AN APPRAISAL OF EMPLOYMENT PROBLEMS AND POLICIES AT THE MICRO-ECONOMIC LEVEL

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SUMMARY

This study has concentrated on the development of an impact simulation model for use at the sub-national level. The necessity for the development of this model was demonstrated by the growth of local economic initiatives during the 1970's, and the lack of monitoring and evaluation exercise to assess their success and cost-effectiveness.

The first stage of research involved the confirmation that the potential for micro-economic and spatial initiatives existed. This was done by identifying the existence of involuntary structural unemployment.

The second stage examined the range of employment policy options from the macroeconomic, microeconomic and spatial perspectives, and focused on the need for evaluation of those policies. The need for spatial impact evaluation exercise in respect of other exogenous shocks, and structural changes was also recognised.

The final stage involved the investigation of current techniques of evaluation and their adaptation for the purpose in hand. This led to a recognition of a gap in the armoury of techniques. The employment-dependency model has been developed to fill that gap, providing a low-budget model, capable of implementation at the small area level and generating a vast array of industrially disaggregate data, in terms of employment, employment-income, profits, value-added and gross income, related to levels of United Kingdom final demand. Thus providing scope for a variety of impact simulation exercises.

Employment; spatial; sectoral; evaluation; policy.

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The errors and ommissions are my own.

J A Lewis
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PART I

INTRODUCTION

PART I

Chapter 1

INTRODUCTION

1.1 Aims, objectives and methodology

The initial impetus to the work reported here was the increasing level of unemployment and associated employment problems; the disparate geographical manifestation of those problems, and the growth of policy responses at the local level. By the mid 1970's local authority concern and the recognition that some employment problems were associated with specifically localised factors had led to the implementation of a number of ad hoc measures to identify problems and initiate remedial action. However various reviews of the situation, especially a survey and appraisal of local authority employment initiatives (J.U.R.U.E., 1978 and 1979) revealed the inadequacy of the monitoring and evaluation exercises related to these local economic initiatives.

The necessity for satisfactory evaluation proceedures had been recognised by the authorities but a number of obstacles appeared to prevent their implementation. Firstly it was suggested that data collection would either be too costly, if obtained by survey work or too aggregate, if obtained from published sources. Secondly no adequate framework of evaluation existed which could usefully be applied at the loacl level. As a result only a small amount of assessment of policy initiatives had been undertaken, and this was marked by a number of weaknesses, because of its incomplete coverage.

The failure of local authorities to identify adequately and evaluate the effect of their policies has led, in some cases, to the pursuit of policies which are 'conspicuous' and 'popular', without any identification of clearly specified aims or any attempt to assess either their success (or otherwise) or their cost-effectiveness.

A major conclusion of the J.U.R.U.E. report (1979 op cit) was that a systematic proceedure for the setting of objectives and the monitoring and evaluation of the results of local authority initiatives, should be undertaken, as a matter of some urgency. It was in response to that recommendation that this work began.

In developing a framework of analysis in which local initiatives could be monitored and evaluated it is necessary to be able to respond to a number of questions, which should be raised with reference to problems and policies which affect the local economy. These questions can be identified as:-

(1) Can local initiatives influence the level of economic activity in the area?

(2) What local initiatives can be taken and how will they influence economic activity in the area?

(3) Can national spatial policies contribute to economic welfare?

(4) Is local intervention likely to be cost-effective?

(5) Do local initiatives contribute to national economic welfare (or are they zero or negative sum games)?

(6) Can micro-economic initiatives (as either a complement to, or a substitute for, macro-economic intervention)

improve economic efficiency?

(7) How can we identify, monitor, evaluate and assess the impact of local initiatives?

(8) How can we identify, monitor, evaluate and assess the spatial impact of central government macroeconomic, microeconomic and spatial policies?

(9) How can we identify, monitor, evaluate and assess the spatial impact of exogenous income changes such as industrial growth or decline?

The recognition that these key questions would need answering led the way to the first stages of the work. The primary concern of the study was to provide a framework of analytical thinking, in which problems and policies could be examined and assessed. The key issue, therefore seemed to be whether an analytical framework or local model could be developed which would facilitate the simulation of a range of exogenous income changes, and policy initiatives, on a local area. If so, we would be in a strong position to answer the key questions raised above.

Throughout the period of study the problem of unemployment has increased, very rapidly since 1979 (doubling in a year in some areas); intervention from central government has declined; and the introduction of local initiatives has mushroomed[1]. Furthermore the growth of unemployment, since 1979 has been associated with a rapid decline of employment, particularly manufacturing employment. This 'deindustrialisation', as it has

1 See J.U.R.U.E. (1981) "A Review of Local Economic Initiatives in the UK."

been labelled[1], has resulted in an unequal growth of unemployment (spatially, industrially and occupationally)[2] and has also affected groups (by age and sex disparately). This differential manifestation of unemploument and the associated concern of local authorities, whose response has been to implement a host of new initiatives, has made the need to develop an operational evaluation framework more urgent. Throughout the period the resources available to local authorities have become scarcer and this provides an additonal incentive to ensure that resources are directed to those areas where the social rates of return are highest.

It was the stimulus of this challenge which led to the search for an evaluation framework which could be used at the local level; would provide a comprehensive and reasonable accurate set of data, which would be useful for policy formulation and assessment. At the beginning of the study, however, it was recognised that an analytical framework, would be constrained to one which would be feasible for local authorities to use and implement. The major constraint would be the budget constraint[3]. This effectively meant that any techniques which were developed should seek to utilise data which was either readily available or relatively easy to collect. The openness of the local economy

1 See Blackaby F. (ed 1978) "De-Industrialisation"

2 See Fothergill and Gudgin (1982) "Unequal Growth"

3 The expected costs had proved to be the major deterrent to the monitoring of policies in the local authority study (op cit).

would also present problems for the development of a suitable model and for the range of local policy options, which would be appropriate. Political factors and the limit to the extent of the legislative powers of local authorities were also recognised as constraints.

The initial intention was to examine a whole range of employment problems[1] (and policies). In practice the problem of unemployment which is in any case the major manifestation of employment problems, and is closely correlated to other employment problems, represented such a broad subject area that the study was restricted to the problem of unemployment. More specifically the spatial manifestation of unemployment was the focus of attention. Similarly from the policy perspective it was the initial intention to examine a wide range of micro-economic[2] policy initiatives. Again, because of the broadness of the subject area, the study focussed on the spatial incidence of policies, though not entirely on spatial policies themselves. The focus of emphasis was not on the specific problems and policies, but on the development of a framework of analysis, in which their potential impacts could be identified and assessed.

The first stage of the work involved the establishment of the existence of involuntary structural unemployment in the United

1 Low pay; low levels of labour market particpation; limited opportunities; poor working conditions are examples.

2 Microeconomic used throughout the thesis refers to aspects of problems or policies which affect individuals rather than the aggregate economy. (Thus spatial, problems and policies are labelled microeconomic even, for example, national spatial policies.)

Kingdom[1], and its enumeration. It was recognised that where unemployment was the result of a deficiency of aggregate demand in the economy this could not be remedied by micro-economic policies nor by spatial policies, applied nationally or locally. Nor could micro-economic policies reduce (frictional) unemployment which is the result of individuals moving from one job to another. Structural unemployment, however, is the result of a mismatch of unemployed workers and potential jobs, either occupationally, industrially or spatially.

Structural unemployment can, in theory, at least, be reduced by mirco-economic initiatives. If however, some of the unemployed are voluntarily unemployed, that is, if they are unwilling to work for the going-wage, then policy initiatives would be unable to reduce this component of unemployment.

The identification and measurement of involuntary structural unemployment would need to be undertaken with respect to theories of unemployment; data availability, and the recognition of the data problems; available methods of identification and classification; a survey of existing empirical studies; and further empirical analysis. It was recognised that a difficulty in quantification might arise because of the inextricable association of structural and demand-deficient unemployment.

1 Throughout the thesis Great Britain and the United KIngdom are referred to. Sometimes data are only available for Great Britain. United Kingdom data are used except when it is unavailable or when comparisons with studies which have used data for Great Britain are made.

The association of the two types of unemployment means that the two cannot easily be identified and measured separately at times of high excess supply of labour. The structural mis-match of job opportunities and available labour is only manifested when the demand for labour is sufficient to create pressure, and reveal the inappropriate skills, abilities and location of labour supply.

The next stage of the work involved the analysis of policy initiatives on employment and unemployment. Macro-economic, mirco-economic and spatial policies were considered within an analytical framework which identifies the potential social welfare costs and benefits of those policies. Local policy initiatives were considered from two aspects: the impact on economic welfare within the area and the impact on national economic efficiency. In the case of both national and local (microeconomic and spatial) policies the impact an individual welfare was considered. The local policy initiatives were examined within the context of the constraints on local initiatives, within an income and employment flows analysis. This flows analysis enables the objectives, instruments and impacts to be identified together. This is an important exercise because otherwise surrogate targets or a single objective may be pursued in lieu of multiple objectives. Then the danger is that policies which affect the surrogate target are preferred to policy instrments which yield higher real positive benefits. (For example where the surrogate target is the level of unemployment, there will be a temptation to reduce the level, by pursuading people to leave the labour market. This does not represent a real welfare gain although it provides an improvement in the indicator.)

From an examination of the potential of the policy instruments the need for an evaluation framework to identify, quantify and assess the spatial impact of exogenous shocks and policy initiatives is apparent. The final stage of the work explored existing and potential evaluation techniques. This work was the main focus of attention. To reiterate the principle aim of the study was:

> To find a technique (or range of techniques) which provide(s) as comprehensive and as accurate data as possible within the budget constraints which are likely to exist, particularly at the small area level.

The search for an appropriate evaluation framework or an appropriate range of frameworks was undertaken through an identification of existing techniques; of data availability; of local authority requirements; and with particular concern to respond positively to the constraints, especially the budget and geographical constraints, posed at the local level.

The announced closure of Bilston Steel Works in 1979 provided the opportunity to examine the applicability of existing economic impact techniques[1]. The techniques used: multiplier analysis and the social accounting framework, provided a reasonable framework

1 The results of this economic impact exercies were included in J.U.R.U.E. (1979) "The Closure of Bilston Steel Works: An Appraisal, Report for West Midlands County Council and Wolverhampton Borough Council."

for identifying the direct effects (of the closure of the plant itself) and the Keynesian multiplier effects of the loss of income to the plant's workforce. However a deficiency was found to exist in the identification of the 'second round effects'. That is it was difficult to identify the local value-added component of suppliers to the plant. The recognition of this difficulty led to the search for a model which would provide industrial linkage and dependency data, in terms of income and employment.

The Bilston study (op cit) also revealed that existing techniques had been developed to assess the impact of expansionary policies: the construction of plants, universities, etc; regional investment programmes; etc. There were a number of differences in the contractionary situation and far more uncertainties. It was therefore necessary to examine these differences and recognise the differential impacts of 'closures' compared to 'openings'.

An intersectoral industrial dependency model has been developed in response to the challenge to search for a low-budget technique which provides as comprehensive and as accurate data as possible. Like all intersectoral models it is based on an input-output approach, with which it is not difficult to find fault. Yet many of the dificulties of input-output analysis can be overcome wherever the budget constraint permits; and no other type of analysis provides such disaggregated data. The model development has one aspect which is not normally found in local and regional modelling techniques: the local or regional economy is treated, not as a separate economy, with a large external trading account, but as an area integrated within the national economy. There a number of reasons for developing the model this way: firstly this seemed to represent the reality from the survey of suppliers to Bilston Steel Works[1] and from those local input-output models developed[2]; secondly if locational decisions of firms exploited agglomeration econmies as locational theory would suggest[3] then this would be reflected in the spatial distribution of industry; thirdly if locational decisions did not reflect industrial linkages then the modelling of local economies would be even more inappropriate; fourthly modelling the economy in this way provided excellent scope for untilising existing data sources to good effect.

1.2 Structure of the thesis

The remainder of the thesis is divided as follows:

There are three major Parts. Part II contains the results of the first stage of the study. There are three chpaters in Part II. In the first of these, Chapter 2, alternative theories of

1 The survey team were surprised to find how insignificant the steel works account was to many of the suppliers (even when quite large amounts were involved) and how the suppliers were frequently more concerned about the impending closure of other large plants. This suggested industrial linkages were more relevant than spatial linkages.

2 For example in the North Staffordshire study (Pullen et al, 1981) 71% of both intermediate inputs and outputs came from and went to the rest of the United Kingdom.

3 Though empirical evidence suggests this may be only a weak influence. (See for example Richter, 1969 and Chapter 9 for a review of the relevant literature.)

unemployment are presented. Chapter 3 includes details of the data problems and the difficulties of identification, classification and measurement of unemployment. The empirical evidence is presented in Chapter 4.

The second stage of the project is reported in Part III. There are three chapters in Part III. Chapter 5 is concerned with macro-economic policies and is brief, providing only a brief summary. Micro-economic policies are considered in Chapter 6. Spatial policies are the subject of Chapter 7.

Part IV contains the results of the major aspect of the thesis, the modelling of micro-economic impacts. There are two chapters in Part IV. The first of these chapters, Chapter 8 contains the analysis of existing evaluation and modelling techniques. Chapter 9 reports on the development, uses, limitations and results from the intersectional model developed, the employment-dependency model.

Finally in Part V, Chapter 10, the major results and findings are reported.

PART II

THE PROBLEM OF UNEMPLOYMENT

PART II
THE PROBLEM OF UNEMPLOYMENT

Introduction

The most obvious manifestation of employment problems is the existence of an unacceptability high level of unemployment. What constitutes an unacceptability high level will undoubtedly be influenced by past levels of unemployment so that a rapid increase in the rate of unemployment will be considered unacceptable. There are two major reasons why unemployment should cause concern to policy makers. Firstly, unemployment represents an under-utilization of one of our scarce resources and therefore indicates that the economy is operating within its production possibility frontier. Secondly, unemployment is associated with poverty and other social problems with which policy makers are concerned. Full employment has been a major policy objective of central governments in the post-war period.

The interpretation of "full employment" is however a question of debate. From 1948 to 1966, the measured unemployment rate of the United Kingdom varied between 1.2 per cent and 2.6 per cent averaging only 1.7 per cent. This meant that even in slumps only about half a million people were registered as unemployed. In retrospect this period would be regarded as one of full employment. Since 1966 much higher levels and rates of unemployment have been recorded so that from an unemployment rate of 1.6 per cent in 1966 the rate has increased to 12.7 per cent at the time of writing (July,1983). The hitherto cyclical pattern has been superceded by a general upward and accelerating trend around which cyclical deviations occur.

The next three chapters examine the problem of unemployment from three perspectives. Chapter 2 examines alternative theories of unemployment and the associated classifiactions. In recent years unemployment has become a controversial issue amongst economists and politicians. An attempt is made here to synthesize the arguments and put forward a rationale for pursing some interventionist policies. Chapter 3 discusses some problems in the measurment and identification of aggregate unemployment and the more difficult problem of identifying and measuring various categories of unemployed. In Chapter 4 some alternative measuring techniques suggested economist are examined. Since however these techniques have become almost obsolete with the current very high levels of unemployment an attempt is made to test the hypothesis that some structural and involuntary unemployment exists, though the measurement of either category proves to be illusive.

CHAPTER 2

UNEMPLOYMENT: THEORY AND CONCEPTS

2.1 Introduction

The purpose of this chapter is to discuss alternative theories and concepts of unemployment. Attention is focussed on current controversies amongst economists and politicians and an argument for pursuing some interventionist policies is put.

The chapter is divided as follows: In turn the classical, Keynesian, monetarist, "new-micro" and "new-new Micro" theories of unemployment[1] are sketched out. This is followed by a synthesis of the theories in a discussion of the 'voluntary' versus 'involuntary' unemployment debate. This controversial debate is continued into the following two chapters when the problems of the identification and measurement are discussed and the empirical evidence in the area is examined.

This chapter presents the theories concepts and definitions necessary for a discussion and examination of these problematic issues.

1 Additionally, though not considered here, Cassan M (1981) has postulated that the labour market may operate in a permanent state of disequilibrium. This approach incorporates social and cultural dimensions of wage bargaining and price setting and seeks to explain the persistence of unemployment in terms of a Keynesian regime where quantity adjustments take place in an economy with essentially administered prices and wages. Reduction of employment would be developed therefore by seeking to influence the behaviour of households and firms.

2.2 Classical analysis

The classical economists such as Ricardo, saw the labour market in the same way as all markets, that is that they tended towards equilibrium. The real wage rate and the equilibrium level of employment were determined by the interaction of the demand for and the supply of labour. The demand for labour was inversely related to the real wage (because of dimminishing marginal productivity of labour), whilst the supply of labour was positively related to the real wage. Unemployment is therefore either voluntary because workers prefer not to work than to work for the current real wage or it is temporary and will not exist once the real wage has had time to adjust downwards (via either falls in the money wage or a rise in prices or some combination of the two).

2.3 Keynesian analysis

Amidst massive unemployment of the 1930's Keynes (1936) challenged this classial view. In particular he argued that the equilibrium level of employment would not necessarily correspond with the full employment level of employment. He also argued that money wages were sticky downward but even if they did fall, employment might not increase.

Firstly, on wage rigidity, he suggested that workers would be more willing to take cuts in real wages through increases in prices than through cuts in money wages. Secondly, he believed that the level of employment and real wage were jointly determined by the level of aggregate demand. Money wage cuts need therefore not necessarily increase employment. Cuts in money wages would result in reductions in the demand for goods and services, prices would fall so that the real wage might remain unchanged having no effect therefore on employment. In fact cuts in money wages might result in falls in employment due to expectations of further declines in wages and prices.

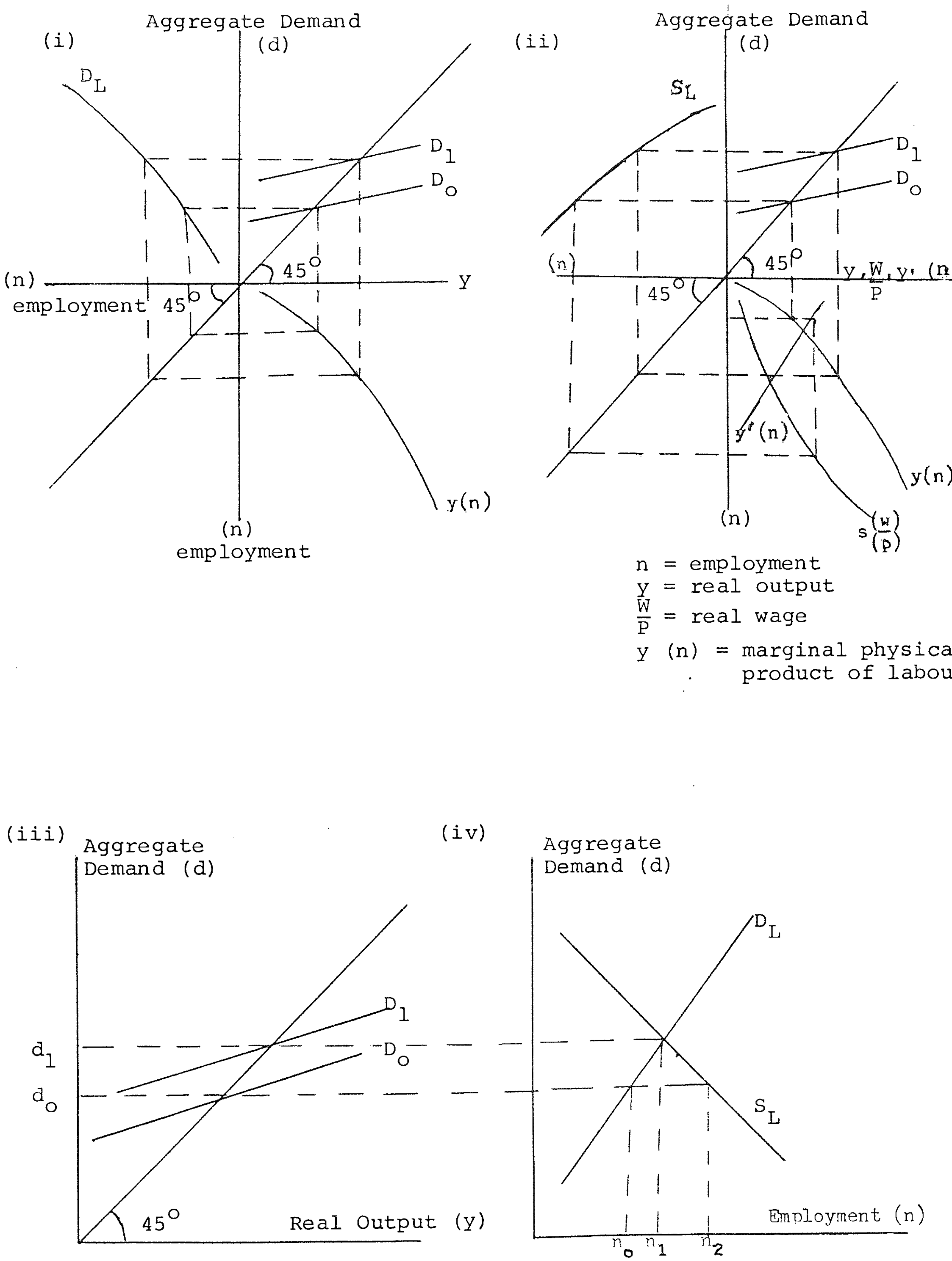
One implication of Keynesian analysis is therefore that involutary unemployment can be cured by monetary and fiscal expansion, with increases in demand bringing about the necessary adjustment to the real wage level, (see Figure 2.1). In Figure 2.1(i),the level of real output (Y) is related to the level of aggregate demand (D_0 D_1) the level of employment (n) is related to the level of output via the total output function y (n). The demand for labour curve (D_L) is therefore derived from the level of aggregate demand. In 2.1 (ii) the supply of labour (S_L) is also derived from the level of aggregate demand Once again the level of aggregate demand determines the level of real output (Y). Supply of labour is determined by the real wage (W/P) and in competetive equilibrium the real wage is determined by the marginal physical product of labour y' (n), (the first derivative of y(n)).

The supply of labour can in this way be derived from the level of aggregate demand. Note that real output, real wage and the marginal physical product can be measured on the same axis although not necessarily in the same units. In panel (iv) the demand for labour and supply of labour functions are combined.

When the level of aggregate demand is d_0 associated with the aggregate demand function D_0, market $Yo = do$, but in the labour market we have involuntary unemployment[1] N_0 N_3. Only at Y_1 d_1 which gives us N_1 employment do we have simultaneous equilibrium in both the goods and labour markets. In the Keynesian analysis this is the full employment level of employment. The aggregate demand function D_2 is associated with excess demand for labour. (The analysis partly relies on the assumption that real wages must fall as aggregate demand increases. In Fig 2.1 (ii) the supply of labour falls as aggregate demand increases because of a fall in real money wages. Keynes hypothesis if correct, would show real wages fell when money rose with output and employment. Dunlop (1938) found the suggestion that real wages moved inverseley with output and employment to be false and Solow and Stiglitz (1968) have found no significant pattern in movements of real wages in the short-run. A rigid short-run real wage would give us an inelastic supply curve relative to aggregate demand. This would not therefore affect the basic hypothesis that the level of employment is responsive to changes in aggregate demand.

1 Keynes own definition of involuntary unemployment was as follows. "Men are involuntarily unemployed if in the event of a small rise in the price of wage goods relatively to the money-wage, both the aggregate supply of labour willing to work for the current money-wage, and the aggregate demand for it at that wage would be greater than the existing volume of employment" Keynes (1936) p.15.

Figure 2.1 The Keynesian Model of the Labour Market



2.3.1 Patinkin's Modifications

Keynes' propositions that real wages fall as output expands and that real wages rise as output conttacts are not supported by empirical evidence. Patinkin (1965) offers some clarification.

A decline in aggregate demand without an immediate fall in prices or wages, would cause a fall in employment and output, as stocks built up. According to the marginal productivity theory of labour demand the output fall would be associated with a higher marginal productivity of labour. According to Keynes therefore the real wage would rise to the new position on the demand for labour curve. Patinkin, however, believes that the marginal product of labour is indeterminate because of the difficulty firms encounter in selling their output. The fall in aggregate demand will both squeeze profits and reduce aggregate employment and the existence of involuntary unemployment would therefore remove upward pressure on the real wage.

2.4 The Monetarist Approach

The main challenge to Keynesian analysis came from E S Phelps (1968) and M Friedman (1968). Phelps wrote:

> "If one further postulates, as Friedman and I did, an "adaptive" or "error-correcting" theory of expectations, then the persistent underestimation of price or wage increases which would result from an unemployment level consistently below the equilibrium rate would cause

expectations continually to be revised upwards so that the rate of inflation would gradually increase without limit; and, similarly, a high, constant rate of inflation, while "buying" a very low unemployment rate at first, would require a gradual rise of the unemployment rate towards the equilibrium rate as expectations of that inflation developed. Therefore, society cannot trade between steady unemployment and steady inflation. Society must eventually drive (or allow) the unemployment rate towards the equilibrium level of force it to oscillate around that equilibrium level"

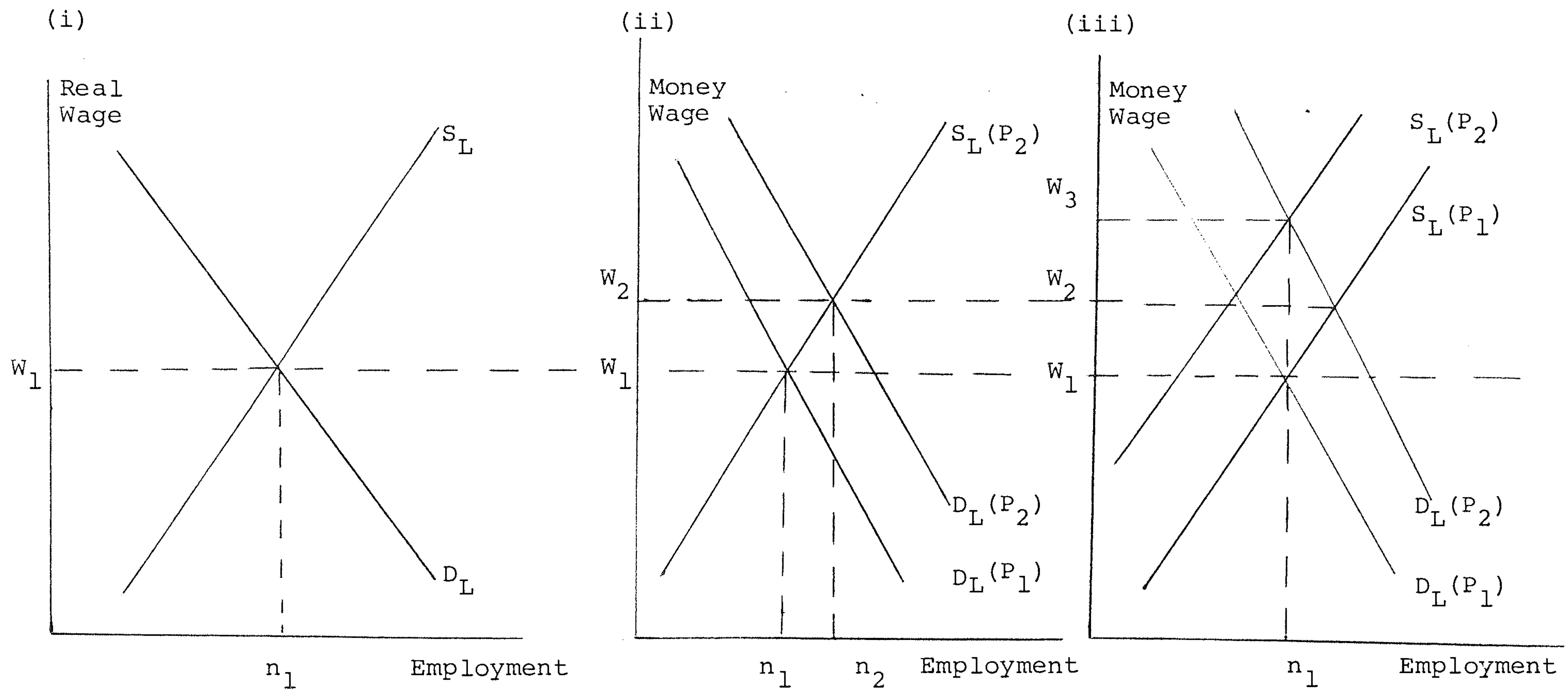
E S Phelps (1968) p.682/3

And Friedman wrote:

"Because selling prices of products typically respond to an unanticipated rise in normal demand, faster than prices of factors of production, real wages received have gone down- though real wages anticipated by employees went up, since employers implicity evaluated the wages offered at the earlier price level. Indeed, the simultaneous fall ex post in real wages to employees and rise ex ante in real wages to employers is what enabled employment to increase. But the decline ex post in real wages will soon come to affect anticipations. Employees will start to reckon on rising prices of the things they buy and to demand higher nominal wages for the future. "Market" unemployment is below the "natural" level. There is an excess demand for labour so real wages will tend to run towards their initial level".

M Friedman (1968) p.10.

Figure 2.2 The Monetarist Model of the Labour Market. The Effect of "Money Illusion".



In particular, Phelps and Friedman challenged Keynes' interpretation that involuntary unemployment exists whenever it can be reduced by raising aggregate demand. They have postulated that there is a 'natural rate' of unemployment and that any attemps to permanently reduce unemployment below this level cannot be achieved without an accelerating increase in the price level. In the short-run they believe that unemployment can be reduced due to 'money illusion' on the part of workers who incorrectly perceive the level of the real wage. There is a lag before workers adjust their evaluation of the real wage rate (i.e. before they fully adjust for increases in the price level). (See Figure 2.2)

In Figure 2.2 (i) the labour market is initially in equilibrium with employment n^1 and real wage level w^1. In Figure 2.2 (ii) the original equilibrium position is interpreted to money wage w^1 equivalent to real wage w^1 in (i) with price level (p^1). Aggregate demandis stimulated to produce a higher aggregate demand for labour D^L (P^2) but this is accompanied by an increase in the price level to (P^2). This brings about an increase in the money wage to w^2 and an increase in employment to n^2. However, according to the monetarist interpretation this is a temporary increase in employment because workers are interpreting the new money wage rate in terms of the old price level. In Figure 2.2 (iii) workers have now adopted their labour supply S^L (P^2) to the new price level and employment falls back to N^1, but at a higher price and money wage level. An employment level higher than N^1 can only be achieved by permanently increasing money wages and prices.

2.5 "New Micro - economic" and "New - New Micro - economic" Approach

"Much work has been devoted to identifying the factors influencing the size of the natural rate" (Phelps et al, (1970), and to explaining why divergence from the natural rate occurs.

The "new micro-economic" approach has concentrated on the process of job search by individuals and on the level of unemployment benefits in relation to earnings, (the replacement ratio), unemployment is essentially seen as voluntary, experienced in large part by utility maximising individuals, who evaluate their present unemployment as preferred to accepting the last job offer. The initial concentration of effort was on the human capital approach to search theory. The unemployed worker engaged in search will have a 'reservation wage' below which he will not accept a job. The 'reservation wage' will depend upon the last wage and any information on the labour market which he has. If his information were perfect he would invest in the optimal amount of search. If his 'reservation wage' is too high, he will invest too much time in search. If it is too low, he will accept an offer too soon. This argument proposed by A A Alchian (1970) and Mortensen (1970) suggests that unemployment is caused by informational inperfections in the labour market.

In addition to search unemployment, the "new micro-economic" approach suggests speculative or precautionary unemployment. This approach suggests that some individual family members will be withdrawn from the labour force during recessions because the current real wage being offered is insufficient to justify their participation. The fall in the real wage is seen as temporary and therefore accepting the new lower real wage may involve the risk of foregoing a later job offer at the normal wage.

The critics of the "new-micro-economic" approach have argued that in the United States most of the long term unemployed are amongst the disadvantaged groups and that on-the-job search is possible for most individuals, off-the-job search appearing to offer no real advantages over on-the-job search. In addition the high level of lay-offs and redundancies are difficult to assimilate into this theory.

The "new-new micro-economics" developed by Bailey (1974) Gordon (1974) and Azariadis (1975) (summarised in R J Gordon, (1976), switches attention to sluggish wage adjustments, which cause changes in demands to brings about quantity rather than price adjustments. The basis of the wage inflexibility is the implicit labour contract. The idea is that rist-averse employees and less risk-averse employers can both benefit from employment insurance. The implicit insurance premium is paid by workers who forego part of their wage entitlement to insure themselves agains unemployment and/or wage instability. A Okun (1975) has applied the theory to prices as well as wages. Okun stresses the notion of fairness rather than risk, both prices and wages are sticky. Firms pursue customer loyalty and employee loyalty, using cost-plus pricing rather than 'exploiting' short-run demand. Imbedded in these wage sticky models is a criterion for layoffs. (Temporary layoffs are a more important aspect of the American labour market). If there is a fall in product demand the firm will lay off workers if the value of the marginal product of a worker is less than the value of unemployment benefit plus leisure if the workers were unemployed. Feldstein (1976) although repudiating the risk-aversion argument believes that the existance of unemployment insurance contributes to the willingness of employees to accept temporary layoffs. The implication is once again that unemployment is essentially voluntary in nature, in this case because unemployment is not costly to the unemployed.

The "new" and "new-new" micro-economic approaches as they have been labelled are attempts to explain why changes in aggregate demand should be reflected in changes in aggregate employment rather than being accommodated by price and wage changes which would bring about Walrasian equilibrium.

2.6 A Summary of Approaches

The presentation of views has inevitably accentuated the difference of approaches but there are, of course, a number of similarities. Unemployment associated with full-employment in the Keynesian analysis is not dissimilar to the 'natural rate' of unemployment of the monetarists. The "new micro-economic" approach is more useful in explaining the duration of unemployment in tight labour markets. The "new-new" micro-economic approach explains, to some extent, the non-clearing of markets due to the inflexibility of wages and prices. The approaches are therefore in many way complementary to each other. However a controversy remains between those who believe that unemployment is essentially 'voluntary' and those who believe it to be 'involuntary'.

2.7 Voluntary and involuntary unemployment

The controversial debate as to whether unemployment is essentially 'voluntary' or 'involuntary' was the subject of a conference of the Royal Economic Society in March 1974: "the concept and Measurement of Involuntary Unemployment"; the papers of which appear in a book of the same title edited by Worswick G.D.N. (1975)

The Keynesian view of unemployment was presented by R.Kahn. He presented Keynes views from both the 'General Theory'[1] and from many other sources as well as his own personal views and of others of the Keynesian era. The keynesian view that emerges is that the distinction between voluntary and involuntary unemployment is to some extent arbitrary and of little importance from the point of view of either policy objectives or measurement. Kahn (1975) writes:

> "the distinction between 'voluntary' and 'involuntary' unemployment, while important conceptually as a basis for the Keynesian system of analysis, has not proved to have any practical significance, either in terms of statistical measurement or in terms of targets or objectives."
> op cit p.27

1 Keynes definition of involuntary unemployment is given in a footnote, Section 2.3.

M.R. Fisher (1975) represents the 'new-microeconomic' view, with its concentration on search theories, Fisher seems to doubt that involuntary unemployment can exist or that Keynesian type intervention has been responsible for improvements in the 'consistently high employment percentages by earlier standards' since the Second World War, he writes:

> "Some of these forms of intervention in the economy ......have to some degree been consistent with Keynesian corrective measures. Yet the whole period since 1918, in both the United Kingdom and the United States, has been characterised by the upheavals and fears of wars, the effects of which cut both ways - the absence of wars could have led to easier adaptation and growth without accompanying high unemployment. Further, many of the interventions of governments undoubtedly made matters worse rather than better. Hence I would maintain than involuntary unemployment as a phenomenon still lacks confirmation, and the success of implied policy correctives is not clearly shown".
>
> Worswick op cit p53

In the "new microeconomic" theory, unemployment is voluntary or frictional A.G. Hines (1975) summarising, though not supporting the "new-microeconomic" approach writes:

> "If the individual is not actually observed to be engaged in search activity, it is to be presumed that he puts a higher valuation upon leisure than the real income he could recieve by accepting employment over the whole range of offers of real wage rates he perceives. Moreover the unemployment

which is associated with the long run equilibrium of the system (the 'natural' rate) has no welfare costs".

Hines in Worswick op cit p69

This, he claims, is not a new view of unemployment, it is "old but bad wine, albeit in elegant new bottles"; It is the view of economic theorists of the 1920's and 1930's (Hicks (1932) et al). Hines' critisms of the theory are firstly that the theory concentrates on the supply side ignoring the loss on the aggregate demand side; secondly the assumption that off-the-job search is invariably more efficient than on-the-job search, whereas we could easily argue that on-the-job search is more efficient and less costly. The empirical evidence by Eagly (1965) for example, that the quit-rate is positively related to the rate of change of money wage rates and negatively related to the level of unemployment seems to repudiate the job search theory, of the "new-microeconomic" theorists.

The 'voluntary' theorists have concentrated on the supply side identifying a reason for a change in the willingness of individuals to choose work as opposed to leisure (unemployment) at the current wage rate. The reason identified is the high 'replacement ratio', but there was however only a once and for all upward shift in this ratio in 1966 and we should therefore expect this to be associated only with a once and for all shift in the 'natural rate' or the full-employment rate of unemployment. If we examine demand side factors we would expect voluntary unemployment to be associated with high levels and durations of unfilled vacancies which employers cannot fill. Yet there has been no upward trend of recorded vacancies. Furthermore the 'high replacement ratio' that is said to exist is often based on calculations of entitlement to benefit for a married man with a non-working wife and two dependent children. This 'Mr Average' has turned out to represent a very small proportion (less than 10 per cent) of the working population. In addition the growth in the level of unemployment has been associated with a growth in the numbers of long-term unemployed (over a year). A growth in long-term unemployment would be expected to take place only when there are demand side factors at work since long-term unemployment is neither lucrative in terms of benefits available nor is it likely to be the result of too high a 'reservation wage' since individuals will (quickly) revise this in the light of experience.

Since 1973 the replacement ratio has fallen and ERS in no longer payable (since January 1982). We must therefore conclude that if the upward movement in the replacement ratio was responsible for an increase in the voluntary level of unemployment (mainly as a result of an increase in the average job-search time), then from 1973 we would expect there to have been a decline in voluntary unemployment. In other wards unemployment is now lower than it would otherwise have been. From the policy point of view, though, the existence of some voluntary unemployment even of a substantial size does not provide justifiction for no positive policy action; unless there are shortages of labour and delays in filling job vacancies, the existence of some voluntary unemployment merely effects 'who' is unemployed not 'how many' are unemployed.

2.8 Conclusion

This chapter has provided an overview of the theories and concepts of unemployment and introduced the basis of current controversial debate on the subject. There is however much to be discussed in this area and we shall return to these theories in the next two chapters as well as throughout the thesis. The next chapter is concerned with identification and measurement problems. In Chapter 4 the empirical evidence is examined.

Chapter 3

UNEMPLOYMENT: IDENTIFICATION AND MEASUREMENT

3.1 Introduction

In the preceding chapter alternative unemployment theories and concepts were introduced. This chapter continues on that same theme with a review of the alternative classification schemes adopted by the theorists and of the attempts at measurement. Like the theories of unemployment, its identification and measurement turns out to be controversial. Firstly the reliability of the data collected by the Department of Employment is examined; how far these data, even if they were perfect, would coincide with the economists labour market view of excess supply of, or demand for labour, is then explored. Section 3.3 considers stocks and flows in the labour market and Section 3.4 the UV relationship. Section 3.5 considers the alternative techniques suggested to classify and measure unemployment, using the unemployment and vacancy data. Finally there is a conclusion.

3.2 The Unemployment and Vacancy Statistics

Much of the analysis of the labour market which takes place is based on the statistics of unemployment and vacancies published by the Department of Employment. Those data, however are imperfect. The unemployment and vacancy statistics relate to registered unemployment. The first problem arises because there are a number of reasons why these statistics may not reflect accurately the true level of unemployment or job vacancies. Secondly, the statistics do not fit into the economist's model of the labour market which relates labour demand and labour supply to the wage rate.

Firstly the inaccuracy of the data: the number of people registering as unemployed is influenced by the requirements for benefit payments under Social Security Acts. Those who voluntarily quit their jobs do not qualify for unemployment benefit until six weeks after registration. If individuals who quit their jobs voluntarily do so because they expect to gain a preferred job within six weeks there will be no incentive to register. At least some of those who voluntarily quit will register.

Many married women have chosen to pay only industrial injury social insurance which does not enable them to claim unemployment benefit. Some of these married women will therefore not register as unemployed[1]. The propensity for married women to register has varied throughout the business cycle. The 'discouraged worker' hypothesis suggests a lower propensity to register when unemployment is high[2].

1 These provisions for reduced national insurance liability for married women will eventually disappear. It is not available to those women who have married since 6th April 1977 nor to women married earlier who had not opted for reduced liability by 11th May 1977. In addition it will cease to be available to those whose marriage ends in divorce or annulment, to those who are not liable to pay reduced contributions in two consecutive tax years after 5th April 1978 (unless because of self-employment), and to those who elect to pay full contributions.
Department of Health and Social Security Leaflet NI 1, February 1978.

2. With effect from October 1980 registration for employment ceased to be a condition of entitlement to unemployment benefit (except for the under 18's) and from November 1980 the basis of the count also changed to include only benefit claimants. (See D.E. Gazette, September 1982)

Those seeking part-time work do not qualify for benefit and are less likely to register because of the small number of part-time jobs notified to Job Centres and Employment Offices.

School leavers who register as unemployed are counted separately and excluded from the main count. The rationale for this is that they normally gain employment very quickly or sometimes return to education and counting them would therefore distort the figures. Students in vacation are also now excluded from the unemployment statistics for a similar reason. Those registering with Professional and Executive Recruitment (PER) are not counted, many of them are in employment and those who are unemployed can also register at a job centre or employment office. (Although it is not necessary to do so to claim benefits).

On the other hand, some of those who are registered as unemployed may be considered unlikely to find work. There are those not interested in finding work but who register for entitlement to benefits or for credits towards retirement pensions. Occupational pensioners are a large group of such people. There are the fraudulently unemployed who register whilst they are at work, often of a casual nature. There are several groups who may be considered "unemployable", for example because they have a minor physical or mental disability but are classified as suitable for ordinary employment (the severely disabled are excluded from the statistics). Some individuals are difficult to place, and others cannot hold a job more than a few weeks.

Census data and the General Household Survey data provide indications of the extent of unregistered unemployment and overcounting. The Department of Employment has estimated that unregistered unemployment ranged from 70,000 to 100,000 males and from 160,000 to 200,000 females during the period 1971-3. (These estimated unregistered unemployment levels represent respectively 11 - 16 per cent of the average registered male unemployment in the period and 134 - 168 per cent of registered female unemployment). Conversely some of those registered may be so unlikely to work that including them overstates the true level of unemployment. For example, in March 1975 50,000 male occupational pensioners were included in the unemployment statistics, as were a further 50,000 disabled but classified as 'suitable for ordinary employment'. A P.E.P survey in October 1973, indicated that possibly 60,000 persons on the register did not regard themselves as members of the labour market. The "unemployables" and the fraudently unemployed are more difficult to identify and quantity.

In addition some workers are hoarded by employers who find it more beneficial to hold onto their labour force if they anticipate they will need labour in the near future. There are several reasons for doing so and the overall decisions will depend upon the costs and benefits (both economic, social and political) involved in laying off workers. Workers in whom firms have a large investment are likely to be retained through periods of temporary demand reduction. Labour hoarding is often accompanied by short-time working thus reducing the costs. Any labour hoarding or short-time working will mean a loss of potential output,so a measure of these two phenomena is strictly speaking, necessary to supplement our unemployment (registered and unregistered), data, if we are interested in loss of potential output. If employers treat labour as a quasi-fixed factor as suggested by Oi (1962) then some underutilization of labour will not be manifested as unemployment. As recession sets in, output and labour utilization will fall. Employment decline will not reflect the fall in output. Similarly, during expansion, output and labour utilization will increase so that employment increases will not reflect the extent of the expansion. Taylor (1970) suggests a trend through peak method to calculate hoarded labour. If it is assumed that the output/labour ratio during peaks is the full-employment/output ratio then subtracting actual from the potential labour/output ratio will give a measure of the extent of labour hoarding.

If we turn to the vacancy statistics we encounter similar problems of both over and under recording. Dow and Dicks-Mireaux (1958) commented:-

> "There are good 'prima facie' reasons for distrusting the statistics of unfilled vacancies since they neither record transactions nor register decisions but represent a sort of queue. The size of the queue many be either more or less than the real unsatisfied demand, people may either duplicate orders or join queues, or they may give up trying and not join a queue at all".
>
> (page 2 op cit)

There is no legal obligations to register a vacancy with a job centre or employment office and many firms recruit by other means. In addition firms who do use the official agencies may either overstate or understate their true needs: either because they wish to increase their choice of candidates or conversely because they feel that until an initial number of vacancies have been filled there is no point in notifying an additional need. The possibilities of mis-reporting are numerous and could result in either an understatement or an overstatement of true levels. Furthermore notified vacancies are likely to be subject to varying levels of accuracy throughout the business cycle. When unemployment is relatively high, vacancies can be easily and quickly filled and reporting to employment offices will decline. When unemployment is low, vacancies are more difficult to fill and recording will increase.

The propensity to register varies between occupations and industries. Some industries having methods of recruitment which do not usually involve the employment offices (entertainment, building, dock working) whilst others use them more frequently.

It is generally accepted that the number of vacancies notified to the Employment Services Division (ESD) of the Manpower Services Commission (MSC) is an understatement of the true level of vacancies. A survey in 1977 by the Department of Employment indicated that approximately a third of all vacancies were notified to the ESD. This global figure however hides the locational and occupational variations as well as cyclical or temporal changes which occur.

Recent research has focused attention on aspects such as the duration of vacancies and on the variation in registration propensities between occupations and exchanges. It is likely that the propensity to register vacancies will be influenced by the success of the agencies in filling vacancies. Beaumont (1978) found that in two Scottish exchanges 33.8 per cent of notified vacancies were cancelled unfilled. Of those filled, single vacancy orders were filled in an average 10.7 days, median 2.7 days, and multiple vacancy orders were filled in an average 14.6 days, median 2.8 days. The difference between the mean and median indicates that many vacancies are filled very quickly (over 60% of filled vacancies taken an exceptionally long time to fill).

An interesting article by Rosewall and Robinson (1980) reports on an examination of vacancies at three towns: Banbury, Oxford and High Wycombe. The notification rates of the three towns being two-thirds, a half and a third respectively. Occupationally the notification rate falls "as one ascends the occupational skill structure for manual workers" and notification rates were lower for managerial and white-collar than for manual occupations. There were also lower notification rates for transport workers, warehousemen and selling occupations. Small firms tended to have lower notification rates than large firms. Overall the survey found under-reporting of about a half. This is less than other studies have found. It may be that employers not responding to the questionnaire were less likely to use the ESD agencies and the true extent of under-reporting would therefore be higher.

A more serious problem in using the vacancy statistics in economic analysis might arise if there were changes occuring in the propensity to register vacancies with employment agencies over time.

Despite certain misgivings about the accuracy of the vacancy statistics, many writers have considered them to be at least an adequate measure of the strength of damand for labour, if not quantitively accurate. For example Dow and Dicks-Mireaux (1958) commented that the vacancy statistics are "reliable indicators of the demand for labour".

Secondly we turn to the problem of using unemployment and vacancy data (even if it were accurate) as a proxy for excess supply of or excess demand for labour. We can define labour supply as the amount of labour offered in any given time period. Labour supply is however difficult to quantify; ideally we would need some unit of measurement which incorporated the number of persons, the number of hours, the amount of effort and the quality of work. The employment, unemployment and vacancy statistics are measured in units of people. But individuals work or seek work and employers offer work of varying hours, skill levels, and with varying degrees of effort involved. In addition, employers' job offers, carry a variety of wage rates and individuals offering themselves for hire in the labour market have different concepts of what they can expect to earn.

So what do the unemployment statistics tell us? They tell us the number of individuals who have registered as having no work on a particular day in the month. In terms of a macro-economic labour market the existence of unemployment could be intrepreted in several ways (see Figure 3.1)

The supply of workers is assumed to be positively related to the wage rate over a large range, eventually the curve becoming vertical when all possible workers are drawn into seeking work. Ultimately the supply of workers may be negatively related to the wage rate as high wages of one family member enable other family members to leave the labour force. The existence of an ultimately backward bending supply of workers curve does not affect this discussion.

The demand for workers is assumed to be inversely related to the wage rate, based on the widely accepted, though often criticised, marginal productivity theory of labour demand. This aggregate demand curve too becomes almost vertical reflecting the essential nature of a minimum work force. Though again this in no way affects the discussion.

Now the number of people who would be registered as unemployed could be anything up to (N^4 - N^2). N^4 is the maximum number of workers, N^2 is the equilbrium employment level. The number who would register and be counted would be determined by their eligibility to benefit.[1] If the wage rate were W^1 a maximum (N^4 - N^2) could be registered as unemployed. However none of them are willing to work for the current wage rate W^1, (but that does not

1 See footnote following page

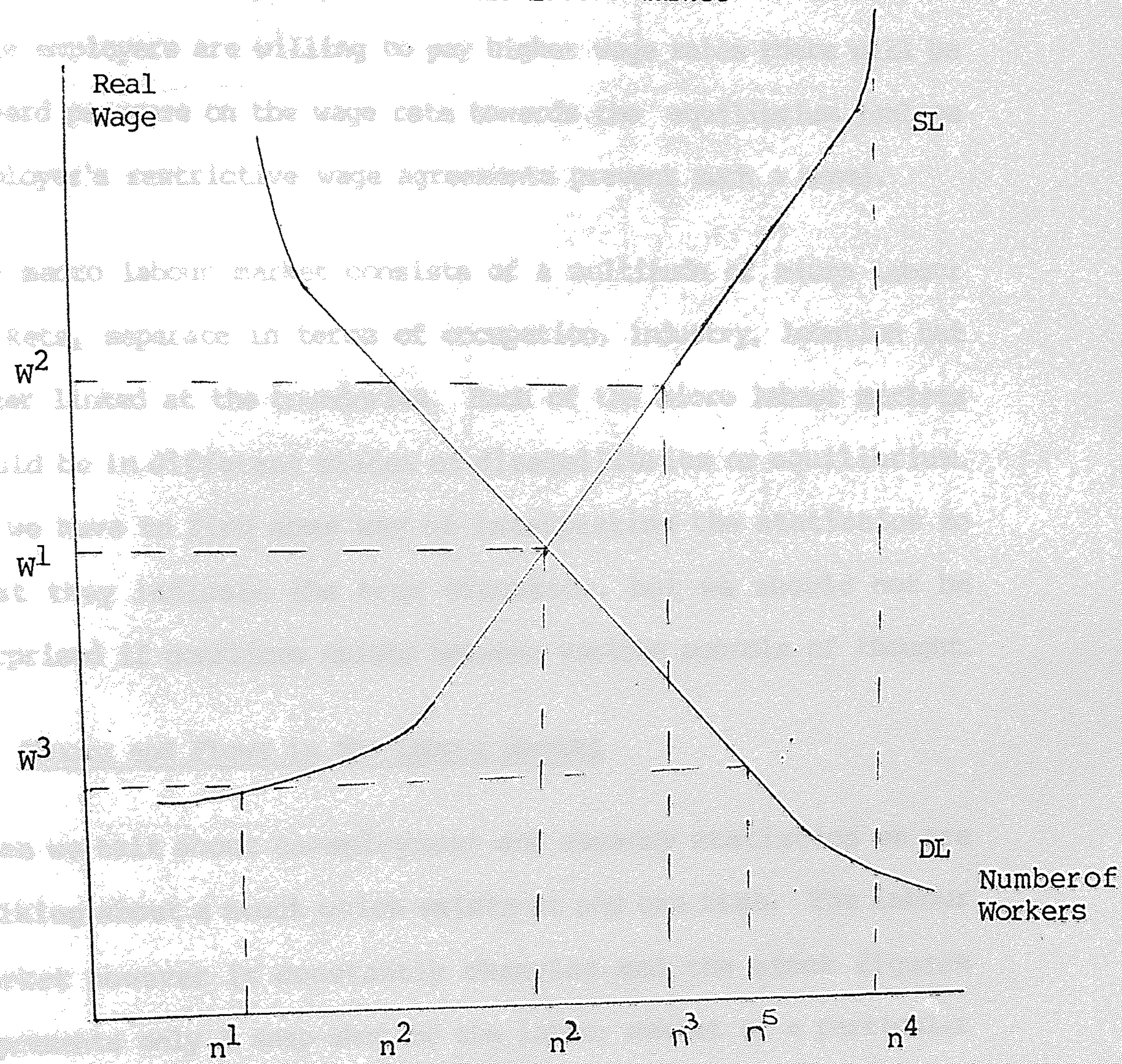
prevent them from registering). Similarly the economic equilibrum can be associated with many vacancies being available below the equilibrium wage rate. There will also be vacancies and unemployed associated with job changes.

Suppose the market is in disequilibrium with a wage rate of W^2, associated with excess supply of labour at that price. the economists measure of excess supply would be $(N^3 - N^2)$ but again up to $(N^4 - N^2)$ can potentially register. In addition there could also be a large number of vacancies available below the going wage rate. This situation in neo-classical analysis should not normally persist since we might expect downward pressure on the wage rate from the large number of unemployed, many of whom are willing to work for wage rates below W^2. If the wage rate is institutionally set by national agreements or minimum wage laws or protected by union restrictive practices this situation could persist.

But the same is true if we reverse the situation and look at disequilibrium with too low a wage rate, say W^3. This wage rate will attract only N^1, workers. The economists perception of excess demand of the order $(N^5 - N^1)$ will exist, although this will not necessarily correspond to the DE count of recorded unfilled vacancies, since employers offering lower wages are not prevented from registering vacancies. In addition, unemployment

1. Under the pre-1982 requirement for being counted those who felt they had some chance of finding work through the official offices would also have registered and been counted in the official statistics

Figure 3.1 The static Macro-Economic labour market



could potentially be of the order $(N^4 - N^1)$ although no-one will be interested in working for the going low wage rate. But since some employers are willing to pay higher wage rates there will be upward pressure on the wage rate towards the equilibrium (unless employer's restrictive wage agreements prevent such a move).

The macro labour market consists of a multitude of micro labour markets, separate in terms of occupation, industry, location but inter linked at the boundaries. Each of the micro labour markets could be in different states of disequilibrium or equilibrium. So we have to find some way of interpreting the statistics so that they indicate the true situation, but we should not be surprised if conflicts exists between various schools of thought.

3.3 Stocks and Flows in the Labour Market

When we talk about unemployment and vacancy statistics we are talking about a stock which exists at any one time. The labour market however is constantly changing and the stock figures represents only a snap-shot of the labour market at a particular point in time. If the stocks are unable to portrary the state of the labour market, an analysis of the flows may be more helpful, since it records changes which are taking place.

The flow through the labour market can best be illustrated using the diagram in Figure 3.2 as used by Holt (1970). As we see the unemployment stock is fed by entrants and re-entrants to the labour force, by voluntary quits and involuntary dismissals or lay-offs from employment.

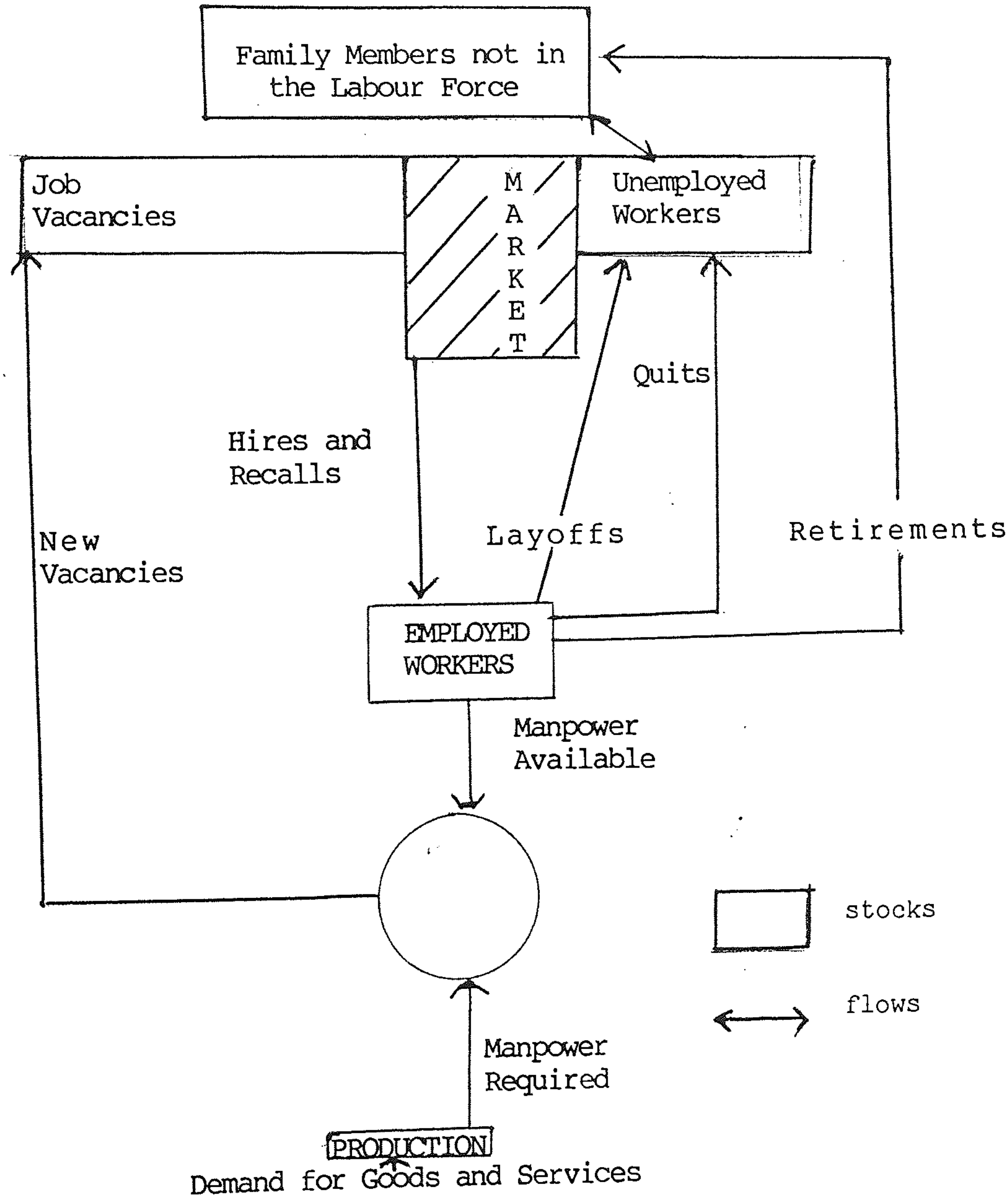


Fig 3.2 A stock flow schematic view of the structure of the labour market. Source: "Job Search Phillips Wage Relation and Union Influence: Theory and Evidence" Charles C Holt in E S Phelps et al. "Micro-economic Foundations of Employment and Inflation Theory" Norton 1970.

The monthly change in the stock of unemployed is small relative to the inflow and outflow from unemployment. For example, between February 1977 and October 1981 an average of 299 thousand joined the register each month whilst an average 277 thousand left the register. (For the 12 month ending May 1982 the two flows were 372 and 352 thousand respectively). The same is true of the vacancy statistics, during the same period, (February 1977 to October 1981) an average of 195 thousand job vacancies were notified each month whilst an average of 197 thousand job vacancies were cancelled. People leave the unemployment register if they find work (or on MSC placement on one of their special schemes) or if they drop out of the labour market. Vacancies are cancelled if they are filled, or if the employer cancels the vacancy.

Throughout the business cycle the flows through unemployment do not substantially change[1]. During the downswing, the layoff rate rises and the voluntary quit rate falls so that there is only a small increase in the total inflow whilst the outflow falls slightly; the larger fall in those leaving to employment being offset by the increase in the dropout rate, (because of the discouragement effect.) Other flows also change throughout the cycle. Of those losing their jobs voluntarily or involuntarily a proportion join the unemployment register whilst some leave the labour force.

During recession an increasing proportion of those losing their

1. Though the severe depression in the labour market since 1979 has been associated with much higher flows.

jobs leave the labour force. They are mainly older workers[1] who retire early and married women who do not qualify for unemployment benefit and therefore have no incentive to register. (And are, in any case, no longer included in the count). For example, between June 1979 and the end of 1980 the working population declined by approximately 250,000 (about 100,000 males and 150,000 females). Despite the increase in the size of the population of working age, the slow rate of economic growth and the downturn in employment there has not been a corresponding increase in unemployment.

So the size of the flows or more precisely the difference between the flows, affect the size of the stock, but the stock influences the size of the flows. During recessionary periods, the average duration of unemployment increases whilst in more prosperous periods the average duration of unemployment falls. An increasing stock of unemployment during recessions is therefore the result of an increase in the numbers of people passing through the pool of unemployed and/or an increase in the average duration of unemployment Hughes P (1982), for example, found that a large part of the increase in unemployment for males (January 1978 to January 1980) was the

1. The Department of Employment found that the higher the regional unemployment rate the higher the inactivity rate of males ages 60-64 (excluding retired) using data collected in the EC Labour Force Survey (DE Gazette, April 1981 p.169)

result of increases in the duration of unemployment whereas for females a large part was the result of an increase in inflow. Stern J (1983) found that most of the regional variation in unemployment was the result of differences in average durations of unemployment rather than differences in the rate of inflow to unemployment.

The introduction of the computerised count of unemployment from October 1982 has led to more accurate and detailed information regarding, for example, the duration of completed spells of unemployment and the frequency of unemployment for individuals. This data has only just become available (see DE Gazette, August 1983) and therefore no major analyses have yet been undertaken. It does however provided scope for future research in this area.

From the data available it is possible to identify some interesting differences of various age groups and geographical areas between the inflow to unemployment and the average duration of unemployment. For example the under 18's have a "very high probability of becoming unemployed, about three to four times the average but remain unemployed, for comparatively short periods averaging about 7 or 8 weeks. "The 18 to 54 age group who once unemployed remain so for about 11 to 14 weeks in October 1982 to January 1983 and 13 to 16 weeks in the following three months. The decline in unemployment rates for this age group reflects the falling inflow rates"[1]. The over 55's "whose higher unemployment rates are due to the substaintially longer periods of

1 DE Gazette August 1983 p.351

unemployment. This is despite having inflow rates which are only about half the average" [1]

Geographically there are some interesting results too. Regionally there was less than an average chance of becoming unemployed in theSouth East, the West Midlands and the East Midlands but, the regions with more than an average chance of leaving unemployment once unemployed were the South East, East Anglia and the South West. (October 1982 to January 1983)

3.4 The UV Relationship

An interesting statistical relationship was shown to exist between the rates of registered unemployment and rates of recorded vacancies. This statistical relationship forms the basis of a number of techniques which have been developed for the identification and measurement of various types of unemployment.

In a recession, job vacancies are relatively low, because employers have little difficulty recruiting from the large pool of unemployed workers. In a boom recorded levels of vacancies are high as employers experience difficulty finding labour. Thus registered unemployed and recorded vacancies are inversely related. In 1958 Dow and Dicks-Mireaux found an inverse relationship between rate of unemployment and vacancies at the aggregate level and for seven separate industrial groups. Both

1 DE Gazette August 1983 p.351

unemployed and vacancy statistics are expressed as a proportion of employees.

Dow and Dicks-Mireaux suggested a linear relationship,

$$U^t = a + b\,V^{t'} \qquad b<0.$$

A scatter diagram (see Figure 3.4) would suggest a log-linear relationship to be more suitable of the form

$$\log U^t = a + \log V^{t'} \qquad b<0$$

as, for example, used by Bowers et al. (1970)

Around 1966, higher and increasing levels and rates of unemployment began to be recorded. At the same time a breakdown of both the Phillips curve (the inverse relationship between the rate of change of wage rates and unemployment) and the UV curve appeared to take place. The consensus view in the early 1970's (see for example Bowers et al, 1972) was that the UV curve (and the Phillips curve) had shifted outwards from the origin.

The upward movement[1] in the UV curve around 1966 stimulated much research into its causes. There are several salient features of the period around 1966 which were considered as contributing to the upward movement at that time.

In 1965-6 the Labour Government was concerned with Balance of Payments problems and in order to encourage a shake-out of

1. The movement could have been caused by either a once and for all shift (an intercept shift) or an upward trend (a slope shift). This is discussed later.

hoarded labour, which might be used by exporting industries unable to expand because of labour shortages, introduced the Redundancy Payments Act (1965) and the National Insurance Act (1966). The Redundancy Payments Act (RPA) made provisions for repayments of a varying proportion of redundancy payments made to employees by firms. In particular it increased the rebate for those aged between 40 - 65. The National Insurance Act introduced earnings-related unemployment benefits, payable between the second and twenty-sixth weeks of unemployment.

Selective Employment Tax (SET) was introduced in 1966 and levied on certain typesof employment, notably service employment, in order to discourage that type of employment. In late 1966 the economy was strongly deflated. The pound was devalued in 1967.

Demographic factors resulted in a change in the age composition of the labour force. As a result of the birth-bulge some twenty years earlier in the post-war period, a large influx of young inexperienced people joined the labour force between 1963 and 1970. This followed a period of shortages of young entrants caused by the slump of births during the war-time period.

Gujarati (1972) emphasized supply-side factors as having caused the shift of the UV curve, brought about by improvement Redundancy Payments and earnings-related benefits causing an increase in voluntary unemployment. Taylor (1972) emphasized the demand-side factors. Up to 1966 business confidence had been high in the post-war period, recessions had been shallow and of only short-duration. Employers were therefore inclined to hoard labour during recessions because the costs of such hoarding were low and because recruitement of skilled labour during upturns was difficult. Since 1966 business confidence in steady state growth has justifiably declined, SET made some labour hoarding more expensive, and the RPA made redundancy cheaper for employers, and more acceptable to employees. The larger pool of available labour, in any case, removed much of the incentive to hoard all but a few types of their workers. Bowers, Cheshire and Webb (1970) suggested labour mobility was causing increasing structural problems in the labour market. However in 1972 Bowers, Cheshire, Webb and Weeden reconsidered the shifts and concluded that immobility was not sufficient to cause the large shift. They believed that a general slackness of aggregate demand and increased labour productivity were responsible for much of the increased level of unemployment. Foster(1973) believed the demographic factors and the new redundancy payments were the main causes. The Department of Employment (Gazette March 1975) estimated that an increase of no morethan 70,000 could be attributed to improvement redundancy andunemployment benefit, mainly caused by an increase in the average duration of unemployment. Bowers (1972) has considered the possibility of an increased propensity to register for unemployment. He found no evidence to support the hypothesis and concluded it would be unlikely to explain such a large shift.

3.5 The Classification and Measurement of Unemployment

It is normal for unemployment to be classified into two broad categories: demand-deficient and non-demand deficient.

Demand-deficient unemployment occurs if and when there is insufficient aggregate demand in the economy to create enough jobs for those seeking work at the current wage level. Non-demand deficient unemployment occurs when there is a mis-match of work available with unemployed workers. The main causes of the mis-match are occupational and geographical although imperfections in the market mechanism, imperfections in information flows or institutional rigidities can also contribute to this mis-match. There may also be other factors which would cause this mis-match such as employer discrimination against workers on the grounds of age, sex, colour, race, religion, etc. or employee distate for certain types of work or particular employer of hours of work offered and so on.

The two broad categories can be further sub-divided depending upon the time scale

	Short-Run	Long Run	Very Long Run
Demand-deficient	Seasonal	Cyclical	Technological or Growth-gap
Non-demand Deficient	Frictional	Structural	

Seasonal unemployment occurs in some industries for some days, weeks or months of the year when demand for labour services falls or weather does not allow work to take place. Examples of industries affected in this way are the tourist industry, the retail trade, the construction industry and the ice-cream industry.

Cyclical unemployment arises as a result of a more persistent shortfall of demand for labour normally associated with the downturn of the business cycle.

Frictional unemployment is normally associated with changing jobs. It is said to arise because workers take time to find new jobs and it is therefore inevitable that at any time some workers engaged in the 'normal' search process will be registered as unemployed.

Structural unemployment is a more permanent type of unemployment similar in character to frictional unemployment but being associated with greater difficulty in matching workers and vacant jobs due to occupational and geographical differences.

In the post 1966 period there has been an upward underlying trend in registered unemployment. The trend accelerated after 1974 and accelerated further after 1979. This has resulted in a surplus stock of unemployment which does not fit easily into any of the four categories which had previously sufficed. This unemployment has been the subject of much controversey within the voluntary versus involuntary unemployment debate.

Gilpatrick E. (1966) has identified this unemployment as growth-gap or technological unemployment. That is unemployment which resulted from increases in productivity of labour and/or of labour supply not matched by sufficiennt increases in aggregate demand to absorb all those seeking work. (It may be that this category is not independent of non-demand-deficiency, since the

Figure 3.3 A Sub-labour Market

Source: Bent Hansen (1970) p.7.

See text for explanation

demand for labour will be influenced by the characteristics of labour supply).

An obvious difficulty arises because we are trying to assess the causes of a change in the size of a stock which is really a relatively small residual between two much larger stocks, the total labour force and the employed labour force.

A classification of unemployment is only of relevance if it can be used, together with the theories (Chapter 2), to identify different types of unemployment.

Thirlwall (1969) suggested that the concept of the UV relationship (see section 3.3) offered a distinction between demand-deficient and non-demand deficient unemployed.

Thirlwall suggested that when measured unemployment and measured vacancies were equal there was no excess demand for, or supply of, labour. This level of unemployment could therefore be considered to be the level of non-demand deficient unemployment. Until 1966 recorded vacancies and registered unemployment had been equal at around the 300,000 level in the United Kingdom.

A theoretical justification for the use of unemployment and vacancy statistics to identify types of unemployment is provided by B Hansen (1970), where the coexistence of registered unemployment and vacancies is explained within the context of an aggregate labour market. (Figure 3.3)

In Figure 3.3 Di Di is the demand for labour in the submarket and SiSi is the supply of labour. Employment is never on either of these curves EiEi represents the employment curve. The assumption is that there are always some employers who do not find sufficient labour even when total supply is greater than demand, and there are always some workers who do not find jobs even when there are more than sufficient jobs available to absorb the unemployed. The closer to equilibrium the market becomes the more difficult it becomes for the matching to coincide. The horizontal distance between DiDi and EiEi measures the number of vacant jobs q_v . The horizontal distance between EiEi and SiSi measures the number of unemployed q_u . In equillbrium unemployment and vacancies are equal. At all other points there is either positive or negative excess demand $q_x{}^1$,

where $q_x{}^1 = q_v{}^1 - q_u{}^1$

In 1974 both A P Thirlwall and J.J Hughes produced papers in which they suggested that the occupational vacancy and unemployment statistics could be used to distinguish structural and frictional unemployement. The menthod is simple. frictional unemployment (U^F) exists if there are unemployed and vacancies in the same occupation, structual unemployment (U^S) exists if there are 'surplus vacancies' in some categories which could be filled by 'surplus unemployed' in other categories, if some retaining were undertaken. Vacancies are therefore of the right type (V^R) if they can absorb some of the unemployed or of the wrong type (V^W) if they cannot absorb the unemployed so that we have:

Total Unemployment (U^T) = demand-deficient unemplyment (U^{DD}) + non-demand deficient unemployment (UNDD).

Where $U^{NDD} = U^F + U^S = V^T$

and $UDD = U^T - V^T$

VT = total vacancies

UT = total unemployment

then $U^S = V^T - V^W = V^R$

This is an adaption of the method suggested by Thirlwall (1969) op. cit.

The accelerating trend of unemployment since 1974 has rendered much of these identification methods using UV data useless. Researchers such as Maki and Spindler (1975), have used regression techniques using prime data to identify the causes of the growth in unemployment. They have concluded that the unemployed have deliberately lengthened their search time, due to a 'high replacement ratio'. (i.e the growth in unemployment has been voluntary). The regression equations of Maki and Spindler have however been shown to be structurally unstable by Junankor (1981). Demand-side factors have been put forward by N.I.E.S.R. (1982) Nickell (1979) and Solow (1980).

3.6 Conclusion

The identification and measurement of unemployment therefore remains a controversial issue as do the theories of unemployment. This chapter has highlighted some of the data problems and the problems of interpretation of those data. The final chapter in this section on unemployment, which follows, draws together these controversies in an examination of the empirical evidence.

Chapter 4

UNEMPLOYMENT: THE EMPIRICAL EVIDENCE

4.1 Introduction

In the preceeding two chapters we have considered the competing theories of unemployment and the problems of classification, identification and measurement of unemployment. The current chapter is concerned with the empirical evidence. We will be drawing on the concepts and theories of Chapter 2 and on the methods of identification and measurement reviewed in Chapter 3. For much of the chapter the framework adopted by J Taylor (1976) is followed.

Taylor reviews the evidence on unemployment between 1951 and 1975 and considers a number of hypotheses. In this chapter we reconsider that evidence in the light of more recent events and suggest that it is open to both a 'supply-side' and 'demand-side' interpretation but that the balance of the evidence, with the benefit of hindsight, appears to favour the 'demand-side' argument.

The rest of the Chapter proceeds as follows; firstly, the framework is presented; this is then followed by evidence related to the demand-side factors. Then structural unemployment is investigated, after which the evidence relating to the voluntary versus involuntary unemployment controversy is considered. Finally there is a conclusion.

4.2 A framework For Assessing The Evidence

The evidence which is available on unemployment is open to a number of interpretations. We need to consider alternative hypotheses using as well structured a framework as possible, though it is not easy to compartmentalise the evidence.

In 1976, J Taylor (see Leontief (ed), 1977) delivered a conference paper which attempted to assess the evidence on unemployment in Britain between 1951 and 1975. Taylor attempts to attribute the increase in unemployment to one or more of three causes:

i) a fall in aggregate demand;
ii) an increase in the structural mis-matching between the demand for and the supply of labour; and
iii) an increase caused by unemployed workers deliberately spending more time in searching for a job.

This framework seems to offer a useful means of assessing the evidence. His interpretations will be examined together with other evidence to show that his own results are open to more than one interpretation and that other available evidence, and more recent evidence would lead us to favour a 'demand-side' interpretation.

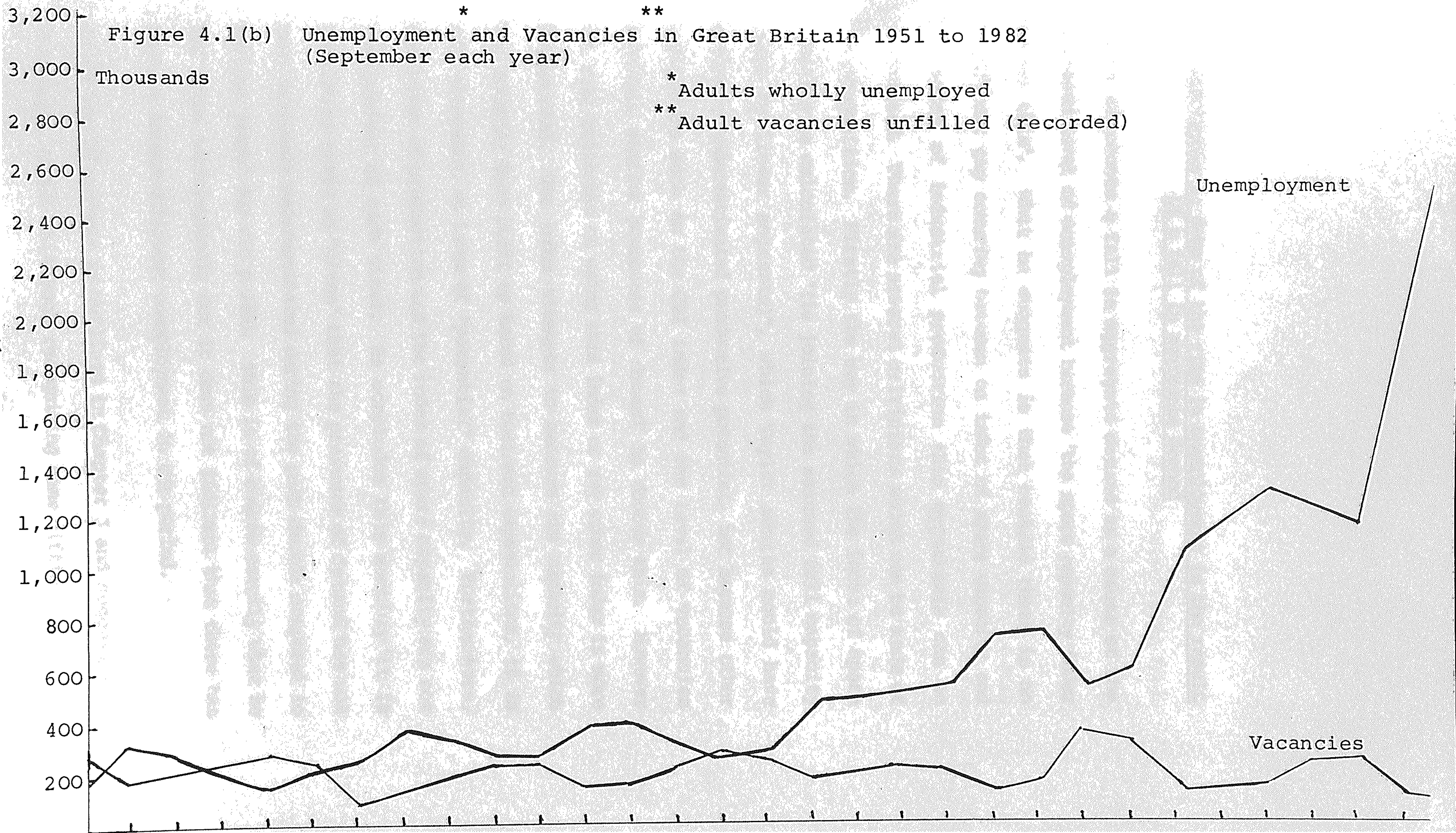
We first examine the hypothesis that some of the rise in unemployment post 1951 has been caused by a fall in the level of aggregate demand. (Figure 4.1 illustrates unemployment and vacancies in Britain 1951 to 1981).

