The Cyclical Behaviour of Wages

Jonathan Michie
Balliol College

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Abstract

In 1938 Dunlop challenged the assertion in the General Theory that wages moved countercyclically. The resulting debate on the cyclical movement of wages deserves study as an episode in the history of economic thought. This is done in chapter 2 which reviews the theoretical issues and chapter 3 which reviews the empirical work.

To understand this history requires some analysis of the meaning and significance of the debate.

At one level the debate can be interpreted as the search for a 'stylised fact'. This is apparently an empirical question and part of the thesis will be concerned to use data for various countries, time-periods, cycle phases, and industries to examine whether there is any systematic cyclical pattern in wage movements.

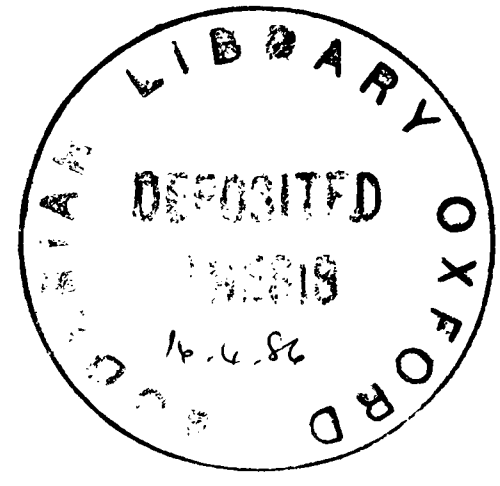
The conclusion of the empirical analysis is that there is no such empirical regularity.

At a second level the debate was theoretical. The empirical observation that wages moved procyclically was thought to falsify a prevailing theory. What is interesting about this debate is the light it sheds on the response of economists to apparent falsification.

A third level of the debate is the issue of inference. Keynes tended to treat theory as prior, attacking 'pseudo natural science procedures'. Keynes was not opposed in principle to statistical work informing theory: although in practice he did not attempt the empirical investigation into cyclical wages for which he called. Thus from a different methodological standpoint Burns & Mitchell criticise the theorist who 'often stops before his work is finished'. Current econometrics would emphasise the need for identifying assumptions before estimates could be used to test hypotheses. In this framework, the implications for theory of any reduced form regularity would be ambiguous in the absence on non-data based identifying assumptions.

This thesis uses the history of the debate and the empirical analysis to illustrate these themes of observation, theory and inference.

For my mother, Anne



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Chapter 1. INTRODUCTION

In 1938 Dunlop challenged the assertion made by Keynes in the General Theory that real wages moved countercyclically. This prompted a debate which has continued to the present day.

The debate on the cyclical movement of wages[1] is an important economic controversy which deserves serious study as an episode in the history of economic thought. This is pursued in chapter 2 of this thesis, which reviews the theoretical issues, and chapter 3 which reviews the empirical work.

To understand this history, however, requires some analysis of the meaning and significance of the debate. This can be examined at a number of levels.

1. The 'stylised fact' of cyclical wages

At one level the debate can be interpreted as the search for a 'stylised fact': that is, the search for a general empirical observation that real wage movements are counter- (or pro-) cyclical. This is apparently an empirical question, and is of some interest in its own right. Indeed, there has been renewed interest in this empirical question since the mid-1970s.

One aim of this thesis is to contribute to that empirical literature, using data for various countries, time-periods, cycle-phases, and industries to examine whether there is any such

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1. Definitions of 'real' and 'product' earnings are discussed in chapter 2.

systematic cyclical pattern in wage movements. For comparability, this empirical analysis will be conducted using the procedures adopted by the participants in the debate. The status of these procedures is discussed further below.

However, even at this simple level of a search for a stylised fact, the empirical question (are wage movements pro- or counter-cyclical?) is not well defined until there is agreement on how to characterise the cyclical pattern of the economy with which wage movements are being compared; but within economics there is no such agreement. The cyclical pattern can be defined in terms of some general reference cycle, or as innovations relative to rational expectations of the variables, or in terms of the correlation of wages with some cyclical variable such as output or employment. There is also considerable controversy about the separation of trend from cycle and the allowance for extraneous influences. The sensitivity of the results to these issues is examined in the empirical analysis.

The conclusion of the empirical analysis reported in this thesis (and of some but not all of the recent literature) is that there is no evidence of a systematic empirical regularity in the cyclical pattern of wage movements. There does not appear to be a stylised fact to be found, which is perhaps a part of the reason why the search and the controversy have proceeded so long. The other necessary part of such an explanation for the durability of the controversy would need to explain why the non cyclical pattern has not yet been generally accepted. The answer may be twofold. First, and more fundamentally, is the belief held by some that there should be a cyclical pattern. Second,

the two (cyclical output and wage) series do appear related, only not directly and the resulting correlation is not a stable one. There may be a perfectly determinate (and explicable) relation between these two economic variables, reflecting, even, a stable structure of the economy; and yet that statistical correlation between the two time series may vary over time as a result of the other variables and relations in the economy. Nevertheless the appearance of temporary correlations between the two series has encouraged the claim of a cyclical pattern to continue to be made at the level of theory and empirical prediction.

1.1 The belief in counter-cyclical real wages

It might appear strange to put as much emphasis as this thesis does on the empirical side of the cyclical wage debate. An examination of the 'stylised fact' of real wages being countercyclical might be thought methodologically redundant (as meaningless without properly identified assumptions to be estimated) and/or already empirically disproved.

