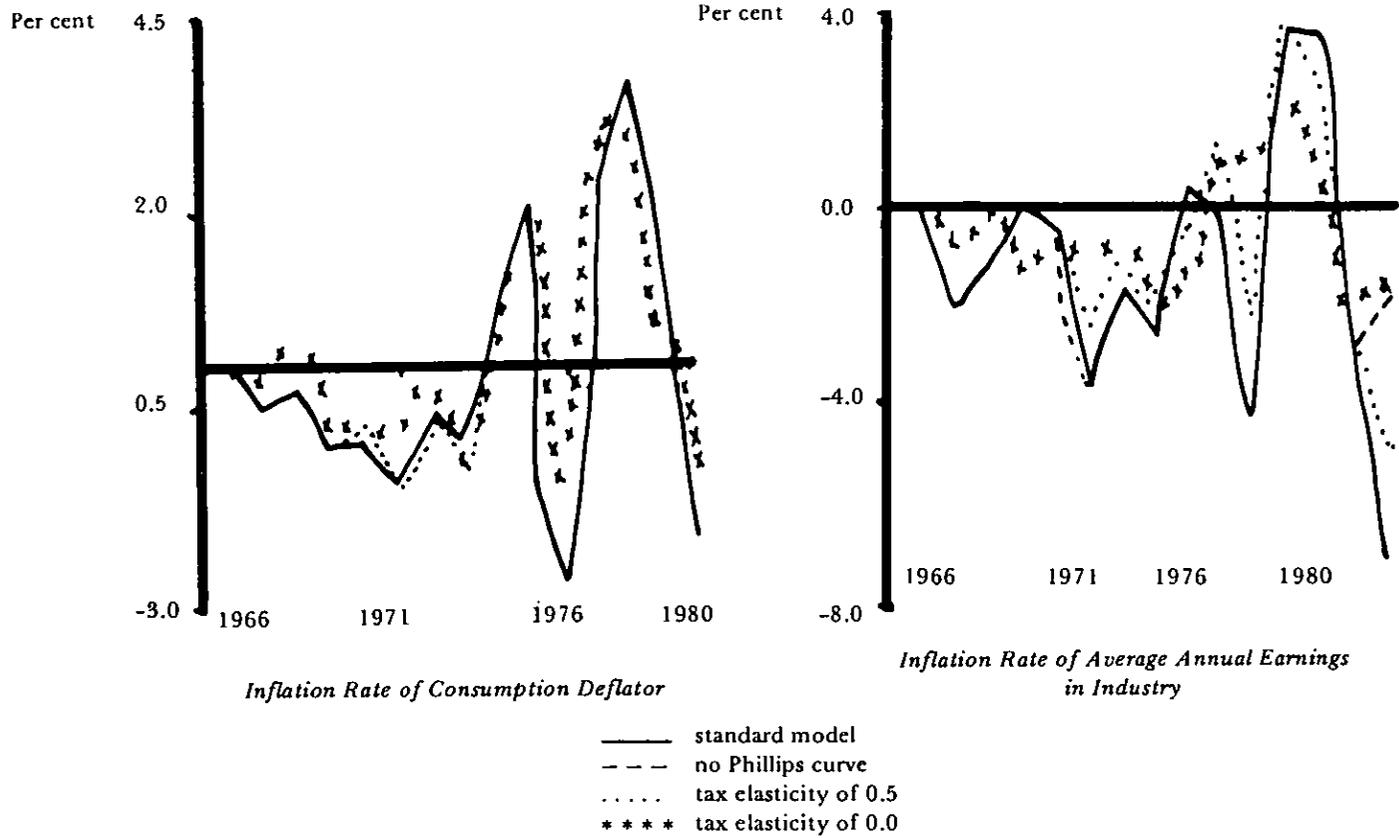
Chapter 6

BUDGETARY OBJECTIVES AND POLICY CONSEQUENCES

In this chapter we attempt to reconcile our analysis of the role of discretionary fiscal policy with the information and analysis contained in the annual budget documents. The budgetary process is not a simple matter but consists of five distinct phases. The first phase consists of publication of the *Book of Estimates*, usually about one month before the budget speech. This document contains detailed estimates of all expenditures on current goods and services on the basis of unchanged policies – a somewhat nebulous term which sometimes means differing types of indexation of the previous year's nominal expenditures and in other cases means unchanged nominal expenditures. The second phase consists of the publication of the *Public Capital Programme*, usually a few weeks before the budget speech. This document gives details of government plans for expenditure on fixed capital formation for the coming year. The third phase consists in the actual budget speech itself, a performance surrounded with much traditional drama and media speculation. Many of the substantive policy changes in the budget deal with current and capital taxation and, in addition to modifying existing tax rates and income tax bands, new taxes, or major changes to existing taxes, can be introduced. Details of provisions being made for the single largest element of current expenditure, i.e., public sector pay, are also announced. In addition, changes to other items of expenditure (social welfare transfers, etc.) are often made. The fourth phase consists in the announcement, usually by the Minister responsible for Social Welfare, of the changes in social insurance contribution rates necessitated by the previously announced alterations in transfer payment rates from the budget speech. The final phase consists of policy changes made to the draft budget during the Dáil debates on the legislation needed to enact the budget.

It should be fairly clear that the complexities of the above process (involving a multitude of policy instruments and complex timing of changes) can only be imperfectly captured by the twenty seven policy instruments contained in our macromodel. Two major simplifications have been made in our analysis. The first is the aggregation of many different policy instruments into a single instrument (e.g., a wide range of different excise duties is treated in the model as a single aggregate index, TEDR, operating on an aggregate tax base, total personal consumption). Similar aggregation is used in dealing with the range of different VAT rates, the range of unemployment transfers,

etc. The second simplification concerns the timing of policy changes. Changes are made at various times throughout the year, thus seriously complicating the timing of policy effects using an annual model. The situation is particularly complex when there is a change of political administration following a budget and the new administration implements policies substantially different from those of its predecessor (as happened in 1977, for example). In our model we quantify the fiscal instruments and their changes in the following way. Suppose a tax rate, T, stands at 100 from January 1 to March 31, is then increased to 120 from April 1 to September 30, and to 150 from October 1 to December 31. The value of the tax rate used in the model is calculated as

$$T_1 = \frac{3 \times 100 + 6 \times 120 + 3 \times 150}{12}$$

i.e., each rate is weighted by the number of months it is in force. If T_0 represents the tax rate for the previous year, the change in tax rate is calculated as

$$\Delta T_{1,0} = T_1 - T_0$$

Hence, if one political administration is responsible for the change from 100 to 120 and another administration makes the change from 120 to 150, it is difficult, with our approach, to disentangle subannual effects, i.e., $\Delta T_{1,0}$ represents "fiscal policy" for one whole year.

In preparing for, and executing a budgetary policy, the public authorities (particularly the Department of Finance) carries out analysis of the kind we have described in the previous chapter. However, in comparing our results with the analysis contained in the budgetary documents, certain differences in approach must be taken into account. First, although formal models of the economy are often used in official budgetary preparation and analysis (Ryan, 1963; Cavanagh and Mooney, 1972; FitzGerald and Keegan, 1982), much budgetary analysis seems to be of a relatively informal or eclectic kind, and is often presented with a strong normative bias.[17] Even in the informal analysis, it is often difficult to interpret what is the government's view of the economy underlying a budgetary strategy. For example, in the 1978 budget, the idea of Ireland as a small open economy appeared to be rejected.[18] Ideally, in addition to using *our* view of the economy, we would

17. "While the Government hope that everybody will play their part in making economic advance possible, they are entitled to expect that business will make the most of an environment favourable to growth" (Budget Speech, 1978, p. 37).

18. "It is fatally easy to adopt the attitude that we must trail along behind the large developed countries and wait for them to pull us out of our troubles. We can rationalise this by facile excuses, by saying that we are a small country, that our industries have a small home market, that our techniques in production and marketing are relatively unsophisticated and so on. Thankfully there are signs that this defeatist attitude is on the wane" (Budget Speech, 1978, p. 36).

like to check the budgetary analysis within the framework used in its pre-paration. On the basis of published information this is impossible so we must settle for a formal analysis using our articulated model framework such as was described in Chapter 2.

A second problem concerns the quality of data available to contemporary budget analysts. If a budget is prepared for presentation in January, its main outline will be drawn up some months before. Hence, the short-run economic indicators will be those of the latter part of the previous year, e.g., inflation, trade statistics, the last quarter's revenue and expenditure data for the public authorities, etc. It is sobering to realise that preliminary national accounting data only become available with a six-month lag (in the publication *Economic Review and Outlook*), and first full estimates of the National Accounts only become available with an eighteen-month lag, and are often the subject of major subsequent revisions. In attempting to study budgetary actions and effects *ex-post* one is in the enviable position of possessing perfect hind-sight. While it is of interest to attempt to isolate the manner in which an incorrect interpretation of the economic indicators led to an inappropriate budgetary stance, such an investigation must await further research. It behoves us to temper our critique of budgetary actions in the light of this important information difference.

A particular case of the issue of the quality of data concerns the manner in which price indexation (as a policy rule) is carried out. *Ex-ante* indexation rules must use available price indicators and the best available forecasts. For some years these forecasts were badly wrong as inflation both accelerated throughout the 1970s and when it behaved erratically, as between 1976 and 1980. For example, in preparing the 1974 and 1975 budgets, it is unlikely that the full magnitude of price inflation was anticipated (15.7% in 1974 and 22.4% in 1975). In our formal analysis of Chapter 5 we assume that the fiscal authorities were able to pursue exactly any given indexation rule. The stylised nature of such strong assumptions must be borne in mind when comparing our results with those of the actual budgets.

We turn now to a brief and very superficial look at the individual budgets of the 1970s. Our objective in doing so is to gain some insight into four issues: what were perceived as the main problems facing the government; what fiscal actions were taken; what were the expected consequences; what actually happened using our method of analysis. Some summary data are contained in Tables 6.1 and 6.2.

The first two budgets of the decade can be seen, in retrospect, as the last of the traditional budgets which characterised the 1960s. They were also the last budgets which accepted the balancing of the current account as a binding constraint on government activity (Whitaker, 1983, pp. 98-108).

Table 6.1: *Summary post-budget estimates from budget speeches*
(£ million)

Years	Taxation		Current expenditure		Deficit
	Additional revenue	*Additional concessions*	*Additional pay*	*Other net expenditure*	
1970/71	20.1	7.4	10.1	11.9	0.0
1971/72	9.25	0.0	0.0	9.4	0.0
1972/73	0.0	14.1	0.0	12.1	34.8
1973/74	22.0	1.3	1.0	38.8	39.3
1974/75	2.50	27.3	0.0	12.0	66.7
1975	39.20	27.8	40.0	32.6	125.4
1976	124.0	17.0	5.5	-4.5	327.0
1977	112.0	55.2	46.0	66.0	217.8
1978	0.0	90.9	40.0	9.3	405.0
1979	57.2	37.0	75.0	26.3	288.9
1980	292.0	143.4	100.0	55.6	353.4

Table 6.2: *The Public Capital Programme*

	Value (£ million)	*% change*	*Volume (£ million, 1975)*	*% change*	*% Inflation*
1970/71	194.5	—	385.9	—	8.4
1971/72	193.4	-0.1	351.6	-8.8	10.2
1972/73	251.3	29.9	420.9	19.7	9.2
1973/74	305.0	21.4	453.9	7.8	10.7
1974/75	384.4	26.0	460.9	1.5	23.4
1975	457.5	19.0	457.5	-0.7	19.0
1976	595.3*	30.3*	501.5*	9.6*	17.9
1977	627.1	15.3**	447.9	-10.7**	17.3
1978	767.3	22.4	494.1	10.3	10.5
1979	974.0	26.9	552.5	11.8	14.1
1980	1154.1	18.5	563.8	2.0	17.9

*Outturn was £544 million (18.9%).
**Percentage change on 1976 outturn.

The main focus of the budget of May 22, 1970, was the widening trade gap of the previous two years which was reflected in the growing deficit on current account of the balance of payments. The aim of the budget was to "get back, as quickly as possible, to the moderate external deficits envisaged in the Third Programme". The rising rates of price and wage inflation were also a preoccupation. In the event, a net increase of about £13 million in

tax revenue was planned, mainly from higher turnover tax rates. From Table 5.4 we see that as a result of fiscal changes in 1970 (i.e., discretionary changes relative to a fully indexed policy), the balance of payments deficit did fall as a percentage of GDP (by 0.20 percentage points in 1970).

Turning to the 1971 budget (introduced on 28 April), the central theme was the reduction of what were perceived as inflationary pressures in the economy, particularly the role played by accelerating wages and increased indirect taxes. Ministers of Finance traditionally make exhortations on the desirability of curbing inflation and the 1971 budget was a good vintage.[19] The 1971 budget increased taxation by £9.25 million and made very minor expenditure changes. From Table 5.10 we see that fiscal policy in 1971 added nearly 2 percentage points to the consumption price inflation rate and nearly 4 points to the industrial wage inflation rate. It is slightly ironic that a budget designed to curb inflation should have been so inflationary in its impact! To some extent the problem may have been that the impact of the rising inflationary background on the taxation system was not fully appreciated at the time. For example, the average implicit direct tax rate rose from 8.9 per cent in 1970 to 11.1 per cent in 1971, a process which, in our analysis of discretionary fiscal policy, will add over 2 percentage points to the wage inflation rate. Public sector employment increased by over 6,000 in 1971, which further exacerbated wage inflation pressures through the Phillips curve. We have already seen (Table 5.7) that the long-run employment consequences were quite serious. By our analysis, the consequences of the 1971 budget would appear to have greatly stoked inflation and had a serious impact on industrial competitiveness. The supplementary expansionary measures taken in the Autumn of 1971 (mainly an extra £20 million PCP injection) may have further increased pressures on prices and wages.

The long-tailed delayed effects of the 1971 budget have already been noted in Chapter 5, particularly in connection with Table 5.3 (real disposable income), and Table 5.7 (numbers unemployed). There appears to have been little contemporaneous formal comment on long-run effects, as distinct from short-run impact. In the case of 1971, the impact effects (other than on inflation) were quite minor. Most of the influence of 1971 fiscal changes took many years to work out and were enduring. They involved a complex interaction of inflation, wage bargaining, competitiveness and supply responses, and were unlikely to have been understood in the absence of formal model-based analysis.

The 1972 budget will probably be best remembered for the introduction

19. "I do not think the general public, the worker, the man in the street, even the business man, fully appreciates the horror of unchecked inflation" (Budget Speech, 1971, p. 30); "This budget is designed to protect the gains we have made and to ensure that all we have achieved does not vanish in an inflationary whirlpool" (ibid., p. 31).

of a planned current deficit of almost £35 million.[20] The budget speech estimate of the rise in growth due to the expansionary policy was 1¾ per cent. Our analysis of Table 5.2 shows just over 2 per cent as the impact effect. The Minister was aware of the effect his policy might have on external balance, but his concern was hardly pressing.[21] In Table 5.4 we saw that the balance of payments deteriorated by 1.2 percentage points of GDP, the borrowing requirement by almost 1 percentage point (Table 5.5), unemployment fell dramatically (Table 5.7), prices were unaffected (Table 5.10), but wages increased by almost 2 percentage points, as the result of discretionary policy by our definition. The main inflationary influence was through the Phillips curve.

The 1973 budget (introduced on May 16) was the first of five budgets prepared under the National Coalition. Besides the obvious commitments contained in pre-election statements, the overriding perception of the state of the economy was of it running well below capacity and a desire to expand economic activity to obtain "a higher growth rate which, apart from increasing employment and improving living standards, will help to take up the slack and underused capacity of recent years" (Budget Speech, p. 7). The deteriorating inflation position was also a major preoccupation, but priority was given to need for stimulus. A deficit on current account was regarded as necessary and it was decided to impose some additional taxation in order to "reduce the deficit to a more tolerable level". The necessary increases in taxation in order to eliminate the deficit were rejected on the basis that they would "only accentuate inflationary pressures". It was estimated that the growth rate of the economy would be about 5½ per cent over the following twelve months and there would be no appreciable deterioration in the balance of payments. To achieve these aims, the PCP was increased by about 21 per cent in value (9.6% in volume), indirect taxes were raised and social welfare expenditure was increased. The opening deficit of £20 million was increased to £39 million by these measures.