Figure 4.1a Unemployment and Vacancies
Half-Yearly Averages 1963-1983

Source: Economic Progress Report, Sept 1983

Figure 4.1(b) Unemployment* and Vacancies** in Great Britain 1951 to 1982
(September each year)

*Adults wholly unemployed
**Adult vacancies unfilled (recorded)



4.3 Hypothesis 1: Some of the rise in unemployment is the result of a fall in aggregate demand

Taylor discounts a fall in aggregate demand as a cause of the increased level of unemployment because 'the spare capacity index denies this'. What he suggests is that because there is no significant gap occuring between an index of spare capacity and the index of industrial production this hypothesis can be discounted. There are several criticisms which can be made of the proposition. Firstly the way in which the index of spare capacity is calculated "(ie joining the assumed full capacity peaks by linear segments)", which Taylor admits could have seriously underestimated productive potential, but because other indicators such as the CBI index and the level of vacancies 'indicate similar pressures of demand' he doubts this. However the real criticism of using this index or any other index is more fundamental. The index attempts to measure the capacity which has actually been built up based on business expectations, it is not, therefore, an index of "potential" capacity. Furthermore, the index of production and the index of spare capacity are not independent of each other. He concludes this section 'it is therefore taken as "given" that the pressure of demand has not been seriously underestimated during the past decade compared to earlier years" (op cit p 169). This is of course exactly what he has shown tautologically but it does not indicate that there has been no demand-deficient unemployment in the period.

Using the UV concept as outlined in Chapter 3 and suggested by Thirlwall (1969) (although recognising some difficulties of the data) a deficiency of aggregate demand would have been responsible for unemployment in all but a few years since 1951. In no year since 1966 have recorded vacancies exceeded registered unemployment. (See Table 4.1)

The demand-deficient unemployment in Table 4.1 is based on a very simple measure: that of a shortfall of vacancies available for the unemployed. It represents both cyclical and growth-gap or technological unemployment referred to in Chapter 3. But it is demand-deficient in the sense that no matter what skills and qualifications the unemployed possessed, no matter how mobile they were, no matter how much investment in search and information gathering were made, 'that number' of individuals would still not find a job; although 'each individual' might be able to improve his/her prospects of finding a job.

If some allowance is made for the underrecording of vacancies, which is generally considered more problematic that that of unemployment, the picture changes only slightly. If, as the DE survey of 1977 revealed, approximately a third of vacancies are notified to employment offices, we can tentatively conclude that at any time the recorded vacancies might underrepresent true vacancies by up to two-thirds. It is likely that vacancies not notified are on the whole the easiest to fill, and probably also consist of a number which employers do not expect to fill from the ranks of the unemployed: as such the recorded vacancies are less likely to be available at any particular point in time. Doubling the vacancy statistics removes demand-deficiency in the years 1950, 1952, 1953, 1957, 1960, 1961, 1964, 1966, 1973 and

Table 4.1

Estimates of Demand-Deficient Unemployment, Great Britain 1948 to 1980.

	(1)	(2)	(3)
Year	Number of ** Registered Unemployed Males & Females Thousands	Number of *** Recorded Vacancies Males & Females Thousands	Demand-Deficient Unemployment (1) - (2) Thousands
1948	282.9	301.5	- 18.6
1949	255.9	273.6	- 17.7
1950	267.0	249.6	17.4
1951	198.5	290.3	- 91.8
1952	316.5	186.7	129.8
1953	271.4	201.9	69.5
1954	209.517	248.1	- 38.6
1955	168.744	297.5	-128.8
1956	209.217	224.911	- 15.694
1957	241.116	189.197	51.969
1958	376.232	120.905	255.327
1959	354.223	175.373	178.850
1960	269.807	228.840	40.967
1961	261.145	222.673	38.472
1962	378.793	147.074	231.719
1963	398.776	158.188	240.588
1964	293.192	238.110	55.082
1965	269.013	275.042	- 6.029

1966	287.135	247.132	40.003
1967	476.774	176.602	300.172
1968	492.524	196.366	296.158
1969	496.151	208.304	287.847
1970	531.547	191.562	339.985
1971	732.948	124.777	608.171
1972	768.290	157.830	610.460
1973	521.059	353.487	167.572
1974	602.380	307.203	295.177
1975	1055.884	140.786	915.098
1976	1202.512	139.404	1063.108
1977	1312.175	158.953	1153.222
1978	1252.236	231.150	1021/086
1979	1161.559	251.510	910.049
1980	1671.111	118.512	1552.599

* September each year

** Adults wholly unemployed

*** Adult vacancies unfilled

Sources: British Labour Statistics Historical Abstract, Tables 165, 175, 179 and 181 and various DE Gazettes.

1974. That is to say only in the 1973/4 boom period was there no demand-deficiency in the post 1966 period. (Trebling the vacancy statistics would add the years 1959, 1962-3, and 1967-70 to the no-demand-deficiency list but we could not include any year since 1974 even if we quadrupled the vacancy statistics).

Cheshire (1973) found that a log linear relationsip between unemployment and vacancies was statistically significant for all regions using data for the period 1962-5, with a mean $R^2 = 0.905$. This result is significant at the 0.1% level on a t test. The rates of unemployment for the regions consistent with non-demand deficient unemployment ranged betwen 0.9% in the Midalnds to 1.77% in Wales.

Demand-deficient unemployment (or an excess supply of labour) using a Keynesian approach would arise through a shortfall in the pressure of demand for final products. The classical analysis and the Monetarist approach would identify the marginal real wage as being too high so that 'workers are pricing themselves out of jobs'.

The National Institute of Economic and Social Research in their review, November 1982[1], examine the recession 1979II to 1981II when total output fell by 7.5% and industrial production by 14%. Only two previous recessions are comparable with this; 1930-2 and 1974-5. The National Institute compare these three recessions. Exports were the major source of the fall in GDP for the 1930-2 recession caused by the collapse of world trade. The two later

1 "The nature and origins of the recession", National Institute Economic Review, November 1982.

recessions were quite different. Foreign trade actually "contributed positively to output and heavy destocking outweighed all other changes". (N.I.E.R. November 1982, p 8)

The National Institute and the London Business School presented papers to the Bank of England's Panel of Academic Consultants. Both used their econometric models to predict what would have happened to the economy if government policy had been 'neutral' and there had been no exogenous shocks, such as the oil price rise in 1979. Differences between output from a 'non-recessionary trend' and actual output are then attributed to four 'causes': "policy, the appreciation in the real exchange rate, the increase in oil prices and excessive growth in real wages". (N.I.E.R. op cit p 9)

Table 4.2 shows the results, which should be treated with the usual caution necessary when models of the economy are used. However, the similarities in the results suggest that some confidence can be placed in them. The major contributors to the 1979-1981 recession appear to have been the restrictive fiscal and monetary policies and the high value of the pound, which is also partly a result of the restrictive measures.

Because of the difficulty in interpretation of recorded vacancy statistics it is not possible to conclusively disagree with Taylor that demand-deficiency was not responsible for the increase in unemployment up to 1974. But unless there has been some substantial fall in the propensity to register vacancies with the ESD it is true that since 1956, more so since 1966 and

Table 4.2 Explanations of the shortfall in output 1979-81 especially since 1974, the pressure of demand for labour relative to its supply has been much lower that in the period 1948-1956, and this must be responsible for a proportion of the increase in unemployment. Moreover output (GDP) during the post 1979 recession has fallen by about 5%, while industrial output (excluding MLH104)[1] and manufacturing output have fallen to levels not previously experience since the 1960's.

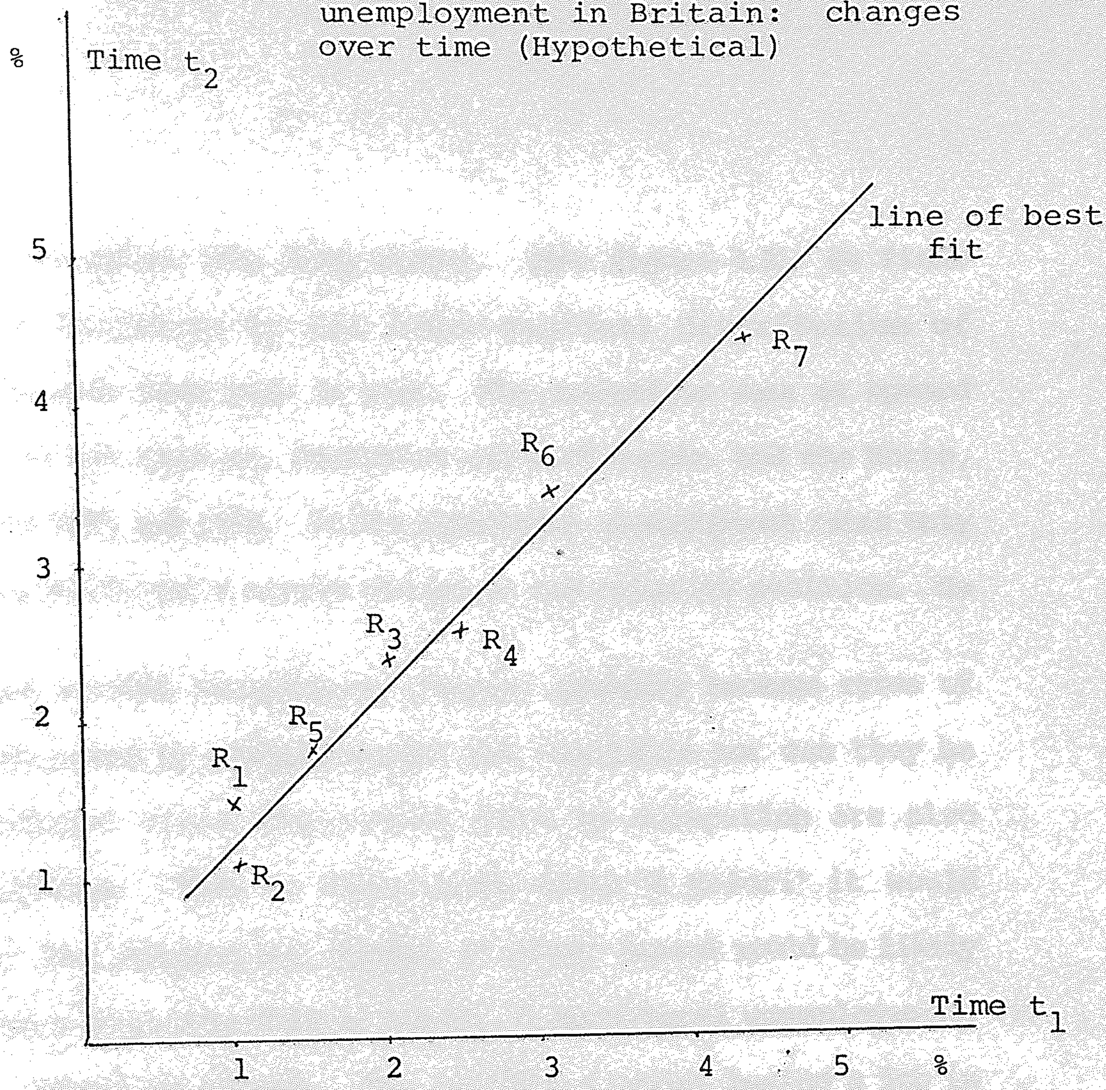
4.4 <u>Hypothesis 2: That some of the rise in unemployment is the result of an increase in the structural mis-matching between the demand for and the supply of workers</u>

> "Structural unemployment occurs if changes in consumption patterns and production techniques take place too quickly. Such changes lead to differential growth rates in the demand for labour between different occupations, industries and different geographical locations; and the supply of labour may not respond quickly enough to the changing pattern of labour demand, with the result that the extent of mis-matching between labour demand and labour supply gets worse ...... If structural unemployment had increased we would expect this to be reflected in a change in either the regional or industrial patterns of unemployment or both"
>
> Taylor (op cit p169-172)

Taylor uses an interesting idea to examine this phenomenon of increased structural mis-matching. He compares unemployment rates by regions and industries separately at peaks in the

1 MLH 104 of SIC, 1968 - extraction of mineral oil and gas

Figure 4.2 The regional distribution of unemployment in Britain: changes over time (Hypothetical)



Each cross represents the unemployment of a region (e.g. R_1) in each of two time periods, say 1951 (t_1) and 1955 (t_2). If the crosses are close to the line of best fit, then the regional dispersion of unemployment is similar at time t_1 to t_2. The basis of Taylor's hypothesis is therefore that structural unemployment would be associated with a change in the dispersion of regional, industrial and occupational unemployment.

business cycles (for both sexes). (See figure 4.2). He finds little variation in the inter-regional distribution of unemployment from peak to peak. The exceptions were an upward shift in two regions, Yorkshire and Humberside, and the North, between 1965 and 1970. In the industrial unemployment rates only mining exhibited a severe change in its relative position. He did not examine occupational changes, probably because rates of unemployment by occupation are not available nor can they be calculated since employment data by occupation are also unavailable. This is unfortunate since 'a priori' it would appear that occupational changes in labour demand would be likely to have a more significant impact on structural unemployment, than industrial change. (For example a typist losing a job in the Steel Industry can be employed in another industry, but a furnaceman in the same industry might have more difficulty switching industries).

Using the same methodology as Taylor the change in unemployment by occupational category was investigated. Since occupational unemployment rates are not available two alternative measures fere used; firstly the unemployment totals by occupation and secondly the U/V ratios by occupation. The period initially chosen for investigation was 1960 to 1968, this was a slightly longer period[1] than Taylor had used and a period for which there

1 A longer period would 'a priori' be expected to pick up any of the structual change, since such changes occur relatively slowly. However if we choose too long a period, we would expect workers to have responded to that structural change.

was available an unchanged series of data. A simple linear regression line was estimated relating the numbers unemployed in each occupational category in one period with those in another period:-

$$U_{T2} = a + bU_{T1} + e \qquad (1)$$

Separate equations were estimated for males and females and a combined equation was estimated. A similar regression equation using U/V data was estimated:-

$$\frac{U}{V}_{T2} = a + b\frac{U}{V}_{T1} + e \qquad (2)$$

The results were as follows:-

1 Male $U_{1968} = 421.26 + 1.94U_{m1960}$

$r^2 = 0.9558$

104 occupational categories

2 Male $U_{1968} = 1433.9 + 1.97U_{m1960}$

$r^2 = 0.9950$

26 broad occupational categories

3 Female $U_{1968} = -29.1016 + 0.97U_{f1960}$

$r^2 = 0.8955$

64 occupational categories

4 Female $U_{1968} = 123.155 + 0.91U_{f1960}$

$r^2 = 0.9061$

23 broad occupational categories

5 Male & Female $U_{1968} = 503.90 + 1.78U_{1960}$

$r^2 = 0.9876$

26 broad occupational categories

6 Weighted $\frac{U_{1968}}{V}$ = $-1132.28 + 3.96$ Weighted $\frac{U_{1960}}{V}$ (Males & Females)

$r^2 = 0.9982$

using 26 broad categories

These results were initially very puzzling, since a perusal of the data indicated that the correlation coefficients would be low, (there were quite large changes in the dispersion, see for example scatter diagram figure 4.3) whereas they are in fact very high. The reason for these high values however proved to be the key to understanding the basic inadquacies of the methodology used here and by Taylor.

Some occupational categories had very large numbers of unemployed in both periods whilst others had very small numbers. About half of the unemployed were in the category of general laourers (male) and other workers (females). These categories were a catch-all for all unskilled workers. This very large category was dominating the results. The regressions were repeated without this large category. The results were:-

1' Male $U_{1968} = 63.16 + 2.36\ U_{m1960}$

$r^2 = 0.9780$

100 occupational categories (excluding 4 categories of 'general labourers')

2' Male $U_{1968} = 142.84 + 2.39\ U_{m1960}$

$r^2 = 0.9950$

25 occupational categories (excluding 'general labourers')

3' Female $U_{1968} = -82.13 + 1.08\ U_{f1960}$

$$r^2 = 0.8460$$

61 occupational categories (excluding 3 categories of 'other workers')

4' Female $U_{1968} = 12.14 + 0.98\ U_{1960}$

$$r^2 = 0.8547$$

22 occupational categories (excluding 'other workers')

5' Male & Female $U_{1968} = 609.17 + 1.755\ U_{1960}$

$$r^2 = 0.8663$$

25 occupational categories (excluding male 'general labourers' and female 'other workers')

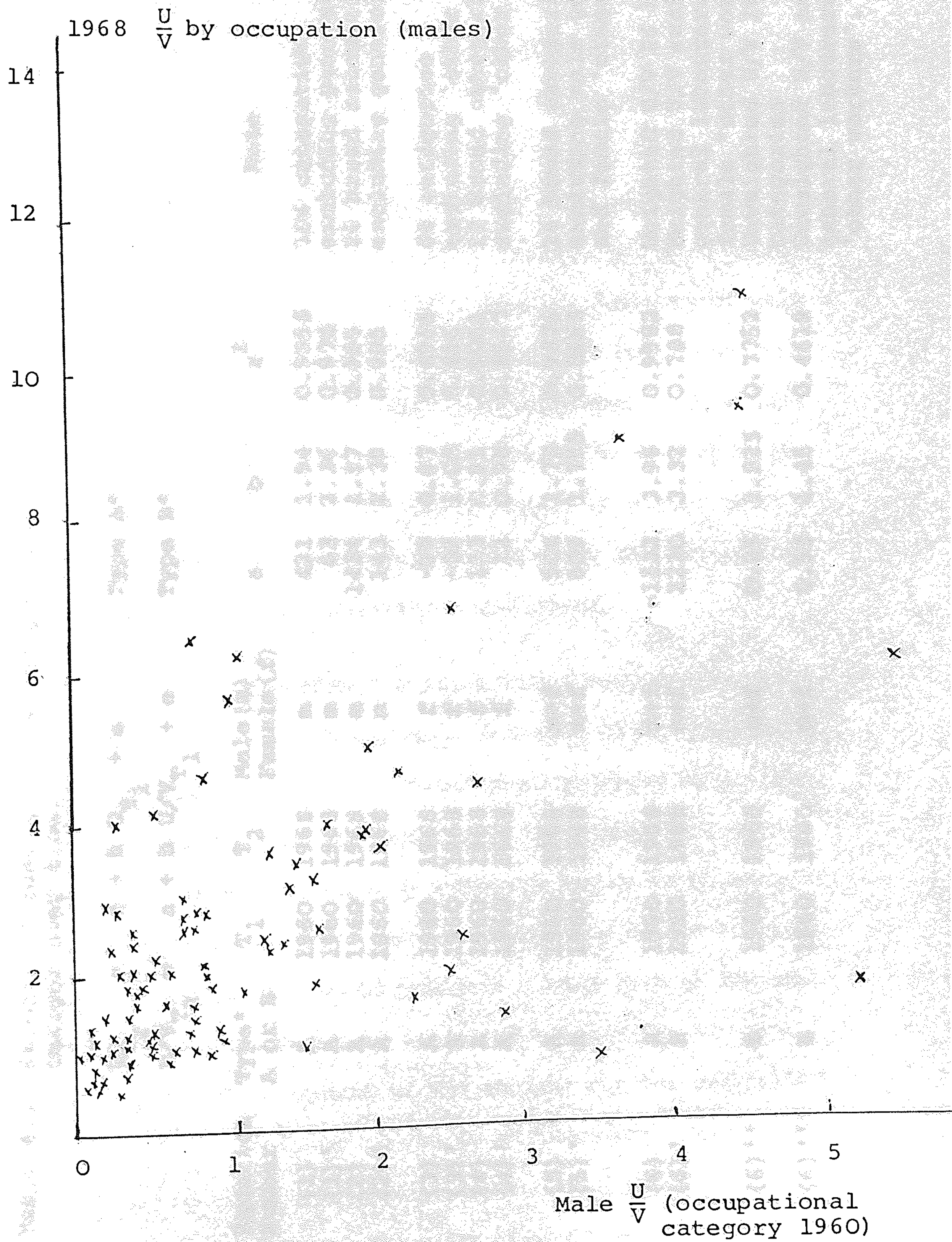
6' Weighted $\frac{U}{V}_{1968} = 2220.13 + 3.32 \frac{U}{V}_{1960}$ (Males & Females)

$$r^2 = 0.7880$$

25 occupational categories (excluding male 'general labourers' and female 'other workers')

The differences between the two sets of results revealed some interesting points. (See Table 4.3) Firstly the male results 1' and 2' showed again very high correlation coefficients but the line of best fit was somewhat different without the 'general labourers'. The female results 3' and 4' showed less change in the slope of the line but more deviation from the norm without the 'other workers' category. The male and female results 5' as before is dominated by the males. (The males being a much larger proportion of total unemployment). Here the line of best fit has changed little without the 'general labourers' and 'other workers' categories but the deviation has increased. Lastly the weighted U/V ratios regression without this same category, 6' shows a much worse fit as well as a quite large change in the slope.

Figure 4.3 The occupational distribution of U/V ratios in Britain: changes over time. Scatter diagram - typical of the whole set (see text).



Note: Not all occupational categories on scatter e.g. 1 category U/V over 9 in 1960 but less than 4 in 1968, others missed because of

Table 4.3 Summary of results - The occupational dispersion of unemployment: changes over time.

$$U_{T_2} = a + b\,U_{T_1} + e \qquad \text{Type A*}$$

$$U/V_{T_2} = a + b\,U/V_{T_1} + e \qquad \text{Type B*}$$

Equation Number	Type* A or B	T_1	T_2	Male (m) Female (f)	a	b	r^2	Note
(1)	A	1960	1968	m	421	1.94	0.9558	104 categories
(1)'	A	1960	1968	m	63	2.36	0.978	excluding general labourers
(2)	A	1960	1968	m	1434	1.97	0.995	26 broad categories
(2)'	A	1960	1968	m	143	2.39	0.995	excluding general labourers
(3)	A	1960	1968	f	-29	0.97	0.8955	64 categories
(3)'	A	1960	1968	f	-82	1.08	0.846	excluding 'other workers'
(4)	A	1960	1968	f	123	0.91	0.9061	23 broad categories
(4)'	A	1960	1968	f	12	0.98	0.8547	excluding 'other workers'
(5)	A	1960	1968	m+f	504	1.78	0.9876	26 broad categories
(5)'	A	1960	1968	m+f	609	1.755	0.8663	excluding male general labourers and female 'other workers'
(6)	B	1960	1968	m+f	-1132	3.96	0.9982	Weighted U/V 26 broad categories
(6)'	B	1960	1968	m+f	2220	3.32	0.788	Weighted U/V excluding male general labourers and female 'other workers'
(6)''	B	1960	1968	m+f	0.25	1.925	0.7752	Unweighted U/V 26 broad categories
(6)'''	B	1960	1968	m+f	0.53	1.45	0.4619	Unweighted U/V excluding male general labourers and female 'other workers'.

These changes in the estimated line of best fit reveal the basic weakness of the methodology and the implicit definition of structural unemployment. If structural unemployment is only said to increase when there is an increase in the variation in unemployment by occupation or industry, or geographical location then by definition a 'general' increase in structural unemployment cannot be identified. Take the category of male 'general labourers' whose level of unemployment increased from 112,258 in September 1960 to 221,014 in September 1968, whilst total male unemployment increased from 194,440 to 421,124 in the same period. Because this category increased by almost exactly the same proportion as total male unemployment the methodology indicates this cannot be structural unemployment.

However we can image a scenario where structural unemployment would increase along with a general increase in unemployment. Suppose the demand for manufactured goods produced by Britain with the technology used by Britain were declining, that British manufactured goods were becoming uncompetitive in world markets due to product design, methods of production or a high value of the pound sterling, this would result in a large general increase in unemployment in the traded sector of the economy, but would spill over into other sectors of the economy via the multiplier effects. There would of course be differential impacts on unemployment but this differential impact would be dominated by the overall general impact. To give an example of the differential impact on unemployment and vacancy ratios, another regression on 'unweighted' U/V ratios was undertaken using the same data as before. The results in themselves are not proof of structural unemployment but they do indicate the spread of U/V ratios.

The results were:

$$6'' \quad \text{(Unweighted)} \quad \frac{U}{V}_{1968} = 0.25 + 1.925 \frac{U}{V}_{1960} \quad \text{(Males \& Females)}$$

$$r^2 = 0.7752$$

26 occupational categories

$$6''' \quad \text{(Unweighted)} \quad \frac{U}{V}_{1968} = 0.53 + 1.45 \frac{U}{V}_{1960} \quad \text{(Males \& Females)}$$

$$r^2 = 0.4619$$

25 occupational categories (excluding male 'general labourers' and female 'other workers')

Comparing these unweighted results with the earlier results 6 and 6' (Table 4.3) indicates how the dispersions of U/V ratios is dominated by the overall general increase. The difference between 6'' and 6''' gives some indication of the dominance of the last category where the U/V ratio was very high in both periods; 4.07 and 9.06 respectively, whilst the next highest was 1.84 and 3.24, respectively (Farming and Fishing).

A method which would overcome some of the methodological problems would be to compare the 'proportions' of unemployed persons in different industrial or occupation groups or in different geographical areas. This would isolate the change in the variation in unemployment from the absolute change, but cannot isolate structural changes which spill over into all occupations, industries and areas. The regional, occupational and industrial 'mix' of registered unemployed were compared at selected times. (Like Taylor, peaks of the business cycle were compared to avoid cyclical variations). In addition the regional and industrial compositions of employment were compared. Regression lines $Y = a + bx + u$ were estimated where Y is the proportion of total unemployment or employment in each category or region in one period and x the proportion in another period. Then an F test statistic was calculated to test Ho: $a = 0 \quad b = 1$. (ie a 45^{o} line) If the proportion employed or unemployed in regions or industrial or occupational categories remained unchanged then Ho could not be rejected.

Table 4.4 shows the regional results. Between 1960 and 1969 male employment changed significantly in its regional dispersion. A reduction in the proportion of males employed in the South East and East Anglia combined was the main change. The female and total dispersions did not significantly alter. The unemployment regional dispersion did not significantly change for males, females or in total, using an F test. (Though the proportions of the unemployed in the West Midlands and Yorkshire and Humberside rose and the proportions in Scotland and the North West fell, 1964 to 1968. See figure 4.6)

Between 1969 and 1979 there was a statistically significant change in the regional dispersion of employment for males and females. The South-East's reduced proportion of both male and female employment was the main change with a smaller decline in the North-West and an increase in the South-West contributing to the change in employment structure. However, no correspondingly

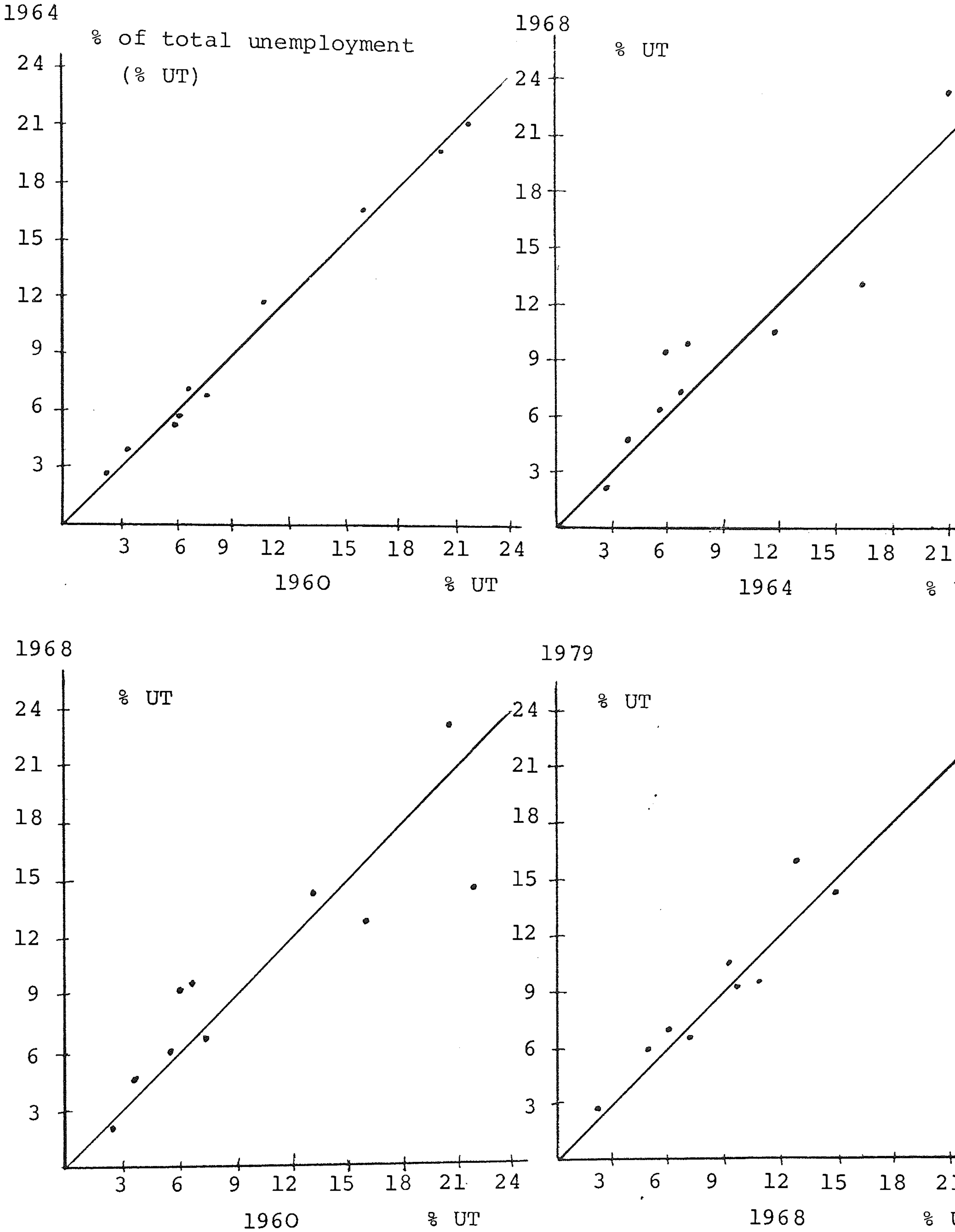


Figure 4.6 The regional distribution of unemployment in Britain: changes over time.

Table 4.4(a) Summary of Results - The regional distribution of employment proportions: changes over time.

$Y = a + bX + e$ F test - Ho : a = 0 b = 1

Y: Employment Proportions in year:	X	Males (m) Females (f)	F statistic	n	Reject Ho? (confidence level)
1960	1969	m	10.4044	8	0.01
1960	1969	f	0.0011	8	No
1960	1969	m+f	3.8703	8	No
1969	1979	m	8.6226	10	0.01
1969	1979	f	12.0486	10	0.01
1969	1979	m+f	9.5660	10	0.01
1973	1979	m	17.1957	10	0.001
1973	1979	f	3.8792	10	No
1973	1979	m+f	14.4665	10	0.01

Table 4.4(b) Summary of Results - The regional distribution of unemployment proportions: changes over time.

1960	1964	m	0.1509	10	No
1960	1964	f	0.1464	10	No
1960	1964	m+f	0.03697	10	No
1964	1968	m	1.1670	10	No
1964	1968	f	2.6564	10	No
1964	1968	m+f	1.4875	10	No
1968	1979	m	0.5751	10	No
1968	1979	f	1.5780	10	No
1968	1979	m+f	0.9180	10	No

See Appendix II for a full set of results and data sources.

significant change occurred in the regional distribution of unemployment. Furthermore the South-East and the North-West experienced declines in their share of total unemployment, whilst the South-West experienced an increase. This would suggest that the changes in the regional structure of employment tended to be matched by movements of labour.

Table 4.5 shows the industrial changes, using the broad SIC categories. Between 1960 and 1968 no significant change occurred in the industrial structure of employment, nor unemployment. Between 1969 and 1979 only the female industrial structure of employment changed significantly, and this was matched by a change in the industrial structure of unemployment. The SIC contributing most to this change was 'miscellaneous services' which accounted for a relative increase in employment and a relative decrease in unemployment.

Table 4.6 shows the occupational changes in the composition of unemployment. (Unfortunately no analysis of all employees in employment by occupation is available for comparison.) It is the occupational or skill composition of the workforce which is most likely to result in structural mis-matches of jobs and workers, so these results are perhaps the most interesting. The occupational categorisation of unemployment changed in 1972 so two periods were analysed: 1960 to 1968 and 1973 to 1979. In both periods there was a significant change in the occupational structure of male unemployment whilst the female unemployment structure did not change significantly. The most likely

Table 4.5(a) Summary of Results - The industrial distribution of employment proportions: changes over time.

$Y = a + bX + e$ F test - Ho : $a = 0$ $b = 1$

Y Employment Proportions in year:	X	Males (m) Females (f)	F statistic	n	Reject Ho? (confidence level)
1960	1968	m	0.0918	24	No
1960	1968	f	1.3639	24	No
1960	1968	m+f	1.4697	24	No
1969	1979	m	0.4718	27	No
1969	1979	f	6.5029	27	at 0.01
1969	1979	m+f	6.7179	27	at 0.01

Table 4.5(b) Summary of Results - The industrial distribution of unemployment proportions: changes over time.

1960	1968	m	0.0096	24	No
1960	1968	f	0.5648	24	No
1960	1968	m+f	0.3891	24	No
1969	1979	m	2.7272	27	No
1969	1979	f	5.8506	27	at 0.01
1969	1979	m+f	2.1498	27	No

Note: The unemployment statistics by SIC used to calculate the regressions for 1960/68 are for the UK (GB not available).

See Appendix II for a full set of results and data sources.

Table 4.6 Summary of Results - The occupational distribution of unemployment proportions: changes over time.

$Y = a + bX + e$ F test $Ho : a = 0 \quad b = 1$

Y	X				
Unemployment Proportion in year:		Males (m) Females (f)	F statistic	n	Reject Ho? (confidence level)
1960	1968	m	22.6469		at 0.001
1960	1968	f	0.1730		No
1960	1968	m+f	-		-
1973	1979	m	19.4816		at 0.001
1973	1979	f	0.0874		No
1973	1979	m+f	21.728		at 0.001

Note 1 Male and female regression not estimated for 1960/8 since occupational categories of males and females not identical.

Note 2 No corresponding data on employment by occupation available.

See Appendix II for a full set of results and data sources.

explanations for these differences between the sexes are the very different nature of attachment to the labour force between men and women, and the changing structure of employment. Firstly because many women have a secondary or peripheral attachment to the labour force they are more likely to leave the labour market when unemployed and join or rejoin when jobs for them are available (or to appear to do so if they do not register when they are unemployed). This tendency would prevent any substantial increase or decrease in the registered proportion of women unemployed in any one category. Secondly because the change in the occupational structure of employment has been moving away from heavy male-typical jobs to more dexterous manual, clerical and service jobs, female opportunities for work have been relatively more numberous than for males. The smaller overall increase in registered female unemployment would be less likely to produce a structural change. The change in male registered unemployment has been large and occupationally diverse.

The main changes between 1960 and 1968 occurred in four categories. Overwhelmingly the biggest change was in the proportion of male unemployment in the category of 'Labourers' falling from 57.7% of total male unemployment in 1960 to 52.5% in 1968, smaller changes took place in 'Engineering and allied trade workers', 'Construction workers', and 'Clerical workers' all three categories experiencing rises in the proportion of male workers registered as unemployed.

Between 1973 and 1979 significant changes in the occupational structure of male unemployment occurred. However, once again the dominant change was the fall in the proportion represented by the final category labelled 'miscellaneous' in the 'List of key occupations for statistical purposes' (KOS), which came into force in 1972. Again this category declined in relative importance, although in absolute terms was still by far the largest single category. Between 1973 and 1979 the proportion of males in this category fell from 50.6% to 43.4%. A fall in proportion of males registered in the category 'clerical and related' took place, whilst there were increases in the proportions registered in the categories 'catering, cleaning, hairdressing and personal services', 'Construction, mining and related not identified elsewhere' and 'Transport operating, materials moving and storing related'.

4.4.1 Other evidence of structural change

J K Bowers (1976) returned to the problem of identifying structural changes in the labour market after having rejected the hypothesis of increased structural unemployment in an earlier paper (Bowers et al 1972). He used an equation relating first differences of vacancy rates to a distributed lag of the quarterly index of GDP estimated over the period 1958 to 1971IV.

$$\Delta V_t = \underset{(1.12)}{-0.1559} + \underset{(2.62)}{0.0319\, Q^*_t} - \underset{(0.02)}{0.0004\, Q_{t-1}} - \underset{(2.56)}{0.0309\, Q_{t-2}^*}$$

$$- \underset{(0.88)}{0.0285D} + \text{seasonals}$$

$R^2 = 0.806$ $\qquad\qquad$ $DW = 1.52$

where Q is a quarterly index of GDP, D is a shift dummy from 1966 IV, t-ratios in brackets, an asterisk indicates significance at the 1% level. Omitting the insignificant dummy variable he used the equation to predict vacancies from 1972 I to 1973 III. From 1972 III vacancies rose much faster than the equation predicted. During this upswing vacancy rates were higher than would have been predicted from previous experience.

Bowers then used an equation relating male unemployment to output calculated over the same period to predict male unemployment from 1972 I to 1973 III.

$$\Delta U_t = 0.5646 - 0.1648\ Q_t^* + 0.1134\ Q^*_{t-1} + 0.0492\ Q_{t-2}$$

$$(1.63) \quad (5.43)$$

$$+\ 0.1670\ D^* + \text{seasonals}$$

$$(2.86)$$

$R^2 = 0.906$ $\qquad\qquad$ $DW = 1.87$

For most quarters this equation under-predicts the decline in unemployment. The outward trend in vacancies against GDP and the inward trend in unemployment against GDP left the actual UV curve virtually unmoved. This stability of the UV curve is what had led Bowers to reject the hypothesis of increased structural unemployment in his earlier paper (1972). But the separate movements of the unemployment and vacancy series led him to accept the hypothesis in 1976. He suggests further evidence of structural shift. Firstly, from early 1972 to mid 1973 both manufacturing output and GDP were rising against trend but employment in manufacturing was falling whilst in the rest of the economy employment was rising with a nett result of falling male unemployment. In addition the mean duration of unemployment of older males deteriorated sharply during 1971 and 1972, which is what would be expected if structural changes were occurring. Finally, Bowers uses UV analysis for manufacturing and non-manufacturing separately to show that the two sectors have exhibited similar shifts from 1966 IV to 1970 but for different reasons. In manufacturing vacancies rose relative to unemployment, whilst in non manufacturing unemployment rose relative to vacancies.

Ball (1983) examines the spatial and structural characteristics of recent unemployment growth, especially post 1979. The post 1979 growth in unemployment has been associated with a massive rise of long-term unemployment (over 52 weeks) of differing geographical incidence (see Table 4.7a and 4.7b). The growth of long-term unemployment in the West Midlands has been far greater than in any other region, although Northern Ireland still has a slightly higher proportion of long-term unemployed in its unemployment total. Ball uses shift-share analysis to highlight the problem areas but they can be identified more easily by examining the percentage change in long-term unemployment (See the final column of Table 4.7, not in Ball's Table 1). The West Midlands and South East,

TABLE 4.7(a) Long Term Unemployment - Great Britain
September each year 1957-1961 - October 1962 to 1982

	MALE			FEMALE		
	Total Unemployed (1)	Over 52 Weeks (2)	Column (2) as a % of Column (1) (3)	Total Unemployed (1)	Over 52 Weeks (2)	Column (2) as a % of Column (1) (3)
	Thousands			Thousands		
1957	180.2	23.4	13.0	80.1	4.4	5.5
1958	296.2	32.7	11.0	119.7	6.0	5.0
1959	285.3	51.5	18.1	108.8	9.2	8.5
1960	213.1	47.1	22.1	84.9	8.1	9.5
1961	211.2	39.9	18.9	79.5	7.0	8.8
1962	345.9	49.0	14.2	121.7	8.3	6.8
1963	341.7	66.0	19.3	120.0	11.1	9.3
1964	252.6	54.6	21.6	87.7	8.6	9.8
1965	233.8	44.1	18.9	74.4	7.0	9.3
1966	292.2	42.0	14.4	82.4	6.0	7.3
1967	429.3	63.5	14.8	102.4	8.8	8.6
1968	450.1	79.6	17.7	88.7	8.8	9.9
1969	456.0	87.3	19.1	86.6	8.3	9.6
1970	483.1	92.9	19.2	93.2	8.7	9.3
1971	638.8	118.5	17.3	134.8	11.5	8.5
1972	652.7	162.0	24.8	136.8	15.6	11.4
1973	425.2	129.2	30.4	81.6	13.3	16.3
1974	507.0	115.9	22.9	103.2	11.9	11.5

CONT'D

TABLE 4.7(a) continued ...

1975	855.1	144.5	16.9	243.5	16.7	6.9
1976	972.2	227.8	23.4	348.8	36.8	10.6
1977	1,028.7	264.9	25.8	427.9	59.4	13.9
1978	946.0	266.7	28.2	418.9	66.4	15.9
1979	925.8	281.4	30.4	441.9	75.7	17.1
1980	1,414.2	313.6	19.4	648.7	87.5	22.2
1981	2,106.4	615.1	29.2	882.3	169.5	19.2
1982	2,207.4	810.2[1]	36.7[1]	841.6	179.1[1]	25.7[1]

Source: DE Gazette, June 1978 - "Statistics on Long-Term Unemployment" and other DE Gazettes.

[1]The figures for October 1982 have been affected by industrial action in 1981. The figures are an underestimate. The DE estimates that the total figure (males plus females) is 1,029.0 thousand an underestimate of approximately 40,000.

Table 4.7(b) Regional Distribution of Long-Term Unemployment 1974-82.

Region	1974		1980		1982		% Δ **
	(000s)	%*	(000s)	%*	(000s)	%	1974-82
South East	15.6	16.6	56.7	15.1	206.8	28.3	+1225
East Anglia	2.5	24.8	7.0	16.6	21.7	28.0	+ 768
South West	7.5	23.8	23.1	20.2	56.9	30.3	+ 659
West Midlands	8.6	21.6	36.8	18.8	142.5	38.6	+1557
East Midlands	7.1	25.7	19.6	17.4	62.7	32.3	+ 783
Yorkshire and Humberside	11.5	26.2	31.9	18.1	100.4	33.9	+ 773
North West	19.6	24.1	61.2	21.6	164.9	36.1	+ 741
North	14.5	29.2	34.9	22.2	86.1	36.9	+ 494
Scotland	18.7	25.6	49.2	20.8	118.6	34.0	+ 534
Wales	7.2	24.1	23.2	19.9	62.3	35.5	+ 765
Northern Ireland	14.5	29.2	20.6	24.3	47.6	39.4	+ 228
United Kingdom	118.6	23.5	364.2	19.2	1070.5	33.6	+ 803

* As a percentage of total unemployment.

** Percentage change in long-term unemployment.

Source: Table 1, Ball (1983) from Regional Statistics, 1975, DE Gazettes, August 1980 and August 1982.

Table 4.8 Changes in Employment and Unemployment by Region

Thousands

Employees in Employment	June 1970	% change between periods 1970/75	1975/80	1970/81	June 1981
SE	7,313	0.1	-0.7	-5.1	6,940
EA	623	7.7	1.9	3.7	646
SW	1,430	6.5	3.7	5.5	1,508
WM	2,247	-1.6	-2.4	-12.0	1,978
EM	1,441	3.1	2.7	0.1	1,442
YH	1,969	0.8	-1.6	-7.5	1,821
NW	2,711	-1.3	-2.7	-10.5	2,425
North	1,233	2.7	-4.1	-8.4	1,130
Wales	967	3.2	-1.2	-5.5	914
Scotland	2,058	0.9	-1.9	-6.4	1,927
NI	478	3.3	1.8	-0.4	476
UK	22,471	1.1	-0.9	-5.6	21,205

Registered Unemployed	June 1970	% change between periods 1970/75	1975/80	1970/81	June 1981
SE	114	60	77	412	584
EA	12	83	74	433	64
SW	32	101	57	400	160
WM	40	105	92	665	306
EM	30	65	104	460	168
YH	53	35	114	374	251
NW	72	89	85	436	386
North	56	28	98	262	203
Wales	33	54	95	355	150
Scotland	82	24	120	273	306
NI	32	22	90	225	104
UK	555	57	91	383	2,681

Source: DE Gazette (various)

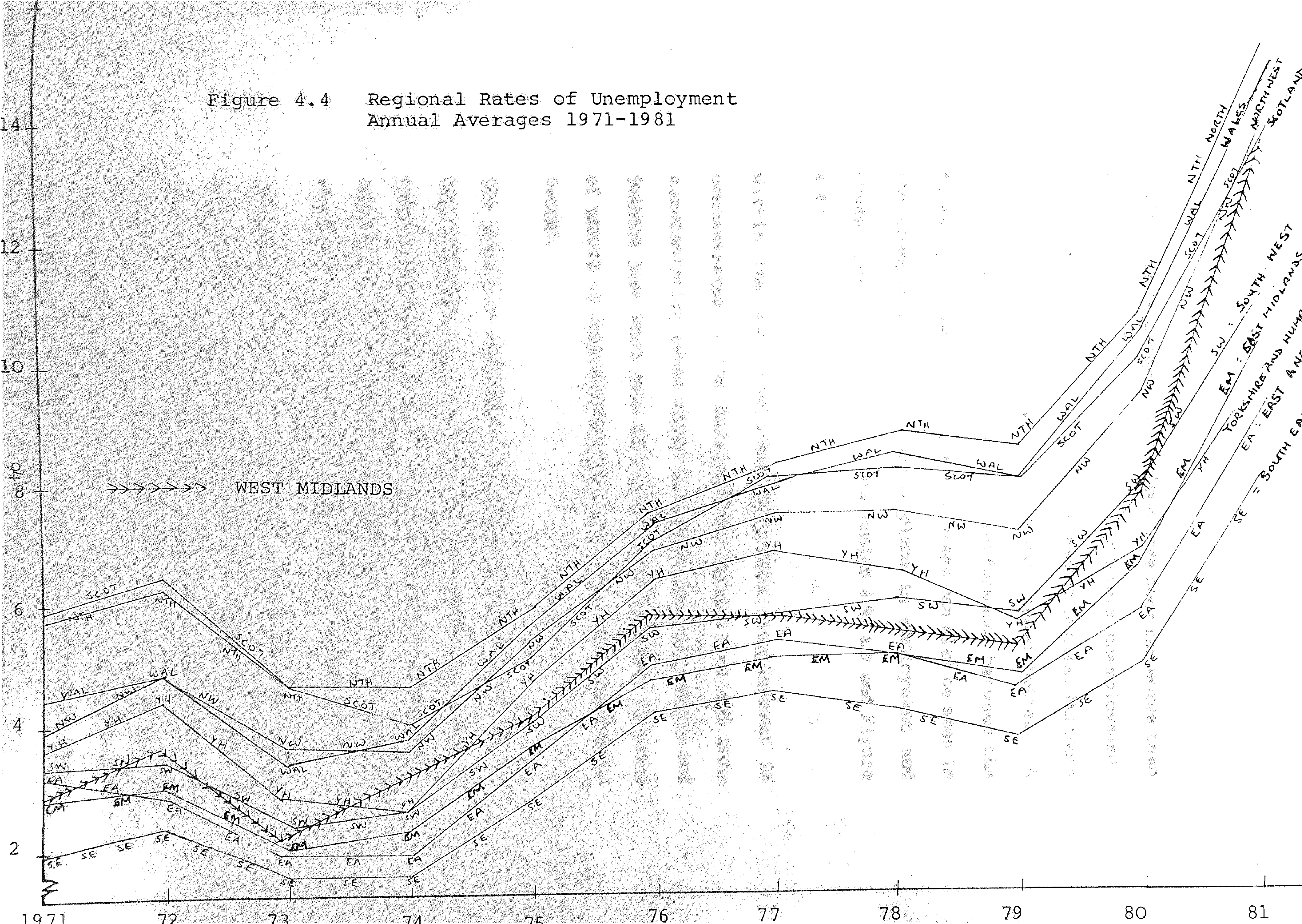
Table 4.9 Regional Unemployment Rates 1971 to 1981 (annual averages)

Males and Females

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981
UK	3.5	3.8	2.7	2.6	4.1	5.7	6.2	6.1	5.8	7.4	11.4
North	5.7	6.3	4.7	4.6	5.9	7.5	8.3	8.8	8.6	10.7	15.3
Yorkshire & Humberside	3.8	4.2	2.8	2.6	4.0	5.5	5.8	6.0	5.7	7.8	12.3
East Midlands	2.9	3.0	2.0	2.2	3.6	4.7	5.0	5.0	4.7	6.5	10.2
East Anglia	3.2	2.9	1.9	1.9	3.4	4.8	5.3	5.0	4.5	5.7	9.2
South East	2.0	2.2	1.5	1.5	2.8	4.2	4.5	4.2	3.7	4.8	7.1
South West	3.3	3.4	2.2	2.6	4.7	6.4	6.8	6.5	5.7	6.8	10.0
West Midlands	2.9	3.6	2.2	n.a	4.1	5.8	5.8	5.6	5.5	7.8	13.7
North West	3.9	4.8	3.6	3.5	5.3	6.9	7.4	7.5	7.1	9.3	13.9
Wales	4.4	4.8	3.4	3.7	5.6	7.3	8.0	8.4	8.0	10.3	14.8
Scotland	5.8	6.4	4.5	4.0	5.2	7.0	8.1	8.2	8.0	10.0	13.8
Northern Ireland	7.9	8.0	6.1	5.7	7.9	10.6	11.0	11.5	11.3	13.7	18.4

Source: DE Gazettes (various)

Figure 4.4 Regional Rates of Unemployment
Annual Averages 1971-1981



traditionally prosperous regions have done far worse than average, in terms of growth of long-term unemployment. Whereas the traditionally more problematic regions, Northern Ireland, the North and Scotland have fared better. A similar pattern of differential performance between the formerly prosperous and problem areas can also be seen in the changes which have taken place in employment and unemployment 1970 to 1981, see Tables 4.8, 4.9 and Figure 4.4.

Within the West Midlands, long-term unemployment is concentrated in the Metropolitan County area and some manufacturing urban areas like Kidderminster, Stoke and Telford (new town) have done worse than 'expected' in terms of growth of long-term unemployment. The rural areas fared better.

The growth of long-term and aggregate unemployment in the West Midlands region reflects to some extent the decline in manufacturing employment (See figure 4.5) and particularly metal-based manufacturing employment on which the region, especially the Metropolitan County area is so dependent.

There is therefore a substantial amount of evidence to support the hypothesis that structural shifts are occuring particularly associated with the decline in manufacturing employment. The identification and measurement of structural unemployment still remains a problematic phenomenon. It is suggested however that the problem is one

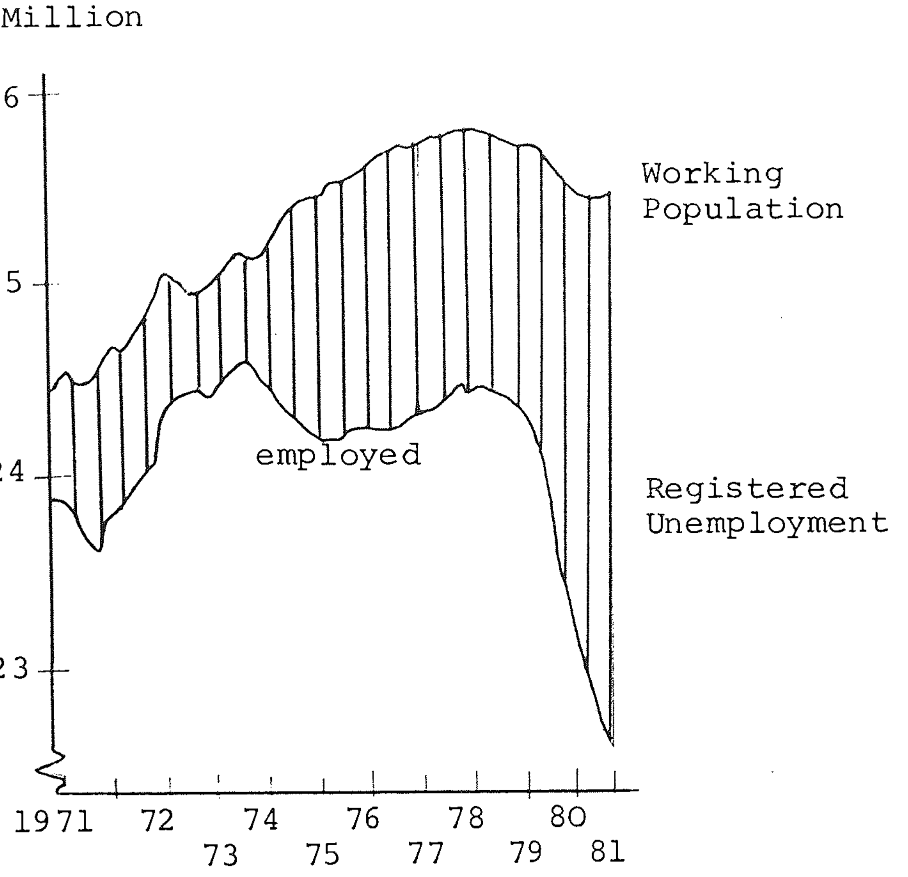


Figure 4.5(a) The change in employment, unemployment and the labour force, Great Britain, 1971 to 1981 (seasonally adjusted).

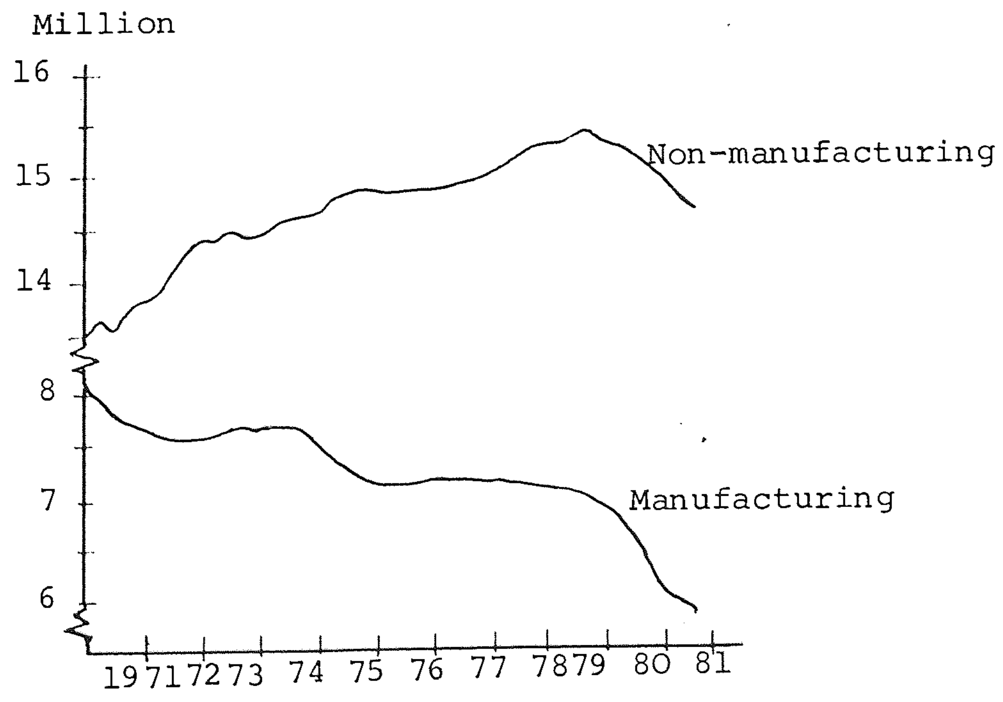


Figure 4.5(b) The change in the structure of employment between manufacturing and non-manufacturing 1971 to 1981 (seasonally adjusted).

Source: DE Gazette

of definition rather than identification. Defining structural unemployment is not easy. It is easier to identify its causes or to suggest cures. The main reason why we cannot define and therefore identify and measure structural unemployment is because structural unemployment is inextricably bound with demand-deficient unemployment.

4.4.2 Demand-deficient and structural unemployment: inextricably bound together

Taylor (op cit) argued that demand-deficiency did not increase significantly up to 1975 (in relation to capacity) and that structural unemployment has not increased because the increase in unemployment has been roughly equal for all regions and industries. On the other hand, the lack of vacancies suggest acute and increasing demand-deficiency since 1966. Bowers evidence suggests structural changes in employment and unemployment, as does the evidence on variation in the proportions of males unemployed in individual occupational categories: the apparently conflicting evidence is however quite reconcilable and the conflict arises through essentially problems of definition.

Firstly, has demand-deficiency increased? In relation to capacity, at least up to 1975; Taylor's implicit definition of demand-deficient unemployment is cyclical unemployment. That is unemployment which arises when the economy is not working at full capacity. However, in relation to measured labour supply, there is acute demand-deficiency.

Secondly, has structural unemployment increased? Again the answer dpends upon its definition. The regional and industrial structure of unemployment has essentially remained much the same. But structural changes have occurred. Because the increase in unemployment has been so large and affected all groups (though not equally) it is difficult to separate the structural component of unemployment and certainly the technique suggested by J J Hughes (1974) and A P Thirwall (1974 op cit) is grossly inadequate at times of high unemployment.Occupationally the evidence presented in Section 4.4 and sub-section 4.4.1 above more conclusively supports the idea of structural change.

Thirdly, demand-deficient unemployment and structural unemployment are inextricably bound together. On the one hand, the skills of a labour force influence the demand for their services whilst on the other hand, low aggregate demand masks skill shortages which only become apparent when aggregate demand for labour is sufficient to create a tight labour market, that is when there are low levels of unemployment.

If the skills of the workforce become obsolete, possibly in conjunction with the obsolesence of physical capital, the demand for the goods produced will decline. Does this result in structural or demand-deficient unemployment? Conversely if demand were to expand, would skill shortages of some types of labour occur before all 'demand-deficient' unemployment were eliminated? If so then is 'demand-deficient' unemployment the correct classification? The quantification of structural unemployment, therefore remains problematic. We are left therefore to define structural unemployment (somewhat unsatisfactorily) as that unemployment which can be reduced by structural improvements in the labour market.

4.5 Hypothesis 3: The unemployed have deliberately lenghtened the duration of the search for a job

The possibility that higher unemployment benefits relative to income foregone have resulted in an increase in average job search time was investigated by Taylor. Costs of job search were greater at the beginning of the study period (1951) than they were at the end (1975). In particular, the introduction of the earnings related supplement in 1966 had boosted unemployment pay for some. Rather than use the data published by DHSS on the ratio of unemployment benefit to net average weekly income, Taylor calculated the net household annual income for households in which the husband is unemployed as a percentage of net income for similar households in which husband is employed. He gives two reasons for calculating these: firstly "the ratio of unemployment benefit to net earnings ignores the fact that tax payments fall as earned-income falls"[1] and secondly it "ignores the fact that many wives work", these estimates show the case of men unemployed for up to 26 weeks when benefit is highest. Few women have benefited from the introduction of the earnings

1 See footnote following page

related supplement. Many did not qualify at all for benefit and of those who did some 36% in 1958 and some 24% in 1974 did not earn sufficient to entititle them to the supplement. Taylor finds evidence only of an upward drift in unemployment rates of males relative to the spare capacity index no such upward drift occurred for women. He also cites an upward movement in unemployment of single women relative to married women, and an increased ratio of single to married women unemployed as evidence of a benefit effect but gives little detail about these findings.

Taylor considers the widening gap between male and female unemployment rates cannot be accounted for solely by the lack of incentive for females to register. He suggests that employers might have found it more economically attractive to employ women than men but because relative wages rates have not changed he discounts this. However this needs more investigation. It is not necessary for 'relative' wage rates to change for employers to substiture female labour which is in 'absolute' terms cheaper than male labour. It could for example arise because of a change of attitudes, a squeeze on profits, an increase in skill or education levels of females relative to males or a combination of these. However, a more significant change in demand for female labour relative to male labour would arise if the change in structure of employment was such that stereotypically male jobs were disappearing whilst stereotypically female jobs werebeing created. This in fact has been occurring. If we look at the

1 See Appendix I for an assessment of the replacement ratio for different categories of individual (by sex and family status) and a computed weighted ratio for 1981.

structure of employment in 1951 of males and females, females represent more than a half of employees in four industries: 'Textiles', 'Clothing', 'Professional services' and 'Miscellaneous services'. By 1975 two of these industries had declined - 'Textiles' and 'Clothing' - but the other two industries have grown sufficiently to more than compensate for that decline. Furthermore by 1975 females dominate in two other industries which have both grown - 'Distribution and Insurance' and 'Banking, Finance and Business'.

Over the same period (1951 - 1975) total employment has risen, although male employment has declined. Employment in the production industries, which are male-dominated (in 1975 52% of male employees but only 26% of female employees were engaged in the production industries) have declined, whilst employment in the female-dominated non-production sector has increased. Furthermore within the productive industries employment in the white-collar jobs has been increasing whilst the blue-collar jobs have been disappearing.

The distribution amongst occupations and industries of women and men are still very different. For example in June 1979 only 24.26% of female employees were engaged in the production industries as opposed to 51% of male employees. Correlating the distribution of male employees amongst SIC's in June 1979 with the distribution of female employees gives:-

Proportion of Male employment in SICi 1979 = -1.3841 + 1.3723

proportion of female

employment in SICi 1979

$n = 27$

$r^2 = 0.4278$

RSS = 570.24

$F_{2.07} = 0.6878$ for H_o: a=0 b=1

The low r^2 and the high residual sum of squares indicates the extent of difference between male and female industrial employment dispersion. The F statistic is too low to reject the hypothesis that the male and female employment dispersion is the same but this is because the residual sum of squares of the line of best fit is so high. Occupationally we have to rely on Census data. In 1971 76.85% of female employees were employed in service-type[1] occupations as opposed to 36.95% of males (excluding the inadequately described occupations).

Correlating the distribution of male and female employees in 26 broad occupational categories from the 1971 census gives:-

Proportion of male employment in occupation j_{1971} = 0.7195 + 0.8129 proportion of female employment in occupation j_{1971}

$n = 26$

$r^2 = 0.1776$

RSS = 1088.5323

$F_{2.26} = 0.1373$ for H_o: a=0 b=1

1 Clerical workers, sales workers, service sport and recreational workers, administrators and managers, professional technical workers and artists.

Here the r^2 is much lower and the residual sum of the squares much higher than for the industrial dispersion, indicating the very wide differences between the occupational mix of male and female employment. (Again the F statistic is insufficiently high to reject the hypothesis that the male and female employment dispersion is the same. Once again this is because of the very high residual sum of squares of the line of best fit. (ie The line of best fit is such a bad fit that it is not a significantly better fit than a 45° line.)

The differences in occupational and industrial employment distribution of males and females indicates that the two sexes are essentially not competing directly in the labour market. (The studies on discrimination in the labour market certainly do not support the idea that females are favourably treated to males see Greenhalgh C. (1980) for example[1]. It may not therefore be that individual employers have directly replaced male employees with cheaper female employees but that growth has taken place in female-dominated industries and occupations, notably services, whilst male-dominated industries and occupations, the production industries and occupations, have experienced employment decline largely due to productivity increases, though since 1979 associated with output decline. The substitution of female labour for male labour has therefore been indirect.

1 She found a 30% residual (unexplained) earnings differential between the earnings of married males and married females in 1976 after the full introduction of the Equal Pay Act 1970.

In his conclusion Taylor states

> "... the underlying trend in the unemployment rate drifted upwards during the first half of the 1960's and then suddenly shifted upwards to a new higher level between 1966 and 1967 ... a plausible explanation for those two phenomena is the fall in search costs for the unemployed workers due to higher unemployment benefits. The main piece of evidence is the disparate behaviour of male and female unemployment rates during the study period." (1951 to 1975)
>
> Taylor (op cit) p 184

The main controversy with regard to unemployment, at the current time appears to be whether the upward drift in unemployment, since 1966 has been caused by demand-side or supply-side factors. Taylor has presented evidence for supply-side factors. The evidence for demand-side factors can be examined.

Firstly, earnings related supplement (ERS) - was introduced in 1966 (and removed completely in January 1982) and we would therefore expect its introduction to have a once and for all effect on unemployment. Once the increased average search duration of those entitled to ERS, together with any increased propensity to quit, had been established, there does not appear to be any reason why the average job search time should 'continue' to rise, or why voluntary quits should continue to rise - yet the increase in the trend in unemployment has continued to rise, at an excelerating rate since 1974, with a further acceleration since 1979.

Secondly, if the supply side factors dominated, then we should expect to see an increase in the number of vacancies as well as unemployment, as employers were unable to attract applicants for their job vacancies, each vacancy taking longer to fill on average as well as an increased flow of vacancies associated with the increased quit rate. Whereas a decrease in vacancies together with an increase in unemployment would be consistent with demand-side factors.

The evidence here overwhelmingly supports the demand-side argument. The unemployment and vacancy stocks continued to be inversely related, and the U/V ratio has increased substanially post 1966. (See Figure 4.1) Furthermore the gap between the male U/V ratio and the female U/V ratio widened in the post 1966 period. The discrepency between male and female unemployment rates cited by Taylor as "the main piece of evidence" for supply-side factors is equally consistent with the demand-side factors. That is that female unemployment did not increase as much as male unemployment because there were far more new opportunities for work for females (up to the mid 1970's) than for males, due to changes in the occupational structure of employment already identified.

Thirdly, since ERS was payable for only 26 weeks (from the 2nd to the 28th week of registered unemployment for those eligible) and since flat-rate beneft (FRB) is payable only for the first 52 weeks of registered unemployment, after which only supplementary benefit can be claimed, we would not expect to see an increase in the numbers unemployed for more than 52 weeks, (unless the real level of supplementary benefit had been rising relative to real take-home pay). Any increase in numbers unemployed for more than a year would support the demand-side factors. An article in the DE Gazette, June 1978 examines this phenomenom and opens:

> "The number of long term[1] unemployed in Great Britain has been increasing along with the increase in unemployment generally". (op cit p 676)

In fact the number of males unemployed for more than 52 weeks is closely correlated to total male unemployment but the trend has been for the long-term unemployed to represent an increasing proportion of total male unemployment, indicated in Table 4.7a.

Junankar (1981) examines the hypothesis put forward by Maki and Spindler (M-S) (1975) that a large part of the post 1966 increase in unemployment can be explained by increased unemployment benefits. Junankar (op cit) tests the M-S equations for structural stability using Chow (and other) tests and finds evidence of instability. Sawyer (1979) critcizes both the empirical results and the theoretical basis of M-S. Nickell (1979) also challenges the 'voluntary' hypothesis firstly because there has been no increase in male inflow into unemployment but more importantly because so few individuals have actually been in receipt of the ERS. (In November 1972 for example only 16.5% of the unemployed stock were in receipt of ERS.) Using cross section data from the General Household Survey (GHS), Nickell carefully specifies and tests several hypotheses and concludes:

1 More than 52 weeks

"... the hypothesis that the impact of the replacement ratio on the probability of leaving work does not diminish with the duration of unemployment can definitely be rejected."

Nickell (1979) p 43

And

"... the decline in the impact of the replacement ratio sets in fairly rapidly after four or five months of a spell and by, at most, the tenth month it is more or less negligible."

Nickell (1979) p 44

Nickell concludes that of the 91.8% increase in unemployment between 1964/5 to 1973 approximately 14% can be attributed to an increase in the level of benefits. Since 1973 the replacement ratio has declined and ERS is no longer payable since January 1982. Therefore if the voluntary hypothesis has any significant relevance to the level of unemployment we must conclude that since 1973 unemployment is lower than it would otherwise have been.

The regression line over the whole period identified by M-S suffers from stability problems as identified by Junankar:

"It appears that the replacement ratio turns out to be significant because in some sense the income variable is 'doing all the work'. When we separate out the variable into its component parts the benefit variable 'collapses'."

Junankar (1981) p 390 commenting on M-S (1975)

It is likely that any variable which was higher at the end of the period than at the beginning would provide a good fit over the whole period because the trend of unemployment has been upwards. However Taylor does not suggest that there has been increased preference for unemployment but "merely that unemployed workers are likely to spend more time searching for a job in 1975 than they did in 1951 (allowing for differences in the demand for labour), the reason being the considerable fall in search costs during the study period". Taylor (op cit) p 184. On policy recommendations Taylor suggests only that the "full-employment" rate of unemployment rose from 1.5% to 2.5% between the 1950's and the first half of the 1970's. Taylor did not recommend that a fall in benefits should take place relative to earnings. However this has in fact occurred. Since 1973 the replacement ratio has fallen and ERS is no longer payable since 1982.

4.6 Conclusion

This chapter has been concerned with an assessment of the empirical evidence regarding unemployment in Britain. Three main hypotheses have been considered: firstly that there has been a growth in demand-deficient unemployment. Secondly that there has been a growth in structural unemployment and thirdly that the unemployed have deliberately lenghtened their search time.

The first hypothesis was rejected by Taylor (op cit) because (up to 1975) unemployment had not increased in relation to estimates of capacity. However in relation to labour supply and real potential[1] capacity there has been a growth of demand-deficient unemployment. The main evidence to support this, is the lack of vacancies and the growth of long-term unemployment; and since 1979 a massive downturn in employment (see figure 4.5a) and a fall in industrial and manufacturing output.

The second hypothesis was rejected by Taylor (op cit) because the structure of unemployment rates between industries and regions had not (up to 1975) substanially altered. It has been shown that the methodology adopted by Taylor precludes the identification of an overall growth of structural unemployment by its implicit definition. Structural labour market shifts have however been identified by a modification of Taylor's method. Occupational shifts have in particular been identified. The existence of long-term unemployed and the high rates of unemployment of older workers together with the spatial variation of unemployment impact (see Figure 4.4) suggest the existence of a structural component.

Taylor (op cit) accepts the third hypothesis largely because the growth of unemployment has been more substantial in the case of males relative to females (few females qualified for ERS). An alternative reason for female behaviour has been postulated: female stereotypical jobs have been relatively more available than male stereotypical jobs. It has been demonstrated that males and females are essentially competing in separate labour markets, both industrially and especially occupationally. Other

1 Not necessarily real existing capacity though potential in the sense that unutilised resources exist.

evidence (Junankar, 1981 and Nickell, 1979) has shown the structural weaknesses of the methodology presented by others. (Maki and Spindler, 1975) The impact of ERS would have had only a once and for all effect so cannot explain a continued rise in unemployment.

From the policy persepctive a voluntary increase in search time is not necessarily something to be discouraged. There are benefits to society from efficient job searching. More importantly though if there has been a voluntary increase in average search time when there is a substantial pool of available labour in all areas, industries and occupations (though not equal) then this merely affects 'who' is unemployed not 'how many' are unemployed.

The following part (Part III) will consider the policy options: macro-economic, micro-economic and spatial. We will be especially interested in micro-economic and spatial policy considerations. We are therefore particularly concerned with the structural component of unemployment. That is because at the micro and spatial level, it is structural unemployment which can best be reduced. Evidence has been presented in this chapter to support the hypothesis that structural changes in the labour market have occurred. Identification and measurement of structural unemployment, however, remains evasive. It has been shown that this evasiveness is a product of the way structural unemployment has been defined. Furthermore it has been hypothesised that structural unemployment is inextricably bound with demand-deficient unemployment. However it is likely that a growth of aggregate demand, associated with a growth in the demand for labour, would result in shortages of labour in some areas, industries and occupations before all demand-deficiency were alleviated[1]. We were left to conclude therefore (Section 4.4.2) that:

> structural unemployment is that component of unemployment which can be reduced by structural improvements in the labour market.

(This is a somewhat unsatisfactory 'ex post' definition.)

We now turn to examine the unemployment policy options.

1 See for example the MSC's "Report on hard-to-fill vacancies", 1979 and "Labour shortages in the West Midlands Region", 1979 - two fifths of reported shortages in the West Midlands were for skilled manual workers.

PART III

EMPLOYMENT POLICIES

PART III

EMPLOYMENT POLICIES

Introduction

There are two broad camps amongst economists (and politicians): the interventionists and the non-interventists.

The non-interventionists believe that markets, including the labour market have self-equilibriating mechanisms. Unemployment for the non-interventionists is, in the long-run, voluntary, and in the short-run, a result of past government intervention or temporary shocks.

The interventionists believe that involuntary unemployment can and will persist unless government intervenes. Intervention can take place at both the macroeconomic (or aggregate) level of the economy and at at the mircroeconomic (or sub-aggregate) level.

An increasing trend of unemployment without a corresponding increase in job vacancies would seem to dispute the argument of the non-interventionists [1]. If there is a 'natural-rate' of unemployment, but that rate is first 2 per cent, then 3 per cent, then 6 per cent and so on, then this evasive 'equilibrium' calls for intervention to either reduce its level or accelerate the equilibriating forces. Solow R M (1980) writes:

1 Together with the other evidence presented in Part II, which has been summarised in the Conclusion of the previous chapter

"... if the labour market is often not in equilibrium, if wages are often sticky, if they respond to nontraditional signals, then there is a role for macro policy and a good chance that it will be effective. Equilibrium theories that conclude the opposite may conceivably turn out to have the right answer, but they simply assume what they purport to prove...All I do claim is that a reasonable theory of economic policy ought to be based on a reasonable theory of economic life".

Solow (1980) p 10

We can postulate several reasons for reducing involuntary unemployment (they have already been mentioned but it is worth reiterating them here). Firstly unemployment of labour signifies the under-untilization of a scarce resource and indicates that an economy is operating within its production possibility frontier. Furthermore, individuals who suffer periods of unemployment, especially frequent spells, or long-periods of unemployment, are likely to suffer from multiple deprivation. Unemployment is often associated with poverty, poor housing, poor health and anxiety, family breakdown, and other such problems. In addition localised pockets of high levels of unemployment are often associated with 'problem areas' where the environment is poor, schools are full of 'no hope' youngsters, morale is low and tension mounts, whilst vandalism, truancy, and petty crimes increase.

In the first instance the unemployment of labour is no more nor no less serious than the unemployment of capital or land. It no less serious than the unemployment of capital or land. It represents an underproduction of society in relation to its production potential. In relation to a utility function for society it is therefore sub-optimal in a Pareto sense. If we define a society's utility function in terms of the sum of utilities of all members; each member's utility being determined by the goods and services (including leisure and environmental goods) consumed; the unemployed resources indicate that society's utility function is not being maximised. A Pareto improvement can be made since some individuals' welfare can be increased without a reduction of welfare being suffered by any other members of society, by increasing the output of goods and services using the previously unemployed resources and thereby reducing the amount of involuntary 'leisure'.

On the second aspect of the unemployment problem we turn our attention to the distribution of utility amongst individuals. Individuals who suffer from involuntary unemployment consume involuntarily a disproportionately low level of produced goods and services (and often environmental goods) whilst at the same time consuming a disproportionately high level of (enforced) 'leisure'. If society decides that economic growth is undesirable or unattainable or it is of insufficient strength to absorb all those who want to work at the current wage rate, the policies for the re-distribution of leisure (and therefore, work) as well as goods and services, (including environmental goods and services) would be appropriate. However, adopting this type of policy option on its own implies either that society is saturated with produced goods and services or that the costs of growth, in terms of inflation and balance of payments problems or in terms of environmental factors, are greater than the benefits that growth bestows. A redistribution of utility does not constitute a Pareto improvement since there are some who lose as well as some who gain. However, it cannot be equitable that one group of society can decide that economic growth is undesirable while at the same time condemning others to pay the price of that choice.