From Table 5.2 we saw in Chapter 5 that the impact effect of 1973 discretionary fiscal policy was to raise the growth rate by over 1½ points, the balance of payments rate deteriorated by about 0.7 points, and the total borrowing requirement rate by over 1½ points. From Tables 5.10 and 5.11

20. "Faced with competing requirements [i.e., high inflation and underutilisation of industrial capacity] the Government have opted for growth rather than stability. The level of Government expenditure this year will, therefore, be determined by reference to our economic requirements and will not be cut back to estimated yield of revenue. There will not be any increases in taxation, and the resultant deficit in the current budget will be financed mainly by borrowing" (Budget Speech, p. 16).

21. "The increased spending power is likely to cause a substantial increase in imports, and the balance of payments deficit will clearly have to be watched carefully. If, however, during the year ahead our costs become more competitive and price increases are abated, I will have no great worry regarding our external position" (Budget Speech, pp. 28-29).

we can see that the 1973 policies were mildly inflationary, adding 0.7 points to consumption price inflation and 1.7 points to wage inflation.

The 1974 budget (3 April) was drawn up in the immediate aftermath of the first OPEC oil crisis and was coloured by the recognition that world growth was not buoyant. Inflation was an abiding preoccupation, particularly wage inflation.[22] There was also a revealing observation concerning tax buoyancy which indicated the very doubtful nature of the process of budgetary calculation.[23] Concerning the objectives of budgetary policy, it was noted that the success of the 1973 policies would have indicated the need for a "neutral" budget in 1974 were it not for the "energy situation, unfavourable movements in world prices of raw materials, and recession in the economies of many of our most important trading partners". In such circumstances it was deemed appropriate to maintain the growth of the Irish economy "at at level close to full utilization of capacity" and to implement a counter cyclical policy. The PCP was increased by 26 per cent in nominal terms (2.1% in real terms). The further stimulation of the economy through large tax concessions and increases in social welfare benefits (by £27 million and £12 million, respectively), was projected to raise national output by 1½ points "over what it would otherwise have been".

Our analysis of Table 5.2 showed the effect of 1974 discretionary policy on growth to have been only 0.8 points. Real personal disposable income rose by 3.7 per cent as a result of discretionary policies (Table 5.3). The price paid for this expansion was very large. The balance of payments rate deteriorated by 3.6 points (Table 5.4) and the public authorities borrowing requirement rate deteriorated by 4.2 points (Table 5.5 adjusted for intervention loan payments). The budget effects on unemployment were beneficial (an impact reduction of 6,700), and there were only minor inflationary consequences (price inflation was reduced by 1 per cent (Table 5.19) and wage inflation was increased by about 0.9 points).

The single most important element of the 1974 budget was that it marked the beginning of a series of rising current deficits (Table 6.1). One is forced to agree with the comment of Whitaker that

> whatever the explanation (which historians will no doubt unearth) the consequences were most unfortunate [. . .] in the mis-

22. "Over the period since 1969, employee incomes have accounted for between one-third and one-half of the rise in consumer prices" (Budget Speech, p. 9).

23. "Last year's budget — which, as I have already mentioned, was deliberately aimed at the expansion of the economy -- envisaged a nominal current deficit of £39 million. I use the word "nominal", because I specifically recognised that raising the growth rate would bring in more tax revenue and reduce the deficit. This is what happened although I must admit that the process was assisted by the higher-than-expected price increases which boosted VAT receipts. Although expenditure was somewhat greater than expected, the actual deficit was £10.4 million" (Budget Speech, p. 13).

guided dismantling of a disciplinary safeguard and in the creation of a spurious respectability for fiscal decisions of a nature and on a scale which in their cumulative effect have misused and almost exhausted our foreign borrowing potential and have deprived fiscal policy of its capacity to serve as an instrument of economic management (Whitaker, 1983, p. 101).

The 1975 budget was the first to be presented on the revised calendar year basis (15 January). It is permeated by a grim realisation of the "intensity, duration and unprecedented nature of the unfavourable economic forces operating across the world since late 1973". There was also a dawning realisation of the very limited power of fiscal policy to insulate the Irish economy from world developments.[24] The central economic strategy was defined as "maintaining employment and preserving living standards", but the danger of the huge balance of payments deficit was also recognised (10% of GNP in 1974). The PCP was increased by 19 per cent in nominal terms (zero change in volume). A net increase of £10 million in tax revenue and an increase of £73 million in current expenditure were budgeted for, with a planned current deficit of £125 million. For the first time in a budget, a large extra sum (£40 million) was allocated for additional public sector pay, thus introducing a curious distinction between the pre-budget *Book of Estimates* and the budget itself. Once again there was an explicit reluctance to raise taxation to meet the deficit "at a time when what the economy needs is the maximum sustainable expansionary action". In his concluding remarks, the Minister characterised his budget as "carefully expansionary", but did not hazard any quantification as to its likely impact of the economy.

In our formal analysis of the impact of discretionary fiscal policy in 1975, we found a small boost to growth (0.4 points, Table 5.2), a stimulation to real disposable income (3.5 points, Table 5.3), a deterioration of the balance of payments (by 2.7 points, Table 5.4) and no effect on the (adjusted) borrowing requirement. Numbers unemployed were reduced by 11,300 (Table 5.7) and there was a drop in inflation by about 1.3 points (assisted by the introduction of subsidies on food, clothing and fuel in a supplementary budget introduced in June 1975) but a rise in wage inflation of about 1.8 points (Tables 5.10 and 5.11). The 1975 budget was the second countercyclical budget. Such a policy stance was greatly facilitated by the improving balance of payments position (due to world recession) and the low real interest rates.

24. "While there is a natural tendency to look upon the budget as the principal national corrective measure, the truth today is that a budget is but one of several economic influences, and on its own can have but limited effect". "Today as we are not dealing with traditional problems we cannot rely solely on traditional ways of handling them" (Budget Speech, p. 7).

The 1976 budget (28 January) opened with a clear statement of three facts which characterised the position of the economy: the vulnerability of the economy to the prevailing world depression; the limited power of domestic policy measures to safeguard employment and living standards in the absence of any increase in world trade; and the expectation that future growth patterns were likely to be less strong than those prior to 1973. Three priorities for policy in 1976 were emphasised; the need to curb inflationary tendencies; the need to safeguard employment within a fiscal constraint; the need to limit growth in government expenditure. The publication of a "tax-free" price index was proposed as a means of preventing workers from "compensating themselves by wage increases for the effect of indirect taxes imposed to finance transfer payments or to meet the general needs of managing demand" (Budget Speech, p. 11). However, there appeared to be no understanding of the equally important role of the direct tax system in influencing wage bargaining. On the issue of the current deficit, there was felt to be no option but to accept it as being continually necessary because of the recession, with the aspiration that it must be reversed when the recession passed. The vulnerability of the large and rapidly growing foreign debt to increases in interest rates was also emphasised. The projected slow growth of the economy in the absence of further stimulus (less than 1 per cent) was unacceptable to the Minister and another large deficit was planned which was only partly financed by massive increases in taxation. On the capital side, the PCP was increased by 28 per cent in nominal terms (10.5% in volume). Tax increases (mainly VAT on "the old reliables") were made to yield an extra £124 million and only trivial tax concessions were given. Essentially no net increases in nominal expenditure were planned. The Minister must have realised the deflationary nature of his budget, but suggested otherwise.[25] An estimate of an extra 1 per cent growth was given by the Minister as the impact effect of the budget. Our analysis of 1976 fiscal policy suggests that the growth rate in fact fell by almost ½ percentage point relative to a policy of strict indexation (Table 5.2). Real personal disposable income suffered a massive fall of almost 6½ per cent (Table 5.3). The balance of payments rate improved by 4.8 points and in the absence of delayed effects from previous years' policies would have gone into surplus. The borrowing requirement rate (adjusted, as before, for intervention payments) improved by nearly 3.7 points. Unemployment rose by 6,600 in the first year, and peaked at an extra 25,900 by the third year due to 1976 fiscal policy (Table 5.7).

25. "There is a misconception that because a budget contains increases in taxation it is therefore necessarily deflationary. [...]. Leaving aside the niceties of academic debate, it is the overall impact of the budget that matters: in other words, the total effect of the increases in current and capital expenditure after account is taken of the offsetting influence of increased taxation" (Budget Speech, p. 37).

The inflation rate jumped by 3.4 points and wage inflation by 4.2 points. If such a budget had been implemented against an economic background as pessimistic as that outlined in the 1976 budget speech, the impact on the economy would have been seriously deflationary. In the event, autonomous economic growth (induced by a strong revival of world trade) mitigated the effects of the budget. In fact the planned deficit of £327 million resulted in an outturn of only £201 million and the budget had a correct counter-cyclical stance.

The 1977 budget (26 January) was the last one prepared under the National Coalition administration of 1973-1977, who went out of office in June 1977. It was characterised by a spirit of optimism that the worst of the world recession had passed and that the world economy was picking up. As in previous budget speeches, one must attempt to infer from the manner and style in which the Minister states his objectives, what his true intentions were.[26] For this particular budget it must be remembered that it was quite likely to be an "election" budget. Hence, the Minister's natural desire to eliminate the current deficit would be tempered by the knowledge of the unpopularity of such policies. For the first time it was recognised that "much of our inflation stems from forces outside domestic control", although there was a reluctance to abandon policies aimed at curbing inflation completely. There was a clear recognition that, since the economy was moving into a recovery phase, a policy of increasing deficits was inappropriate but that any "over-sharp" reduction in the deficit would seriously affect the performance of the economy. An increase of 15 per cent in the nominal PCP (a fall of 2% in volume) was planned. Large improvements to social welfare payments were planned (£33.4) and a sum of £46 million was allocated for public service pay. The income tax system was overhauled, involving concessions costing £50 million in lost revenue. There was an understandable reluctance to increase taxation, where explicit changes were confined to tax on farm income (£35 million) and Post Office charges (£17 million). The remaining £60 million extra tax revenue was somewhat ingenuously referred to as originating from "tax revenue buoyancy arising from the budget". An essentially unchanged budget deficit of £218 million was planned, but the Minister congratulated himself on the fact that "this deficit, which is a reduction of one-third on that envisaged when last year's budget was introduced, represents a very considerable progress towards fulfilling the Government's declared aim to phase out the current deficit as

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26. "The main aims of economic policy for 1977 will be to expand economic growth closer to existing capacity so as to facilitate the transition to the higher growth rates outlined in the recent Green Paper, to cut our inflation rate further and to reduce unemployment to the maximum extent possible. Public expenditure will continue to be subjected to stringent control" (Budget Speech, p. 9).

announced in last year's budget statement" (Budget Speech, p. 38). An interesting observation was also made towards the end of the speech concerning the "unwanted side effects of increased public expenditure which has resulted in a diversion of an increasing share of national resources away from the private sector" (*ibid.*, p. 38). No firm quantitative predictions on the likely effects of the budget were made by the Minister.

A new administration came into office in June 1977, whose commitment to economic planning was characterised by what Whitaker (1983) has termed "irrational optimism".[27] Immediately on taking office the new Fianna Fáil administration resumed public service job creation, increased capital spending ("effective measures were taken to ensure that there would be no repeat of the massive underspending . . . of the previous year" (Budget Speech, 1978, p. 8)), and cut a range of indirect taxes. This extra expenditure was largely offset by savings on expenditure, mainly on the lower cost of servicing debt due to a fall in interest rates and a rise in the value of sterling.

Our formal analysis of the impact effect of 1977 fiscal policy indicated that discretionary actions led to a slight fall in the growth rate (by $\frac{1}{3}$ of one percentage point), a slight fall in real disposable income, no effect on the balance of payments rate, a rise of 1 point in the borrowing requirement rate (Table 5.5), and a fall of 3,200 in numbers unemployed. Price inflation fell by slightly more than ½ percentage point (Table 5.10) and wage inflation was unaffected. The expansionary post-budget changes of the Fianna Fáil administration seem to have effectively neutralised the deflationary bias in the original National Coalition budget.

The 1978 budget (February 1) was the first full budget of the new Fianna Fáil administration and was set in the context of a formal and positive commitment to medium-term planning. (*National Development 1977-1980*, and *Programme for National Development, 1978-1981*). A crucial element in the 1978 budget and in its accompanying planning document was its rejection of the limitations of policy in a small open economy (refer footnote 18 above). The PCP was increased by over 22 per cent in nominal terms, (11% in volume), no increases in tax revenue were planned, tax concessions costing £91 million were granted (mainly income taxes and business taxes), and net expenditure increases of £49 million were proposed. The opening deficit of £265 million became £405 million as a result of budgetary changes. A stress was laid on the "temporary" nature of this increase in the deficit, which would be fully

27. "Conscious planning of development was a casualty of the first oil crisis and when it did reappear in 1977, top-of-the-scale targets were set which could be realised if at all only in ideal conditions. Public expectations, never easy to contain, were thus inflamed, with effects on the rate of pay increase and the scale of expansion of public services which have rendered almost insoluble the problem of budgetary imbalance. Demand management sank in a sea of current deficits" (Whitaker, 1983, p. 14).

justified if "the challenge is taken up by workers and employers alike". No formal quantification of the likely effects of the 1978 budget was contained in the speech itself. However, the budget was designed to "underpin" financially the policies outlined in the White Paper *National Development, 1977-1980*, issued in January 1978. The key aggregate targets for the period 1977-1980 were as follows:

Targeted variables	1977	1978	1979	1980
Reduction in numbers unemployed	5,000	20,000	25,000	30,000
End-year rate of inflation	10¾	7	5	5
Increase in National Output	5	7	7	7
Borrowing as % of GNP	11	11	10½	8
Balance of Payments as % of GNP	4	13	n.a.	6¼

In achieving these targets, both a projected domestic fiscal stance was assumed, together with an optimistic world trade scenario. Four constraints were identified: investment and its financing, the evolution of the public sector deficit, the balance of payments and the rate of growth in world trade. In relation to the first, the lack of detailed analysis hardly inspired confidence, and it is difficult to see upon what basis the second and third constraints were evaluated (see table above). No formal view was taken of likely developments in world activity other than the expectation that "growth rates during the next few years in the member countries of the EEC should be strong enough to support the projected expansion of exports" (*National Development, 1977-1980*, p. 26).

Our formal analysis of Chapter 5 indicated that the impact effect of 1978 discretionary fiscal policy added 0.4 percentage points to the growth rate, 4.1 points to real disposable income, and reduced unemployment numbers by 11,400. However, the balance of payments rate deteriorated by 3.7 points, and the borrowing requirement rate by 2.7 points. Price inflation fell by 2.5 points, and wage inflation by 1.2 points.

The 1979 budget initiated the second stage of the government's medium-term strategy and was accompanied by an updated White Paper, *Programme for National Development 1978-1981*. The first stage of this strategy (1978) was marked by direct government action to boost growth, increase employment and reduce inflation. In this second stage, public resources were to be used again to the same ends, with the expectation that the "increased dynamism of the private sector, resulting from the success of the government's policies, will enable the contribution to growth from the public sector

to be scaled down" (Budget Speech, p. 7). However, the White Paper intro-
duced a slightly plaintive note: "It is unfortunate that the degree of pay
moderation and of industrial relations harmony required to ensure success
in the fields of employment and inflation were not forthcoming, especially
having regard to the tax reliefs afforded by the 1978 Budget" (White Paper,
p. 16). Cutting through the detail of the actual budgetary proposals, the
1979 budget was very similar to the 1978 one, with the exception that
additional tax revenue was raised (£57 million), tax concessions costing
£37 million were granted, and slightly over £100 million in extra expenditure
was planned. A budget deficit of £289 million was estimated. In the event,
the deficit outturn was £522 million, i.e., 81 per cent up on the estimate.
As Whitaker comments:

> One of the most disturbing features of the administration of the
> public finances in recent years is the chasm that has opened up
> between budgetary projections and actual results. The under-
> estimation of current deficits, and consequently of the exchequer
> borrowing requirement, has been so seriously disproportionate as
> to invalidate the whole budgetary exercise (Whitaker, 1983, p. 112).

As shown in Table 6.3, the error in 1979 was to be merely the first of a
series of such errors.