As long as involuntary unemployment exists there cannot be an economic case for no government action. Either we decide that our real level of produced goods and services is sufficient to maximise society's welfare function, in which case income or work (or both) need to be redistributed so that those who experience involuntary unemployment are sufficiently compensated by their income, or we decide to reduce involuntary unemployment in order to produce more goods and services so that society's welfare function is improved.

In the following chapters macro, micro and spatial economic policies are discussed in the context of improving economic welfare. Although discussed separately each in a separate chapter, the policies are intended to be complementary rather than alternatives to each other. The discussion provides the necessary overview, and it is intended to be no more than an overview, in order to set the scene for a focus on some specific micro economic and spatial policy assessment frameworks in Part IV.

CHAPTER 5

MACRO ECONOMIC POLICIES

5.1 Introduction

Macroeconomic policies are used to pursue a number of objectives simultaneously. A high and stable level of employment is only one of those objectives. A stable price level, a satisfactory external balance of trade and finance, and a steady and substantial rate of growth of national income will be pursued at the same time. The remainder of this Chapter examines firstly the objectives of economic policies followed by the policy instruments; fiscal, monetary and direct. Then Section 5.4 considers policies specifically for 'full employment', incorporating Keynesion short-run stabilisation policies and monetarist policies, finally there is a conclusion.

5.2 Policy objectives

Growth of real national income [1] can be viewed as the over-riding objective, whilst the control of inflation, the pursuit of full employment and balance of payments objectives are ways of achieving that over-riding goal. Controlling inflation, pursuing

1 Real national income would include imputed values for social costs and benefits, as well as imputed values for unmarketed output, such as housework and do-it-yourself activities

full employment objectives or seeking balance of payments equilibrium, without any benefits to the real national income in the short or long run would have no economic justification. Sometimes, however, there are short-run benefits to be gained but long term social costs or disbenefits result. The policy option then becomes a cost-benefit exercise in which the short-run benefits have to be compared with the discounted anticipated long-term social costs, before a policy decision can be made. Alternatively there may be short-run costs but long-term benefits, of say controlling inflating or supporting jobs. The policy choice then becomes an investment decision where the short-run costs are compared with the discounted flow of expected long-term benefits. (In practice these decisions are often made on the basis of political doctrine; but the implicit assumption of political policy choices is that the necessary cost-benefit comparisons have been considered).

5.3 Policy instruments

To pursue their policy objectives the central authorities have a number of fiscal and monetary instruments at their disposal, as well as some direct controls which can be used.

5.3.1 Fiscal instruments

Thefiscal instruments are the rates and level of direct and indirect taxation, transfer payments, such as pensions, unemployment, sickness, maternity and supplementary benefits, and the level of government spending on publicly produced goods and services, as well as subsidies to the private industrial sector.

5.3.2 Monetary instruments

Monetary instruments are the control of the level and rate of growth of the money supply (or some specified definition of the money supply), the rate of interest and the value of the pound sterling.

5.3.3 Direct instruments

Direct instruments include prices and income controls, import controls and credit restrictions.

5.4 Demand-management policies for 'full' employment

The classical economists such as Ricardo and Pigou believed full employment was an inevitable outcome of a freely operating labour market. Only voluntary unemployment would persist since involuntary unemployment would lead to competition for jobs and downward pressure on wage rates. A new lower equilibrium wage rate would be achieved where labour supply and labour demand were equated. There was therefore no necessity for government policy to bring about full employment.

The persistently high levels of unemployment in the 1920's and 1930's in Britain were accompanied by falls in wage rates, but unemployment continued to increase. Keynes' 'General Theory' published in 1936 challenged that existing paradigm of economic theory. According to Keynes, the classicists failed to see the importance of the circularity of income. Income from employment generates demand for goods and services, from which the demand for labour is derived, which in turn provides income. The cutting of wages reduces the consumption of goods and services and thereby reduces the demand for labour. Keynes wrote:-

> "... given the propensity to consume and the rate of new investment, there will be only one level of employment consistent with equilibrium, since any other level will lead to inequality between the aggregate supply price of output as a whole and its aggregate demand price..... But there is no reason in general for expecting it to be equal to full employment."
>
> Keynes (1936) p 28

Furthermore he forecast that the more prosperous a nation became, the greater the tendency for the economy to diverge from full employment. He wrote:-

> "Moreover, the richer the community, the wider will tend to be the gap between its actual and potential production, and therefore the more obvious and outrageous the defects of the economic system."
>
> Keynes (1936) p 31

Keynes recommended two policies: the redistribution of income and wealth (from rich to poor) in order to maintain a high propensity to consume out of income; and government consumption and investment to fill the growing gap left by the market.

Keynesian interventionist policies are more usually associated with the latter policy recommendation, although Keynes might have favoured the former.

5.4.1 Short-run stabilisation policies

Most of the post-war era has been characterised by what have come to be known as Keynesian interventionist policies: not just in Britain but in other Western developed nations too. Full employment has been pursued in order to maintain a growing and stable level of real income. The emphasis has been placed on stabilising what would otherwise be a fluctuating income stream.

Real national income is the total level of output achieved in any one time period, (or the sum total of factor incomes in any period, or the sum of expenditures on home produced goods in any period).

We have:

$$Y = C + G + I + (X - M) \qquad (1)$$

where Y = national income

C = consumption

G = government consumption and investment

I = investment

X = exports

M = imports

If personal consumption and private investment (by firms and households) is subject to cyclical fluctuation, [1] then government consumption and investment can be varied to compensate for those fluctuations and stabilise national income.

From a social welfare perspective a stable level of income would be pursued to avoid under-utilisation of resources in the slump of the business cycle, and to avoid 'overheating' of the economy during the boom period. In practice it is difficult to achieve complete stabilisation. There is a lag to the effect of government expenditure, and the extent of the recession is difficult to predict in advance, as are the 'turning points'. In addition much government expenditure is difficult to turn on and off as stabilisation would dictate. There are, however, some 'automatic stabilisers'. That is some government expenditure automatically increases during slumps and falls during booms. For example when income rises direct and indirect tax receipts increase whilst transfer benefits fall and vice versa for income falls.

1 The question of why (C+I) varies through the business cycle in Western developed nations is the subject of a vast amount of literature. The effect of self-fulfilling business expectations, of changes in inventories, the multiplier and accelerator effect, the 'floors' and 'ceilings' hypothesis, all have something to offer the debate. For our purposes here it is sufficient to accept that fluctuations do occur.

Short-run stabilisation policies involve fluctuations in the relationship between government expenditures and revenues; expenditures relative to revenues increasing in downswings and falling in upswings. Fiscal policy instruments are the main Keynesian policy instruments, although the monetary variables are manipulated to stimulate or dampen private expenditure and investment as policy dictates.

5.4.2 Monetarist policies

In 1968, both M Friedman and E S Phelps criticised the use of fiscal policy, because of its inability to operate 'fine-tuning' of the economy. They argued against increasing aggregate demand to increase employment. In their view, there is some natural rate of employment, consistent with the absence of involuntary unemployment, beyond which employment can only be expanded in the short-run due to 'money illusion' on the part of workers. As workers recognise that increasing prices have left the real value of their money wages unchanged, the level of employment will fall back to the natural level, with the real wage unchanged but the money wage at a higher level. Successive increases of demand will merely push up the money wage rate further and have only short-run effects on the level of employment. Furthermore, workers will learn to evaluate the real value of money wages more quickly as they become accustomed to inflation and will push for wage rises ahead of price rises thus pricing themselves out of work. Monetarists recommend a strict control of the money supply as a major policy instrument. The monetarist policy recommendations are concerned more with creating a basis on which future growth of income can take place, than creating income and employment in the short-run. A strict control of the money supply is expected to affect expectations by lowering wage-expections in response to announced targets of growth of the money supply. The reduction of growth of the money supply is to be achieved by interest rate manipulation and by cutting government expenditure in order to reduce its borrowing requirement some of which contributes to an expansion of the measured money supply.

In practice monetary policy is not without problems either. Firstly, cutting government expenditure, reduces income and employment and the resultant fall in consumer expenditure further reduces income and employment, so that net government revenues also falls due to falls in taxation receipts and increases in transfer benefits. Secondly, reducing the public sector borrowing requirement (PSBR) by reducing subsidies to nationalised industries who subsequently increase prices to recoup that reduction in subsidy is self-defeating as is increasing the rate of indirect taxation (ie it does not bring about a reduction of the money supply). Thirdly, when money is tight near money substitutes are developed to short-circuit problems of liquidity (for example, inter-firm credits are utilised more than bank loans or overdrafts) so that the velocity of circulation of the money supply increases to compensate for the reduced money supply. Fourthly, the increase in interest rates necessary to reduce inflationary demand pressures adversley affect investment. Fifthly, any gains made in terms of reduced wage settlements may be offset by a rising value of the pound, aided by high interest rates, so that there might not be any overall improvement in international competitiveness. Finally, even if the policy is successful in bringing down inflation unless that reduced inflation is sustainable when an expansion of employment takes place then there will not be any long-term benefits to offset the social and economic short-run costs in terms of foregone income and employment. The theory that controlling the PSBR, which in turn controls the money supply, which in turn controls inflation is not supported by empirical evidence in Britain.

The success of monetary policy would seem to depend upon the private sector taking up the resources released from the reduction in public provision of goods and services. This would involve either a direct transfer of production to the private sector or the private sector using the released resources to provide 'more desirable' goods and services. However, there are no welfare gains from government 'savings' unless previously no benefit were accruing to society from that government expenditure (eg unproductive bureaucracy), and also those newly released resources are subsequently used for productive purposes.

5.4.3 Some common ground between Keynesians and monetarists

Neo-Keynesians and monetarists have found some common ground not least of which is an agreement that inflation can adversely affect the level of employment.

While the monetarists favour control of the money supply to achieve a reduction in the rate of wage and price inflation, Keynesians have suggested the use of direct instruments such as prices and income controls, either legally introduced, or by negotiation between industry, trades unions and government.

The difficulty of encouraging individual workers or unions to accept wage restraint is that although at the aggregate level it is not difficult to identify the benefits of wage restraint at the microeconomic level the individual union, or individual will benefit from the highest settlement possible. When national income is stagnant or even contracting the problem becomes more intransigent. The fight by individual unions to protect their members' relative positions becomes of paramount importance, with adverse effects for the economy as a whole.

5.5 Conclusion

The shortcomings of Keynesian interventionist policies of the post-war era appear to have been exagerated. The period up to the mid 1970's was one of growth of national income. The promises of monetarist policies have not materialised. The self-equilibriating mechanism has either failed to produce an acceptable 'natural rate' of unemployment or the mechanism is too slow to be left to its own devices.

Government expenditure has to be assessed on its own merits using a social cost-benefit approach. It is a fallacy to assume that the manufacturing sector is the wealth creating sector on which the rest of the economy is dependent, or that the public sector is supported by the private sector. All output of goods and services contribute to society's social welfare function, whether they are provided by private or public institutions. We do not want public wealth and private squalor any more than we want private wealth and public squalor: as long as there are unemployed resources this debate is futile. If there are unemployed resources and if there are projects which yield positive net present values to society then these investments must take place. We do not appear to have reached the stage in our development when these projects become difficult to find.

Within the context of fiscal and monetary expansions there are a whole range of distributional considerations. The impact of expansion on the economy is not independent of the programme of expansion. Furthermore within the context of a tight government monetary and fiscal policy there are changes which can be made to improve society's social welfare function. These distributional aspects are considered in the next chapter under the heading of microeconomic policies. Many of these policies usually fall within the category of macroeconomic, in the sense that they are introduced at the macro level. However, in this case it is more appropriate to consider them in the micro area since they effect individual firm and household behaviour.

Chapter 6

MIRCROECONOMIC POLICIES

6.1 Introduction

The expansion of aggregate demand is often constrained by other policy objectives, such as the control of price changes and a satisfactory balance of payments position, and by the Government's ability to raise revenue through taxation or borrowing. Furthermore, the level of economic activity is not independent of the behaviour of individuals and firms, which are themselves influenced by the distribution of resources.

The range of policy options to be considered here are those which involve a redistribution of resources. Each is considered in relation to the anticipated impact on the level of economic activity, withing a utility maximising framework. (This same framework is used in the next Chapter to consider the impact of spatial policies).

This Chapter is not intended as a survey of any empirical work but deals only with a theoretical appraisal of mircro-economic policy.

There are several areas of policy which involve a redistribution of resources and which therefore influence the level of resource utilisation within the economy. Firstly, a redistribution of income and wealth can be seen as a policy objective in itself but also it can be seen as means to providing a growth of aggregate demand.

Secondly, the level of economic activity in the labour market is influenced by the structure of taxation and benefits. The existence of a 'poverty trap' or 'benefit trap' together with anomolies which exist in the tax and benefit structure as well as the differential treatment afforded to males and females with-in the structure introduce rigidities into the labour market which unnecessarily inhibits labour force participation decisions.

Thirdly, the composition, as well as the aggregate level, of public expenditure influences the level of economic activity. It is possible therefore that social welfare can be improved by a redistribution of public expenditure from some 'negative' areas (eg unemployment support, crime prevention, bureaucracy) to more 'positive' areas (eg investment in projects which utilise unemployed labour and provide positive rates of return).

Fourthly, imperfections in labour markets inhibit the utilisation of labour so that individuals receive imperfect signals since relative wage rates will not reflect relative marginal productivities. Consequently, individuals will invest in skills and education and move to areas where relative rates of return are highest but where queues may develop. The labour market imperfections and their consequences suggest that a rationale exists for labour market intervention at the microeconomic, spatial or aggregate level.

Finally, in conclusion it is suggested that intervention in labour markets is justified whenever there is reason to believe that society's welfare can be improved. That is to say whenever a net growth of domestic output or social benefit can be achieved by the utilisation of involuntarily unemployed resources.

The rest of the chapter proceeds as follows: in the next section the redistribution of personal income and wealth is considered in relation to the impact on the incentive to work and the level of economic activity; Section 6.3 then goes on to examine the structure of taxation and benefits and then its influence on the incentive to work; this is followed in Section 6.4 by a study of the effect of the composition of public expenditure on the level of economic activity; then in Section 6.5 the manifestations of labour market imperfections are contemplated and finally there is a conclusion in Section 6.5.

6.2 A redistribution of personal income and wealth

If income and wealth are redistributed from rich to poor then there are two ways in which total welfare can increase. Firstly redistribution can be considered as an end in itself since 'a priori' we would expect individuals to experience diminishing marginal utility from both income and wealth. Redistribution (from rich to poor) therefore increases the total utility of the recipients more than it reduces the total utiltiy of the donors. Secondly, it can be used to increase the level of aggregate demand in the market. Lower income earners have higher marginal propensities to consume than their wealthier counterparts. Redistribution of income can therefore provide a growth of demand. (This is true in a world-wide as well as national sense, as the Brandt Report (1981) has argued).

Furthermore lower income households have lower propensitites to consume imported goods than higher income households, so a redistribution of income could facilitate expansion without the same balance of payments constraints. In the case of wealth holdings, similar arguments apply. Large wealth holders are more likely to leave resources lying idle for speculative purposes than are small wealth holders, and are more likely to invest abroad than small wealth holders. The higher marginal tax rates of the higher income earners or wealth holders, which would be necessary in order to redistribute income might act as a disincentive for them to work or invest; however, lower marginal tax rates for lower income earners would provide them with an increased incentive to work. The effect of taxation on the incentive to work can be considered withing the context of the income-leisure choice using indifference curve analysis.

Suppose an individual gains utility (U) from social goods (S), marketed goods and service (G) and from leisure (L). Marketed goods and services can be purchased using income (Y) gained from market work.

We have $U = F\ (S,G,L)$ (1)

An individual wishing to maximise his utility is constrained by a time constraint and a budget constraint. The time constraint arises because there are only so many hours available in any one period (eg 24 hours in a day). The budget constraint is determined by the hourly wage rate (w) an individual's labour can be hired in the labour market. Since social goods (such as roads, schools, hospitals) are 'free' goods to the individual they are excluded from the individual's framework of choice.

We have $T = L + M$ (2)

That is the total time available (T) in any period can be assigned to market work (M) or non-market-work: 'leisure' (L)

And $\frac{Y}{P} = wM$ (3)

Real income $\frac{Y}{P}$, where p is the price level, is determined by the wage rate (w) and the amount of market work (M). We require to maximise utility (U), as in (1), subject to the time constraint in (2) and the budget constraint in (3).

The individual is assumed to have a given set of preferences between income and leisure, such that more income is always preferred to less income, more leisure is always preferred to less leisure, and that there are diminishing marginal rates of substitution between income and leisure. (As illustrated in Figure 6.1)

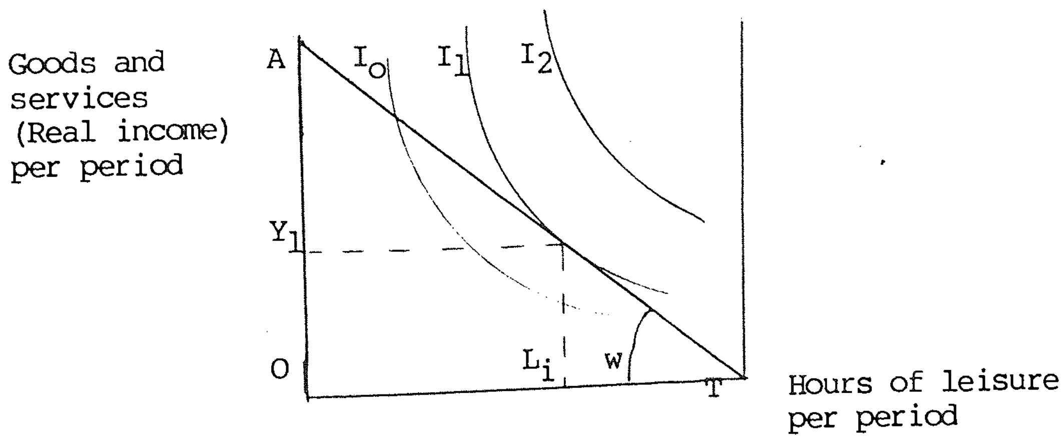
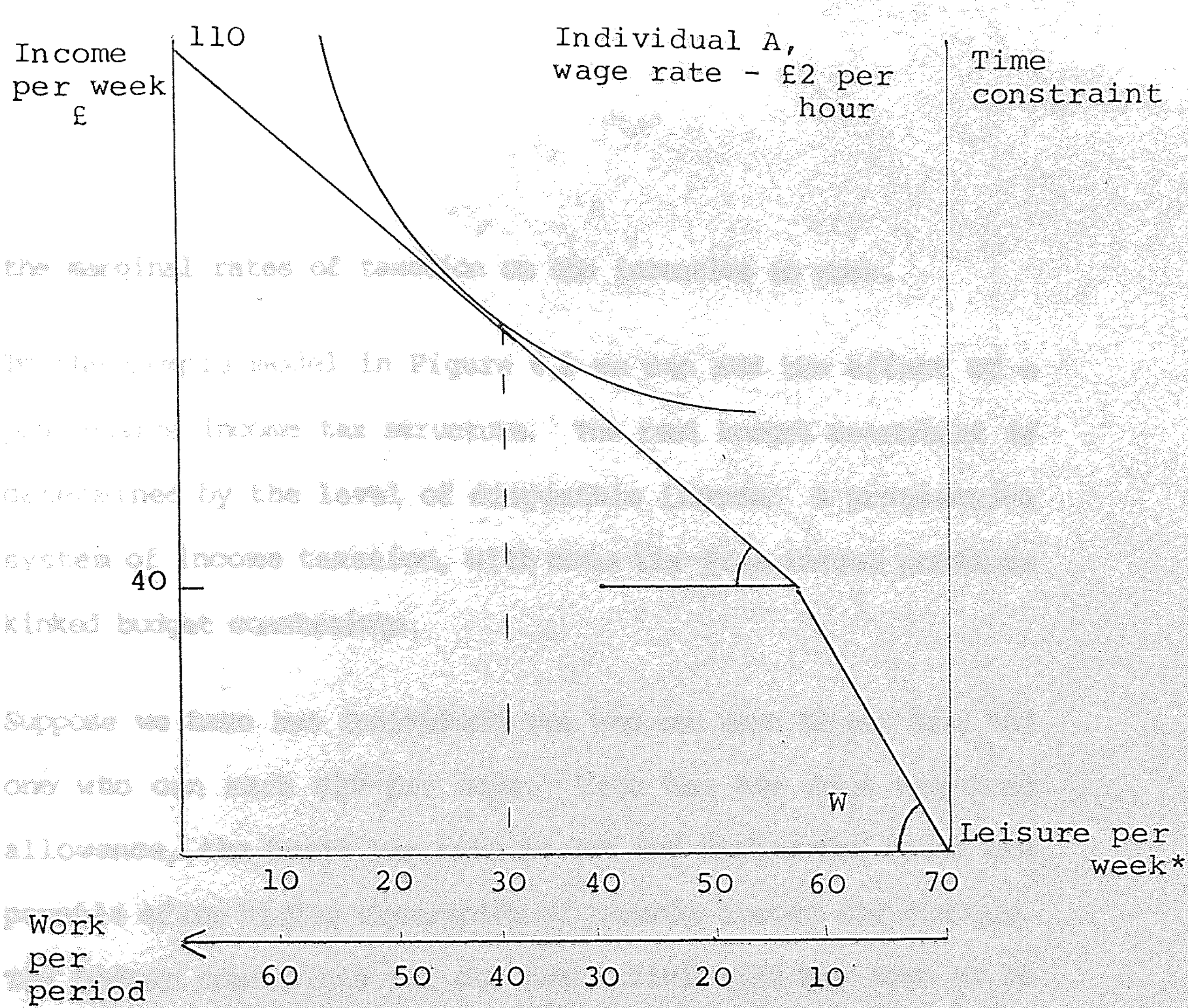


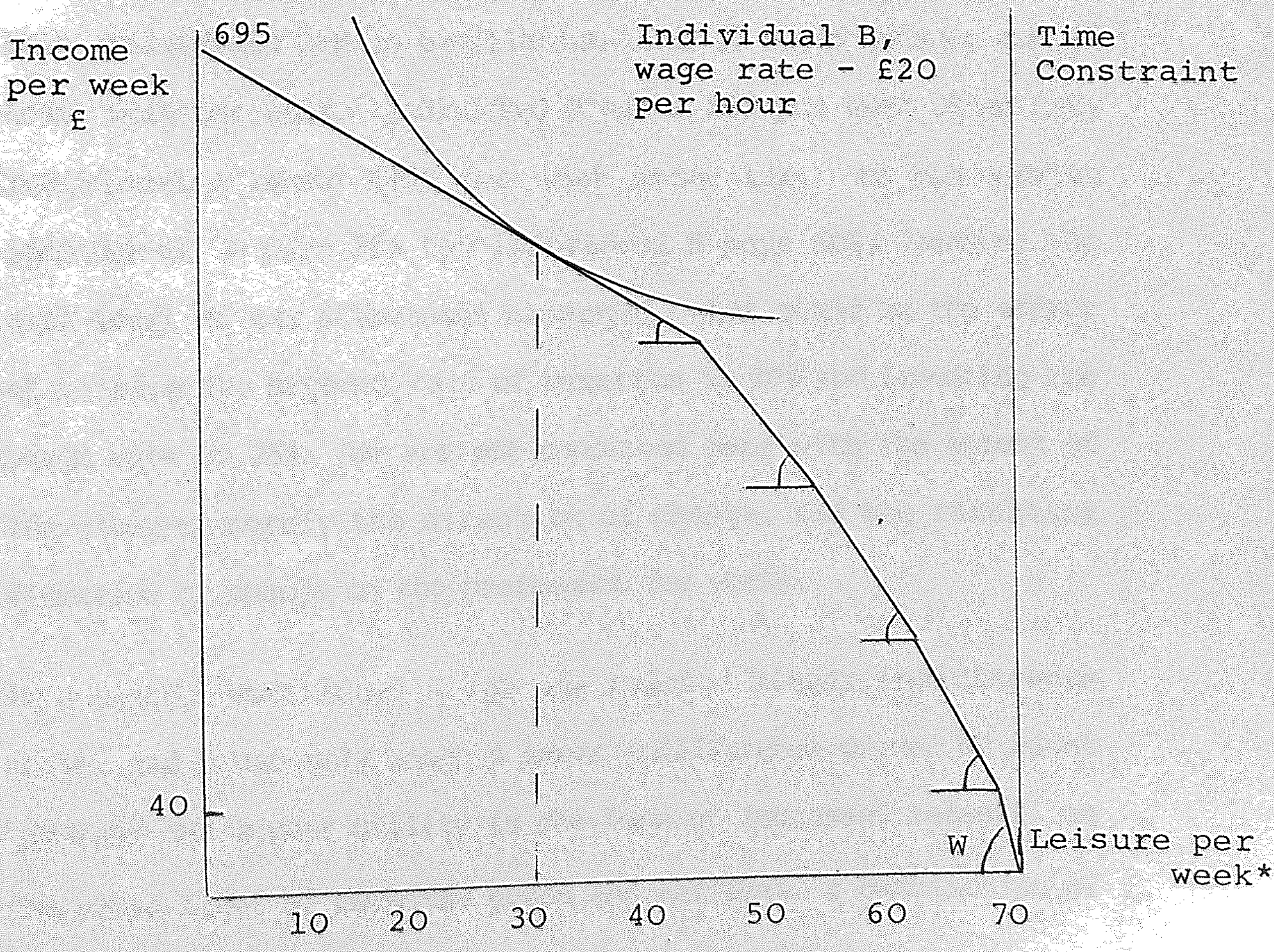
Figure 6.1 The individual's choice between work and leisure

In Figure 6.1 the individuals preferences are illustrated by the indifference curves (I_0 I_1 I_2). T is the time constraint, the budget line (TA) determines the level of utility the individual can achieve, its slope determined by the wage rate (w). The point of tangency between an indifference curve and the budget constraint determines the point of equilibrium. This is the maximum level of utility the individual can reach at the current wage rate. In Figure 6.1 the optimal position is at x, with real income OY, and leisure OL, (L_1 T represents the amount of work per period necessary to achieve the optimal amount of goods and services).

In reality individuals are constrained in other ways by for example a standard work week, which might involve individuals choosing between sub-optimal positions. In addition there may be different hourly rates for overtime, individuals may have some unearned income which allows them to reach a higher level of utility with a lower quantity of market work, and income of other family members may be treated as unearned income. Not all of the time which is not devoted to market work is in fact devoted to leisure. Some leisure time will be devoted to necessary activities such as sleeping and eating as well as to non-market work within the home such as cooking, cleaning, caring for children and home maintenance activities. In practice labour supply decisions will be made withing the context of the household and market and non-market work distributed between members. The structure of taxation will also influence those decisions. Here we are interested in the effect of changes in

The post-tax budget constraint





* It is assumed that only 70 hours per week are available after essential non-market-work activities are subtracted.

the marginal rates of taxation on the incentive to work.

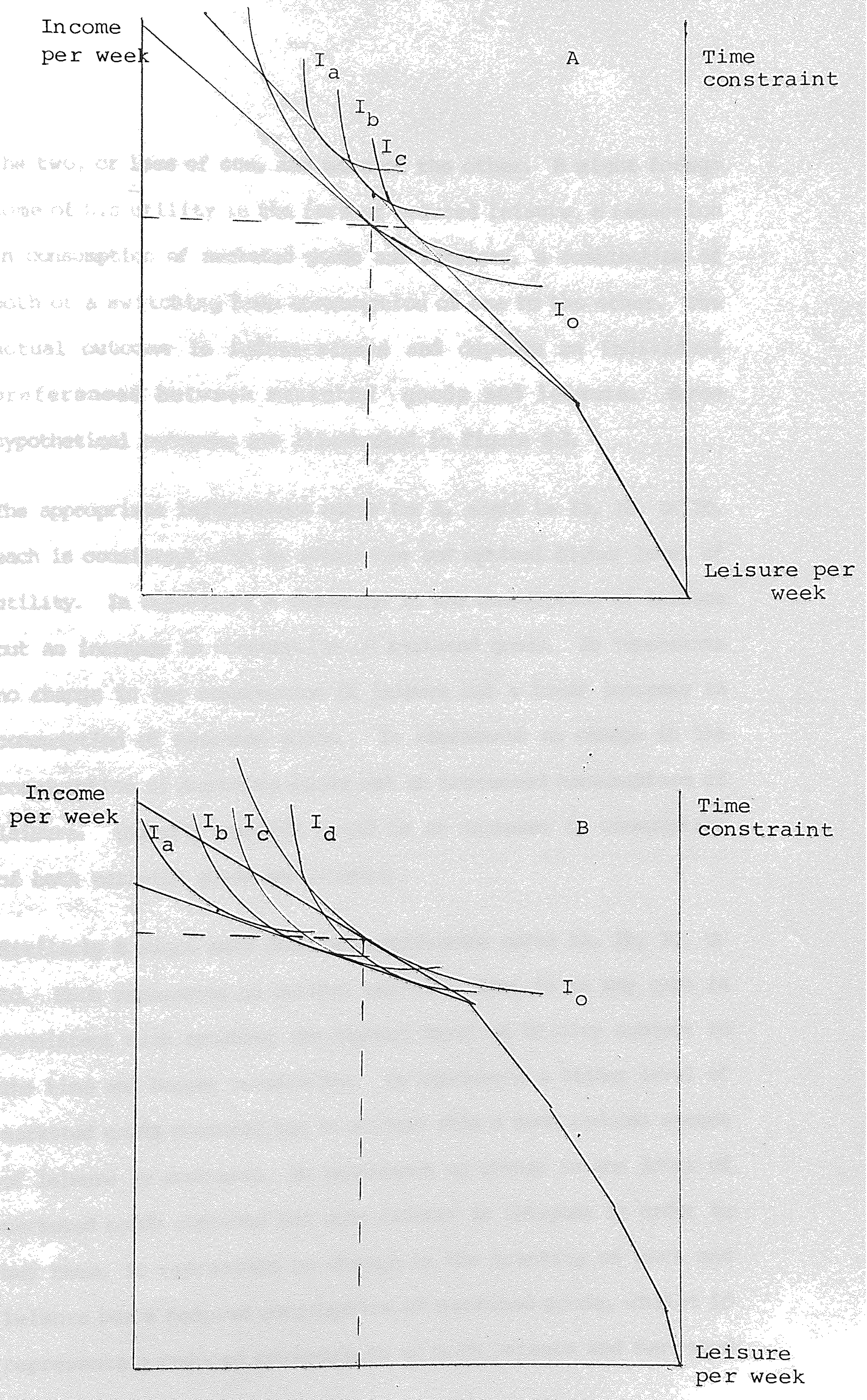
To the simple model in Figure 6.1 we can add the effect of a progressive income tax structure. The real budget constraint is determined by the level of disposable income. A progressive system of income taxation, with some tax-free income produces kinked budget constraints.

Suppose we have two individuals one who can earn £2 per hour and one who can earn £20 per hour. Each has the same tax-free allowance, the basic tax rate is 30% and higher tax rates are payable after higher thresholds of taxable income are reached. The budget contraints for our two individuals are then as in Figure 6.2.

Both individuals are in equilibrium with 30 hours leisure and 40 hours work per week. Individual A earns £68 per week after tax, Individual B earns £455 per week after tax. At the margin individual A pays 30% tax individual B pays 60%, leaving the real level of tax allowances unchanged, what would be the effect of raising the highest rate of taxation to 80% and lowering the basic rate to 25%. (We are not concerned here with the extent of the change, merely the direction of change, and the resultant direction of change on the preference for work).

As a result individual A can now reach a higher indifference curve, and B can only reach a lower indifference curve. 'A' might 'consume' his higher utility in the form of increased leisure, an increased level of marketed goods and services, a combination of

Figure 6.3 The effect of changing the marginal tax rates.



the two, or less of one, and more of the other. B might forego some of his utility in the form of reduced leisure, a reduction in consumption of marketed goods and services, a combination of both or a switching from consumption of one to the other. The actual outcome is indeterminate and depends on individual preferences between marketed goods and leisure. Some hypothetical outcomes are illustrated in Figure 6.3.

The appropriate indifference curve for A, might be Ia, Ib, or Ic, each is consistent with an attainable and optimal higher level of utility. Ia represents a reduction in the consumption of leisure but an increase in consumption of marketed goods. Ib represents no change in the consumption of leisure but a lower increase in consumption of marketed goods. Ic represents no change in the consumption of marketed goods but an increased consumption of leisure. (Equally possible would be an increase in consumption of both marketed goods and leisure).

Similarly B might move down to indifference curve Ia, Ib, Ic, or Id. Each represents an optimal position, that is to say each is consistent with reaching the highest level of utility subject to the time and budget constraints. Ia represents a higher level of marketed goods consumed but to achieve this a much reduced amount of leisure is consumed. Ib represents no change in the level of marketed goods consumed but some leisure is foregone in order to buy them. Ic represents no change in the quantity of work and leisure but a reduced consumption of marketed goods, whilst Id represents a reduced consumption of both leisure and marketed goods.

The reason for the variety of possible outcomes in both cases is that changes in the real value of the wage rate, due to changes in the money wage, changes in the price level, or changes in the marginal tax rates, have two effects, each having the opposite effect on the consumption of leisure.

There is an income effect and a substitution effect. The income effect means that as the real value of the wage increases, more leisure can be consumed, as well as marketed goods. The substitution effect means that as the real value of the wage increases, leisure has become relatively more expensive, whilst marketed goods relatively cheaper. If leisure is a normal good an increase in the real wage would result in an increase in its consumption. Only if leisure is an inferior good would a reduction in its consumption take place through the income effect. However, if leisure has become relatively more expensive, we would expect consumers to substitute goods which had become relatively cheaper. This effect will be to reduce the consumption of leisure. Figure 6.4 shows the income and substitution effect of an increase in the real wage rate.

Real income (Goods and services per period)

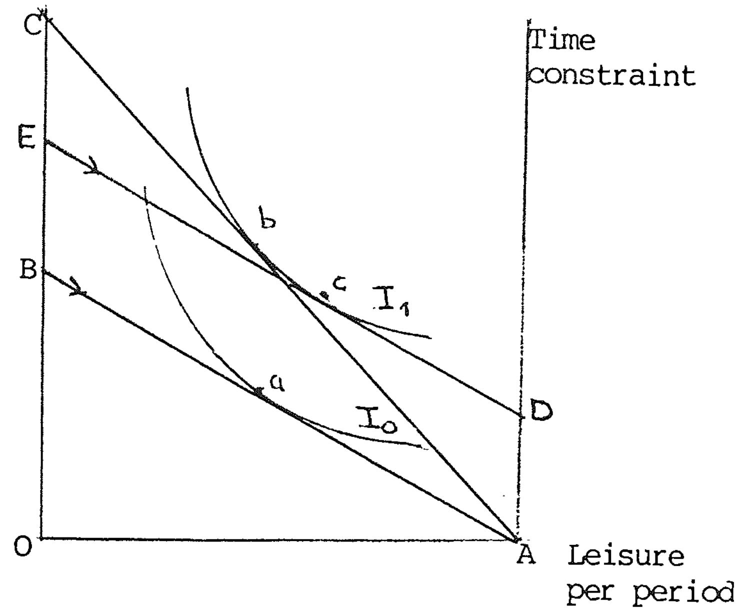


Figure 6.4 the income and substitution effect of a real wage change.

AB is the original budget constraint

AC is the new budget constraint

a is the original equilibrium position

b is the new equilibrium position

DE is the line parallel to AB, the original constraint, but tangential to I_1 the new higher attainable indifference curve. This line isolates the income effect, since it removes the effect of the change in relative prices.

The vertical distance AD represents the level of unearned income which would be necessary to reach the higher attainable level of utility, without a change in the real wage, and so represents the income effect.

ac is the income effect, which enables a higher level of consumption of marketed goods and/or leisure.

c can lie to the right or left of a and can lie either above or below a. To the right and above a is the most likely position. Below and to the right would indicate that marketed goods had become inferior goods, above and to the left, leisure had become an inferior good.

cb is the substitution effect.

b is always to the left of (and not below) c, (mathematically because DE is flatter than AC), because leisure has become more expensive relative to marketed goods. Therefore marketed goods are substituted for leisure.

The overall outcome depends which effect dominates the income or the substitution effect, and is therefore the result of individual preferences between marketed goods and leisure. 'A priori' we would anticipate that leisure was a normal but luxury good (certainly not an inferior good). That is to say that for real income rises, lower income earners consume relatively more marketed goods, and higher income earners consume relatively more leisure. However this depends very much on individual preferences and whilst observations of coal miners buying more leisure with wage rises might not apply to entrepreneurs, suggestions of reduced leisure as the real wage rises[1] at the top end of the income scale seems to stretch the imagination.

1 And conversely that for real income falls moe leisure would be consumed.

At lower rates increases in the wage are more likely to provide an incentive to work more hours (or join the labour market) than a marginal increase for high wage earners would have. This would suggest a 'backward-bending' labour supply curve.

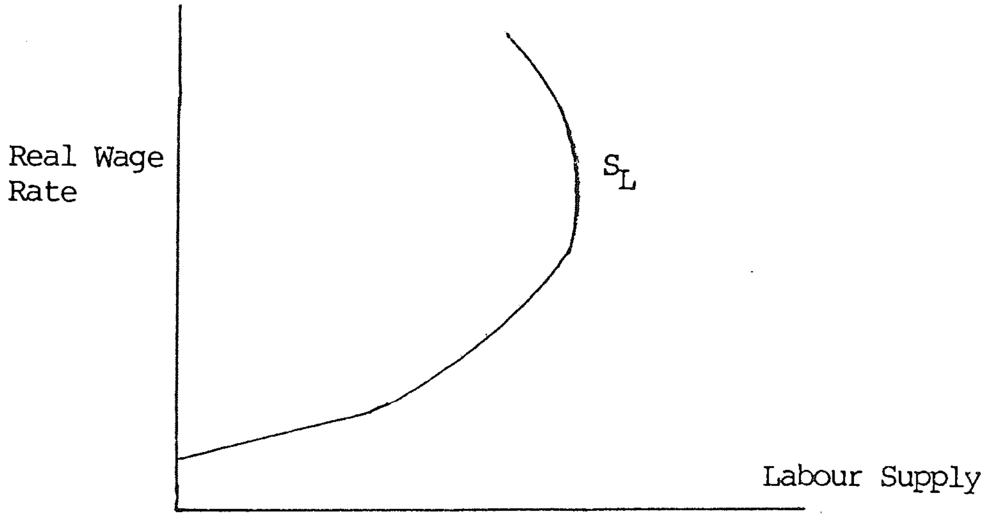


Figure 6.5 The backward-bending labour supply curve.

Returning to our individuals A and B the most likely utility choices after our redistributional tax changes would be for our lower income earner either to work the same number of hours but consume more market goods or to work more hours to consume even more marketed goods due to the increased incentive of keeping more of his earnings. Our higher income earner is likely to work a similar number of hours but cut down on his consumption of marketed goods or to work more hours in order to maintain his previous level of consumption.

The model used ignores savings and unearned income as well as the nature of taxation, whereby household income, rather than individual income, is taxed. It also ignores the interrelationships between earnings of family members and the effect they have on each other. However, it is by no means evident that high marginal rates of taxation act more as a disincentive at the higher end of the income distribution than relatively lower marginal rates of taxation do at the lower end. Theoretically or 'a priori' it would appear that taxation at the lower end of the income scale would be much more likely to act as a disincentive. Furthermore the loss of benefits and income subsidies at the bottom end of the income scale often mean that real marginal rates of 'taxation' are much higher than the income tax structure suggests. This creates a poverty-trap which is examined in the next two sections.

6.3 The structure of taxation and benefits

The structure of taxation and benefits is a useful instrument for altering the distribution of income and influencing the level of economic activity.

The present structure contains a number of anomolies which inhibit the operation of the labour market. Firstly the complexity of the system is costly in terms of administration; secondly the existance of what has been termed the 'poverty-trap', means that some households find themselves hardly or not at all better off when working than when unemployed; lastly the differential treatment between males and females under the rules of the system inhibits role reversal within families and therefore inhibits optimal labour market decision-making.

Many of the problems of the system could be overcome by the introduction of a single system of tax and benefit payments, in the form of negative and positive rates of income tax. Alternatives would involve greater emphasis on increasing the tax threshold and reducing the rate of the regressive national insurance payments; of increasing the non-means-tested allowances, such as child benefits, as well as encouraging a higher take-up of allowances available to those in work but on low incomes, such as family income supplement and rent and rate rebates and allowances, and finally by changing the tax, national insurance and benefit rules so that either males or females can take on the role of 'breadwinner'.

6.3.1 The Poverty-trap

Individuals find themselves caught in a poverty trap through one or more of several factors. Those factors are a low hourly-wage rate potential, the availability of only casual or part-time work, a relatively high level of benefit entitlement, the complexity of additional benefits to which the unemployed and/or low income earners are entitled and the low threshold of income above which income tax becomes payable. The result is that some individuals find themselves only marginally better off or sometimes worse off when working than when not working.

We can examine these effects within the context of the income-leisure framework. Firstly let us consider the effect of a high 'replacement ratio'. An individual's replacement ratio is the level of benefits he is entitled to when not working expressed as a proportion of potential earnings. Figure 6.6 shows the effect of benefits of an indivduals choice between work and unemployment.

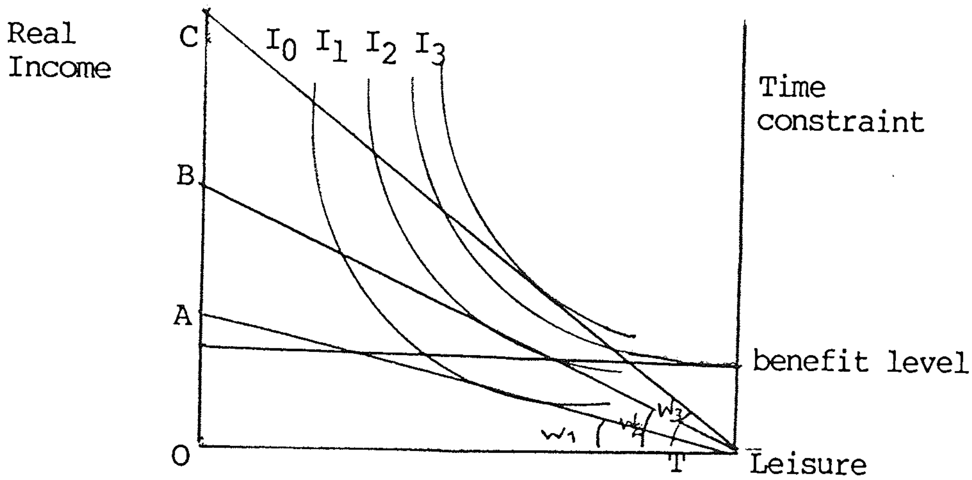


Figure 6.6 **The choice between work and unemployment**

In Figure 6.6 a family of indifference curves I_3 I_2 I_1 I_0 is illustrated together with a number of budget constraints TA, TB and TC, associated with wage rates w_1, w_2 and w_3, respectively. The benefit level is also indicated and it is assumed that either benefits or wages are received, but not both. Firstly this individual can reach I_2 level of utility without any income from work, the rational individual will therefore not work unless the wage rate is sufficient to provide him with a higher level of utility than I_2 (it is not enough for work to provide him with a higher level of income). In this example only the highest wage rate, w_3, would enable the individual to reach a higher level of utility than the benefit level provides. In general the higher the wage rate and the lower the benefit level the more likely the individual is to choose work in preference to unemployment. If in addition the level of income at which income tax becomes payable is low relative to the benefit level the incentive to remain unemployed is exacerbated. Figure 6.7 shows the choice between work and unemployment when the effect of income tax is added to our model. Only basic rate taxation is applicable since we are dealing only with those likely to fall into the poverty-trap.

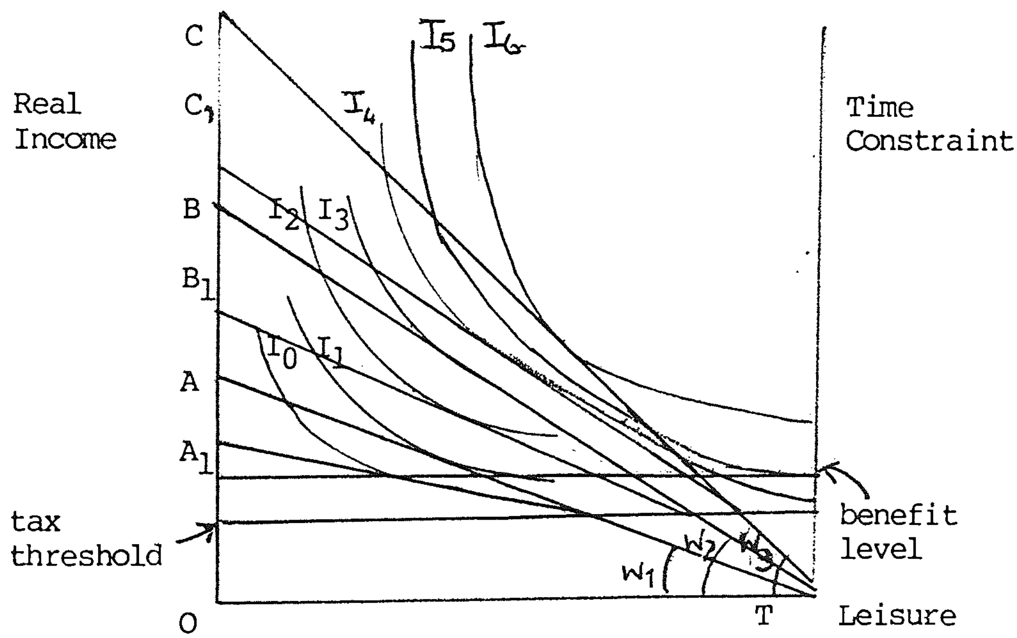


Figure 6.7 The choice between work and unemployment and the effect of income tax.

In Figure 6.7 we have a family of indifference curves $I_6 > I_5$ $I_4 > I_3 > I_2 > I_1 > I_0$. The budget constraints before taxation are again TA, TB and TC, associated with wage rates w_1, w_2 and w_3 respectively, the benefit level once again is illustrated. After taxation the budget constraints become TA_1, TB_1 and TC1 respectively. During periods of

Table 6.1 Replacement ratio for a married man with dependent wife and two dependent children. (April each year, except 1981, see note 3)

Year	Benefit[1] as a percentage of net income[2]
1970	66.5
1971	61.4
1972	66.7
1973	65.0
1974	65.4
1975	67.1
1976	64.7
1977	67.8
1978	64.7
1979	59.5
1980	57.0
1981[3] (Nov)	53.8

1 Benefit is the standard rate of UB or SB plus earnings related supplement (ERS) plus family allowances/child benefit.

2 Net income is the gross average income plus family allowances/child benefit less tax and national insurance contributions at the non-contracted out rate. Income tax calculated using the tax allowance and tax rate effective at April each year.

3 November,1981 ratio calculated from SB* rates applicable at November 1981 to November 1982. Net income is gross average earnings as at November 1981 plus child benefit, less tax and national insurance contributions at the non-contracted out rate. Income tax calculated using tax allowance and tax rate effective April 1981 to April 1982.

* UB is lower than SB level and is therefore inapplicable.

Source: Social Security Statistics, 1980 (except 1981 - see note 3).

unemployment the individual reaches a level of utility I_5. In order to behave rationally he will need to reach a higher level of utility than I_5 before he will prefer work to unemployment. Without the effect of taxation a higher level of utility can be reached by an individual able to earn wage rate w_3. After taxation however this wage rate W_3 is insufficient to provide a higher level of utility than is provided by the social benefit which can be claimed whilst unemployed. The lower the threshold of taxation and the higher the basic rate of taxation the more likely there will be a disincentive effect for those with low earnings potential to seek work. (It is also probable that there are expenses, such as travelling expenses, which are directly related with work, and if considered would further reduce the incentive to work).

It is this type of reasoning which has led to the belief that the level of benefits is too high and that much of the increase in unemployment has been caused by these 'generous' payments. Furthermore this suggestion has been taken seriously by policy-makers and translated into reduced benefits for those in need, especially the unemployed. (See Table 6.1) An investigation of both the theory and the evidence regarding the effect of the benefit level on the incentive to work would suggest that different policy options might be more appropriate.

Let us examine the level and type of benefits available to the out of work. There are three broad categories of benefits available: there are the national insurance benefits to which people are entitled in return for the national insurance contributions paid while at work, in this case we are interested in unemployment benefit (UB); there are non-contributory benefits which are payable under certain circumstances the most important one is child-benefit which is available for all children; and there are the means-tested benefits; the most important of these is supplementary benefit (SB) but also in this category are the family income supplement (FIS) and the rent and rate rebates/allowances.

Many of the suggestions that people are better off unemployed are based on the 'replacement ratio' of the 'average' man with wife and two dependent children who when in work earned the average gross earnings of full-time adult male employees aged 21 and over. Table 6.1 shows the replacement ratio for this 'average' man between 1970 and 1980. One obvious criticism of the voluntary unemployment hypothesis is that the largest increases in unemployment have taken place whilst the replacement ratio has been falling (since 1977, and especially since 1979). This highlights the most obvious flaw in the argument; that is that the incentive to look for work only has relevance when there is work to look for. Furthermore this 'average' man has become less and less typical of the unemployed. (The notionally average man, married with two children and a non-working wife represents only five per cent of the total labour force, according to the 1979 General Household Survey). One reason for this is the increased participation of married women in the labour force. Consequently there is an increased probability that a married man will have a working wife (approximately a half of married women now participate in the labour market.) In addition there will be an increased likelihood that some of the unemployed will themselves be married women, many of whom have no entitlement to benefit in their own right. Only about a half of married women in the labour market pay full Class 1 National Insurance contributions . Only those paying 'full contributions' are entitled to the insurance benefits and only married women (husbands present) with incapacitated husbands can claim supplementary benefits themselves. The entitlement to benefit is highest of all for a married man with a dependent wife and dependent children (ceteris paribus) so representing this replacemnt ratio as an average replacement ratio is incorrect. In 1979 for example almost one fifth of the registered unemployed were not in receipt of either unemployment or supplementary benefit. Furthermore the entitlement to benefits varies not only because of the number of dependants, but also due to entitlement to the supplementary allowances, especially rent, or mortgage interest and rates, which can result in quite substantial variations in benefit entitlement. (These supplementary allowances are excluded from the ratios in Table 6.1).

Appendix I, (Table A.I.1) shows the situation of individuals in different family situations and earnings levels after losing their job, as well as a weighted ratio of benefits as a proportion of gross earnings reduction. In November 1981 this weighted ratio was 34%, indicating that on average some 34% of gross income losses were made up by transfer benefits. In addition some 30% of gross earnings were previously paid in taxation and NI contribution. This would suggest that unemployment results in some 50% reduction in disposable income on average and is very expensive in terms of the effect on the government budget. This calcualtion probably exagerates the real ratio: firstly because entitlement to rent and rate rebates and family income supplement whilst working have not been taken into consideration; secondly the ratio is based on the newly unemployed (this affects mainly the two income households whose entitlement to benefit will cease after a year, where the working partner's income lifts them above SB levels); and thirdly the calculations have been based on entitlement to claim benefits rather than actual take-up rates, which are not 100%.

The overall weighted ratio is however only one aspect of the benefit and tax structure. There are two other aspects which are perhaps equally important. The first is the variation in entitlement to benefits, amongst individuals. Even of those examined in Appendix I there is a variation between no entitlement and an entitlement of 78% gross earnings loss. For individuals on lower earnings with more children (ceteris paribus) the ratio would be greater. The second aspect of interest is the complexity of the system and some obvious anomolies contained therein.

6.3.2 Anomolies in the tax and benefit structure

One immediate striking anomily of our tax and benefit system is that income tax becomes payable at a level of income which entitles households to claim some family support.

Secondly when income tax becomes payable it does so at a rate of 30% this is a very large jump from 0% to 30% at such a low income level. Moreover once the minimum income threshold has been surpassed NI contributions (8.75 per cent from April 1982 for those contracted in) become payable on all income.

Thirdly there are several agencies involved in income support; the Department of Health and Social Security administers Supplementary Benefitand the Family Income Supplement; the Department of Employment administers Unemployment Benefit; the Local Authorities administer the rent and rates rebates and taxation is paid to the Inland Revenue. The administration costs are therefore more expensive than necessary and the customer receives a poor uncoordinated service.

Fourthly the recent reductions in the real rate of UB have increasedthe proportion of the unemployed whorely on supplementary allowances. Social security has always attracted a stigma since it is a means-tested benefit, so that we are likely to have a lower take-up rate than in the past.

An obvious improvement would be to coordinate direct tax and benefits into a single system administered through a single agency with one point of call for the consumer, whether a payer or receiver: ie a system of positive and negative income tax payments, related both to income and need. But we need the system both to provide incentives to work as well as support if no work is available (and to be less expensive to run than the present system).

Allowances against income would be based on basic needs, such as those currently determined by the supplementary benefit allowances, based on household sizes rent (or mortgage interest subject to a ceiling), rates, heating and so on. In addition work associated allowances, such as travelling and superannuation as well as a minimum dicounted income [1] would be set against earnings of those in work. Negative income tax would be payable to those households whose income fell below basic needs in the case of those unemployed and to those whose income fell below basic needs plus work associated allowances and minimum discounted income[1] for those working a minimum number of hours per week. (Though in this case the negative rate of tax need

1 The additional discounted income could be determined either as a lump sum, as a proportion of earnings, or as a proportion of basic needs.

not be 100%). The result is to remove the poverty trap since no-one can fall below the basic needs allowances and no-one can be better off not working than working.

This type of system[1] cannot be introduced in the short-run and is not possible to contemplate until the Inland Revenue system is fully computerised. In the meantime there are improvements which could be made to the present system to remove the poverty trap. Firstly the tax-free allowances could be raised in line with the rate of inflation, to avoid aggravating an already anomolous situation. Secondly any income tax reductions could be concentrated on increasing these allowances, since this reduces administrative costs, by taking people out of the system whilst at the same time reducing everyone's tax bill. Thirdly the increase in national insurance rates from April 1982, at a time when real benefits are falling, is a disguised rise in income tax, (it has been put onto NI only for political reasons) but is more inequitable since it affects the low-paid most of all. National insurance is a regressive tax; it comes into effect at a very low level of income, is the same rate regardless of income, and is subject to an upper income limit so that the average rate is lower for those whose

1 A variety of such schemes are discussed in Atkinson (1975)

income is outside the upper limit. This rate could therefore be reduced and the upper limit removed or increased substantially. Fourthly child benefit could be increased. This benefit goes to families with children, the group with the highest replacement ratio (ceteris paribus) and therefore the group most likely to experience a disincentive to work. A differential rate dependent on children's ages could be used to pay for the increases. It is those families with young children who are most likely to suffer from the 'poverty-trap', since it is more difficult for both parents in these families to go out to work and their entitlement to benefit is high, because of the number of family members. Higher levels of support for children under say 10 would assist the families in greatest need and remove any disincentive to work. Lastly a higher take-up rate for rent and rate rebates and allowances and the family income supplement could be encouraged. These benefits are payable to people in work but on low incomes are therefore in the spirit of negative income tax and do not discourage labour market participation. The major result of these measures would be to increase the tax threshold above the level of benefit entitlement. Consequently it would be more unlikely that anyone would positivel choose unemployment (Figure 6.8 below).

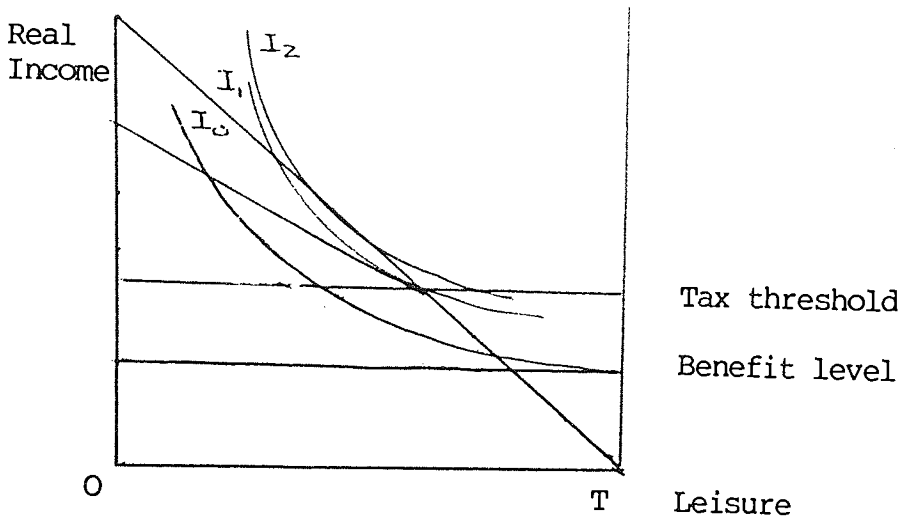


Figure 6.8 The effect of lifting tax threshold on the incentive to work.

6.3.3 The current approach to benefits to the unemployed.

Under the Social Security No 2 Act 1980, unemployment benefit, together with other benefits was increased by five per cent less than the forecast in the inflation rate and at the same time the earnings related supplement (ERS) began to be phased out. The five per cent reduction was rationalised because employment and other benefits are tax-free. There wereproposals to tax those benefits under the 1981 Finance Act, and there are now proposals to restore the five per cent, in November 1983. Short-term benefits rose less than the rate of inflation in 1982. The removal of the ERS in effect means that workers now get a poorer rate of return from the national insurance scheme. The consequences of this move is that a much greater proportion of the unemployed (as well as the sick and the old) will now rely on the means-tested social security benefits; a level of income which is deemed to provide a very basic level of income for a short period of time. It has never been envisaged that families could survive on it for long periods. Yet the unemployed 'never' qualify for the long-term benefit rates (unless they are over 60), however long they remain unemployed. More realistically our efforts could be concentrated on more positive incentives to work, whilst at the same time stimulating economic activity. An obvious way to do that would be to increase unemployment benefit, since the unemployed have high marginal propensities to consume (possibly 100%) and low marginal propensities to import (as is the case with all low-income groups).

6.3.4 Diffential treatment of males and females

Under the national insurance scheme, the system of benefits and the income tax structure males and females receive quite different treatment. Husbands are treated as heads of households, wives as dependants, unless husbands are incapable of work due to disability or ill-health.

Since wives are not able to claim for dependants under the non-means-tested allowances: unemployment, sickness, and maternity benefits and the retirement pension, role-reversal is difficult to accommodate. The result is that males cannot easily take over household work from their working wives. This is unforturnate at a time when much of the emphasis of market work has moved away from male stereotypical to female stereotypical work. The system prevents the household from implementing a flexible system of allocation of market and non-market work between household members. The result is that male job losses always result in unemployment whilst some female job losses can more easily be accommodated by a rearrangement of non-market work. Equal treatment under the social security system would allow husbands as well as wives to move in and out of the labour market more easily in response to changes in the demand for labour. Some of the resultant measured changes in unemployment would not of course represent any real change in the number actually desiring work, but some older males, or younger males with children, would be able to perform non-market work in the home, if their wives were to earn for them their entitlements to benefits such as retirement pension, which they at present earn for their wives when they are in work.

When 'male jobs' are declining relative to 'female opportunities', (and since females have longer life expectancies than males), the rationale for male retirement at 65 and female retirement at 60, becomes questionable. (The job release scheme has enabled early male (and female) retirement without penalty to the retirement pension. However not everyone qualifies for this scheme since an unemployed person has to take the older person's job either directly or indirectly, so a more formal equalisation of pensionable age would seem more desirable.) There is in any case no compulsion to retire at the retirement age, it is the age of entitlement to the retirement pension. (There is no reason why these changes should have a net cost to government, the entitlement to allowances for husbands by wives and the earlier payment of retirement pension to males can be affected by the increased contributions of females, after the age of 60, and the later entitlement to the retirement pension by them.)

Husbands are entitled to a higher tax allowance than females or single males, whether or not they work, and whether or not their wives work. The higher allowance for males whose wives do not work seems to have some justification, for those whose wives work and who themselves claim a married woman's allowance (equal to a single person's allowance) the rationale seems somewhat questionable. Even more anomolous is the eligibility of the wife whose husband does not work to both her own allowance and that of her husband to be set against tax. The impact of this on the labour market would be the reverse to the impact of the social security entitlements. The tax structure favours working wives, especially those whose husbands do not work, although the lower average earnings of females almost certainly exclude many wives from taking full advantage of the allowances. It would seem more logical to have a single allowance available for adults which could be claimed either by individuals on their own behalf or by one household member where only one person were earning. This would involve a redistribution of taxable allowances from households where wives worked (whether or not husbands worked) to households where only husbands worked. Once again the impact on the labour market would be to encourage a greater flexibility in labour force participation between household members.

The overall advantage of equal treatment of males and females under the tax and benefit system would be to improve economic efficiency in that households would be free to distribute market and non-market work on the basis of objective criteria (personal choices and capabilities, wage rates, etc.) without constraints from the institutional framework. In spite of the massive increase in female participation in the labour market, the commitment to equal pay and the removal of blatant discrimination (eg. the Equal Pay Act 1970 and the Sex Discrimination Act 1975), the tax and benefit structure has not responded toaccommodate the changing face of the labour market.

6.3.5 Some Final Comments on Benefits to the Unemployed

On grounds of equity we must be prepared to compensate individuals adequately for the failure of society to provide them with a means of self-support. Unemployment benefit is payable only to those who have contributed to the national insurance scheme during the qualifying period. It has become a very expensive contribution and the returns when unemployed have become by comparison very poor. So much so that it seems likely that in the future (now that the earnings related supplement is no longer payable and the real value of the basic rate has been reduced) the benefit will not even provide the minimum level of living standard as defined by the Supplementary Benefit Level. This will mean that with the exception of those with generous redundancy payments or large savings (currently over £2,500) or those with working spouses, the majority of the unemployed will depend upon Supplementary Benefit rather than Unemployment Benefit during periods of unemployment. The counter-argument that high levels of benefit are a disincentive to look for work are only applicable when employers experience difficulty recruiting labour.

Lastly, if a lower level of employment than that which would remove involuntary unemployment provides the optimal level of social welfare then work-sharing as well as income sharing should be contemplated. That is not to say that compulsory reduced working weeks per year, or years per worker need be introduced. A more flexible national insurance scheme and tax system could be used to encourage moves in this direction. For example the current framework of tax and national insurance benefits are based on the principle of a male head and wives as dependants. Whereas the number of single parents is increasing, more wives work and the nature of work has changed such that females might have more opportunity to find work than males. The equal treatment of men and women under the tax and national insurance scheme would enable households to decide for themselves how best to apportion market and non-market work between household members.

6.4 The distribution of public expenditure

The macroeconomic aggregate of public revenue and expenditure and the public sector borrowing requirement (PSBR) affect the level of economic activity. The level of economic activity and the level of real income are not however independent of the composition of government expenditure.

All public expenditure has an opportunity cost and some government expenditure is not matched by any output of consumable goods and services.

To give some examples: An increase in crime, vandalism, public disorder, which was matched by an increase in public expenditure on law and order would not represent any increase in real incomes or welfare. An increase in unemployment and a consequent fall in tax receipts and increase in benefit payments does not represent increases in real incomes. An increase in the defence expenditure on missiles or the armed forces does not represent any rise in real incomes since we cannot consume the output. Increasing expenditure on bureaucracy represents no real benefit to society.

That is not to say that there are no indirect gains to real income from some of these expenditures but if we focus attention on aggregate government expenditure, we will fail to understand the full impacts and the opportunity costs involved.

Returning to our individual utility function in section 6.2, we had

$$U = F(S, L, G)$$

Individual utility is a function of social goods (S), marketed goods and services (G) and leisure (L). G and L were considered in the last section. Here we are considering the contribution of S to our level of utility.

Not all publicly provided goods contribute to this utility function, even though they may be necessary in an indirect sense. The greater the proportion of national income devoted to 'negative' areas - defence, unemployment, sickness, crime, vandalism, pollution, bureaucracy and so on - the fewer the resources that will be available for the more 'positive' areas, which directly contribute to our utility. If we are using resources in one area we can switch their use to other areas, without inflationary consequences. Some of these 'negative' areas of expenditure have 'positive' areas of investment associated with them.

Unemployment as we have seen is expensive. Whilst wages may be a variable cost at the level of the firm, a high proportion of the cost of labour is fixed as far as society is concerned. That is to say the support to the unemployed represents a high proportion of wages. Suppport to workers in work would seem therefore to be preferable to supporting unemployment. We do not need to support workers in declining uncompetitive industries, we have much useful work which needs doing, often in areas of high unemployment, and often using the most abundant types of unemployed labour (construction workers and unskilled male manual workers). Examples are not difficult to find: refurbishment of our decaying inner urban areas, through demolition, refurbishing and rebuilding programmes; replacing and repairing much of our sewerage system which is (almost?) at breaking point (especially in the North-West where the oldest sewers are); repairing our roads and motorways; electrifying our railway system; building a channel tunnel. All of these and many more would almost certainly provide high positive rates of return under a social cost-benefit analysis. Times of low economic activity are ideal opportunities to invest in these types of programme since the opportunity costs are much lower, attracting as they do labour from unemployment rather than other productive areas. Furthermore, through the multiplier and accelerator effects, tax receipts rise further and benefit payouts fall more than through the initial direct impact of the public programme.

Sickness is also very expensive and our Health Service is geared up to patching up and curing illnesses rather than on preventive medicine and health education. Once again investment in health education and preventive measures would provide much more utility in the long-run in terms of increased output from a healthier and fitter work force, as well as providing benefits to the individuals who are 'saved' from illness and greater job satisfaction to the medical profession.

Crime and vandalism increase in times of high unemployment and are most prevalent in areas of physical decay. Investment in the physical environment and in programmes which reduce unemployment will almost certainly therefore result in some additional savings in the costs of law and order. Here again prevention is preferable to punishment.

Pollution imposes external costs on society. These costs often fall on already disadvantaged groups who live close to industrial and congested areas such as the inner cities. The problems of industrial illnesses and of brain damage from the effects of lead in petrol are obvious problem areas. Whilst we have made many improvements in these areas the scope for prevention rather than cleaning up is nowhere near fully utilised.

Bureaucracy is costly to society, the scope for computerisation in many areas of government activities is enormous. The advantages would not only arise in terms of savings in costs (mainly labour costs) but in the flexibility the system would offer.

Defence is a controversial area. The costs of sophisticated weapons is enormous and often inaccurately predicted. Here it is more difficult to identify an associated 'positive' expenditure. However, we cannot ignore the opportunity costs involved in devoting large amounts of government expenditure to such projects.

A general switching of expenditure from the 'negative' to the 'positive' areas would increase our utility function and reduce the inflationary pressure of that part of government expenditure, which has no associated consumable output.

Government expenditures should be evaluated in terms of a social cost-benefit approach. We need to consider not only the level of government expenditure but its composition. If we have areas with low or negative net benefits to society then we need to switch to areas which have higher net benefits. If it is believed that there are areas of wasteful expenditure then equally there are areas where positive gains are experienced. So long as such projects can be found and we have unutilised resources we cannot justify a 'non-interventionist' stance.

6.5 The operation of the labour market

If labour markets and all other markets, behaved like perfect markets then involuntary unemployment would not exist. Prices (wages) would be flexible and respond instantly to changes in demand or supply; labour would be homogenous and completely, instantly and costlessly mobile; no employer or group of employers would have monopsonistic or obligopsonistic control over the demand for a particular kind of labour; no employee group would be a monopolistic or oligopolistic seller of a particular kind of labour; and workers as well as employers would have perfect knowledge of prices and quantities in all sectors of the labour market. In addition other markets which are linked to the labour market would also need to be perfect - the housing market; the transport market; the foreign exchange market; the money market; the stock market. Furthermore the output produced by labour would have to be sold in perfect markets.

In reality none of these conditions hold. The labour market is not perfect:-

Wage rates do not respond instantly. They are sticky downwards in money terms and probably to a large extent, in real terms too. In some industries minimum wage laws exist. Sometimes wage bargaining is undertaken on an industry wide basis. In fact national agreements are very common. This means that the scope for geographical differentials is somewhat limited. This will prevent geographical differences in demand and supply conditions from being reflected in a high wage area wishing to attract relatively low-paid workers (London Transport for example). The cost of housing in Central London or the cost of commuting into London from outside will restrict the supply of workers to the firm, but national agreements (even with London weightings) might be insufficent to attract a sufficient number of workers with suitable qualities required by the firm at that wage.

Labour is not homogenous, even within a particular occupation there are differences between capabilities of workers (and even between the abilities of the same worker at different times of the day). More importantly however are the differences in levels of skill which workers possess. Skills are not instantly or costlessly acquired. Consequently labour cannot be instantly and costlesssly mobile from one job to another.

Geographically too there are costs involved in mobility, costs which must be recouped in terms of higher discounted earnings in the future. Furthermore, workers will not be indifferent between their current employer and other employers. They will have built up seniority rights, will have social relationships within the workplace, and might have to forego some superannuation rights on changing jobs. Employers too will not be indifferent between their current employees and untested potential employees. Some training will be specific to each employer, in terms of working practices, channels of communication and so on. All new workers will have to learn these skills and a high turnover of labour would therefore involve employers in substantial costs. Neither employers nor employees therefore will respond to small differences in wage rates.

Large employers can hold monopsonistic power over workers. Where a single large employer dominates a town or district he will be able to depress wages below a level he would need to pay if he were subject to competition by other firms. Occupationally too an employer may be the single (or one of only a few) buyers of a particular skill in an area, once again giving him monopsonistic power.

Trades unions, professional bodies or other employee groups can similarly exert exploitative control over their employees. Extracting higher wages than would be paid in their absence.

Perfect knowledge of the labour market is not held by either workers or employers, so that different wage rates can exist for similar kinds of labour even within the same town.

Neither do the housing transport, foreign exchange, money or stock markets respond perfectly and instantly to changes in supply and demand conditions.

The output of firms is also not sold in perfect markets. Much of the national output is not marketed at all (eg Education, Health and other publicly provided goods and services). Many firms have some monopolistic control in production and are consequently able to secure a monopolistic profit, which as well as distorting the product market, distorts the labour market in turn.

6.6 Conclusion

Once we move away from an aggregated analysis and begin to examine the implications of policy from an individual perspective the scope for influencing the level of economic activity and the operation of the labour market appears much greater. Even within the context of a government budget constraint there is scope for redistributing income, and public sector expenditures; for reorganising the tax and benefit framework; and for influencing the spatial distribution of resources.[1] Furthermore there may be areas of investment in human and physical capital where government borrowing could be justified in terms of investment criteria, subject to the 'crowding-out' constraint. (That is that government borrowing does not 'crowd-out' private borrowing where private investments provide higher social returns).

1 This is the subject of the next chapter.

If we return to the concept of wishing to maximise society's utility function where we have:

	Society's utility	=	$\sum$ individuals' utilities
	and Individual utility	=	f (S, G, L)
where	S	=	social goods and services
	G	=	private goods and services
	L	=	leisure

Substituting GDP as a proxy for social and private goods and services:-

Society's utlility	=	f (GDP + L)
GDP	=	gross domestic product
GDP	=	average productivity (AP) x employment (E)

We wish to Maximise U = f (GDP + L)

We have some constraints on our function;

The time constraint	T	=	E + L
where	T	=	total time available (determined by the size of the population of feasible working age)
	E	=	employment
	L	=	leisure

and the budget constraint

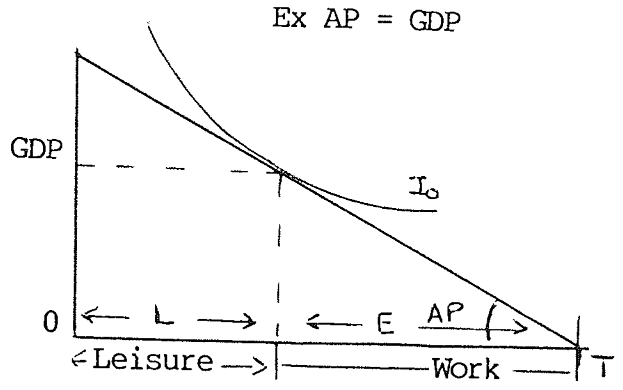


Figure 6.9 Utility maximisation of society with average productivity constraint.

If average productivity ultimately decreases with the level of employment (that is if labour is subject to diminishing marginal productivity at the macro level) we have:

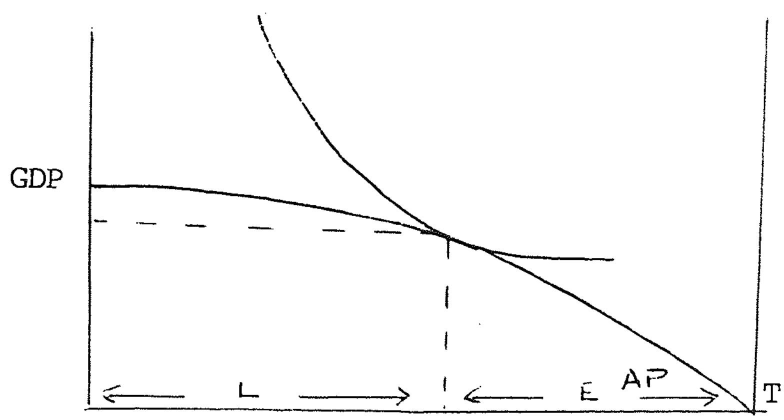


Figure 6.10 Utility maximisation of society with average productivity related to the level of employment

At the point of equilibrium the slope of the budget constraint is equal to the slope of the indifference curve.

The slope of the indifference curve is the marginal rate of substitution between work and leisure. The slope of the average productivity slope is the marginal productivity of labour. In equilibrium therefore society is indifferent between the marginal unit of output and the marginal unit of leisure. The distribution of work and leisure between individuals would be determined by individual preferences between work and leisure. If the wage rate reflects the marginal productivity of labour then the aggregate equilibrium position is equal to the sum of individual preferences, assuming there are no constraints on the number of hours worked per period and there are no disincentives to work as a result of the tax and benefit structure.

It follows therefore that if society is in an optimal utility maximising position no involuntary unemployment will exist. And conversely if voluntary unemployment exists then society's welfare can be improved by increasing output through an increase in employment and thereby reducing the associated involuntary 'leisure'.

The next chapter examines another aspect of micro-economic policy initiatives; those which affect the spatial distribution of resources. The same utility-maximising framework and social welfare approach, used to assess the distribution of resources in this chapter, is used to discuss spatial policies.

Chapter 7

SPATIAL POLICIES

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Chapter 7

SPATIAL POLICIES

7.1 Introduction

There are a range of policy options which concern the spatial distribution of resources. The policies have been introduced to redistribute resources from 'prosperous' to 'problem' areas. The major objectives in doing so would appear to be firstly to achieve a more equitable distribution of resources between individuals and secondly to enable an expansion of economic activity when otherwise 'bottlenecks' and 'overheating' would occur:

> "The economic structure is unfortunately rigid ... The later stages of recovery require a different technique. To remedy the condition of the distressed areas, ad hoc measures are necessary."

Kahn, R (1975) quoting from Keynes (1937) 'How to avoid a slump'

Spatial policies are pursued at the macro level in order to achieve macroeconomic objectives, such as economic growth and full employment, with less inflationary pressure than would be the case with other types of aggregate expansion.

Recently a number of local initiatives have been introduced by, for example, local authorities. The objectives of these policies, though not always clearly specified, would seem to be to improve the economic welfare of the local community. There is in many ways much less scope for local initiatives because of the 'openness' of the local economy though this has not prevented a proliferation of initiatives. Furthermore in spite of the constraints that exist for local initiatives there are many ways in which local authority action influences the operation of the labour market through, for example, housing, education, and welfare services. Many of the recent initiatives have been more directly concerned with attracting employment opportunities by, for example, industrial promotion, and the provision of sites and premises.

It is important however that such policies should be properly monitored and evaluated. That is to say that clear objectives should be laid down, that the net results of policies should be clearly identified and that the results should be assessed by an objective evaluation exercise. Furthermore from society's point of view we similarily need to evaluate the net costs and net benefits of local spatial policies to avoid the possibility that one area's gain is not simply another's loss. That is to say that the exercise is not a 'zero-sum' game (or worse a 'negative-sum' game).

The purpose of this chapter is not to list all types of spatial policy and consider each in turn[1]. Its purpose is to consider how spatial policy can be used to affect economic activity, to theoretically assess the anticipated effect of different types of policy; to introduce a local income and employment flow chart to consider the local impacts of local authority initiatives and to

1 This has already been adequately covered by the literature. In the case of regional policy - see Armstrong and Taylor (1978) and McLennan and Parr (1979) and for local authority initiatives see J.U.R.U.E. (1979 and 1981)

suggest utility-maximising criteria, as used in the assessment of micro-economic policies, for the assessment of spatial policies.

When policy is considered within strictly specified criteria for assessment a number of anomolies emerge. These arise from a number of special factors; the constraints imposed at the local level; the conflict between one area's objectives and anothers; the pursuit of a single objective as a proxy for a range of economic objectives; or a failure to recognise the real opportunity costs involved in pursuit of specified goals.

The chapter continues thus: firstly a brief overview of spatial policies is given, followed by an examination of the objectives of national spatial policies and a critical approach to how theoretically those objectives can be met by spatial policy. In Section 7.4 a consideration of the range of potential spatial policy instruments is undertaken and in Section 7.5 a discussion of how the impact of those policies should be assessed takes place. This is followed by a transfer of emphasis from the national to the local level with firstly a brief overview of locally implemented spatial policies and in Section 7.7 a study of how and why employment problems will be manifested in local areas. In Section 7.8 an examination of the objectives of locally implemented spatial policies is presented using the same utility-maximising framework laid down and used in Chapter 6 for assessing micro-economic intervention and also used in Section 7.3 for assessing national spatial policies. The range of instruments of local spatial policy is introduced in Section 7.9

and an income and employment flow analysis is used to investigate their likely impact. Local action is however somewhat constrained and the constraints are explored in Section 7.10. This is followed by a return to an examination of the possibilities of local action in improving social welfare (from a micro perspective, using a utility-maximising framework) subject to the constraints faced by individuals and by local policy initiators. The following section (Section 7.13) returns to the problem of evaluation and assessement this time at the local level. Evaluation and assessment is essential in order to direct resources to those areas which provide the greatest net positive benefits. Finally in conclusion the arguments are drawn together in a section which also attempts to reconcile the difficult questions raised regarding the conflict between national economic objectives and local economic objectives.

7.2 Spatial Policies

The major area of spatial economic policy has been regional policy. Regional policies in one form or another have been used in Britain for over half a century. In 1928 the Industrial Transference Board was set up to assist in the transfer of workers, mainly miners, out or areas where pits were closing. Since then various policies have been introduced either to encourage the mobility of labour from depressed to more prosperous areas or to encourage the transfer or setting up of capital investment programmes in the depressed regions. The emphasis has been on encouraging the development of principally manufacturing industry in areas designated by the Department of

Industry and simultaneously discouraging growth in those areas implicity designated as prosperous regions.

Other spatial policies have included the setting up of new towns; aid to designated inner urban areas; designation of enterprise zones where planning controls have been relaxed; and the policies of local authorities to attract growth within their areas.

7.3 Objectives of National Spatial Policies

Spatial policies applied from the national level will almost certainly fall within the overall national primary economic objective of increasing social welfare. We have:-

$$U_T = f(G, L, E, Q, \ldots..) \qquad (1)$$

where total utility (U_T) is derived from goods and service (G), leisure (L), environmental equality (E) and equality (Q). We may also wish to include other variables in our social welfare function. In attempting to maximise our utility function, we may use proxy variables to measure our progress. For example, gross domestic product per head or unemployment may be used as proxy target variables. Where we set a single objective or a reduced range as our proxy target there is a danger that the proxy target variable(s) take(s) precedence over the other variables, and further that 'cosmetic' achievements are used to indicate a greater level of success in reaching the target, for political reasons. For example, the discouragement of individuals to participate in the labour market, or to register as unemployed in order to improve the measured target of unemployment, provides no benefit to social welfare.

Regional or spatial policies of central government may be introduced for any combination of the following reasons:-

(i) as a means of moving towards equality, where spatial equality acts as a proxy for equality amongst individuals, ie, to increase (Q) in the national social welfare function;

(ii) to redistribute production or labour in order to increase the national output of goods and services, ie to increase (G) in the national social welfare function; and

(iii) to improve the environmental quality of areas, ie to increase (E) in the national social welfare function.

Examining each objective in greater detail:

7.3.1 Improving Spatial Equality

If equality amongst individuals is a nationally defined policy objective, then wide variations of income, unemployment, the incidence of poverty and so on between areas may be considered undesirable. Public policies which directly or indirectly result in the increased output of areas designated as in need of such aid might be considered as contributing to the equality objective.

However, there is no guarantee that the increase in welfare will accrue to the most deprived individuals of the area unless the policy is one of income transfers, or unless steps are taken for example to ensure employment of local unemployed labour. In the case of the latter this may be an unacceptable option for reasons of economic efficiency and in the case of the former income transfers are not normally idnetified as spatial policy instruments. This is an important point because if there are overall costs to society, in terms of foregone output, of encouraging locational choices which conflict with real locational advantages, then higher welfare benefits to the most deprived individuals through income transfers might be the most efficient way of achieving national economic welfare objectives too; if individuals in receipt of income transfers have relatively low marginal propensities to save, and relatively high marginal propensities to consume locally produced goods, (as 'a priori' we would expect), this would result in relatively high local and national multiplier effects, compared to other spatial policies.

7.3.2 Promoting Economic Growth

At the aggregate level of the economy the achievement of economic growth is frequently thought to be constrained by other policy objectives; the control of inflation, the external trading account, and environmental factors. The trade-off between economic growth and other objectives has in the past reached a critical position in the prosperous areas whilst the less prosperous areas still had a substantial amount of unutilised resources. It has therefore been considered desirable to relieve the pressure in the congested areas in order to enable an increased level of economic activity to take place before inflationary pressures, balance of payments problems or environmental factors make restrictive fiscal and monetary policies desirable.

The rationale for public policy intervention to encourage this decongestion of the prosperous areas arises from the failure of the market to establish an optimum distribution of economic activity. There are several reasons why the prices of factors of production may not accurately reflect their social costs, including locational aspects. This arises from the many imperfections in the markets for factors:

(i) The existence of external costs and benefits, (such as agglomeration economies, pollution and road congestion), for which no price or compensation is paid.

(ii) The immobility of factors of production, notably labour and including entrepreneurs.

(iii) The lack of perfect information in the markets for labour, land and capital.

(iv) The geographical movement of firms and/or workers is not cost-free.

(v) Where investments in such movements are considered worthwhile the funds necessary may be difficult to obtain.

(vi) The existence of monopolistic institutions in product and factor markets means that prices and wages may be manipulated by power factors.

(vii) The existence of a large untraded sector of the economy, such as health, education, and other public sector services where prices of output and wages are not determined through the market.

From the perspective of spatial policy the first five imperfections provide a rationale for intervention in locational choices. The last two will most certainly be impossible to interpret from a locational perspective.

In periods when the growth of economic activity is constrained by balance of payments problems, or environmental factors the rationale for spatial policies, if the market fails to provide an optimum locational distribution of economic activity, may be justified, if the benefits, in terms of growth of economic output, exceed the costs of the policies; however the rationale for these reasons is more questionable during periods of nil or negative economic growth[1]. The justification would then be dependent on other policy objectives viz equality and environmental improvements.

7.3.3 Improving Environmental Quality

The objective of improving environmental quality will result in spatial differences in the allocation of resources for that purpose. The need for environmental improvements will almost certainly be concentrated in the poorest and most depressed areas, where the incidence of environmental

1 See Chisholm (1976)

problems especially the existence of an obsolete physical industrial structure is likely to be greatest. The pursuit of environmental improvements can, therefore, contribute to improving spatial equality and increasing employment and income without the constraints of inflation or balance of payments problems. (That is not to say that environmental problems will not exist in the relatively prosperous regions, there will be problems there of pollution, congestion and environmental decay). The depressed areas are likely to be able to make environmental improvements with little or sometimes no resource opportunity costs compared with relatively large positive benefits.

7.4 Instruments of National Spatial Policies

Although most of the emphasis of spatial policy has been placed on the re-location of industry the range of policy instruments is much wider. Haveman (1976) has identified the following instruments, sub-divided into demand-side factors, supply-side factors, direct market intervention, direct cash transfers, and the influencing of technology. On the demand side Haveman identifies:-

(i) altering the composition of public sector purchases in favour of specific areas;

(ii) public intervention to employ idle capital or labour either within a specific area or elsewhere when a direct or indirect effect on the area will be felt;

(iii) public activities to affect the tastes of individuals towards the output of the area, (the advertising of Welsh Crafts or Scottish Tweeds for example); and

(iv) the transfer of income by taxes or deficits to increase income levels inside or outside the area which will raise demand for the area's output.

On the supply-side Haveman identifies:-

(i) public investments in the natural resource base or social infrastructure of the area;

(ii) public investments in the quality of the labour force or in regional amenities which induce capital investment in the area;

(iii) public sector activities to increase the labour force participation of the existing population of the area; and

(iv) public policies related to population and migration.

Under the heading of direct market intervention Haveman identifies:-

(i) subsiding the output of the area thereby reducing the price relative to that of the output of other areas;

(ii) administering a rise in the price of the output of the area which would increase income in the area (a prerequisite is that demand for the area's output is inelastic);

(iii) subsiding the use of labour and capital located in the area, increasing the return to the use of these factors vis a vis other areas.

A fourth strategy Haveman identifies involves direct cash transfers to individuals in the region; and a final strategy would operate on the technology of the region, altering the production function of the region's output and thereby increasing output from the same volume of input flows.

7.5 Evaluating the Effect of National Spatial Policies

National spatial policies should be implemented wherever and whenever the discounted anticipated benefits, including social benefits, exceed the real costs of those policies. Identifying all the benefits and the real costs, however, requires a sophisticated knowledge of the direct, indirect and induced effects on the areas receiving aid and on any areas which are adversely affected by spatial policies. In order to identify the real costs, an estimation of what would have happened in the absence of spatial policy, needs to be made, so that all opportunity costs can be identified.

Ideally therefore we need a multi-area model of the economy capable of simulating with minimum error the effects of alternative strategies on all areas and sectors of the economy; in order that we recognise and evaluate all real effects whether gains or losses. Treyz (1980) attempts to design an ideal multi-regional model for the United States, and sets the objectives of such a model:

"A multi-regional policy analysis model should be capable of generating accurate and comprehensive forecasts conditional on alternative values for government policy instruments".

He goes on to identify the features this ideal model should have:

"(1) both the inter and intra-regional interindustry structure ;

(2) changes in inter and intra-regional trade flows based on changes in comparative advantage;

(3) derived demand for the labour and other factors of production, including the determination of relative regional input intensities based on relative factor costs;

(4) technological change, based on and consistent with national technological changes;

(5) interregional migration and population changes based on past trends, relative real earnings after taxes and labour market conditions;

(6) wage determination dependent on labour market demand and supply conditions, for each sector of the economy in each state;

(7) relative regional price determination based on relative regional costs and consumer taxes;

(8) regional allocation of national final consumption demands, based on relative regional income and spending propensities;

(9) a system whereby federal or state policy instruments can be manipulated at the level of government for which the analysis is being performed; and

(10) a system where all variables are time-dated and simulation results of policy changes are determined by comparing an alternative forecast, conditioned on alternative values for government policy instruments, with the control forecast. This system will be applicable to simulations ranging from short-term regional supply-demand disequilibrium to long-run regional development planning."

Treyz, 1980 pp 191-192

7.5.1 Evaluation of Spatial Policies where multiple objectives are identified

The net effect of spatial policies offer four possibilities:

(i) that there is a real gain in national welfare, and no individual suffers a loss of welfare;

(ii) national output remains constant but some spatial redistribution of welfare takes place;

(iii) there are some positive national gains to welfare, but some redistribution of welfare also takes place;

(iv) there is a redistribution of spatial welfare but nationally a loss of welfare occurs.

Only outcome (i) above is indisputably accetable, since this represents a Pareto improvement. To accept outcome (ii) above requires that redistribution of welfare towards individuals with relatively low welfare is a social objective. However, spatial policies provide no guarantee that socially deprived individuals will benefit, nor that socially deprived individuals in areas designated as prosperous will not suffer welfare losses. For example provision of a rent-free factory in Wales might result in a mass transfer of a plant from another area, bringing all its work force. Demand for housing and other goods by the workforce and demand for inputs by the factory will almost certainly have a local input but any extra jobs, might be filled directly or indirectly by migrants to the area, and increased incomes might accrue to those in the area with already relatively high incomes.

For outcome (iii) to be acceptable redistribution of welfare must be a stated policy objective again. As in (ii) there is no guarantee that the increased welfare accrues to the most socially deprived individuals, nor that the socially deprived in the designated prosperous regions do not suffer decreases in welfare.

Outcome (iv) can only be accepted if the welfare of individuals in the designated depressed areas who gain in weighted more heavily than the welfare of individuals in the areas designated as prosperous who lose. Then the sums of the weighted gains to the individuals who gain in the depressed areas would need to exceed the sums of the weighted welfare losses of the individuals in the prosperous areas who lose.

Therefore, if outcomes other than (i) above are to be considered acceptable, we need some consensus of aggreement on the weights attached to marginal welfare gains and losses of individuals, as well as a comprehensive knowledge of who gains and who loses. Simply knowing which areas gain and which areas lose gives no indication of the extent to which our stated equality target is being met. As stated earlier the only policy instruments which guarantee hitting the equality target are those policies which give direct transfer payments to the socially deprived or those projects specifically designed to provide goods, services, or employment, which add to the utility of socially deprived individuals.

The enormous data requirements necessary to fully monitor and evaluate the spatial impact of economic policies including spatial policies requries a sophisticated model of the economy. Researches have devoted much effort to the development of such a model particularly in the United States. (These models and other evaluation techniques are considered in Part IV.)

Over the past decade a number of spatial policy initiatives have been taken at the local level, usually initiated by local authorities and it is to these policies which we now turn.

7.6 Locally Implemented Spatial Policies

Local authority intervention in the economy and labour market within their areas of administration has been taking place at an accelerating pace in Britain since the early-mid 1970's (see J.U.R.U.E. 1978 and 1981). The incentive for that intervention arises firstly from the alarm of local authorities at the increase in unemployment manifesting itself in their area, secondly from the recognition of factors peculiar to their areas and finally from the awareness of the number of potential policy instruments which fall within their sphere of influence.

7.7 The Manifestation of Unemployment Within the Local Area

The manifestation of unemployment with the local labour market is to some extent a reflection of conditions in the national labour market, but in addition it reflects particular localised factors, such as the area's industrial composition, national spatial policies (eg regional policy), the quantity, quality and characteristics of the physical and human capital stock (including their age profiles), the infrastructure, the geographical position with regard to accessibility to markets and input requirements as well as the area's natural resources.

Furthermore unemployment will not necessarily affect the same groups of people to the same extent in all areas. A particular area may have a particular problem with youth employment, or female unemployment, or unemployed steel workers with similar skills, and so on. Once again the differential impact arises from localised factors.

In addition to those factors in the previous paragraph which influence the general level of unemployment, the participation rates of various groups reflecting localised patterns of social behaviour and income levels will contribute to particular groups having partiuclar localised problems.

In 1978 J.U.R.U.E. undertook a survey of local authority areas within the West Midlands Region to establish the percetions of local authorities with regard to employment problems within their area and also to examine any measure being taken to eliminate those perceived problems. This is an interesting study because it was undertaken at a time when many local authorities hand been taking local initiatives on a fairly 'ad hoc' basis but were beginning to recognise the need to co-ordinate those policies and to understand the characteristics of their local economy in more detail than had previously been necessary.

Interestingly there was perceived to be a wide range of problems within the West Midlands, between local authority areas, and often, within the Metropolitan Borough areas. Problems within local areas were usually identified according to two criteria; an absolute crtierion and a relative crtierion. The absolute criterion results in the identification of a problem when a large number of individuals are affected. The relative criterion results in a problem being indentified if in relation to either past conditions, or national conditions, a particular group within the area or in the whole area is suffering from a disproportionate rate of unemployment.

7.8 Objectives of Locally Implemented Spatial Policies

With the wide range of instruments identified, and subject to certain constraints (see 7.10 below) the local policy makers will be seeking to maximise the social welfare function of the local authority area. The area's social welfare function can, as with society as a whole, be identified as the sum of the utilities of all individuals (and establishments) resident in that area. (This may be a changing group of individuals in an area of high mobility). We therefore have:

$$U_1 = f\ (G, L, E, Q......) \qquad (2)$$

As with society as a whole, utility in this case, local utility (U_l) is derived from goods and services (G), leisure (L), environmental quality (E), equality (Q) and other factors if so identified.

If goods and services and leisure are seen as private goods which yield utility to households and if environmental goods are public goods which also yield utility to households, we can identify optimum combinations for individuals using the income/leisure framework. (See Figure 7.1). Individuals wishing to maximise their level of utility will be constrained by the amount of time they have available to divide between market work and leisure, by the wage-rate they can earn by the level of unemployment or social security benefit which they claim whilst out of work, and by the level of goods, services and environmental benefits which influence the quality of life but for which individuals do not make payments, ("Free goods").

7.9 Instruments of Local Spatial Policies

In the JURUE survey (1978/9) local authorities identified a number of policy instruments. It was fairly clear that at that time these instruments were being used in an uncoordinated manner and that no overall framework for the rationale for the use of the instruments had been undertaken, and very little monitoring of the effects of the policies had been initiated.

Since that time local authorities have taken far more initiatives, have begun to improve their monitoring proceedures and also to consider the wider implications of their actions. We

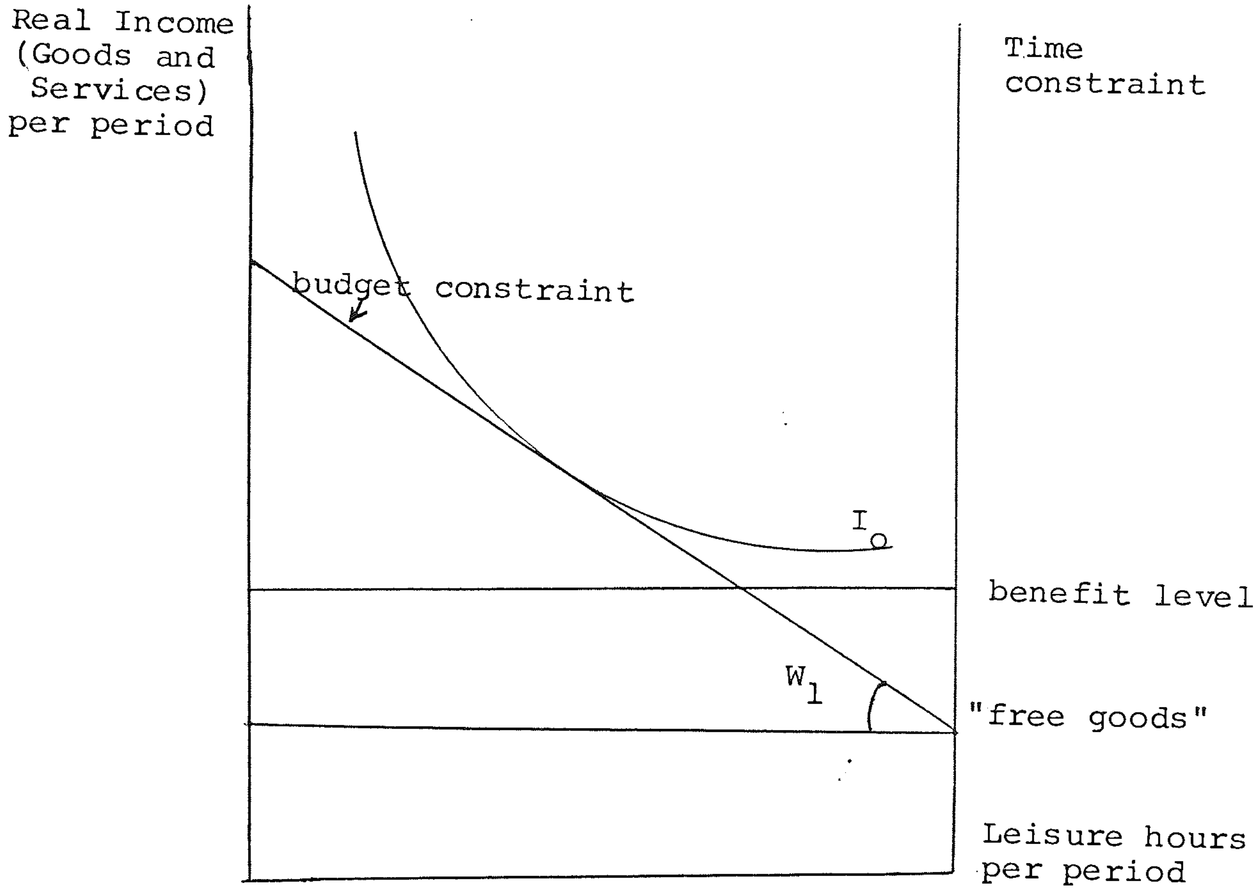


Figure 7.1 The choice between 'work' and 'leisure' for individuals.

can develop a simple employment and income flow model to examine the influence of local policy on the local economy (Figure 7.2, 7.3 and 7.4). It is immediately apparent that not only can local authorities 'tinker' with the operation of a local labour market but they influence the stocks, flows and the mechanism of the labour market, through the implementation of their statutory activities, whether or not they intentionally try to achieve specific goals.

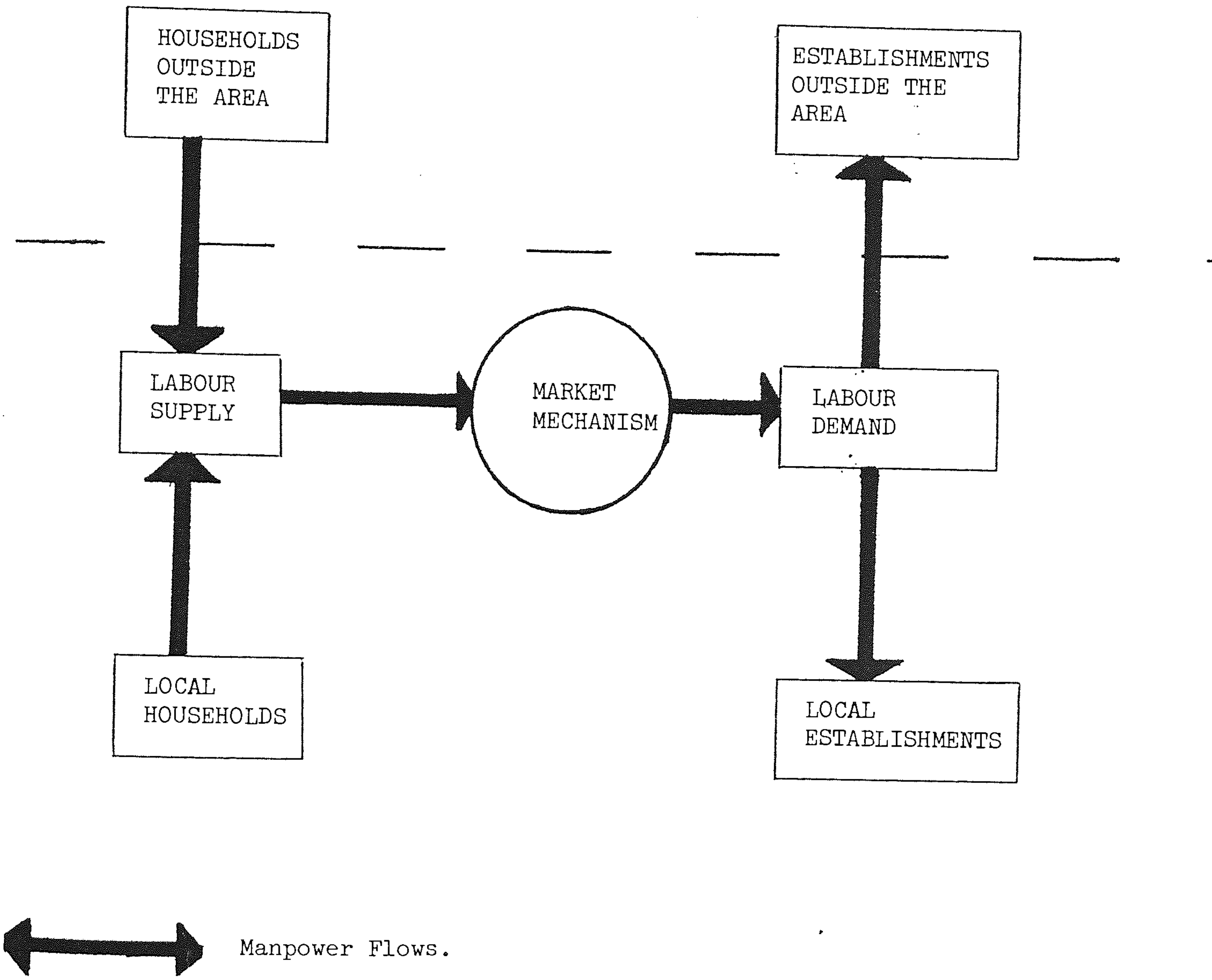
Through this model of the local economy we can examine where the statutory provisions and potential instruments for intervention will be. This will enable a structured framework to be developed, which will provide the rationale for intervention and enable a monitoring procedure to be developed.

Figure 7.2 illustrates the flows of manpower from households to firms through the labour market. There is some cross-flow across the boundaries. Some residents from the area working outside the area, and some residents commuting into the area to work.

Figure 7.3 includes all the income as well as manpower flows. (Only the income flows which directly involve local households or local establishments have been included in the diagram). Local households will receive income from establishments to whom they sell or hire, land, labour, money or capital, whether those establishments lie within or without the local area. Households will save, and will pay taxes to local and central government and some will receive transfer benefits from central and sometimes local government. Households will buy goods and services from

Figure 7.2

The Labour Market in the Local Authority Area: Manpower Flows



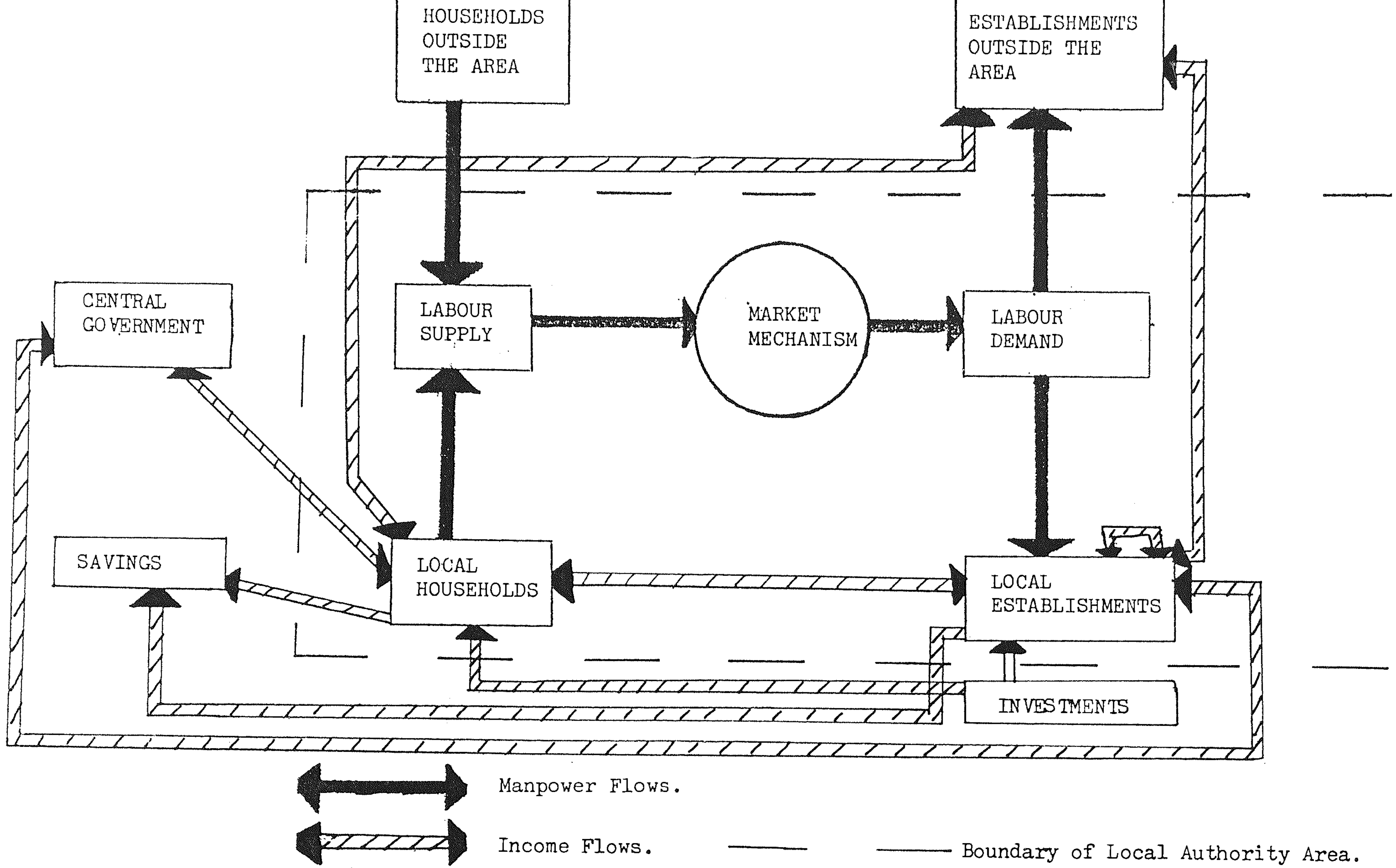


Figure 7.3

The Labour Market in the Local Authority Area: Manpower and Income Flows local and non-local establishments. Households without the area will receive and spend income in a similar way, although the weightings of income receipts and expenditures will be locationally different.

Local establishments will pay wages, profits, rent and interest to households and establishments within the area and outside the area, who sell or hire to them labour, capital, land or money. They will pay taxes to, and some will receive subsidies, grants or loans from central and local government. Local establishments will save and will invest. They will receive income from consumers of their outputs, whether households or establishments, outside or inside the area, or local or central government. Establishments outside the area will also receive and spend incomes but as with households the locational weightings will be different.

Figure 7.4 shows the areas of involvement or potential involvement of local government in this local economy. The instruments can be identified under the headings: demand-side policies; supply-side policies; policies to aid the market mechanism and other miscellaneous policies. (Several instruments are listed under more than one heading).

7.9.1 Demand-side Local Policy Instruments:

(i) provision of information for prospective and existing firms;

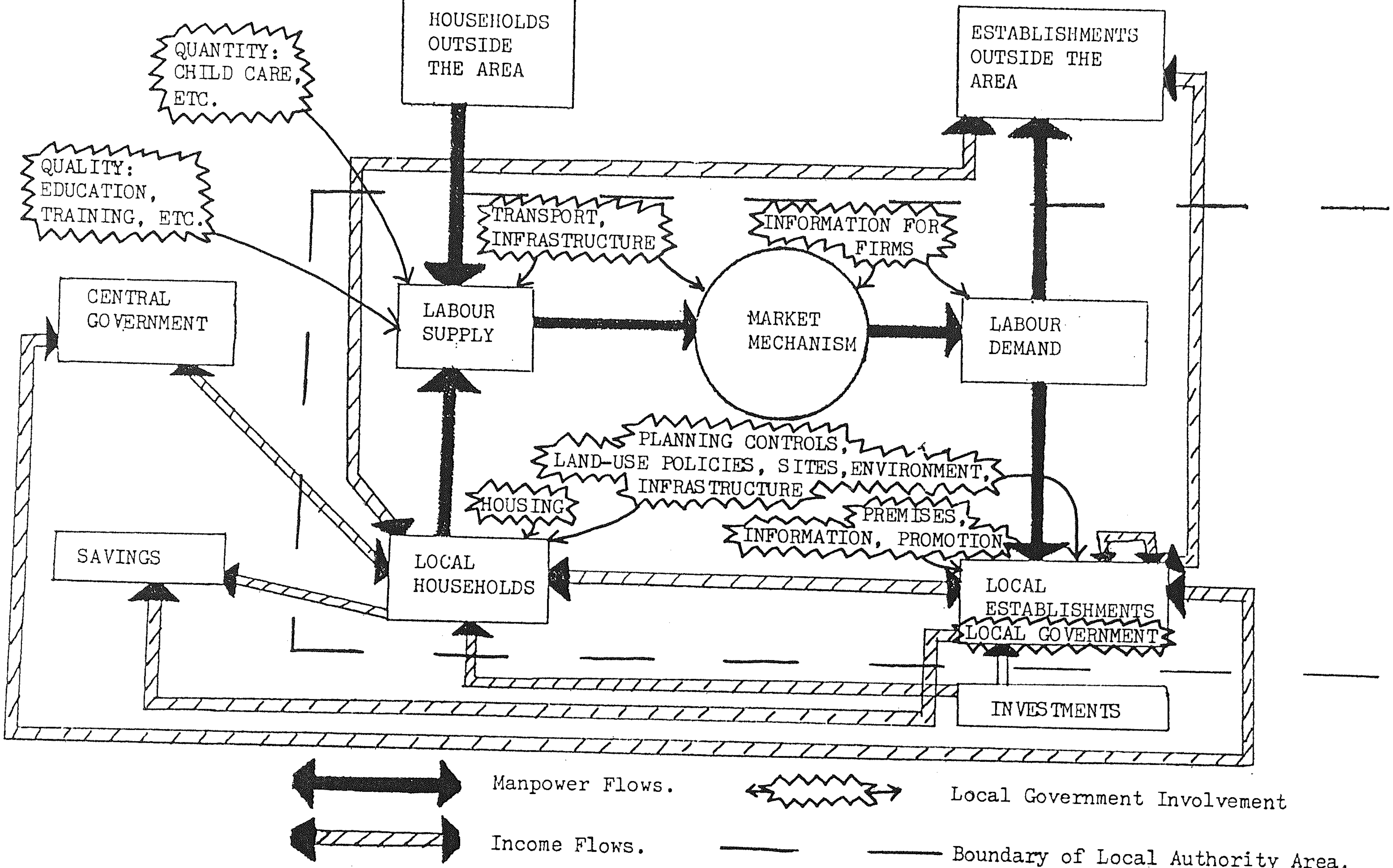


Figure 7.4

The Labour Market in the Local Authority Area: Manpower and Income Flows and Main Areas of Local Authority Involvement

(ii) advertising and promotion to attract new firms;

(iii) provision of sites;

(iv) provision of premises;

(v) infrastructure developments (to aid accessibility to markets and workers);

(vi) environmental policies, control of firms' activities through implemation of planning controls etc.;

(vii) provision of finance for loans or risk capital;

(viii) reducing costs to firms. For example, by co-ordinating joint services or acquainting firms with new technologies; and

(xi) attracting sales to local firms through trade missions, promotion or through their own purchasing policies.

7.9.2 Supply-side Local Policy Instruments:

(i) provision of information to job seekers; eg. through careers offices;

(ii) provision of housing;

(iii) provision of sites for housing development;

(iv) infrastructure development (to aid accessibility to jobs);

(v) provision of education, training and work experience;

(vi) provision of transport

(vii) provision of child-care facilities, such as nurseries; and

(viii) promotion of the area to attract households, especially key workers, high income earners and young, healthy, enthusiastic individuals.

7.9.3 Local Policy Instruments to Aid the Market Mechanism.

(i) provision of information;

(ii) development of the infrastructure;

(iii) provision of transport; and

(iv) land-use designation and housing policies; and

(v) education and training policies.

7.9.4 Miscellaneous Local Policy Instruments.

(i) advocacy to influence central government decision-making;

(ii) local authority employment policies;

(iii) provision of information and encouragement to local firms and households in relation to the take-up of transfers, loans and grants to which they may be eligible from central government, or the E.E.C. etc; and

(iv) promotion of or setting up of establishments, co-operatives, or self-help organisations.

7.10 Constraints to Local Action

Whilst central government economic policy objectives may be subject to some constraints, the constraints at the local level are likely to be more severe and will include a budget constraint, an expertise constraint, a legislative constraint, a geographical and a political constraint. We can examine each in turn.

7.10.1 The Budget Constraint

Local authorities will not have large funds for funding research, implementing policies or monitoring policies. This will probably prevent them from developing sophisticated models of their economies, from funding large-scale investments eg. within firms (where this was within their statutory powers), or from tracing the full impact of their policies withing the area. This constraint might therefore inhibit the extent of measures which might be taken.

7.10.2 The Expertise Constraint.

This constraint is related to the budget constraint. The personnel within local authorities will have expertise within their particular field of operation. The range of policy instruments above indicates that any interventionist policies will need to be coordinated and monitored from a central position but most of the implementation will fall upon a wide range of sections within the authority.

Economies of expertise within local authorities can be made if an acceptable framework for intervention can be developed and utilised by many, if not all, local authorities. The development of an overall framework with guidelines for its implementation will need, however, to recognise the limitations in the expertise of those who will operate the policies.

7.10.3 The Legislative Constraint.

Local authorities have limited powers delegated to them through Parliament. Local authorities will therefore need to behave in accordance with the law and will need to extend their powers if and where necessary through Local Acts of Parliament.

7.10.4 The Geographical Constraint.

A local authority area may not coincide with what would be regarded as a 'local labour market'. In practice of course it would be very difficult to form a concensus view on what geographical area would constiture a 'local labour market'.

The local labour market for one type of labour may be small relative to that for another type whose members were prepared to travel greater distances to work. Different levels of mobility have been observed by occupations, skill and sex, for example. Even if a 'local labour market' could be identified it is unlikely that the boundaries of that labour market would not be crossed. A spatial labour market exists because of imperfections in information and because there are costs involved in commuting and migrating. Those costs will consist of the nominal costs of, for example, fares or removal, of opportunity costs such as time and of psycological costs in terms of leaving familiar surroundings and friends. Those costs will not be the same for all individuals neither will the socio-economic retúrn to those costs be the same for all individuals. Even within a single group, say, male unskilled manual workers living within an urban area the labour market boundary will bot easily be determined, although we might reasonably assume that their labour market area would be smaller than that of the male professional/managerial workers living in the same urban areas. Hunter and Reid (1968) offer a useful definition of a local labour market:

> "the bulk of the area's population habitually seeks employment there and .... local employers recruit most of their labour from that area."

However this gives no precision to the practical identification of such an area. Drewitt (1967) has developed the concept of the SMSA (Standard Metropolitan Statistical Area) and the MELA (Metropolitan Economic Labour Area) originally based on the United States but also later for the U.K. (See Drewitt, 1967, Hall et al, 1973, Drewitt, 1974, Hasluck 1980). These concepts recognise the existence of an inner urban core with a high level of inward commuting surrounded by a ring of areas closely related to the core with an outer ring of areas more loosely related to the core. The SMLA consists of the core and the inner ring, whilst the MELA is a larger area incorporating the SMLA and the outer ring. From the point of view of the local authority, unless the local authority area coincides to some extent with a 'local labour market' then intervention may have to be restricted to a limited number of initiatives. In any case the geographical constraint will restrict the number of options which yield positive and acceptable social rates of return to local initiatives, simply because of the high volume of leakages from the local economy. To some extent this constraint can be overcome by collaboration with neighbouring or higher tier local authorities.

7.10.5 The political constraint.

Firstly the party political constraint might inhibit the types of policies which will be considered. Within the wide range of potential policy instruments there is a wide range of potential impacts upon individuals. For example, some policy instruments will favour local businesses whilst others will favour local households.

Secondly the political constraint which inhibits local policy-makers is that they wish to be seen to be implementing policies, and also seen to be having success. This may lead to the use of some policy instruments where there are visible signs of the policies, (for example providing premises for firms) or to the use of cosmetic policies which improve the measured target variables, (such as reducing the numbers of registered unemployed within their areas, by say, the encouragement of people to leave the labour market.)

7.11 Influencing the level of utility maximisation

Subject to the above constraints local policy-makers will have some influence over the utility levels of individuals within their area. The potential policy instruments have been introduced in Section 7.9 and the constraints in 7.10. We can now examine the influence of some policy initiatives on the level of utility of individuals within an indifference map analysis presented in Section 7.8. Firstly local authorities can influence the amount of time available for work:

7.11.1 Influencing the amount of time available for work.

One of the major time constraints of some individuals arises from the amount of non-market activities which individuals perform. These activities include:

the care of young children;

the care of sick or elderly relatives; and

travelling to employment.

Where local authorities provide services which reduce the time input of individuals to such activities then individuals will be able to devote more time to work or leisure. The provision of nurseries, holiday play schemes and other child-care facilities will increase the amount of time mothers (and sometimes, fathers) have to devote to work. Similarly care facilities for the sick or elderly will release time of those who care for them within households. (These facilities are labour-intensive services which will also provide some employment within the area). Even where payment is made for these services, individuals will be able to reach higher levels of utility so long as the marginal cost of the care is less than the marginal wage gain. (Figure 7.4).

In Figure 7.5 before (say) child-care facilities are introduced an individual has little time available to devote to work. (Many will have no time available). Assuming work is available at wage rate, w_1, for the few hours the individual is able to consider work, the real income Y_2 is earned and utility level I_o is reached. If now child-care facitlities become available at cost C per hour, (in this case C is less than w_1) for up to AB hours per period, then the individual will have OB hours available, and will be able to work more hours, and therefore reach a higher level

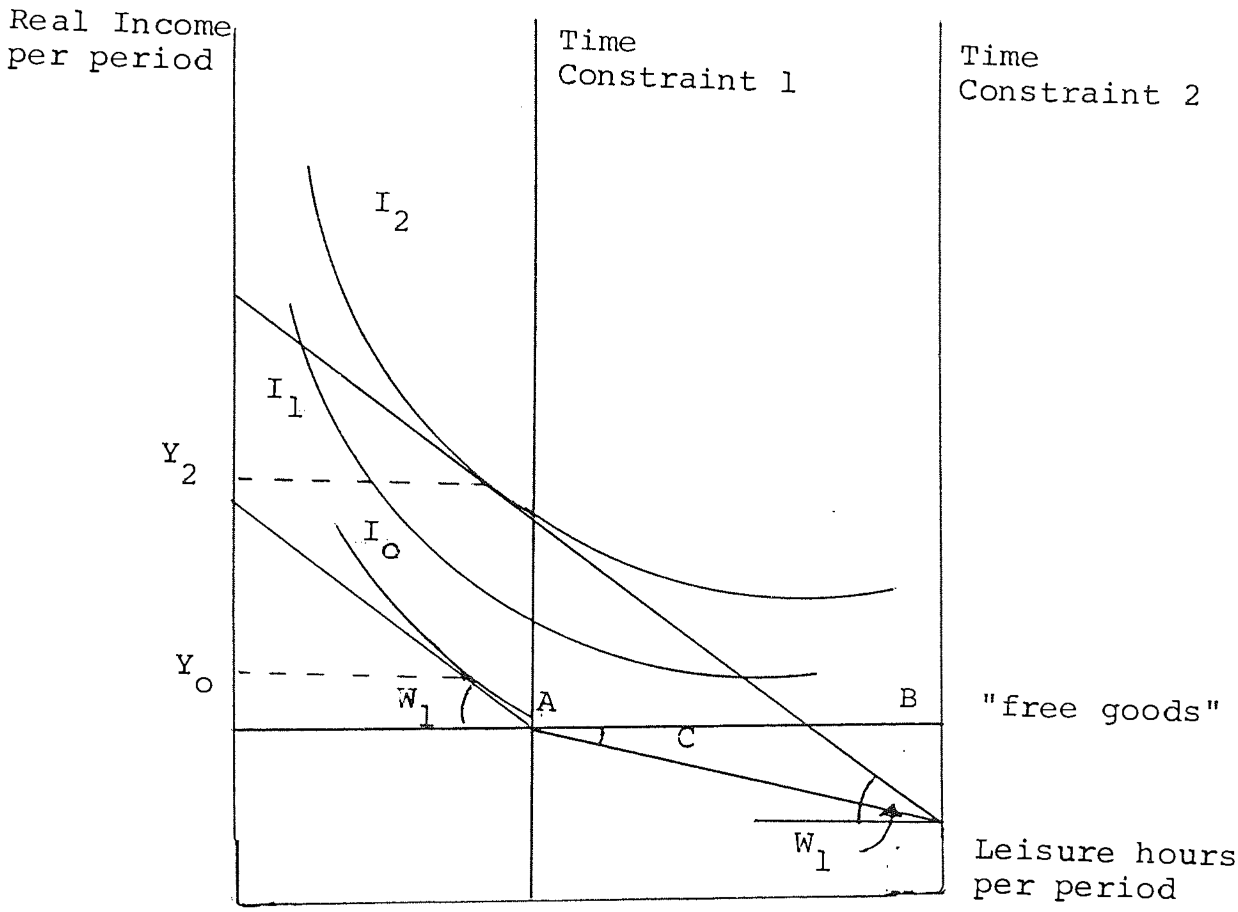


Figure 7.5 The provision of child-care facilities and the impact on the utility of the individual.

of utility. In this case, with the wage-rate unchanged at w_1, the individual is able to earn real net income Y_2 (after paying BC nursey fees) and reaches a higher level of utility, I_2. An additional benefit to the individual may accrue if higher wage-rates are earned by full-time workers, (which is often the case). The benefits accrue whether nursery provision is provided by local authorities or by private enterprise. Unless there are social as well as private benefits local authorities might therefore try to encourage private nurseries through local firms or through cooperative ventures with local families for example or provide the service on a break-even basis. If however, there are social benefits in the form of lower incidences of families falling into the social services net, or reductions in crime (by parents and children), etc then local authorities may justify subsidising private nursery places or providing the service themselves at a subsidised price. In either case local authorities may be in a position to provide the service most efficiently by the utilisation of spare capacity in schools or other buildings they maintain.

The same analysiss applies to the provision of care facilities for the sick and elderly, and to the provision of efficient transport networks which reduce commuting time.

7.11.2 Influencing the potential wage-rate (or the ability to secure a job at the current wage).

(a) Supply-side factors.

The real wage rate individuals can earn will be determined to some extent by their potential contribution to the output of firms. This in turn will be related in part to the level of skills, education and training that individuals possess. Local authorities will be able to influence these levels by investment in schools, colleges and other educational and training facilities. These decisions will fall into the context of human capital investment decision-making, where investment in training/education should be made wherever the investment reaps an acceptable social rate of return. (Some of the investment costs will be bourne by the individuals at least in terms of foregone earnings, who will also reap some benefits in terms of increased lifetime earnings, status and improved lifestyles).

Housing, and transportation, infrastructure and land-use policies will affect the accessibility of individuals to employment opportunities. The provision of information and advice to individuals through, for example, careers offices will also aid the access to employment.

From the local policy perspective each of these areas constitute investments in human capital, to which local authorities can expect to reap social benefits for individuals and society in terms of increased future outputs, wages and living standards, and the decision-making process should therefore be made in the context of an acceptable social rate of return to those investments.

(b) Demand - side factors

Real-wage rates in an area will also be influenced by the extent of demand for labour in the area, and also through the demand for the area's output. Policies may therefore be aimed at attracting public or private establishments to the area; at improving the prospects of local firms; or at encouraging demand for the output of firms. In seeking to increase the level of labour demand in the area, local authorities will be seeking to either increase the wage-rate or increase the number of jobs available in the area at current wage-rates.

The potential instruments are listed in 7.9.1 and are self-explanatory. The effect of an increase in the real wage on the level of individual utility is illustrated in Figure 7.6. Real wage rate rises always result in increased levels of utility, in the form of increased levels of either goods and services or leisure or a combination of the two. The appropriateness of utilitising any of the instruments will once again be dependent upon an assessment of the costs and benefits of the intervention.

(c) Improving the market mechanism

Where improvements in the matching of workers and jobs can be made, the likely gains will be in the form of a faster filling of vacancies, and a more efficient matching of workers and jobs so that output and wage rates can improve.

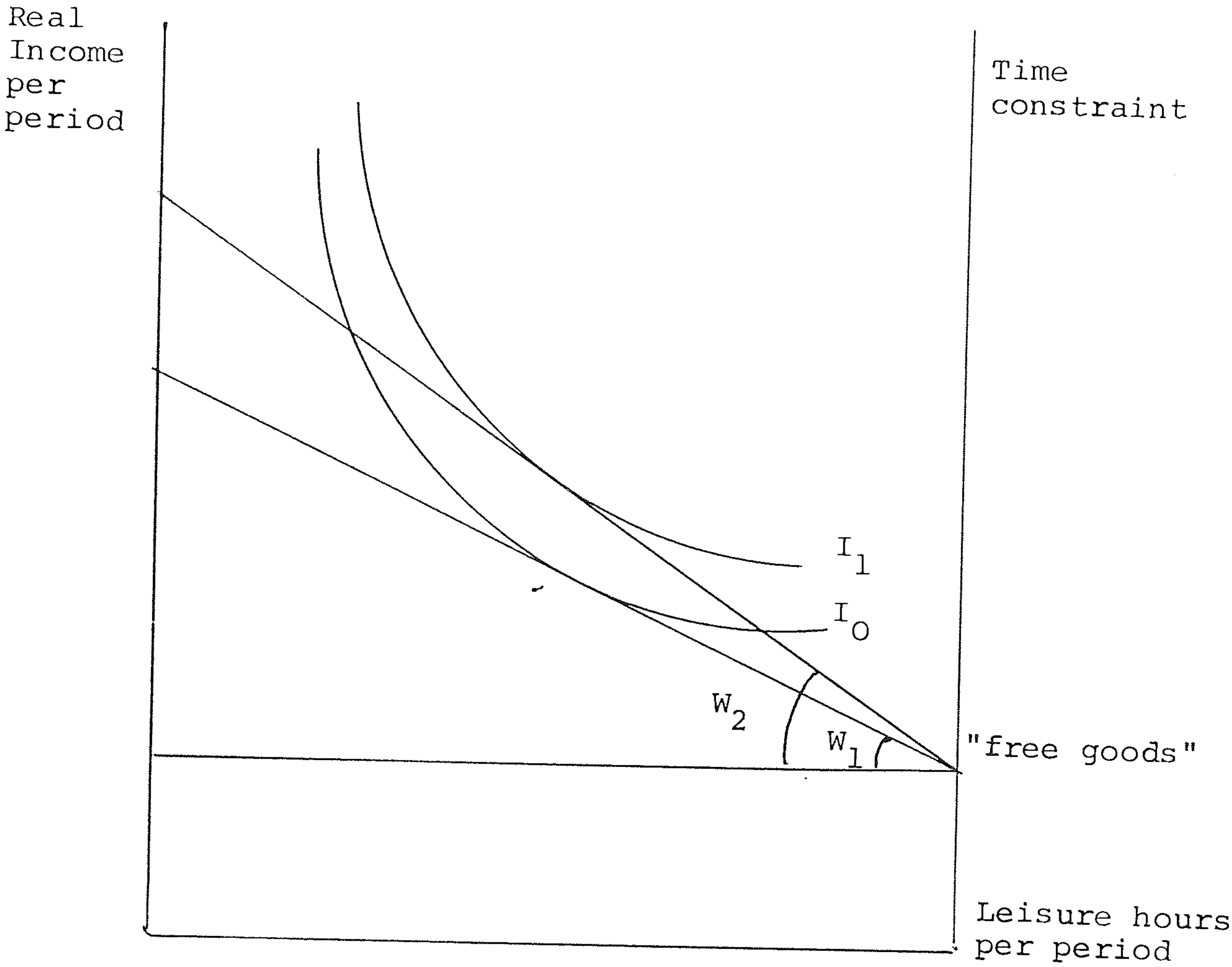


Figure 7.6 The effect of a real wage-rate rise on utility.

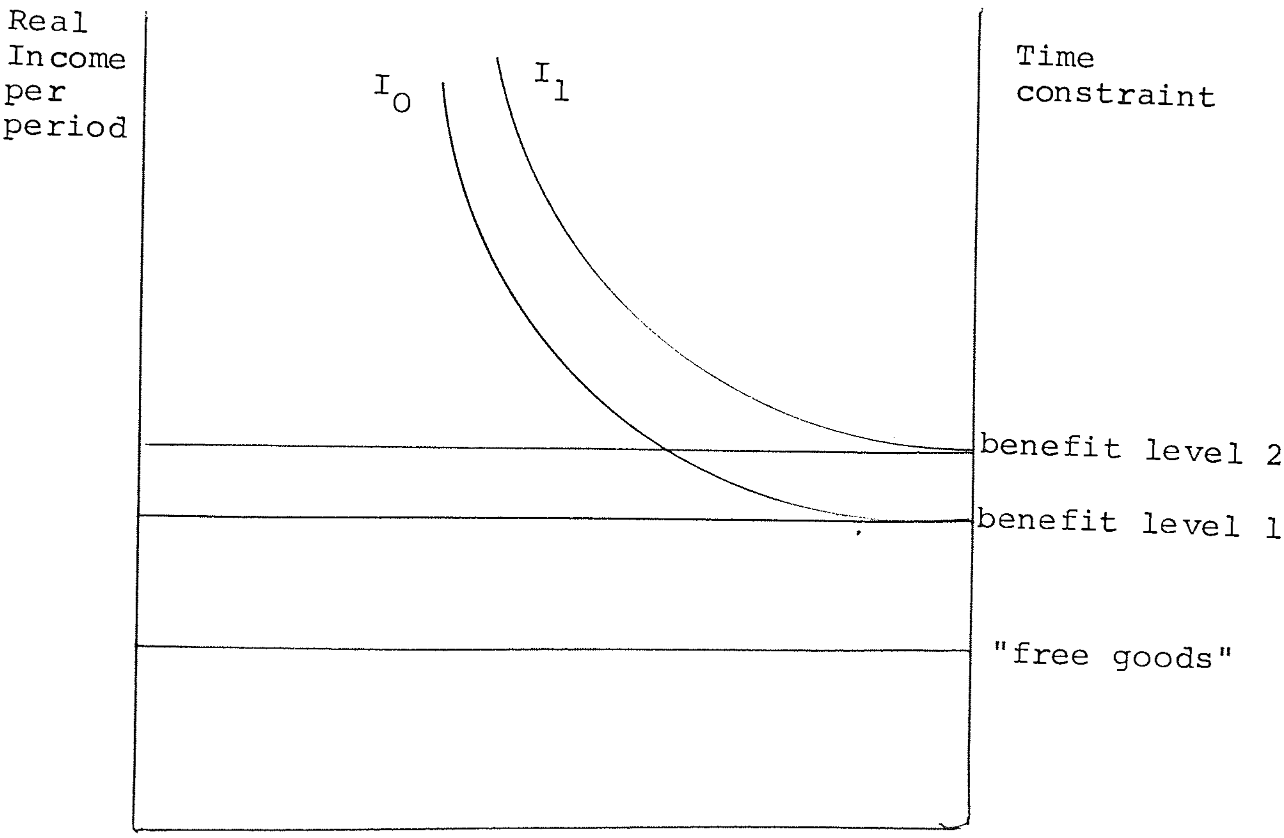


Figure 7.7 The effect of an increase in benefit for an unemployed individual.

Where, for instance, information can be provided to job-seekers or potential employers, where the infrastructure or the public transport network assists the mobility of workers, or where land-use and housing policies improve accessibility of workers to areas of employment or where education and training improves the employability of workers, there will be real wage gains. Figure 7.6 illustrates how this improves the level of individual utility.

7.11.3 Influencing the level of government transfers.

Government transfers such as grants, social security payments, national insurance benefits etc.; influence the level of utitlity individuals can reach when they are unable to gain employment or in some cases, for example in the case of family income supplement (F.I.S.), when the level of earnings from work is low.

Where local authorities can improve the take-up of these transfers they will improve the level of utility those households can achieve. The effect of an increase in the level of benefit an individual receives is illustrated in Figure 7.7. Again the effect is to move individuals to a higher level of utility (I_0 to I_1). From a higher benefit take-up, we can expect a higher level of consumption of goods and services, some of which will have a local value-added component resulting in a local multiplier effect, which we have already suggested might be somewhat higher

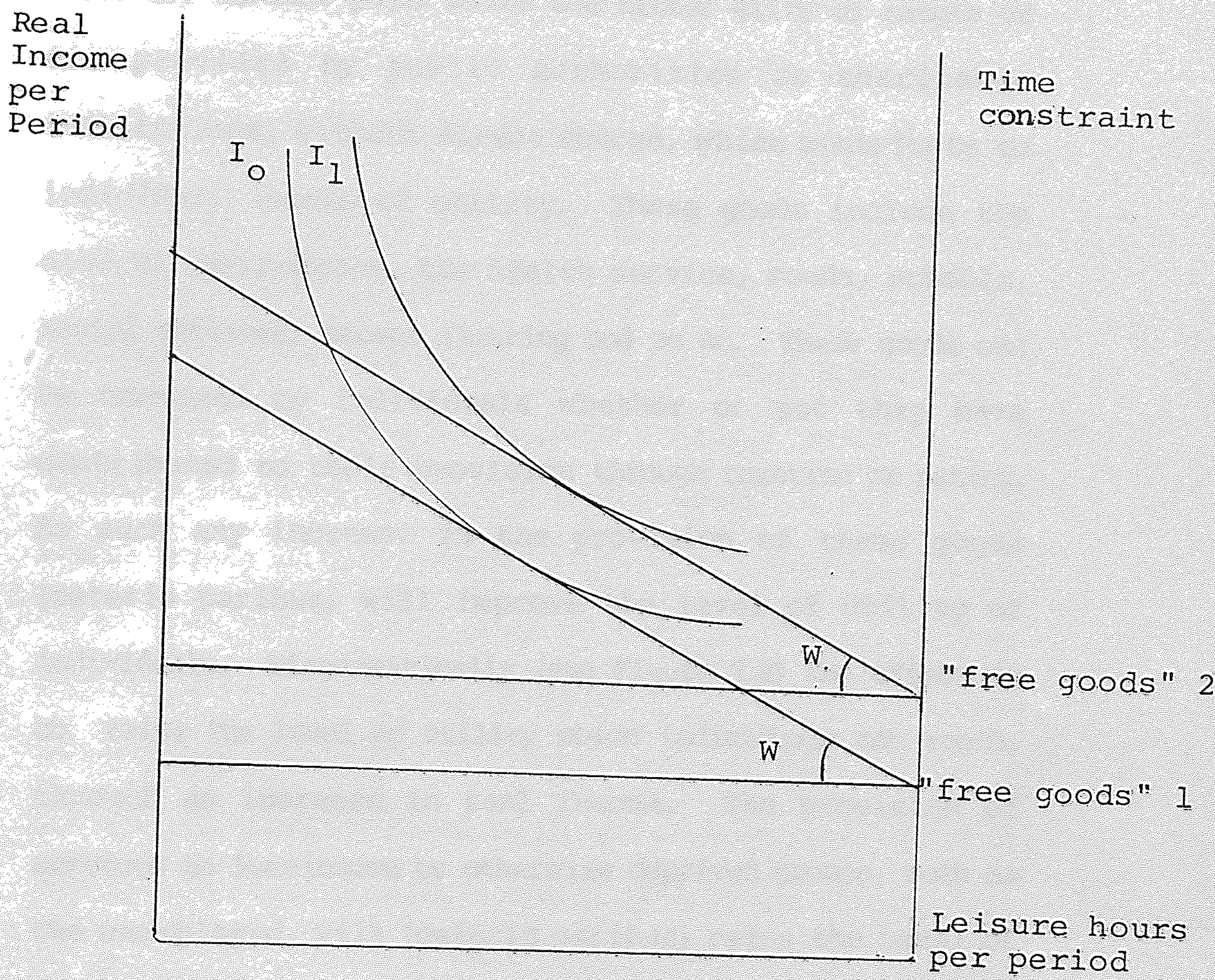


Figure 7.8 The effect of an increase in "free goods" on individual utility.

than for other groups because of the relatively low marginal propensities to save and import.

7.11.4 Influencing the level of 'free' goods.

There are certain goods which are either gifts of nature or are provided by public authorities or charitable institutions, without direct charge, which contribute to individual levels of utility. These goods include the natural environment, the health service, roads, schools, social services, street lighting and so on. These goods can be consumed by individuals whether or not they have contributed to their provision through taxation or rating. As such any increase in the provision of these goods (ceteris paribus) will improve the level of utility of individuals. Diagramatically (see Figure 7.8) the effect is to raise the level of utility which individuals can reach, through an increase in real income. The provision of services to low-income or otherwise deprived groups, such as the unemployed, will (ceteris paribus) raise the level of utility of these groups viz a viz other households. So that this type of policy will influence the distribution of utility within the area.

The decision to expend monies or increase expenditure of monies on these 'free' goods which fall within the remit of the local authority must however be taken within the social cost-benefit framework. Only those goods which provide expected net increases in future welfare (discounted to present value) within the area should be provided by local authoritites.

7.11.5 Influencing the number of households in the area

Through their housing, land-use, promotion, infratructure, transport and environmental policies local authorities are able to influence the number of households, (and to some extent the type of people) in their areas.

Policies to attract new households will yield benefits in the form of increased demand for locally produced (including publicly provided) goods and services. Economies of scale may result in increased efficiency in their provision. In addition incoming households might contain workers with scarce skills or entrepreneurial talents. Mobile households often consist of young people, who are frequently net contributors to society, have relativley high marginal propensities to consume and have relatively high levels of skill. High income households can also be considered as desirable community members and policies aimed specifically at attracting them may also be pursured (by for example designation of land for executive housing, golf clubs etc.)

In some areas, however, there may be problems associated with overcrowding and congestion. Benefits may therefore accrue if households and establishments are pursuaded to move to suburban sites or other areas.

7.11.6 Influencing equity

Whilst local authorities cannot easily influence the distribution of income and wealth within their areas, they can do much to influence the distribution of utility amongst households.

Education is the single most important variable affecting earnings capacity (other than age and sex). Yet many households are unable to make investments in education even where those investments yield net positive benefits. At 16-18 years of age, the cost of investment in education, in the form of forgone earnings or foregone social security benefits, is one that low income families find impossible to meet. Similarly the investment cost of courses [1] for the over 18's, which do not attract mandatory grants is similarly difficult to meet for many families. Whilst central government fails to provide funding for these people, local authorities might find support for them to yield net positive benefits to the local area, for example, by attracting new firms or by improving the efficiency of existing local firms, or developing the talents of young people sufficiently for them to develop their own small enterprises.

The distribution of other services provided by the local authority might also be directed at the most deprived households, thus improving their relative quality of life.

1 Foregone earnings or benefits plus direct costs such as fees, books, etc.

In assessing the various policy options local authorities might wish to weight the welfare of low income families more heavily than that of higher income households.

Alternatively policies which satisfy the criteria of assisting, say the unemployed, might automatically be given priority over policies with a less immediate effect on the unemployed.

During periods of high unemployment local authorities (and governments) might be tempted to believe that reducing the labour supply might constitute a welfare gain. (Based on the assumption that there are a fixed number of jobs to go round.) Whilst any decline in labour supply, through the discouraged worker effect, might initially have a cosmetic effect on the unemployment statistics, eventually the effects of reduced consumption also affect the level of employment. (Through the deflationary income and employment multiplier effects.)

However, where an individual with a relatively low preference for leisure viz a viz market goods replaces an individual in the labour market with a relatively high preference for leisure viz a viz market goods, it is possible that a net welfare gain can be made. Similarly if a worker is replaced by a more productive worker a real output gain can be made. Furthermore if in the short-run the labour market is believed to be unable to absorb all those looking for work, then, work - (and leisure) sharing may be considered preferable to income sharing, through high levels of taxation. Local authorities may be able to encourage this through their own employment policies. However, (ceteris paribus) encouraging an increase in labour supply and leaving other areas to discourage participation, results in long term welfare gains to the area. (Although an increase in the registered number of unemployed may be the initial effect.)

7.12 Evaluating the effect of local spatial policies (at the local level and financing their implementation.

Ideally local authorities would want to implement all those policies which yield net positive discounted benefits within their areas. In order to undertake this action however, they need to be able to identify the appropriate policies and to raise the finance to undertake the social investments. The two cannot be separated since the effects of the raising of the finance (by rating or borrowing or whatever) need to be considered within the social accounting analysis. Only where the finance comes from exogenous sources (such as central government or the EEC) will the local authority be in a position to concentrate almost exclusively on the benefits.

Given the limited resources, expertise and legislative powers, how can local authorities choose the most appropriate policy instruments? We can suggest some guidelines:

7.12.1 Provision of services which only the local authority can provide primary policies.

Firstly there are some local authority statutory activities such as the provision of education and transport, land-use planning, infrastructure development, housing, environmental policies etc. which have an impact on the local economy and which cannot be provided by other agencies. It would therefore seem logical to initially concetrate on the coordination of these policies and the examination of their anticipated effects on the local labour market. The examination of the implementation of these policies must be given priority by local authorities, since their effect is very important and the short-falls cannot be corrected by individuals or private establishments, except to a limited extent. In this sense these are the primary policies.

7.12.2 Ranking of secondary policies

After the examination of the quality of provision of the primary services, the secondry possibilities need to be ranked. We must recognise that local authorities cannot undertake major comprehensive social cost-benefit analyses of every political policy instrument in order to identify and rank those which yield net positive discounted benefits.

However, local authorities will be able to recognise the major effects and costs of their policies, with the aid of some economic models and tools of analysis. Regional and local multiplier effects can be recognised; the social accounting framework can be used, (concentrating only on the major effects). This will reveal not only the overall costs and benefits but will identify the recipients of the benefits and the bearers of the costs; the input-output table will yield further details the industrial impact of the policies. These techniques and models are discussed in the next two chapters, together with a model - the employment-dependency model - which can be used for identifying the major effects (on local areas) of changes in national economic and industrial variables.

In using these or other methods of analsis, local authorities should include in their calculations, or assessments only those costs and benefits which are incremental (marginal) and not those which would arise without local authority action. For example if local authorities provide premises for firms, and those firms are profitable and able to pay economic rents for those premises, then this is probably a 'service' which would be provided efficiently by the market. The social benefits or externalities from this service appear to be close to zero (unless the market fails to provide premises). In other areas too the benefits may accrue mainly to the recipients of the service, in which case subsidies to those who are unable to pay, might be preferable to total provision. For example in the case of nursery places or day places for elderly or infirm persons, many benefits accrue to the family; if some families are able to pay, then benefits will accrue from either private or public provision of this service. However if there are external benefits to society

[1], or if some families are unable to pay the full economic costs of places, the local authorities may consider subsidising some places in private institutions, or providing places in schools, hospitals etc., which would lower the costs to individuals. Similar criteria would apply to the provision of loans or risk capital, local authorities should rank projects according to their discounted social benefits and give priority to those which the market is unwilling to finance, perhaps because of lack of collateral; (although in this case the underwriting of loans might be preferable to financing so that finance is left available for other projects.)

It is also imperative that local authorities recognise the real opportunity costs of their policies. For example, many costs will fall on ratepayers, both private and commercial. Many low-income families are entitled to rate rebates or have their rates paid by DHSS. However, many households who do not qualify for such assistance will nevertheless find the rate burden a heavy one (and experience a reduction in their level of utility which may not be compensated for by the services provided). Similarly many firms will find the

1 External benefits will accrue to society if for example,parents otherwise neglect children and if children and elderly or infirm people otherwise fall into the care of the local authority. Day care facilities will be much cheaper to provide than permanent places.

rate burden heavy. At the margin the rate burden may seriously affect some households and firms.

Other policies may also have costs, which may be overlooked. For example if local authorities have a policy of buying British or of buying from within their area, this clearly will have long-term and possibly short-term consequences on the cost of those goods and services.

Setting out all the costs and benefits (but not necessarily quantifying them all) will in many cases be sufficient to prioritise policy options. The JURUE study (op cit) was able tentativley to rank those policies which local authorities were pursuing. It was found, for example, some policies were extremely cheap with real returns clearly identified. (This was so in the case of providing information about sites and premises available in the area.) Site provision was more beneficial than provision of premises, since local authorities often experienced scale economies in the former but private contractors often had more accurate information of client needs in the case of the latter, although the private market did seem slow to recognise the growing need for small start-up units by individuals. Advertising and promotion of an area was popular but expensive and few authorities could identify real returns. When compared to the budgets of new towns the likelihood of success seemed to be something of a gamble, although the pay-off is potentially large. (In areas with nothing to offer by way of regional aid the probability of success is especially low compared to areas with some assistance to offer.) Many local authorities have developed special units for economic development within their areas (sometimes more than one per authority). Mostly their work has centred around promotion of the area and industrial development projects, such as the provision of sites and premises. These units usually attract high sallaried professionals and are expensive to set up and run. Most are in the early stages, some can identify a number of successes, others have not yet developed their strategies. The establishment of the West Midlands Economic Development Unit and the West Midlands Enterprise Board (both set up by the Metropolitan County Council) is in some ways an innovative venture. There are for example, proposals to use money raised through rating and staff pension funds as risk captial in ventures, with the Board taking equity and providing expertise. Hopefully careful monitoring and assessment of this work will be undertaken so that it becomes available for others to consider. However, there is a danger that these type of ventures are pursued for political, rather than economic objectives, (the being seen to be doing something philosophy), and that other policies possibly with higher rates of return, such as coordinating of departmental responsibilities which affect the labour market, or providing information to households and firms, are neglected because of their lack of exitement.

7.13 Conclusion

The range of potential spatial policy instruments which can be applied from either the national or local level is wide. In terms of absolute social welfare however, some conflict may exist between the objectives of one local authority and another or between the objectives of central government spatial policy objectives and local governement policy objectives. Furthermore it is not always apparent what social or economic objective spatial policy is intending to satisfy and therefore the evaluation of its success is made more difficult. It has for example been argued (Section 7.3.1) that spatial policy does not guarantee that a spatial redistribution of resources from prosperous to poor areas has any real effect on the personal distribution of income, wealth or utility. Nor is it clear that spatial policy necessarily contributes to economic growth. During times of high pressure of demand for example it may seem desirable to encourage movement to areas where there are relatively few bottlenecks. We need to know not only what effect regional policy has had on the designated 'problem' regions[1] and the effect there has been on the prosperous regions[2] but also

1 Moore and Rhodes (1976) estimated that 165,000 manufacturing jobs were created in the depressed regions as a result of regional policy.

2 Tyler (1980) estimated that at least 46,000 jobs were diverted from the West Midlands by regional policy between 1960 and 1973, although he found:

> "the loss of manufacturing jobs.... has been largely replaced by other manufacturing jobs in other West Midlands firms"
> Tyler op cit p 161

the longer term consequences of locating firms in areas which are sub-optional in many respects[1], and the full opportunity costs of the regional policy programme. When the pressure of demand is low regional policy as a means of achieving economic growtn becomes much more questionable, as Chisholm (1976) as argued. This is also true of local authority promotional ventures, unless aimed at foreign companies or customers or where the objective is to provide information to enable optimum locational decisions to be made. Otherwise one area's gain is at the expense of another (a zero-sum game). Interestingly the opposite view is put by Haveman and Krutilla (1968) and Haveman (1976) who suggest:

> "... in an economy with unemployed resources, immobilities, or increasing returns to scale, these secondary effects may generate real national efficiency impacts."
>
> Haveman (1976) p455

Although Haveman's arguments may be rationally sound it is not clear that spatial policy would be an appropriate policy instrument at times of high unemployment. The benfits to which he refers would apply to any expansionary policies and may be lower in the case of locational incentives than the benefits which might accrue from general investment subsidies, which do not restrict the location to specified areas.

1 Stoney (1983) for example found that three large car assembly plants, attracted to Merseyside by regional incentives, continued their sourcing almost entirely as before their move. This must have increased their costs of communication and transport, and reduced their competitveness.

The conflict which exists between national and local policy initiatives and between one area's initiatives and another is one of aggregation. The sum of local utility (which are themselves the sum of individuals utiltity within and area) is greater than total social welfare:

$$\sum U_L > \sum U_T \qquad (3)$$

It has already been suggested that local authority action to pursue social welfare within their area, can contribute to increasing total social welfare. There are however, a number of policy actions which conflict with the overriding objective of increasing total welfare. Those policies may result in one or more of a number of possible outcomes:

- inefficiently produced output because firms are attracted to sub-optional locations, (although they may be optimal to the firm in the short-run);

- lower levels of welfare of households attracted to new environments, which subsequently prove less attractive than the 'home' locality, (although there may be gains in utility in the short run);

- an unnecessarily large amount of resources devoted to advertising and promotion;

- the growth of local monopolists, for some goods and services, where for example local authorities purchase only from local suppliers (this may result in monopolistic exploitation and/or increased costs of production in industries where economies of scale are left unexploited); and

- polarisation, as younger, healthier, more skilled, more enthusiastic individuals are attracted to some areas, leaving behind the less-abled, older, unskilled, less dynamic individuals in declining areas. This problem will arise in any case if some areas are expanding rapidly relative to others, but may be exacerbated by the image selling of local authorities, or by national regional policies.

The reconciliation of local and national needs must rest with central government. Some local action may need to be controlled in order to avoid the pursuit of zero-sum (or negative-sum) games. Similarly, local action may need to be encouraged, where local authorities can make positve-sum social gains more efficiently than central government. A number of ways in which local government can influence the level of social welfare of individuals, through the provision of services such as nursery places, education and training, housing and transport, have been examined here (section 7.11).

If we assume that the pursuit of economic welfare is a primary objective which can be achieved partly through spatial policies (as well as through micro and macro economic policies) then we need to develop techniques which can be used to evaluate the impacts of those policies. We will need a comprehensive analytical framework which will encompass the costs and benefits which accrue to all areas. Only a comprehensive framework will reveal the anomolies that may arise from the pursuit of spatial objectives in isolation of other economic objectives. Those anomolies may be the result of constraints at the local economy level (geographical, legislative, economic, informational, or political); of the conflict between the objectives of one area and another; of the pursuit of a single proxy objective (such as the reduction of measured unemployment); or of the failure to recognise the full opportunity costs of policies. It is to the pursuit of an evaluation framework that we now turn our attention.

PART IV

MODELLING MICROECONOMIC IMPACT

PART IV

MODELLING MICRO-ECONOMIC IMPACT

Introduction

In order to evaluate the expected impact of policy initiatives or exogenous shocks it is necessary to have a number of economic models which can simulate the policy effects. Some aggregate models of the economy, such as the Treasury's own model, have been developed to a high degree of sophistication. At the disaggregate level modelling is much less advanced. The growth of interest in policy initatives at the spatially disaggregate level and the necessity for the sectoral and spatial impacts of macro-economic policy to be predicted would suggest the development of such models to be a valuable area of research and development.

The next two chapters explore these areas of micro-economic and spatial impact modelling. In the first of these chapters the concept, theory, development and practical applications of regional and local income and employment multipliers is developed, together with the deflationary applicability of the concept. The cost-benefit and social accounting approaches are then considered. Chapter 8 goes on to examine the regional input-output model and the intersectoral flows analysis which provide more dissagregate models of local economies. Finally in Chapter 9 an 'employment-dependency model' is developed. This model encaptulates the benefits of the multi-regional input-output model and the intersectoral flows model, providing maximum information from minimum resource costs and overcoming many of the problems of both the questionnaire and the non-survey approaches to modelling the regional or local economy previously developed. It is not and cannot be a perfect model, but it provides an improvement on current intersectoral models, by both reducing resource input costs and improving the quality of the information.

Chapter 8

ECONOMIC IMPACT ANALYSIS

CONTENTS

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ECONOMIC IMPACT ANALYSIS

8.1 Introduction

A number of studies have been carried out to examine the economic impact, on regional and local economies, of public and private investment programmes. During the late 1960's many British studies were undertaken to investigate the impact of regional investment programmes, initiated mainly as a result of regional policy. A decade or so later we are more interested in the impacts of plant closures (e.g. steel works), the decline of investment in manufacturing industry and of cuts in public current and capital expenditure.

This chapter reports on the development of analytical techniques to assess the economic impact of exogenous shocks on regional and area economies. The chapter continues thus: firstly a survey of regional (area) multiplier analysis is undertaken, this is followed by a consideration of the multiplier process in a deflationary context. The differences, in the short-run, between the expansionary and contractionary multiplier process are highlighted. Estimation of the size of the regional expansionary and deflationary multiplier is then undertaken. A case-study of the Bilston Steel Works closure is used to exemplify some of the practical as well as theoretical difficulties involved in economic impact analysis. As well as multiplier anyalysis, the case-study introduces the use of the social cost-benefit and the social accounting frameworks for evaluation purposes. The single area and multi-area input-output analyses are then considered. A survey of some of the vast literature in this area is carried out. The advantages and limitations of the single-area model are the focus of this survey. Some alternative models: the intersectoral flows model and econometeric models are presented and discussed. Finally there is a conclusion.

8.2 Multiplier Analysis

A comprehensive survey of economic impact analysis using multiplier analysis is undertaken here. A main focus of the examination of this literature is to consider the applicability of the concept for exogenous falls in income. There are some differences between the contractionary and expansionary multiplier effects, particularly in the short-run. These differences exist because of redundancy payments, savings, social benefits (and differences between short-term and long-term rates), special income support schemes, income-tax rebates, early retirement schemes and so on. These payments serve to protect income and expenditure in the short-run. Policy responses by local and central government might also mitigate against or exacerbate any effect on the area. Without taking these short-run factors into consideration, the regional (area) multiplier turns out to be small. The short-run factors would tend to reduce it further in the case of contraction. This suggests that the major impact would be the initial exogenous shock (e.g. plant closure). However, the basic multiplier model does not incorporate the induced effect on other investment decisions nor the impact of any local or central government policy response. The overall impact, may therefore, be much more complicated than the simple regional (area) multiplier model would suggest.