Our formal analysis of Chapter 5 confirms the expansionary nature of the
1979 discretionary policies: the growth rate raised by 1.5 points, real dis-
posable income raised by 3.9 points, and unemployment numbers reduced
by 20,100. Price inflation was reduced by 1.3 points and wage inflation was

Table 6.3: *Current deficits: budget projections and outturns*

Year	*(£ million)* budget projection	*(£ million)* outturn	*(£ million)* Excess of outturn over projection
1974/75	66.7	64.2	-2.5
1975	125.4	259.0*	133.6
1976	327.0	201.0	-126.0
1977	217.8	201.0	-16.8
1978	405.0	397.0	-8.0
1979	289.0	522.0	233.0
1980	353.4	547.0	193.6
1981	495.0	802.0	307.0
1982	679.0	988.0	309.0

*Deficit at June 1975 supplementary budget was £222 million.

only marginally raised (by 0.6 points). However, the price paid in terms of balance of payments and borrowing requirement deterioration was high: the balance of payments rate deteriorated by 3.7 points (to an actual value of -11.3 per cent of GDP); the borrowing requirement deteriorated by 2.3 points (to an actual value of -14.6 per cent of GDP). These modest gains in growth and unemployment reduction, combined with serious external and internal imbalances, could have been (and were) foreseen by many economic commentators. Whitaker, in a speech in Seanad Eireann on 17 May 1978 had drawn attention to the fact that the government programmes for economic development and their accompanying budgets made

> . . . no allowances for contingencies, inadequate discussion of the stringent conditions necessary to attain the objectives, no precaution against the disruption of confidence by failure to do so and undue reliance on global demand expansion rather than selective supply side measures

(Whitaker, 1983, p. 110). The mood of optimism had almost completely evaporated by 1980.

The introductory paragraphs of the 1980 budget (27 February) dealt with the downturn in world economic activity as a result of the second major OPEC price rises of 1979, and the rather dismal prospects for the year 1980. The massive overrun in the borrowing requirement for 1979 (14.6 per cent of GNP as against the earlier projections of 10.5) and the emergence of a balance of payments deficit of 11.3 per cent of GNP as against the target of about 4 per cent), were singled out as being particularly serious. A sense of realism began to colour the government's view of the inter-relationship between borrowing, the external deficit and the level of external reserves.[28]

The PCP for 1980 was increased by 15 per cent over the 1979 outturn (0.5% in volume). On the expenditure side, a provision for £100 million in extra public service pay was made even though "there would not appear to be scope from a strictly economic viewpoint for further increases in rates of pay". A further increase in net expenditure (mainly social welfare) of £56 million was made. Given the opening deficit of £346.4 million, net tax increases of an amount planned to almost exactly offset the net expenditure rise were planned (i.e., about £190 million from the "old reliables", £44 million from income and resource taxes, £18 million from VAT). Tax concessions of £143 million were granted, mainly in the personal income tax

28. "Borrowing, the balance of payments and the external reserves are all interlinked. Government borrowing allows a higher level of expenditure in the economy, which generates a demand for further imports and adds to the external deficit. A reduction in borrowing is required in the short-term in order to help reduce the balance of payments deficit to a sustainable level" (Budget Speech, p. 12).

system. The projected deficit was £353.4 million, only £7 million higher than the opening deficit.

No formal quantification of the likely effects of the budget were presented in the speech. In the event, the projected deficit was so different from the actual outturn (£353.4 million as against £547 million) that any such estimate would be of little interest. Given our restriction to the 1967-1980 period, our formal analysis can only deal with the impact effects of the 1980 budget. From Table 5.2, 1.3 points were added to the growth rate as a result of fiscal discretion and real disposable income was lowered by 1.9 per cent. While the balance of payments rate was improved by 1.2 points, the borrowing require-ment was unchanged. Unemployment fell by 4,200, but, rather ominously, employment in the market sector also fell by 2,400. From Tables 5.7 and 5.8, the pattern of the budgets of 1971 and 1976 indicate the likely long-term detrimental effects of the 1980 budget in terms of higher unemployment and lower market sector employment. The explanation partially lies in the effects of the budget on price and wage inflation (rises of 3.1 points and 4.4 points, respectively). In terms of its impact on the inflation rate, the budget of 1980 was second only to that of 1976. In terms of its impact on wage inflation, the 1980 budget was the highest over the 1967-1980 period in absolute terms, although exceeded by the 1971 effects in relative terms (refer Table 5.11).

The decade of the 1970s was characterised by fluctuations in the inter-national economy of a kind which had not been experienced since the 1930s. Even with the wisest and most prudent fiscal management it would have been impossible for the Irish economy to have emerged unscathed from the world recession. In this chapter we have seen the budgetary policy in Ireland during the 1970s started in a very conventional manner, the previous major departures from convention going back to the early 1950s when the concept of a *Public Capital Programme*, funded by borrowing, was intro-duced. In 1972, for the first time a planned deficit on current account was budgeted for, and during the first OPEC oil crisis (with its consequential depressing effect on world activity) this deficit was progressively widened in a vigorous and sustained counter-cyclical policy aimed at insulating Ireland from the effects of world recession. Although an initial attempt was made in 1976 to reverse this trend, particularly in view of the improving world situation, the budgets of 1978 and 1979 were decidedly pro-cyclical. The budget of 1980 marked the end of such policies but by then the fiscal imbalance had become so serious as to largely predetermine budgetary policy for the greater part of the 1980s. In our final chapter we turn to some of the lessons which we might learn from the experience of the 1970s with the benefit of hindsight.

Chapter 7

CONCLUSIONS AND FUTURE RESEARCH

In this paper we have attempted to quantify the effects of fiscal policy on the Irish economy over the 1967 to 1980 period using the technique of Blinder and Goldfeld. (1976) in conjunction with the macro-econometric model described in Chapter 2. We now turn our attention to an overview of the effectiveness of fiscal policy and the lessons which might be learnt for the present period. We also consider some of the areas of the model which could be improved with future research.

REVIEW

In Chapter 6 we examined individual budget speeches and, from what can be inferred from these documents, fiscal policy over the period in question had two main purposes — first, the management of short-term demand in order to keep capacity utilisation high and to maintain what was perceived as a required standard of living, and second, the creation of an environment in which economic growth could be sustained over a longer period. This latter aim was promoted by a number of means, which in many cases may have been contradictory. Behind the complex and extensive changes which were made during the 1970s there were two basic types of policy. First, there was policy which aimed to promote growth via increased government expenditure, taking up pre-existing slack in the Irish economy and promoting growth of GDP, from which increased tax revenue would help to repay any increased public sector debt. The alternative policy stance which was taken during the 'seventies was to reduce inflation, or the balance of payments deficit, rather than increase demand, as a result of which gains in competitiveness would have caused growth of GDP. The usual manifestation of such a policy was in reduced government expenditure and increased rates of taxation.

Our analysis, provided in Chapters 5 and 6, suggests that neither of these stylised policies has proved successful in the creation of an environment where long-term growth could be encouraged. Rather, the overall impression taken from the two preceding chapters is of a fiscal policy which has succeeded in attaining short-run benefits to either demand, the balance of payments or inflation with no beneficial long-term consequences. Furthermore, the expansion of current government expenditure in excess of growth in tax revenues has resulted in a situation where governments of the 1980s have inherited a public authorities deficit of almost 16 per cent of GNP,

which will impose a severe constraint on fiscal policy for years to come. This level of debt might be justified if expansionary fiscal policy over the period considered had succeeded in increasing GDP and living standards by an approximately similar amount. However, our estimates of the cumulative effects of fiscal policy, given by the integral approach in Chapter 5, suggest that by 1980 its effects on GDP and living standards were small. Ironically, it appears to us that the long-term effects of *aggregate* fiscal policy from 1967 to 1980 has simply been to provide a constraint in the form of a huge debt which must be repaid in future periods rather than create an environment for growth.

The purpose of the demand expansion budgets was to return the economy towards full utilisation of capacity and, consequently, full employment. It was presumed that expansion of the economy would allow for the garnering of sufficient tax revenue to pay off some of the required borrowing incurred by the expansion of demand. For this to happen, a favourable world economy was usually envisaged. This did not, in general, occur, particularly in the 1979 and 1980 period when booming world conditions were supposed to bring in increased revenue in order to begin to pay off previous debts. Unfortunately, the second OPEC-induced price crisis occurred with the result that unemployment increased, interest rates became high in real terms and GDP growth fell, all of which imposed further pressures on the public finances. The governments of the 'seventies cannot be held to blame for a failure to forecast the unexpected price shocks of 1973 and 1979. It should be noted, however, that even in conditions of booming world demand these policies need not have been appropriate.

It is our view, based on the properties of the macromodel, that even had world demand growth continued in line with the expectations made in the budgets of the 1970s, governments seriously underestimated the leakages from the economy, in the form of increased savings and imports, so that it is unlikely that sufficient tax revenue to repay debts incurred would be raised on the basis of GDP growth alone. Such counter-factual analysis would be a relatively simple procedure within the framework of the model and could be considered for future research.

A more fundamental problem regarding the handling of the public finances during the 1970s is the apparent lack of continuity or symmetry in governments' views of the economy. Demand expansion was seen as an instrument where major gains in growth could be obtained without seriously impairing inflation. For instance, in the 1975 budget speech it was asserted that a "failure to pursue the objectives of maintaining employment and preserving living standards would be likely to lead to further inflationary pressures" (Budget Speech, 1975, p. 9). Similarly in 1976, though it was conceded

that "some economic commentators . . . point to the rapid growth in public expenditure as a primary cause of inflationary pressure in the economy" (Budget Speech 1976, p. 12) this view was brushed aside by suggesting that "this is an over-simplified view of the situation and tends to blur the distinction between cause and effects" (*ibid.*, p. 12). In 1978, in a year characterised by an increase of 7,300 in public sector employment, it was asserted that "the improvement in competitiveness resulting from Government economic proposals should also stimulate investment in the exporting sector and lay the foundations for continued export-led growth" (Budget Speech, 1978, p. 11). On the other hand, demand contraction, such as that carried out in 1976, was aimed at controlling inflation without serious effects on GDP or living standards. The lack of symmetry in these views should be apparent.

Another example of the inability to perceive or acknowledge trade-offs between economic objectives lies in the manner in which the balance of payments is treated in successive budgets. By 1971 it was believed that increases in taxation with consequent reduction in demand would improve the balance of payments. By our analysis, this policy proved correct with a reduction of over 0.5 per cent of GDP occurring as a result of discretionary fiscal policy. By 1975, the problem of the balance of payments deficit had arisen once again where it was suggested that "unless we start now the corrective process will be more abrupt and more painful" (Budget Speech, 1975, p. 9) advising that "any domestic action that would cause it to rise must of course be avoided" (*ibid*, p. 9). Yet government expenditure increases that year raised disposable income and imports with a consequent fiscally-induced increase in the balance of payments deficit of 3.6 per cent of GDP (see Table 5.4).

Those budgets which were used directly to increase output appear to have been reasonably successful in the first year of their implementation. Gross Domestic Product grew by between 0.3 per cent and 2.1 per cent as a result of individual expansionary policies in the year of implementation at the expense of increases in the borrowing requirement rate of between 0.9 per cent and 4.0 per cent. It is worth noting that our analysis suggests that there is no simple relationship between fiscally-induced increases in GDP and a rise in the borrowing requirement. For instance, a 2 per cent growth in GDP was obtained by fiscal policy in 1972 at the expense of an increase of 0.9 per cent in the borrowing requirement. At the other extreme, a 0.4 per cent increase in GDP was induced by fiscal policy in 1978, though in this case at the expense of a 2.7 per cent increase in the borrowing requirement.

The major failure of expansionary fiscal policies over the 1970s has not been their inability to increase GDP over the short run but rather their ineffectiveness over the long run. The tables in Chapter 5 provide a depressing

characterisation of the long-run effects of demand expansion in that increases in GDP which were induced by expansionary government policy were, by the second year, either eliminated (1979) or reversed (1972, 1973). This must be seen within the context of a government which is continuing to borrow to provide finance for the revenue shortfalls induced by previous years' policies. The reason for this turnabout in the effects of fiscal policy are due to the links between demand expansion and inflation. The 1970s were characterised by rapidly increasing direct tax rates with variable indirect tax rates showing a slow trend increase also. Increases in indirect taxation feed directly into consumer price inflation which influence the determination of wage bargains. Furthermore, we have determined wage bargains net of direct taxation so the historical increases in rates of direct taxation during the 'seventies, used to partially pay for increased government expenditure, also induce further wage inflation. The consequence of such cost-induced wage inflation on competitiveness on world markets should be obvious, with the resulting "crowding-out" of the exposed sectors.

This explanation of cost-induced inflation brought about by fiscal expansion can be used to interpret partially the early to mid-1970s, though not the 1978 and 1979 period where rates of indirect taxation were reduced sufficiently for price inflation to initially fall, relative to a fiscally-indexed policy. Further strengthening the increases to inflation induced by tax rises is a pressure on wages brought about by the Phillips curve. Government policy over the 'seventies succeeded in initially creating increases in both public and private sector employment, thus reducing the unemployment rate below that which would have resulted under fiscal indexation. As a result, bargaining strength of workers increased and wages rose as employees sought to capitalise on a stronger bargaining position than they would otherwise have experienced. This form of inflation, brought about by excess demand in the labour market, appears to have eliminated any gains to GDP caused by fiscal policies of 1978 and 1979 in the succeeding years.

Our analysis suggests that deflationary policies have been little more successful. Fiscal policies of 1976 and 1977 appear to have long-tailed negative effects upon GDP, disposable income and employment. The assumption underlying these budgets was presumably that inflation, caused either by the Phillips curve or bottlenecks in supply, could be averted by reduced disposable income and government expenditure, with beneficial effects on the borrowing requirement. Furthermore, it was presumed that the contraction of demand would improve the balance of payments position. From our analysis presented in Chapter 5, such budgets were partially successful. Fiscal policy in 1976 and 1977 did, in fact, reduce the balance of payments deficit and borrowing requirement quite considerably. On the other hand,

these policies were singularly unsuccessful in containing inflation. While they may have been partially successful in constraining demand-induced inflation, the increases in direct and indirect taxation were sufficient to add 4.2 per cent to wage inflation in 1976 and to leave it relatively constant in 1977. This apparent link between taxation and inflation appears to explain the failure of the private sector to respond to these supposed output incentives.

The budgets of 1971 and 1980 are possibly the most interesting of those implemented. Both budgets managed initially to increase GDP — by 1.14 per cent in 1971 and 1.29 per cent by 1980 — while suffering no disimprovement in the borrowing requirement. In fact, the fiscal policies of 1971 reduced the borrowing requirement by 1 per cent. This combination of beneficial effects, almost unique in the history of Irish fiscal policy, was obtained by rapidly increased rates of direct taxation. This would appear to follow the textbook pattern of a balanced budget multiplier where reductions in leakages via savings and relative propensities to import succeed in increasing GDP. However, problems arise when taxation increases induce inflation, the effects of which cumulate over a two to three year period, competitiveness deteriorates and output is lost. This is evident in Chapter 5 where the delayed effects of the policies of 1971 reverse the initial increase in GDP via inflation. Similar results are unavailable for 1980 as it is the last year of the sample but we have little doubt but that a similar situation will evolve.

Throughout the calculations discussed above, there is an assumption that policies introduced in one period are independent of those taken in any other period. One instance where this assumption may be less appropriate is in the aftermath of a deflationary budget such as that of 1976. By reducing the borrowing requirement by 4 per cent as we suggest, pressure upon future fiscal policy is reduced since finance was no longer necessary for payment of interest on that portion of debt. As a result, there is more finance available for future government expenditure domestically with a constant borrowing requirement. Therefore, it should be noted that some of the benefits of deflationary budgets, in the form of reduced pressure on future fiscal policy, are not given in the analysis of Chapter 5. On the other hand, fiscal expansion resulting in an increased borrowing requirement exacerbates the constraints on future fiscal policy since part of tax revenue must now be used to pay for expenditures already made, with the result that the expansionary effects of those types of budgets over the long run is over-stated in Chapter 5. The issue of temporal independence of policies is returned to below.

At the beginning of this chapter, we highlighted two roles for government — the maintenance of living standards in the short term and the creation of growth in a more long-term perspective. By its policies during the 1970s,

governments have certainly succeeded in maintaining short-term living standards, though at the expense of a massive borrowing requirement which will surely stunt growth in the future. It is because government has this dual role to play that it would be unfair to criticise the overall effect of fiscal policy. For instance, transfer payments have increased at a rate far in excess of that which would have been envisaged under policies of fiscal indexation. It is impossible to suggest that merely because in our counter-factual experiments GDP growth was as high as with historical fiscal policy, this represents a failure on the part of government since welfare considerations, both short term and long term, must be taken into account in evaluating fiscal policy. As a result, in our analysis we must limit ourselves to an evaluation of fiscal policy in terms of its effects on economic growth.