There are several implications which follow from these findings. Firstly if the multiplier effect is small then far more attention needs to be given to correctly identifying the size of the multiplicand. Secondly if income and expenditure are isolated to some extent from the realities of the economic enviroment as would appear, then the implications are that unemployment is very expensive for government (or more correctly, society). It is perhaps therefore important that we consider the impact within a wider framework such as a cost-benefit or social accounting framework. By examining the effect within this wider context we can see more clearly the implications of plant closures on the economy. Much of the material for this consideration of multiplier analysis has been generated from a study of the anticipated impact of the closure of Bilston Steel Works[1] and many of the problems encountered in case-study work are highlighted. We turn first to the simple multiplier concepts.

8.3 Multiplier Concepts

8.3.1 The Keynesian Income Multipier

The basic concept of the multiplier is simple. If money is injected into an economic system, the income of that system, increases by some multiple of the money injection.

The multiplier model assumes that there are some unemployed resources within the economic system, otherwise the increase in induced income would accrue to owners of factors outside the system, or would result in increased prices. The size of the multiplier depends upon the extent to which income leaks from the system. Not all income received will be spent on goods and services provided in the system. For instance the income will be subject to income tax and national insurance contributions, part of expenditure will be an indirect taxation payment, some goods and services will be provided from outside the system and some income will be saved. The greater the proportion of income these leakages form, the smaller will be the multiplier. Each round of expenditure creates income, but the income created at each round becomes successively smaller.

In order to calculate the size of the income multiplier for an economic system it is necessary to develop a model of the system and estimate the proportion of income which leaks in the various forms.

8.3.2 The Employment Multiplier

The multiplier concept can also be applied to employment creation. The size of the employment multiplier will indicate the relationship between the eventual total change in employment and the original change in employment.

8.4 Survey of the Literature on Regional Multipliers

There was a revival of interest in regional multipliers in the UK between 1976 and 1972, which seems to have been stimulated by the interest in the impact of regional policy on the development areas.

The studies have been concerned with both methodological issues [1] and with establishing specific values for regional multipliers[2].

More recent studies have been concerned with particular issues, such as the identification of the multiplicand[3], specification of the type of multiplier[4], and the first round effect. Lever[5] has considered the multiplier from the establishment level and has also considered changes in local income multiplier[6] over time. The sectoral approach to multiplier analysis has so far been restricted mainly to tourist industry multipliers[7], but has many advantages.

1 See for example Archibald (1967), Brown (1967) and Wilson (1968)

2 See for example Steel (1969) and (1972, Greig (1971), Allen (1969)

3 See for example Brownrigg (1973)

4 See Sinclair and Sutcliffe (1978)

5 Lever (1974a)

6 Lever (1974b)

7 See Archer (1973)

8.4.1 The Simple Model

The simple income multiplier model ignores the effect of induced investment. A change in regional income is equal to an injection into the region, multiplied by the regional multiplier.

$$Yr = Kr\ J \qquad (1)$$

Where Yr is regional income, Kr is the regional income multiplier and J the original injection.

The basic model assumes that investment, government expenditure and exports are exogenously determined and therefore constant. Spare capacity within the system is assumed to exist and initially the problem of lags is ignored. Deriving the multiplier model from first principles facilitates a thorough understanding of the multiplier process. Most writers have either not done this or have not reproduced the derivation in their published work nor made it clear what type of multiplier is being calculated. This makes it difficult to assess the accuracy of some calculations and becomes critical where authors borrow parameters from other work.

Suppose

$$Y = C + I + G + X - M - Ti \qquad (2)$$

Where

Y = GDP at factor prices

C = Consumption

G = Public expenditure

X = Exports

M = Imports

Ti = Indirect taxes (and subsidies)

The following identities hold

$$C = \overline{C} + c\ (Yd) \quad (3)$$

$$Yd = Y - Td + U \quad (4)$$

$$Td = td\ (Y) \quad (5)$$

$$U = -u\ (Y) \text{ or } U = \overline{U} - u\ (Y) \quad (6)$$

$$I = \overline{I} \quad (7)$$

$$G = \overline{G} \quad (8)$$

$$X = \overline{X} \quad (9)$$

$$M = \overline{M} + m\ (C) \quad (10)$$

$$Ti = ti\ (C - M) \quad (11)$$

Capitalletters represent the variables and small letters the parameters.

$\overline{C}$, $\overline{I}$, $\overline{G}$, $\overline{X}$, $\overline{M}$ are constant terms

Yd = disposable income

Td = direct taxation and national insurance contributions.

U = Transfer payments e.g. unemployment benefit

C – M = Locally produced goods and services for consumption

By substitution

$$C = \overline{C} + c\ (Yd) \qquad (3)$$

From (4) (5) (6) $C = \overline{C} + cY\ (1-td-u)$ (12)

$$M = M + m\ (C) \qquad (10)$$

From (12) $M = \overline{M} + m\overline{C} + mc\ Y\ (1-td-u)$ (13)

$$Ti = ti\ (C - M) \qquad (11)$$

From (12) (13) $Ti = ti\overline{C} + ticY\ (1-td-u) - ti\overline{M} - tim\overline{C} - timcY\ (1-td-u)$

$$Ti = tiC + ticY\ (1-td-u)\ (1-m) - ti\overline{M} - tim\ \overline{C} \qquad (14)$$

substituting in equation (2)

From (12) (7) (8) (9) (13) (14) gives

$$Y = \overline{C} + cY\ (1-td-u) + \overline{I} + \overline{G} + \overline{X} - \overline{M} - m\overline{C} - mcY\ (1-td-u) - ti\overline{C} - ticY\ (1-td-u)\ (1-m) + ti\ \overline{M} + tim\ \overline{C}$$

Collecting all Y's together

$$Y - cY\ (1-td-u) + mcY\ (1-td-u) + ticY\ (1-td-u)\ (1-m) = \overline{C}\ (1-m-ti+tim) + \overline{I} + \overline{G} + \overline{X} - \overline{M}\ (1-ti)$$

or

$$Y\ (1-c)\ (1-td-u) + mc\ (1-td-u) + tic\ (1-td-u)\ (1-m) = \overline{C}\ (1-m)\ (1-ti) + \overline{I} + \overline{G} + \overline{X} - \overline{M}\ (1-ti)$$

therefore

$$Y = \frac{\overline{C}\ (1-m)\ (1-ti) + \overline{I} + \overline{G} + \overline{X} - \overline{M}\ (1-ti)}{1-c\ (1-td-u)\ (1-m)\ (1-ti)} \qquad (15)$$

The multiplier will be the change in total income divided by a change in one of the exongenous variables G, I or X.

$$\text{Therefore } Kr = \frac{\Delta Y}{\Delta G} = \frac{\Delta Y}{\Delta I} = \frac{\Delta Y}{\Delta X}$$

Differentiating (14) gives

$$Kr = \frac{1}{1-c\ (1-td-u)\ (1-m)\ (1-ti)} \qquad (16)$$

This is therefore the multiplier for GDP at factor prices applicable to an exogenous change in public expenditure, investment or exports.

There is some variation in the specification of the models and in the choice of symbols. Sinclair and Sutcliffe (1978) point out that the type of multiplier which is being measured is not always made clear. It is possible to have regional income multipliers for GDP, GNP or disposable income and unless the complete derivation of the model is given it is not possible to identify the type.

Archibald (1967) uses a simplified model for the regional income multiplier

$$Kr = \frac{1}{1 - (c - m) \quad (1 - t)} \tag{17}$$

Where he allows B to equal (c–m) the 'propensity to add value locally' and t is the 'marginal rate of tax', presumably income tax, c and m are marginal propensities to consume and import respectively, from disposable income. He makes an initial guess that the regional multiplier would lie within the range 1.2 to 1.7 and then attempts to improve on the guess by estimating the propensity to add value locally. From this exercise he concludes that the minimum value of a regional multipler would probably be not less than 1.25 for a standard region.

He ignores indirect taxation, (if t is direct taxation) and the effect of transfer payments, such as unemployment benefits.

Brown (1967) calculated that for a very small area the multiplier would be 1.24 and that for the development areas as a whole the multiplier would be 1.28. The equation for his multiplier is given as:

$$Kr = \frac{1}{1-c\ (1-td-u)\ (1-m-ti)} \tag{18}$$

this is slightly different from equation (16) above, although the parameters have the same meaning. The problem with using this equation is the danger of double counting the indirect taxation paid on imported goods. In (18) either m would need to be the propensity to import net of indirect tax or ti would need to be the propensity to pay indirect tax on only regional goods but expressed as a proportion of total consumption. Brown borrows values for the parameters m and ti and it therefore seems possible that the adjustment has not been made. Correcting for this (if it has not been done) would change the values of his multipliers slightly; the development areas would have a multiplier of 1.33, a standard region 1.30 and the national multiplier would be 1.50 instead of 1.46.

Allen (1969) uses the relationship

$$Kr = \frac{1}{s + t + p} \tag{19}$$

where s represents savings, t represents taxation (both direct and indirect) and p represents purchases of goods produced outside the region. He estimated that the Scottish Multiplier would be between 1.4 and 1.5.

The first attempt to calculate values for all the British regions is made by Steele (1969) using 1964 data. His model differs from other models slightly.

$$Kr = \frac{1}{1 - (1 - \alpha s)\ (1 - t)\ (1 - m)} \tag{20}$$

S is an amalgamated savings figure which includes the effect of direct taxes, savings and transfer payments. That is s is the difference between personal income and expenditure, α is a coefficient to convert average propensities into marginal propensites; t represents indirect taxation and m represents imports.

For England and Wales the values of regional multiplers calculated by Steele lie between 1.19 and 1.41. For Scotland, Steele calculated two multipliers based on slightly differenct methods of imputing the import leakage coefficient. Both values are relatively high; 1.89 and 1.70; the high values arise because of very low imputed leakages for Scotland.

Most of the empirical studies estimate values for the regional multiplier which are positive, and lie for the most part within a relatively narrow range corresponding to Archibald's original guess of between 1.2 and 1.7. Sadler, Archer and Owen (1973) suggest however, that it is possible that a regional or sub-regional multiplier could be negative. This could arise only if marginal leakages from income were greater than the increase in income. Sadler et al suggest that this could happen due to expenditure switching as income rises. If locally produced goods have the characteristics of 'inferior goods' then the parameter m could be greater than one. Regional income would therefore decrease as a result of a project due to changes in the pattern of consumption as income rises. In a developed economy this would be unlikely, although it is worth remembering that the possible range of the multiplier is greater than the narrow range the concensus suggests. Certainly it is conceivable that the multipler is less than one.

A study by Greig (1971 a) on the impact on a sub-region of the Pulp and Paper Mill at Corpach introduced another new aspect; the importance of immigration. If the increases in sub-regional or regional earnings is paid to immigrants to the area then the income generated through their expenditure will have a different impact than if the income went to residents. There will for instance be no loss of social benefits to consider and the contribution they make to regional expenditure will depend upon their average propensities to consume, pay tax, import etc., rather than marginal propensities as would be appropriate for residents. In addition an influx of new residents will add to the demand for publicly provided services such as education and health care. The basic multiplier models assume public expenditure to be exogenously determined and therefore constant. Greig's estimate for sub-regional multiplier, with immigration an important aspect, was a range between 1.44 and 1.54.

Wilson (1968) points out the relative insignificance of the regional multiplier effect compared to the multiplicand itself. If the regional multiplier has a value less than two (and none of the studies surveyed here suggested a value greater than two) the major component of regional income increase is the initial income increase. The total of all the income generated in subsequent rounds is less than the initial increase. Wilson therefore suggests we pay greater attention to estimating the value-added component of the initial injection, that is the multiplicand. Some confusion has arisen over the definition of the multiplicand. Lever (1974a) uses a multiplier model which incorporates leakages from the original injection into the multiplier calculation. Lever's multiplier estimates are therefore less than one but apply to the total project cost rather than the value-added component. Archer (1976) attempts to clarify the position. Clearly the choice of model will depend to a certain extent on the data available but there is some danger in using estimates from an exercise such as the one Lever suggests for other projects where leakages from the original injection are different. Borrowing estimates from other studies is always dangerous but becomes more so where there are differences of concepts and models.

Greig (1971b) identifies three types of multiplicand. The initial injection he names 'the primary multiplicand', the ongoing multiplicand as a result of increased permanent employment in the sub-region he names 'the secondary multiplicand' and the induced investment he names 'the tertiary multiplicand'. A similar family of multiplicands is used by Brownrigg (1973) for his study of the economic impact of the University of Stirling; viz: Initial construction expenditure (J_1) staff salaries and wages (J_2) students income (J_3) and induced investment expenditure (J_4). Brownrigg's model then becomes

$$Yr = KrJ_1(1-m^1) + KrJ_2 + KrJ_3 + KrJ_4 \quad (1-m4) \qquad (21)$$

Where

m_1 = import content of the initial construction expenditure

m_4 = import content of the induced investment expenditure

Kr = the regional multiplier

Brownrigg uses the same value for the multiplier applied to each type of multiplicand. It seems unlikely that the four multiplicands would generate the same induced effects. Consider J_2 and J_3 which represent staff income and student income respectively. It would be unlikely that the marginal propensities to consume, save, import and pay tax would be equal for these two groups (or that there would be compensating differences). A family of multiplicands should surely be accompanied by a family or regional multipliers. Brownrigg does not calculate his own multiplier values but uses a range based on other studies. For the lower case he uses Brown's small region estimate of 1.24 and for the upper case he uses Greig's (1971a) upper estimate of 1.54, which is high because of the importance of immigration in Greig's study.

Steele (1969) excludes undistributed profits from the multiplicand, in order to develop a personal income multiplier model. Sinclair and Sutcliffe (1978) indicate that it is necessary to reduce the multiplicand by <u>all</u> first round leakages, including taxes, direct taxes and national insurance contributions, loss of benefits, and all payments to non-residents, because none of these leakages become personal income to residents.

The empirical studies have revealed a remarkable conformity regarding the range of the multiplier, mostly they fall within the range of 1.2 to 1.5. The parameters needed for the estimation of the multiplier are not readily available and it is worth surveying both the methods used for estimating them and the proxy variables used to replace them.

Transfer payments, savings and taxation proved to be the least troublesome. The values are relatively small, some data are available and regional differences tend to be minimal. The import coefficient was the most difficult to estimate. Some fairly sophisticated methods were used to calculate this coefficient but no matter how sophisticated the method a large element of guesswork, albeit well informed guesswork, crept in.

Archibald attempts to calculate a minimum value for a regional multipler where

$$Kr = \frac{1}{1 - (c - m)\ (1 - t)} \tag{22}$$

He assumes c = 0.9, and then proceeds to calculate minimum values of local value added components for selected industries. He assumes all regions import "all their requirements of food and primary fuel, and of manufactured and processed goods". He goes to great lengths to estimate the local value added component of the selected industries, but ignores indirect taxation and transfer payments. It is important to attempt a balance in the use of valuable research resources, a more sophisticated model would have provided a more rigourous base and the accuracy of the import leakage would then become less important.

Brown uses borrowed coefficients. The problem with this is the danger of double-counting indirect taxation on imported goods by including it in the indirect taxation coefficient and the import coefficient, as stated earlier. The idea of borrowing coefficients from other work seems sensible in order to economise on valuable research resources and especially so where an approximaiton only is required, but care must be taken to ensure that the borrowed coefficients have the intended definitions.

Allen uses three methods to calculate the multiplier for Scotland. His first method using average rather than marginal propensities is a quick method based basically on the principles of location quotients. His second method is a little more sophisticated but again uses average propensities. This method is based on the principle of a self-sufficiency table relating output, population and consumption for commodities. His third method attempted to correct average propensities into marginal propenities. He apologises for a somewhat cavalier use of statistics but his methodology seems to balance well the trade-off between accuracy and valuable research resources.

Steele's studies are very useful because he is the first one to look at all the regions of Great Britain. By stating the income multiplier in a slightly different form Steele is able to make an estimate of the sum of direct taxes, savings and transfer payments by subtracting personal expenditure from personal income. He adjusts this figure by a coefficient which converts the leakage from an average to a marginal propensity.

$$\text{Therefore } Kr = \frac{1}{(1 - \alpha s)\ (1 - t)\ (1 - m)} \qquad (23)$$

Where s is the sum of direct taxation, savings and transfer payments, t is the indirect taxation coefficient, and m is the import leakage coefficient excluding indirect taxation.

Steele's first study appeared in 1969. s is derived form the Family Expenditure Survey by subracting expenditure from income. α was calculated as 29% from the 'Blue Book' by subtracting the average proportion of direct taxation out of income for the income group containing the average income from the proportion for the next income group.

Conducting a similar exercise for savings ratios from the Family Expenditure Survey gave a 28% figure. And as a further check the difference between the average savings ratio of all households for 1961/63 and the (average)[1] savings ratio over the period 1964/66 is a 25% proportionate difference.

For m Steel calculated the ratio of total imports to final demand applied to the propensity to consume after all taxes and savings have been deducted. He divided imports into four categories

inter-regional imports of goods
inter-regional imports of services
international imports of goods
international imports of services

1 Steele says marginal here - but presumably he means average

Inter-regional imports of goods were traced through the two mains modes of transport - road and rail. The Ministry of Transport Road Goods Survey and the 'Martech' Consultant Study were used to estimate inter-regional imports of goods by road. The Beeching Survey was used for goods transported by rail.

Inter-regional imports of services were computed using regional employment figures together with an average salary figure, allowing a 30% profit margin. He then took the GB employment for a group of MLH which he considered to be non-local services, took away the exported content and distributed the balance between the regions according to per capita income.

International imports of goods were taken from the 'Martech study.' The destination was taken as the place where goods were broken up and therefore regions with ports were allocated all imports which passed through as well as their own.

International imports of services were calculated by the same method as inter-regional imports of services. The gross figure was taken from the Blue Book.

In 1972 Steele returned to the problem of the regional multiplier. This time Steele takes account of more leakages and pursues the problems of feedbacks from other regions and induced investment expenditure.

Greig studied the impact on a sub-region of the new Pulp and Paper Mill at Fort William in Scotland. This study is interesting because he brings to light some of the problems arising from attempting to apply a theoretical concept to a case study. For instance, because a large proportion of the mill's employees were immigrants to the region, Greig used average propensities, rather than marginalpropensities, to measure first round leakages. For the most important leakage, imports, an estimate of the local value added component was made. Greig also identifies an interaction between employment and income multipliers and estimates the impact on sub-regional employment as well as income.

Another example of an application of the regional multiplier theory, is Brownrigg's study of the impact of Stirling University. Brownrigg does not estimate the parameters or the multiplier himself but uses a range based on Greig's study for the upper case and Brown's minimum value for the lower case. Brownrigg carries out a useful exercise on the multiplicand; clarifying the different types of multiplicand and the time lags involved in the impact on the region. Sinclair and Sutcliffe also emphasize the importance of first round leakages from the multiplicand.

8.4.2 Changes in income multiplers

Garnick (1970) and Lever (1974 a and b) examined the change in the local income multiplier which might occur over time.

Garnick (1970) identified three long-run factors and two short-run factors associated with changes in regional income multipliers. The long-run factors were changes in the region's industrial structure leading to substitution of imports by regional production, changes in personal consumption patterns and changes in exogenous supply and demand phenomena. The short-run factors were inelasticities in local supply and cyclical effects on regional industry. McGilvray and Simpson (1969) examined the effect of changes in the factor mix over time which would affect the regional multiplier. Lever (1974)[1] examined the possible causes of changes in local income multipliers at establishment level. The branch plant might have high leakages initially and later switch to home supplies; the local entrepreneur might have few leakages but later switch to imported inputs or the expanding plant might be forced to expand the imports or inputs due to local inability to keep pace with rising demands. Similarly managerial

1 Lever's definition of the multiplier is different to that already used leakages at plant level are considered by Lever in the calculation of the multiplier. In the work already surveyed leakages at plant level would reduce the size of the multiplicand.

influence will apply to sales of output, also affecting the size of the multiplier.

8.5 Feedback from other regions

The simple multiplier model makes no allowance for the increases in regional income which feed back into the regional economy from other regions. Some of the expenditure which leaks to other regions will find its way back into the region of origin through exports to the other regions. A more sophisticated model could allow for this feedback if it were believed to be significant.

8.6 The accelerator effect

The multipler model can also be developed to take account of any induced investment effect in the region by use of the accelerator theory. The assumption would be that investment is related to changes in the level of income. That is;

$$I = i\Delta Y \tag{24}$$

where i is the investment coefficient.

This equation could also be incorporated into the model. The coefficient i would be difficult to estimate for a region Some writers have attempted to include feedback and acceleration effects into their models.

8.7 Sectoral Multipliers

Some studies, such as Archer (1973) have examined the multiplier for a particular sector (in this case the tourist industy). Tourist multipliers have been relatively easy to examine because the routes of supply have been easy to identify[1]. Multipliers for other industrial sectors are more problematic but are interesting to policy makers. It would be useful to have some indicaiton of which sectors will expand in response to increasing demand in another sector (so that appropriate investment decisions in human capital, physical capital and infra-structure can be made). The major scope for development in this area lies in sectoral multipliers from an input-output type approach. This approach is discussed later in the chapter and in the following chapter.

8.8 The Deflationary Multiplier

For the purpose of assessing the impact of a plant closure as old industries decline or of the effect of cuts in regional aid, or of reduced public expenditure programmes, we need to consider the deflationary or contractionary multiplier.

8.8.1 The short-run and the long-run

A distinction between the short-run and long-run effects has to be made. In the short-run there may be special measures taken to alleviate the problems caused by plant closures. These special reasons might reduce the effect on the local community for a time. In the long run, however, the community might have to cope with a reduced level of income and economic activity.

The specification of a deflationary multiplier is identical to that of an expansionary multiplier but the coefficients of

1 See J.U.R.U.E (1977) "The Impact of the National Exhibition Centre"

marginal propensities have a different interpretation. For example c, the marginal propensity to consume out of disposable income, becomes the marginal propensity to reduce consumption as a proportion of the fall in disposable income. Why do these propensities differ?

1. Past savings can be used to meet consumption needs. This will be true particularly when a decline in income, as a result of unemployment, is expected to be temporary. Dis-saving as a proportion of a fall in income might therefore be higher than saving is as a proportion of an income increase.

2.Redundancy payments can be used to meet consumption needs. Very little is known about how redundant workers use their redundancy payments. Clearly it will be affected by age, expectations of future earnings capacity, income of other family members and so on. In all probability the pattern of consumption is likely to change as laid-off workers find themselves in some cases with more money than they have ever had before but with a reduction in their permanent income.

3.Social benefits and tax rebates can be used for consumption needs. Because earnings-related unemployment supplement was payable for six months after the second week of unemployment (the amount was reduced from January 1981 and was phased out altogether in January

1982) and because workers normally receive income tax rebates when income ceases, workers can often maintain consumption patterns in the early months of unemployment. The European Coal and Steel Community (ECSC) offers income supplements and early retirement schemes from age 55 which also protect income.

The simple deflationary multiplier would be based on the assumption that resources released from plant closures or other falls in output remain idle at least in the short-run. If resources released were immediately used in other productive uses then the concept would itself be redundant. There are number of possibilities which need to be considered therefore when assessing the deflationary multiplier:

1. Some redundancy payments might be used to invest in small businesses in the region.

2. The release of resources such as skilled labour or sites might attract alternative investment to the area.

3. BSC Industries might successfully direct investment to one of BSC redundant sites.

4. Special area status could be granted and this might also attract investment.

5. Local authorities might take action which would attract new investment.

6. The closure of a plant might induce emigration from the area and cause further falls in consumption expenditure.

The first five possibilities would contribute to the deflation being lower than estimated by the simple multiplier, whereas the last possibility would increase the deflationary impact. The most appropriate method for allowing for these possibilities is by estimating the probabilities of them occurring based on local knowledge, and incorporating the result into either the multiplier computation or the multiplicand.

8.9 The Multiplicand in the Deflationary Model

As with the expansionary multiplier model care needs to be taken in identifying the multiplicand. The multiplicand will be the most significant fall in income to the system, with the total effect of further rounds being significantly less. There are two possible ways of identifying the multiplicand. The first follows Wilson (1968) and others. Here the multiplicand is the value-added component of the intial injection, or in this case, withdrawal of income. The alternative is that used by Lever (1974a). He uses the gross initial income gain, in this case loss, as the multiplicand and incorporates the leakages into the size of the multiplier, which is therefore significantly lower. The problem with this latter approach is that initial leakages may vary from leakages in later rounds and the multiplier is therefore inappropriate. As Archer (1976) pointed out, the choice of model will depend to some extent on the data available, but care needs to be taken in the specification of the model and in the estimation of the parameters.

Brownrigg (1973) and Greig (1971b) have identified several types of multiplicand. This approach is useful where for example one effect is once and for all, whereas other effects are permanent. Greig suggests three multiplicands. The 'primary multiplicand' the 'secondary multiplicand' and the 'tertiary multiplicand'. In the case of contraction the primary multiplicand would be less appropriate since in contraction there is no equivalent negative cost involved in destruction as opposed to construction cost. The secondary multiplicand would consist of the loss of income to employees, the loss of income to suppliers of goods and services and the loss of income to capital goods industries of replacement capital. The equivalent tertiary multiplicand would refer to any induced loss of investment expenditure by firms which subsequently close plants or reduce operations as a result of lost orders from the intial income loss. Brownrigg subdivides the secondary multiplicand into income to different groups.

8.10 The Deflationary Model

Following the expansionary multiplier model identified earlier we have

$$Kr = \frac{1}{1-c\ (1-td-u)\ (1-m)\ (1-ti)} \qquad (16)$$

This is the multiplier for GDP at factor prices applicable to an exogenous change in public expenditure, investment or exports for changes in consumption.

In the context of contraction the parameters have the following interpretation

c = the marginal propensity to reduce consumption out of losses in disposable income;

td = the marginal propensity to reduce direct taxation out of gross income loss;

u = the marginal propensity to receive transfer payments as a result of gross income loss;

m = the marginal propensity to reduce consumption of imported goods out of consumption as income falls.

ti = the marginal propensity to reduce indirect taxation payments out of consumption of non-inported goods and services.

8.11 Estimating the parameters

Here we can benefit from the experience of research work undertaken for the expansionary multiplier whilst making any appropriate adjustments.

8.12 The Marginal Propensity to Consume

Keynes (1936) in his 'General Theory' suggested that as income rose consumption would increase "but not as much as the increase in their income". This would imply a marginal propensity to consume (MPC) which is positive and less than one. MPC has not been particularly stable, not always fractional and not always positive. The MPC has tended to rise in the downturn and increase in the upturn. The explanation of this lies in the 'permanent income hypothesis' of M Friedman (1957) and in the 'relative income hypothesis' of Duesenberry (1949).

In this case we are interested in what will happen to consumption as income falls. Consumption could be maintained if disposable income falls by i) drawing on savings

and ii) using redundancy payments.

It is conceivable that consumption could actually rise as a result of large redundancy payoffs. This would mean that the marginal propensity to consume (c) would be equal to zero or have a negative value for reductions in income. Ignoring the possibility of changes in other parameters, for the moment, this would imply that the multiplier could conceivably be one, or less. That is that total income could fall by no more than, or less than the initial fall in income, (in the short-run that is , it would be unlikely however in the long run).

We have little empirical work on which to base out estimates for (c). We know very little about how people spend their redundancy payouts for example. The decision will be affected by local employment conditions, age, expectations, and other household income.

Consumption theories can help us with the estimation of c.

8.12.1 The Absolute Income Hypothesis

Keynes (1936) hypothesised that:

1. Consumption is related to real disposable income.
2. The marginal propensity to consume (MPC) is smaller in the short-run than in the long run.

3. As income increases in the long run, consumption will increase less than proportionately with income and so the long-run marginal propensity to consume will be smaller than the average propensity to consume (APC).

4. Consumption wil be affected by changes in wealth holdings.

The first hypothesis suggests that a fall in disposable income would tend to reduce consumption. The second suggests that initially households would try to maintain consumption but eventually consumption would fall more. The third hypothesis is inappropriate and the fourth implies that the redundancy payments could affect consumption.

8.12.2 The Relative Income Hypothesis

In 1942 Kuznets discovered that over a long period (back to 1869) the percentage of disposable income had been constant, although there had been a large growth of income. The long run MPC was therefore constant and equal to APC. Duesenberry's relative income hypothesis

(1949) attempted to explain differences between long-run and short-run consumption patterns.

Consumption is based not on absolute income, but on relative income, Duesenberry suggested. In households whose income rises but whose positions relative to other households remain unchanged, consumption will increase by a similar percentage to the percentage rise in income. If income rises improve the households relative position, consumpton will rise by a lower percentage than the income rise. The reason for this is that household spending is influenced by the expenditure of friends, neighbours and so on. An increase not experienced by other households would push this household into a leading consumption pattern which would be undertaken cautiously without the benefit of the demonstration of other households to follow.

A more relevant aspect of Duesenberry's hypothesis was in terms of his predictions regarding falls in absolute income. If absolute income were to fall he predictd that households would not cut back on consumption as much as the resluting decline in disposable income. This would involve a rise in APC and fall in MPC. The reason for this behavioural pattern is based on the idea that once a particular level and pattern of consumption has been reached, it is difficult for households to reduce that consumption relative to the fall in disposable income.

8.12.3. The Wealth Hypothesies

Tobin (1951) examined the absolute and relative income hypothesis in the light of empirical evidence. In the process he discovered the relevance which wealth holdings had for the patterns of consumption. Whilst Keynes had also recognised the wealth effect, Tobin recognised the link which wealth played between the long and short run studies. The growth of wealth in the United States had caused upward movements of cross-sectional consumption functions over time. So that the average cross-sectional APC was equal to the long-run aggregate APC and MPC; although in the short-run MPC was lower than APC from cross-sectional data.

8.12.4. The Permanent Income Hypothesis

Friedman (1957) hypothesized that consumption was based not on current income but on expected future income or the household's permanent income. Individuals in relatively secure regularly paid work will have stable propensities to consume. Individuals whose income flows are more erratic will have more short-term variations in their expenditure patterns. Over a long period however one or two years, APC would be more stable.

8.12.5. The 1970's

During the 1970's the personal savings ratio rose dramatically. Up to 1972/3 savings appeared to be heavily dependent on the level of personable disposable income, whilst other factors such as credit controls, had only temporary effects. After 1972/73 there was a substantial increase in the personal savings ratio. Several hypotheses have been put forward to explain this increase. Firstly that institutional savings - life insurance premiums, superannuation and mortgage repayments - increased. Whilst there is some evidence for this, discretionary savings formed the major part of the increase; Secondly precautionary savings increased due to the increased threat of unemployment and the increase in the rate of inflation. Thirdly savings increased to resore the real value of assets whose value in real terms fall with rises in the rate of inflation.

The trigger of the increase in the savings ratio appears to have been the oil price rises and the following recession 1973-77, when the fall in real disposable income was associated with a fall in the average propensity to consume (APC). The rate of inflation accelerated during this period and unemployment rose. This would suggest that whilst income is a contributory factor, since 1972 it does not fully explain the pattern of consumption and saving. For the purpose of the deflationary multiplier calculations we are interested in the marginal propensity to consume (MPC) during periods of declines in real income. Between 1972 and

1973 the APC fell whereas from 1974-77 the APC rose, although real disposable income fell throughout the whole period. Deaton (1977) argues that this is the result of inflaton and 'money illusion'. Households are more aware of changes in nominal income than prices. Consumers will mistake absolute price changes for relative price changes, postponing purchases of goods and increasing savings. Eventually mistakes will be recognised and adjustments made. Many consumers making such mistakes will result in an increase in savings permanently.

It seems therefore that we can no longer postulate that consumption and savings are a function almost entirely of income. However real disposable income is a significant variable. Davidson et al (1978) have estimated a long-run MPC out of personal disposable income of 0.74 using an equation with a price change variable. (This estimate is based on a growth rate of 2% and a rate of inflation of 15%).

There are other implications of the high rate of savings in the 1970's. Some of the newly unemployed will have savings in excess of £2000 [1] which will exclude them from entitlement to supplementary benefit (as would high redundancy payments). Also there will be an increased likelihood that those suffering unemployment or income reductions will be able to maintain their levels of consumption.

1 Now £2500 (1982/3)

8.13 Direct Taxation Coefficient

The basic rate of income tax for 1980/81 and 1981/82 was 30% and higher rates came into effect after £11,251 of chargeable income. Where jobs are lost the appropriate fall in tax payments would be the average rate previously payable on income. For a married man the allowance was £2,145, a single person's allowance was equivalent to a wife's earned income allowance of £1,375. Other allowances against income tax would be available for superannuation[1] payments. We can calculate average tax deductions for various categories of individuals:

1 40-45 per cent of employees are contracted out of the State scheme.

Table 8.1 Direct tax reductions as a proportion of earnings reductions

		£	
A	Married man no superannuation earnings £5000 p.a. (wife not working)	5000	Gross pay
		2145	allowance
		2855	taxable pay
		856.5	tax payable
		17.13%	tax as a proportion of gross pay.
B	Single person no superannuation earnings £5000 p.a.	5000	Gross pay
		1375	allowance
		3625	taxable pay
		1087.5	tax payable
		21.75%	tax as a proportion of gross pay
C	Married man paying 6% superannuation earnings £8000 p.a. (wife not working)	8000	gross pay
		2145	allowance
		5855	taxable pay
		1756.5	tax payable
		21.96%	tax as a proportion of gross pay
D	Single person 6% superannuation earinings £8000 p.a.	8000	gross pay
		1375	allowance
		6625	taxable pay
		1987.5	tax payable
		24.8%	tax as a proportion of gross pay
E	Married man no superannuation earnings £5000 p.a. Wife's earnings £3750 no superannuation.	8750	Total earnings husband & wife
		3520	allowances
		5230	taxable pay
		1569	tax payable
		17.93%	average tax rate

i)	If husband loses job	3750	earnings
		1375	allowances[1]
		2145	
		230	taxable pay
		69	tax
		1.84%	average tax rate
	Reduction in earnings =	5000	
	reduction in taxation =	1500	
	Tax reduction as a proportion of earnings reduction =	30%	
ii)	If wife loses job	5000	earnings
		2145	allowances
		2855	taxable pay
		856.5	tax
		17.13%	average tax rate
	Reduction in earnings =	3750	
	reduction in taxation =	712.5	
	Tax reduction as a proportion of earnings reduction =	19%	
F	Married Man paying 6% Superannuation earnings £8000 p.a Wife's earnings £7500 p.a 6% superannuation	15500	earnings
		3520	allowances
		11980	taxable pay
		366.6	tax 40% x 729 = 291.6
			30% x 11251 = 3375.3
		23.66%	average tax rate

1 If a wife is working and a husband is not the wife is entitled to claim both the married man's allowance and the wife's earned income allowance.

If we have information about the individuals losing jobs and their circumstances we can more accurately choose the appropriate rate of tax reduction. For example in the case of a Steel Works closure, most job losses will be of older males. We may not know how many are married or how many wives work. Local economic activity rates of women will give us some indications of the proportion of wives likely to be working. The age distribution if known will also give us some idea of the number who are likely to be married.

The reduction in personal tax payments in the above examples range between 17.13% to 30.91% depending on income and whether or not wives work. (In February 1981 The Economic Progress Report indicated that the average rate of tax for all those on PAYE in 1978 was about 18% but close to 16% for those experiencing long spells of unemployment. The failure to increase the tax bands in 1981 will have contributed to an increase). However an average rate of income tax reduction was assumed to be 23 per cent.

In addition National Insurance payments will be reduced. For those not contracted out Class 1 employee contributions are 7.75 per cent (8.75 per cent from April 1982). For those contracted out the rate is 6.00 per cent (of earnings less superannuation payments) (7.00 per cent from April 1982). The limits of earnings are £27 to £200 per week (£29.50 to £220 from April 1982).

The appropriate rates of national insurance reductions and tax rate reductions in the above categories are as follows:-

		N.I.	Tax	Total
A		7.75	17.13	24.88
B		7.75	21.75	29.50
C		5.64	21.96	27.60
D		5.64	24.84	30.48
E	i	7.75	30.00	37.75
	ii	7.75(2.75)*	19.00	26.75(21.75)*
F	i	5.64	30.91	36.55
	ii	5.64(2.585)*	21.51	27.15(24.095)*

Table 8.2 Marginal Tax Redeductions For Job Losses

* Married women opted out of full N.I. contributions

For individuals who suffer only short-term unemployment or whose income is reduced due to say short-time working, a fall in bonus payments or loss of commission, the appropriate rate of direct taxation reduction would be the marginal tax rate plus the marginal national insurance rate. In the categories above this would be:

		Marginal tax rate	Marginal N.I rate	Total
A		30.00	7.75	37.75
B		30.00	7.75	37.75
C		30.00	6.00	36.00
D		30.00	6.00	36.00
E	i	30.00	7.75	37.75
	ii	30.00	7.75(2.75)	37.75
F	i	40.00*	6.00	46.00
	ii	40.00*	6.00(2.75)	46.00

* For income losses up to £729 p.a. thereafter 30.00

Table 8.3 - Marginal direct tax reduction for reduced earnings.

These marginal tax reduction rates are somewhat higher then for job losses. Since the first round of job losses are the most significant in the deflationary as in the expansionary multiplier process those marginal tax rate reductions will be most appropriate but for the purpose of calculating the multiplier will be slightly pulled upwards by the marginal tax rates of income losers. Given the distribution of marginal tax reduction in Table 8.2 and 8.3 and the domination of the rates in Table 8.2 a parameter of td of 0.3 seems reasonable. This is also consistent with the Treasury estimate[1] of 23 per cent marginal tax reduction plus 7 per cent average marginal national insurance reduction.

1 Costing unemployment, Economic Progress Report, February 1981.

8.14 <u>Transfer Benefits Coefficient</u>

Social security benefits are normally uprated each November and with effect from November 1981 the following benefits were payable.

Unemployment benefit	- £36.40 for a married couple
	£22.50 for a single person
	plus £ 0.80 for each dependent child
Social security benefits	- £37.75 for a married couple
	£23.25 for a single person

In addition to the Social Security benefits payments are made for dependent children (although child allowance will be treated as income and deducted from the payments), for heating, for most rent or mortgage interest, for rates, water charges, ground rent and repairs.

Not everyone who loses a job will claim either of the above benefits. Married women (husbands present) who have been paying reduced national insurance payments will not be eligible for unemployment benefit or social security benefits. Some older males may have accepted early retirement and may be in receipt of private pension payments or payments from say the European Coal and Steel Community (ECSC). Alternatively some will have opted for the Job Release Scheme.

Once again we may have information which will enable us to obtain a fairly accurate estimate of the income to be received by the redundant workforce. But for a more general estimate we can consider the benefit entitlements of our previous set of hypothetical persons.

Table 8.4 Benefit entitlement as a proportion of foregone earnings

		Unemployment benefit Only as a percentage of previous gross income	Social Security payments as a proportion of previous gross income (no children)	ditto (2 children aged 11-15)	ditto (1 child under 11)
A		37.86	64.53	78.36	67.29
B		23.40	40.56	47.53	39.88
C		23.66	46.02	54.66	47.74
D		14.625	35.52	39.68	35.10
E	i	23.40	12.93	26.87	24.23**
	ii	31.20* (Nil)	Nil	Nil	Nil
F	i	14.60	Nil	15.67**	15.15**
	ii	15.60* (Nil)	Nil	Nil	Nil

** Indicates entitlement to UB, where no entitlement to SB

* Approximately half of the married women in the labour market are not entitled to unemployment benefit.

Most of our individuals will be better off on supplementary benefit (SB) than on unemployment benefit[1], unless they have working spouses or their savings exceed £2000 and they are therefore excluded from claiming SB. Large redundancy payments would also exclude them. For males and single women the average

1 See footnote following page

rates of income support vary from 23.4% for our married man (wife working) previously earning £8000 per annum to 78.36% for our married man (wife not working) with 2 children aged 11-15 previously earning £5000 per annum. For married women (husbands present) in our table income support is much lower, often nil, the highest rate of support going to those having paid full N.I contributions and therefore entitled to unemployment benefit.

For a more general transfer benefit coefficient we might adopt a weighting reflecting the composition of the workforce. This gives us an approximate transfer benefit parameter of 0.34 (For assumptions and calculations see Appendix I). That is to say approximately 34% of gross income loss is made up by transfer benefits to the unemployed. Of those who do not lose their jobs but whose income is affected, some will be able to claim SB, some rent and rate rebates, family income supplement and some will be able to obtain free school dinners for their children. The effect of this is difficult to calculate, many will not claim and the so-called poverty trap often means at the margin benefits can actually exceed lost income. For the purpose of this calculation a transfer benefit parameter of 0.34 is to be used.

8.15 <u>The Import Leakage Coefficient</u>

As with the regional expansionary multiplier this is a difficult parameter to estimate. We can assume that there will not be a significant difference between the marginal propensity to

1 This means that they will be eligible to Supplementary Allowances to bring UB up to the SB level.

increase expenditure on imports (MPM) as income rises and the marginal propensity to decrease expenditure on imports as income falls. The MPM would be expected to be higher than the average propensity to import because imports from abroad (and probably from other regions) rise as income increases. This parameter is the one most likely to vary between the regions. Steele (1972) for example using two methods found that the import parameter varied between 0.55 in South-East and 0.74 in Yorkshire and Humberside with an average 0.65 for the English regions and Wales (Scotland is excluded because it has a much lower import leakage and is therefore untypical), using one method. The second method incorporating feedback gives variations between 0.44 for the South-East and 0.89 for the West Midlands with an average 0.66 (see Table 21 Steele (1972)). These estimates were based on 1964 and 1967 data so are somewhat old. However the difficulty in estimating this leakage, justifies the practice of borrowing coefficients. Furthermore a sensitivity test shows that an error in a parameter of this size of the magnitude of up to 50% does not affect the size of the multiplier by more than 5%.

8.16 Indirect Taxation Coeffient

The best initial indicator of the approximate size of this parameter would be the current rate of VAT. Currently this is 15% (January 1982). However some expenditure notably food is VAT free and some expenditure carries excise duty which is not a proportionate tax but a lump sum tax per bottle of wine or spirit, per packet of cigaretts, per gallon of petrol, etc. When income falls we would expect households to be unlikely to reduce consumption of food and other zero-rated goods which tend to be "essentials" and also possibly to reduce their consumption of some "luxury" items which might carry high excise duty. An indirect taxation parameter of 0.15 seems reasonable therefore.

8.17 Adjustments For Deflationary Short - Run Effects

In an earlier section it was suggested that in the short-run there might be some temporary phenomena which would affect the size of the multiplier (such as redundancy payments, the level of past savings, early retirement schemes, tax rebates etc). Any adjustments will be based on rough estimates until some research into expenditure patterns of the newly unemployed is undertaken[1].

There are two alternative approaches we might take. Firstly we could deduct from the multiplicand an estimate of the proportion

1 The 1980 Family Expenditure Survey does now include a separate assessment of expenditure of households with employee heads who are not working, although many will be long-term unemployed. Here we are concerned with the newly unemployed.

of lost income which could be made up from the extraordinary payments as well as any proportion of redundancy money which we estimated would be used to buffer the effect of either unemployment or income falls in the short-run. We must be careful not to over allow for these factors because the marginal propensities already allow for some buffer to expenditure. An alternative would be to adjust the parameters to allow for the extraordinary short-term payments.

8.18 The size of the regional multiplier

8.18.1 The expansionary multiplier and the long-run deflationary multiplier

The long-run deflationary multiplier we have postulated to be similar to the expansionary multiplier.

$$\text{If } Kr = \frac{1}{1 - c\ (1\text{-}td\text{-}u)\,(1\text{-}m)\,(1\text{-}ti)} \qquad (16)$$

We have suggested following Davidson et al (1978) that c = 0.74. For td we have suggested a value 0.3 for u a value 0.34 and for ti a value 0.15. From Steel (1972) we have

m = 0.65 (an average regional import parameter excluding Scotland)

or

	N	Y+H	EM	EA	SE	SW	W	WM	NW	Sc
m	0.82	0.54	0.78	0.71	0.44	0.48	0.68	0.89	0.64	0.47

Using the above parameters we have

$$Kr = \frac{1}{1-0.74\ (1-0.34-0.3)(1-0.65)(1-0.15)}$$

$$Kr = \frac{1}{1-(.74)(.36)(.35)(.85)}$$

$$= \frac{1}{1-0.079}$$

$$= 1.086$$

for an average region (excluding Scotland) or for the regions separately:

	N	Y+H	EM	EA	SE	SW	W	WM	NW	Sc
Kr	1.042	1.116	1.052	1.070	1.145	1.133	1.078	1.026	1.089	1.136

These are somewhat smaller than the values from the earlier studies reflecting to some extent the lower level of consumption and the higher levels of VAT and NI contributions. Any emigration from the region or any induced investment would reduce the multiplier value further.

The closeness to unity of the computed values emphasises the importance of the multiplicand and the relative insignificance of the multiplier effect. Furthermore the short-run deflationary multiplier might be smaller due to exceptional factors discussed below.

8.18.2 The Short-run deflationary multiplier.

In the short-run there are some effects which need to be considered.

Firstly direct taxation payments will normally fall more rapidly in the early stages of unemployment because tax rebates will be payable[1].

Secondly the transfer payments parameter might also be larger due to the various schemes available for income support provided by both employers, government or the European Community (1-td-u) will therefore become smaller. That is the income loss will be cushioned.

Consumption and imports could also be affected by redundancy payments, which might enable one-off purchases of consumer durables such as cars, household appliances or holidays to be made. For many losing their jobs however redundancy payments are quite modest. Consumption in the short-run might also be cushioned by the savings of households. The high savings ratios in the 1970's would imply that many households have increased their wealth holdings and might in the 1970's would imply that many households have increased their wealth holdings and might therefore be able to maintain their consumption patterns for some time,

1 Tax rebates from April 82 will only be paid out at the end of the tax year or in adjustments to pay when re-commencing work, and unemployment benefit is to be taxable.

especially if unemployment were expected to be of only short duration. We can postulate that the higher level of unemployement the less likely the individuals will be to anticipate a short duration of unemployment.

Any changes in c, td, and u therefore will reduce the size of the multiplier. A change in imports would be most likely to increase the size of import leakage (m) and increase the multiplier effect.

We can only speculate on the extent of the impact of these changes, which can be influenced by many factors: the age, sex, marital status, income group and wealth holdings of those losing their jobs, the size of redundancy payments, the local labour market conditions and so on. It seems likely that the overall effect would be to reduce the size of the multiplier in the short-run. This would suggest that the short-run deflationary multiplier could be barely more than unity.

8.19 Induced effects

It may be that the induced effect of further plant closures or reduced investment programmes in suppliers to the plant might have more serious consequences to the region. Furthermore the loss of rate revenue to the local authority or the loss of tax revenue to central government, at a time when central government is committed to reducing its own borrowing requirement and curbing local authority expenditure may result not in remedial investment, but in futher falls in expenditure in the region. We need also to consider the wider implications of, say a plant closure, to the economy as a whole. In order to do this we can examine the impact of a plant closure and look at the effect in terms of, not only the regional multiplier effect but also within the context of a cost-benefit or social accounting framework. We can perhaps examine this best by looking at a case study . The closure of Bilston Steel works within the Borough of Wolverhampton in the Region of the West Midlands provides an interesting example.

8.20 The Closure of Bilston Steel Works - A Case Study

The British Steel Corporation (BSC) proposal to close the Bilston Steel Works was placed in a wider social and economic perspective by a study undertaken by J.U.R.U.E. in 1979. That study forms the basis of this section.

8.20.1 A Social Cost-benefit approach

In order to assess the real social costs and benefits of a plant closure we need to identify all the costs and benefits and to determine acceptable values of those costs and benefits. The determination of those values is probably the most contraversial area of social cost-benefit analysis. Social costs and benefits are likely to be subject to varying values, depending on who makes those valuations. A problem arises because those who bear the costs, the losers, and those who reap the benefits, the gainers, are normally two different sets of people. No potential Pareto improvement can be made since there are both losers and gainers, but a social welfare gain may be possible if the Kaldor-Scitovsky compensation principle - that the gainers are able to more than compensate the losers - is satisfied. If we define the sum of money necessary to make an individual no better or worse off after an economic change than before, as the compensating variation (CV), then where the sum of CVs of the gainers exceeds the sum of the CVs of the losers a potential social welfare improvement can be made. Since however the gainers do not need to compensate the losers the cost-benefit approach does not guarantee that there will be a social welfare improvement, merely that one is possible.

If prices reflected marginal costs, then the market mechanism would provide social optimum solutions and there would be no necessity for social cost-benefit analyses. Since prices do not reflect marginal costs, social cost-benefit analyses are necessary. However the absence of prices which reflect marginal costs causes problems for the evaluation of the costs and benefits in the social cost-benefit approach; where there are no prices in the case for example of 'public goods'[1] and where there are 'externalities'[2]. If there is an absence of market prices or if market prices are imperfect, 'shadow prices' can be used. Shadow prices can be based on consumer surpluses (wilingness-to-pay) or on opportunity cost measures.

The main draw-back of the social cost - benefit approach is that it ignores the distributional question. Summing the benefits and costs and comparing them ignores the question of who bears the costs and who reaps the benefits. These problems are especially relevant in the case of a steel works closure. Firstly because the interests of the local and national economies may be different. Secondly because the interests of the British Steel Corporation (BSC) may differ from the interests of society as a whole; BSC is a nationalised industry and the savings to BSC accrue to the taxpayer as do the costs of income support, welfare benefits and redundancy. For these reasons a social accounting framework was used in the J.U.R.U.E. report. This approach is similar to the 'planning balance sheet' PBS approach suggested by Lichfield (1962,1966,1970).

1 A Pure public good is one which once produced may be consumed by an (unlimited) number of individuals, at no cost e.g. A lighthouse, a area of natural beauty

2 An externality is an untraded interdependency. Externalities arise as by products from production or consumption which represents costs or benefits to individuals, groups or firms not involved in the production or consumption process. e.g. water pollution, air pollution, noise pollution

8.20.2 The Social Accounting Approach

The Social Accounting approach involves identifying costs and benefits for different sections of society in order to identify the various interests. The case-study under investigation, the closure of the Bilston Steel Works, revealed some interesting questions. For example if the 'best option' for BSC was to close the plant but the 'best option' for Society (or more precisely, the taxpayers) was to keep the plant open then this option would have implications for BSC's objective to break even. Further it would have implications for other Steel Works, keeping Bilston open would make other plants more vulnerable to closure. In addition it would have implications for the political approach to nationalised industries, which has lately shifted towards profitability. In practice the value placed on this political objective may be weighted so highly (by politicians) that it would outweigh substantial social costs. However the White Papers of 1977 (CMND 7149) and 1978 (CMND 7188) recognised the necessity to consider the wider social and economic costs involved in such proposals.

As with any evaluation of this kind some costs and benefits are more easily identified and measured than others. For the purpose of this study the costs of transfer payments to the unemployed were used to evaluate the social costs of unemployment. Whilst many would recognise that these costs underestimate[1] the real cost of unemployment, any other type

1 See footnote following page

of evaluation would be subject to criticism. Other costs could not be evaluated - the 'strategic' value of the plant to BSC and its locational advantages - for example. Further many of the costs will continue until there is a general increase in economic activity and much depends upon the assumptions made regarding the duration of unemployment. For the purpose of this study a time limit of five years was placed on the transfer costs and the numbers of unemployed resulting from the closure were assumed to decline annually.

If there is no increase in economic activity then those who gain employment, do so at the expense of other unemployed people, with the exception perhaps of the generally skilled[2]. This would suggest that the costs of unemployment might have been underestimated. Once again the main rationale for this cautious estimation was to avoid accusations of exagerating costs.

Identifying the extent of the first round or multiplicand of the income loss to the region also produced difficulties. The multiplicand consisted of; the loss of income to workers at the Steel Works, and to some firms on site, which existed solely to provide a service to the works; and to the regional value-added component of suppliers to the plant, and to the firms on site. The income to workers at the

1 For example those older males, or married females who do not register are assumed to have no costs of unemployment.

2 Generally skilled (e.g. electricians) as opposed to those with skills specific to the steel industry.

plant was easily identified, the income to workers at the firms on site was a little more difficult since we were unable to approach these firms. However we had information regarding their workforce and using average industrial wage rates this estimation would not be too inccuarate. More problematic was the regional value-added component of suppliers. Firstly we had no knowledge of suppliers to the firms on site. Secondly whilst we had a full list of suppliers we could not contact all of them. There were approximately 100 firms in the region suppliying the steel works with goods or services valued over £6.000 per annum and this was used as the basis for a survey. Eliminating suppliers from outside the region, ignores the possibility that some input from the region could have been made to suppliers outside the region. Of those firms contacted within the region (24) the estimated proportion of regional input varied enormously (from virtually nil[1] to 100 per cent) and many of the responses to our survey were 'guesstimates'. The estimation of this part of the multiplicand is therefore subject to a wide margin of error, probably underestimating the real regional income loss.

The effects of closing Bilston Steel Works, of investing in an electric arc furnace and of investing in Q-Bop (a technologically new process to Britain) are summarised in

1 In this case the only regional input was the billing and collection of payment.

Tables 8.5, 8.6 and 8.7. These identified costs and benefits reveal some interesting factors

(i) All three options result in gains to BSC although closure provides the largest gains (so BSC is behaving retionally in choosing to close the plant)

(ii) All options result in some job losses but closure obviously results in the greatest losses.

(iii) The Electric Arc option provides the greatest overall gains to society but the Q-Bop option might be more attractive in that Bilston would be an ideal plant to test the new technology and would provide BSC with more production flexibility and diversification of production techniques. (The Q-Bop option, therefore has benefits to society which the study was unable to evaluate).

(iv) In order to fully compensate the losers some remedial investment would be necessary to transform the derelict steel works site to a productive area once again. The costs of such remedial action were estimated at a minimum of £20 Million (excluding land accqusition and reclamation costs).

(v) These remedial investment costs exceed the costs of proposed capital investments in the steel plant. It may be that the expected benefits from such an investment would exceed the expected benefits from investment in steel. Such remedial investment would carry no guarantee of attracting firms and

Table 8.5 The Main Sectors of the Economy affected by Investment in Q-BOP at Bilston Works

	Net discounted gains or losses ( ) on base over a 5-year term £m
National Economy	
BSC	
(a) Fixed cost change)	
(b) Cash flow change)	23.3
(c) Market share loss)	
(d) Redundancy payments	(4.0)
BSC Sub-Total	19.3
Central Government	(8.05)
Private Steel sector outside West Midlands region	-
ECSC	(0.65)
National Economy Net Gain or Loss	10.6
West Midlands Regional Economy	
Employees of BSC Bilston	(0.8)
Suppliers of Inputs and Services to BSC, Bilston	(1.0)
Regional Customers of BSC Bilston	-
Regional Private Steel Sector	-
General Industry, Commerce, Transport (Multiplier)	(0.3)
Local Authorities (especially Wolverhampton MDC)	-
West Midlands Net Gain or Loss	(2.1)
OVERALL NET GAIN OR LOSS	8.5

Source: JURUE (1979) The Future of Bilston Steel Works - An Appraisal.

Table 8.6 The Main Sectors of the Economy affected by Closure of Bilston Works

	Net discounted gains or losses ( ) on base over a 5-year term
	£m
National Economy	
BSC	
(a) Fixed cost change)	
(b) Cash flow change)	56.0
(c) Market share loss)	
(d) Redundancy payments	(10.1)
BSC Sub-Total	45.9
Central Government	(27.1)
Private steel sector outside West Midlands region	2.6
ECSC	(2.3)
National Economy Net Gain or Loss	19.1
West Midlands Regional Economy	
Employees of BSC Bilston	(5.2)
Suppliers of Inputs and Services to BSC Bilston	(3.6)
Regional Customers of BSC Bilston	negligible
Regional Private Steel Sector	2.6
General Industry, Commerce, Transport (multiplier)	(1.5)
Local Authorities (especially Wolverhampton MDC)	(0.5)
West Midlands Net Gain or Loss	(8.2)
OVERALL NET GAIN OR LOSS	10.9

Source: as table 8.5

Table 8.7 The Main Sectors of the Economy affected by Investment in Electric Arc at Bilston Works

	Net discounted gain or losses ( ) on base over a 5-year term
	£m
National Economy	
BSC	
(a) Fixed cost change)	
(b) Cash flow change)	32.5
(c) Market share loss)	
(d) Redundancy payments	(5.1)
BSC Sub-Total	27.4
Central Government	(8.75)
Private Steel Sector outside West Midlands region	-
ECSC	(0.65)
National Economy Net Gain or Loss	18.0
West Midlands Regional Economy	
Employees of BSC Bilston	(1.0)
Suppliers of Inputs and Services to BSC Bilston	(1.0)
Regional Customers of BSC Bilston	-
Regional Private Steel Sector	-
General Industry, Commerce, Transport (multiplier)	(0.3)
Local Authorities (especially Wolverhampton MDC)	-
West Midlands Net Gain or Loss	(2.3)
OVERALL NET GAIN OR LOSS	15.7

Source: as Table 8.5

the benefits are therefore impossible to predict accurately. In any case we could not be sure that this remedial investment would actually take place.

Whilst accepting the report, the British Steel Corporation, went ahead and closed the Bilston Steel Works. In retrospect the severe recession which followed the report would in any case, have had an impact on the evaluations of both the new investment options and the closure option: The costs of closure being greater and the benefits of either of the new investments being lower. The balance has probably shifted towards the remedial investment option. The important conclusion of the study is that such investigations should take place when decisions regarding plant closures are being contemplated. The whole study was undertaken in a relatively short-time, several months, and the cost of the report insignificant in terms of the information it provided and the costs involved to society.

The most problematic area of impact estimation lay in the area of the multiplicand, and the difficulty in obtaining information regarding regional inputs. We now go on to explore the area of regional input-output techniques and intersectoral flows analysis. These models if developed successfully provide some scope for estimating the regional inputs using an alternative method.

Such models have limitations but can provide useful information for regional (area) impact analysis and have the additional advantage of providing details of sectoral impacts.

8.21 Input - Output models

Input-output economics is a well established but recently neglected area of economics. It is almost fifty years since Leontief's input-output model (Leontief, 1936) was first developed. At the sub-national level much pioneering work was undertaken some fifteen or so years later, first by Isard (1951), then Moses (1955). A great deal of development of the basic model and applications of the technique followed this work initially in the United States but later in other countries too.

Much of the enthusiasm for the technique at the sub-national level has now largely evaporated, with some justification, but it has continued to be used and developed because of the usefulness of the data generated for regional or local policy-makers.

There are high resource costs involved in the development of these models, particularly when survey data is used, or when attempts are made to overcome the static nature of the trading patterns and to continually update the model. Yet the detailed inter-sectoral linkage information generated by the models has continued to provide an incentive to search for a model providing an acceptable level of accuracy within the budget constraint available. At the urban or sub-regional level these budget constraints are likely to be relatively more restrictive. Yet the increasing interest of urban and county policy-makers in the economic development of their areas[1], at a time when "regional planning is in the doldrums"[2] continues to generate interest in an input-output approach[3].

8.22 The basic input - output model

Leontief's input-output model of the United States in 1936 probably marks the beginning of the development of inter-linkage models. (Although it is reported that an earlier Soviet model had been produced.) In Leontief's first model there are a basic set of linear equations, estimated empirically, linking intermediate and final ouputs to total outputs. The linear production functions imply fixed technological relationships

1 See J.U.R.U.E. (1981) "A Review of local economic initiatives" for example

2 P Hall (1983) The Planner Vol 69 No 4 p 112

3 For example M T Pullen et al (1981) "An input-output Study of North Staffordshire"

between sectors related to the levels of outputs of purchasing sectors. All products within sectors are assigned identical production functions. Factor substitution, economies of scale and lags in the production stages are ignored.

Dorfman (1954) describes Leontief's input-output model as a simplification of the Walrasian general equilirium model. However this understates its importance; not only does input-output provide a balance (equilibrium) between inputs and outputs, it has the additional advantage of providing detailed inter-industry linkage data, which are subsumed in aggregate econometric models.

The basic set of equations used in national and single area models are based on those first developed by Leontief[1].

1 For a full explanation see Leontief (1966) or Yan (1969)

Figure 8.1 Input-Output Transactions Table

Sales by	Purchases by Industry 1,2,3...n	Total Intermediate	Final Demand Consumption Government Fixed Capital Stocks Exports	Total Final Output	Total Output
Industry 1 2 3 . . . . n					
Total Intermediate					
Imports Sales by final demand Taxes less subsidies Income from employment Gross profits and trading income					
Total inputs					

Basically we have:

$$X = I + F \tag{25}$$

Where X = Gross Sales

I = Intermediate Sales

F = Final Sales

For each industry i, we have

$$X_i = \sum_{j=1}^{n} I_{ij} + F_i \tag{26}$$

where X_i = Gross sales of industry i

$\sum_{j=1}^{n}$ =Sum of intermediate sales of industry i to industry j

F_i = Final sales of industry i

Intermediate sales can be expressed as a proportion of gross output and can be represented by **A X**

where **A** is a matrix of sales from each industry to all other industries, where output is expressed as a proportion of the receiving industry's gross output

so that a_{ij} = industry i's sales purchased by industry j as a proportion of industry j's gross output

therefore $A = \dfrac{I_{ij}}{X_j}$ (27)

and X is the vector of gross output.

We therefore have

$$AX+F=X \tag{28}$$

and therefore

$$X= (I - A)^{-1}F \tag{29}$$

The ij'th element of the inverse matrix $(I - A)^{-1}$ represents the total direct and indirect outputs required in each industry to produce a unit of final output (of say £1,000) for the corresponding column industry.

The Central Statistical Office produces input-output tables for the United Kingdom. Aggregate output is constrained to the national accounting aggregates in the National income and Expenditure Blue Book for the specific year. The intermediate sales are based on either the full Census of Production, (1954[1], 1963[2], 1968[3] and 1974[4]), or are updates on earlier years computed using the RAS method (1970[5], 1971[6],1972[7] and 1973[8]). The RAS method takes a matrix for an earlier year and a set of desired row and column totals for the current year, and iteratively adjusts the coefficients until the row and column totals are achieved (Bacharach 1970 describes the method in full).

1 Studies in Official Statistics No 8, Input-Output Tables for the United Kingdom 1954, Board of Trade and Central Statistical Office (HMSO 1961)

2 Studies in Official Statistics No 16, Input-Output Tables for the United Kingdom 1963, Central Statistical Office (HMSO 1970)

3 Studies in Official Statistics No 22, Input-Output tables for the United Kingdom 1968, Central Statistical Office (HMSO 1973)

4 Business Monitor PA 1004, Input-Output Tables for the United Kingdom 1974 (HMSO 1980)

5 Business Monitor PA 1004, Input-Output Tables for the United Kingdom 1970 (HMSO 1974)

6 Business Monitor PA 1004, Input-Output Tables for the United Kingdom 1971 (HMSO 1975)

7 Business Monitor PA 1004, Input-Output Tables for the United Kingdom 1972 (HMSO 1976)

8 Economic Trends, June 1978, p 104 to 115

There are limitations to such a method and the longer the period from the matrix based on a full census the lesser the confidence in the imputed coefficients (see Economic Trends, April 1975). The 1973 tables were published with a reduced number of industries and with a number of elements in the matrix 'fixed' in order to make the tables more reliable. The national input-output tables are derived from three basic tables:

i) The make matrix - showing the commodities produced by industries

ii) The absorption matrix - showing the commodities purchased by industries and final demand, and

iii) The imports matrix - showing imported commodities purchased by industries and final demand.

The make matrix is dominated by the leading diagonal. Most industries produce a high proportion of their output in the form of comodities of the industrial sector to which they belong. However, since the industries do not produce 100% of their 'own' commodity it is necessary to ascertain the proportion, and make any necessary adjustments.

The absorption matrix has three main parts: The final demand section; consisting of current expenditure by consumers and public authorities, gross fixed domestic captital formation, and net additions to stocks, and exports of goods and services; the primary input section consists of income from employment and gross profits, and taxes and subsidies on sales; the third part of the absorption matrix, consists of the intermediate transactions between industries within the economy.

The imports matrix is based on the import purchasing patterns of industries.

Once these three basic matrices have been compiled, the industry - by - industry matrix (I_{ij}) and the inverse matrix $(I - A)^{-1}$ can be computed. Sub-national input-output models can be compiled by a number of techniques:

i) A full survey of establishments is undertaken and a regional (or area) input-ouput model is compiled by the same method as the national table. Exports (and imports) from the region are treated in the same way as in the national model.

ii) A sample survey of establishments is undertaken. The area model is then compiled in the same way as the national model. The assumption here is that the sampled establishments are representative of their industrial sector in terms of spatial and industrial linkages.

iii) A sample survey of establishments is undertaken to estimate the proportion of inputs and outputs which come from or go to the area and conversely the proportion which represent imports to or exports from the area. The important assumptions here are that the industrial linkages are identical to the national industrial linkages, and that the sampled firms are representative of their industrial sector in terms of spatial linkages.

iv) Non-survey techniques are adopted. In this case the area aggregates of output and employment data are used together with the technological relationships between industrial sectors of the national tables to establish an area input-output table.

There are variations in the method which can be adopted to 'balance' the tables, and inevitably a great deal of adjustment has to be made. This is especially true in the cases of the last two methods. The first method involves the largest amount of resources but presumably the highest level of accuracy possible within this framework.

The second method appears to combine a tolerable amount of resource inputs with a relatively high level of confidence in the results, although the sample size and sampling technique adopted are crucial factors. This method was used by Burdekin (1978) in the Scottish study and by Pullen et al (1981) in the North Staffordshire study. Both study samples aimed at surveying firms represnting 20% of employment. In Pullen et al "the original sample consisted of 198 establishments ... 112 Minimum List Headings ... are represented in the study area" Pullen et al p119. This size of sample may therefore be insufficient to capture any differences in product-mix, production function, trading pattern, etc, that exists in the local/regional economy. Appendix D of Pullen et al, however, suggests the actual sample size was larger, circa 230, but there were many MLH's (50) where only 1 firm was surveyed (though in some instances the firm was the only employer). There were also some MLH's (19) where the sample represented less than 10% of employment. A further 41 MLH's appear not to have been surveyed (they are not identified in the list of MLH's having no major employer).

The third method appears to offer some benefits over the fourth although the experience of the West Midlands County Council's input-output study (Hodgson and Handley, 1978), initiated but not completed seems to contradict this assumption. Respondents were encouraged to estimate proportions where there was uncertainty. Whilst this improves the response rate it simultaneously reduces the quality of the data collected.

The last method[1] almost certainly uses the least resources, but has been subject to much criticism for unreliability[2]. Some of this criticism may not be fully justified until we have established more clearly that survey-based approaches are superior or more particularly offer higher rates of return to the investment in them.

1 See the Merseyside study by DeKanter and Morrison (1978)

2 See Shaffer (1976), Shaffer and Chu (1969) and Jensen (1978)

8.22 Sub-national input-output models

A comprehensive survey of the development of input-output models at the sub-national level was undertaken by Richardson[1]. A brief outline of that development is given here together with a more detailed examination of recent studies.

Isard (1951) began with the theoretical development of an 'ideal' interregional model; its implementation having enormous data requirements. Moses (1955) developed the first empirical interregional model for the United States; Chenery (1953) developed a two-region model for Italy; Isard and Kuenne (1953) developed an interlinkage model to estimate the effects of expansion of a particular industry (steel) on a region; and Leontief (1953) developed a framework for assessing the impact of national industries on local economies based on a hierarchical system of regions. The input-ouput models of the 1950's and 1960's which followed were regional models rather than interregional. Two alternative approaches were taken either the national input-output coefficients were adjusted to take account of different regional production functions, products and marketing practices, (for example Moore and Peterson, 1955), or survey data was used (for example Hirsh, 1959). Hirsh's study and other survey-based studies, which followed, involved large resource costs, but some uncertainty in the results remained, and a considerable amount of unscientific estimation for some data was always involved. Dissappointments with the results of such

1 See Richardson (1972)

high cost studies were probably responsible for the shift of emphasis back to techniques using national coefficient adjustments with or without supplementary survey data.

In the United States regional models have continued to proliferate. The 1970's however saw a slow down in the number of new projects, although several more ambitious multi-regional Input-Output Models (Polenske, 1970) were undertaken. Tiebout's forecasting model (Tiebout, 1969) developed the idea, which had always been suggested, but very seldom considered, of using input-output tables to forecast the effect of change on regional employment. Tilanus questioned the use of "average" input coefficients for forecasting, (Tilanus, 1967). Tilanus explored the possibility of deriving marginal input coefficients, that is, "ratios of changes in inputs to the associated changes in output" (Tilanus, op cit p140) for forecasting input requirements for any given combination of final outputs. Tilanus used a simple technique to derive marginal input coefficients, using the change in inputs in relation to the change in outputs over 5 years.

The forecasts reproduced using Swedish data performed less well than those using average coefficients. 'A priori' we would expect marginal coefficients to perform better. The poor performance may therefore be attributable to an unsatisfactory technique for deriving the coefficients. Survey data might be more accurate.

In the United Kingdom work has been much more sporadic and on a much less ambitious scale. Resource constraints have prevented the proliferation of either large scale survey-based models, or the development of an interregional model. Regional and urban policy makers are at least as eager as they ever were to secure the information that a regional, interregional or local input-output type model would provide, yet the resource constraints exist, at least as much as ever. The need for the input-output model by planners and policy makers at the sub-national level is now based on the need to assess the impact more of declining than expanding industries and demand (in contrast to the earlier days of its development) as was in the case of the multiplier analysis referred to earlier.

The Manpower Research Group at the University of Warwick, set up in 1975 to assess UK employument prospects in the medium term, has developed a model (see Keogh and Elias, 1979, and Elias, 1982) to incorporate the medium-term employment forecasts of the Cambridge Growth Project developed in the Department of Applied Economics at Cambridge (see Barker, 1976). The Cambridge model incoporates an input-output analysis which enables an intersectoral simulation of exogenous changes to be undertaken. The Warwick regional employment forecasts are determined by adjusting the UK sectoral forecasts (from the Cambridge model) for regional factors based on past employment trends. The Cambridge project also now disaggregates forecasts of employment and income to the regional level though not by sector.

The United States studies have become extremely ambitious. Haveman (1976) describes an 'ideal' analytical framework for regional impact estimation:

"A full evaluation of the welfare effects of a policy measure requires a knowledge of the willingness to pay of each citizen for either the benefits of the measure or the avoidance of its costs. These estimates of willingness to pay should capture the present value of future effects as well as current effects and could be grouped by region, income class, or other socio-economic characteristics. Given the stipulation of either regional or individual welfare weights, the relationship of the gains and losses of reallocation from both a national and a regional point of view could be ascertained."

Haveman (1976) p 456

Such an analytical framework would require a multi-dimensional model of the economy incorporating inter-industry and inter-spatial flows of goods, services and income. Furthermore the effect of changes in technology, prices, wages, interest rates, the international value of currencies, etc, would need to be modelled. Further, weights to either individual or regional welfare, would have to be determined; and the willingness to pay for benefits or the avoidance of costs for all policy measures by all affected individuals (or a sufficiently large representative sample) would be required. Whilst such a model would appear an impossibility several models of the United States economy have been developed incorporating many of there features[1]. The

1 See Crow (1973), Putnam (1975), Ballard and Glickman (1977), Treyz et al (1977) for multiregional but subnational models of the United States and Polenske (1972), Harris (1973), Dresch and Goldberg (1973), for national multiregional models of the United States.

availability of data is far greater than in Britain and the resources devoted to the development of such models is enormous. Basically there are two approaches that these models take in their construction: the "bottom-up" approach, where the national model is the sum of the independently constructed area models; or the "top-down" approach where the national model is dissected to provide the area models.

Treyz (1980) describes the requirements of an 'ideal' multi-spatial policy analysis model:

> "A multi-regional policy analysis model should be capable of generating accurate and comprehensive forecasts conditional on alternative values for government policy instruments."
>
> Treyz (1980) p 191

The approach taken by Treyz is eclectic, incorporating input-output, economic base, neo-classical general equilibrium, Keynesian macro-modelling, regional locational analysis, segmented labour market analysis and econometric modelling. The model design Treyz presents is not a repart of a currently operational model, although many features have been incorporated into the Massachusetts Economic Policy Analysis (MEPA) Model.

Treyz suggests the specific features required for his model (see Chapter 7, section 7.5).

Once again the data requirements and resource costs are enormous. Some of the features are less important in the British economy. (There is for example, less variation in prices, wages, rating and consumer taxes, across regions in Britain.)

8.23 Limitations of the sub-national input-output models

The input-output technique has several drawbacks, most of which can be overcome at some cost. At the sub-national level there are more severe problems which cannot easily be overcome unless a multi-regional approach is taken. The cost of this latter approach makes it an infeasible alternative in many cases.

The fundamental problems of input-output analysis lie in the restrictive underlying assumptions[1]. The trading relationships are static; there are constant returns to scale; all products within an industry have the same trading patterns and production functions; technology is fixed; the production functions are linear and their coefficients are fixed; there are no lags. Essentially these assumptions mean that the model has limited value since it cannot be used to forecast for long-run planning exercises.

Tiebout (1957) and Isard (1960) identified these operational limitations at an early stage and much research effort has gone into overcoming these problems. Tiebout himself devoted much time to both the theoretical and practical development of regional input-output models eventually incoporating a forecasting model (Tiebout 1969) in a paper published posthumously. Miernyk et al (1970) have identified means of overcoming these restrictive assumptions. Production

1 This is true at national and sub-national level.

coefficients and trading patterns can be determined or verified by survey. Secondly production functions, they argued, need not be fixed, Miernyk et al used the production techniques of the most advanced firms within an industry as indicators of likely technological developments. Thirdly their dynamic model used endognously (rather than exogenously) generated capital requirements. Fourthly changes in the structure of the regional economy were simulated using several economically feasible new activities to examine the impact on forecasts. Finally their model incorporates the impact of technological changes on the occupational and industrial structure of employment. Although therefore the simplest models may be restrictive many of the restrictions can be relaxed where the budget constraint permits.

What if the budget constraint does not allow such development: does this render the technique completely useless? The answer to this must be a qualified 'no'. Firstly so long as factor substitution and technological change are sufficiently slow to make the input requirements of industries relatively fixed the model will be useful for several years after its development. The longer the period after the model's construction the less reliable it is likely to be (unless adjustments to the model are made). Secondly although the quantitative measure of economic impact simulation may be subject to a growing degree of error, it is unlikely that the scale of impact in various sectors will have changed sufficiently to reveal completely erroneous impact simulations. Thirdly we can economise on updating the sub-national model by concentrating on those sectors where we know large-scale changes have occured, on sectors which are important to the area and on sectors where some policy proposals are feasible. Fourthly we can use the input-output data as a basis for more detailed investigations into sectors or for economic impact analyses of particular policy proposals, plant closures or whatever.

A more difficult problem for sub-national models arises from the openness of the economy. This inevitably means that a large proportion of the area's intermediate output is simply assigned to exports and similarly a large proportion of inputs to imports. In the North Staffordshire study (Pullen et al, 1981), for example, 71% of intermediate sales went to other regions outside the area and (coincidentally) 71% of inputs came from outside the area.[1] If we treat these very large 'export' flows as if they were final demand (and therefore exogenous) we will create a misleading picture of the sectors of final demand on which the area is dependent; ("results of some empirical work show that the interregional feedback effects may be quite significant," Round (1978)); furthermore a major difficulty arises in the determination of the final output and final demand vectors. The Leontief-Strout method[2] can be used for a multi-area but not a single area model. In the single area model the information is

1 However the Scottish economy appears to be more self-sufficient and has lower levels of intermediate trade with other regions. (Burdekin 1978).

2 See Leontief (1966) Ch 11 or Yan (1969) pp 117-119

often generated from the survey data (for example Pullen et al). This can be misleading since we cannot be sure that double-counting does not occur.