To conclude, our analysis suggests that the effect of fiscal policy on economic growth has fallen well below that which was expected of it by policy makers. Rather than create an environment in which growth could flourish, fiscal policy during the 'seventies has imposed a financial constraint in the form of a massive public debt, which will hinder growth for future generations. The reasons behind the failure of economic policy during this period are twofold. First, the world recessions occurred unexpectedly in 1973 and 1979, thus greatly hindering possibilities for the correction of public deficits. It is, of course, debatable whether government policies during this period would have been appropriate even with a buoyant world economy. Second, there appears to have been fundamental misunderstandings of the structure of the Irish economy, most particularly the relationship between fiscal expansion, taxation, and competitiveness. This has, we believe, resulted in a major shift of resources from the exposed industrial sector to the public sector, and has thus left the economy less capable of reacting to an improvement in world conditions than it otherwise might have been.

FUTURE RESEARCH

In considering ways in which the analysis of this paper could be improved upon it is best to look at it under two different headings. First of all, we consider how we could improve the specification of our model as a representation of the Irish economy. Second, we consider the whole methodology of policy evaluation and possible shortcomings of the Blinder-Goldfeld approach.

Model Specification

The results of the dynamic simulations and multiplier calculations presented in Chapter 3 suggest that while our model is a good representation of major relations in the Irish economy, it is far from being perfect. In con-

sidering possible improvements to the model we will go through it block by block as outlined in Chapter 2 and Appendix 2.

In the industry sector we have reservations about the concept of capacity output and its determination. Capacity output is an elusive concept and we measure it rather crudely using a linked-peaks approach (see Bradley and Fanning, 1984, Chapter 3). Capacity output thus defined is specified as being determined by expected "world" GDP and expected competitiveness. This specification may underestimate the obviously very important role played by the IDA in the development of industrial capacity in Ireland and the role of other elements of the Public Capital Programme in providing new infrastructure. The restrictive nature of the two factor (KL) CES putty-putty technology is also undesirable but was forced on us by the difficulties we experienced in trying to operationalise more flexible specifications. While a four factor (KLEM) putty-clay technology might seem more attractive, our experience with the HERMES project leaves us sceptical about the feasibility of operationalising such a specification (see, for example, Bradley and Wynne, 1983 and Wynne, 1984).

The key weakness in the agriculture sector lies in our inability to implement any form of consistent technological relationship between output and factor inputs. We measure capacity (gross) output using a moving average of actual output. Material inputs as a fraction of output are determined solely by a time trend: a relationship such as this may track well within sample but will invariably cause problems when out of sample forecasting is attempted. Ideally we would like a situation where the inputs of labour, capital and materials were determined in a manner consistent with the determination of agricultural output on the basis of some assumption (such as cost minimisation or profit maximisation) about farmers' behaviour. Indeed, before such a system could be implemented in a model it might be necessary to break agricultural enterprises down into two or more groups, such as commercial and subsistence, and posit different behavioural assumptions for each. In addition, output may need to be disaggregated into its main components.

In the model we have attempted to decompose service sector activities into market and non-market components. This breakdown is, of necessity, very crude, due to the poor quality of the data available on this sector. Further advances here must await new and better data. It is difficult to know to what extent it is reasonable to hope for improvements in our modelling of the behaviour of public administration, given that the decision processes are very different to those normally looked at by economists (Delorme, 1984).

As regards improving the equations in the absorption block of the model there are two immediate issues which we must tackle. First of all, the deter-

mination of imports of industrial materials for further production as a residual item to ensure balance between output and expenditure means that the resultant series picks up all of the errors in the other absorption and supply block equations. One could consider trying to model such imports explicitly as part of the firm's decision process. But if we are to determine all of the components of output and expenditure by behavioural equations we must abandon any hope of ensuring that the national income identity of output and expenditure will hold. The price paid for obtaining exact equality is the residual determination of at least one variable on either the output or the expenditure side.

Second, the equation determining non-agricultural exports in the standard model is in essence a hybrid equation with industrial exports determined by world income and competitiveness. The statistical fit was not particularly good. In future work we would hope to develop a better equation that takes more account of explicit supply constraints.

The main problems in the modelling of the income distribution block come from our inadequate treatment of the monetary sector. In particular, we are dissatisfied with the way in which the relationship between the size of the national debt and the interest payments thereon is dealt with in the model. One of the shortcomings of the analysis in the previous chapters stems from the fact that in the model interest payments on the foreign debt were determined as if all foreign bonds were perpetuities, with the amount of net foreign borrowing endogenously determined as the component of the budget deficit remaining after the take-up of debt by domestic agents. While this does not create problems for the within-sample tracking performance of the model, it does have implications for the multiplier calculations and the policy analysis for which the model is used. Although domestic debt interest payments are formally endogenous to the model, the manner in which they are endogenised by relating them to two other exogenous variables leaves a lot to be desired. More research is required in this area if we are to improve on these rather crude representations. Such research might be undertaken as part of a larger project aimed at modelling the way in which the financial sector interacts with the real economy in Ireland.

The Methodology of Policy Evaluation

In evaluating fiscal policy in Ireland we used a methodology that was explicitly model-based. This means that using the same methodology with different models could possibly give different inferences about the effect of fiscal policy. Only if the model being used is a good representation of the economy being examined can we have any confidence in the results of such an analysis. Thus, to the extent that the model we used is imperfect in cap-

turing important interactions in the Irish economy the results of the analysis of fiscal policy in Chapter 5 must be interpreted with caution. We would want to repeat our calculations, either with an improved version of the present model or else with a different model, in order to increase confidence in the answers we obtained.

The second source of errors in the analysis is in the Blinder-Goldfeld methodology itself. Perhaps the key assumption underlying their approach is that of independence of policies. This assumption has two dimensions to it. First, it is assumed that policy actions in any given year are all strictly independent of one another. However, one can easily conceive of situations where a decision by the government to undertake some particular policy change necessitated a variety of other concomitant changes in policy. Second, temporal independence of policy actions is assumed also. Again it is not difficult to imagine a situation in which a government might decide to increase expenditure this year with the intention of raising taxes the following year. The extent to which this assumption is violated in any particular application of the Blinder-Goldfeld methodology largely depends on how well the model being used captures adequately the features of the decision-making processes of the fiscal authorities. This issue ties in with the question about whether one should look at changes in nominal or real instruments. By looking at changes in nominal instruments we implicitly assume that the government has absolute discretion about whether to hold certain items of, say, expenditure fixed in the face of high inflation. By doing so they would exert a deflationary pressure on the economy and in reality they may in some sense feel "obliged" to increase such expenditure in line with inflation. By looking at instruments in real terms we go some way towards capturing this phenomenon but at the price of classifying a decision to index fully in line with inflation as no change in policy. Our use of real instruments is no more than a very crude way of modelling the response of the fiscal authorities to inflation. What is really needed is better modelling of the behaviour of the fiscal authorities that endogenised most, if not all, components of taxation and expenditure by allowing them to respond to *expected* (rather than actual) inflation.

Finally, mention must be made of the Lucas critique of econometric policy evaluation as a possible source of error in our analysis. There is little to be added at this stage to our discussion of this point in Chapter 1, except perhaps to note that it can only undermine our analysis of fiscal policy if it can be shown that the parameters of the behavioural equations of our model are not invariant with respect to the type of policy changes being considered. How one might go about establishing such invariance is no simple matter and is an area of active research in macroeconomics.

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APPENDIX 1

MODEL VARIABLE DEFINITIONS

Exogenous Variables Listed by Main Category

(i)   Taxation Instruments
(ii)   Expenditure Instruments
(iii)   Other Fiscal Variables
(iv)   Financial and Monetary Variables
(v)   Agricultural Variables
(vi)   European Economic Community Variables
(vii)   World Variables
(viii) Other Exogenous Variables

Endogenous Variables Listed in Alphabetical Order

(i) Taxation Instruments: *Endogenous Variables Listed by Main Category*

GREVK	:	Total revenue on capital account (£m)
SOCR	:	Implicit average social insurance contribution rate
TAGLEV	:	Revenue from agricultural levies (£m)
TAU	:	Effective corporate tax rate
TAVR	:	Effective VAT rate
TCARR	:	Motor vehicle road tax rate
TCDR	:	Implicit rate of customs duty
TEDR	:	Rate of excise duty on alcohol, petrol, etc.
THE	:	Rate of initial depreciation allowances on capital goods
TIOR	:	Implicit rate of indirect taxation on residual category
TRATE	:	Revenue from property taxes (£m)
TYA	:	Revenue from taxes on agricultural incomes (£m)
TYRA	:	Implicit average rate of direct taxation
TYW	:	Revenue from wealth taxes
YGI	:	Government trading and investment income (£m)

(ii) Expenditure Instruments:

CGOV	:	Government current expenditure on goods and services, excluding the public administration wage bill (£m)
GEXPKO	:	Residual capital expenditure category (£m)
IFGOV	:	Other public sector direct fixed investment expenditure (£m)
IFGV	:	Fixed investment by public administration sector (£m)
IHGV	:	Public authorities housing investment expenditures (£m)
LPA	:	Employment in public administration and defence ('000)
LSNM	:	Employment in non-marketed services sector ('000)
SUBCR	:	Implicit rate of subsidy on private consumption
SUBO	:	Residual category of subsidies (£m)
TRKH	:	Capital transfers to households for housing purposes (£m)
TRKI	:	Capital transfers to industry (£m)
TRPO	:	Residual category of personal transfers (£m)
TRUR	:	Unemployment transfer payment rate

(iii) Other Fiscal Variables:

DUMED	:	Dummy variable for state secondary education scheme
WK1	:	Proportion of social insurance contributions paid by employers
WL1	:	Proportion of road tax duties paid by company sector

(iv) Financial and Monetary Variables:

DC	:	Private sector domestic credit (£m)
FGN	:	Government net capital receipts from abroad (£m)
FSPFN	:	Private international capital transfers (£m)
FXA	:	£ Irish/£ US exchange rate
NFLB	:	Net foreign liabilities of commercial banks (£m)
ONLB	:	Other net domestic liabilities of the banking system (£m)
RD	:	Ordinary deposit rate of interest
RF	:	Rate of interest on new foreign borrowing
RFGL	:	Average rate of interest on foreign loans outstanding
RGL	:	Rate of interest on national loans
RPL	:	Prime lending interest rate
SECBG	:	Banking sector lending to government (£m)
SECCBG	:	Central Bank lending to government (£m)
SECGNL	:	National Loans outstanding (£m)
SECHGDL	:	Change in private non-bank holdings of government debt (£m)
SECHGO	:	Residual category of government borrowing from private non-bank sector (£m)
SECTF	:	Stock of foreign debt outstanding (derived) (£m)
TRCFG	:	Government current transfers abroad (£m)
TRCGF	:	Government current receipts from abroad (£m)
TRDIF	:	Debt interest payments on foreign borrowing (£m)
YFNPER	:	Net factor income from abroad, excluding foreign debt interest on government borrowings (£m)

(v) Agricultural Variables :

IIA	:	Agricultural stock changes (£m, 75)
IIAV	:	Agricultural stock changes (£m)
OFF	:	Value-added in forestry and fishing (£m, 75)
OFFV	:	Value-added in forestry and fishing (£m)
PQA	:	Price of gross agricultural output
PXA	:	Price of agricultural exports
WEATH3	:	Index of weather (degree-days above 6°C)

(vi) European Economic Community Variables:

ECBUD	:	Irish EEC budget contribution (£m)
IIEC	:	Intervention stock changes (£m, 75)
IIECV	:	Intervention stock changes (£m)

SUBEC	:	Subsidies from the EEC (£m)
TMCA	:	Monetary compensation amounts (£m)
TREC	:	Transfers from the EEC (£m)
YASAEC	:	Adjustment for intervention stock appreciation (£m)

(vii) World Variables:

PMG	:	Price of imports of goods
PMMFPA	:	Price of imports of agricultural raw materials
PMS	:	Price of imports of services
PWORLD	:	Trade-weighted price of world exports of manufactured goods
URUK	:	Unemployment rate in the United Kingdom
WIRUK	:	Index of real industrial earnings in the United Kingdom
YWORLD	:	Trade-weighted index of real world GDP
UCLW	:	Trade-weighted index of world unit labour costs

(viii) Other Exogenous Variables:

D73M	:	Dummy variable to eliminate the year 1973
D74M	:	Dummy variable to eliminate the year 1974
D75	:	Dummy variable to eliminate the year 1975
T	:	Time index (1953=1)
W_i	:	Expectation weight (0.5 (i = 1), 0.25 (i = 2), 0.125 (i = 3)

Endogenous Variables Listed in Alphabetical Order

BPTV	:	Balance of trade surplus (£m)
BPV	:	Balance of payments surplus (£m)
BPVR	:	Balance of payments surplus as percent of GDP

CCAAFFV	:	Depreciation allowances in agricultural sector (£m)
CCAIV	:	Depreciation allowances in industry (£m)
CCASV	:	Depreciation allowances in services (£m)
CG	:	Public net current expenditure on goods and services (£m, 75)
CGO	:	CG, less public administration wage bill (£m, 75)
CGV	:	Public net current expenditure on goods and services (£m)
COI	:	Average unit factor costs in industry
COIL	:	Ratio of added-value deflator to unit labour costs in industry
COSML	:	Ratio of added-value deflator to unit labour costs in marketed services
CPER	:	Personal consumer expenditure (£m, 75)

CPERV	:	Personal consumer expenditure (£m)
CURI	:	Rate of industrial capacity utilisation in industry
ECOI	:	Expected value of the variable COI
ECOMP	:	Expected international competitiveness in industry
EDPR	:	Working age participation rate in full-time education
EGDAOI	:	Expected value of the variable GDAOI
EGSOSM	:	Expected value of the variable GSOSM
EOPRI	:	Expected value of the variable OPRI
EOPRS	:	Expected value of the variable OPRS
EPRX	:	Ratio of EPXNA and EUCLI, i.e., export profitability
EPSI	:	Rate of investment grants in industry
ERAW	:	Expected value of the variable RAW
ERFPI	:	Ratio of EWI and EUCCI, i.e., expected relative factor prices in industry
ERFPSM	:	Ratio of EWSM and EUCCS, i.e., expected relative factor prices in marketed services
EUCCI	:	Expected value of the variable UCCI
EUCCS	:	Expected value of the variable UCCS
EUCLI	:	Expected value of the variable UCLI
EWI	:	Expected value of the variable WI
EWSM	:	Expected value of the variable WSM
EYWORLD	:	Expected value of the variable YWORLD
FPN	:	Net capital inflow of the non-bank private sector
GBR	:	Public authorities borrowing requirement (£m)
GBRCR	:	Public authorities current borrowing requirement-GDP ratio
GBRR	:	Public authorities borrowing requirement-GDP ratio
GDA	:	Gross domestic absorption (£m, 75)
GDAOI	:	Gross domestic absorption of industrial output (£m, 75)
GDAV	:	Gross domestic absorption (£m)
GDE	:	Gross domestic expenditure (£m, 75)
GDEV	:	Gross domestic expenditure (£m)
GDGDPR	:	Public authorities debt-GDP ratio
GDPFC	:	Gross domestic product at factor cost (£m, 75)
GDPFCV	:	Gross domestic product at factor cost (£m)
GDPM	:	Gross domestic product at market prices (£m, 75)
GDPMDOT	:	Rate of change of GDPM (%)
GDPMV	:	Gross domestic product at market prices (£m)
GEXPC	:	Public authorities total current expenditure (£m)

GEXPK	:	Public authorities total capital expenditure (£m)
GEXPR	:	Public authorities expenditure-GDP ratio
GFD	:	Gross final demand (£m, 75)
GFDV	:	Gross final demand (£m)
GFX	:	Official external reserves (£m)
GFXR	:	Official external reserves-total imports ratio
GNP	:	Gross national product (£m, 75)
GNPV	:	Gross national product (£m)
GREVC	:	Public authorities total current revenue (£m)
GREVR	:	Public authorities total current revenue-GDP ratio
GSOI	:	Gross expenditure on industrial goods (£m, 75)
GSOSM	:	Gross expenditure on marketed services (£m, 75)
IFAFF	:	Fixed investment in agriculture (£m, 75)
IFAFFV	:	Fixed investment in agriculture (£m)
IFG	:	Fixed investment by public authorities (£m, 75)
IFI	:	Fixed investment by industry (£m, 75)
IFIV	:	Fixed investment by industry (£m)
IFS	:	Fixed investment by marketed and non-marketed services (£m, 75)
IFSM	:	Fixed investment by marketed services sector (£m, 75)
IFSV	:	Fixed investment by marketed and non-marketed services (£m)
IFT	:	Total fixed investment (£m, 75)
IFTNG	:	Total non-public administration fixed investment (£m, 75)
IFTV	:	Total fixed investment (£m)
IH	:	Total housing investment (£m, 75)
IHG	:	Public authorities housing investment (£m, 75)
IHP	:	Private housing investment (£m, 75)
IHPV	:	Private housing investment (£m)
IHV	:	Total housing investment (£m)
IINA	:	Non-agricultural stock changes (£m, 75)
IINAV	:	Non-agricultural stock changes (£m)
IIT	:	Total stock changes (£m, 75)
IITV	:	Total stock changes (£m)
KFAFF	:	Fixed capital stock in agriculture (£m, 75)
KFCIP	:	Full capacity capital stock in industry (£m, 75)
KFI	:	Fixed capital stock in industry (£m, 75)
KFSM	:	Fixed capital stock in marketed services (£m, 75)
KINA	:	Non-agricultural stock level (£m, 75)
KINAV	:	Non-agricultural stock level (£m)

L	:	Total numbers employed ('000)
LAFF	:	Numbers employed in agriculture, forestry and fishing ('000)
LBFGN	:	Public authorities net foreign borrowing (£m)
LCIP	:	Industrial employment at full capacity utilisation ('000)
LF	:	Total number in labour force ('000)
LFPR	:	Labour force participation rate
LI	:	Numbers employed in industry ('000)
LM	:	Numbers employed in marketed sector ('000)
LNA	:	Numbers employed in the non-agricultural sector ('000)
LNM	:	Numbers employed in non-marketed sector ('000)
LS	:	Numbers employed in non-public administration services ('000)
LSM	:	Numbers employed in marketed services sector ('000)
MAT	:	Material inputs in agriculture (£m, 75)
MATV	:	Material inputs in agriculture (£m)
MC	:	Imports of consumption goods (£m, 75)
MG	:	Total imports of goods (£m, 75)
MGS	:	Total imports of goods and services (£m, 75)
MGSV	:	Total imports of goods and services (£m)
MGV	:	Total imports of goods (£m)
MMFPA	:	Imports of agricultural raw materials (£m, 75)
MMFPI	:	Industrial materials imports for further production (£m, 75)
MMFPIV	:	Industrial materials imports for further production (£m)
MON	:	Broad money supply (£m)
MPCG	:	Imports of producers capital goods (£m, 75)
MS	:	Imports of services (£m, 75)
NDPFCV	:	Net domestic product at factor cost (£m)
NGE65	:	Population numbers aged 65+ ('000)
NLE14	:	Population numbers aged less than 15 years ('000)
NLF	:	Population of working age not in the labour force ('000)
NLFED	:	Population of working age in full-time education ('000)
NMA	:	Net migration abroad ('000)
NT	:	Total population ('000)
N1564	:	Population numbers aged between 15 and 64 years ('000)
N1564A	:	N1564 less NLFED ('000)
OA	:	Added value in agriculture (£m, 75)
OAFF	:	Added value in agriculture, forestry and fishing (£m, 75)
OAFFV	:	Added value in agriculture, forestry and fishing (£m)
OAV	:	Added value in agriculture (£m)

OCI	:	Capacity output in industry (£m, 75)
OI	:	Added value in industry (£m, 75)
OIV	:	Added value in industry (£m)
OPA	:	Added value in public administration (£m, 75)
OPAV	:	Added value in public administration (£m)
OPRI	:	Labour productivity in industry
OPRS	:	Labour productivity in services
OPRSM	:	Labour productivity in marketed services
OS	:	Added value in services (£m, 75)
OSM	:	Added value in marketed services (£m, 75)
OSMV	:	Added value in marketed services (£m)
OSNM	:	Added value in non-marketed services (£m, 75)
OSNMV	:	Added value in non-marketed services (£m)
OSV	:	Added value in services (£m)

PCGO	:	Deflator of the variable CGOV
PCPER	:	Deflator of the variable CPERV
PCPERDOT	:	Inflation rate of the variable PCPER
PGDE1	:	Deflator of the variable GDEV from expenditure side
PGDE2	:	Deflator of the variable GDEV from the output side
PGDPFC	:	Deflator of the variable GDPFCV
PGDPFCDT	:	Inflation rate of the variable PGDPFC
PGNP	:	Deflator of the variable GNPV
PIF	:	Deflator of total non-public administration investment
PIFAFF	:	Deflator of the variable IFAFFV
PIFG	:	Deflator of the variable IFGV
PIFI	:	Deflator of the variable IFIV
PIFS	:	Deflator of the variable IFSV
PIH	:	Deflator of the variable IHV
PIINA	:	Deflator of the variable IINAV
PKINA	:	Deflator of the variable KINAV
PMAT	:	Deflator of the variable MATV
PMGS	:	Deflator of the variable MGSV
POAFF	:	Deflator of the variable OAFFV
POI	:	Deflator of the variable OIV
POS	:	Deflator of the variable OSV
PQTI	:	Price of gross output of transportable goods industries
PSUBT	:	Deflator of the variable SUBT
PTET	:	Deflator of the variable TET
PXGS	:	Deflator of the variable XGSV
PXNA	:	Deflator of non-agricultural exports

PYAFS   : Deflator of the variable YAFS

QA   : Gross agricultural output (£m, 75)
QAV   : Gross agricultural output (£m)
QCA   : Capacity gross output in agriculture (£m, 75)
QDA   : Domestic absorption of gross agricultural output (£m, 75)

RATWI   : Real after tax annual earnings in industry (£'000, 75 pa)
RATWSM   : Real after tax annual earnings in marketed services
RAW   : Average agricultural earnings relative to non-agriculture
RE   : Employment rate in Ireland relative to UK
RETRAT   : Average retentions ratio from wages (%)
RW   : Real earnings rate in Ireland relative to the UK

SECTD   : Total public authorities domestic loans outstanding (£m)
SOC   : Total revenue from social security contributions (£m)
SOCE   : Employer's social security contributions (£m)
SOCP   : Employee's social security contributions (£m)
SUBC   : Subsidies on consumption (£m)
SUBRT   . Total subsidies (£m, 75)
SUBT   : Total subsidies (£m)

TAV   : Revenue from value added taxes (£m)
TAVB   : Tax base for value added taxes (£m, 75)
TCD   : Revenue from protective customs duties (£m)
TED   : Revenue from specific excise and customs duties (£m)
TEMVDC   : Portion of road tax of vehicles paid by company sector (£m)
TERT   : Total indirect tax revenue (£m, 75)
TET   : Total indirect tax revenue (£m)
TINC   : Average net indirect tax rate on consumption
TIO   : Revenue from residual category of indirect taxes (£m)
TMVD   : Total revenue from road taxation of vehicles (£m)
TOTRADE   : Overall terms of trade
TRDI   : Total public authorities debt interest payments (£m)
TRDID   : Public authorities debt interest on domestic debt (£m)
TRDIR   : Public authorities debt interest — GDP ratio
TRPT   : Total personal transfer payments (£m)
TRU   : Unemployment assistance and benefit transfers (£m)
TRUYW   : Pay-related unemployment transfers (£m)
TYC   : Revenue from company taxes (£m)
TYMVDP   : Portion of road tax on vehicles paid by household sector (£m)
TYPER   : Revenue from tax on personal non-agricultural incomes (£m)

TYT   : Total revenue from taxes on incomes (£m)
TYTOTR   : Total implicit average direct tax rate

U   : Total numbers unemployed ('000)
UCCAFF   : User cost of capital to agricultural sector
UCCI   : User cost of capital to industrial sector
UCCS   : User cost of capital to services sector
UCLI   : Unit labour costs in industry
UCLS   : Unit labour costs in services
UCLSM   : Unit labour costs in marketed services
UR   : Unemployment rate
URNAT   : Trend unemployment rate

WAFFIMP   : Implicit average annual earnings in agriculture (£'000 pa)
WI   : Implicit average annual earnings in industry ('000 pa)
WIDOT   : Rate of inflation of the variable WI
WIRIR   : Real non-agricultural average annual earnings
WIRIRDOT   : Rate of inflation of the variable WIRIR
WNA   : Implicit average annual earnings in non-agriculture
WPA   : Implicit average annual earnings in public administration
WS   : Implicit average annual earnings in services
WSM   : Implicit average annual earnings in marketed services
WSMDOT   : Rate of inflation of the variable WSM
WSNM   : Implicit average annual earnings in non-marketed services

XA   : Total agricultural exports (£m, 75)
XGS   : Total exports of goods and services (£m, 75)
XGSV   : Total exports of goods and services (£m)
XNA   : Total non-agricultural exports (£m, 75)

Y   : Net national product at factor cost before adjustment for
                stock appreciation (£m)
YAFF   : Income in agriculture, forestry and fishing (£m)
YAFS   : Adjustment for financial services (£m)
YASA   : Adjustment for stock appreciation (£m)
YC   : Total non-agricultural profits (£m)
YCI   : Industrial profits (£m)
YCI75   : Industrial profits deflated by the investment price, PIFI
YCI75R   : Real industrial profits per unit of industrial capital stock
YCU   : Undistributed non-agricultural profits (£m)
YC75   : Total non-agricultural profits deflated by PIF
YFN   : Net factor income from abroad (minus indicates net outflow)
YP   : Private income (£m)

YPER	:	Personal income (£m)
YPERD	:	Personal disposable income (£m)
YPERT	:	Taxable income (£m)
YPO	:	Non-wage taxable income (£m)
YRAFS	:	Adjustment for financial services (£m, 75)
YRFN	:	Net factor income from abroad (£m, 75)
YRPERD	:	Personal disposable income (£m, 75)
YWI	:	Wage bill in the industrial sector (£m)
YWNA	:	Wage bill in the non-agricultural sector (£m)
YWPA	:	Wage bill in public administration (£m)
YWS	:	Wage bill in services (£m)
YWSM	:	Wage bill in marketed services (£m)
YWSNM	:	Wage bill in non-marketed services (£m)

APPENDIX 2

LISTING OF MODEL EQUATIONS

In this appendix we present a concise listing of all the equations in the model. For those equations estimated using time-series data, we present the estimated coefficients and a variety of diagnostic statistics. In all cases the estimation technique used was single equation ordinary least squares (OLS) except in the case of the joint factor demand system for industry and for marketed services, where full information maximum likelihood (FIML) was used. In cases where autocorrelation was seen as presenting a serious problem (DW less than d_L), the equation was re-estimated using generalised least squares (GLS) with the error term assumed to be a first order autoregressive process. In such cases the estimate of the autocorrelation coefficient (RHO) is presented with the estimation results.

In presenting the statistical results, the following notation is used:

(i) RSQ denotes the multiple correlation coefficient, corrected for degrees of freedom
(ii) DW denotes the first-order Durbin-Watson statistic
(iii) EST indicates the period of estimation
(iv) RHO gives the first-order autoregressive parameter
(v) The t-statistics are indicated in parentheses below the coefficients.

Descriptions of the variable mnemonics are contained in Appendix 1. This listing is intended only for reference purposes and should be read in conjunction with the economic description of the model. Full details of the computer data bank can be obtained on application to the authors.

THE SUPPLY BLOCK

Industry

Three versions of the equation for capacity output in industry (OCI) are provided:

(i) log OCI = 7.05 + 1.32 log EYWORLD - 1.22 log ECOMP + 0.04 T
                (36.7) (5.3)   (4.2)   (9.4)

RSQ = 0.993   DW = 1.79   EST = 1965- 80

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(ii) $\log OCI =$ $7.01 + (1.09 + 3.94 \, \Delta\log EGDAOI) \log EYWORLD$
           (39.5)   (4.2)   (1.8)

           $- 1.15 \log ECOMP + 0.04 \, T$
              (4.2)   (11.6)

     $RSQ = 0.995 \quad DW = 2.00 \quad EST = 1965\text{-}80$

(iii) $\log OCI = 2.15 + 1.992 \, [0.572 \log EYWORLD + (1 - 0.572)$
              (1.7)   (5.7)   (3.9)

           $\log EGDAOI] - 1.119 \log ECOMP$
                                    (2.4)

     $RSQ = 0.976 \quad DW = 1.48 \quad EST = 1965\text{-}80$

The assumption that the technology of the industry sector is of CES type gives the following long-run factor demand equations for capital (KFCIP) and labour (LCIP):

$$\log KFCIP = -(1/m\mu) \log a + (s(1-s)) \log (1-d) + (1/m\mu) \log OCI - lmk \, T$$
$$+ (s/(1-s)) \log [(d/(1-d))^s \, ERFPI^{(1-s)} \exp\{(s-1)(lml\text{-}lmk)T\} + 1]$$

$$\log LCIP \;\; = -(1/m\mu) \log a + (s/(1-s)) \log d + (1/m\mu) \log OCI - lmk \, T$$
$$+ (s/(1-s)) \log [(d/(1-d))^s \, ERFPI^{-(1-s)} \exp\{-(s-1)(lml\text{-}lmk)T\} + 1]$$

Estimation by FIML yielded the following production functions parameters:

	Parameter Interpretation	IRS	CRS
a	Scale/Efficiency parameter	1.5536	1.5536
mu	Returns to scale parameter	1.3	1.0
s	Elasticity of substitution	0.2926	0.2926
d	Labour intensity parameter	0.7745	0.7745
lmk	Capital saving rate of technical change	- 0.0562	- 0.0447
lml	Labour saving rate of technical change	0.0251	0.0367

These long-run factor demand equations are translated into actual factor demand equations by means of error-correction mechanisms (ECM):

$$\Delta\log KFI = a_1 \, \Delta\log KFCIP + a_2 \log (KFCIP/KFI_{-1})$$
$$+ a_3 \, (a_1 \log CURI + (a_2 - a_1) \log CURI_{-1})$$

$$\Delta\log LI \;\; = b_1 \Delta\log LCIP + b_2 \log (LCIP/LI_{-1})$$
$$+ b_3 \, (b_1 \log CURI + (b_2 - b_1) \log CURI_{-1})$$

CRS: a_1 = 0.668 (8.8) b_1 = 0.395 (2.9)
     a_2 = 0.553 (4.1) b_2 = 0.646 (4.1)
     a_3 = 0.117 (0.5) b_3 = 0.851 (4.3)
     RSQ = negative   RSQ = 0.543
     DW = 1.73   DW = 1.89

IRS: a_1 = 0.678 (9.6) b_1 = 0.349 (2.3)
     a_2 = 0.582 (4.4) b_2 = 0.766 (4.6)
     a_3 = 0.118 (0.6) b_3 = 0.803 (5.0)
     RSQ = negative   RSQ = 0.609
     DW = 1.83   DW = 1.91

$IFI = KFI - (1 - 0.05) KFI_{-1}$

Industrial capacity utilisation is determined as a function of sales-capacity disequilbrium and of short-run profitability.

$\log CURI = -0.157 + 0.615 \log (GSOI/OCI) + 0.270 \log COIL$
                (12.4)   (18.7)   (7.4)

RSQ = 0.950   DW = 2.51   RHO = -0.69   EST = 1965-80

$OI = CURI * OCI$
$OIV = POI * OI$
$UCCI = PIFI * (0.02*(1 - TAU*THE - EPSI) + 0.05)/(1 - TAU)$
$EPSI = TRKI / IFIV$
$EWI = w_1 * WI_{-1} + w_2 * WI_{-2} + w_3 * WI_{-3} + (1 - w_1 - w_2 - w_3) * WI_{-4}$
$EUCCI = w_1 * UCCI_{-1} + w_2 * UCCI_{-2} + w_3 * UCCI_{-3} + (1 - w_1 - w_2 - w_3) * UCCI_{-4}$
$ERFPI = EWI / EUCCI$
$YWI = LI * WI$
$YCI = OIV - YWI - CCAIV$
$YCI75 = YCI / PIFI$
$YCI75R = YCI75 / KFI$
$UCLI = WI / OPRI$
$EUCLI = w_1 * UCLI_{-1} + w_2 * UCLI_{-2} + w_3 * UCLI_{-3} + (1 - w_1 - w_2 - w_3) * UCLI_{-4}$
$OPRI = OI / LI$
$EOPRI = w_1 * OPRI_{-1} + w_2 * OPRI_{-2} + w_3 * OPRI_{-3} + (1 - w_1 - w_2 - w_3) * OPRI_{-4}$
$COI = (LI * WI + UCCI * KFI) / OI$
$ECOI = w_1 * COI_{-1} + w_2 * COI_{-2} + w_3 * COI_{-3} + (1 - w_1 - w_2 - w_3) * COI_{-4}$

$COIL = POI / UCLI$

$\text{Log CCAIV} = -0.900 + 0.717 \log (\text{PIFI} * \text{KFI}_{-1})$
$\qquad\qquad\qquad (2.5) \quad (13.9)$

$\text{RSQ} = 0.910 \quad \text{DW} = 1.53 \quad \text{RHO} = 0.794 \quad \text{EST} = 1961\text{-}80$

$\text{ECOMP} = w_1^* \text{ COMP}_{-1} + w_2^* \text{ COMP}_{-2} + w_3^* \text{ COMP}_{-3} + (1 - w_1 - w_2 - w_3)^* \text{ COMP}_{-4}$

Agriculture, Forestry and Fishing

Agricultural capacity output is derived as a five year moving average of actual output.