Nevin Roe and Round (1966) recognising these problems attempted to alleviate many of the difficulties by differentiating between exports of intermediate outputs and exports of final outputs. Their model of the Welsh economy appears to offer a reasonable amount of confidence in a non-survey approach to the construction of a single area input-output table. Their model is dependent on three assumptions: Firstly that total intermediate output of each industry in the region is distributed as inputs into national (U.K.) industries in the same relative proportions as the distribution of the total intermediate output of the corresponding U.K. industry amongst U.K. industries; secondly intermediate inputs into each industry in the region are obtained from national industries in the same relative proportions as each corresponding industry in the nation as a whole obtains its intermediate inputs from national industries; and thirdly the industries within each region obtain as far as possible their inputs from supplying industries within the region, and likewise industries within the region sell their outputs, as far as possible to industries within the region. These assumptions facilitate the formulation of a regional input-output table for one region which would be consistent with similar tables for other regions, and the necessity to treat large flows of intermediate goods and services as if they went to final consumption is eliminated. However, the final assumption is perhaps questionable. In a recent study by Stoney P.J.M. (1983) into the 'Employment Impact of the Merseyside Motor Vehicle Assembly Industry' it was found for one plant that only 6.9% of inputs come from the North West, this compared with 5.0% of inputs from the North West into the company in the United Kingdom. Furthermore, some services like gas, electricity and water had to be purchased from the region. Tests of the relationship between spatial and industrial linkages such as Richter (1969), Streit (1969), Czamanski and Czamanski (1977) and Bopp and Gordon (1977) suggest that industrial linkages are positively but weakly associated with spatial concentrations. Harrigan (1982) using more sophisticated 'cluster analytic procedures' one of which incorporates 'indirect and complementary linkages' as well as direct linkages, using United Kingdom data, found similar evidence of a relationship between industrial association and spatial association. To support the assumption 3 in the Welsh model evidence of such relationships is neither necessary nor sufficient; but if firms purchasing patterns were based on that assumption we would anticipate firms setting up plants close to potential customers to take advantage of such policies and therefore stronger relationship to be apparent. Taylor (1973) and Lever (1972) found some significant relationships betwen functional and spatial associations, indicating the importance to some industries of access to suppliers and customers. However, the high level of inter-regional trading patterns recorded by small area and regional input-output models would appear to repudiate the assumption.

The development of a multi-regional input-output model provides almost the only[1] satisfactory means of adequately assigning sectoral employment and income to the appropriate final demand sector. We already collect most of the necessary data for such an exercise in the Census of Production. This information is currently used by the Central Statistical Office to produce the aggregate Input-Output tables. Ideally, we would need to collect the information with respect to spatial sources and destinations of inputs and outputs in addition to the industrial (sectoral) sources and destinations. Constructing a set of multi-regional models would require a massive resource input. Polenske (1972) describes the Harvard Economic Research Project multi-regional input-output model of the United States, and details the construction of the model. She gives some indication of the size of the task:

> "Since there are 4386 figures for each particular component, a complete multi-regional input-output set of data for a single year contains more than 300,000 numbers. A considerable amount of research effort was of course required just to assure that as the data was assembled, on internal consistency was maintained between the state figures and the national aggregates."
>
> Polenske (1972) p 172-3

1 The employment-dependency model developed in the next chapter provides an alternative.

This project used 44 regions and 78 industries, so a British multi-regional data set could be made smaller, but the resource costs would still be large.

Whilst the possibility of the construction of a multi-regional model is a fruitful area for research, its implementation involves heavy resource costs. At the same time there exists a need to develop techniques for the local area to assess the impact of national policies or other exogenous changes on employment and income within a local area. An alternative technique which we examine now is the intersectoral flows analysis.

8.24 Intersectoral Flows Analysis

The intersectoral flows analysis was first introduced by Hansen and Tiebout (see Hansen and Tiebout, 1963) in order to reduce some of the resource costs involved in setting up a subnational model to examine the impact of external forces on an area. Their model was devised to assess the impact of changes in the Federal defence budget on the State of California, where defence expenditure was significant. The major difference between input-output and the intersectoral flows analysis is that the coefficients of intersectoral and interspatial linkages are expressed in terms of employment rather than income.

In the intersectoral flows analysis economic activity in a region (or other spatial area) is influenced by internal and external forces. The effects on employment of changes in final demand are divided into three categories - the direct effect, the indirect or second round effects and the induced or multiplier effects. The final demand sectors are - consumption, investment, local and central government expenditure, to other regions and countries.

The final table shows flows of output from industries (rows) to industries withing the region and to final demand (columns). Inputs are therefore local inputs and all intermediate outputs are indirectly assigned to final demand via the industries supplied.

Hansen and Tiebout used survey data to establish the flows from industries to final demand. Firms were asked only about their outputs. The basic assumption was that firms have more accurate information about their outputs; it is more likely to be monitered for example, and in addition the input bundle is normally more complex. (Bramhall, 1962), however, has criticised this approach since it effectively removes any consistency checks). Results from questionnaires are weighted by firm size and scaled up for the industry in terms of employment. For the non-manufacturing groups, information may be available without the necessity of implementing a survey.

From the basic data set, a table can be constructed indicating the number of jobs in the row industry that are related to employment in a column industry. Then dividing each entry in the table by its respective column total, yields employment input coefficients indicating the amount of regional employment required in the row industry per employee in the column industry (in the region). Finally, employment is related to final demand.

Employment dependent on intermediate industries is assigned to final demand via the industries it supplies. The final table indicates the final demand sector on which jobs in the area are dependent, from which sectoral employment multipliers can be calculated. If the number of final demand sectors is reduced to one, the resultant multiplier is the economic base multiplier.

Intersectoral flows analysis is a hybrid of input-output and the economic base mulitiplier approach. Lee, Lewis and Moore (1971) have extended the approach to a multi-regional model. The single area model will suffer from the same problems as the single area input-output model. That is if intersectoral movements of goods outside the region are treated as if they are exports, then any feedback into the region will result in double-counting. The multi-regional version of the model, like the multi-regional versions of the input-output model, avoids this problem, but as with input-output it is an expensive alternative for anyone interested only in a single area.

Richardson (1972) in his comprehensive survey and examination of the development of input-output in relation to regional economic analysis, having discussed the high resource costs involved in the construction of input-output tables (chapter 6 op cit) said of the intersectoral flows model.

> "Although it is obvious that this model cannot generate much of the useful information from a traditional I-O Model, its benefits suggest that it is worth serious consideration. It is inexpensive, it is very simple to operate and its main

product - employment mulitipliers - is possibly one of the more useful tools in regional economic analysis."

Richardson, 1972 p 133

Bramhall's early criticism (Bramhall, 1962) that the model has no consistency checks, has been reiterated in a recent note by Giarratani. Giarratani (1980) shows that without the input data the Leontief inverse cannot be valid, even though an approximation of the Leontief inverse can be generated. He therefore, argues that whilst the multipliers may appear useful, there is no internal consistency, and therefore, the model must be rejected on the grounds that it is unscientific. Clapp (1977) has also made similar criticisms but accepts that the ISF model may have limited descriptive value even though it cannot be used for impact analysis or for forecasting. Clapp offers some suggestions for augmenting the row data with some column data to obtain inexpensive regional input-output tables. Clapp argues that ISF is a special case of input-output(Clapp op cit p 80-83), and is only appropriate where the distribution of sales to final demand sectors is constant, and furthermore, the exclusion of a household sector in the ISF model does not enable the whole effect of round after round of household purchases originating from an increase in final demand (the Keynesian multiplier effect) to be incorportated. Clapp suggests that if the output data are collected in terms of sales (rather than employment) then secondary sources of column data might be available for consistency checks in some cases. Barnard and Ballman (1979) however, found the employment multipliers derived from the intersectoral flows analysis (ISF) to forecast employment changes at least as well as, and often better than alternative forecasts.

8.25 Sub-national Econometric Models

The deficiencies and limitations of multiplier concepts, input-output models and the intersectoral flows analysis have led some researchers (See for example, Glickman 1977, Chakravarty 1982) to turn to econometric models, which use time series data to estimate a series of regression equations to be used for economic simulation and forecasting purposes at the sub-national level.

Econometric models at the regional level can be designed so that they are relatively inexpensive to construct and contain a number of simple regression equations of the general form:

$$Y_{it} = J\ (Z_{jt}, u_t)$$

Where

Y_{it} is the ith endogenous variable in period t

Z_{jt} is the jth exogenous variable in period t

and u_t is the error term. The equations are estimated from time-series data and then solved simultaneously.

In order to construct a more sophisticated model multiple regression equations are constructed and lags introduced into the system.

The models, once developed, need to be constantly amended and updated to reflect any changes which occur in the regional or local and national economy. These models offer many advantages over input-output and multiplier analysis: they can introduce more recent data than input-output models, are flexible and can be used for forecasting purposes. They do not, however, provide the disaggregated industry data that the input-output models provide.

8.26 Conclusion

There appears to be a need for a technique of economic impact analysis which economises on the use of resources, can be used at the small area planning level, yet provides disaggregated industry data. The next chapter introduces a technique which is both simple and economical, uses, in its simplest form, readily available data, and provides a disaggregated industrial picture of the local economy.

Chapter 9

AN EMPLOYMENT - DEPENDENCY MODEL

9.1 Introduction

The employment-dependency model (E-D model) developed here has been developed for the purpose of identifying the intersectoral linkage patterns within the local or regional economy, where the budget constraint prevents the construction of a multi-area input-output model. The incentive to develop such a model arises from the increasing need of urban and county policy - makers to understand these linkages for sectorally disaggregated economic impact analyses and strategic planning. This increasing need arise because of the growing number of locally implemented economic initiatives (see J.U.R.U.E.,1979 and 1981) and because of the sectorally and spatially differentiated impact of de-industrialisation[1], both of which need to be monitored locally.

The rest of the chapter is divided as follows: firstly alternative approaches are discussed and compared with the E-D approach. Secondly, the underlying assumptions of the model are presented and critically examined. The model and its methodology are then explained and a sample of the results obtained are presented and discussed. This is followed by a discussion of the model's uses and limitations. Testing of the

1 De-industrialisation here is defined as 'a contraction of industrial employment', whatever its cause. There is some controversy over the definition of this term and a thorough discussion of its meaning, causes, measurement etc can be found in Blackaby F(ed) (1978)

model is reported in Section 9.7; future possibilities for updating and developing the model are then discussed and finally there is a conclusion.

9.2 Alternative approaches of single area economic models[1]

Regional and urban economic models have been developed to a sophisticated level particularly in the United States. Models have been developed for forecasting and for assessing or simulating the economic impact of exogenous shocks on the area. Two types of model have emerged; the input-output model[2] and the econometric model.[3]

The major problems with these single area models are; firstly the large amount of resources necessary not only to develop but also to maintain and update the model; secondly the inapplicability of the institutionally defined geographical area as the appropriate area of impact for some studies; thirdly the lack of information regarding the impact outside the area, which may be more significant than the impact within the area; and lastly the failure of the single area model to identify the feedback effects from other areas.

1 See Chapter 8 for a full survey of alternative approaches.

2 See Richardson (1972) for a survey of early models; See Miernyk W (1973) for an appraisal of U.S. input-output models; See De Kanter J (1978), Burdekin R (1978) and Pullen (1981) for U.K. models.

3 See Glickman N.J (1977) for a discussion of econometric models.

The problem of resource costs has been overcome, to some extent by the developement of the intersectoral flows analysis, by non-survey approaches to input-output modelling and by using simple econometric models. In doing so the quality of the generated information inevitably deteriorates. The other specified problems require us to be able to assess the impact outside the study area and this difficulty can only be overcome by a multi-regional approach[1] or by linking a single area model to a national model.[2,3]

The problem appears to be one of developing a model which satisfies the information requirements of policy-makers with as much detail as accurate as possible, for a minimum amount of resource inputs. These objectives are to some extent conflicting, and we will almost certainly have to accept a trade-off between minimsing costs and maximising benefits. The optimum amount of resource inputs would be where the quality (value) of the output exceeded the costs of the inputs by the maximum amount (assuming such a position existed). This would

1 See Polenske (1972) and Round (1978) for multi-regional models.

2 See Klein and Glickman (1977), Maki et al (1977), Ballard and Glickman (1977), Keogh and Elias (1979) and Elias (1982) for single area models linked to national models.

3 An interesting multi-regional 'bottoms-up' model of Australia is being developed by Liew (See Liew L H 1982) using a combination of input-output relationships and CES functions. However, in conclusion Liew writes:

> "The factor imposing the greatest problem for model improvement is the supply of inter-regional input-output data."
>
> op cit p471

be where the marginal costs of the research input were equal to the marginal benefit. There are, almost certainly, ultimately increasing marginal costs of research input and diminishing marginal increases in the quality of the output. In practice research of this kind does not come in small marginal input units so we have to choose between small scale and large scale programmes at the outset. Resources are likely to be constrained at less than optimum and the 'second best' solution becomes one of maximising the quality and quantity of output subject to the time and budget constraint imposed.

The E-D model has been developed here with the above constraints and objectives in mind. In its basic form the E-D model is a simple technique for modelling a single area as an integral part of the national economy (rather than a separate economy with a large external trading account.), using a minimum amount of readily data and a simple computing exercise. It uses a 'top-down' approach so that the sum of all area models is equal to the national model. Yet the basic model is flexible enough to be amended with supplementary data, whenever available or whenever the budget constraint is sufficiently large to permit empirical work to be undertaken. In any case attempts to improve the quality of the output will be most productive when concentrated in certain sectors for example, those which a simply constructed model fails to accurately simulate; those which are significant employers in the area[1] and those which are experiencing rapid change.

1 Nevin, Round and Roe (1966) for example surveyed five industries important to Wales for their Mark II model of Wales.

Unlike the single area input-output model, which treats the area as essentially a self-contained economy with a large external trading account, the E-D model treats areas as interdependent economies. There are a number of reasons for and advantages of treating the local economy in this way. Firstly as already discussed, the size of the external trade of the region and particularly the urban area or sub-region is extremely large. This means that the feedback effects cannot easily be identified. Secondly the single area models relate output and employment in the area to final demand for the areas output. Yet, no data on final demand for region's (or the area's) output by industry is available, and has often to be estimated from U.K. industrial final demand or output. This being so there seems to be only a small advantage for some purposes in formulating the model this way whilst the costs are great. By treating the local economy as an integral part of the national economy the benefits of the comprehensive approach of multi-area modelling are captured without all the flows through all areas being traced; but the final sectoral destinations of outputs are traced through the Leontief inverse.

A simple example will illustrate the relationship between the models. Suppose a tyre manufacturer in Wolverhampton supplies a car assembly plant on Merseyside. The single area model will treat this as an export of tyres from Wolverhampton and so will not indicate the final sector of demand[1] on which the tyre manufacturer is dependent. The model will indicate that the tyre manufacturers are dependent on final demand in the region

Figure 9.1 Single area input-output model for Area 1 eg The Welsh model (Nevin, Round and Roe, 1966)

	Area 1 Industry 1 2 ... n	Rest of U K* Industry 1 2 ... n	Total Intermediate	Final Demand	Gross Outputs
Area 1 industry 1 industry 2 . . . n Rest of United Kingdom industry 1 industry 2 . . . n					
intermediate inputs Primary inputs					
Gross inputs					

for tyres. The multi-area model would trace the flow via both sector and area through to final demand. The E-D model will trace the flow through to the final demand sector without identifying the intermediate area(s) of destination; But the main advantage of the E-D model over the multi-area input-output models lies in the enormous resource savings. Like the multi-area model the E-D model is consistent with a full set of regional (area) tables. (See figures 9.1,9.2, and 9.3 for a diagramatic explanation of the flows).

It was suggested in Chapter 7 that at the national level we need to evaluate the spatial and sectoral impacts of policy decisions and exogenous changes. Maleki (1981) and Elias (1982) have suggested that by comparison with explicit spatial and regional policy expenditure other public expenditures are huge and their spatial distribution may therefore be much more significant. If we are interested in economic impacts at the local and regional level therefore we need to assess not only, exogenous changes which occur at the area level, such as investments or plant closures, but also the impact of exogenous changes which occur at national level but which indirectly effect the region.

1 Some single area studies have identified the initial intermediate sector in the rest of the economy but these cannot always satisfactorily be attributed to final demand without tracing the full inter-sectoral and inter-area flows. (See for example Nevin, Roe and Round,1966)

Figure 9.2 Multi-area input-output model (3 areas) e.g. United States model (K Polenske, 1973)

	Area 1 Industry 1,2....n	Area 2 Industry 1,2....n	Area 3 Industry 1,2....n	Total Inter-mediate	Final Demand	Gross Outputs
Area 1 Industry 1						
2						
⋮						
n						
Area 2 Industry 1						
2						
⋮						
n						
Area 3 Industry 1						
2						
⋮						
n						
Intermediate Inputs						
Primary Inputs						
Gross Inputs						

Figure 9.3 Employment - Dependency Model for Area 1

	The whole of the United Kingdom Industry 1, 2 ...... n	Total Inter-mediate	Final Demand	Gross Outputs
Area 1 Industry 1 2 . . . n				
Intermediate Inputs				
Primary Inputs				
Gross Inputs				

9.3 Assumptions of the E-D Model

In its basic form the E-D model is based on some fairly restrictive assumptions.

i) that the technical relationships of local industries are the same as those for the national industry;

ii) that (local) industry purchases and sales are based on industrial linkages rather than spatial linkages. (Additionally the usual assumptions of input-output models apply - see Chapter 8).

These restrictions can be relaxed if evidence is available, or can be collected which contradicts either of these assumptions, where the alternatiue hypothesis is sufficiently well supported empirically and is implementable.

The first assumption is one commonly adapted for single area models, especially as a first stage, because it involves the least resources. That is the reason for initially adopting it here. It is worth considering the range of circumstances which would render it inapplicable: Where the product-mix of a local industry was very different from the national product-mix of the industry; or where the production functions used by firms producing similar products in different locations were different, perhaps because of regional policy or differences in factor prices or product prices.

Harris (1982) estimated CES production functions for various industries in different regions. In conclusion he wrote:

"The results generally lead to the conclusion that there exists no marked difference between higher and lower unemployment regions in terms of technological conditions prevailing.....The exception to this conclusion is Northern Ireland"

Harris (1982) p 257

That is not to say all production functions for all industries, in all regions (except N.I.) are identical. His results indicate some variation in capital intensity, factor efficiency, elasticity of factor substitution and returns to scale.

Harrigan, McGilvray and McNicoll (1980) compared the Scottish input-output coefficients with the U.K. coefficients for 1973 and found some "significant differences in individual coefficients" (p804). However, Scotland is a more isolated regional economy than most others and additionally the authors felt it:

"probable that these (differences) are in large part attributable to the differences in product mix which are known to exist in some sectors". p806.

It should in any case be noted that the 1973 U.K. table is an update of the 1968 table by RAS and is itself subject to error.

Morrison and Smith (1974) found the U.K. technical coeffients to be "satisfactorily" for Peterborough. Karaska (1968), however, found significant variations in technologies in the same industry in a single region. Although we should 'a priori' expect there to be more significant interregional differences it may be difficult to identify the differences even by survey work.

Stevens and Trainer (1978) and Drake (1974 and 1976) found that in regional input-output models the regional purchase coefficients were the major determinant in determining the output multipliers, the technical coefficients having much less effect.

The second assumption is related to spatial trading patterns, and is an assumption which is more difficult to test than might at first be apparent. Dobson (1982) in a comprehensive review of United Kingdom literature on industrial linkages concluded:

> "In almost all the micro level studies it was found that there exist strong local linkages and that these are spatially significant........"
>
> S Dobson (1982) p 38

Yet if these spatial linkages are reflected in the industrial structure of the area or region assumption (ii) will be supported (not refuted). But assumption (ii) implies that firms (and therefore industries) purchase their input requirements from geographical locations, directly proportional to the geographical concentration of the industry producing the product in question. Taylor (1973) in his study of iron foundries found that West Midlands foundries dealt:

> "twice as much as would be expected with the local area".
>
> M J Taylor (1973) p 393

Lever W F (1972) also found evidence of functional and spatial linkages being interrelated. On the other hand Moseley (1973) studied a number of growth centres in East Anglia and found that although new firms increased their local purchases over time the scale was quite small and most of the spin-off occurred outside the area.

Walker S R (1977) examined the linkages of 'tertiary' and 'quaternary' activities in Oxford and found very high levels of local inter linkages. She found:

> "...50% on average of the sampled establishment's supplies were met within the Oxford city and region, 66% of the services, 91% of the labour force, and 73% of the market."
>
> S R Walker (1977) p 267

Many of these 'service' industry linkages are likely to be non-industry-specific, and, as such, are probably more related to the aggregate level of economic activity in the area than to the particular industry-mix. Almost certainly therefore these linkages would need to be determined by survey work, though if the linkages are not industry specific the input-output framework is perhaps less useful than multiplier analysis for analsis of impact on or of these industries.

Work by Streit (1969), Richter (1969), Czamanski and Czamanski (1977) and Bopp and Gordon (1977) using cluster analytic procedures suggests that industrial linkages only weakly influence spatial concentrations. Harrigan (1982) incorporating a sophisticated type of cluster analysis to identify indirect and complementary linkages, using U.K. data found evidence to support the theory that:

"the proximate location of industrial activities is influenced by the degree of their mutual integration."

Harrigan F (1982) p 30

But as before this evidence does not inoperationalise our assumption (ii), if these agglomeration tendencies of related industries are reflected in each area's industrial composition.

Hoare A (1975 and 1978) has attempted to examine the importance of linkages to firms in terms of 'attitude' to and 'awareness' of 'local' linkage opportunities. He found:

"Northern Ireland's engineering sector is a dual economy: one half locally oriented in markets, supplies and managerial outlook, while the other has its economic and administrative ties outside the region".

Hoare A (1978) p 179

Northern Ireland is in any case a remote region with transportation difficulties. Hoare's study of London firms (Hoare 1975) suggested that firms perceive local linkages as more important than the actual physical volumes of goods flowing to and from them suggests.

Marshall studied the

"possible significance of establishment linkage patterns for economic development in the Northern Region of the United Kingdom."

Marshall J N (1979) p 532

He found some variation in linkages related to ownership and differences were particularly evident in the case of those externally owned establishments with a large proportion of their material inputs coming from their own organisation, but

> "Managerial operating decisions concerning the production technology of the establishment, perceived environmental uncertainty and establishment employment size"
>
> op cit p 555

primarily contributed to regional linkage.

Stoney P J M (1983) in his study of suppliers to three motor vehicle assembly plants on Merseyside concluded:

> "Apart from being a very important direct employer in Merseyside, ..., the sector did not have a large indirect effect on the supply side in the Merseyside S D A ".
>
> Stoney P J M (1983) p 40

One Merseyside plant (company x) received only 6.89% of supplies from the whole North West Region, and this compared with 5.02% of supplies from the North West Region going to the whole U.K. company. When it is recognised that some inputs, like gas, electricity and water, would have to be purchased from the region it seems certain that there could be no significant specifically local linkages.

The inputs from the South-East and the West Midlands, where there are high-volume suppliers of components, were much more significant. About a quarter of the inputs to Company X in the U.K. came from each of the West Midlands and the South East, and a similar proportion went from each of the two regions to the Merseyside plant.

This is an important finding which lends strong support to assumption (ii) of the E-D model and also illustrates the advantage of the approach. If the West Midlands and the South East component suppliers are equally dependent on car assembly plants whether or not they are situated within their areas, then the modelling of the region as if it were an integral part of the U.K. will more accurately reflect its industrial dependency than a single area input-output model.

In the survey of firms supplying B.S.C. Bilston works (J.U.R.U.E.,1979) the researchers were surprised to find not only that a large proportion of suppliers were located outside of the region but also the insignificance of Bilston works as a customer to many of the supplying firms. It also became apparent during the survey that some of those firms were more concerned about the potential closure of other B.S.C. plants which were situated outside the region but were of a larger scale and were therefore more significant customers.

Overall, therefore, the evidence is inconclusive though it does tend to suggest that some preference for local suppliers may exist. (In fact 'a priori' we would expect that, ceteris paribus, a local supplier would be preferred). The 'service' industries are especially likely to deviate from assumption (ii) but it has already been suggested that multiplier analysis may be more appropriate for these industries. We must recognise however, that if the assumption were inaccurate there would be a downward bias in the size of estimated impact on the area where the initial final demand expenditure occurs and a corresponding over estimate for all other areas.

9.4 The Basic Employment-Dependency Model

Like the ISF model the E-D model uses employment as the unit of measurement. The employment data are converted from sales data via a value-added approach. There are two main reasons for choosing employment as the central element of the model; firstly detailed data on employment are collected regularly and secondly local policy-makers are often concerned about employment prospects within their areas.

The model is set up to identify the impact of changes in final demand on employment in an area.

We have $E_i = \sum E_{ij} + \sum E_{ik}$ (1)

Employment in the area (i) is generated from intermediate sales to industries in the national[1] economy (E_{ij}) and from sales to final demand (E_{ik}). Final demand sectors are those used in the input-output matrix - consumption, public expenditure, fixed capital formation, stocks and exports.

1 In the single area input-output and ISF models intermediate sales are confined to intermediate sales within the area. Intermediate sales to other areas are then treated as exports, that is they are treated as if they went to final demand. This has been the main weakness of the single area model, and whilst attempts have been made to estimate feedback from the intermediate sales, the problem can never be fully overcome because the flows are so large. (see Pullen et al for example where on average the percentages of intermediate inputs and outputs from and to the rest of the U.K. were 71% in both cases.)

The effects on employment in an area can be divided into three catergories - the direct effect, the indirect or second round effect, and the induced or multiplier effect. The final table of the model shows the dependency of employment in an area within each industry (row) on industries (columns) of the national economy of which the area is a part, and to the final demand sectors (also columns). All employment in the area can be assigned to final demand in the national economy via the industries supplied.

The data requirements for the basic E-D area model are the national input-output table computed for the United Kingdom by the Central Statistical Office from the Census of Production (or updated using the RAS method) and the annual census of employment data at the regional (or area) level. The industry groups used are those used in the national input-output tables which correspond to the Standard Industrial Classifications (SIC's), Minimum List Headings (MLH's) combinations of SIC's and/or MLH's used in the Census of Employment. This makes data collection and analysis extremely economical.

An initial table which can be constructed, shows the direct dependency of the area employment. Each row represents on industry group. Each column represents the first destination of the output of the corresponding row industries. Each entry therefore represents the immediate destinations of outputs of industries in the area and assigns employment on the basis of that distribution. For the basic model the destination of the area's industry sales is assumed to be equivalent to the national distribution for each industry's output. The model development here assumes the area is a region. However, its development is intended for use at a smaller area level (eg County or urban area.) For a regional model using the same technique, apportionment of industrial dependency based on output shares (rather than employment shares) might be more appropriate. Output will respond more quickly than employment to changes in final demand. At the smaller area level however, industrial output data are not available.

Since total outputs (Xi) are the sum of intermediate outputs (I_{ij}) and final outputs (F_i);

$$X_i = \sum I_{ij} + F_i \qquad (2)$$

then total employment in the region (**RX**) can be expressed as the sum of employment related to intermediate sales and employment related to final sales,

$$\mathbf{RX} = \mathbf{RAX} + \mathbf{RF} \qquad (3)$$

R is a diagonal matrix of the region's employment per unit of gross output.

X is a vector of total outputs (national)

F is a vector of final outputs (national) and

$$\text{matrix } \mathbf{A} = \frac{I_{ij}}{X_j} = \frac{\text{intermediate sales of industry i to industry j}}{\text{total output of industry j in the national economy}}$$

I_{ij} is equivalent to Table D of the national input-output tables (1974) but the diagonal coefficients I_{ii} are excluded.

X and X_j are respectively the total output column and row elements from the same table.

F is final output, also from the same table.

R can be compiled from the census of employment data.

The table can also be computed for the United Kingdom when

$$\mathbf{EX} = \mathbf{EAX} + \mathbf{EF} \qquad (4)$$

Where **E** is the diagonal matrix of United Kingdom employment per unit of gross output.

A second matrix can now be computed which will include the direct and indirect effects. If a region's sales are dependent on the sum of intermediate sales and sales to final demand,

$$\mathbf{X} = \mathbf{AX} + \mathbf{F} \qquad (5)$$

and therefore the region's output can be directly related to final demand.

$$\mathbf{X} = (\mathbf{I} - \mathbf{A})^{-1} \qquad (6)$$

The Leontief inverse, $(\mathbf{I} - \mathbf{A})^{-1}$ is equivalent to table **E**[1] of the national input-output tables (1974). If we multiply $(\mathbf{I} - \mathbf{A})^{-1}$ by R (or **E**) we have a matrix, say **Z**, where **Z** is a matrix of employment coefficients. Each column of **Z** indicates the employment in each industry which would be necessary to increase output for final demand by £1,000 in the industry corresponding to that column, and includes the direct and indirect effects. An alternative method of determining **Z** would be to invert the regional employment matrix, from (3) above we have:

1 Table **E** of the national input-output tables (1974) is a matrix of sales coefficients. Each column indicates the value of inputs from each industry, which would be necessary to produce a £1,000 units of final output in the industry corresponding column industry.

$$RX = RAX + RF \quad (3)$$

$$RF = R(I-A)\ X \quad (7)$$

$$RX = R(I-A)^{-1}\ F \quad (8)$$

$$Z = R(I-A)^{-1} \quad (9)$$

If **Z** is multiplied by any vector of final demand **F**, this will show the employment in each industry necessary to produce **F**.

Suppose we have a simple national economy depicted by the following table:

Table 9.D Industry-by-industry flow matrix

Sales by	To Industry 1	2	3	Final Demand	Gross Output
Industry 1	20	30	40	110	200
Industry 2	30	40	50	180	300
Industry 3	40	60	80	220	400
Total Intermediate	90	130	170		
Value added	100	150	180	-	430
Imports, taxes, etc	10	20	50	60	140
Gross inputs	200	300	400	570	1470

(This is equivalent to Table D of the input-output tables, 1974).

The intermediate sales and primary inputs can be expressed as a proportion of gross outputs to show the direct domestic input requirements per unit of industry gross output, $A = \frac{I_{ij}}{X_j}$.

Input from	Output to Industry 1	2	3
Industry 1	0.1	0.1	0.1
Industry 2	0.15	0.133	0.125
Industry 3	0.2	0.2	0.2
Value added	0.5	0.5	0.45
Imports, etc	0.05	0.067	0.125

Table 9.D (i). Direct domestic input requirements per unit of gross ouput.

From this we can compute the Leontief invers $(I-A)^{-1}$ to show total requirements per unit of final output for each industry in terms of gross outputs:-

Table 9.E Total requirements of final industrial output in terms of gross output.

	Industry 1	2	3
Industry 1	1.1794	0.1764	0.1750
Industry 2	0.2558	1.2348	0.2249
Industry 3	0.3588	0.3528	1.3500
Column Totals	1.7940	1.7640	1.7499

(This equivalent to Table E of the input-output tables, 1974)

A unit increase in U.K. final demand for industry 1 requires a total increase in gross output of 1.794 (1.1794 from industry 1 itself, 0.2558 from industry 2 and 0.3588 from industry 3).

Now if employment in a particular area, say a region, for the three industries in respectively 20,60,20, we have:

$Z = R(I-A)^{-1} =$	0.11794	0.01764	0.0175
	0.05116	0.24696	0.04498
	0.01794	0.01764	0.0675
Column totals	0.18704	0.28224	0.12998

Table 9.Z Area employment requirements per unit of Final Demand.

The column totals of Z indicate the number of jobs in the region (area) which are dependent on a unit of output in U.K. aggregate demand in each of the associated column industries. (For example, a unit of U.K. final demand in industry 1 requires a total employment of 0.18704 of a job, 0.11794 in industry 1 itself, 0.05116 in industry 2 and 0.01794 in industry 3 in the region). Employment in other areas is also dependent on the unit of final demand.

If we make the assumption (at least initially) that value-added for each industry is distributed on the same basis as employment, we can also compute a matrix, say **V**, which indicates the value-added in the region dependent on a unit of U.K. aggregate demand. Todo this we multiply **Z** by the row of value-added per unit of industry gross output. From Table 9.Di we have a row 0.5,0.5,0.45, so that:

	£	£	£
V =	0.05897	0.00882	0.00875
	0.02558	0.12348	0.02249
	0.00807	0.00794	0.03037
Column totals	0.09262	0.14024	0.06161

Table 9.Y Area value-added requirements per unit of final demand.

The colomn totals of **V** indicate the value-added in the region dependent on a unit (£) increase in U.K. aggregate demand in each of the associated column industries. (For example a unit of U.K. final demand in industry 1 requires regional value-added of 0.09262, 0.05897 in industry 1 itself, 0.02558 in industry 2, 0.00807 in industry 3). It also requires some value-added in other regions.

Similarly we can compute matrices of employment income (**Y**) dependency in the region, of profit (**P**) dependency in the region, and of gross primary inputs (**G**) dependency in the region, by multiplying (**Z**) by the appropriate row of primary input coefficients.

The column totals of this family of matrices will indicate the total requirements per unit of final demand and a ranking of industries can be formulated, indicating the benefits to the region in terms of value-added, employment, employment income, profitability or primary inputs. This gives the regional (local) policy-maker a range of information on which to act.

From the national perspective we are able to assess the regional distribution of dependency on aggregate final demand in terms of employment, value-added, employment income, profitability and primary inputs for each industry. If we multiply **Z** by a diagonal matrix[1], say **FDIAG** whose diagonals represent U.K. final demand for any current year then the resultant matrix, **ZFDIAG** indicates the industries on which each job in each industry in the region is dependent.

In our example the diagonal values of **FDIAG** are 110,180 and 220 and we can identify the industrial dependence of the jobs in the region:

				Row Totals
ZFDIAG = Z x FDIAG =	12.9734	3.1752	3.8500	20
	5.6276	44.4528	9.8956	60
	1.9734	3.1752	14.8500	20
Column Totals	20.5744	50.8032	28.5956	

In this example although only 20 people are emloyed in industry 3 a total 28.5956 jobs are dependent on final demand for industry 3 (3.85 in industry 1, 9.8956 in industry 2 and 14.85 in industry 3). Alternatively, we may be interested in the ultimate dependence of jobs in a particular industry[2]. We know that for

1 A diagonal matrix is chosen in preference to a vector so that the full industrial impact is revealed in the resulting matrix (as opposed to only the total effect in.a vector.)

2 Especially in the case of an industry which is very heavily concentrated in the region, is in decline, but whose output goes predominantly to intermediate rather than final use. An example of such an industry in the West Midlands would be fasteners, See WERU Report (1983)

industry 1, although 12.9734 (65%) of jobs are dependent on final demand for the industry itself 3.1752 (16%) are dependent on industry 2 and 3.85 (19%) on industry 3. We could also multiply **V**,**Y**,**P** and **G** by **FDIAG** to indicate which industry each unit of value-added, employment income, profits and gross primary inputs in the region is ultimately dependent upon.

9.5 United Kingdom Regional employment-dependency results

It was decided to compute **Z** for the United Kingdom and all the standard regions and additionally to compute **V**,**P**, **Y** and **G** for the West Midlands Region using 1974 data. The practical problems of implementing the model and the results obtained are reported in this section.

9.5.1 Data

The latest input-output tables available for the United Kingdom are those for 1974. (Business Monitor PA1004, 1980). These tables are based:

> "largely on the results of the annual census of production for 1974 and the associated purchases inquiry and of the quarterly sales inquiries for the same year..... Unlike the tables for 1970, 1971 and 1972 (which were estimated from the tables for 1968, updated by means of partial information), the present tables are as firmly based as those for 1968..... They are consistent with the national accounts for that year in the Blue Book .... 1980".
>
> (C.S.O, PA1004 1980 op cit p 2)

There are 103 industries in these input-output tables. In order to make these industries compatible with employment data published by the Department of Employment some amalgamation of industries has to take place. Seven input-output industry categories are affected (numbers 73,75,99,100,101,102 and 103)[1]. The problem arises because each of these industries contain a (some) industry(ies) which are equivalent to parts of Minimum List Headings (MLH'S) of the 1968 Standard Industrial Classification (SIC) 1968. Industry 73 is amalgamated into industry 75, identified as 75*. These two industries have small and similar coefficients. More problematic are the other 5 industries, 99,100,101,102 and 103. These have to be amalgamated into a single industry in order to allocate employment data by MLH to an equivalent industry. This amalgamation of industries 99,100,101,102 and 103 becomes industry 99*. This newly created industry is now very large comprising the whole of SIC's XXIV,XXV,XXVI and XXVII. (Insurance, banking, finance and business services, professional and scientific services, miscelllaneous services and public administration). This would appear to result in some loss of information. However, this may not be a severe problem. As already discussed these service industries are in any case diverse

1 See table 9.2 for description and MLH'S

Table 9.2 Sectors of the E-D model and associated MLH's of the SIC,1968

Industry	Minimum List Heading of the Standard Industrial Classification,1968
1 Agriculture	001
2 Forestry and fishing	002,003
3 Stone,slate,chalk,sand,etc.extraction	102,103
4 Other mining and quarrying	109
5 Water supply	603
6 Gas	601
7 Electricity	602
8 Coal mining	101
9 Petroleum and natural gas	104
10 Coke ovens and manufactured fuel	261
11 Mineral oil refining,lubricating oils and greases	262,263
12 Grain milling	211
13 Bread and flour confectionery and biscuits	212,213
14 Meat and fish products	214
15 Milk and milk products	215
16 Sugar	216
17 Cocoa,chocolate and sugar confectionery	217
18 Animal and poultry foods	219
19 Oils and fats	221
20 Other food	218,229
21 Soft drinks	232
22 Alcoholic drink	231,239
23 Tobacco	240
24 General chemicals	271
25 Pharmaceutical chemicals and preparations	272
26 Toilet preparations	273
27 Paint	274
28 Soap and detergents	275
29 Synthetic resins and plastics materials,synthetic rubber	276
30 Dyestuffs and pigments	277
31 Fertilizers	278
32 Other chemical industries	279
33 Iron castings,etc.	313
34 Other iron and steel	311,312
35 Aluminium and aluminium alloys	321
36 Other non-ferrous metals	322,323
37 Agricultural machinery	331
38 Machine tools	332
39 Pumps,valves and compressors	333
40 Industrial engines	334
41 Textile machinery	335
42 Construction and mechanical handling equipment	336,337
43 Office machinery	338
44 Other non-electrical machinery	339
45 Industrial plant and steelwork	341
46 Other mechanical engineering	342,349
47 Instrument engineering	351,352,353,354
48 Electrical machinery	361
49 Insulated wires and cables	362
50 Telegraph and telephone equipment	363
51 Radio and electronic components	364
52 Television,radio and sound reproducing equipment	365
53 Electronic computers	366
54 Radio,radar and electronic capital goods	367
55 Domestic electrical appliances	368
56 Other electrical goods	369
57 Shipbuilding and marine engineering	370
58 Wheeled tractors	380
59 Motor vehicles	381
60 Aerospace equipment	383
61 Other vehicles	382,384,385
62 Engineers' small tools	390
63 Cutlery etc.,jewellery and precious metals	392,396
64 Bolts,nuts,screws,etc.	393
65 Wire and wire manufactures	394
66 Cans and metal boxes	395
67 Other metal goods	391,399
68 Production of man-made fibres	411
69 Cotton,etc.spinning and weaving	412,413
70 Woollen and worsted	414
71 Hosiery and other knitted goods	417
72 Carpets	419
74 Textile finishing	423
75* Other textiles	415,416,418,421,422 ,429
76 Leather,leather goods and fur	431,432,433
77 Clothing	441,442,443,444,445,446,449
78 Footwear	450
79 Bricks,fireclay and refractory goods	461
80 Pottery and glass	462,463
81 Cement	464
82 Other building materials,etc.	469
83 Furniture and bedding,etc.	472,473
84 Timber and miscellaneous wood manufactures	471,474,475,479
85 Paper and board	481
86 Packaging products of paper,board,etc.	482
87 Other paper and board products	483,484
88 Printing and publishing,etc.	485,486,489
89 Rubber	491
90 Plastics products n.e.s.	496
91 Other manufacturing	492,493,494,495,499
92 Construction	500
93 Railways	701
94 Road transport	702,703,704
95 Sea and inland water transport and ports	705,706
96 Air transport and miscellaneous transport services	707,709
97 Communication	708
98 Distributive trades	
99* Insurance,banking and finance; Property owning and managing,etc.	SIC's XXIV, XXV, XXVI and XXVII.
99* Lodging and catering; Other services	
99* Public administration,domestic service,ownership of dwellings	

with diverse industrial dependence and dependent to some extent on the level of economic activity rather than its composition. It is unlikely therefore that an intersectoral model particularly, one based on national coefficients, would appropriately identify their industrial dependence.

The second data set required for this exercise is the number employed by MLH in the regions and the U.K. An employment census is undertaken in June each year and the results including the regional breakdown, published in the Department of Employment Gazette.

The data for June 1974 were used to be consistent with the input-output data. These data were published in the DE Gazette, July 1975 for all regions, except Northern Ireland, for Great Britain and for the United Kingdom. (Northern Ireland data can therefore be extracted.)

9.5.2 Methodology

The methodology has already been fully described (Section 9.4). However, it is necessary to explain how the amalgamation of industries, 99 to 103, referred to above, was undertaken. There were two alternatives; one was to sum the coefficients in the flow matrix and recalculate the Leontief inverse, the second method (which was adopted) was to amend the final column[1] (99*) to iteratively make it 'balance',[2] after all errors had been fully identified and

1 The rows can be summed.

2 So that the row sums of **ZFDIAG** for the U.K. agreed with the total employment in each industry.

corrected. (This was thought to use the least resources, since checking and correction was in any case essential because achieving a 'balance' would not guarantee that compensating errors were not providing an illusion of accuracy).

In any case this final amalgamated industry was likely to provide only very poor estimates because of its enormity and the inappropriateness of identifying industrial dependency of these service industries without survey data. (As already referred to above). In practice it was not a highly ranked industry in terms of employment dependency for any particular region, being an industry which was relativelty equally dispersed geographically (except for a heavier concentration in the South East) and one which tended to be demanded by other industries rather than to create demand for other industries.

In addition there was some difficulty with the employment data for Northern Ireland and also therefore for the United Kingdom. Only combined figures were available for certain industries, MLH 109 includes MLH 103 data and MLH 338 includes MLH 339 data. It was decided to allocate the employment data for Northern Ireland to the MLH's on the assumption that the distribution of employment between the pairs of industries 109 and 103 and 338 and 339, was equivalent to the distribution in the rest of the United Kingdom. Relatively small numbers are involved 2.3 thousand in 109 and 103 and 3.7 thousand in 338 and 339. The affected input-output industry numbers are 3 and 4 (109 and 103) and 43 and 44 (338 and 339).

9.5.3 Results: Employment dependency in the regions

The resultant matrices are each 98 by 98 in size and are therefore not published here.[1] A sample of results are presented to show the output which can be generated from the model.

The most interesting results are those drawn from the column totals of the **Z** matrix for each region. These show the number of jobs in each region which are dependent on a unit (£1 million) of **U.K.** final demand for the associated industry. These results should not be confused with other regional input-output results which relate income or employment to a unit of **regional** final demand. Table 9.3 shows the top ten industries in terms of job dependency per unit (£1 million) of **U.K.** final demand for the United Kingdom, and the West Midlands region, and the top 5 industries for the other U.K. regions.

The U.K. results are presented so that comparisons can be made. A high job dependency in the U.K. reflects labour intensity in the industry. A high job dependency industry

1 See Appendix III for more detailed results.

in the region will reflect a combination of factors: labour intensity of the industry, regional concentration of the industry, and regional concentration of industries supplying the industry.

Table 9.3

Job-dependency on £1 million of U.K. final demand United Kingdom and Regions (1974)

(See text for derivation)

United Kingdom - Top 10

Industry No	Title (MLH)	No of jobs per £1 million U.K. final demand '74
77	Clothing (441-6,449)	364
8	Coal Mining (101)	340
51	Radio and electronics components (364)	331
57	Shipbuilding and Marine engineering (370)	328
93	Railways (701)	327
74	Textile finishing (423)	326
78	Footwear (450)	323
56	Other electrical goods (369)	309
71	Hosiery and knitted goods (417)	308
61	Other vehicles (382,384,385)	307
Bottom 5		
9	Petroleum and natural gas (104)	109
16	Sugar (216)	94
95	Sea and inland water transport and ports	

	(705,706)	79
19	Oils and Fats (221)	72
11	Mineral oil refining, lubricating oils and greases (262,263)	28

West Midlands - top 10 (11)*			Metropolitan County[1] (ranking in brackets)
64	Bolts, nuts, screws etc (393)	107	77 (1)
80	Pottery and glass (462,463)	90	14 (41)
38	Machine tools (332)	74	52 (3)
67	Other metal goods (391, 399)	73	54 (2)
56	Other electrical goods (369)	69	44 (6)
33	Iron castings etc (313)	68	51 (4)
59	Motor Vehicles (381)	65	47 (5)
62	Engineers small tools (390)	62	41 (7)
35	Aluminium and aluminium alloys (321)	55	31 (11)
40)	Industrial engines (334)	54)	17 (31)
)		)*	
48)	Electrical machinery (361)	54)	25 (14)

* Industries 40 and 48 joint 10th

1 The Metropolitan County figures were computed using employment data for 1978 (1974 was not obtainable)

Table 9.3 (contd)

South East - top 5

Industry No	Title (MLH)	No of jobs per £1 million U.K. final demand '74
54	Radio, radar and electronic capital goods (367)	140
47	Instrument engineering (351-4)	127
51	Radio and electronics components (364)	122
43	Office machinery (338)	121
26	Toilet preparations (273)	113

East Anglia - top 5

37	Agricultural machinery (331)	37
78	Footwear (460)	18
14	Meat and fish products (214)	16
1	Agriculture (001)	15
51	Radio and electronic components (364)	14

South West - top 5

60	Aerospace equipment (383)	35
4	Other mining and quarrying (109)	34
3	Stone, slate, chalk, sand etc extraction (102-3)	31
78	Footwear (460)	30
51	Radio and electronic components	28

East Midlands - top 5

82	Other building materials (469)	112
88	Printing and publishing etc (485,486,489)	93

84	Timber and misc. wood manufactures (471, 474,475,479)	66
40	Industrial engines (334)	42
33	Iron castings (313)	37

Yorkshire and Humberside - top 5

70	Woollen and worsted (417)	111
10	Coke ovens and manufactured fuel (216)	57
62	Engineers small tools (390)	56
72	Carpets (419)	56
77	Clothing (441-6,449)	49

North West - top 5

69	Cotton, etc, spinning and weaving (412,413)	115
74	Textile finishing (423)	78
41	Textile machinery (335)	67
77	Clothing (441-6, 449)	60
75	Other textiles (415-6,418,421-2,429)	59

North - top 5

57	Shipbuilding and marine engineering (370)	64	
8	Coal mining (101)	45	
50	Telegraph and telephone equipment (363)	32	
4	Other mining and quarrying	30	
77)	Clothing (441-6,449)	25)	) joint 5th
10)	Coke ovens and manufactured fuel (261)	25)	

Wales - top 5

8	Coal mining (101)	36

34	Other iron and steel (311,312)	31	
55	Domestic electrical appliances (368)	26	
10)	Coke ovens and manufactured fuel (261)	21)	joint 4th
35)	Aluminium and aluminium alloys (321)	21)	

Scotland - top 5

57	Shipbuilding and marine engineering (370)	60
43	Office machinery (338)	47
2	Forestry and fishing (002,003)	43
77	Clothing (441-6,449)	35
74	Textile finishing (423)	35

Northern Ireland - top 5

69	Cotton etc spinning and weaving (412, 413)	20	
77	Clothing (441-6,449)	19	
41	Textile machinery (335)	18	
71)	Hosiery and other knitted goods (417)	16)	joint 4th
74)	Textile finishing (423)	16)	

<u>The West Midlands Region and County</u>

The heavy concentration of metal-based manufacturing industry of the Metropolitan County area together with the Pottery (and glass) industry concentrated in North Staffordshire are reflected in the job-dependency table of the region and Metropolitan County.

<u>Other regions</u>

The concentration of industries in the regions is reflected in the job-dependences: The agricultural sectors of East Anglia, the woollen industries of Yorkshire, the textile industries of the North West and Northern Ireland and coal and steel in Wales are the industries on which the respective regions are shown to depend.

The size of job-dependency reflects the size of the employment stock in the region (in the small regions all the coeffiecients are small) and the distribution of employment.

9.5.4 Results: Employment-dependency in a region (the West Midlands) on U.K. final demand in a particular industry (motor vehicles)

We can examine the results in greater detail by considering the industries which depend on final demand for a particular industry in a particular region. Let us examine the vehicle industry (number 59, MLH 381) and its dependency in the West Midlands region.

The column (59) of the Z matrix for the West Midlands indicates the number of jobs in each industry dependent on a unit of U.K. final demand for motor vehicles, in the West Midlands. There are an estimated 65 jobs in the West Midlands dependent on every £1 million of U.K., final demand for motor vehicles. 87% of West Midlands employment-dependency on motor vehicles is in 6 industries made up as follows:

No	Industry	%
33	Iron castings etc	3.6
34	Other iron and steel	2.6
56	Other electrical goods	2.4
59	Motor Vehicles	71.6
64	Bolts, nuts, screws etc	1.8
67	Other metal goods	4.9

Table 9.4 Employment dependency - motor vehicles (percentages of total WM dependency) West Midlands

The column (59) of the **ZFDIAG** for the West Midlands indicates the number of West Midlands jobs which were dependent on demand for motor vehicles in 1974. There were an estimated 189,995 jobs in the West Midlands dependent on motor vehicles. Again 87% in the 6 industries. (See Table 9.5).

Industry No	Estimated number of jobs in West Midlands (1974) dependent on final demand motor vehicles.
33	6855
34	4856
56	4645
59	135944
64	3409
67	9253
Total (in these 6 industries)	164962
Total WM Jobs	189995

Table 9.5 Employment dependency in West Midlands on U.K. final demand for motor vehicles (1974)

Note:

There were 169.9 thousand people employed in the motor vehicle industry in 1974 in the West Midlands. Not all of those were dependent on final demand for motor vehicles. Some motor vehicle production goes to intermediate demand. Some jobs in other industries, which supply motor vehicle producers directly or indirectly, are dependent on its final demand.

There are jobs in other region also dependent on final demand for motor vehicles. In the United Kingdom there were an estimated 719,129 jobs directly or indirectly dependent on final demand for motor vehicles in 1974. This means 26% of all jobs dependent on final demand for motor vehicles are in the West Midlands, a further 27% are situated in the South East. (These figures are consistent with the survey findings of Stoney P J M 1983; see section 9.3 above).

9.5.5 Results: Final destination of a region's output of a particular industry. (Fastener output in the West Midlands region)

We may be interested in the final demand on which an industry in an area is dependent. The fastener industry is very heavily concentrated in the West Midlands region. In 1974 62% of U.K. employment in the fastener industry was located in the West Midlands region. It has the highest location quotient for the County and Region and is by far the highest industry in terms of employment-dependency per unit of final demand. Yet most of the industry's output goes to intermediate industries (82% in 1974).

The row (64) of the **Z** matrix for the West Midlands indicates the number of jobs in the fastener industry (64) dependent on a unit increase in final U.K. demand for each of the column industries. The corresponding row of the **ZFDIAG** matrix for the West Midlands indicates the job-dependency of the industry (64) in 1974. Table 9.6 indicates the main industries on which industry 64 was dependent in 1974 together with the estimated number of jobs. A number of relatively smaller industries have been amalgamated.

As we might expect the industry's output is spread across many manufacturing industries, particulary the metal-based industries and it indirectly provides an input into almost every industry.

Table 9.6 Industrial dependence of West Midlands Fastener Industry employment

Industry (Final Demand in U.K.)		Estimated employment 1974, West Midlands	% of total employment fasteners
64	Fasteners (final demand)	4353	11.2
59	Motor Vehicles	3409	8.7
60	Aerospace equip.	1365	3.5
92	Construction	1094	2.8
91	Other Manufacturing	1021	2.6

34-47*	Misc Metal and Eng.	4681	12.0
48-56*	Misc Electrical Eng	2629	6.8

* See table 9.2 for details

9.5.6 Results: Regional distribution of employment-dependency on U.K. final demand for a particular industry's output (Electronic Computers)

Suppose we are interested in the distribution of employment dependency on a particular industry (a declining or expanding one for example). The corresponding column totals of the regional Z matrices indicate the number of jobs in each region dependent on a unit of U.K. final demand for the industry.

The estimated regional distribution of employment-dependency for electronic computers is illustrated in Table 9.7

Table 9.7 Distribution of Employment-Dependency: Electronic computers 1974

Region	Estimated employment per £1 million if U.K. final demand for electronic computers	% Distribution	% Distribution of U.K. employment (1974)
SE	102.7	41.1	32.3
EA	4.5	1.8	2.9
SW	10.2	4.1	6.7

WM	22.6	9.0	9.9
EM	7.8	3.1	6.5
YH	9.0	3.6	8.7
NW	33.3	13.3	11.9
North	7.6	3.0	5.5
Scot	33.8	13.5	9.1
Wales	6.5	2.6	4.4
NI	5.9	2.4	2.2
U.K.	249.9[1]	100.0[1]	100.0[2]

1 Regions do not sum to U.K. total because regional industries with less than 1000 employees are assigned nil values in the DE census table.

2 Total does not sum to 100 due to rounding.

9.5.7 Results: Employment income-dependency for the West Midlands Region.

The Y matrix for the region indicates the employment income dependent on a unit increase of U.K. final demand in the column industries. From the column totals of the Y matrix for the West Midlands we can rank the industries in order of employment-income dependency. Table 9.8 indicates the top 10 industries in terms of employment income dependency for the West Midlands Region, 1974.

Table 9.8 Employment income dependency in the West Midlands Region, 1974

Industry (Ranking in terms of job dependency in brackets)		Employment-income generated per £1 million of U.K. final demand, 1974 (£000)
64	Bolts, nuts, screws etc (1)	214
80	Pottery and glass (2)	194
59	Motor Vehicles (7)	181
38	Machine tools (3)	165
33	Iron castings etc (6)	155
62	Engineers small tools (8)	145
67	Other metal goods (4)	138
35	Aluminium and aluminium alloys (9)	133

40	Industrial engines (10)*	122
48	Electrical machinery (10)*	120

* Ranked joint 10th in terms of employment-dependency

The high ranking industries in terms of employment income dependency are the same as those for employment dependency, though some reordering takes place. Other electrical goods ranked fifth in terms of employment dependency drops to twelfth position. Motor vehicles rises to third place in terms of employment income from seventh in terms of jobs.

9.5.8 Results: Profit dependency for the West Midlands Region.

The **P** matrix for the region indicates the profit dependent on a unit increase of U.K. final demand in the column industries. From the column totals of the **P** matrix for the West Midlands Region we can rank the industries in order of profit dependency. Table 9.9 indicates the top 5 industries in terms of profits for the West Midlands Region, 1974.

Table 9.9 Profit dependency in the West Midlands Region, 1974 Top 5.

Industry		Profits generated per £1 million of U.K. final demand, 1974 (£000)
7	Electricity	73
5	Water supply	73
36	Other non Ferrous Metals	63
1	Agriculture	56
22	Alcoholic drink	38

As can be seen from Table 9.9 these industries are not those which are very highly ranked in terms of job or employment income dependency. (Though industries 64 and 80, which were ranked first and second respectively in terms of both job and employment income dependency generated £32 and £36 (000) profits per £1 million of U.K. final demand respectively.)

These results are probably subject to a wider degree of inaccuracy than any of the others. This is because we are apportioning profits to regions on the basis of their employment shares. This is less likely to be accurate than in the case of employment income. Another problem with the profit element is that it is subject to more variability over time. One year's figures are therefore not necessarily a reliable indicator of profit levels.

9.5.9 Results: Value-added dependency for the West Midlands Region.

The **V** matrix (Y + P) for the region indicates the value-added element dependent on a unit increase of U.K. final demand in the column industries. From the column totals of the **V** matrix for the West Midlands Region we can rank the industries in order of value-added dependency. Table 9.10 indicates the top 10 industries in terms of value-added for the West Midlands Region, 1974.

Table 9.10 Value-added dependency in the West Midlands Region - Top 10 1974

Industry (Job-dependency ranking in brackets)		Value-added generated per £1million of U.K. final demand, 1974 (000)
64	Bolts,nuts,screws etc (1)	246
80	Pottery and glass (2)	231
59	Motor Vehicles (7)	204
62	Engineers small tools (8)	170
38	Machine tools (3)	170
33	Iron castings etc (6)	167
67	Other metal goods (4)	165
34	Other iron and steel (28)	159
50	Telegraph and telephone equipment (12)	144
56	Other electrical goods (5)	143

The industries ranked highly in terms of regional value-added are for the most part those ranked highly in terms of jobs. Industry 34 jumps to eighth in terms of value-added from twenty-eighth in terms of jobs because of the high profit element (in 1974 at least). But again a note of caution should be expressed in the reliability of the profit element. (See Section 9.5.8).

9.5.10 Results: Gross-income dependency for the West Midlands Region.

The G matrix for the region indicates the gross income dependent on a unit increase of U.K. final demand in the column industries. From the column totals of the G matrix for the West Midlands Region we can rank the industries in order of gross income dependency. Table 9.11 indicates the top 10 industries in terms of gross income dependency for the West Midlands Region, 1974.

Table 9.11 Gross income dependency in the West Midlands Region, 1974 - Top 10

Industry		Gross income generated per £1 million of U.K. final demand, 1974 (£000)
64	Bolts,nuts,screws etc	752
36	Other non-ferrous metals	604
35	Aluminium and aluminium alloys	524

59	Motor vehicles	480
80	Pottery and glass	465
18	Animal and Poultry foods	459
10	Coke ovens and manufactured fuel	454
40	Industrial engines	425
67	Other metal goods	422
34	Other iron and steel	412

With the exception of industry 18, these seem to be the industries we would expect to see in this ranking from the earlier tables. Industry 18 has found its way there for two reasons: firstly it has a high U.K. gross income multiplier (2.053 and the third highest for the U.K.) and secondly it directly and indirectly uses the output of a number of industries concentrated in the Wet Midlands (notably other metal goods, pottery and glass).

9.5.11 Results: Summary

Only a small sample of the results have been presented here. For every area we can generate a family of matrices: **Z,ZFDIAG, Y, YFDIAG P, PFDIAG, V, VFDIAG, G, GFDIAG.**

The **Z, Y,P,V and G** matrices indicating employment, employment-income, profits, value-added and gross income per unit of U.K. final demand. **ZFDIAG, YFDIAG, PFDIAG, VFDIAG, GFDIAG** represent the employment, employment-income, profits, value-added and gross income related to the level of U.K. final demand in a particular year. The results presented here are based on 1974.

Each matrix is 98 by 98 the results presented above are taken from rows and columns or column totals.

9.6 Uses and limitations of the E-D model.

Sections 9.4 and 9.5 have demonstrated the vast amount of data that can be generated in terms of a single year's income and employment dependency of an area on U.K. final demand. It has been suggested (section 9.2) that dependency on U.K. final demand is more meaningful because the inter-regional exports and imports of an area, even as large as a region, are so great as to be inappropriately assigned to the position of exogenous flows. Furthermore data regarding final demand for an area is seldom available. There may however be instances when this data (for a particular project for example) is available. In these cases we can adjust the results of the E-D model to reflect this. For example suppose we know that an order of £1 million of final demand for vehicles, say, is to accrue in area X. Now the E-D model suggests that total employment generated from this order in the West Midlands Region would be 65; but this is based on the increase in final demand being spread across areas on the basis of the employment distribution of the vehicle industry. If we substitute the whole of the direct impact on the U.K. industry for the direct impact in the West Midlands we can calculate the estimated total effect. The leading diagonal element of the Z matrix for the U.K. (Zuk_{ii}) multiplied by the reciprocal of the leading diagonal element of the Leontief inverse for U.K. $\frac{(1000)}{(l_{ii})}$

is the estimated direct impact on jobs in industry i in the U.K. for an increase in final demand for industry i. The corresponding element of the Z matrix for the region (zr_{ii}) multiplied by the reciprocal of the diagonal of the Leontief inverse for the U.K. is the estimated direct impact on jobs in industry i in the region (based on the assumption that the initial impact is proportional to the regional distribution of employment in industry i). The estimated indirect impact in the region is the sum of the column total of the **Z** matrix for the region in industry i $\left(\sum_{j=1}^{n} z_{ji} \right)$ less the direct effect.

We have therefore total estimated employment effect of an increase in final demand for industry_i, where the direct impact falls on region R

$$= z_{iiuk} \frac{(1000)}{(l_{ii})} - z_{iir} \frac{(1000)}{(l_{ii})} + \sum_{j=1}^{n} z_{ji} - z_{iir} \frac{(1000)}{(l_{ii})}$$

$$= z_{iiuk} - 2z_{iir} \frac{(1000)}{(l_{ii})} + \sum_{j=1}^{n} z_{ji} \qquad (7)$$

In the above example we have:

$$= 137 - (2)(47) \frac{(1000)}{(1004.4)} + 65$$

$$= 108$$

That is to say if the £1 million initial increase in final demand falls wholly in the West Midlands, then the total estimated impact on West Midland's employment is 108 jobs. We can use the same method with any of the dependency matrices replacing Z with g,v,p,y.

Because the E-D model (as developed here) is based on a static input-output framework, its uses are constrained to the limitations placed on all such models and already discussed in Chapter8. The main limitations are in terms of its reliability for forecasting purposes without any further development (sections 9.7 and 9.8 deal with these aspects more fully). However because it has been developed as a low resource-using model, based on readily available data it is suggested that the model offers a high rate of return to the inputs used. It can be used to generate a huge amount of industry disaggregated income and employment dependency data and its limitations are no greater than those that are placed on all static input-output models, which are normally more expensive in terms of input requirements and provide less disaggregated results (the North Staffordshire model (op cit) for example has only 27 sectors, the Peterborough model only 12).

One of the main uses of this model would be to provide background data for more detailed sectoral and economic impact studies. The West Midlands County Council for example are currently commissioning a number of sector studies, one (of the fastener industry W.E.R.U.,1982), was able to draw on some provisional results of this model. Sectors selected for analysis can be identified by the model itself; those highly ranked in terms of job or income dependency for example. Alternatively, sectors vulnerable to decline or expected to expand can be examined in terms of the anticipated impact on other sectors in the area.

Any number of impacts can be simulated using any vector of known or hypothetical (for example based on forecasts from national forecasting models) final demands. Simulations can be made in terms of employment, employment income, value-added, or gross-income.

9.7 Testing the Model

The main difficulty of testing the model is that we do not have any accurate data with which to compare the results.

Usually we are able to compare results of one model with those of others and check for consistency. This is more difficult in this case because other single area models have not been developed on the same basis as the E-D model. That is to say single area models are usually concerned with the impact of changes in final demand for the areas output rather than changes in U.K. final demand.

A number of possibilities were explored. An initial possibility which looked promising was to compare the results of the E-D model with those of the North Staffordshire model (Pullen et at, 1981). On examination of the sectors, however, it was discovered only two were identical (sector 13 and 16 in the N.Staffs model; 79 and 80 in the E-D model respectively). It was also not possible to use the employment data by MLH provided in an appendix of their report (Table D.3) since a large number of MLH's appeared to be missing from both the list of employees in MLH's and MLH's with no significant employers (See Appendix D, Pullen et al, 1981). No comparison of sector 79 (E-D model) with sector 13 (N.Staffs model) could be made because the sector was recorded as having nil [1] employees in the West Midlands Region in the published employment census data. A limited comparison could be with pottery and glass, sector 80 (E-D model) and sector 16 (N.Staffs model).

We can convert the estimated impact in the West Midlands region of a change in final U.K. demand for pottery and glass (in the E-D model) to an estimated impact in the West Midlands Region of a change in final demand for West Midlands output of pottery and glass, by replacing the diagonal of the U.K. gross income matrix for the diagonal of the West Midlands gross income matrix [2]. This gives us

(465 - 418) = indirect and induced effect all industries except pottery and glass.

1000.7 = direct and indirect effect on pottery and glass

1047.7 = total effect.

1 Sectors with less than 1000 employees are assigned nil values in the published tables.

2 This is not strictly in accordance with equation 7 but where the diagonal in the Leontief inverse is close to 1000 the result is insignificantly different and much easier to compute. In any case there is some justification for using this method. It assumes that all the direct, indirect and induced effect on the industry itself is felt in the area, while all other indirect and induced effects only fall within the area on the basis of the share of an industry's employment in the area.

This is for a £1 million increase, which is equivalent to a multiplier of 1.048, somewhat smaller (17%) than the 1.262 from The North Staffordshire study, although, a priori, we would expect the West Midlands regional multiplier to be larger, since it is a larger area, incorporating North Staffordshire.

Another possibility was to compare the results of the E-D model with those for Scotland (Fraser of Allander Institute, 1978). Here there was more scope for comparison because 41 sectors were identical and the years of construction were only one year apart. (1973 for Scotland and 1974 for the E-D model).

A priori it could be anticipated that the Scotland tables would indicate higher gross income multipliers than the E-D model would predict for Scotland. There are two reasons for this. Firstly; the multiplier work reported in Chapter 8 reveals much higher aggregate income multipliers for Scotland, than the other regions, due to a much lower import leakage coefficient. (See for example Steele (1969 and 1972)); and secondly the basic E-D model assumes there are no specifically local linkages.

The method of calculating the E-D gross income multipliers was the same as for the comparison with North Staffordshire. The comparable gross income multipliers are presented in Table 9.12.

All the E-D multipliers are lower than those in the Scottish model (as anticipated). The degree of difference is perhaps greater than expected in the case of MLH 214 (industry 14,9). The Scottish multiplier is much higher in this industry than that for the United Kingdom (1.4525). The E-D model would never yield a regional (or area) multiplier greater than that for the United Kingdom, because of the way it has been set up. (The E-D model distributes the United Kingdom indirect and induced effects between the regions on the basis of employment shares). The Scottish multiplier is very high and it is difficult to explain why it should be greater than that for the United Kingdom. The sector multipliers are between 44 and 6 per cent lower (17 per cent on average) in the E-D model than in the Scottish model. Given the high average consumption multipliers in the Scottish studies (eg. Grieg, Allen, Brownrigg op cit) surveyed in Chapter 8, due to the low estimated import leakage coefficients [1], we might conclude that the E-D model would underestimate impacts on the Scottish economy, and possibly more accurately reflect the regional impacts in areas such as the West Midlands with high import coefficients (mpm = 0.89 in Steele, 1972). We also know that the E-D model is likely to reveal lower multipliers than other studies, in its basic form, because it assumes no specifically spatial linkages exist. These results reaffirm that hypothesis.

1 For example Steele, 1972 estimated the Scottish marginal propensity to import at 0.47 compared with an average of 0.65 for the other British regions.

Table9.12 Gross output multipliers. A comparison between the Employment-dependency model and the Scottish model.

Industry Number

E-D Model	Scottish model	E-D multiplier	Scottish multiplier	E-D multiplier as a % of Scottish multiplier
8	5	1.0531	1.3138	80.8
9	7	1.2818	1.3069	98.1
13	8	1.0548	1.6858	62.6
14	9	1.1949	2.1445	55.7
23	15	1.0882	1.3335	81.6
31	19	1.2672	1.5138	83.7
36	21	1.1178	1.3644	81.9
37	22	1.0764	1.1713	92.0
38	23	1.0503	1.3553	77.5
42	25	1.1025	1.2824	86.0
43	26	1.0612	1.1516	92.2
45	27	1.1129	1.2600	88.3
47	29	1.0425	1.1983	87.0
48	30	1.0570	1.2392	85.3
55	33	1.0691	1.2686	84.3
56	34	1.0392	1.1880	87.5
57	35	1.0381	1.3017	79.8
60	37	1.0337	1.1048	93.6
65	38	1.1314	1.2802	88.4
66	39	1.1111	1.2149	91.5

68	41	1.1106	1.4803	75.0
69	42	1.0644	1.2021	88.5
71	44	1.0618	1.3333	79.6
72	45	1.1227	1.4161	79.3
77	48	1.0462	1.1801	88.7
78	49	1.0360	1.1599	89.3
79	50	1.0545	1.4604	72.2
85	55	1.0976	1.2731	86.2
86	56	1.0975	1.2510	87.7
87	57	1.0732	1.2634	84.9
88	58	1.0479	1.2609	83.1
89	59	1.0608	1.3106	80.9
92	62	1.0618	1.6453	64.5
6	63	1.1111	1.2875	86.3
7	64	1.2196	1.4809	82.4
5	65	1.0574	1.3662	77.4
93	66	1.0276	1.2424	82.7
94	67	1.0265	1.2308	83.4
95	68	1.060	1.2804	82.8
97	70	1.0226	1.0886	93.9

Another possiblility for comparison was with the results of a survey of component suppliers to the car industry in the West Midlands Region undertaken by the Department of Industry (Crompton, Barlow and Downing, 1976). One of the questions they attempted to answer was concerned with the hypothetical closure of a car factory:

> "How many other jobs will be lost in the component suppliers and service industries?"
>
> Crompton et al op cit p 1, para 3

In conclusion they wrote:

> "In June 1975 the West Midlands car assemblers had a total employment of 99,900 and the "first round" dependency in the WM component suppliers was 103,400. The total of 203,000 represented 9.0% of all WM employees or 18.8% of all manufacturing employees. This is a lower level of dependency than those shown in previous estimates (para 10)."
>
> Crompton et al op cit p 41, para 34

It seems from this conclusion that they were attempting to estimate the direct effect on employment of the total elimination of car assemblers and component manufacturers in the West Midlands. This makes comparison with the E-D model more difficult. If we examine the results in Table 9.5 the E-D model estimates there are 189,995 jobs in 1974 in the West Midlands dependent on final demand for U.K. produced motor vehicles. This includes direct, indirect and induced effects but the results are not based on the elimination of motor vehicles manufacture but on the elimination of final demand for motor vehicles. This is an important distinction; of the 169.9 thousand people employed in the motor vehicle industry in 1974 only 135.9 thousand were estimated to be dependent on final demand for motor vehicles. The remainder were dependent on the demand for industries to which the motor vehicles industry provides intermediate supplies. Grossing up the total estimate by 169.9/135.9 will give an approximate figure to compare with the DI estimate. We have:

$$190 \times 169.9/135.9 = 237.5 \text{ thousand}$$

This is higher than the DI estimate of 203 thousand but includes induced and all indirect effects and jobs in 'non-inlcuded' [1] industries. From the matrix (**ZFDIAG** for the West Midlands) we can estimate the number of 'non-included' industries. These totalled 10.6 thousand jobs. This reduces our estimate to 226.9 thousand but includes the induced and all indirect effects.

1 In practice it is difficult to identify the 'non-included' industries. The DI study "does not consider employment in the service industries in distribution, dealer networks, banking, public utilities, catering and so on. op cit para 5. For the estimate, industries 1 to 30, 68 to 71, 74, 76 to 79, 81 to 88, 92 to 99* were indentified as the 'non-included' industries.

This estimate is some 12 per cent higher than the DI estimate but still includes the induced effects and all the indirect effects (except in the excluded industries). Of course we cannot be sure that all industries have been excluded which they did not include. In any case the estimate seems reasonably comparable.

This exercise of comparison with the DI study reveals the value, use and cost-effectiveness of the E-D model. The DI study involved a large survey, only 'first-round' effects were identified and the study concentrated on a single industry in a single region. The E-D model however can detail a comprehensive estimate of total (or partial) effects in terms of jobs, income, employment-income, value-added, gross income in all regions (areas) for all industries, has probably involved less resources to be set up, and has produced a similar overall estimate.

9.8 Updating and developing the model

As yet the model has not been updated from its 1974 base. The problem of updating input-output type models is well known. (And is the reason for the delay in updating national I-O tables). The RAS method is most widely used, (it is used for the national updating) but is subject to many problems of implementation [1], in addition to any problems with the technique itself (which is essentially an iterative proceedure albeit with a scientific basis which minimises errors).

1 For example we need to have total output figures by MLH but although these are available for the manufacturing and production industries they are not available forall the others, and not on a consistent basis.

For the purpose of the E-D model an update of the national I-O tables would be required. Since this table is in any case updated (eventually) by C.S.O. the use of valuable research time at the local level to duplicate this exercise would appear particularly wasteful.

A method which would update only a local model would therefore be more appropriate. In doing so we could therebye concentrate on relevant sectors.

Suppose we have a known set of U.K. final demands for a later year we can estimate the predicted number and industrial distribution on employement in an area, based on the table constructed for an earlier year. This can then be compared with the actual distribution and level of employment. We can then attempt to correct the model where relevant discrepancies occur. At the same time we can allow for changes which are known to have occured: price changes for industrial outputs, by sector; productivity increases, by sector; changes in production functions; changes in import ratios and export ratios. Much of these data are available from the census of production. If relevant sectors are concentrated on this will reduce the size of the exercise. Where errors in prediction of sectoral employment occur an indication of the reason for the error can be gleaned if a similar prediction is made for the United Kingdom. Where errors are generated both nationally and locally we know we are looking for something which is industry wide. Where the error is more specifically in local predictions we know we are looking for identified dependent sectors in the U.K. matrix for the same sectors in the area model.

Survey data can be collected and used to adjust the model to more accurately reflect local dependency. Survey data however are costly to collect and, since the model has been developed as a low-cost model, this exercise should be kept to a minimum. We can minimise survey data collection by once again concentrating only on relevant sectors, and by concentrating on regional purchasing proportions (rather than the technical coefficients). Stevens and Trainer (1978) for example, concluded after undertaking extensive simulations of input-output matrices, that the regional purchase coefficients (the proportion of demand for an industry's output which is purchased locally) were the major determinant of the output multipliers, whilst the technical coefficients had much less effect. Drake (1976) also found the technical coefficients had little effect in determining the output multiplier. [1]

1 These findings motivated Burford and Katz (1981) to develop a formula $\hat{u}_j = 1 + \left(\frac{1}{1 - \bar{W}}\right) w_j$, where $\hat{u}_j$ is the estimated gross output multiplier for sector j, W_j, $1 \leq j \leq n$ is the column sum of the regional purchase matrix for industry j and $\bar{W}$ the average column total (n is the number of intermediate sectors). Harrigon (1982), using their method to estimate multipliers for Scotland found that "for the second-to-final-round impacts Burford and Katz's formula generates percentage errors which average 22.2 per cent in comparison to 14.8 per cent for the prior probabilty augmented approach." Harrigan op cit p 380. The 'prior probability augmented approach' to which Harrigon refers is based on the anticipated distribution of the coefficients in the A matrix, based on other regional models or the national model. This Harrigon claims would be superior to the Burford and Katz assumption of "equal prior likelihoods for all non-negative matrices satisfying the column sum control" Harrigon op cit p 377

spatial factors.

We have assumed we have a known set of U.K. final demands. In fact this is not so. The census of production collects output figures for production industries. Estimates of final demand can be made for these industries on the basis of the same proportion of output going to final demand as in 1974. There will still remain the problem for other non-production industries. Some data are available but others are not, estimates will have to be made and the aggregate constrained to sum to the total output data in the National Income and Expenditure (Blue Book) accounts.

A further development of the model, which may be necessary in order to improve its impact simulations, would involve the 'dependent' sectors. There is a traditional view that some industries are basic, and sell their output outside (and inside) the area. Other industries are dependent and sell their output to the local market. The retail trade, many personal services and so on are likely to fall into this latter category. The E-D model has been developed in its basic form to ignore this distinction. Yet it was recognised at the outset that this would necessitate refinement at a later stage. The simplest way to allow for this would be to identify those sectors which would be deemed basic and those which would be dependent. If we can do this the exercise of estimating the predicted impact on an area is very simple. The technique would be similar to that used to convert the effect of a change in final demand in the U.K. to a change in final demand for the area (equation 7). Basically it involves replacing the relevant sums of the impacts in the

9.9 Conclusion

An evaluation technique which would simultaneously provide a comprehensive set of reasonably accurate, industrially and spatially disaggregated, data from economic impact simulations, on a relatively low budget, was sought. The E-D model has been developed to achieve a balance between these somewhat conflicting crtieria.

Other single area models have attempted to model the region (area) as if it were a local economy, treating its exports as a sector of final demand for the area's output. These flows are very large, particularly for the small area, and the export flows of intermediate goods are not strictly exogenous, since some feedback will occur. The multi-regional input-output models encapture these feedback effects but are expensive to develop. The E-D model was developed to overcome this problem for the single area model by modelling the local economy as an integral part of the national economy.

In its basic form the E-D model has a number of fairly restrictive assumptions: that the technical relationships of local industries are identical to those of the U.K. industries and that local industry purchases and sales are based on industrial purchasing and sales patterns rather than spatial linkages. The first assumption is commonly adopted for low budget models, the latter is more unusual.

The justifications for the latter assumption were: that for many industries it would be reasonably accurate, though it was recognised that for some industries in the tertiary sector, in particular, it was likely to be inappropriate; that it would facilitate the development of a very simple technique, using the national input-output model and employment data; that it would overcome the problem of the identification of feedback effects; and that the results would be generated in terms of an expansion (or reduction) in U.K. final demands, rather than regional (or local) final demands, which are seldom known or anticipated. (Though a technique for estimating the impact of known or forecast changes in local final demand is also given.)

The basic model attributes industrial-dependency to regions (areas) on the basis of the distribution of employment throughout the regions (areas). The basic matrix, the **Z** matrix, indicates the employment-dependency of an area. Each column of **Z** indicates the number of jobs in each industry dependent on a unit of **U.K.** final demand for the industry. The column totals represent total employment dependency in the area on a unit of **U.K.** final demand for the corresponding column industry. **Z** is obtained by pre-multiplying the national Leontief inverse (table E of the 1974 input-output tables) by a diagonal matrix **R** where r_{ii} is the proportion of total employment in sector i located in the area.