$\text{QCA} = (\text{QA}_{-1} + \text{QA}_{-2} + \text{QA}_{-3} + \text{QA}_{-4} + \text{QA}_{-5}) * 1.11753 / 5.$

Actual agricultural output is determined by capacity output, but is modified by profitability and the weather conditions.

$\text{QA} = 211.1 + [0.00215 \text{ WEATH3} + 0.340 (\text{PQA}/\text{PMAT}_{-1})] \text{ QCA}$
$\qquad (4.4) \quad\;\; (3.5) \qquad\qquad\qquad (4.3)$

$\text{RSQ} = 0.893 \quad \text{DW} = 209 \quad \text{EST} = 1962\text{-}80$

The materials/output ratio is determined simply as a time trend.

$\log (\text{MAT}/\text{QA}) = -1.362 + 0.027 \text{ T}$
$\qquad\qquad\qquad\quad (32.7) \quad (12.8)$

$\text{RSQ} = 0.895 \quad \text{DW} = 1.50 \quad \text{EST} = 1961\text{-}80$

$\text{OA} = \text{QA} - \text{MAT}$
$\text{OAFF} = \text{OA} + \text{OAFF}$
$\text{QAV} = \text{PQA} * \text{QA}$
$\text{MATV} = \text{PMAT} * \text{MAT}$
$\text{OAV} = \text{QAV} - \text{MATV}$
$\text{OAFFV} = \text{OAFF}* \text{ PQA}$

Employment in agriculture is a function of the relative agriculture/non-agriculture earnings, the overall national unemployment rate and a time trend (acting as a proxy for labour productivity or technical change).

$\log \text{LAFF} = 6.151 + 0.073 \log \text{ERAW} + 0.011 \log \text{UR} - 0.029 \text{ T}$
$\qquad\qquad (127.0) \quad (1.8) \qquad\qquad (0.5) \qquad\qquad (14.3)$

$\text{RSQ} = 0.930 \quad \text{DW} = 1.48 \quad \text{RHO} = 0.898 \quad \text{EST} = 1963\text{-}80$

$\text{ERAW} = (\text{RAW}_{-1} + \text{RAW}_{-2})/2.$

The agricultural capital stock is a function of output (added-value) and the real cost of capital. The relationship displays great inertia.

$$\log KFAFF = -0.563 + 0.162 \log (OAFF_{-1} + OAFF_{-2})/2$$
$$\qquad\qquad (2.1) \qquad (2.6)$$
$$\qquad\qquad -0.057 \log (UCCAFF/POAFF) + 0.924 \log KFAFF_{-1}$$
$$\qquad\qquad (2.6) \qquad\qquad\qquad\qquad\qquad (43.0)$$

$RSQ = 0.998 \quad DW = 1.72 \quad RHO = 0.656 \quad EST = 1963\text{-}80$

$UCCAFF = PIFAFF * (0.02 + 0.05)$
$YAFF = OAFFV - CCAAFFV$
$WAFFIMP = YAFF / LAFF$
$RAW = WAFFIMP / WNA$
$IFAFF = KFAFF - (1.0 - 0.05) * KFAFF_{-1}$

The fraction of total agricultural output which is absorbed domestically is very stable and trending downwards slowly.

$$QDA / QA = 0.565 - 0.010 \, T$$
$$\qquad\qquad (36.1) \quad (12.1)$$

$RSQ = 0.884 \quad DW = 2.15 \quad EST = 1961\text{-}80$

$XA = QA - QDA - IIA - IIEC$

$$\log CCAAFFV = -2.52 + 0.957 \log (PIFAFF * KFAFF)_{-1}$$
$$\qquad\qquad\qquad (8.1) \quad (20.5)$$

$RSQ = 0.957 \quad DW = 1.16 \quad RHO = 0.944 \quad EST = 1961\text{-}80$

Services Sector

(i) Marketed Services:

Two versions of the equation determining marketed services output are provided. The key explanatory variable is a weighted measure of gross sales, where the weights reflect the services output content of each component of sales.

(i) $\log OSM = 0.709 + 0.873 \log EGSOSM + 0.313 \log COSML$
$$\qquad\qquad (2.6) \quad (27.6) \qquad\qquad (1.9)$$

$\qquad RSQ = 0.982 \quad DW = 1.66 \quad EST = 1965\text{-}80$

(ii) $\log OSM = 1.091 + 0.850 \log EGSOSM$
$$\qquad\qquad (4.0) \quad (21.3)$$

$\qquad RSQ = 0.968 \quad DW = 1.74 \quad RHO = 0.274 \quad EST = 1965\text{-}80$

The technology of the marketed services sector is of generalised Leontief form, with the factor demand equations estimated using FIML.

$KFSM / OSM = -2.18 + 1.045\ ERFPSM^{0.5} - 0.053\ T$
$\qquad\qquad\quad (3.1)\quad (3.7)\qquad\qquad (1.9)$

$RSQ = 0.982\quad DW = 0.530\quad EST = 1965\text{-}80$

$LSM / OSM = 0.202 + 1.045\ ERFPSM^{-0.5} - 0.005\ T$
$\qquad\qquad\quad (2.2)\quad (3.7)\qquad\qquad (3.3)$

$RSQ = 0.947\quad DW = 0.96\quad EST = 1965\text{-}80$

$UCCS = PIFS * (0.02 + 0.05)$
$EUCCS = w_1^*\ UCCS_{-1} + w_2^*\ UCCS_{-2} + w_3^*\ UCCS_{-3} + (1 - w_1 - w_2 - w_3)^*\ UCCS_{-4}$
$EWSM = w_1^*\ WSM_{-1} + w_2^*\ WSM_{-2} + w_3^*\ WSM_{-3} + (1 - w_1 - w_2 - w_3)^*\ WSM_{-4}$
$ERFPSM = EWSM / EUCCS$
$OSMV = POS * OSM$
$YWSM = LSM * WSM$
$UCLSM = WSM / OPRSM$
$COSML = POS / UCLSM$
$OPRSM = OSM / LSM$
$IFSM = KFSM - (1.0 - 0.05) * KFSM$

Non-marketed services output is determined by labour inputs with a small correction for the trending "quality" of labour.

$\log (OSNM / LSNM) = 1.05 + 0.0087\ T$
$\qquad\qquad\qquad\qquad (16.2)\ (2.8)$

$RSQ = 0.294\quad DW = 1.60\quad RHO = 0.500\quad EST = 1964\text{-}80$

$\log YWSM = 0.719 + 0.880\ \log CGOV$
$\qquad\qquad\quad (11.0)\quad (76.5)$

$RSQ = 0.997\ DW = 1.75\ EST = 1965\text{-}80$

$LSNM = YWSNM / WSNM$
$OSNMV = YWSNM$

$\log OPA = 1.214 + 1.011\ \log LPA + 0.004\ T$
$\qquad\qquad (3.9)\quad (10.7)\qquad\qquad (1.1)$

$RSQ = 0.994\quad DW = 1.39\quad EST = 1961\text{-}80$

$YWPA = OLA * WPA$
$OPAV = YWPA$

LS = LSM + LSNM
IFS = IFSM + IFGOV / PIFS
OS = OSM + OSNM
OSV = POS * OS
YWS = YWMSM + YWSNM
UCLS = WS / OPRS
OPRS = OS / LS

$$EOPRS = w_1^* \ OPRS_{-1} + w_2^* \ OPRS_{-2} + w_3^* \ OPRS_{-3} + (1 - w_1 - w_2 - w_3)^* \ OPRS_{-4}$$

$$\log CCASV = -1.770 + 0.914 \log (PIFS * KFS_{-1})$$
$$\quad\quad\quad\quad (7.5) \quad (26.9)$$

RSQ = 0.974   DW = 1.85   RHO = 0.760   EST = 1961-80

Imports and the Balance of Payments

Imports of producers capital goods are determined by total fixed investment and the rate of industrial capacity utilisation.

$$\log MPCG = -2.370 + 1.222 \log IFT + 0.576 \log CURI$$
$$\quad\quad\quad\quad (11.9) \quad (38.8) \quad\quad\quad (1.4)$$

RSQ = 0.988   DW = 1.74   EST = 1961-80

Imports of consumption goods are determined by total personal consumption (with an imposed unitary elasticity), a relative price term, a time trend to capture the rising average import propensity and dummy variables to eliminate the years 1973-1975.

$$\log (MC/CPER) = -2.57 + 0.039 \ T - 0.607 \log (PMG/PQTI) - 0.180 \ D73M$$
$$\quad\quad\quad\quad (20.7) \ (6.7) \quad (1.5) \quad\quad\quad\quad\quad\quad (3.0)$$
$$\quad\quad\quad\quad -0.209 \ D74M - 0.173 \ D75$$
$$\quad\quad\quad\quad (3.3) \quad\quad\quad (3.2)$$

RSQ = 0.789   DW = 1.68   RHO = 0.617   EST = 1965-80

Imports of agricultural raw materials are determined by agricultural output (with an imposed unitary elasticity), relative prices and a time trend.

$$\log (MMFPA/QA) = -3.137 + 0.036 \ T - 0.488 \log (PMMFPA/PQA)$$
$$\quad\quad\quad\quad (16.8) \quad (4.3) \quad\quad (2.0)$$

RSQ = 0.523   DW = 1.96   EST = 1965-80

Imports of materials for further production in industry are derived residually from the output-expenditure identity.

MMFPI = CPER + CG + IH + IFT + IIT + XGS - GDPM

            - (MPCG + MC + MMFPA + MS) - STATDIS

MMFPIV = PMG * MMFPI

Total imports of services are determined by total GDP.

log MS = - 1.856 + 0.428 log GDPFC + 0.688 log MS$_{-1}$
            (1.6)   (1.8)   (4.3)

RSQ = 0.942   DW = 1.74   EST = 1962-80

MG = MPCG + MC + MMFPA + MMFPI
MGV = PMG * MG
MGS = MG + MS
MGSV = PMG * MG + PMS * MS
PMGS = MGSV / MGS
TOTRADE = PXGS / PMGS
YFN = YFNPER - TRDIF
YRFN = YFN / PMGS
BPTV = XGSV - MGSV
MPV = BPTV + YFN + FSPFN + TREC + (TRCGF + TRCFG)
BPVR = 100 * (BPV / GDPMV)

Labour Supply and Demography

Total population and the population in the three age groupings are determined in terms of a "natural" growth rate and a migration leakage.

ΔNT + NMA = 0.011 NT$_{-1}$
                    (16.5)

RSQ = 0.195   DW = 2.04   EST = 1962-80

ΔNLE14 = 0.009 NLE14 - 0.212 NMA
                    (14.2)   (4.9)

RSQ = 0.603   DW = 2.64   EST = 1962-80

ΔN1564 = 0.012 N1564 - 0.665 NMA
                    (14.5)   (6.3)

RSQ = 0.734   DW = 1.48   EST = 1962-80

NGE65 = NT - (NLE14 + N1564)

The participation rate in full time education by the working age population is trended and has a policy dummy variable.

$\log$ EDPR = 1.108 + 0.114 DUMED + 0.035 T
                (9.2)   (1.8)   (6.0)

RSQ = 0.800   DW = 0.97   RHO = 0.064   EST = 1961-80

NLFED = EDPR * N1564 / 100
N1564A = N1564 - NLFED

The labour force participation rate is a function of the unemployment rate.

$\log$ LFPR = 4.241 - 0.015 $\log$ UR
                (518)   (3.0)

RSQ = 0.349   DW = 1.60   RHO = 0.818   EST = 1961-80

LF = LFPR * N1564A / 100
NLF = N1564 - LF
L = LI + LAFF + LS + LPA
LNA = LI + LS + LPA
U = LF - L
UR = 100 * (U / LF)
URNAT = $(\text{UR} + \text{UR}_{-1} + \text{UR}_{-2} + \text{UR}_{-3})$ / 4.0

Net migration abroad is a function of the relative attractiveness of the UK labour market and the domestic market.

NMA = -189.5 + $(0.166 - 0.056 \text{ RE}_{-1} * \text{RW}_{-1})$ * $(\text{N1564A} + \text{N1564A}_{-1})$ / 2.0
            (2.5)   (2.5)   (2.3)

RSQ = 0.764   DW = 2.58   EST = 1963-80

RE = (1.0 - UR/100) / (1.0 - URUK/100)
RW = WIRIR / WIRUK

THE ABSORPTION BLOCK

Personal consumption is a function of real personal disposable income.

CPER / NT = 0.130 + 0.418 (YRPERD/NT) + 0.326 (CPER/NT_{-1}) - 0.052 D75
                (3.2)   (5.9)   (2.9)   (6.6)

RSQ = 0.941   DW = 1.78   RHO = 0.767   EST = 1962-80

CPERV = PCPER * CPER
CGV = OPAV + CGOV
CG = OPA + CGO
CGO = CGOV / PCGO

Private housing investment is a function of real personal disposable income, housing transfers and a real interest rate.

$$\log IHP = -11.8 + 2.00 \log YRPERD + 0.102 \log (TRKH/PIH)$$
$$\quad (6.5) \quad (11.1) \qquad\qquad (1.0)$$
$$\quad -0.258 \ [\log(RPL/100) - \log(PIH/PIH_{-1})]$$
$$\quad (1.4)$$

RSQ = 0.964   DW = 1.56   EST = 1962-80

IHPV = PIH * IHP
IHG = IHGV / PIH
IH = IHP + IHG
IHV = IHPV + IHGV
IFIV = PIFI * IFI
IFAFFV = PIFAFF * IFAFF
IFSV = PIFS * IFS
IFTNG = IFI + IFAFF + IFSM
IFG = IFGV / PIFG
IFT = IFI + IFAFF + IFS + IFG
IFTV = IFIV + IFAFFV + IFSV + IFGV

A simple partial adjustment model determines non-agricultural inventory changes.

$$IINA = 63.88 + 0.323 \ OI - 0.529 \ KINA_{-1}$$
$$\quad (2.7) \quad (4.2) \qquad (3.9)$$

RSQ = 0.56   DW = 2.30   EST = 1963-80

IINAV = PIINA * IINA
KINA = IINA + KINA$_{-1}$
KINAV = PKINA * KINA
IIT = IIA + IINA + IIEC
IITV = IIAV + IINAV + IIECV

Three variants of the non-agricultural exports equation are provided: the first is a pure supply equation and is driven by industrial capacity and profitability; the second has an added disequilibrium term in real world activity;

the third is a demand function.

(i) $\log (XNA/OCI) = -1.33 + 1.134 \log EPRX + 0.037\ T$
              (8.1)   (3.9)   (10.5)

      RSQ = 0.890   DW = 2.08   EST = 1965-80

(ii) $\log (XNA/OCI) = -1.48 + 0.838 \log (YWORLD/EYWORLD)$
                 (10.5) (2.9)

              $+ 1.183 \log EPRX + 0.039\ T$
                (5.0)   (12.1)

      RSQ = 0.930   DW = 1.77   EST = 1965-80

(iii) $\log XNA = 4.39 + 1.027 \log YWORLD + 1.403 \log EPRX + 0.072\ T$
              (43.3) (3.4)   (5.0)   (17.3)

      RSQ = 0.992   DW = 1.56   EST = 1965-80

$XGS = XNA + XA$

$XGSV = PXNA * XNA + PXA * XA$

$GDA = CPER + CG + IFT + IH + IIT - STATDIS$

$GDAV = CPERV + CGV + IFTV + IHV + IITV$

$GDAOI = 0.17216\ (CPER - STATDIS) + 0.09500\ CG + 0.61746\ IH$
         $+ 0.34626\ IFT + 0.25260\ IINA + 0.19890\ IIEC + 0.08091\ IIA$

$EGDAOI = w_1^* \ GDAOI_{-1} + w_2^* \ GDAOI_{-2} + w_3^* \ GDAOI_{-3} + (1 - w_1 - w_2 - w_3) *$
         $GDAOI_{-4}$

$GSOI = 0.17216\ (CPER - STATDIS) + 0.09500\ CG + 0.61746\ IH$
       $+ 0.34626\ IFT + 0.25260\ IINA + 0.19890\ IIEC + 0.08091\ IIA$
       $+ 0.31134\ XNA + 0.19890\ XA$

$GSOSM = 0.22065\ (CPER - STATDIS) + 0.07426\ CG + 0.09816\ IH$
        $+ 0.10731\ IFT + 0.25238\ IINA + 0.09639\ IIEC + 0.06764\ IIA$
        $+ 0.23223\ XNA + 0.09639\ XA$

$EGSOSM = w_1^* \ GSOSM_{-1} + w_2^* \ GSOSM_{-2} + w_3^* \ GSOSM_{-3} + (1 - w_1 - w_2 - w_3)*$
         $GSOSM_{-4}$

$GDE = CPER + CG + IFT + IH + IIT - STATDIS + XGS - MGS$

$GDEV = CPERV + CGV + IFTV + IHV + IITV + XGSV - MGSV$

$PGDE1 = GDEV / GDE$

$GFD = CPER + CG + IFT + IH + IIT - STATDIS + XGS$

$GFDV = CPERV + CGV + IFTV + IHV + IITV + XGSV$

$EYWORLD = w_1 * YWORLD_{-1} + w_2 * YWORLD_{-2} + w_3 * YWORLD_{-3}$
           $+ (1 - w_1 - w_2 - w_3) * YWORLD_{-4}$

THE INCOME DISTRIBUTION BLOCK

Three variants of the industrial added-value producer price equation are provided: the first is a markup model on domestic labour costs; the second relates industrial prices to world prices with a disequilibrium term in domestic labour costs; the third determines industrial prices simply as a function of world prices.

(i) $\log POI = 0.282 + 0.710 \log (WI/EOPRI) + (1 - 0.710) \log (WI/EOPRI_{-1})$
            (13.7)   (4.2)

    RSQ = 0.996   DW = 1.63   EST = 1965-80

(ii) $\log POI = 0.064 + 0.368 \log PWORLD + (1 - 0.368) \log PWORLD_{-1}$
                (3.6)   (2.5)
                + 0.560 $\Delta \log (UCLI/EUCLI)$
                   (2.7)

    RSQ = 0.994   DW = 1.50   EST = 1965-80

(iii) $\log POI = 0.066 + 0.387 \log PWORLD + (1 - 0.387) \log PWORLD_{-1}$
                (3.7)   (2.8)

    RSQ = 0.983   DW = 1.82   EST = 1963-80

The gross industrial output price is a function of the added-value component, import prices and agricultural prices.

$\log PQTI =$
$- 0.019 + 0.184 \log POI + 0.531 \log PMGS + (1 - 0.184 - 0.531) \log PQA$
  (4.8)   (4.1)   (11.6)

RSQ = 0.999   DW = 1.59   EST = 1961-80

Service sector output prices are a simple markup on domestic labour costs.
$\log POS = 0.483 + 0.627 \log (WS/EOPRS) + (1 - 0.627) \log (WS/EOPRS)_{-1}$
            (9.8)   (4.5)

RSQ = 0.995   DW = 1.75   RHO = 0.909   EST = 1965-80

The price of agricultural inputs are determined by industrial prices and agricultural output prices.

$\log PMAT = 0.003 + 0.942 \log PQTI + (1 - 0.942) \log PQA_{-1}$
              (0.4)   (13.3)

RSQ = 0.999   DW = 1.49   EST = 1962-80

POAFF = OAFFV / OAFF
PGDPFC = GDPFCV / GDPFC
$PGDPFCDT = 100 * (PGDPFC/PGDPFC_{-1} - 1.0)$

The common format for the main expenditure deflators is as follows:

$\log PEX = a_0 + a_1 \log PGDPFC + (1 - a_1) \log PMGS$

where PEX is a specific expenditure deflator, PGDPFC is the GDP deflator and PMGS is the deflator of total imports. The export price equation is included only as a comparison with the others, a different version being used in the model (see below).

Deflator	a_0	a_1	RSQ	DW	RHO	EST
PCPER/(1 + TINC)	- 0.117 (2.1)	0.704 (18.6)	0.988	1.65	0.979	1962-80
PCGO	- 0.030 (0.1)	0.900 (−)	0.958	1.09	1.000	1962-80
PIFI	0.054 (3.3)	0.534 (9.5)	0.992	1.50	0.799	1962-80
PIFS	0.034 (7.9)	0.588 (13.9)	0.999	1.10	−	1962-80
PIFAFF	0.010 (0.12)	0.554 (9.2)	0.976	1.80	0.976	1962-80
PIFG	- 0.025 (3.5)	0.754 (10.5)	0.998	1.66	−	1962-80
PIH	0.020 (0.002)	0.633 (5.5)	0.904	1.45	1.000	1962-80
PXNA	0.051 (0.001)	0.372 (5.4)	0.956	1.91	1.000	1962-80

PIF = (IFIV+IFAFFV+IFSV) / (IFI+IFAFF+IFS)

The export deflator used in the model is determined by world prices.

$\log PXNA = 0.093 + 0.661 \log PWORLD + (1 - 0.661) \log PWORLD_{-1}$
             (4.5)   (8.0)

RSQ = 0.987   DW = 1.82   RHO = 0.770   EST = 1963-80

PXGS = XGSV / XGS
$EPXNA = w_1 PXNA_{-1} + w_2 PXNA_{-2} + w_3 PXNA_{-3} + (1 - w_1 - w_2 - w_3) PXNA_{-4}$
EPRX = EPXNA / EUCLI

The non-agricultural stock change deflator is a function of the deflator of stock levels and of changes in import prices relative to industrial output prices.

log PIINA = 1.0 log [(PKINA + PKINA) / 2] + 0.501 log (PMG/PQTI)
$$(2.2)$$

RSQ = 0.993   DW = 2.32   EST = 1961-80

log PKINA = 0.076 + 0.366 log PGDPFC + (1 - 0.366) log PMGS
            (1.8)   (4.8)

RSQ = 0.970   DW = 1.98   RHO = 0.908   EST = 1961-80

The deflators of the adjustment for financial services, of total indirect taxes and of total subsidies, are related to the overall GDP deflator.

log PYAFS = - 0.062 + 1.0 log PGDPFC
            (0.90)

RSQ = 0.864   DW = 1.68   RHO = 0.601   EST = 1964-80

log PTET = 0.015 + 1.0 log PGDPFC
           (0.40)

RSQ = 0.948   DW = 1.46   RHO = 0.685   EST = 1964-80

log PSUBT = - 0.155 + 1.0 log PGDPFC
            (0.41)

RSQ = 0.699   DW = 1.49   RHO = 0.964   EST = 1964-80

Wage Determination

RATWI = WI * RETRAT / PCPER

A series of five possible target industrial wage rates are specified in terms of historical average values.

WIT1 = AVLSH1 * POI * OPRI / RETRAT   (AVLSH1 = 0.614)
WIT2 = AVLSH2 * POI * OPRI   (AVLSH2 = 0.725)
WIT3 = AVLSH3 * PCPER * OPRI / RETRAT   (AVLSH3 = 0.582)
WIT4 = AVLSH4 * PCPER * OPRI   (AVLSH4 = 0.688)
WIT5 = AVLSH5 * PCPER*OPRI / RETRAT**0.5   (AVLSH5 = 0.633)

Ten variants of the industrial wage equation are included. The general form of the wage equation is as follows:

$$\Delta \log WI = a_1 \Delta \log WITi + a_2 \log (WITi / WI_{-1}) + a_3 (UR - URNAT_{-1})$$

where WITi can take one of five possible forms and the last term represents the deviation of the unemployment rate from its trend value.

Target Wage	a_1	a_2	a_3	RSQ	DW	EST
1	0.914 (20.0)	0.482 (2.7)		0.678	1.58	1965-80
2	0.955 (20.9)	0.579 (3.4)	-0.0218 (2.1)	0.739	1.81	1965-80
3	1.000 (−)	0.247 (1.1)		0.609	1.70	1965-80
4	1.000 (−)	0.230 (1.1)	-0.0111 (1.0)	0.608	1.76	1965-80
5	0.937 (18.6)	0.523 (2.3)		0.621	1.71	1965-80
6	0.982 (18.8)	0.592 (2.8)	-0.0217 (1.9)	0.679	1.65	1965-80
7	1.000 (−)	0.205 (1.1)		0.653	1.87	1965-80
8	1.000 (−)	0.156 (0.9)	-0.0126 (1.2)	0.661	1.87	1965-80
9	1.003 (19.4)	0.604 (2.3)		0.667	1.69	1965-80
10	1.044 (19.4)	0.624 (2.5)	-0.0189 (1.7)	0.709	1.67	1965-80

$$WIDOT = 100 * (WI / WI_{-1} - 1.0)$$

The wage rate in marketed services is determined by the industrial wage rate.

$$\Delta \log WSM = 0.778 \Delta \log WI + 0.073 \log (WI / WSM_{-1})$$
$$(3.01) \qquad (0.9)$$

$$RSQ = 0.366 \quad DW = 2.07 \quad EST = 1965-80$$

$$RATWSM = WSM * RETRAT / PCPER$$
$$WSMDOT = 100 * (WSM / WSM_{-1} - 1.0)$$

WSNM = WPA
WS = YWS / LS

The wage rate in public administration is determined by the industrial wage rate. The dummy variables deal with the "bunching" of public sector pay awards.

Δlog WPA = 0.0027 + 1.0 Δlog WI + 0.046 WPADU − 0.068 WPADD
                     (0.5)   (4.3)   (7.3)

RSQ = 0.925   DW = 2.07   EST = 1964–80

WNA = YWNA / LNA
WIRIR = (WNA / PCPER)
WIRIRDOT = 100 * (WIRIR/WIRIR$_{-1}$ − 1.0)
COW = UCLW
ECOW = w_1^* COW$_{-1}$ + w_2^* COW$_{-2}$ + w_3^* COW$_{-3}$ + (1− w_1 − w_2 − w_3)* COW$_{-4}$
ECOMP = ECOI / ECOW

Fiscal Redistribution
   A series of four technical equations determine tax revenue from excise duties, value-added tax, a residual category and motor vehicle duties.

log TED = − 1.122 + 0.768 log TEDR + 0.884 log CPER + 0.332 log PCPER
                 (2.5)   (18.1)   (15.3)   (8.4)

RSQ = 0.999   DW = 1.37   EST = 1961-80

log TAV = − 2.560 + 1.086 log TAVR + 1.381 log TAVB
                 (0.5)   (7.7)   (2.3)
             +0.993 log (0.75 PCPER + 0.25 PCPER$_{-1}$)
             (8.3)

RSQ = 0.996   DW = 1.26   EST = 1964–80

TAVB = 0.75 * CPER + 0.25 * CPER$_{-1}$

log TIO = − 5.372 + 1.428 log TIOR + 1.078 log CPER + 1.016 log PCPER
                 (1.7)   (3.5)   (2.7)   (5.7)

RSQ = 0.984   DW = 1.40   EST = 1961-80

log TMVD = − 8.695 + 0.928 log TCARR + 1.533 log CPER
                   (7.3)   (12.0)   (9.8)

RSQ = 0.936   DW = 1.73   RHO = 0.644   EST = 1961-80

TCD = TCDR * MGSV
TEMVDC = TMVD - TYMVDP
TET = TED + TAV + TIO + TEMVDC + TCD + TRATE + TAGLEV + TMCA
TYPER = TYRA * YPERT
SOC = SOCR * YPERT
SOCE = WK1 * SOC
SOCP = SOC - SOCE
TYTOTR = TYRA + SOCR
RETRAT = 1 - TYTOTR

Company tax revenue is simply linked to total profits.

$\log$ TYC = - 1.135 + 0.836 $\log$ YC$_{-1}$
            (3.9)   (16.9)

RSQ = 0.940   DW = 2.18   RHO = 0.482   EST = 1962-80

TYMVDP = (1 - WL1) * TMVD
TYT = TYPER + SOC + TYC + TYMVDP + TYA
GREVC = TET + TYT + YGI + TRCGF + TYW
SUBC = SUBCR * CPER
SUBT = SUBC + SUBO + SUBEC

Expenditure on unemployment assistance and benefit is determined by a rate of benefit and the numbers unemployed.

$\log$ TRU = - 2.083 + 1.173 $\log$ TRUR + 0.690 $\log$ U
            (5.3)   (28.4)   (5.9)

RSQ = 0.998   DW = 1.57   EST = 1961-80

TRUYW = K2 * U * WNA$_{-1}$
TRPT = TRU + TRUYW + TRPO

Interest payments on national loans are determined by an interest rate and the change in loans outstanding.

ΔTRDID = 2.841 + 0.005 RGL * ΔSECGNL + 0.003 RGL$_{-1}$ * ΔSECGNL$_{-1}$
            (1.8)   (8.5)   (5.1)

RSQ = 0.965   DW = 2.77   EST = 1963-80

TRDI = TRDID + TRDIOD + TRDIF
GEXPC = CGV + (SUBT- SUBEC) + TRPT + TRDI + TRCFG + TMCA
            + ECBUD
GEXPK = IHGV + IFGV + IFGOV + TRKI + TRKH + GEXPKO

TINC = (TET - SUBT) / CPERV
GREVR = 100 * (GREVC + GREVK) / GDPMV
GEXPR = 100 * (GEXPC + GEXPK) / GDPMV
GBR = (GREVC - GEXPC) + (GREVK - GEXPK)
GBRR = 100 * (GBR / GDPMV)
GBRCR = 100 * (GREVC - GEXPC) / GDPMV
SECTD = SECGNL + SECOD
LBFGN = - GBR - ΔSECTD
TRDIFR = 100 * TRDIF / GDPMV
TRDIR = 100 * TRDI / GDPMV
GDGDPR = 100 * (SECTD + SECTF) / GDPMV

National Income Identities
GDPFC = OI + OAFF + OS + OPA - YRAFS
GDPFCV = OIV + OAFFV + OSV + OPAV - YAFS
YRAFS = YAFS / PYAFS
GDPMV = GDPFCV + (TET - SUBT)
PGDE2 = GDPMV / GDE
GDPM = GDPFC + (TERT - SUBRT)
TERT = TET / PTET
SUBRT = SUBT / PSUBT
GNPV = GDPMV + YFN
GNP = GDPM + YRFN
PGNP = GNPV / GNP
NDPFCV = GDPFCV - (CCAIV + CCAAFFV + CCASV)
Y = NDPFCV + YFN + YASA
YASA = ΔKINAV - IINAV + YASAEC
YP = Y - YGI + TRDI + TRPT + FSPFN
YPER = YP - YCU
YPERD = YPER - (TYPER + SOC + TYA + TYW + TYMVDP)
YRPERD = YPERD / PCPER
YC = NDPFCV - YAFF - YWNA + YASA + YAFS
YC75 = YC / PIF

Undistributed profits are a simple function of total profits.