If **Z** is multiplied by any vector of **U.K.** final demand this indicates the total number of jobs and their industrial distribution required to produce that final demand.

From the basic **Z** matrix we can also compute a matrix **Y** indicating the employment-income dependency in the region, by multiplying **Z** by a row of employment income per unit of industry gross output. Similarly we can compute a matrix **G**, of gross income, a matrix **P** of profits and a matrix **V** of value-added. In each case the assumption is that their spatial distribution is proportional to the employment distribution.

This family of matrices then enables a vast amount of data to be simulated with a range of units of measurement. The results so far generated from the basic model have been regional. Although the model has been developed for use at the local area level, only regional employment data are published. Some West Midlands County data were also obtained but the year was incompatible with the input-output data. These results are presented with the regional results.

To illustrate the use of these data a number of tables have been produced, indicating: the ranking of industrial dependency in the regions in terms of employment; the industrial structure of dependence on final demand for a particular industry (motor vehicles) in the West Midlands region; the number of jobs in 1974 in the West Midlands dependent on that industry and in which industries they were employed; the ultimate industrial dependency of a particular industry (fasteners) in the West Midlands region; the regional distribution of employment dependency on a particular industry (electronic computers); the rankings of employment-income dependency, profit dependency, value-added dependency and gross income dependency of the West Midlands region.

These results illustrate the vast number of uses of the model for economic simulation exercises. The model can also be adapted to simulate the effect of specifically regional (local) impacts. The limitations of the model are those which normally apply to input-output based models, that is their use for forecasting purposes, though where the budget constraint is relaxed this limitation can be overcome to some extent. One of the major uses of the model would therefore be to provide background data for more detailed sectoral analyses.

A number of comparisons of the model's results with those from other studies were made. Only one sector of the North Staffordshire model proved compatible with the E-D model and the West Midlands region E-D multiplier for that sector was some 17% lower than that from the N. Staffs model, (a priori we would expect the West Midlands regional multiplier to be higher than for one of its sub-regions). The comparision with the Scottish model also revealed low E-D multipliers by comparison, again an average 17% lower. We know that the Scottish multipliers are on average high, due to a relatively low import coefficient. Furthermore we would anticipate the E-D multipliers to be low because of the assumption of no specifically spatial purchases These comparisons might therefore enable us tentatively to conclude that in its basic form the E-D model tends to provide a base line or minimum impact estimation, but that if revised to incorporate the full impacts on the 'tertiary' or 'dependent' sectors, (using the method suggested in Section 9.8 above) the results would be broadly similar to those gained by survey data.

The comparison with the Department of Industry study which attempted to estimate the indirect impact of vehicle industry decline illustrates the real value of the model. The results from the E-D model were broadly similar to those gained from the survey, but were much more extensive and detailed. The results were also broadly similar to a recent study of the vehicle industry on Merseyside. (Stoney 1983, see Section 9.3)

As with any economic model the potential for revision and refinement remains. A number of possibilities have been suggested. Since however, one of the major advantages of this technique lies in its low resource utilisation the suggestions for development have also concentrated on this aspect. In order to avoid expensive survey and data collection the concentration on a number of key sectors has been postulated. Key sectors would be those where forecasting errors were significant, those which were important in terms of dependency, those with large numbers of employees (relatively or absolutely) and those where information was relatively easy to collect.

PART V

CONCLUSION

PART V

Chapter 10

CONCLUSION

The work reported here began with the recognition that there was an increasing level of unemployment and associated employment problems; that the manifestation of those problems was geographically disparate; and that there was a growing response to those problems at the local level. Throughout the period of study (1977 to 1983) the problems of the labour market have increased; the geographical incidence of those problems has remained disparate; central government intervention in the economy has been reduced; and local initiatives have mushroomed, despite a tightening of local authority finances. In spite of this, the early recommendations[1] that local initiatives should be monitored, evaluated and set within the context of a coherent framework of intervention, has not been adapted. In this final chapter, we attempt to summarise the main findings of the various stages of research. This is done by structuring the remainder of the conclusion around the series of questions raised in the introduction to the thesis. Each question will be raised and the appropriated answers provided.

1 J.U.R.U.E. (1979)

The initial question was:

(1) Can local initiatives influence the level of economic activity in the area?

In order to attempt to answer this question it was necessary to investigate the nature, causes and manifestations of unemployment in the context of alternative theories of the operation of the labour market and with a recognition of the limitations of the data. The results of this exercise are reported in Part II. Three hypostheses were considered: that some of the increase in unemployment was the result of demand-deficiency; that some of the increase in unemployment was structural and therefore the result of an increasing mis-match of jobs and workers; and that some of the increase in unemployment has been caused by unemployed workers deliberately lengthening their job search time.

That there has been a growing level of demand-deficient unemployment in relation to labour supply is apparent. The major pieces of evidence to support this are the acceleration of unemployment, the lack of job vacancies, the growth of long-term unemployment, and since 1979 the massive downturn in employment and fall in industrial and manufacturing output.

A growing mis-match of jobs and workers is also apparent. Here the evidence was more difficult to assemble. Structural unemployment is difficult to identify when there is an excess supply of labour. This is because the methods, using unemployment and vacancy statistics, previously employed by economists, are based on the assumption that a general increase in structural mis-matching cannot take place. Yet if workers have redundant skills or no skills and experience, whilst production techniques, in some industries at least, become more sophisticated, then technologically superior products will be manufactured in other countries.

Although in a narrow sense the unemployment which results is demand-deficient, (and vacancies will not exist for those jobs), in the real sense this unemployment is the result of a change in the demand for labour not matched by a change in the skills of the workforce. The separate identification of structural and demand-deficient unemployment therefore proved impossible. However, evidence of structural change in employment and unemployment could be identified. The existence of long-term unemployment, particularly of older males, indicates not only that there is demand-deficiency but that the problem of re-employment is more acute for those who are difficult or uneconomical to retrain. This is supported by the fact that young people who are also suffering very high relative unemployment rates are experiencing relatively short average durations of unemployment. The spatial variation in the growth of unemployment, exemplified by the disproportionate growth of West Midlands unemployment also suggests structural changes. In addition the shifts in the proportions of employment and unemployment distributed amongst occupations indicates the structural components of the unemployment growth. This is also supported by the differential impact of unemploymnet on males and females. Taylor J (1976) interpreted these differences as evidence of an increase in voluntary unemployment. But it has been clearly demonstrated that both occupationally and industrially women and men are essentially participating in different labour markets; and furthermore the female labour market has been in a much healthier state than the male labour market, at least in terms of employment, (women full-time workers earn on average only 74 per cent of male earnings).

That there was a once and for all shift in the level of unemployment, as a result of the introduction of earnings related supplement, associated with an increase in the average duration of unemployment seems certain. (Though since ERS is no longer payable we might reasonably expect that this component of unemployment (voluntary) is now no greater than pre-1966 and must be insignificant). That unemployment has continued to increase as a result of 'generous' unemployment compensation resulting in a high 'replacement ratio' is not supported by the evidence[1]. Only a small proportion of the unemployed have been in receipt of ERS and the replacement ratio has declined since 1977. If the average search time had increased as a result of an increase in the replacement ratio this might in any case have improved the matching of jobs and vacancies and would therefore not have been

1 Those studies (eg. Maki and Spinder 1975, Cubbin and Foley 1977) which have indicated that the size of the 'replacement ratio' has continued to contribute to a growing level of unemployment have been shown (by Junakar 1981 and Nickell 1979) to be based on structually unsound regression results.

unequivolically undesirable; but during periods of excess labour supply when job vacancies are relatively few any increase in voluntary unemployment would be reflected in who is unemployed rather than how many are unemployed.

Although evidence of a growth of structural and demand-deficient unemployment was found, the separation and evaluation of the two types, which were shown to be inextricably bound together, proved impossible.

The existence of involuntary structural unemployment provides a rationale to search for micro-economic and spatial policies to facilitate an improvement in the operation of the local labour market. (That task is however extremely difficult in the sense that since job vacancies do not exist, speculations about the types of skills that would improve the prospects of workers are difficult to identify.)

The next question to be raised was:

(2) What local initiatives can be taken and how will they influence economic activity in the area?

No attempt was made to survey and list the range of local authority initiatives. However, the potential range of demand and supply side instruments and the potential for improving the operation of the labour market were identified. The potential for local initiatives is, on the one hand wide-ranging, but, at the same time, constrained by a number of factors. The analysis (in Chapter 7) concentrated on how local initiatives could improve the social and economic welfare of the population of the area subject to the constraints that exist. It was shown, for example, how the provision of care facilities for children or old persons would contribute to the welfare of individuals who had responsibility for their care; how the earnings potential of individuals could be influenced; and how economic welfare could be redistributed amongst individuals. The main framework for examining this issue was an income flow chart mapping the income into and out of the area and identifying the areas of influence of the local authority. From this framework it was clear that local authorities, not only could, but inevitably would influence the level of economic activity in their area, and the distribution of welfare between individuals.

It is useful to consider policies within a coherent framework because it brings together the identification of instruments with the identification of objectives. This is an important exercise in order to recognise the expected effect of their policies. (For example, if the over-riding objective of local economic initiatives is to improve total welfare within the area, as postulated, then it is clear, for example, that instruments should be aimed at improving local labour supply either quantitively or qualitatively. However, if local authorities choose surrogate targets, such as reducing the local unemployment rate, then they may, misguidedly try to reduce local labour supply. They may therefore hit the surrogate target, whilst moving futher away from the real target.)

Next the question was raised:

(3) Can national spatial policies contribute to economic welfare?

Spatial policies of central government may seek to improve economic welfare in a number of ways. Policies may be pursued to relieve the pressure in the prosperous areas; to create growth in the areas where some 'slack' exists; and to redistribute income and wealth. Yet it is not clear that regional policy, for example, has achieved real net gains to society. That is partly because it is difficult to evaluate the full effect of policies and the full opportunity costs involved. Chisholm (1976) has noted the problems for the 'prosperous' regions during periods of slow growth. Even when pressure of demand exists in prosperous areas it is not clear that real welfare gains are made by diverting plants to sub-optimal locations. The car assembly plants of Merseyside, for example, continue to be sourced from the South East and the West Midlands. We need to evaluate the full effect of these increased costs in any assessment that is made. It is also not clear that a redistribution of resources from prosperous to poor areas redistributes individual welfare. The gains might accrue to the rich in in the poor areas and the losses fall on the poor in the prosperous areas. The pursuit of a redistribution of personal income and wealth, might be a more appropriate means of achieving a more equitable spatial distribution, through, for example, higher social benefits.

The fourth question raised was;

(4) Is local intervention likely to be cost-effective?

There is an obvious danger that local authorities will choose policies which are both 'conspicuous' and 'popular'. The promotion of the area and the provision of sites and premises are notable examples of these popular policies. These policies can be cost-effective, but unless the marginal benefits to the area and the full opportunity costs of their provision are identified this will not be known. Those services for which the local authority has sole responsibility (education, infrastructure, land-use zoning, transport etc) and their co-ordination into a coherent package of policy objectives might provide higher real rates of return[1]. Local initiatives can be cost-effective; but evaluation exercises involving the indentification of the discounted expected benefits and the full opportunity costs will be necessary to ensure that the cost-effective criterion is met.

Fifthly we asked:

(5) Do local initiatives contribute to national economic welfare, or are they zero-sum or negative sum games?

This problem is particularly relevant in the case of promotional activities of Local authorities. Many local authorities (if not most) now have at least one industrial or economic development

1 That is not to say that we should prejudge the outcome of evaluation exercises, but that some services can only be provided by local authorities, (and therefore shortfalls cannot be made-up by private provision); and there is much scope for those services to influence local economic activity.

officer, some have small teams and others have whole units or departments, whose main activity is to sell the area to potential entrepreneurs. Some of their activities provide information, other promotional ventures are aimed at overseas investors, yet a vast amount remains which is directed at attracting investment from other areas. Clearly there will be few, if any, net gains to society from this, and there must be an opportunity cost involved. There is also a risk tht the locational decisions of firms will be sub-optional resulting in a further cost to society. This presents local authorities with a dilemma. Each has to compete for the few foot-loose expanding firms, and to retain its existing stock.

In order to do this it may feel it has to promote the image of the area in order to avoid the lure of the neighbouring authority's jingle. From society's viewpoint therefore, there may be a loss of welfare, which has to be reconciled, but it cannot be done from the local level. Again, in order to determine the net benefits of these actions evaluation exercises are essential.

The next question raised was:

> (6) Can micro-economic initiatives, (as either a complement to, or a substitute for, macro-economic initiatives,) improve economic efficiency?

Micro-economic initiatives were shown to provide much scope for making an improvement in economic welfare. A whole range of potential improvements exist. The analytical framework used to identify the impact of micro-economic policy on individuals was the utiltiy-difference curve analysis.

Within this framework the effect of the redistribution of income and wealth; the effect of changes in the structure of taxation and benefit provision; removal of anomolies in the tax and benefit structure, (especially in the case of benefits to the unemployed) and an equalisation of treatment of males and females under the tax and social security legislation, all were shown to offer scope for improving economic welfare.

The next three questions were concerned with the identification and evaluation of locally implemented policies, of central government macro, micro and spatial policies and of other macro-economic changes, on local areas. Those questions were:-

(7) How can we identify, monitor, evaluate and assess the impact of local initiatives?

(8) How can we identify, monitor, evaluate and assess the spatial impact of national spatial policies and other central government micro-economic and macro-economic policies?

(9) How can we estimate the spatial impact of macro-economic changes, such as industrial growth or decline?

These questions can be answered together. This is the area where the research effort was concentrated, after an early recognition that many questions would remain unanswered until comprehensive monitoring and evaluation exercises had been undertaken. The results of the review of existing techniques were presented in Chapter 8. Chapter 9 considered the development of a technique to estimate the employment, employment income, profits, value-added and gross income dependency of an area. The technique can be used to simulate the effect of exogenous shocks and policy initiatives on local areas.

Many of the existing techniques of impact analysis have been develped to examine the effect of expansionary projects - new plants, regional investment aided programmes and so on. One of the main techniques of evaluation is the regional or area multiplier. This technique models the aggregate impact on a local economy of an initial investment. Most of the leakage coefficients were re-estimated (except for the regional import coefficient; the most problematic). The regional multiplier effects turned out to be small very close to unity. The marginal propensity to import from abroad has increased (since the calculations of Steele (1972) based on 1967 data), so the actual regional multipliers would on average be smaller. This effectively means that almost the whole impact on the area will be the initial exogenous shock. The model, however does not include the effect of any further investment effects which might result; nor does it include any response from central or local government. Where these occur the total impact will be more complicated and will be greater in the case of further investment effects; as would be the case if public expenditure was positively correlated with income. Where however public expenditure is counter cyclical the impact would be reduced.

The multiplier in the short-run, for exogenous falls in income, was shown to be somewhat lower than for exogenous rises is in income. This was due to the protection of income for short periods after redundancy (redundancy pay, savings, special income support schemes such as ECSC payments, and ERS and tax-rebates when these were applicable); and to local and central government remedial action whenever applicable (site clearance and development, award of special area status, etc).

The (Keynesian) multiplier analysis identifies the aggregate change in local income which results from an exogenous change in income via changes in consumption of the income recipients (or losers in the case of exogenous income falls.) This is a somewhat limited approach. Firstly, although the impact of the exogenous shock is identified the (opportunity) costs of the project are not considered; secondly, it fails to identify the 'gainers' and the 'losers', and thirdly, it fails to incorporate the full inter-industry effect which occurs not only via consumption but also via inter-firm purchases of intermediate goods and services.

The identification of the costs and benefits can be formulated within the cost-benefit analysis. The social accounting technique or Planning Balance Sheet (PBS) provides a more detailed statement, including those items which cannot be given monetary values and identifying the 'losers' and the 'gainers'.

Input-output analysis offers a more comprehensive model, incorporating the intersectoral linkage patterns within the local or regional economy. The main limitations of the input-output technique relate to its usefulness for long-term forecasting, where econometric models, may provide significantly better (though aggregate) results.

The main problem facing the constructers of any area or regional model relate to their cost-effectiveness. At the outset therefore, a decision between survey and non-survey techniques must be made. There has evolved an assumption that, because there are spatial differences in, for example, production functions and product-mix, survey based models are superior to non-survey techniques. Yet many survey-based models involve such a high degree of industrial aggregation that their usefulness will be much reduced. Nor is it clear that spatial differences are so great as to make the survey-based models more accurate. (The coverage of the survey may be crucial factor). In addition some spatial differences may be identified, and used to supplement non-survey models.

The single area input-output model once constructed indicates the industrial interlinkages, related to units of final demand or gross outputs of the area. A large proportion of industrial outputs will be in the form of exports from the area. These exports will consist of intermediate goods whose ultimate destination (final demand) may be within or without the area. The multi-area approach has been developed to incorporate fully these feedback effects, which the single area model cannot fully incorporate. The multi-area model however is extremely expensive and difficult to build.

The intersectoral flows model has been formulated as a low-budget alternative to the input-output model. This model uses readily available employment data as the unit of measurement, as opposed to income flows, and is based on the destination only of firms' outputs, no input data is collected. This method has been criticised for offering no consistency checks, yet it has been shown to perform at least as well as other models.

In spite of this armoury of techniques, it appeared that there existed a need for a model which could be implemented at the small area level; would be relatively easy to construct, and therefore of low-cost; would detail intersectoral linkages, at a reasonable level of disagregation; would provide a reasonable degree of confidence in the results; and could be adjusted and refined with supplementary data when available or whenever the budget constraint permitted empirical collection of data.

Employment data were collected regularly and were available to local authorities by area. The national input-output tables were compiled and published, though with some delay. These two sets of data seemed to provide therefore an ideal basis for construction of an industrial-dependency model. The development and construction of the basic model was based on a number of assumptions. Firstly, that intersectoral technical trading coefficients (a_{ij}'s) were identical to the national coefficients. Secondly, that industrial purchases of goods and services were distributed between areas on the basis of the distribution of employment between areas. The latter assumption is restrictive and 'a priori' likely to be inaccurate for local impacts. However, it facilitates the generation of data at a very low cost and the results are known to be biased downwards for known local impacts. For more general national impacts, whose spatial distribution is unknown, errors are less likely. Furthermore it offers scope for revision and refinement whenever the budget constraint permits additional data to be collected. Collecting of additional data would, in any case, be most cost-effective if effort were concentrated on certain key sectors. The way in which this simplicity in the model is achieved is by relating industrial dependency to U.K. final demands rather than area final demands.

The matrices of employment-dependency which were generated were almost as large as the national model for 1974, (ie 98 x 98 as opposed to 103 x 103). A number of industries had to be aggregated because of incompatibility with the employment data.

Additional matrices of employment-income dependency, profits-dependency, value-added dependency and gross-income dependency could be generated by assuming that employment-income, profits, value-added and gross-income were spatially distributed in proportion to the employment distribution.

As a result a large amount of industrial dependency data, for an area for which employment data were available, could be generated. Using regional data[1] and the West Midlands County area data[2] a large number of results were obtained. For example, from the employment-dependency matrices for each area, we could select the industries for which a unit change in final demand would be most significant. Not surprisingly, metal-based manufacturing industries and pottery dominated the West Midlands results; coal and steel in Wales; cotton and textiles in Northern Ireland and Lancashire; shipbuilding and coal in the North; and so on. We could also examine the industrial compostion of employment-dependency in an area on a single industry. The West Midlands for example was found to have 190 thousand jobs dependent on U.K. final demand for motor vehicles in 1974. Many jobs were in the industry itself but other metal-based industries were shown to be dependent on the industry. We could similarly examine the industrial dependency of a particular industry in an area. This is especially useful for primary industries, whose output is diverse and has a wide range of uses. The fastener industry in the West Midlands was shown to be dependent on final demand for motor vehicles, aerospace equipment, a wide range of miscellaneous metal-based engineering and electrical industries and construction. Jobs, income, and profits in the industry could therefore be assigned to sectors of final demand.

1 These data were easily and readily obtained from the DE Gazette.

2 The employment data of the West Midlands County area were for 1978, whereas the I-O tables were for 1974.

Also the spatial distribution of employment-dependency on a particular industry could be identified. We might, for example, wish to know the spatial dependency on an expanding or a declining industry. Electronic computers were chosen to illustrate this usage. The South East, Scotland and the North West were shown to have a disproportionate dependency on this industry. The number of jobs in each region per unit of final demand could be estimated.

From the employment-income dependency matrices a ranking of important industries could be made for each area. Comparing the results for the West Midlands region with the employment-dependencyresults illustrates,for example, thatthe motor vehicle industry is more important in terms of employment income genertion than job generation per unit of final demand, whereas 'other metal goods' is relatively less significant.

The profit-dependency results are probably subject to a greater degree of error than the others. Profits are less likely to be distributed on the basis of employment distribution than, say, employment-income, and are more variable from one year to another.

There is a great variation in the level of profitabiltiy from one industry to another and therefore some industries tend to dominate many areas; electricity and agriculture for example.

The value-added results combine employment-income and profits. Fasteners rank first in the West Midlands in terms of employment,

employment-income, value-added, and gross-income per unit of final demand. This result might have been anticipated, since 60 per cent of the United Kingdom employment in this industry is located in the West Midlands region.

All these data, which exist for all regions and all 98 industries, generated by the simple technique described in Chapter 9, relate dependency in an area to U.K. final demand. There can be no doubt that the method is economical.

It has a number of limitations, arising for a number of reasons: firstly it is subject to the criticisms which apply to all input-output models, and arise, basically, because of the static nature of the coefficients; Secondly it is subject to the criticisms which are levelled at non-survey techniques, and arise because there are spatial differences in product-mix, production functions, spare capacity and so on; thirdly it generates data which reflect the industrial dependency of an area to U.K. final demand rather than to the area's final demand.

The last limitation will only be a problem for some situations, in others it will be an advantage. Where however the exogenous change is known to occur within a particular spatial economy an adjustment can be made to identify the estimated effect of this change. This is done by replacing the direct impact proportion[1]

1 This can easily be caluculated as:

$$e_{ii} \frac{(1000)}{(L_{ii})}$$

where e_{ii} is the diagonal of the employment-dependency matrix and l_{ii} is the diagonal of the Leontief inverse matrix.

of the diagonal coefficient of the area impact matrix with the aggregate direct impact.

Where the budget permits supplementary data can be collected to improve the quality of the information generated. Concentration on a number of key sectors will improve the rate of return. Key sectors can be those with a heavy concentration in the area, those where recent changes are known to have occured, those where the area's industry is known to be dissimilar, for example, in terms of product mix, or those where expansion or decline is anticipated. The results from the model may be used as background to detailed sector studies for example.

The results were compared with those from other studies. Because of the high degree of aggregation in some studies (eg Pullen et al) the possibilities for comparison were limited. Only one sector of the North Staffordshire input-output study could be compared. The E-D model produced a smaller gross-income multiplier for the West Midlands region that that produced for North Staffordshire[1].

More scope for comparison existed with the Scottish input-output model: 41 sectors were identical. All the E-D gross income multipliers were lower in these sectors than in the Scottish model, by an average of 17 per cent.

1 North Staffordshire is a sub-region of the West Midlands region, 'a priori' we would anticipate a higher multiplier for the region than the sub-region.

There is a specific reason why the E-D model would produce multipliers which were too low for Scotland: The Scottish consumption multipliers are known to be relatively low, Scotland having a relatively low marginal propensity to import in consumption (Steele 1972). More generally, however, it was anticipated that the E-D model would produce minimum impact estimates, because of the assumption that all purchases are geographically distributed in relation to the distribution of the industry's employment. Economic base theory suggests however, that certain industries are 'dependent', selling only to the local economy. If we identify these industries (retail, personal services etc) we can again replace the coefficients of the local matrix with the coefficients from the aggregate (U.K.) matrix. In any case the estimates may be closer for regions such as the West Midlands, where the marginal propensity to import is relatively high.

This latter presumption is confirmed to some extent by a comparison with a Department of Industry study of dependency on vehicle assembly in the West Midlands. The results from the Department of Industry's survey of component suppliers to the car industry in the West Midlands Region were very similar to those generated from the E-D model.

The E-D model revealed a far more extensive set of impact estimates than the DI study, Stoney (1983) surveyed suppliers to the car assemblers on Merseyside. His results are also comparable with the E-D results, indicating that approximately 25 per cent of dependency on motor vehicle assembly is located in the West Midlands and a similar proportion in the South East.

These comparisons reveal the high degree of cost-effectiveness of the E-D model. These results were obtained very easily once the model had been set up. Furthermore, results in terms of employment, employment-income, value-added, or gross-income can be generated, whichever is thought applicable. In addition this information is for one industry, and the model has similar data for all industries, all areas.

As always the potential for revision, refinement and further testing remains. The model has, however, been developed as a low resource model. The high rate of return, in the form of the vast amount of data which can be generated for a range of simulations, has been revealed.

To summarise: it has been demonstrated that some involuntary structural unemployment exists. This offers the potential for micro-economic and spatial policy initiatives to improve the aggregate level of economic welfare. Those initiatives however, need to be monitered and evaluated within a framework, which identifies all the real benefits and the full opportunity costs. Techniques exists which can be put to that use, and used for the identification of the impacts of other exogenous shocks and structural changes. Yet at the small area level there remained difficulties in finding a suitable model which could be implemented with a minimum amount of resources and would provide industrially disaggregated impact simulations. It has been demonstrated that the use of the employment-dependency model developed in this study is capable of responding to those requirements.

APPENDICES

Appendix I

WEIGHTED REPLACEMENT RATIO (1981)

Assumptions used in weighting transfer benefits (1981)

(1) 60% of job losses experienced by males
40% by females

(2) 65% of females married
35% non-married

(3) 73% males married
27% non-married

(4) 50% of married males have a dependent wife
50% have a working wife

(5) 50% of married females pay full NI contributions
50% pay the reduced rate

(6) 60% of married males in the labour force have dependent children

(7) 35% of working married females have dependent children
65% have no dependent children

(8) Earnings of £5,000 for males and £3,750 for females (Females earn approximately 75% of male earnings. Although average earnings exceed £5,000, those of the newly unemployed are close to this figure.)

(9) 10% of the newly unemployed are excluded from claiming supplementary benefit, having savings in excess of £2,000.

(10) Refers to loss of full-time jobs

Table AI.1 shows the entitlement to benefit (Nov 1981) for individuals
Table AI.2 shows the weighting based on assumptions (1) to (10) above
Table AI.3 shows the calculations of the weights
Table AI.4 shows how the weighted total benefit ratio is calculated.

Sources of data: General Household Survey, Tables 4.18, 4.19, 4.20 and 4.21; National Insurance leaflets NI 196, November 1981; "Costing Unemployment", Economic Progress Report, February 1981.

[1] Two dependent children assumed.

TABLE AI.1 Entitlement to Benefit
(Rates at November 1981)

I No children

A Married man with dependent wife (householder)

£37.75	Scale rate for married couple
3.30	Heating payment
12.00	Mortgage interest or rent
1.50	Water charges
6.00	Rates
1.50	Repairs and insurance
£62.05	per week (£3,226.60 per annum)

B Single person (in rented flat)

£23.25	Scale rate for single person
NIL	Heating
10.00	Rent
1.25	Water
4.50	Rates
£39.00	per week (£2,028 per annum)

C Married man with dependent wife (householder)

£37.75	Scale rate
3.30	Heating
20.00	Mortgage interest or rent
1.75	Water charges
6.50	Rates
1.50	Repairs and insurance
£70.80	per week (£3,681.60 per annum)

D Single person (householder)

£23.25	Scale rate
1.65	Heating
20.00	Mortgage interest or rent
1.75	Water charges
6.50	Rates
1.50	Repairs and insurance
£54.65	per week (£2,841.80 per annum)

E (i) Married man (householder)

£37.75	Scale rate
3.30	Heating
25.00	Mortgage interest
2.00	Water charges
7.00	Rates
1.50	Repairs and insurance
£76.55	per week (£3,980.60 per annum)

Deduct - wife's earnings (£4 + expenses (£4) per week are excluded) (£3,334)

£646.60 social security payable

(ii) If wife loses job:

No social security payable

F (i) Married man (householder)

£37.75	Scale rate
3.30	Heating
30.00	Mortgage interest
2.25	Water
8.00	Rates
1.50	Repairs and insurance
£82.80	per week (£4,305.60 per annum)

Deduct wife's earnings less allowances (£6,084):

No social security payable

(ii) If wife loses job:

No social security payable.

II <u>With 2 children aged 11-15</u>

A

£62.05	As in IA
13.30	Plus allowance for children (2x£11.90) less child benefit allowance (2x£5.25)
£75.35	weekly benefit (£3,918.20 per annum)

B	£39.00	As in IB
	6.70	Plus allowance for children (2x£11.90) less child benefit allowance and single parent allowance (2x£8.55)
	£45.70	weekly benefit (£2,376.40 per annum)
C	£70.80	As in IC
	13.30	Plus allowance for children less child benefit allowance
	£84.10	weekly benefit (£4,373.20 per annum)
D	£54.65	As in ID
	6.70	Plus allowance for children less child benefit and single parent allowance
	£61.35	weekly benefit (£3,190.20 per annum)
E (i)	£76.65	As in IE
	13.30	Plus allowance for children less child benefit allowance
	£89.95	weekly entitlement (£4,677.40 per annum)

Deduct wife's earnings less allowances (£3,334)

£1,343.40 social security payable

(ii) If wife loses job:

No social security payable

F (i)	£82.80	As in IF
	13.30	Plus allowance for children less child benefit allowance
	£96.10	weekly benefit (£4,997.20 per annum)

Deduct wife's earnings less allowances (£6,084)

No social security payable

(ii) If wife loses job:

No social security payable

III <u>1 child under 11 years old</u>

A	£62.05	As in IA
	2.65	Plus child allowance (£7.90) less child benefit allowance (£5.25)
	£64.70	weekly benefit (£3,364.40 per annum)
B	£39.00	As in IB
	-0.65	Plus child allowance less child benefit allowance and single parent supplement
	£38.35	weekly benefit (£1,994.20 per annum)
C	£70.80	As in IC
	2.65	Plus child allowance less child benefit allowance
	£73.45	weekly benefit (£3,819.40 per annum)
D	£54.65	As in ID
	-0.65	Plus child allowances less child benefit allowance and single parent supplement
	£54.00	weekly benefit (£2,808 per annum)
E (i)	£76.55	As in IE
	2.65	Plus child allowance less child benefit allowance
	£79.20	weekly entitlement (£4,118.40 per annum)

Deduct wife's earnings less allowances (£3,334)

No social security payable

(ii) If wife loses job:

No social security payable

F (i)	£82.80	As in IF
	2.65	Plus child allowance less child benefit allowance
	£85.45	weekly entitlement (£4,443.40 per annum)

Deduct wife's earnings less allowances (£7,084)

No social security payable

(ii) If wife loses job:

No social security payable

TABLE AI.2 Weightings used in benefit entitlement calculations

Males(.6) - Married(.73) - with dependent wife(.5) - dependent children(.6)
no dependent children(.4)
wife working(.5) - dependent children(.6)
no dependent children(.4)
Supplementary Benefit(.9)(SB)
Unemployment Benefit(UB)(.1)

Non-married(.27)

Females(.4) - Married(.65) - husband working(.9) - dependent children(.35)
no dependent children(.65)
husband not working (.1) - dependent children(.35)
no dependent children(.65)
Full NI(.5)
Reduced NI (.5)
SB(.9)
UB(.1)

Non-married(.35)

Notes

1. It is recognised that this is an oversimplification of relationships e.g. there is not an equal probability of a husband being unemployed whether he has dependent children or not: a higher proportion of married males with no dependent children are unemployed than with dependent children. However, since we are concerned with job losers (rather than the existing stock of unemployed) this treatment is justified.

2. There are some unmarried males and females with dependent children but these represent a relatively small proportion of the labour force.

3. The overall ratio is only sensitive to quite large changes in any one weighting.

TABLE AI.3 Weightings derived from the assumptions

Males:	(.6)x(.73)x(.5)x(.6)x(.9)	= 0.11826	M, DW, Ch, SB or UB
	(.6)x(.73)x(.5)x(.6)x(.1)	= 0.01314	M, DW, Ch, UB only
	(.6)x(.73)x(.5)x(.4)x(.9)	= 0.07884	M, DW, SB or UB
	(.6)x(.73)x(.5)x(.6)x(.1)	= 0.00876	M, DW, UB only
	(.6)x(.73)x(.5)x(.6)x(.9)	= 0.11826	M, WW, Ch, SB or UB
	(.6)x(.73)x(.5)x(.6)x(.1)	= 0.01314	M, WW, Ch, UB only
	(.6)x(.73)x(.5)x(.4)x(.9)	= 0.07884	M, WW, SB or UB
	(.6)x(.73)x(.5)x(.4)x(.1)	= 0.00876	M, WW, UB only
	(.6)x(.27)x(.9)	= 0.1458	U, SB or UB
	(.6)x(.27)x(.1)	= 0.0162	U, UB only
		0.6	
Females:	(.4)x(.65)x(.9)x(.65)x(.5)x(.9)	= 0.068445	M, HW, Full NI, SB or UB
	(.4)x(.65)x(.9)x(.65)x(.5)x(.1)	= 0.007605	M, HW, Full NI, UB only
	(.4)x(.65)x(.9)x(.65)x(.5)x(.9)	= 0.068445	M, HW, Red. NI, SB or UB
	(.4)x(.65)x(.9)x(.65)x(.5)x(.1)	= 0.007605	M, HW, Red. NI, No entitlement
	(.4)x(.65)x(.9)x(.35)x(.5)x(.9)	= 0.036855	M, HW, Ch, Full NI, SB or UB
	(.4)x(.65)x(.9)x(.35)x(.5)x(.1)	= 0.004095	M, HW, Ch, Full NI, UB only
	(.4)x(.65)x(.9)x(.35)x(.5)x(.9)	= 0.036855	M, HW, Ch, Red. NI, SB only
	(.4)x(.65)x(.9)x(.35)x(.5)x(.1)	= 0.004095	M, HW, Ch, Red. NI, No entitlement
	(.4)x(.65)x(.1)x(.65)x(.5)x(.9)	= 0.007605	M, HU, Full NI, SB or UB
	(.4)x(.65)x(.1)x(.65)x(.5)x(.1)	= 0.000845	M, HU, Full NI, UB only
	(.4)x(.65)x(.1)x(.65)x(.5)x(.9)	= 0.007605	M, HU, Red. NI, SB only
	(.4)x(.65)x(.1)x(.65)x(.5)x(.1)	= 0.000845	M, HU, Red. NI, No entitlement
	(.4)x(.65)x(.1)x(.35)x(.5)x(.9)	= 0.004095	M, HU, Ch, Full NI, SB or UB
	(.4)x(.65)x(.1)x(.35)x(.5)x(.1)	= 0.000455	M, HU, Ch, Full NI, UB only
	(.4)x(.65)x(.1)x(.35)x(.5)x(.9)	= 0.004095	M, HU, Ch, Red. NI, SB only
	(.4)x(.65)x(.1)x(.35)x(.5)x(.1)	= 0.000455	M, HU, Ch, Red. NI, No entitlement
	(.4)x(.35)x(.9)	= 0.126	U, SB or UB
	(.4)x(.35)x(.1)	= 0.014	U, UB only
		0.4	

For abbreviations and notes see Table AI.4 below

TABLE AI.4 Weighted Benefit Ratio (Newly Unemployed)

Weights (1)		Benefit as a Proportion of Lost Earnings %[1]	Weighted Benefit Ratio (1) x (2)	
Males				
0.11826	x	78	9.22428	M, DW, Ch, SB or UB
0.01314	x	40	0.5256	M, DW, Ch, UB only
0.07884	x	65	5.1246	M, DW, SB or UB
0.00876	x	38	0.33288	M, DW, UB only
0.11826	x	27	3.19302	M, WW, Ch, SB or UB
0.01314	x	25	0.3285	M, WW, Ch, UB only
0.07884	x	23	1.81332	M, WW, SB or UB
0.00876	x	23	0.20148	M, WW, UB only
0.1458	x	41	5.9778	U, SB or UB
0.0162	x	23	0.3726	U, UB only
0.6				
Females				
0.068445	x	31	2.35755	M, HW, Full NI, SB or UB
0.007605	x	31		M, HW, Full NI, UB only
0.068445	x	Nil	-	M, HW, Red. NI, SB only
0.007605	x	Nil	-	M, HW, Red. NI, No entitlement
0.036855	x	31	1.26945	M, HW, Ch, Full NI, SB or UB
0.004095	x	31		M, HW, Ch, Full NI, UB only
0.036855	x	Nil	-	M, HW, Ch, Red. NI, SB only
0.004095	x	Nil	-	M, HW, Ch, Red. NI, No entitlement
0.007605	x	89	0.676845	M, HU, Full NI, SB or UB
0.000845	x	31	0.026195	M, HU, Full NI, UB only
0.007605	x	89	0.676845	M, HU, Red. NI, SB only
0.000845	x	Nil	-	M, HU, Red. NI, No entitlement
0.004095	x	89	0.331695	M, HU, Ch, Full NI, SB or UB
0.000455	x	31	0.014105	M, HU, Ch, Full NI, UB only

TABLE AI.4 (continued)

0.004095	x	89	0.364455	M, HU, Ch, Red. NI, SB only
0.000455	x	Nil	-	M, HU, Ch, Red. NI, No entitlement
0.126	x	68	0.8568	U, SB or UB
0.014	x	31	0.434	U, UB only
1.0	Total of weights		34.10202	Total weighted benefit ratio[2]

Abbreviations and Notes:

- M - Married
- U - Unmarried
- DW - Dependent Wife
- WW - Working Wife
- Ch - Children
- Full NI - Married woman paying full NI contributions
- Red. NI - Married woman paying reduced rate NI contributions
- SB - Supplementary Benefit
- UB - Unemployment Benefit
- SB or UB - Whichever is higher
- UB only - Not entitled to SB (savings over £2,000)
- SB only - Married women not entitled to UB (reduced rate NI)
- No entitlement - Married women not entitled to UB as above and family entitled to SB (savings exceed £2,000)

1. Does not include the effect of tax reduction i.e. it is expressed as a proportion of gross income. (See Chapter 8 for estimate of direct taxation coefficient.)

2. Total weighted benefit ratio calculated on the basis of 100% take up of entitlement.

Appendix II

RESULTS OF TESTS ON STRUCTURAL CHANGES IN EMPLOYMENT AND UNEMPLOYMENT 1960-1979

To test the hypothesis that the distribution of (un)employment at time t_1 is insignificantly different from the distribution at time t_2.

Three measures of distribution were used:

regional, occupational and industrial.

An F test was used to test the null hypothesis

H_o : a = 0 b = 1

where $Y = a + bX + u$

and Y = (un)employment distribution in time t_1

X = (un)employment distribution in time t_2

The F statistic = $\frac{(SR-S)/g}{S/(n-k)}$ where g is the number of restrictions (2) and (n-k) the number of degrees of freedom in the unrestricted estimation (n-2).

The results were as follows:

	Males — % 1969	Employment — % 1979	Regions (change)[2]	
SE	33.93	32.40	2.34	
EA	2.87	3.13	0.07	
SW	5.82	7.03	1.46	$Y=0.70 + 0.93X$
WM	10.25	10.15	0.01	$r^2 = 0.9974$
EM	6.29	6.95	0.43	S=RSS= 1.6019
YH	9.00	9.11	0.01	Fstat = 8.6226
NW	12.55	11.72	0.69	
N	5.70	5.78	0.01	Reject H_o at 0.01 level
W	4.42	4.61	0.04	
SC	9.11	9.11	0.00	
Total	100.00[1]	100.00[1]	5.06=SR	

1. Note percentages may not exactly sum to 100 due to rounding.

	Males — % 1960	Employment — % 1969	Regions (change)^2	
SE) EA)	35.42	36.80	1.90	$Y = -0.67+1.05X$ $R^2 = 0.9993$
SW	5.74	5.82	0.01	RSS= 0.5618
WM	10.15	10.25	0.01	Fstat = 10.4044
EM) YH)	15.42	15.29	0.02	
NW	12.88	12.55	0.11	Reject H_o at 0.01 level
N	6.17	5.70	0.22	
W	4.71	4.42	0.08	
Sc	9.51	9.11	0.16	
TOTAL	100.00	100.00	2.51	

Males — % 1973	Employment — % 1979	Regions (change)^2	
33.08	32.40	0.46	$Y = 0.32+0.97X$
2.99	3.13	0.02	$r^2 = 0.9986$
6.35	7.03	0.46	RSS= 0.8540
10.31	10.15	0.03	F stat = 3.2696
6.44	6.95	0.26	
8.94	9.11	0.03	Cannot reject H_o
12.24	11.72	0.27	
5.87	5.78	0.01	
4.72	4.61	0.01	
9.06	9.11	0.00	
100.00	100.00	1.55	

Males — % 1969	Employment — % 1973	Regions $(\text{change})^2$
33.93	33.08	0.72
2.87	2.99	0.01
5.82	6.35	0.28
10.25	10.31	0.00
6.29	6.44	0.02
9.00	8.94	0.00
12.55	12.24	0.09
5.70	5.87	0.03
4.42	4.72	0.09
9.11	9.06	0.00
100.00	100.00	1.26

$Y = 0.38+0.96X$
$r^2 = 0.9996$
RSS= 0.2384
Fstat = 17.1957

Reject H_o at 0.001 level

Females — % 1969	Employment — % 1979	Regions $(\text{change})^2$
35.37	33.27	4.41
2.67	3.05	0.14
5.68	7.13	2.10
9.79	9.58	0.04
5.96	6.75	0.62
8.62	8.69	0.00
13.20	12.10	1.21
5.35	5.49	0.02
3.76	4.32	0.31
9.56	9.58	0.00
100.00	100.00	8.87

$Y = 0.91+0.91X$
$r^2 = 0.9967$
RSS= 2.2117
Fstat = 12.0486

Reject H_o at 0.01 level

Females — % 1960	Employment — % 1969	Regions (change)^2	
37.74	38.04	0.09	
5.30	5.68	0.14	
9.90	9.79	0.01	$Y = 0+1X$
14.60	14.58	0.00	$r^2 = 0.9983$
14.20	13.20	1.01	RSS= 1.4066
5.04	5.35	0.10	Fstat = 0.0011
3.55	3.76	0.04	
9.66	9.56	0.01	Cannot reject H_o
100.00	100.00	1.41	

Females — % 1973	Employment — % 1979	Regions (change)^2	
34.50	33.27	1.51	
2.86	3.05	0.04	$Y = 0.68+0.94X$
6.24	7.13	0.79	$r^2 = 0.9964$
9.79	9.58	0.04	RSS= 2.3846
5.23	6.75	2.31	Fstat = 4.5673
8.47	8.69	0.05	
12.68	12.10	0.34	Reject H_o at 0.05
5.54	5.49	0.00	
4.18	4.32	0.02	
9.51	9.58	0.00	
100.00	100.00	5.11	

Females — % 1969	Employment — % 1973	Regions (change)^2
35.37	34.50	0.76
2.67	2.86	0.04
5.68	6.24	0.31
9.79	9.79	0.00
5.96	5.23	0.53
8.62	8.47	0.02
13.20	12.68	0.27
5.35	5.54	0.04
3.76	4.18	0.18
9.56	9.51	0.00
100.00	100.00	2.15

$Y_2 = 0.25 + 0.97X$
$r^2 = 0.9985$
RSS= 1.090
Fstat = 3.8792

Cannot reject H_o

Males & Females — % 1969	Employment — % 1979	Regions (change)^2
34.47	32.77	2.89
2.80	3.10	0.09
5.77	7.07	1.69
10.08	9.91	0.03
6.17	6.87	0.49
8.85	8.94	0.01
12.80	11.88	0.85
5.57	5.66	0.01
4.17	4.99	0.10
9.28	9.31	0.00
100.00	100.00	6.15

$Y_2 = 0.77 + 0.92X$
$r^2 = 0.9972$
RSS= 1.8148
Fstat = 9.5660

Reject H_o at 0.01 level

Males & Females — Employment — Regions % 1960	% 1969	$(\text{change})^2$
36.25	37.27	1.04
5.58	5.77	0.04
10.06	10.08	0.00
15.13	15.02	0.01
13.35	12.80	0.30
5.77	5.57	0.04
4.30	4.17	0.02
9.56	9.28	0.08
100.00	100.00	1.53

$Y = -0.43+1.03X$
$r^2 = 0.9992$
RSS= 0.6667
Fstat = 3.8702

Cannot reject H_o

Males & Females — Employment — Regions % 1973	% 1979	$(\text{change})^2$
33.63	32.77	0.75
2.94	3.10	0.03
6.31	7.07	0.58
10.11	9.91	0.04
6.35	6.87	0.27
8.75	8.94	0.04
12.41	11.88	0.28
5.74	5.66	0.01
4.51	4.49	0.00
9.24	9.31	0.00
100.00	100.00	1.99

$Y = 0.4+0.96X$
$r^2 = 0.9986$
RSS= 0.9038
Fstat = 4.8095

Reject H_o at 0.05 level

Males & Females — Employment — Regions % 1969	% 1973	$(\text{change})^2$
34.47	33.63	0.70
2.80	2.94	0.02
5.77	6.31	0.29
10.08	10.11	0.00
6.17	6.35	0.03
8.85	8.75	0.01
12.80	12.41	0.15
5.57	5.74	0.03
4.17	4.51	0.12
9.28	9.24	0.00
100.00	100.00	1.35

$Y = 0.38+0.96X$
$r^2 = 0.9996$
RSS= 0.2924
Fstat = 14.4665

Reject H_o at 0.01 level

Males — % 1960	Unemployment — % 1964	Regions (change)^2	
20.90	21.21	0.10	$Y_2 = 0.21+0.98X$
2.42	2.38	0.00	$r^2 = 0.9874$
5.62	5.35	0.07	RSS= 5.4207
5.77	5.63	0.02	Fstat = 0.1509
3.66	3.67	0.00	
6.81	6.99	0.03	Cannot reject H_O
15.43	16.39	0.92	
10.74	11.81	1.14	
6.81	6.50	0.10	
21.86	20.06	3.24	
100.00	100.00	5.63	

Males — % 1964	Unemployment — % 1968	Regions (change)^2	$Y = 2.14+0.79X$
As above	23.75	6.45	$r^2 = 0.8103$
	2.20	0.03	RSS= 62.407
	5.78	0.18	Fstat = 1.1670
	9.35	13.84	
	4.88	1.46	Cannot reject H_O
	9.65	7.08	
	12.96	11.76	
	11.08	0.53	
	6.67	0.03	
	13.68	40.70	
100.00	100.00	80.61	

Males — % 1968	Unemployment — % 1979	Regions (change)^2	
As above	22.29	2.13	$Y_2 = 0.82+0.92X$
	2.32	0.01	$r^2 = 0.9480$
	6.95	1.37	RSS= 15.2390
	9.99	0.41	Fstat = 0.5751
	5.71	0.69	
	9.11	0.29	Cannot reject H_O
	15.62	7.08	
	8.97	4.45	
	6.26	0.17	
	12.77	0.83	
100.00	100.00	17.43	

Females — % 1960	Unemployment — % 1964	Regions (change)^2
18.79	17.48	1.72
1.69	2.01	0.10
5.96	5.51	0.20
6.36	5.83	0.28
3.58	3.28	0.09
6.76	6.78	0.00
17.59	16.53	1.12
9.34	10.81	2.16
8.25	7.52	0.53
21.67	24.26	6.71
100.00	100.00	12.92

$Y_2 = -0.33 + 1.03X$
$r^2 = 0.9732$
RSS= 12.4616
Fstat = 0.1464

Cannot reject H_0

Females — % 1964	Unemployment — % 1968	Regions (change)^2
As above	19.91	5.90
	2.10	0.01
	6.75	1.54
	8.30	6.10
	4.20	0.85
	7.85	1.14
	12.50	16.24
	9.85	0.92
	8.41	0.79
	20.02	17.98
100.00	100.00	51.475

$Y_2 = 2.09 + 0.79X$
$r^2 = 0.9038$
RSS= 30.9328
Fstat = 2.6564

Cannot reject H_0

Females — % 1968	Unemployment — % 1979	Regions (change)^2
As above	18.96	0.90
	2.20	0.01
	6.69	0.00
	10.64	5.48
	5.35	1.32
	9.54	2.86
	13.62	9.73
	9.30	0.30
	7.09	1.74
	14.61	29.27
100.00	100.00	51.61

$Y_2 = 2.14 + 0.79X$
$r^2 = 0.84325$
RSS= 37.01137
Fstat = 1.57799

Cannot reject H_0

Males & Females — % 1960	Unemployment % 1964	— Regions (change)^2
20.31	20.28	0.00
2.22	2.29	0.00
5.72	5.39	0.11
5.94	5.68	0.07
3.63	3.57	0.00
6.80	6.94	0.02
16.04	16.42	0.14
10.32	11.56	1.54
7.21	6.75	0.21
21.84	21.10	0.55
100.00	100.00	2.65

$Y = 0.07 + 0.99X$
$r^2 = 0.9939$
RSS= 2.6225
Fstat = 0.03697

Cannot reject H_o

Males & Females — % 1964	Unemployment % 1968	— Regions (change)^2
As above	23.13	8.12
	2.18	0.01
	5.94	0.30
	9.18	12.25
	4.77	1.44
	9.38	5.95
	12.88	12.53
	10.88	0.46
	6.95	0.04
	14.70	40.96
100.00	100.00	82.07

$Y = 2.27 + 0.77X$
$r^2 = 0.8124$
RSS= 59.8264
Fstat = 1.4875

Cannot reject H_o

Males & Females — % 1968	Unemployment % 1979	— Regions (change)^2
As above	21.20	3.72
	2.28	0.01
	6.86	0.85
	10.20	1.04
	5.59	0.67
	9.25	0.02
	15.62	7.45
	9.10	3.17
	6.53	0.18
	13.38	1.74
100.00	100.00	18.85

$Y = 1.05 + 0.89X$
$r^2 = 0.9434$
RSS= 15.3322
Fstat = 0.91805

Cannot reject H_o

Males — Employment — Industries$_2$ (SICs, 1958)

% 1960	% 1968	(change)^2
3.55	2.37	1.39
5.23	3.29	3.76
3.13	3.26	0.02
2.69	2.55	0.02
3.82	3.59	0.05
10.44	11.78	1.80
1.69	1.24	0.20
5.555	4.90	0.43
2.455	2.66	0.04
2.64	2.42	0.05
0.26	0.22	0.00
1.07	0.90	0.03
1.81	1.95	0.02
1.61	1.84	0.05
2.73	2.97	0.06
1.27	1.49	0.05
9.54	10.01	0.22
2.31	2.51	0.04
9.76	9.29	0.22
9.39	8.73	0.44
2.15	2.49	0.12
4.66	6.21	2.40
5.67	6.46	0.62
6.38	6.84	0.21
100.00	100.00	12.24

$Y = -0.08 + 1.02X$

$r^2 = 0.9469$

RSS = 12.1418

Fstat = 0.0918

Cannot reject H_o

Females — % 1960	Employment — % 1968	Industries (SICs, 1958) (change)^2
1.17	0.91	0.07
0.29	0.24	0.00
4.38	4.065	0.10
1.87	1.60	0.07
0.96	0.85	0.01
6.98	7.23	0.06
0.16	0.14	0.00
1.57	1.28	0.08
2.50	2.22	0.08
5.94	4.08	3.46
0.34	0.28	0.00
5.28	4.30	0.96
1.005	0.885	0.01
0.76	0.72	0.00
2.68	2.52	0.03
1.54	1.60	0.00
0.87	1.04	0.03
0.55	0.67	0.01
3.16	3.17	0.00
18.38	18.11	0.07
2.98	3.68	0.49
16.73	21.31	20.98
14.805	13.97	0.70
4.41	5.12	0.50
100.00	100.00	27.73

$Y = -0.26 + 1.07X$

$r^2 = 0.9665$

RSS = 24.6732

Fstat = 1.3639

Cannot reject H_0

Males & Females — % 1960	Employment — % 1968	Industries (SICs, 1958) $(\text{change})^2$
2.70	1.825	0.765625
3.48	2.15	1.7689
3.58	3.56	0.0004
2.40	2.20	0.04
2.80	2.56	0.0576
9.21	10.07	0.7396
1.15	0.83	0.1024
4.14	3.545	0.354025
2.47	2.50	0.0009
3.82	3.05	0.5929
0.285	0.25	0.001225
2.565	2.17	0.156025
1.52	1.55	0.0009
1.31	1.42	0.0121
2.71	2.80	0.0081
1.36	1.53	0.0289
6.46	6.65	0.0361
1.68	1.82	0.0196
7.41	6.995	0.172225
12.59	12.25	0.1156
2.44	2.94	0.25
8.95	11.88	8.5849
8.92	9.27	0.1225
5.68	6.19	0.2601
100.00	100.00	14.19

$Y = -0.34 + 1.08X$

$r^2 = 0.9561$

RSS = 12.5181

Fstat = 1.4697

Cannot reject H_0

Males — % 1969	Employment — % 1979	Industries (SICs, 1968) $(change)^2$
2.25	2.06	0.04
3.02	2.46	0.31
3.49	3.09	0.16
0.36	0.24	0.01
2.36	2.40	0.00
3.66	3.04	0.38
6.98	5.80	1.39
0.67	0.73	0.00
3.91	3.59	0.10
1.26	1.16	0.01
5.11	4.99	0.01
3.07	2.91	0.03
2.56	1.87	0.48
0.23	0.16	0.00
0.94	0.65	0.08
1.92	1.49	0.18
1.78	1.57	0.04
3.03	2.76	0.07
1.50	1.53	0.00
9.67	8.90	0.59
2.40	2.12	0.01
9.14	9.09	0.00
8.50	9.31	0.65
3.09	4.30	1.46
6.27	8.67	5.76
5.99	7.78	3.20
6.69	7.41	0.51
100.00	100.00	15.52

$Y = -0.22 + 1.06X$

$r^2 = 0.9340$

RSS = 14.9527

Fstat = 0.4718

Cannot reject H_0

Females — % 1969	Employment — % 1979	Industries (SICs, 1968) (Change)^2
0.87	0.94	0.00
0.22	0.16	0.00
4.20	2.95	1.56
0.08	0.04	0.00
1.63	1.34	0.08
0.84	0.57	0.07
2.35	1.50	0.72
0.64	0.56	0.01
4.14	2.94	1.44
0.15	0.13	0.00
1.28	0.97	0.10
2.36	1.53	0.68
3.93	2.21	2.96
0.28	0.19	0.01
4.31	2.99	1.74
0.88	0.64	0.06
0.68	0.53	0.02
2.53	1.91	0.38
1.59	1.22	0.14
1.04	1.11	0.00
0.70	0.74	0.00
3.15	2.98	0.03
17.60	16.56	1.08
5.35	6.69	1.80
21.89	26.80	24.11
12.19	15.13	8.64
5.12	6.63	2.28
100.00	100.00	47.93

$Y = -0.56 + 1.15X$

$r^2 = 0.9684$

RSS = 31.5289

Fstat = 6.50286

Reject H_0 at 0.01 level

Males & Females — Employment — Industries (SICs, 1968)

% 1969	% 1979	$(\text{change})^2$
1.73	1.60	0.02
1.96	1.50	0.21
3.76	3.03	0.53
0.26	0.16	0.01
2.08	1.96	0.01
2.59	2.01	0.34
5.22	4.01	1.46
0.66	0.66	0.00
4.00	3.32	0.46
0.84	0.73	0.01
3.66	3.32	0.12
2.80	2.34	0.21
3.08	2.01	1.14
0.25	0.17	0.01
2.22	1.62	0.36
1.53	1.14	0.15
1.36	1.14	0.05
2.83	2.41	0.18
1.54	1.40	0.02
6.40	5.62	0.60
1.75	1.54	0.05
6.87	6.55	0.10
11.95	12.32	0.14
3.95	5.29	1.80
12.27	16.21	15.52
8.34	10.84	6.25
6.10	7.08	0.96
100.00	100.00	30.71

$Y = -0.75 + 1.2X$

$r^2 = 0.9501$

RSS = 19.9758

Fstat = 6.7179

Reject H_o at 0.01 level

Males - Unemployment - Industries (SICs, 1958)
(United Kingdom)

% 1960	% 1968	$(\text{change})^2$
5.27	3.06	4.88
2.52	5.73	10.30
3.24	3.03	0.04
1.48	1.78	0.09
2.07	2.55	0.24
4.59	7.00	5.81
5.58	2.12	11.97
1.71	2.19	0.23
1.57	2.40	0.68
2.52	1.98	0.29
0.27	0.20	0.00
0.63	0.57	0.00
1.53	1.53	0.00
1.21	1.28	0.00
0.85	1.14	0.08
0.90	1.16	0.07
19.98	23.39	11.63
1.12	1.30	0.03
11.16	7.69	12.04
10.17	9.76	0.16
1.44	2.14	0.49
1.84	2.05	0.04
11.03	9.97	1.12
7.52	6.00	2.31
100.00	100.00	62.53

$Y = 0.03 + 0.99X$

$r^2 = 0.8897$

RSS = 62.4729

Fstat = 0.0095

Cannot reject H_o

Females - Unemployment - Industries (SICs, 1958)
(United Kingdom)

% 1960	% 1968	$(Change)^2$
1.40	1.22	0.03
0.25	0.24	0.00
6.51	5.38	1.28
1.79	1.47	0.10
0.77	0.86	0.01
6.00	6.85	0.72
0.38	0.24	0.02
1.02	1.10	0.01
2.17	2.20	0.00
8.17	4.77	11.56
0.25	0.24	0.00
4.47	4.40	0.00
1.02	0.86	0.03
0.64	0.61	0.00
1.92	2.08	0.03
1.79	1.71	0.01
0.51	0.86	0.12
0.25	0.37	0.01
2.43	2.44	0.00
18.90	20.42	2.31
1.02	1.96	0.88
7.02	9.05	4.12
27.46	25.55	3.65
3.19	4.64	2.12
100.00	100.00	27.01

$Y = 0.16 + 0.96X$

$r^2 = 0.9717$

RSS = 25.6899

Fstat = 0.5648

Cannot reject Ho

Males & Females - Unemployment - Industries (SICs, 1958)
(United Kingdom)

% 1960	% 1968	$(\text{change})^2$
3.99	2.77	1.49
1.81	4.86	9.30
3.84	3.40	0.19
1.47	1.73	0.07
1.62	2.29	0.45
4.65	6.98	5.43
3.96	1.83	4.54
1.43	2.02	0.34
1.62	2.36	0.55
3.74	2.42	1.74
0.25	0.21	0.00
1.53	1.17	0.13
1.31	1.42	0.01
1.00	1.17	0.03
1.06	1.29	0.05
1.06	1.25	0.04
13.98	19.84	34.34
0.84	1.15	0.10
8.33	6.86	2.16
11.67	11.44	0.05
1.25	2.11	0.74
2.99	3.15	0.02
14.35	12.42	3.72
5.99	5.79	0.04
100.00	100.00	65.54

$Y = 0.1 + 1.04X$

$r^2 = 0.8697$

RSS = 63.2994

Fstat = 0.38906

Cannot reject Ho

Males - Unemployment - Industries (SICs, 1968)

% 1969	% 1979	$(\text{change})^2$
2.87	2.50	0.14
5.87	3.34	6.40
3.21	3.55	0.12
0.33	0.25	0.01
1.42	1.49	0.00
2.50	3.06	0.31
3.81	4.35	0.29
0.27	0.31	0.00
2.16	2.05	0.01
1.66	1.42	0.06
2.13	2.25	0.01
2.41	3.40	0.97
1.91	2.12	0.04
0.22	0.26	0.00
0.61	0.70	0.01
1.65	1.21	0.19
1.37	1.37	0.00
1.34	1.48	0.02
1.20	1.67	0.22
23.26	20.62	6.97
1.46	0.85	0.37
7.99	6.53	2.13
9.29	9.48	0.04
2.47	2.49	0.00
2.25	3.51	1.59
10.12	11.91	3.20
5.82	7.36	2.37
100.00	100.00	25.496

$Y = 0.31 + 0.91X$

$r^2 = 0.9589$

RSS = 21.0746

Fstat = 2.7272

Cannot reject Ho

Females - Unemployment - Industries (SICs, 1968)

% 1969	% 1979	$(\text{change})^2$
1.50	1.09	0.17
0.23	0.14	0.01
4.72	4.94	0.05
0.10	0.10	0.00
1.43	1.63	0.04
0.89	0.79	0.01
2.07	1.87	0.04
0.57	0.60	0.00
3.82	3.58	0.06
0.18	0.14	0.00
1.05	1.00	0.00
2.41	2.54	0.02
3.81	3.42	0.15
0.28	0.35	0.00
4.35	5.30	0.90
0.89	0.77	0.01
0.73	0.67	0.00
2.22	1.97	0.06
1.87	1.91	0.00
0.96	1.22	0.07
0.39	0.43	0.00
2.89	2.65	0.06
19.45	18.78	0.45
3.00	4.21	1.46
9.48	11.46	3.92
25.85	21.02	23.33
4.73	7.20	6.1
100.00	100.00	36.93

$Y = 0.4 + 0.89X$

$r^2 = 0.9660$

RSS = 25.4653

Fstat = 5.850587

Reject H_0 at 0.01 level

Males & Females - Unemployment - Industries (SICs, 1968)

% 1969	% 1979	$(change)^2$
2.67	2.08	0.35
5.05	2.40	7.02
3.43	3.96	0.28
0.30	0.20	0.01
1.43	1.53	0.01
2.27	2.39	0.01
3.56	3.62	0.00
0.31	0.39	0.01
2.40	2.50	0.01
1.44	1.05	0.16
1.97	1.88	0.01
2.41	3.15	0.55
2.18	2.50	0.10
0.23	0.29	0.00
1.15	2.06	0.83
1.54	1.08	0.21
1.28	1.16	0.01
1.46	1.62	0.03
1.30	1.74	0.19
20.04	14.90	26.42
1.30	0.72	0.34
7.25	5.39	3.46
10.76	12.22	2.13
2.55	2.99	0.20
3.30	5.86	6.55
12.39	14.60	4.88
5.66	7.32	2.76
100.00	100.00	56.54

$Y = 0.47 + 0.87X$

$r^2 = 0.8879$

RSS = 48.2442

Fstat = 2.1498

Cannot reject Ho

Males - Unemployment - Occupations

% 1973	% 1979	$(\text{change})^2$
0.22	0.17	0.00
1.42	1.58	0.03
0.73	1.13	0.16
0.96	1.10	0.02
1.77	1.78	0.00
1.81	2.59	0.61
11.35	8.49	8.18
2.06	2.39	0.11
0.52	0.60	0.01
2.18	3.27	1.19
1.06	1.49	0.18
1.11	0.88	0.06
1.47	2.14	0.45
9.15	10.04	0.79
2.06	2.65	0.35
4.55	6.44	3.55
6.95	9.84	8.33
50.62	43.39	52.28
100.00	100.00	76.28

$Y = 0.85 + 0.85X$

$r^2 = 0.9868$

RSS = 22.20495

Fstat = 19.4816

Reject H_o at 0.001

Females - Unemployment - Occupations

% 1973	% 1979	$(\text{change})^2$
0.03	0.01	0.00
1.23	1.23	0.00
4.42	6.07	2.72
2.17	1.53	0.41
0.79	0.64	0.02
0.67	0.85	0.03
27.41	31.06	13.32
9.54	13.99	19.80
0.06	0.06	0.00
16.72	14.63	4.37
0.82	0.65	0.03
2.17	0.53	2.69
2.67	2.56	0.01
1.09	0.69	0.16
5.49	3.81	2.82
0.03	0.01	0.00
0.99	1.05	0.00
23.70	20.62	9.49
100.00	100.00	55.88

$Y = -0.13 + 1.02X$

$r^2 = 0.9578$

RSS = 55.2795

Fstat = 0.0874

Cannot reject H_0

Males & Females - Unemployment - Occupations

% 1973	% 1979	$(change)^2$
0.19	0.12	0.0049
1.39	1.48	0.0081
1.26	2.60	1.7956
1.13	1.23	0.01
1.63	1.44	0.0361
1.65	2.07	0.1764
13.66	15.225	2.449225
3.13	5.85	7.3984
0.46	0.44	0.0004
4.27	6.66	5.7121
1.02	1.24	0.0484
1.27	0.78	0.2401
1.64	2.27	0.3969
7.99	7.25	0.5476
2.55	2.99	0.1936
3.90	4.53	0.3969
6.10	7.22	1.2544
46.75	36.60	103.0225
100.00	100.00	117.97952

$Y = 1.2 + 0.78X$

$r^2 = 0.9747$

RSS = 31.7485

Fstat = 21.728

Reject H_o at 0.001 level

Males - Unemployment - Occupations

% 1960	% 1968	$(\text{change})^2$
1.80	1.20	0.36
0.50	0.28	0.05
0.09	0.09	0.00
0.04	0.04	0.00
0.03	0.04	0.00
0.31	0.45	0.02
0.70	1.47	0.59
5.15	7.34	4.80
0.58	1.10	0.27
0.29	0.14	0.02
0.51	0.28	0.05
0.44	0.27	0.03
0.38	0.36	0.00
0.13	0.25	0.01
0.05	0.05	0.00
0.12	0.16	0.00
0.84	2.04	1.44
0.93	1.37	0.19
0.76	0.90	0.02
6.27	6.54	0.07
1.35	1.37	0.00
8.75	9.90	1.32
1.80	1.79	0.00
4.35	3.46	0.79
6.07	6.60	0.28
57.73	52.48	27.56
100.00	100.00	37.89

$Y = 0.34 + 0.91X$

$r^2 = 0.9950$

RSS = 13.1244

Fstat = 22.6469

Reject H_o at 0.001 level

Females - Unemployment - Occupations

% 1960	% 1968	$(\text{change})^2$
0.34	0.58	0.06
0.24	0.06	0.03
0.11	0.03	0.01
0.13	0.11	0.00
0.12	0.06	0.00
0.09	0.15	0.00
2.77	2.67	0.01
0.06	0.05	0.00
0.30	0.31	0.00
4.39	1.37	9.12
3.09	2.33	0.58
0.96	0.47	0.24
0.77	0.42	0.12
0.06	0.02	0.00
0.32	0.27	0.00
0.13	0.08	0.00
1.82	2.41	0.35
2.93	2.19	0.55
15.83	24.51	75.34
11.49	11.09	0.16
21.16	16.74	19.54
2.91	7.01	16.81
29.95	27.04	8.47
100.00	100.00	131.39

$Y = 0.17 + 0.96X$

$r^2 = 0.9060$

RSS = 129.2639

Fstat = 0.1730

Cannot reject H_o

Note: Males and Females cannot be summed because occupational categories pre 1973 are different for males and females.

Data Sources: DE Gazettes and British Labour Statistics Historical Abstract. Employment data June each year. Unemployment data annual averages (pre 1969) or single equivalent month (post 1968). Wholly unemployed. All data Great Britain unless otherwise stated.

Appendix III

EMPLOYMENT - DEPENDENCY MODEL RESULTS

The tables presented in this appendix have been generated from the development of an employment-dependency model, which is fully described in Chapter 9 of the main text. The tables are mostly self-explanatory, but a few general notes and notes relating to specific tables will assist in their interpretation.

General notes

1. Each matrix is 98 x 98, the sectors are given in Table AIII.1.
2. Rows 1 to 72 in the printouts represent industries 1 to 72. Row 73 represents industry 74, row 74 represents industry 75*, row 75 represents industry 76 and so on up to row 98, which represents industry 99*. Industries 75* and 99* representing amalgams of industries in the UK input-output tables (see main text for details).
3. The columns follow the same ordering as the rows but are not numbered.
4. The format is difficult to follow for columns but is the result of the way the programme has been written.
5. The number of decimal places does not necessarily signify such a high degree of accuracy.
6. Column 98 (industry 99*) is subject to error (see main text).

The following tables are included, notes relating to each are given where there are specific factors.

Table AIII.1 Sectors in the E-D model.

Table AIII.2 Vectors of jobs per £1 million UK final demand, 1974 prices, in the respective industries, for all British Regions, the West Midlands County Council area, Great Britain and the United Kingdom.

Notes:

1. The West Midlands County results were computed using 1978 employment data for the County.

2. Northern Ireland can be computed by subtracting Great Britain from the United Kingdom.

Table AIII.3 Vectors of job-dependency based on the level of UK final demand in 1974 in the West Midlands Region and the United Kingdom in the respective industries.

Table AIII.4 Vectors of jobs, gross income, employment income, profits and value-added in the West Midlands County area and the West Midlands Region per £1 million of UK final demand, 1974 prices, in the respective industries.

Note: WMC results are of the order $(10)^3$ greater than actual results, because of the form in which the data were input.

Table AIII.5 Vectors of jobs, gross income, employment income, profits and value-added in Scotland per £1 million of UK final demand, in 1974 prices, in the respective industries.

Table AIII.6 Vectors of jobs, employment income, profits and value-added in Yorkshire and Humberside per £1 million of UK final demand, 1974 prices, in the respective industries.

Table AIII.7 Matrix of job-dependency in the West Midlands Region, per £1 million, 1974 prices, of UK final demand in the respective column industries.

Note: The column sums of this matrix are in Tables AIII.2 and AIII.4 above.