YCU = 14.677 + 0.246 YC
      (2.4)   (28.6)

RSQ = 0.977   DW = 1.31   EST = 1961-80

$$YPERT = \begin{cases} YWNA + (YWPA_{-1} - YWPA) + YPO_{-1} - SOCE & : \text{pre-1974} \\ YWNA + YPO_{-1} - SOCE & : \text{post-1974} \end{cases}$$

$YPO = YC - YCU + YASA - YGI + TRDI + YFN - YAFS$

$YWNA = YWI + YWS + YWPA$

Monetary Sector

The demand for money is determined by GDP, the inflation rate and an interest rate differential term.

$$\log (MON / PGNP) = -1.313 + 1.121 \log GNP - 0.461 \log (PGNP/PGNP_{-1})$$
$$(2.0) \quad (13.5) \quad\quad\quad (1.5)$$
$$+ 0.033 \log (RD / RGL)$$
$$(1.0)$$

$RSQ = 0.968 \quad DW = 1.30 \quad EST = 1961\text{-}80$

$\Delta GFX = \Delta MON + \Delta ONLB - \Delta DC$

$GFXR = 100 * (GFX / MGSV)$

$FPN = \Delta GFX - BPV - \Delta NFLB - FGN - LBFGN$

$$YAFS = -32.282 + 0.037 \, GDPMV + 2.344 * (RPL - RD)$$
$$(3.0) \quad\quad (19.6) \quad\quad\quad (1.6)$$

$RSQ = 0.953 \quad DW = 1.32 \quad RHO = 0.714 \quad EST = 1961\text{-}80$

APPENDIX 3

A NOTE ON POLICY INDEXATION RULES

The purpose of this note is to examine some different approaches to the treatment of policy indexation. More specifically, we consider two types of indexation — first, where policy is indexed relative to some fixed base period, which we term "fixed base" indexation and second, where policy is indexed relative to the previous year's policy, which we call "floating base" indexation.

Let us assume that our model is of the following simple linear dynamic form:

$$y_t = \alpha + \beta x_t + \gamma y_{t-1} \tag{1}$$

where y_t is an endogenous variable and x_t refers to the single policy variable available. Over a particular time period, the policy variable will take on certain specific values $\{x_t, t = 0, 1 \ldots n\}$. We call this set of values "actual" policy. In carrying out counter-factual analysis such as analysing the effects of "neutral" fiscal policy, we are required to give hypothetical values to the policy variable, x_t, which corresponds to "neutral" fiscal policy, however defined.

If $\{y_t, t = 0, 1 \ldots n\}$ represents the solution of Equation (1) with actual policies and $(y'_t, t = 0, 1 \ldots n)$ refers to the solution of y_t where actual policies are replaced by whatever form of indexation is chosen, then $\{y_t - y'_t, t = 0, 1 \ldots n\}$ represents the extent to which y is affected by policy activism in the period in question.

One method of determining "neutral" or indexed policy is by using the following simple policy rule,

$$x'_s = \alpha^s x_0, s = 0, 1 \ldots n. \tag{2}$$

where α refers to a constant parameter which might represent a constant growth rate. This method of policy indexation implies that from a given base period value x_0, the policy variable is indexed by increasing x_0 in successive periods by $(\alpha-1)x_0$. In other words, policy is always changed by some proportion of the value of x_t in period 0, i.e., we use a fixed base method of policy indexation. This implies that if the authorities controlling the policy variable wish to follow a path of indexation by the above policy rule, then they must increase the policy variable by $(\alpha-1)$ times its value in some base period.

An alternative method of determining a "neutral" policy rule is to use the following:

$$x''_s = \alpha x_{s-1} \tag{3}$$

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This method of policy indexation implies that, if the policy variable is to be indexed in any given period s, the authorities should increase it by $(\alpha-1)$ times the value of x in the previous period, s- 1. Therefore, the authorities need not refer back to some previous base period on which to base neutral policies, but only need the policies of the previous year.

Let us now distinguish two methods of analysing fiscal policy over a number of time periods. One manner is to consider the aggregate effects of fiscal policy, implemented in previous years, on a given year. We call this approach "integral" fiscal policy analysis and it amounts to comparing actual x_t against neutral x_t defined from a base period for each time period regardless of actual policies in the intervening period. This rather vague description is clarified in Figure A3.1 below.

In time period s, actual policy is given by x_s and neutral policy by x'_s. Therefore, the extent to which policy was over-indexed, i.e., the extent to

Figure A3.1: *Integral fiscal policy indexation with a fixed base*
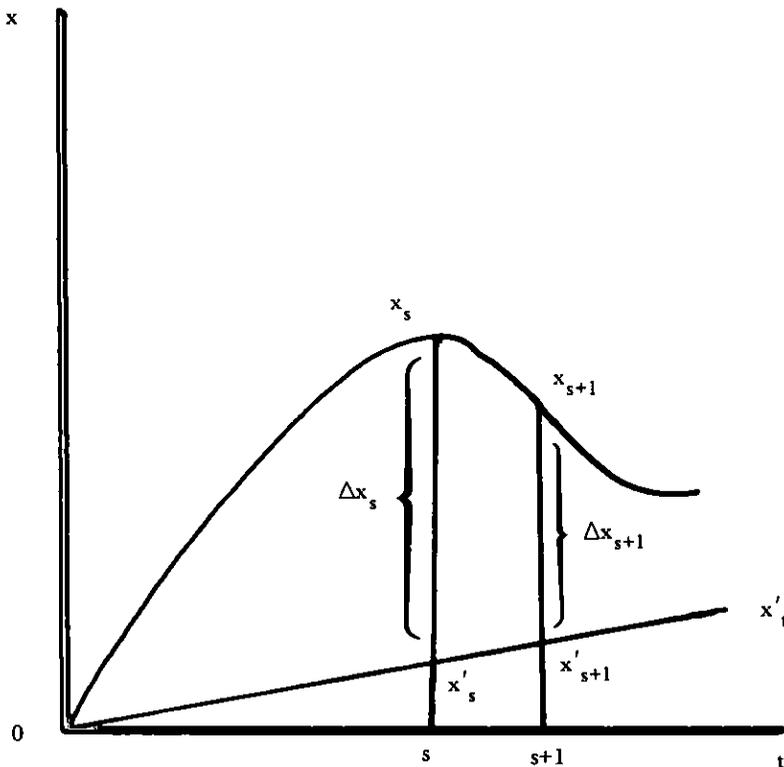
which actual policy exceeded neutral policy, is given by Δx_s. In period $s + 1$, policy activism under an integral fiscal measure is given by Δx_{s+1}, regardless of the fact that policy is over-indexed to a lesser extent than in the previous period, i.e., the position that it inherited from period s. In other words, no reference is made to the extent of policy non-indexation in previous periods.

It has become more realistic in recent times to take account of the position which has been inherited by an administration in period s, i.e., the value of x_t in period s- 1. This method of policy indexation supposes that government has less discretion than is assumed by the integral approach. This approach implies that all policies which have been previously implemented must be seen as permanent and indexation must be considered relative to the position inherited in the previous period. By such a mechanism we can isolate the effect of individual period's policy throughout the entire sample period. We term this approach "incremental" fiscal policy anaysis. Again we refer to graphical presentation in Figure A3.2.

Assume, for simplicity, that s is the first period so that there is no previous position inherited. Therefore, policy activism is given by Δx_s. Because this

Figure A3.2: *Incremental fiscal policy indexation with a fixed base*
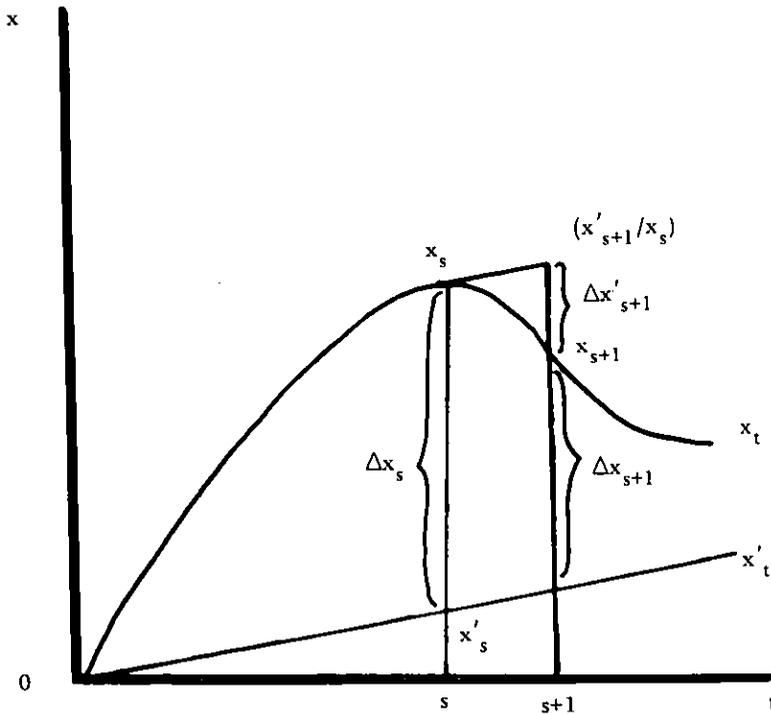
change is considered as permanent its effects must now be considered until the end of the sample. Therefore, the effects of this single period's policy can be determined by simulating the model with this value of policy activism, Δx_s, removed from all time periods from s until the end of the time period. In this way we can examine the effect of the policies of period s for all future time periods. Turning now to analysing the effects of policy in period s + 1, we must now take account of the level of policy in the previous period, x_s. Let us first assume that indexation has been determined from a fixed base. Therefore, the policy indexation is obtained by increasing the policy variable at period s by $(\alpha - 1)x_0$. This is given by the point $(x'_{s+1} x_s)$ which means indexed policy for period s + 1 using a fixed base *given* historical policies of time period s. (This contrasts with the previous integral policy analysis where no reference was made to the level of the policy variable in any previous periods except the base period). Therefore, policy activism for period s + 1 is given by $-\Delta x_{s+1}$. This value is again subtracted from actual policy (i.e., Δx_{s+1} is added) and the model simulated from periods s + 1 onwards in order to examine the effect of policy of year s + 1.

By carrying out this procedure for all time periods we can isolate the effects of the policies of all time periods for each subsequent period. An interesting question to ask is whether the effects of the individual period's policies can be meaningfully summed in order to obtain the aggregate effect of all policy changes from the base period to a given end period, and, if so, will it give identical results to the integral approach which does a similar calculation but more directly? It can be shown algebraically that results obtained from the "integral" approach are identical to those from the fixed base "incremental" approach for the simple model described by Equation (1). This result depends on the assumptions that the model is linear and that α is exogenous to the model, but not necessarily constant.

More generally, we can say that under the assumptions of linearity and exogeneity of α, the "integral" effect and the sum of the incremental effects will be identical for our model if the cumulative sum of $\Delta x'_i$, policy activism under incremental policy for period i, for all periods previous to i, is equal to Δx_i under the integral approach. This is the case in Figure A3.2 where $\Delta x_s - \Delta x'_{s+1}$ is equivalent to the extent to which policy is over-indexed under an integral approach, Δx_{s+1}.

Let us now consider the case where the base is allowed to "float" from one period to the next, where indexation is determined by the value of the policy variable in the immediately previous period. In this case, indexation implies increasing x_t by $(\alpha - 1)x_{t-1}$ rather than by $(\alpha - 1)x_0$. This situation is illustrated in Figure A3.3.

Figure A3.3: *Incremental fiscal policy indexation with a floating base*
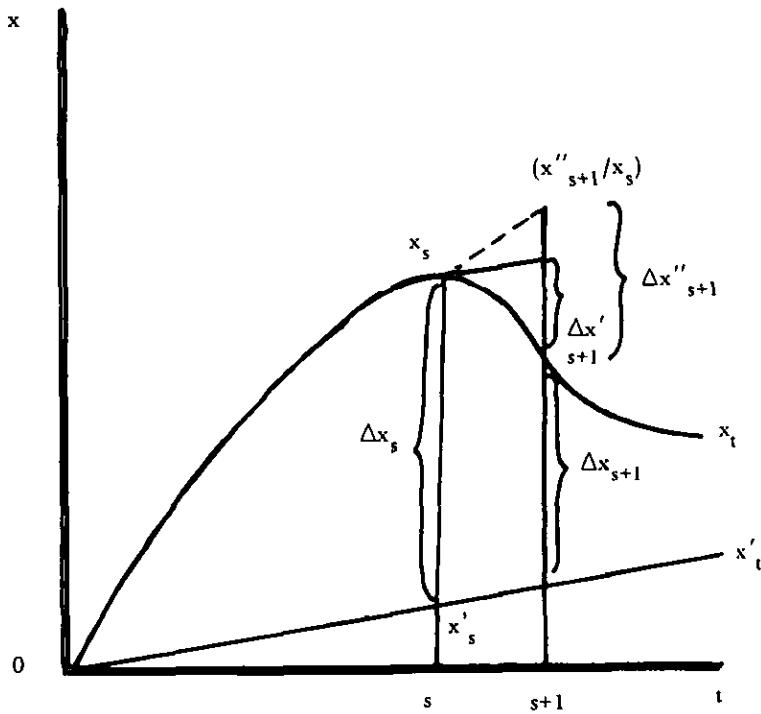
As before, incremental policy analysis is implemented by substituting neutral policy for actual fiscal policy in each of the periods of the sample in order to examine the effect of individual period's policies. In this case, in order to index x in period $s + 1$ we increase the policy variable by $(\alpha - 1)x_s$ rather than $(\alpha - 1)x_0$, bringing indexed policy to the point (x''_{s+1}/x_s) which denotes indexed policy in period $s + 1$ using a floating base and given historical policy in year s. The reason why this exceeds the fixed base equivalent is that the constant growth rate $\alpha - 1$ is now being applied to a larger base under the floating base approach (x_s) than under the fixed base approach (x_0).

To put this last distinction into more concrete terms, this implies that, say, government expenditure can increase by 5 per cent of last year's value of government expenditure rather than by 5 per cent (i.e., similar α) of government expenditure in some remote base period. Therefore, this method of indexation only has relevance given that historical policy was set at previous years' levels unlike the incremental approach with a fixed base or the integral approach where the extent to which the policy variable

increased depended only upon α and the base value of the policy variable, x_0. As a result, it is implausible to add the impact effect of "indexed" policy in period s to the delayed effect of "indexed" policy of period s-1 on period s since indexation with a floating base in periods implies historical policy of period s-1. To put this in the same context as in the fixed base case, the cumulative sum of incremental policy with a floating base will not, in general, be equal to the measure of policy activism by an integral measure. We are not comparing like with like and additivity will not hold except in restrictive cases. The only case where the incremental approach with a floating base will be equivalent to the incremental approach is where policy has been fully indexed for *all* time periods, i.e., $x_s = x'_s = (x'_s/x_{s-1}) = (x''_s/x_{s-1})$. This refers to the case where actual policy followed a path of indexation for all periods, clearly a redundant case for policy analysis.

Let us now consider the relative merits and demerits of each of the above two forms of incremental policy analysis. The advantage of the fixed base case lies in the fact that it can be compared to the integral approach to provide a test of model linearity, given an exogenous α. The disadvantage of a fixed base approach is that it assumes that indexation involves the addition of a constant amount (αx_0) to the policy variable regardless of its level in the intervening period. Consider the implication of such a mechanism for the Irish economy over the last twenty years. The size of the public sector has increased considerably over that time period so that adding a constant fraction, of say, the size of the public sector in 1960 will represent a considerably smaller proportion of the size of the public sector in 1980 than it did in 1960. This can be seen as one advantage of the floating base approach to incremental fiscal policy since it can take account of the growing size of the policy variable over time, thus indexing by a constant proportion of the increasing policy variable. In this way we can introduce a mechanism which ensures that the ratio of government expenditure to GDP can be maintained roughly constant, i.e., by setting α equal to 1 plus the rate of growth of GDP. This is not possible under the fixed base case except in highly restrictive cases. Another advantage of this definition of neutrality is that it is much simpler for authorities to implement — they need refer only to the previous year's level of x rather than determine a base year from which indexation should occur. The main drawback of this approach is that it no longer allows aggregation of each year's fiscal policy for a given year since each calculation only has relevance if the policy variable was set at historical levels for all previous years.

Another reason why tests of additivity has not been performed in Chapter 5 is that we have violated one of the assumptions mentioned above which

are necessary for additivity to occur — namely, the exogeneity of α. In our model α is related to the rate of growth of GNP and, where the policy variable concerned is in nominal terms, the price deflator of GNP. Both these variables are endogenously determined and depend in part upon previous years' fiscal policy. When implementing incremental fiscal policy we assume that all *previous* fiscal policy was set at "actual" levels so that "actual" prices and rates of growth of GNP are used to determine indexed values of the policy variable for the year of implementation. However, under an integral fiscal policy measure, because fiscal policies for periods previous to that being examined differ from "actual" policies, the endogenously determined prices and growth rate of GNP may differ from those experienced under "actual" policy. Therefore, fiscal indexation under an incremental and integral measure will involve different prices and growth rates so that, in this case different α's will result in alternative values of policy activism. As a result, a situation will arise where the cumulative effects of incremental fiscal policy, *even under a fixed base assumption*, will differ in general from an incremental approach.

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