Table AIII.1 Sectors of the E-D model and associated MLH's of the SIC 1968

Industry	Minimum List Heading of the Standard Industrial Classification,1968
1 Agriculture	001
2 Forestry and fishing	002,003
3 Stone,slate,chalk,sand,etc.extraction	102,103
4 Other mining and quarrying	109
5 Water supply	603
6 Gas	601
7 Electricity	602
8 Coal mining	101
9 Petroleum and natural gas	104
10 Coke ovens and manufactured fuel	261
11 Mineral oil refining,lubricating oils and greases	262,263
12 Grain milling	211
13 Bread and flour confectionery and biscuits	212,213
14 Meat and fish products	214
15 Milk and milk products	215
16 Sugar	216
17 Cocoa,chocolate and sugar confectionery	217
18 Animal and poultry foods	219
19 Oils and fats	221
20 Other food	218,229
21 Soft drinks	232
22 Alcoholic drink	231,239
23 Tobacco	240
24 General chemicals	271
25 Pharmaceutical chemicals and preparations	272
26 Toilet preparations	273
27 Paint	274
28 Soap and detergents	275
29 Synthetic resins and plastics materials,synthetic rubber	276
30 Dyestuffs and pigments	277
31 Fertilizers	278
32 Other chemical industries	279
33 Iron castings,etc.	313
34 Other iron and steel	311,312
35 Aluminium and aluminium alloys	321
36 Other non-ferrous metals	322,323
37 Agricultural machinery	331
38 Machine tools	332
39 Pumps,valves and compressors	333
40 Industrial engines	334
41 Textile machinery	335
42 Construction and mechanical handling equipment	336,337
43 Office machinery	338
44 Other non-electrical machinery	339
45 Industrial plant and steelwork	341
46 Other mechanical engineering	342,349
47 Instrument engineering	351,352,353,354
48 Electrical machinery	361
49 Insulated wires and cables	362
50 Telegraph and telephone equipment	363
51 Radio and electronic components	364
52 Television,radio and sound reproducing equipment	365
53 Electronic computers	366
54 Radio,radar and electronic capital goods	367
55 Domestic electrical appliances	368
56 Other electrical goods	369
57 Shipbuilding and marine engineering	370
58 Wheeled tractors	380
59 Motor vehicles	381
60 Aerospace equipment	383
61 Other vehicles	382,384,385
62 Engineers' small tools	390
63 Cutlery etc.,jewellery and precious metals	392,396
64 Bolts,nuts,screws,etc.	393
65 Wire and wire manufactures	394
66 Cans and metal boxes	395
67 Other metal goods	391,399
68 Production of man-made fibres	411
69 Cotton,etc.spinning and weaving	412,413
70 Woollen and worsted	414
71 Hosiery and other knitted goods	417
72 Carpets	419
74 Textile finishing	423
75* Other textiles	415,416,418,421,422, ,429
76 Leather,leather goods and fur	431,432,433
77 Clothing	441,442,443,444,445,446,449
78 Footwear	450
79 Bricks,fireclay and refractory goods	461
80 Pottery and glass	462,463
81 Cement	464
82 Other building materials,etc.	469
83 Furniture and bedding,etc.	472,473
84 Timber and miscellaneous wood manufactures	471,474,475,479
85 Paper and board	481
86 Packaging products of paper,board,etc.	482
87 Other paper and board products	483,484
88 Printing and publishing,etc.	485,486,489
89 Rubber	491
90 Plastics products n.e.s.	496
91 Other manufacturing	492,493,494,495,499
92 Construction	500
93 Railways	701
94 Road transport	702,703,704
95 Sea and inland water transport and ports	705,706
96 Air transport and miscellaneous transport services	707,709
97 Communication	708
98 Distributive trades	810,811,812,820,821,831,832
99* Insurance,banking and finance	860pt,861,862
Property owning and managing,etc.	863pt
Lodging and catering Other services	SIC's XXIV, XXV, XXVI and XXVII.
Public administration,domestic service,ownership of dwellings	

Table AIII.2

```
** :VPRINT ZWMSUM


Row  vector :-
   17.0     9.9    16.3    10.9    14.7    18.5    19.0    28.8     8.5    20.
    9.1     9.6    17.9    18.6    18.8     5.9    28.8    11.9     4.7    13.
   24.3    20.9     7.0    11.3    10.3    13.8    18.3     9.9    14.7    11.
   10.8    15.5    67.6    28.8    54.3    37.5    40.1    74.1    35.2    53.
   18.9    38.1    28.9    30.9    36.8    44.5    23.2    53.8    16.6    50.1
   26.7    19.9    22.6    14.0    38.8    68.9    14.5    29.7    65.3    25.5
   39.6    61.6    25.6   106.6    30.2    25.6    73.2    15.0    11.1     8.7
   12.8    35.4    12.1    15.5    23.8    18.6    22.3    10.5    89.9    15.8
   23.3    20.9    17.7    11.7    13.2    14.8    15.5    45.1    27.6    24.
   21.3    23.5    25.2     2.3     8.5    18.6    25.0    21.8
** :VPRINT ZWMCSUM


Row  vector :-
  5492.   5921.   6483.   6730.   5777.   9062.   6796.   8563.   5751.   7978.
  1318.   5021.   9107.   6660.   7040.   3198.  21884.   5448.   3425.   6239.
 11665.   9738.   4403.   7079.   6358.   9298.  13993.   6963.  10355.   7145.
  7119.   9351.  50864.  21186.  30637.  24065.  19298.  52224.  21009.  17227.
 14491.  22645.  16818.  17651.  25286.  27267.  15053.  25008.  12063.  35025.
 20919.  14522.  10671.   8843.  24453.  44008.   9502.  39570.  47261.  18906.
 70732.  41431.  24338.  76560.  18499.  14224.  53920.   9481.   5645.   4182.
  5765.   5207.   4756.   8173.  17307.   9038.   8726.  12342.  13756.   8784.
  8779.  11288.   9847.   6099.   7718.  19660.   8952.  19417.  17752.  14335.
 11886.  14022.  17257.   1654.   6040.  11240.  14988.  14420.
** :VPRINT ZSCSUM


Row  vector :-
   20.3    43.2    12.9    10.6    11.5    16.6    18.6    32.1    18.8    20.
    2.4    13.4    26.8    29.1    18.9     6.2    13.9    14.6     4.8    13.
   23.7    32.7     7.2    10.0    13.6    10.5    12.5     9.2    11.7     8.
   11.7    20.4    28.7    19.5    16.2     7.3    28.1    17.7    30.5    12.
   15.4    24.2    47.3    21.8    29.7    18.3    29.1    17.4     9.6    17.
   28.7    10.2    33.8    19.2    28.3    18.9    60.2    11.0    14.8    16.
    7.9    19.1     3.4    20.3    21.9    19.0    17.6    11.5    21.4    25.
   35.0    33.0    35.1    33.1    14.6    35.3    11.5    27.1    12.8    14.
   21.6    15.7    21.4    20.9    17.1    14.7    18.8    16.5    12.0    14.
   23.3    28.2    27.1     7.4    10.3    17.8    26.0    25.8
** :VPRINTZ  ZWALSUM


Row  vector :-
   10.4    10.7    11.8     5.6     9.4     8.0    14.6    36.1     3.5    20.
    1.6     5.2     7.9     8.5    10.4     3.1     7.7     5.6     2.2     4.
    5.7     7.1     3.1     6.5     7.1     5.6     5.4     4.6     7.9     4.
    4.9     9.0    12.5    30.5    20.7     4.8     9.1     6.7    11.1     8.
    6.9    12.4     6.5    10.9    14.1    13.4    10.4    11.1     5.2    14.
   17.4     5.5     6.5     7.7    25.8    10.8     8.0     7.5    12.9     6.
    6.7     6.6     2.1    16.2    17.7    14.9    15.2     4.5     3.4     4.
    6.7     3.5     3.6     3.7     7.3    14.0     8.3    12.0     7.8     5.
   12.1     8.2     5.7     8.1     6.1     3.6     5.7    10.3    11.9    18.
   10.4    16.2    11.4     3.4     2.9     9.3    10.8    11.7
```

VPRINT ZSLSUM

51.8	45.6	45.2	41.8	39.2	66.3	47.4	35.3	36.2	34.8
9.7	47.0	60.2	58.7	56.6	28.7	56.9	41.9	21.6	48.3
72.1	59.7	40.4	33.1	84.0	112.9	66.5	46.2	40.9	34.5
34.6	73.5	53.5	32.6	50.9	31.8	68.6	70.9	62.1	60.1
37.7	67.7	121.1	76.5	56.9	81.4	127.4	60.4	50.2	81.0
121.5	107.8	102.7	140.3	82.5	101.5	77.3	48.1	66.9	57.1
29.2	78.0	49.6	55.0	39.6	58.2	65.1	29.0	28.3	22.0
31.7	25.6	41.7	41.3	57.9	83.3	45.8	55.8	47.3	75.1
70.8	85.8	67.9	50.2	54.3	69.4	115.0	55.1	78.9	91.4
59.8	111.6	72.1	35.5	81.9	93.3	104.3	108.0		

** :VPRINT ZSLSUM

Row vector :-

51.8	45.6	45.2	41.8	39.2	66.3	47.4	35.3	36.2	34.8
9.7	47.0	60.2	58.7	56.6	28.7	56.9	41.9	21.6	48.3
72.1	59.7	40.4	33.1	84.0	112.9	66.5	46.2	40.9	34.5
34.6	73.5	53.5	32.6	50.9	31.8	68.6	70.9	62.1	60.1
37.7	67.7	121.1	76.5	56.9	81.4	127.4	60.4	50.2	81.0
121.5	107.8	102.7	140.3	82.5	101.5	77.3	48.1	66.9	57.1
29.2	78.0	49.6	55.0	39.6	58.2	65.1	29.0	28.3	22.0
31.7	25.6	41.7	41.3	57.9	83.3	45.8	55.8	47.3	75.1
70.8	85.8	67.9	50.2	54.3	69.4	115.0	55.1	78.9	91.4
59.8	111.6	72.1	35.5	81.9	93.3	104.3	108.0		

** :VPRINT ZSVSUM

Row vector :-

20.0	13.1	30.6	34.3	11.2	11.1	11.5	6.2	5.0	6.2
1.3	12.0	15.9	20.9	23.1	4.9	15.5	13.2	3.7	8.7
13.5	13.3	5.6	6.3	8.3	17.9	7.0	7.3	9.1	5.9
12.7	9.8	10.9	6.4	8.1	5.7	19.2	16.6	25.9	9.0
7.0	15.0	8.6	15.2	10.3	18.2	25.5	18.8	4.4	8.0
28.3	23.1	10.2	14.2	14.5	10.0	29.1	6.2	9.2	35.3
4.9	16.9	2.5	6.7	5.5	11.8	11.1	5.6	5.3	6.9
5.2	8.7	5.0	7.9	15.2	13.5	30.5	6.1	9.8	8.2
17.8	12.7	14.6	12.0	15.8	9.7	15.0	15.2	15.5	9.7
14.2	15.5	15.7	3.3	7.7	15.6	21.1	20.1		

** :VPRINT ZEASUM

Row vector :-

15.0	2.6	5.6	3.2	3.9	4.7	4.4	2.6	7.4	2.6
3.5	5.4	5.7	15.5	19.1	2.7	7.0	7.6	1.6	12.3
2.9	6.1	2.3	2.7	2.8	3.7	6.4	2.5	4.3	2.4
6.7	5.2	2.7	3.1	2.3	1.8	36.5	6.0	8.4	3.2
2.6	5.7	3.4	7.2	4.8	5.3	8.5	6.8	1.7	2.5
14.1	10.6	4.5	7.6	11.7	4.3	16.5	2.3	4.4	1.3
1.9	1.6	1.0	2.6	2.4	2.6	3.8	2.3	1.9	1.7
1.8	1.9	2.1	2.1	2.3	5.3	18.3	10.5	2.3	3.2
6.0	6.6	5.5	2.1	4.4	6.8	8.3	4.0	10.3	6.9
6.3	7.9	7.0	1.9	2.9	6.1	8.6	8.2		

** :VPRINT ZEM SUM

Row vector :-

10.0	6.7	16.7	31.6	9.8	11.2	13.7	24.3	4.3	15.3
1.3	7.7	13.1	15.5	14.1	4.3	9.4	11.8	3.0	11.[illegible]
11.6	9.2	4.5	5.6	5.8	7.4	13.4	6.1	11.2	5.5

```
   5.7     11.7     37.1     15.6      7.9      4.[illegible]      5.6     23.[illegible]     10.2     41.6
  34.6     27.9     21.8     21.1     14.9     20.2     11.5     20.1      6.9     23.2
  18.6      9.7      7.9     15.8      8.4     14.9      9.6     10.0     10.7     22.2
   6.8     15.5      2.4     13.3     13.4      9.2     15.1      6.7     11.9      7.5
 112.0      7.1     65.8     30.5     15.8     36.9     93.6     26.3     14.5     10.1
  20.7     13.6     14.1      5.9     12.9      7.4     12.2     13.5     16.3     16.1
  13.5     19.7     15.7      1.2      5.1     10.9     17.4     14.9
** :VPRINT ZNSUM


Row  vector :-
   8.7      9.9      9.6     29.6      8.6     11.4     16.7     44.5      4.1     25.4
   1.3      5.5     11.0     10.4      9.8      3.4      8.7      5.8      2.7      8.2
  14.1      9.4      4.0     17.7      6.6      6.7     13.4      9.9     10.7     11.3
   7.8      8.2     14.6     22.0     10.4      5.8      8.6     16.9     10.4      8.9
   7.2     18.6      7.8     15.8     24.7     15.6     11.8     21.7      8.5     31.7
  19.4     10.4      7.6      5.1     20.1     19.1     64.3      7.0      8.8      3.6
   6.4      5.9      2.2      9.1     16.5     11.7     11.3      7.9     12.2     10.5
  13.5      9.3     11.0      8.4     10.4     25.4     20.9     15.2     13.6     11.9
  13.7     10.4      8.7      7.5      8.3     10.4      8.8     10.3     13.4      9.1
  14.0     16.3     14.4      4.7      3.6      8.1     14.8     13.4
** :VPRINT ZWSUM


Row  vector :-
  16.3     17.9     11.5     14.5     16.8     20.8     19.3     21.9      9.1     16.9
   3.7     18.9     42.6     24.7     21.2      7.2     26.8     17.4     14.2     22.8
  31.9     20.5     10.9     26.7     32.3     16.7     32.3     39.0     25.6     30.9
  19.4     27.3     20.1     14.7     17.9     15.5     23.1     20.4     25.1     15.6
  67.0     27.9     14.2     38.0     27.5     26.1     25.1     32.9     42.0     37.3
  38.0     14.7     33.3     18.2     34.3     39.3     23.1     15.5     32.7     33.9
  39.7     23.7      5.0     22.2     28.4     34.3     25.8     28.4    115.2     19.8
  33.6     32.7     78.0     58.8     30.4     60.9     46.5     23.6     45.5     16.2
  28.6     36.7     21.6     25.0     31.9     31.4     26.2     40.9     28.4     32.9
  23.9     36.6     32.5     11.8     14.7     25.6     35.5     31.3
** :VPRINT ZYMSUM


Row  vector :-
  16.4     29.7     15.9     10.7     15.5     17.1     27.3     71.4      8.1     56.8
   1.8     11.8     19.8     24.6     16.2      5.8     45.3     13.4      8.1     16.1
  20.2     15.2      6.3     12.5     12.5     16.8     17.4      9.6     10.5     32.0
  15.4     17.2     34.8     38.8      9.5     13.7     28.2     35.5     24.5     15.9
  37.5     24.8     21.5     28.3     23.7     31.2     15.0     25.1     10.5      7.8
  17.4     19.0      9.9      7.1     21.6     17.7     19.3     13.7     17.0     13.2
  23.7     56.4     27.3     25.7     39.3     29.1     30.9     22.3     25.7    110.9
  31.7     [illegible]     49.4     23.9     22.8     49.2     15.6     33.0     28.5     19.3
  21.7     24.4     20.9     10.3     11.7     15.5     16.8     14.4     16.8     13.8
  19.3     31.7     22.6      5.0      7.5     17.6     24.3     22.1
** :VPRINT ZUKSUM


Row  vector :-
 200.0    222.7    196.4    240.9    146.3    190.2    204.9    340.4    109.1    268.3
  28.6    149.0    232.9    236.8    208.6     93.8    225.0    152.9     72.5    165.9
 237.6    201.7    165.3    136.3    214.6    239.4    197.0    158.2    153.7    162.6
 136.6    203.9    289.5    218.9    204.1    128.7    291.7    294.1    253.4    285.2
 265.8    209.0    301.2    271.9    247.6    292.9    293.1    274.8    165.0    287.3
 330.6    241.5    249.9    249.8    294.1    308.5    328.2    226.9    247.2    223.7
 707.1    209.7    175.7    284.2    222.5    261.9    277.6    184.9    271.3    226.4
```

[illegible]	[illegible]	306.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	283.1	[illegible]
[illegible]	[illegible]	212.7	158.1	179.7	[illegible]	247.1	[illegible]	[illegible]	278.
[illegible]	[illegible]	249.6	79.4	[illegible]	[illegible]	[illegible]	[illegible]		

** :[illegible]

ROW vector :-

[illegible]	[illegible]	189.9	232.9	142.[illegible]	[illegible]	201.2	338.5	167.7	266.
27.[illegible]	[illegible]	226.8	229.7	201.[illegible]	[illegible]	222.9	147.7	71.[illegible]	143.[illegible]
[illegible]	[illegible]	149.0	134.7	212.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
133.7	[illegible]	287.3	217.3	202.[illegible]	127.4	298.8	292.8	251.4	282.[illegible]
248.[illegible]	[illegible]	297.2	268.2	245.2	[illegible]	285.2	271.2	162.2	[illegible]
327.7	237.[illegible]	244.0	248.0	289.3	[illegible]	314.6	225.3	245.2	217.[illegible]
[illegible]	[illegible]	134.3	282.2	220.0	[illegible]	274.[illegible]	[illegible]	251.[illegible]	221.[illegible]
292.3	[illegible]	310.6	255.9	204.7	[illegible]	315.4	248.9	279.9	228.[illegible]
241.[illegible]	267.7	[illegible]	156.4	176.[illegible]	[illegible]	243.[illegible]	227.8	232.3	275.[illegible]
208.[illegible]	225.7	245.3	77.8	147.6	[illegible]	288.6	279.7		

** :[illegible]

Table AIII.3

```
** :VPRINT ZFDIAGSUM

Row vector :-
  22073.   1904.   1213.    274.   5627.  17911.  31398.   5736.   1[illegible].   2175.
   7826.   1292.  18590.  22744.  19628.    991.  15420.   2669.   4[illegible].  14783.
   6156.  24408.   3470.  12814.   6366.   3267.   2461.   2519.   5505.   2477.
   1066.   6204.   3196.  16304.   4846.  15923.   6589.  23837.  13035.   6363.
   4651.  26830.   4396.  31251.  38850.  20576.  17690.  27973.   2250.  21430.
   9157.  10207.   9049.   6731.  15935.  15863.  10171.   9300. 189995.  32907.
   5324.   6970.   8204.   5299.   2679.    648.  42053.   4355.   4028.   2796.
   7755.  11829.     76.   4055.   5015.  24219.   7940.    684.  24874.    348.
   3229.  10098.   7603.   2296.    591.   7078.  14034.  14330.   4698.  11777.
 265034.  15568.  14122.   6165.   7892.  21491. 236377. 614462.
** :VPRINT ZFSUMUK

Row vector :-
 377549.   24988.   14591.    6972.   55812.  142860.  339269.   67769.    1320.   29220.
  49925.   29385.  240763.  289704.  217154.   15652.  120650.   74212.    6920.  213765.
  60158.  240044.   82470.  154174.  133045.   56633.   26435.   40193.   55502.   36707.
  13510.   81436.   13696.  124126.   18141.   61189.   47893.   94590.   93813.   33655.
  66423.  184545.   45757.  274860.  261261.  135456.  223120.  142811.   22318.  122863.
 114902.  129749.   99592.  119961.  120680.   71507.  230074.   79967.  719130.  288681.
  41242.   37765.   43477.   14125.   19749.    6627.  159536.   52[illegible].   98698.   72550.
 177492.   77861.    2056.   70548.   43753.  473883.  115227.   16512.   78368.    5140.
  34515.  192792.   91100.   31148.    8949.   40260.  226340.   75449.   40059.  131418.
2059446.  214847.  139866.  210480.  139477.  658226. 2782469.  775617.
```

Table AIII.4

** :VPRINT ZWMSUM

Row vector :-

17.0	8.9	16.3	10.9	14.7	19.3	19.0	28.8	8.4	29.1
2.1	9.9	17.9	18.6	18.8	8.3	28.8	11.5	14.7	13.3
24.3	20.5	7.0	11.3	10.3	13.9	18.3	9.6	14.7	11.0
10.8	15.5	67.6	28.8	54.5	57.5	40.1	74.1	45.2	53.9
18.6	38.1	28.9	30.9	36.8	44.3	23.2	53.8	16.5	50.1
26.7	19.0	22.6	14.0	38.8	68.5	14.5	29.7	65.3	25.5
39.6	61.6	25.6	106.6	30.2	25.6	73.2	15.0	11.1	8.7
12.8	35.4	12.1	15.5	23.8	18.6	22.3	10.5	89.9	15.8
23.3	20.0	17.7	11.7	13.2	14.8	15.5	45.1	27.6	24.9
21.3	23.5	25.2	2.3	8.5	18.6	25.0	21.8		

** :VPRINT CROSSVHMSUM

Row vector :-

170.7	85.5	174.7	92.3	163.7	199.6	302.7	121.6	331.5	453.6
337.3	303.2	125.7	229.4	346.3	208.4	229.1	455.2	252.9	198.9
224.2	245.5	84.8	190.1	96.0	131.1	242.9	216.3	294.8	187.5
334.9	159.7	411.5	283.6	523.8	603.5	265.4	403.8	250.5	424.6
131.7	318.4	171.5	197.8	337.4	237.4	122.4	329.0	241.7	365.4
115.0	161.7	205.4	91.2	252.2	361.8	45.1	354.6	480.3	163.4
192.8	306.5	277.4	752.0	337.4	221.1	422.0	195.4	60.5	57.5
79.2	345.9	50.3	103.6	172.5	75.3	100.8	67.1	405.2	211.8
185.4	178.7	121.0	153.5	137.1	131.7	92.2	319.9	201.2	161.5
173.2	190.4	132.4	44.7	78.8	153.4	115.0	86.8		

```
** :VPRINT WMETYDEP74SUM

Row  vector :-
   26.6    37.2    44.4    25.6    37.3   [illegible]  55.4    81.4    33.1    60.4
    6.4    21.1    37.6    35.1    42.9    17.5    51.0    34.4    13.4    27.4
   42.9    51.4    16.8    28.9    20.6    24.4    45.6    24.2    44.0    39.1
   54.8    37.2   154.6    80.2   133.4    77.1    68.7   165.4    90.9   121.5
   45.6    92.3    60.8    68.8   104.8   [illegible]  49.3   119.6    41.6   117.1
   40.8    29.0    41.0    36.6    73.5   116.0    35.2    79.6   [illegible]  68.5
   93.7   144.9    48.4   214.3    68.5    48.7   137.4    40.1    18.3    15.5
   21.3    74.7    20.5    28.5    41.2    24.6    39.0    24.0   194.2    43.0
   48.3    42.4    37.5    28.3    31.3    36.0    39.1   103.3    54.2    44.6
   58.1    58.4    55.6     7.2    41.1   [illegible]  48.1    51.4
** :VPRINT WMPROFITSDEP74SUM

Row  vector :-
   57.5    11.6    21.7     8.2    72.8    47.7    73.0     4.7   -23.9    23.9
    7.7    23.8     4.6     8.5    28.5    16.0    14.8    18.7    15.9    17.5
   25.6    40.3     5.8    17.1    12.5    14.4    19.7     7.5    27.7    24.9
   33.8    14.1    12.0    19.2    25.5    62.5    20.5     4.2    12.5     9.4
    8.9     8.2    11.1    14.5    12.6    13.6     4.4    11.1     2.1    26.9
   10.9    10.7    25.8     7.0     3.0    27.0    -5.3     6.3    23.6     5.0
    2.1    24.7     5.8    31.8    22.2     6.0    27.0    13.7     3.1     4.4
    2.7    14.7     2.7     5.1    12.4     4.5     5.4     3.9    36.2    22.3
   14.2     9.2     9.7     8.7     8.2     9.2     8.3    24.6    17.9    10.4
   38.1    18.4    29.9     4.3     8.0    28.1    22.1    20.7
** :VPRINT WMVADEPSUM

Row  vector :-
   84.1    48.9    66.1    33.9   110.2   100.0   132.4    86.1     9.2    84.3
   14.1    44.9    42.2    43.6    71.0    33.9    65.9    53.1    29.3    44.8
   68.5    91.7    22.6    46.0    33.1    38.8    65.3    31.8    71.7    64.0
   88.7    51.3   166.7    99.4   158.9   139.6    89.2   169.6   103.4   130.9
   54.5   100.4    71.8    83.2   117.5   110.2    53.8   130.7    43.7   144.0
   51.7    39.7    66.8    43.6    76.5   143.0    29.9    85.9   204.2    73.6
   95.8   169.7    54.1   246.1    90.5    54.7   164.5    53.7    21.3    20.0
   24.0    89.4    23.2    33.6    53.5    29.0    44.4    28.0   230.5    65.4
   62.5    51.6    47.2    36.9    39.5    45.1    47.4   127.9    72.1    55.0
   96.2    74.7    85.5    11.5    49.2    89.3    70.3    72.1
```

```
** :VPRINT ZWMCSUM
Row   vector :-
  5492.2   5921.0   6482.9   6730.3   5777.3   9061.7   6796.4   8562.8   5750.8   7978.1
  1317.7   5021.1   9106.7   6659.6   7039.9   3197.5  21884.1   5447.6   3424.5   6239.2
 11665.2   9738.3   4402.8   7069.6   6358.1   8298.2  13993.4   6962.9  10355.4   7144.9
  7111.7   9350.6  50863.7  21185.9  30634.7  24064.8  19298.5  52223.5  21007.8  17226.5
 14491.3  22645.3  16817.9  17651.0  25285.8  27267.0  15053.0  25007.8  12062.7  35025.4
 20919.0  14922.3  10671.5   8842.6  24452.7  44008.0   9502.4  39570.1  47261.2  18905.9
 30738.3  41431.3  24337.9  76560.0  18499.0  14224.5  53919.8   9481.3   5645.5   4181.7
  5764.6   5207.1   4755.8   8173.3  17306.8   9037.9   8726.0  12341.6  13755.6   8784.3
  8778.9  11288.2   9846.8   6098.7   7718.4  10659.7   8952.3  19417.1  17752.0  14334.7
 11886.1  14021.8  17257.5   1653.8   604[illegible].0  11240.1  14987.5  14419.9
```

```
Row vector :- VPRINT SCETYDEP74SUM.
   31.9   179.8    35.0    24.9    29.2    46.[illegible]  58.3    90.8    77.7    63.[illegible]
    7.2    28.4    56.2    35.0    42.6    12.[illegible]  24.6    42.1    13.4    29.3
   41.0    82.0    17.5    25.4    27.3    18.6    31.1    22.6    35.1    30.8
   59.6    49.7    65.8    54.5    39.6    16.7    48.1    39.4    78.9    27.9
   37.7    58.6    99.3    48.5    84.6    39.8    61.9    38.6    23.9    41.5
   44.5    15.5    61.3    59.1    53.5    [illegible]   145.9    29.6    40.8    45.2
   18.8    45.1     6.5    40.8    49.5    56.1    33.0    30.9    35.3    45.8
   58.4    69.5    59.4    69.9    25.[illegible]  48.5    20.1    62.3    27.7    58.8
   44.8    32.5    45.3    50.8    40.4    35.7    47.4    37.8    23.7    26.6
   63.6    79.9    59.8    23.0    49.6    58.6    50.1    69.8
** :VPRINT SCPROFITSDEP74SUM
```

```
Row vector :-
   68.8    56.2    17.1     8.0    56.9    42.7    71.7     5.2   -53.2    24.9
    8.7    32.0     6.9    13.3    28.5    16.6     7.1    22.9    15.9    18.7
   25.0    64.3     6.9    15.1    16.6    11.0    13.4     7.0    22.1    19.6
   36.8    18.5     5.1    13.0     7.6    13.5    14.3     1.0    10.8     2.2
    7.4     5.2    18.1    10.2    10.2     5.6     5.6     3.6     1.2     9.5
   12.0     5.8    38.7     9.7     2.2     7.4   -22.0     2.3     5.3     3.3
    0.4     7.7     0.8     6.0    16.1     4.4     6.5    10.5     5.9    12.8
    7.4    13.7     7.9    10.8     7.6     8.5     2.8    10.2     5.2    20.1
   13.2     7.1    11.7    15.5    10.6     9.1    10.0     9.0     7.8     6.2
   41.6    22.0    32.2    13.6     9.7    26.9    23.0    24.5
** :VPRINT SCVADEP74SUM
```

```
Row vector :-
  100.6   236.0    52.1    32.9    86.1    89.5   130.0    96.0    20.5    87.9
   15.9    60.4    63.1    68.3    71.1    35.2    31.7    65.0    29.3    48.0
   66.9   146.3    23.5    40.5    44.0    29.6    44.5    29.6    57.2    50.5
   96.4    67.2    70.9    67.5    47.2    30.2    62.5    40.4    89.7    30.1
   45.1    63.8   117.4    58.7    94.8    45.4    67.5    42.2    25.1    51.1
   56.4    21.3   100.0    59.7    55.7    39.4   123.9    31.9    46.1    48.6
   19.2    52.7     7.2    46.8    65.6    40.5    39.5    41.4    41.2    57.7
   65.8    83.2    67.3    71.7    32.8    55.0    22.9    72.5    32.8    58.9
   57.9    39.5    57.0    66.4    51.0    44.8    57.4    46.8    31.5    32.8
  105.2    92.0    92.0    36.6    59.3    85.9    73.1    85.3
** :VPRINT  GROSSVSCSUM
```

```
Row vector :-
  204.2   413.1   137.6    89.8   128.0   178.7   297.2   135.6   738.2   472.9
  379.7   459.0   188.2   359.2   347.0   216.8   110.4   562.0   253.1   212.8
  218.7   391.6    88.2   167.5   128.3   180.0   165.5   201.6   227.5   147.9
  364.1   209.3   175.1   192.7   155.4   130.7   185.9    96.2   217.3    97.6
  109.0   202.3   280.3   139.5   272.3    95.0   153.5   106.4   139.0    94.1
  125.5    86.6   307.4   124.9   183.7    91.4   270.3   131.8   108.5   107.8
   38.6    93.4    37.1   143.1   244.3   102.9   101.4   143.0   128.4   165.7
  192.3   322.0   145.5   221.4   105.6   142.1    52.0   174.1    66.3   190.9
  172.0   106.0   146.1   275.8   177.2   130.0   111.7   117.0    87.8    96.3
  189.6   120.3   142.4   142.6    95.0    99.0   119.6   102.6
```

V PRINT ZSCSUM

```
Row vector :-
   20.3    43.2    12.9    10.6    11.5    16.6    18.6    32.1    18.8    20.8
    2.4    13.4    26.8    29.1    18.9     6.2    13.9    14.6     4.8    13.[illegible]
   23.7    32.7     7.2    10.0    13.6    10.5    12.5     9.2    11.7     8.[illegible]
   11.7    20.4    28.7    19.5    16.0     7.3    28.1    17.7    30.5    12.[illegible]
   15.4    24.2    47.3    21.8    29.7    18.3    29.1    17.4     [illegible]    17.[illegible]
   28.7    10.2    33.8    19.2    28.3    18.[illegible]    10.2    11.0    14.5    13.[illegible]
    7.9    19.1     3.4    20.3    21.0    19.[illegible]    17.6    11.5    21.4    25.[illegible]
   35.0    33.0    35.1    33.1    14.6    35.[illegible]    11.5    27.1    12.6    14.[illegible]
   21.6    15.3    21.4    20.9    17.1    14.7    18.8    16.5    12.0    14.[illegible]
   23.3    28.2    27.1     7.4    10.3    17.8    26.0    25.8
```

Table AIII.6

** :VPRINT YHETYDEP74SUM

Row vector :-

25.6	123.4	43.4	25.3	39.1	48.3	55.4	201.5	31.7	172.0
5.5	25.1	41.6	46.5	36.6	17.5	80.4	38.6	22.7	33.8
35.7	38.2	15.1	31.8	25.1	29.8	43.4	23.5	31.3	113.9
78.1	41.1	79.5	108.1	23.2	31.5	48.3	79.2	63.4	35.8
91.9	60.0	45.2	62.9	67.4	67.7	32.0	55.7	26.3	18.1
20.7	29.2	16.4	18.5	40.9	29.9	46.7	36.6	47.0	35.4
55.9	132.8	51.6	51.6	89.0	55.4	58.0	59.8	42.4	198.5
53.0	118.6	83.5	44.0	39.4	64.9	27.4	75.9	61.6	52.5
44.9	51.7	44.2	25.1	27.8	37.7	42.4	33.0	33.1	24.6
52.7	77.7	49.8	15.4	36.2	44.6	46.8	53.9		

** :VPRINT YHPROFITSDEF74SUM

Row vector :-

55.4	38.6	21.2	8.1	76.3	44.0	105.0	11.6	-22.9	68.1
6.6	28.3	5.1	11.3	24.5	15.6	23.4	20.9	27.1	21.6
21.3	30.0	5.2	18.8	15.3	17.6	18.7	7.3	19.7	72.6
48.2	15.6	6.2	25.9	4.4	25.5	14.4	2.0	8.7	2.8
18.0	5.3	8.2	13.2	8.1	9.6	2.9	5.2	1.3	4.2
5.6	10.8	10.3	3.6	1.7	7.9	-7.0	2.9	6.1	2.6
1.3	22.7	6.1	7.7	28.9	6.2	11.4	29.4	7.1	56.3
6.7	23.3	11.1	7.8	11.8	11.8	3.8	12.4	11.5	27.3
13.2	11.7	11.5	7.7	7.3	9.6	9.0	7.9	10.9	5.7
34.5	24.5	26.8	9.1	7.1	20.5	21.5	21.7		

** :VPRINT YHVADEF74SUM

Row vector :-

81.1	162.0	64.6	33.4	115.5	92.3	190.4	213.2	8.8	240.1
12.1	53.4	46.6	57.8	61.2	33.9	103.8	59.5	49.8	55.4
57.0	68.1	20.3	50.6	40.4	47.3	62.1	30.8	51.0	186.5
126.4	56.6	85.7	134.0	27.7	57.9	62.7	81.2	72.1	38.5
109.2	65.3	53.4	76.1	75.6	77.3	34.8	60.8	27.7	22.3
26.3	40.1	26.7	22.1	42.5	36.9	39.7	39.5	53.2	38.0
57.2	155.5	57.7	59.3	117.9	62.2	69.4	80.2	49.5	254.8
59.6	142.0	94.6	51.8	51.2	76.8	31.2	88.3	73.1	79.8
58.2	63.0	55.7	32.8	35.1	47.3	51.4	40.9	44.0	30.4
87.2	192.1	76.6	24.5	43.3	65.1	68.4	75.6		

** :VPRINT ZYHSUM

Row vector :-

16.4	29.7	15.9	10.7	15.5	17.1	27.3	71.4	8.1	56.8
1.8	11.8	19.8	24.6	16.5	5.8	45.3	13.4	8.1	16.1
20.2	15.2	6.3	12.5	12.5	16.8	17.4	9.6	10.5	32.0
15.4	17.2	34.8	38.8	9.5	13.7	28.2	35.5	24.5	15.9
37.5	24.8	21.5	28.3	23.7	31.2	15.0	25.1	10.5	7.8
13.4	19.2	9.9	7.1	21.6	17.7	19.3	13.7	17.0	13.2
23.7	56.4	27.3	25.7	39.3	29.1	30.9	22.3	25.7	110.9
31.7	56.3	49.4	23.9	22.8	49.2	15.6	33.0	28.5	19.3
21.7	24.4	20.9	10.3	11.7	15.5	16.8	14.4	16.8	13.8
19.3	31.3	22.6	5.0	7.5	13.6	24.3	22.1		

Table AIII.7

** :MPPINT ZWM FORMAT

ROW : 1

8.73	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01
0.00	2.02	0.67	3.72	4.27	0.90	0.25	1.99	0.13	0.52
0.12	0.81	0.02	0.06	0.08	0.02	0.02	0.06	0.03	0.02
0.02	0.20	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.03	0.13
0.03	0.04	0.01	0.08	0.45	0.04	0.08	0.00	0.02	0.01
0.01	0.01	0.01	0.05	0.02	0.02	0.01	0.01	0.01	0.09
0.00	0.01	0.01	0.01	0.07	0.00	0.03	0.12		

ROW : 2

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 3

0.02	0.01	6.77	0.01	0.01	0.01	0.01	0.01	0.00	0.01
0.00	0.00	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.01
0.01	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.00

0.01	0.01	0.08	0.03	0.01	0.01	0.01	0.02	0.03	0.02
0.02	0.01	0.01	0.01	0.03	0.02	0.01	0.01	0.00	0.00
0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.09	0.02
0.51	0.01	0.01	0.06	0.02	0.01	0.01	0.03	0.01	0.01
0.16	0.04	0.00	0.00	0.00	0.00	0.00	0.01		

ROW : 4

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 5

0.03	0.02	0.01	0.01	7.33	0.01	0.03	0.01	0.00	0.02
0.01	0.01	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.02
0.03	0.03	0.01	0.03	0.02	0.01	0.03	0.02	0.07	0.05
0.05	0.02	0.01	0.02	0.02	0.01	0.02	0.00	0.01	0.01
0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.01
0.02	0.00	0.00	0.01	0.02	0.02	0.02	0.01	0.01	0.01
0.02	0.01	0.01	0.02	0.03	0.01	0.01	0.04	0.01	0.02
0.04	0.02	0.07	0.01	0.01	0.02	0.01	0.02	0.02	0.01
0.01	0.01	0.00	0.02	0.02	0.02	0.01	0.02	0.02	0.02
0.01	0.01	0.00	0.01	0.00	0.01	0.02	0.01		

ROW : 6

0.02	0.01	0.02	0.04	0.01	7.65	0.11	0.02	0.01	0.27
0.01	0.02	0.04	0.03	0.02	0.04	0.02	0.03	0.02	0.03
0.03	0.04	0.02	0.21	0.06	0.03	0.04	0.04	0.08	0.10
0.09	0.05	0.08	0.06	0.07	0.04	0.05	0.04	0.03	0.04
0.04	0.03	0.03	0.04	0.04	0.05	0.03	0.04	0.04	0.02
0.04	0.02	0.02	0.02	0.04	0.04	0.03	0.04	0.04	0.02
0.05	0.04	0.02	0.05	0.06	0.06	0.06	0.07	0.02	0.02
0.03	0.03	0.07	0.03	0.02	0.02	0.02	0.09	0.14	0.11
0.06	0.02	0.02	0.07	0.03	0.03	0.02	0.05	0.04	0.04
0.02	0.04	0.01	0.01	0.02	0.02	0.05	0.02		

ROW : 7

0.10	0.09	0.25	0.45	0.26	0.06	5.61	0.28	0.03	0.22
0.02	0.09	0.09	0.11	0.11	0.04	0.09	0.10	0.05	0.09
0.09	0.10	0.05	0.28	0.12	0.07	0.10	0.12	0.20	0.18
0.22	0.11	0.21	0.25	0.24	0.09	0.12	0.11	0.12	0.13
0.10	0.11	0.08	0.10	0.11	0.14	0.09	0.11	0.12	0.08
0.11	0.06	0.06	0.06	0.12	0.11	0.13	0.12	0.12	0.08
0.13	0.12	0.05	0.17	0.20	0.16	0.14	0.28	0.18	0.13
0.14	0.11	0.19	0.13	0.07	0.08	0.08	0.20	0.19	0.56
0.21	0.08	0.07	0.16	0.09	0.11	0.06	0.16	0.16	0.12
0.07	0.10	0.03	0.01	0.03	0.05	0.12	0.05		

ROW : 8

0.10	0.09	0.24	0.35	0.25	0.09	4.08	18.24	0.06	5.40
0.02	0.09	0.09	0.10	0.11	0.18	0.11	0.10	0.05	0.12
0.16	0.11	0.06	0.34	0.12	0.09	0.14	0.13	0.20	0.27
0.22	0.19	0.67	1.56	0.26	0.13	0.36	0.27	0.07	0.27
0.24	0.33	0.15	0.27	0.36	0.23	0.12	0.24	0.18	0.11
0.15	0.07	0.08	0.08	0.24	0.19	0.25	0.28	0.31	0.12
0.31	0.28	0.08	0.41	0.66	0.67	0.37	0.38	0.17	0.15
0.14	0.13	0.24	0.14	0.08	0.08	0.09	0.49	0.17	2.58

0.40	0.10	0.00	0.29	0.12	0.13	0.07	0.17	0.17	0.16
0.15	0.21	0.04	0.02	0.03	0.04	0.10	0.05		
ROW : 9									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 10									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 11									
0.01	0.02	0.04	0.02	0.01	0.01	0.03	0.01	0.00	0.01
0.23	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01
0.01	0.01	0.00	0.04	0.01	0.01	0.01	0.01	0.02	0.01
0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00
0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01
0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.03	0.01	0.02
0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
0.01	0.01	0.02	0.01	0.01	0.00	0.01	0.00		
ROW : 12									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 13									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	10.08	0.07	0.00	0.00	0.01	0.00	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.03		
ROW : 14									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	5.24	0.00	0.00	0.00	0.01	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.10	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.05		
ROW : 15									
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.02	0.10	0.04	4.80	0.00	0.08	0.04	0.00	0.10
0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.02		
ROW : 16									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 17									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.01	0.34	0.01	0.03	0.01	19.98	0.00	0.00	0.01
0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.04		
ROW : 18									
0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.07	0.03	0.13	0.14	0.03	0.01	1.32	0.02	0.03
0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 19									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

```
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
ROW : 20
   0.01   0.07   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.02   0.03   0.02   0.01   0.01   0.02   0.02   0.00   3.44
   0.01   0.01   0.00   0.00   0.02   0.00   0.00   0.00   0.00   0.00
   0.00   0.01   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.01   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.04   0.01   0.01   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.01   0.00   0.00   0.01   0.02
ROW : 21
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.25   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.01
ROW : 22
   0.05   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.01   0.00   0.02   0.02   0.00   0.03   0.07   0.00   0.03
   0.06   8.10   0.00   0.00   0.05   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.01
ROW : 23
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
ROW : 24
   0.06   0.02   0.06   0.14   0.04   0.02   0.05   0.02   0.06   0.05
   0.05   0.02   0.04   0.05   0.05   0.03   0.05   0.05   0.03   0.04
   0.08   0.07   0.02   3.24   0.43   0.08   0.28   0.23   0.83   0.65
   0.68   0.33   0.03   0.04   0.03   0.01   0.03   0.02   0.02   0.02
   0.02   0.02   0.03   0.04   0.07   0.07   0.04   0.03   0.04   0.03
   0.07   0.03   0.02   0.02   0.06   0.06   0.02   0.03   0.06   0.02
   0.07   0.01   0.02   0.02   0.03   0.05   0.04   0.64   0.07   0.07
   0.10   0.11   0.17   0.11   0.07   0.04   0.07   0.05   0.10   0.03
   0.07   0.04   0.03   0.06   0.06   0.03   0.03   0.14   0.03   0.10
   0.03   0.02   0.02   0.01   0.01   0.01   0.01   0.01
ROW : 25
   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00   0.00
```

OK, SEQ CYSMAT

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 26

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 27

0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01
0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
0.02	0.01	0.00	0.00	0.01	0.01	7.15	0.00	0.00	0.00
0.01	0.01	0.02	0.01	0.03	0.00	0.06	0.02	0.02	0.03
0.02	0.03	0.02	0.03	0.03	0.01	0.01	0.03	0.02	0.01
0.02	0.01	0.01	0.01	0.05	0.03	0.05	0.03	0.05	0.02
0.04	0.00	0.00	0.01	0.01	0.17	0.06	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
0.01	0.07	0.05	0.01	0.02	0.00	0.00	0.00	0.01	0.03
0.09	0.01	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 28

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 29

0.02	0.02	0.02	0.03	0.01	0.01	0.01	0.01	0.01	0.01
0.00	0.02	0.06	0.03	0.03	0.01	0.06	0.02	0.01	0.04
0.04	0.02	0.06	0.04	0.05	0.18	0.48	0.06	5.24	0.03
0.05	0.21	0.04	0.02	0.02	0.01	0.03	0.03	0.02	0.02
0.02	0.02	0.05	0.03	0.03	0.03	0.08	0.05	0.20	0.07
0.11	0.11	0.04	0.03	0.17	0.08	0.02	0.03	0.04	0.02
0.03	0.01	0.02	0.02	0.05	0.04	0.04	0.24	0.04	0.03
0.05	0.20	0.07	0.13	0.07	0.04	0.17	0.02	0.05	0.02
0.04	0.07	0.04	0.06	0.16	0.09	0.03	0.35	0.93	0.24
0.05	0.02	0.02	0.00	0.01	0.02	0.02	0.01		

ROW : 30

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 31									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 32									
0.04	0.01	0.06	0.09	0.00	0.01	0.01	0.03	0.01	0.02
0.00	0.02	0.02	0.03	0.03	0.01	0.09	0.04	0.01	0.03
0.03	0.02	0.04	0.02	0.08	0.06	0.06	0.03	0.06	0.02
0.03	5.74	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.03
0.02	0.02	0.04	0.02	0.01	0.14	0.01	0.01	0.01	0.01
0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01
0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.02	0.01	0.01
0.02	0.01	0.04	0.01	0.01	0.01	0.07	0.03	0.03	0.03
0.04	0.03	0.03	0.04	0.18	0.11	0.12	0.02	0.04	0.05
0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.02		
ROW : 33									
0.10	0.10	0.08	0.08	0.99	0.49	0.12	0.15	0.06	0.12
0.01	0.05	0.05	0.07	0.07	0.04	0.04	0.05	0.02	0.05
0.07	0.06	0.03	0.06	0.05	0.04	0.06	0.04	0.06	0.07
0.07	0.18	51.95	0.27	0.09	0.00	1.42	2.42	1.77	1.91
0.96	1.14	0.39	1.02	0.61	1.45	0.26	0.79	0.06	0.07
0.07	0.06	0.08	0.08	0.32	0.11	0.51	5.94	2.36	0.09
0.34	0.48	0.04	0.19	0.19	0.14	0.32	0.00	0.05	0.04
0.04	0.04	0.05	0.05	0.04	0.03	0.04	0.10	0.07	0.12
0.20	0.00	0.09	0.05	0.04	0.04	0.03	0.07	0.00	0.16
0.51	0.08	0.12	0.04	0.02	0.02	0.03	0.05		
ROW : 34									
0.16	0.25	0.18	0.22	0.28	0.34	0.34	0.84	0.43	0.54
0.05	0.10	0.12	0.17	0.23	0.09	0.14	0.28	0.05	0.42
0.74	0.24	0.10	0.20	0.17	0.29	0.52	0.18	0.18	0.24
0.31	0.26	0.89	15.50	0.39	0.19	2.69	1.71	1.97	1.43
1.46	2.50	0.83	1.96	2.84	1.70	0.48	1.69	0.70	0.43
0.63	0.28	0.35	0.33	1.53	0.67	1.55	1.31	1.67	0.56
1.99	2.02	0.30	3.04	5.71	6.08	2.74	0.13	0.14	0.10
0.10	0.10	0.09	0.14	0.13	0.09	0.13	0.23	0.18	0.31
0.78	0.27	0.31	0.17	0.16	0.13	0.07	0.31	0.26	0.50
0.48	0.69	0.12	0.06	0.04	0.07	0.05	0.06		
ROW : 35									
0.07	0.08	0.07	0.08	0.10	0.12	0.10	0.13	0.00	0.11
0.02	0.05	0.20	0.16	0.17	0.04	0.35	0.12	0.12	0.18
0.32	0.12	0.39	0.13	0.23	0.44	0.19	0.22	0.09	0.12
0.11	0.23	0.42	0.20	41.77	0.35	0.37	0.51	0.74	1.11
0.92	0.35	0.50	0.89	0.62	1.26	0.77	0.52	1.66	0.35
0.54	0.18	0.24	0.46	1.18	0.79	0.32	0.55	0.88	0.79
0.50	0.24	0.08	0.38	0.86	2.10	1.53	0.07	0.07	0.05
0.05	0.05	0.05	0.09	0.15	0.05	0.07	0.10	0.16	0.12
0.15	0.17	0.28	0.10	0.46	0.07	0.07	0.10	0.26	0.22
0.20	0.12	0.06	0.02	0.04	0.11	0.04	0.04		
ROW : 36									

OK, SEG SYSMAT

0.09	0.12	0.07	0.08	0.33	0.16	0.22	0.21	0.07	0.16
0.02	0.04	0.05	0.07	0.07	0.03	0.05	0.07	0.02	0.07
0.14	0.08	0.04	0.40	0.11	0.09	0.17	0.08	0.16	0.28
0.16	0.11	0.69	0.84	0.52	25.98	0.40	0.62	1.01	0.52
0.40	0.49	0.35	0.52	0.77	0.81	0.54	1.14	6.41	0.78
0.64	0.23	0.35	0.29	0.66	1.30	0.57	0.37	0.45	0.41
0.34	0.53	1.08	1.29	1.12	0.71	1.11	0.12	0.07	0.05
0.06	0.06	0.07	0.10	0.06	0.05	0.07	0.09	0.12	0.13
0.20	0.11	0.09	0.08	0.06	0.07	0.10	0.16	0.11	0.47
0.54	0.16	0.06	0.03	0.03	0.40	0.04	0.05		

ROW : 37

0.10	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01
0.00	0.02	0.01	0.04	0.05	0.01	0.00	0.02	0.00	0.01
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	19.16	0.00	0.00	0.01
0.00	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 38

0.01	0.01	0.01	0.02	0.03	0.03	0.00	0.03	0.06	0.02
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.02
0.02	0.01	0.05	0.04	0.07	0.01	0.08	57.09	0.25	0.07
0.15	0.26	0.04	0.29	0.26	0.18	0.02	0.03	0.04	0.02
0.04	0.01	0.02	0.02	0.04	0.05	0.08	0.07	0.08	0.06
0.00	0.11	0.01	0.15	0.15	0.11	0.09	0.02	0.02	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02
0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.03
0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01		

ROW : 39

0.02	0.05	0.06	0.03	0.46	0.13	0.06	0.18	0.01	0.13
0.01	0.02	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.03
0.05	0.04	0.03	0.05	0.03	0.02	0.03	0.02	0.05	0.07
0.07	0.03	0.09	0.09	0.05	0.03	0.35	0.25	17.93	0.31
0.25	0.56	0.05	0.29	0.32	0.10	0.04	0.06	0.04	0.03
0.04	0.03	0.02	0.02	0.05	0.04	0.40	0.07	0.06	0.20
0.04	0.03	0.01	0.06	0.06	0.08	0.05	0.03	0.01	0.01
0.01	0.01	0.02	0.01	0.03	0.00	0.03	0.09	0.07	0.14
0.08	0.02	0.03	0.07	0.05	0.04	0.02	0.06	0.05	0.05
0.06	0.00	0.01	0.01	0.01	0.01	0.01	0.01		

ROW : 40

0.01	0.12	0.16	0.01	0.08	0.01	0.04	0.07	0.01	0.04
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01
0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.01	0.02	0.02	0.01	0.00	0.40	0.08	0.26	29.15
0.05	0.78	0.06	0.08	0.04	0.02	0.03	0.45	0.01	0.03
0.01	0.01	0.03	0.02	0.05	0.01	0.22	0.03	0.03	0.02
0.50	0.01	0.00	0.01	0.01	0.01	0.05	0.01	0.01	0.00
0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.02
0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
0.02	0.08	0.01	0.03	0.00	0.00	0.00	0.00		

ROW : 41

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

OK, SEG SYSMAT

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 42

0.01	0.02	0.03	0.01	0.02	0.02	0.04	0.07	0.01	0.04
0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.00	0.02	0.01	0.01	0.00	0.04	0.03	0.04	0.03
0.03	14.98	0.01	0.16	0.20	0.01	0.01	0.03	0.01	0.00
0.01	0.00	0.01	0.01	0.02	0.01	0.20	0.04	0.00	0.01
0.03	0.01	0.00	0.01	0.03	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02
0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01
0.13	0.01	0.00	0.01	0.00	0.00	0.00	0.01		

ROW : 43

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	11.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		

ROW : 44

0.04	0.03	0.10	0.40	0.38	0.05	0.18	0.64	0.02	0.34
0.01	0.06	0.10	0.07	0.07	0.04	0.08	0.05	0.04	0.07
0.10	0.08	0.05	0.03	0.03	0.02	0.02	0.03	0.03	0.04
0.03	0.03	0.09	0.10	0.03	0.02	0.09	0.05	0.09	0.08
0.07	0.13	0.06	12.97	0.26	0.07	0.04	0.04	0.03	0.03
0.03	0.02	0.02	0.03	0.05	0.04	0.16	0.07	0.05	0.03
0.05	0.05	0.04	0.06	0.09	0.06	0.04	0.03	0.02	0.02
0.02	0.02	0.02	0.02	0.07	0.07	0.03	0.05	0.03	0.16
0.06	0.02	0.02	0.16	0.11	0.10	0.07	0.04	0.03	0.05
0.28	0.03	0.01	0.01	0.01	0.01	0.03	0.02		

ROW : 45

0.04	0.04	0.03	0.04	0.40	0.40	0.10	0.07	0.20	0.12
0.07	0.02	0.02	0.03	0.03	0.01	0.02	0.02	0.01	0.02
0.02	0.02	0.01	0.20	0.11	0.07	0.17	0.12	0.19	0.30
0.26	0.05	0.24	0.03	0.03	0.02	0.04	0.06	0.05	0.06
0.09	0.75	0.17	0.24	16.92	0.04	0.04	0.26	0.02	0.10
0.02	0.02	0.03	0.02	0.04	0.02	0.08	0.08	0.05	0.02
0.04	0.02	0.01	0.02	0.02	0.03	0.02	0.25	0.03	0.04
0.05	0.04	0.05	0.04	0.02	0.02	0.02	0.03	0.03	0.06
0.04	0.02	0.02	0.03	0.02	0.02	0.02	0.17	0.05	0.04
0.36	0.04	0.02	0.01	0.01	0.01	0.02	0.02		

ROW : 46

0.05	0.13	0.10	0.08	0.14	0.09	0.17	0.20	0.07	0.13
0.01	0.03	0.04	0.05	0.05	0.03	0.05	0.04	0.02	0.05
0.09	0.06	0.03	0.07	0.05	0.06	0.07	0.04	0.06	0.07
0.07	0.26	0.79	0.68	0.56	0.26	1.57	1.50	1.43	3.89
1.74	1.80	3.25	0.90	0.53	29.50	0.13	0.53	0.27	0.24
0.34	0.22	0.24	0.72	0.71	0.53	0.92	0.52	0.40	0.30
1.09	0.37	0.26	0.52	0.56	0.32	0.45	0.06	0.22	0.04
0.06	0.05	0.05	0.10	0.06	0.05	0.11	0.76	0.38	0.53
0.45	0.26	0.26	0.06	0.05	0.05	0.04	0.11	0.06	2.24
0.19	0.21	0.06	0.04	0.02	0.03	0.03	0.03		

ROW : 47

0.00	0.01	0.00	0.01	0.00	0.05	0.01	0.00	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.06	0.03	0.05
0.07	0.03	0.04	0.03	0.02	0.01	8.87	0.05	0.00	0.02
0.01	0.02	0.10	0.08	0.06	0.01	0.04	0.02	0.01	0.03
0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01		

ROW : 48

0.00	0.22	0.10	0.13	0.12	0.05	1.08	0.58	0.03	0.32
0.01	0.03	0.03	0.04	0.00	0.02	0.03	0.03	0.02	0.03
0.04	0.00	0.02	0.07	0.00	0.03	0.00	0.00	0.06	0.06
0.07	0.05	0.28	0.14	0.07	0.03	0.83	1.14	0.58	1.91
1.47	0.96	2.23	1.08	0.50	0.36	0.84	37.46	0.04	0.84
0.12	0.37	1.35	0.81	1.68	0.16	0.89	0.20	0.15	0.27
0.90	0.09	0.02	0.24	0.09	0.08	0.12	0.08	0.06	0.04
0.04	0.04	0.06	0.05	0.03	0.03	0.03	0.07	0.05	0.20
0.07	0.03	0.00	0.06	0.03	0.04	0.03	0.05	0.04	0.13
0.07	0.30	0.02	0.06	0.01	0.02	0.03	0.02		

ROW : 49

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 50

0.00	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.02
0.02	0.03	0.03	0.03	0.01	0.01	0.03	0.01	0.00	37.19
0.01	0.02	0.05	0.03	0.03	0.36	0.02	0.02	0.01	0.58
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
0.01	0.19	0.01	0.02	0.02	0.28	0.01	0.01		

ROW : 51

0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.01	0.01	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.12	0.02	0.03
0.03	0.02	0.70	0.05	0.01	0.02	0.70	0.19	0.07	0.67
12.04	1.05	2.02	0.98	0.18	0.08	0.04	0.02	0.01	0.04
0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
0.01	0.01	0.00	0.01	0.00	0.02	0.01	0.01		

ROW : 52

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01
0.00	6.52	0.02	0.01	0.00	0.00	0.00	0.00	0.01	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 53

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01
0.00	0.01	9.32	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 54

0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01
0.00	0.00	0.01	2.66	0.00	0.02	0.06	0.00	0.00	0.04
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 55

0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.02
0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.01	0.02
0.02	0.02	0.02	0.03	0.02	0.01	0.02	0.01	0.01	0.01
0.01	0.01	0.00	0.01	17.06	0.01	0.05	0.00	0.03	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.01
0.01	0.01	0.01	0.00	0.00	0.00	0.04	0.00		

ROW : 56

0.10	0.17	0.17	0.14	0.13	0.11	0.28	0.43	0.10	0.27
0.02	0.07	0.07	0.10	0.10	0.05	0.09	0.08	0.05	0.08
0.13	0.11	0.06	0.07	0.09	0.10	0.10	0.09	0.08	0.10
0.10	0.08	0.25	0.20	0.15	0.05	0.20	0.13	0.12	0.66
0.15	1.98	0.16	0.49	0.38	0.09	0.94	0.63	0.05	0.90
0.19	0.11	0.16	0.30	2.10	52.96	1.07	1.88	1.60	0.23
0.47	0.27	0.03	0.13	0.12	0.15	0.15	0.08	0.06	0.05
0.06	0.06	0.07	0.07	0.04	0.05	0.04	0.13	0.09	0.22
0.13	0.07	0.27	0.07	0.06	0.06	0.06	0.09	0.10	0.07
0.31	0.33	0.58	0.14	0.05	0.04	0.11	0.14		

ROW : 57

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 58									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
ROW : 59									
0.39	0.47	0.49	0.54	0.24	0.36	0.30	0.33	0.31	0.34
0.00	0.27	0.28	0.38	0.37	0.21	0.32	0.32	0.15	0.26
0.54	0.40	0.21	0.21	0.32	0.34	0.34	0.29	0.27	0.30
0.31	0.27	0.90	0.48	0.27	0.19	0.57	0.42	0.48	0.73
0.36	0.95	0.32	0.36	0.61	0.31	0.20	0.48	0.20	0.21
0.26	0.27	0.33	0.25	0.28	0.25	0.69	7.51	46.73	0.31
0.46	0.32	0.09	0.41	0.32	0.41	0.26	0.24	0.20	0.15
0.19	0.21	0.25	0.41	0.15	0.16	0.13	0.50	0.31	0.68
0.47	0.25	0.26	0.21	0.20	0.21	0.21	0.26	0.27	0.28
0.31	0.24	2.13	0.37	0.15	0.14	0.26	0.47		
ROW : 60									
0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.03	0.01
0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.02	0.01	0.00	0.01	0.01	0.00	0.01	0.01
0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	14.27
0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.01	0.36	0.00	0.02	0.00		
ROW : 61									
0.01	0.00	0.28	0.10	0.00	0.01	0.01	0.02	0.00	0.05
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.06	0.01	0.03	0.07	0.01	0.00	0.02	0.01	0.01	0.02
0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.00
24.40	0.01	0.01	0.02	0.03	0.04	0.02	0.01	0.00	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.02	0.01	0.09
0.06	0.00	0.00	0.01	0.01	0.01	0.03	0.01	0.01	0.02
0.01	3.37	0.00	0.00	0.01	0.05	0.01	0.01		
ROW : 62									
0.04	0.06	0.07	0.14	0.12	0.39	0.09	0.10	2.04	0.11
0.01	0.04	0.08	0.06	0.05	0.03	0.04	0.05	0.02	0.06
0.11	0.08	0.00	0.08	0.12	0.11	0.10	0.11	0.09	0.13
0.11	0.11	0.57	0.45	0.27	0.16	0.52	0.40	0.60	0.53
0.57	0.45	0.24	0.38	0.32	0.56	0.30	0.31	0.19	0.25
0.29	0.14	0.16	0.27	0.18	0.39	0.26	0.64	0.43	0.34
0.43	49.33	0.16	1.11	0.32	0.28	0.38	0.11	0.30	0.09
0.22	0.13	0.21	0.16	0.08	0.08	0.20	0.20	0.17	0.15
0.19	0.14	0.13	0.09	0.08	0.08	0.05	0.14	0.24	0.26
0.12	0.10	0.08	0.01	0.02	0.02	0.02	0.02		
ROW : 63									
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.01	0.01	0.00	0.12	0.02	0.01	0.01	0.01	0.13	0.03

0.03	0.02	0.01	0.01	0.12	0.12	0.01	0.08	0.01	0.00
0.02	0.02	0.04	0.02	0.08	0.00	0.19	0.12	0.04	0.21
0.40	0.25	0.05	0.10	0.07	0.00	0.01	0.01	0.01	0.01
0.01	0.37	20.24	0.02	0.05	0.01	0.02	0.07	0.01	0.01
0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.07	0.01
0.03	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.03	0.03
0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01		

ROW : 64

0.00	0.10	0.08	0.00	0.10	0.10	0.12	0.24	0.16	0.20
0.02	0.05	0.06	0.07	0.07	0.03	0.07	0.06	0.03	0.05
0.09	0.08	0.07	0.10	0.07	0.09	0.10	0.07	0.10	0.10
0.10	0.10	0.24	0.19	0.24	0.24	1.43	0.77	0.89	1.35
0.85	1.21	0.75	0.77	0.67	0.71	0.62	0.85	1.15	0.66
0.51	0.40	0.66	1.14	1.22	0.80	0.59	1.32	1.17	1.06
0.88	0.54	0.07	87.60	0.15	0.13	0.84	0.06	0.06	0.14
0.05	0.05	0.05	0.10	0.10	0.05	0.14	0.00	0.07	0.13
0.19	0.13	0.45	1.03	0.27	0.19	0.10	0.08	0.10	2.16
0.11	0.17	0.10	0.03	0.04	0.03	0.03	0.03		

ROW : 65

0.03	0.06	0.02	0.02	0.02	0.03	0.04	0.06	0.02	0.04
0.00	0.01	0.00	0.02	0.02	0.01	0.00	0.02	0.01	0.01
0.02	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.02
0.02	0.04	0.04	0.05	0.04	0.11	0.07	0.19	0.06	0.07
0.11	0.11	0.06	0.06	0.08	0.13	0.09	0.11	1.21	0.12
0.21	0.11	0.08	0.05	0.18	1.28	0.07	0.07	0.09	0.04
0.11	0.15	0.03	1.71	12.54	0.04	0.15	0.01	0.02	0.01
0.00	0.02	0.01	0.05	0.01	0.01	0.02	0.02	0.07	0.03
0.27	0.08	0.04	0.07	0.03	0.04	0.02	0.24	0.04	0.13
0.16	0.04	0.03	0.01	0.01	0.08	0.01	0.01		

ROW : 66

0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.01	0.04	0.07	0.06	0.01	0.03	0.21	0.01	0.26
0.59	0.12	0.04	0.01	0.06	0.17	0.32	0.01	0.01	0.01
0.01	0.13	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00
0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
0.01	0.00	0.01	0.01	0.01	6.25	0.01	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01		

ROW : 67

0.63	1.02	1.00	0.49	0.83	2.50	0.81	0.63	0.31	1.58
0.37	0.39	0.60	0.64	0.64	0.43	0.52	0.59	0.34	0.74
1.99	1.38	0.42	1.57	1.10	1.20	1.65	0.96	1.55	2.75
2.43	1.17	2.80	2.47	4.21	1.07	3.47	2.24	0.47	4.11
3.60	2.98	1.68	3.43	4.38	2.60	2.75	2.75	1.08	2.55
3.23	2.20	0.87	0.97	4.10	2.36	1.50	3.37	3.18	3.06
2.48	1.76	0.59	3.31	1.97	2.09	59.44	0.62	1.19	1.07
0.92	1.00	0.53	1.18	1.15	0.93	1.19	1.25	1.20	1.78
1.28	2.12	0.90	0.94	0.66	0.76	0.36	1.79	1.67	1.64
1.21	1.20	0.39	0.11	0.20	0.16	0.23	0.24		

ROW : 68

0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00
0.00	0.00	0.01	0.00	0.00	0.01	0.03	0.01	0.02	0.03
0.00	0.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.02	0.01
0.01	0.01	0.00	0.00	0.02	0.01	0.30	0.01	0.01	0.00
0.01	0.00	0.00	0.00	0.02	0.02	0.00	6.60	0.49	0.59
0.82	0.60	0.01	0.53	0.62	0.20	0.04	0.05	0.01	0.01

0.01	0.06	0.01	0.02	0.02	0.06	0.01	0.09	0.06	0.08
0.01	0.00	0.01	0.00	0.02	0.01	0.00	0.00		

ROW : 69

0.00	0.02	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00
0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03	2.40	0.02
0.21	0.13	0.02	0.33	0.02	0.15	0.04	0.00	0.00	0.00
0.01	0.11	0.00	0.01	0.01	0.01	0.00	0.09	0.01	0.05
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 70

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	2.08
0.29	0.34	0.00	0.04	0.00	0.21	0.01	0.00	0.00	0.00
0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 71

0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.40	0.00	0.00	0.11	0.00	0.42	0.07	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 72

0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.08	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	26.89	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.15	0.00	0.01	0.00	0.01	0.00	0.03	0.03		

ROW : 73

0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.12	0.02	0.09
0.06	0.09	5.03	0.06	0.01	0.02	0.01	0.00	0.00	0.00
0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00		

ROW : 74

0.04	0.47	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01
0.00	0.01	0.01	0.04	0.02	0.00	0.01	0.00	0.01	0.01

0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.01
0.01	0.04	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.02	0.00
0.00	0.01	0.00	0.00	0.02	0.00	0.02	0.06	0.04	0.00
0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.46	0.02
0.19	0.52	0.01	6.37	0.01	0.31	0.10	0.01	0.01	0.01
0.07	0.15	0.03	0.01	0.01	0.01	0.03	0.09	0.01	0.03
0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01		

ROW : 75

0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.06	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01
0.01	0.00	0.00	0.00	0.00	0.01	0.10	0.00	0.00	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00
0.06	0.00	0.05	0.01	0.00	0.00	0.01	0.01	0.00	0.00
0.01	0.00	0.00	0.00	16.77	0.21	2.37	0.00	0.01	0.01
0.00	0.03	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.06
0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00		

ROW : 76

0.01	0.03	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.02
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01
0.02	0.01	0.00	0.02	0.02	0.00	0.01	0.01	0.02	0.02
0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01
0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.01	0.00	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.10	0.00
0.01	0.00	0.00	0.01	0.00	11.16	0.00	0.02	0.02	0.01
0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.01	0.05	0.02	0.00	0.01	0.02	0.02	0.00		

ROW : 77

0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00
0.02	0.01	0.00	0.01	0.02	0.01	0.00	0.01	0.02	0.02
0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.02	0.01
0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00
0.01	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.00
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	11.55	0.01	0.01	0.01
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
0.00	0.02	0.01	0.00	0.00	0.01	0.00	0.00		

ROW : 78

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 79

0.17	0.09	0.08	0.06	0.12	0.15	0.15	0.15	0.06	0.10
0.02	0.09	0.10	0.27	0.61	0.05	0.21	0.13	0.15	0.89
2.83	1.75	0.03	0.11	0.80	1.83	0.11	0.26	0.28	0.14
0.21	0.16	0.17	0.09	0.09	0.05	0.10	0.10	0.08	0.15
0.11	0.19	0.16	0.16	0.30	0.07	0.54	0.69	0.12	0.21
1.14	0.20	0.25	0.36	0.70	2.28	0.22	0.22	0.50	0.11
0.25	0.39	0.13	0.09	0.10	0.00	0.48	0.07	0.06	0.05

0.06	0.06	0.06	0.07	0.27	0.06	0.10	0.08	80.81	0.12
0.36	0.58	0.44	0.06	0.05	0.05	0.05	0.09	0.51	0.30
1.47	0.21	0.06	0.02	0.03	0.02	0.23	0.14		

ROW : 80

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 81

0.08	0.02	0.03	0.04	0.08	0.05	0.08	0.07	0.02	0.04
0.00	0.02	0.01	0.04	0.04	0.02	0.01	0.03	0.01	0.01
0.02	0.02	0.01	0.03	0.03	0.01	0.07	0.03	0.03	0.02
0.02	0.02	0.08	0.10	0.02	0.01	0.04	0.03	0.03	0.03
0.03	0.04	0.02	0.06	0.17	0.03	0.03	0.11	0.05	0.03
0.07	0.02	0.02	0.02	0.08	0.04	0.02	0.03	0.03	0.01
0.03	0.07	0.02	0.04	0.05	0.05	0.06	0.02	0.01	0.01
0.03	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.03	0.03
10.95	0.03	0.08	0.01	0.01	0.04	0.01	0.06	0.02	0.04
0.57	0.18	0.01	0.00	0.01	0.02	0.01	0.02		

ROW : 82

0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01
0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
0.03	0.40	0.02	0.01	0.01	0.01	0.04	0.01	0.00	0.00
0.01	0.01	0.00	0.01	0.01	0.01	0.02	0.00	0.00	0.01
0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	9.85	0.03	0.01	0.01	0.01	0.01	0.01	0.00	0.01
0.05	0.00	0.01	0.00	0.00	0.00	0.03	0.07		

ROW : 83

0.11	0.08	0.06	0.05	0.03	0.04	0.08	0.23	0.02	0.13
0.01	0.05	0.07	0.07	0.08	0.05	0.07	0.06	0.01	0.04
0.05	0.03	0.04	0.04	0.08	0.06	0.07	0.07	0.05	0.05
0.07	0.06	0.04	0.05	0.05	0.02	0.10	0.05	0.06	0.12
0.17	0.06	0.04	0.06	0.08	0.04	0.07	0.06	0.08	0.04
0.03	0.08	0.03	0.03	0.06	0.03	0.08	0.06	0.07	0.02
0.11	0.03	0.02	0.04	0.07	0.07	0.09	0.03	0.03	0.02
0.02	0.02	0.03	0.03	0.04	0.02	0.06	0.13	0.08	0.06
0.07	0.59	10.51	0.13	0.08	0.08	0.04	0.10	0.06	0.09
0.38	0.09	0.01	0.01	0.09	0.02	0.07	0.03		

ROW : 84

0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.01
0.00	0.03	0.05	0.03	0.03	0.02	0.05	0.03	0.01	0.04
0.04	0.04	0.11	0.02	0.04	0.08	0.02	0.06	0.06	0.02
0.01	0.07	0.01	0.01	0.03	0.01	0.02	0.01	0.01	0.01
0.01	0.01	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.01
0.02	0.03	0.01	0.01	0.03	0.02	0.01	0.01	0.02	0.01
0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.02	0.01
0.02	0.02	0.03	0.03	0.02	0.02	0.06	0.01	0.03	0.02
0.06	0.03	0.03	2.68	0.63	0.41	0.19	0.02	0.06	0.09
0.01	0.02	0.03	0.00	0.01	0.01	0.03	0.01		

ROW : 85

0.07	0.02	0.06	0.09	0.01	0.01	0.01	0.01	0.01	0.01

0.01	0.13	0.22	0.14	0.14	0.10	0.27	0.15	0.03	0.29
0.20	0.21	0.51	0.05	0.18	0.35	0.06	0.43	0.08	0.05
0.03	0.16	0.03	0.02	0.05	0.03	0.04	0.04	0.03	0.03
0.04	0.03	0.07	0.04	0.02	0.05	0.07	0.04	0.04	0.03
0.07	0.14	0.03	0.03	0.14	0.12	0.02	0.03	0.03	0.02
0.03	0.04	0.06	0.07	0.03	0.06	0.06	0.08	0.07	0.05
0.12	0.06	0.07	0.10	0.05	0.08	0.16	0.05	0.17	0.16
0.08	0.08	0.03	0.08	5.85	0.21	0.08	0.06	0.12	0.22
0.02	0.02	0.01	0.00	0.01	0.01	0.09	0.02		

ROW : 86

0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.01	0.02
0.00	0.02	0.03	0.03	0.02	0.01	0.04	0.02	0.01	0.02
0.03	0.03	0.42	0.01	0.04	0.06	0.03	0.03	0.02	0.02
0.02	0.03	0.02	0.02	0.02	0.01	0.03	0.03	0.03	0.04
0.03	0.03	0.05	0.03	0.03	0.03	0.04	0.06	0.07	0.04
0.05	0.04	0.03	0.04	0.07	0.05	0.03	0.03	0.03	0.03
0.02	0.03	0.02	0.04	0.02	0.02	0.03	0.02	0.02	0.02
0.03	0.02	0.03	0.02	0.01	0.03	0.02	0.02	0.03	0.02
0.03	0.03	0.02	0.02	0.05	7.79	0.58	0.02	0.03	0.03
0.02	0.04	0.02	0.01	0.02	0.01	0.03	0.05		

ROW : 87

0.07	0.07	0.06	0.07	0.04	0.07	0.06	0.05	0.05	0.05
0.02	0.09	0.07	0.09	0.09	0.04	0.09	0.08	0.04	0.11
0.10	0.17	0.41	0.05	0.17	0.51	0.13	0.09	0.07	0.06
0.07	0.14	0.07	0.06	0.06	0.06	0.12	0.07	0.07	0.11
0.07	0.08	0.14	0.08	0.09	0.10	0.14	0.07	0.04	0.05
0.10	0.17	0.08	0.06	0.26	0.06	0.06	0.12	0.10	0.04
0.06	0.05	0.08	0.09	0.05	0.06	0.08	0.05	0.07	0.05
0.10	0.07	0.07	0.07	0.06	0.11	0.09	0.05	0.16	0.06
0.07	0.15	0.06	0.08	0.15	0.12	9.09	0.07	0.07	0.14
0.06	0.11	0.07	0.03	0.12	0.11	0.32	0.16		

ROW : 88

0.30	0.10	0.53	0.59	0.10	0.09	0.12	0.25	0.08	0.18
0.02	0.24	0.38	0.32	0.35	0.33	0.30	0.29	0.13	0.28
0.48	0.38	0.21	0.09	0.10	0.17	0.11	0.14	0.10	0.09
0.15	0.14	0.44	0.15	0.11	0.08	0.70	0.27	0.36	0.30
0.26	0.40	0.24	0.43	0.28	0.31	0.53	0.23	0.24	0.20
0.33	0.18	0.13	0.15	0.82	0.44	0.21	1.37	1.12	0.19
0.45	0.15	0.11	0.25	0.21	0.29	0.23	0.08	0.09	0.07
0.08	0.10	0.14	0.26	0.28	0.15	0.99	0.93	0.57	1.11
0.87	0.33	0.25	0.72	0.41	0.39	0.19	35.82	0.62	0.34
0.22	0.28	1.26	0.06	0.12	0.07	0.21	0.07		

ROW : 89

0.07	0.05	0.04	0.20	0.13	0.09	0.04	0.05	0.03	0.04
0.01	0.05	0.14	0.12	0.25	0.03	0.14	0.06	0.04	0.29
0.39	0.11	0.03	0.08	0.30	1.59	0.12	0.58	0.10	0.08
0.32	0.28	0.09	0.05	0.04	0.03	0.12	0.10	0.10	0.06
0.13	0.09	0.40	0.16	0.09	0.05	0.43	0.15	0.10	0.33
0.34	0.39	0.13	0.15	0.62	0.29	0.06	0.09	0.29	0.04
0.13	0.06	0.13	0.07	0.15	0.09	0.16	0.14	0.04	0.07
0.12	0.08	0.27	0.08	0.14	0.15	0.80	0.09	0.06	0.05
0.05	0.67	0.08	0.08	0.07	0.05	0.03	0.07	17.07	0.51
0.30	0.13	0.04	0.01	0.06	0.08	0.15	0.07		

ROW : 90

0.01	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.01
0.00	0.01	0.01	0.02	0.01	0.01	0.05	0.02	0.01	0.01
0.02	0.02	0.02	0.01	0.02	0.02	0.04	0.02	0.01	0.02
0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.02
0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.04	0.01

0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.03
0.02	0.01	0.01	0.09	0.14	0.06	0.35	0.02	0.02	0.02
0.02	0.14	0.02	0.01	0.01	0.03	0.03	0.02	0.02	9.71
0.02	0.01	0.09	0.01	0.02	0.01	0.02	0.02		

ROW : 91

0.35	0.24	0.07	0.09	0.15	0.71	0.47	0.57	0.15	0.34
0.01	0.13	0.09	0.20	0.21	0.08	0.07	0.13	0.05	0.08
0.09	0.16	0.06	0.08	0.08	0.08	0.08	0.08	0.07	0.08
0.07	0.09	0.12	0.12	0.10	0.04	0.07	0.08	0.08	0.10
0.07	0.13	0.07	0.09	0.84	0.09	0.07	0.07	0.04	0.05
0.08	0.06	0.06	0.06	0.07	0.07	0.09	0.07	0.07	0.09
0.09	0.08	0.04	0.13	0.10	0.09	0.10	0.08	0.09	0.08
0.09	0.08	0.08	0.08	0.07	0.09	0.07	0.09	0.10	0.18
0.12	0.07	0.09	0.08	0.08	0.07	0.10	0.08	0.08	0.08
9.94	0.08	0.04	0.02	0.10	0.03	0.14	0.24		

ROW : 92

0.05	0.02	1.02	0.35	0.01	0.03	0.03	0.08	0.01	0.17
0.01	0.04	0.03	0.04	0.04	0.04	0.03	0.03	0.03	0.02
0.03	0.05	0.05	0.06	0.03	0.04	0.03	0.02	0.03	0.04
0.20	0.04	0.10	0.25	0.03	0.02	0.08	0.05	0.05	0.05
0.08	0.06	0.03	0.05	0.07	0.05	0.05	0.06	0.12	0.02
0.03	0.03	0.03	0.02	0.05	0.03	0.05	0.05	0.07	0.02
0.08	0.06	0.02	0.07	0.11	0.16	0.06	0.03	0.02	0.03
0.03	0.03	0.04	0.03	0.03	0.03	0.02	0.09	0.15	0.33
0.20	0.02	0.02	0.04	0.02	0.04	0.11	0.03	0.03	0.06
0.05	12.36	0.01	0.00	0.01	0.17	0.04	0.02		

ROW : 93

0.53	0.25	0.10	0.17	0.09	0.13	0.18	0.20	0.61	0.46
0.06	0.46	0.32	0.65	0.78	0.72	0.58	0.47	0.25	0.62
0.52	0.47	0.17	0.12	0.21	0.39	0.37	0.50	0.35	0.33
0.81	0.32	0.71	0.59	0.57	0.37	0.61	0.37	0.36	0.39
0.39	0.44	0.27	0.33	0.68	0.19	0.15	0.46	0.32	0.18
0.22	0.19	0.26	0.13	0.43	0.28	0.24	0.34	0.21	0.11
0.30	0.29	0.16	0.46	0.85	0.99	0.24	0.22	0.19	0.16
0.19	0.28	0.21	0.25	0.22	0.15	0.18	1.39	0.51	1.35
1.17	0.21	0.39	0.47	0.42	0.38	0.12	0.34	0.36	0.36
0.24	0.11	17.15	0.02	0.05	0.04	1.32	0.09		

ROW : 94

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

ROW : 95

0.04	0.02	0.03	0.15	0.01	0.07	0.03	0.04	0.34	0.08
0.02	0.06	0.04	0.05	0.05	0.07	0.04	0.05	0.06	0.04
0.04	0.05	0.04	0.06	0.04	0.05	0.04	0.05	0.05	0.05
0.10	0.05	0.06	0.05	0.05	0.06	0.05	0.04	0.04	0.04
0.06	0.05	0.04	0.04	0.04	0.04	0.05	0.04	0.04	0.03
0.04	0.04	0.04	0.03	0.04	0.04	0.04	0.05	0.05	0.03
0.04	0.03	0.08	0.04	0.05	0.06	0.04	0.05	0.05	0.05
0.05	0.05	0.03	0.04	0.05	0.04	0.03	0.04	0.04	0.13
0.07	0.03	0.03	0.05	0.03	0.04	0.05	0.04	0.04	0.05
0.03	0.06	0.01	0.08	4.75	0.05	0.26	0.02		

ROW : 96

0.17	0.27	0.17	0.19	0.08	0.21	0.16	0.13	0.11	0.13
0.03	0.14	0.12	0.18	0.15	0.08	0.15	0.15	0.08	0.13
0.16	0.18	0.12	0.11	0.19	0.24	0.19	0.16	0.14	0.15
0.14	0.17	0.15	0.11	0.13	0.10	0.16	0.14	0.17	0.19
0.16	0.18	0.16	0.15	0.14	0.13	0.18	0.15	0.10	0.15
0.17	0.17	0.21	0.18	0.17	0.14	0.11	0.13	0.13	0.11
0.09	0.14	0.11	0.19	0.12	0.13	0.14	0.13	0.13	0.11
0.15	0.14	0.14	0.15	0.11	0.12	0.12	0.14	0.15	0.16
0.18	0.13	0.14	0.11	0.12	0.14	0.31	0.15	0.15	0.20
0.11	0.23	0.23	0.08	0.28	14.79	0.41	0.44		

ROW : 97

1.33	0.62	0.65	0.59	0.34	0.48	0.53	0.44	0.63	0.40
0.59	2.46	1.18	2.29	2.36	1.09	0.95	2.13	1.24	1.24
1.03	1.32	0.43	0.80	0.69	0.77	1.05	1.36	0.81	0.72
0.77	1.16	2.08	1.90	1.77	2.32	2.09	1.03	1.19	1.41
1.28	1.37	0.91	1.12	1.21	1.05	0.88	1.07	1.26	0.61
0.80	1.09	0.60	0.73	1.12	1.85	0.91	1.19	1.99	0.51
0.95	0.78	0.54	1.12	1.63	1.85	1.29	0.82	1.67	1.10
1.25	1.23	0.91	1.38	1.50	1.16	0.94	0.71	0.66	0.44
0.95	0.77	0.31	1.36	0.54	0.52	0.40	0.83	0.83	1.04
0.73	0.42	0.49	0.08	0.13	0.17	18.73	0.22		

ROW : 98

2.04	3.00	2.71	4.24	0.71	2.85	2.78	2.70	2.68	2.93
0.30	2.07	1.51	2.15	1.70	0.76	2.89	2.09	1.37	1.87
3.07	3.10	2.40	1.79	3.47	3.78	3.40	2.86	2.92	2.86
1.93	2.39	1.69	1.20	1.83	1.00	1.18	1.18	1.53	2.12
1.72	1.69	2.03	1.38	1.49	1.47	1.46	1.48	1.04	1.95
2.43	2.99	3.73	1.97	1.49	1.89	1.37	1.01	1.17	1.00
1.06	2.12	0.68	2.71	1.06	1.22	1.39	2.57	1.97	1.53
1.89	1.94	2.36	1.97	1.05	1.59	1.13	1.72	2.63	3.10
2.21	1.64	1.55	1.43	1.54	1.78	2.37	2.29	2.37	1.87
1.01	1.06	1.65	0.73	1.26	1.26	1.30	18.28		

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