The former question is considered separately, below.

As for the latter, this is not the case: there are at least three groups of writers who imply that real wages actually are countercyclical.

First, there are passing references made from outside the cyclical wage literature, including in textbook presentations of the diminishing marginal product of labour curve, which imply, or even state, that real wages do move countercyclically. For example an article by Stanley Dennison (1984, p.64) claims 'that

Keynes himself...fully accepted the "orthodox" analysis', citing Keynes' General Theory statement that

> 'an increase in employment can only occur to the accompaniment of a decline in the rate of real wages. Thus I am not disputing this vital fact which the classical economists have (rightly) asserted as indefeasible'.
> (Keynes, 1936, p.17)

As discussed in chapter 3, Keynes himself in 1939 dissociated himself from this view. But the real point here is that Dennison appears to believe what Keynes did in 1936, namely that real wages do, empirically, move countercyclically.

Second, and most important for the empirical work reported in later chapters, there are some participants in the cyclical wage debate itself who report having found that real wages are, indeed, countercyclical. An example would be Otani (1978). This, and the other studies, are reported and discussed in chapter 3.

Third, last, and most topical are the economic and political commentators, from Samuel Brittan in the Financial Times, to the Chancellor of the Exchequer, who imply that a cyclical reduction in real wages is necessary and/or sufficient for a cyclical expansion in employment and output.

A typical such article by Samuel Brittan appeared in the July 26 1984 Financial Times:

> '...real wage growth would need to slip below two per cent per annum and probably below one per cent and stay there for several years if unemployment were to be reduced in the remainder of the 1980s.
>
> 'Unemployment is being swollen by...high real wages...

> '...if a rise in real wages is associated with a fall in employment for a given capital stock, labour productivity will rise...the economy has moved up the demand curve for labour to a lower employment level'.

Brittan's article was based on Symons (1984) which argued that:

> '...the fall in manufacturing employment since 1978 is entirely consistent with an operative neoclassical demand for labour schedule...' (p.1)
>
> 'What these calculations do at least show is that the data do not contain an obvious refutation of the proposition that the real wage is too high'. (p.9, emphasis in original).

2. Theory, facts and falsification

Despite the views illustrated in the previous section it is not surprising that there is no simple cyclical pattern to real wages. This point has been made in reply to the current government claims referred to above, for example by Nickell (1985). Chapter 2 also shows that even the assumption underlying much of the counter-cyclical wage viewpoint - the shape of the marginal product of labour, and cost, curves - has long been open to dispute.

At a second level, then, the cyclical wage debate was, and is, a theoretical one. The controversy generated such heat because the empirical observation that wages did not move countercyclically was thought to falsify a prevailing theory. The perceived theoretical significance of the result is discussed in chapter 2. What is particularly interesting about the debate at this level is the light it sheds on the response of economists to apparent falsification.

2.1 Falsification and the methodological responses

Behind the different responses of economists to apparent falsification lie different methodological beliefs as to the status of falsificationism, and what the response of theory *should* be.

First a working definition of what is meant by 'falsificationism' is needed:

> 'Falsificationism. A methodological standpoint that regards theories and hypotheses as scientific if and only if their predictions are, at least in principle, empirically falsifiable; "naive falsificationism" holds that theories can be refuted by a single test, whereas "sophisticated falsificationism" holds that it requires a large number of tests to refute a theory'. (Blaug, 1980, p.266)

The methodological approach most impervious to falsificationism would be apriorism:

> 'If a contradiction appears between a theory and experience, we must always assume that a condition pre-supposed by the theory was not present, or else that there is some error in our observation. The disagreement between the theory and the facts of experience frequently forces us to think through the problems of the theory again. But so long as a rethinking of the theory uncovers no errors in our thinking, we are not entitled to doubt its truth'. (Ludwig von Mises, 1933, p.30 in 1960 edition. Cited in Katouzian, 1980, pp.39-40)

The strongest counter-influence to the philosophical approach typified by this passage from von Mises would be from the falsificationists of the Popper school. Blaug, in advocating falsificationism, acknowledges Duhem's argument that no individual scientific hypothesis is conclusively falsifiable since the particular hypothesis is always tested in conjunction with auxiliary statements, hence we can never be sure that we have confirmed or refuted the hypothesis itself rather than the

auxilliary statements (Duhem, 1954: translated from Duhem, 1906). Thus Blaug describes the view that a single test alone could refute a hypothesis as 'naive falsificationism'. He also argues that Popper's whole methodology was conceived to deal with this difficulty:

> 'In point of fact, no conclusive disproof of a theory can ever be produced; for it is always possible to say that the experimental results are not reliable, or that the discrepancies which are asserted to exist between the experimental result and the theory are only apparent and that they will disappear with the advance of our understanding'.
> (Popper, 1959, p.50; cited in Blaug, 1980, p.18)

The arguments here about the reliability of experiments are not actually the crucial ones for Duhem's irrefutability hypothesis, the latter being explicitly discussed elsewhere in Popper's Logic of Scientific Discovery, and more fully in Conjectures and Refutations:

> 'Now it has to be admitted that we can often test only a large chunk of a theoretical system, and sometimes perhaps only the whole system, and that, in these cases, it is sheer guesswork which of its ingrediants should be held responsible for any falsification; a point which I have tried to emphasise - also with reference to Duhem - for a long time past.'
> (1972, p.239)

The relevance of this to the argument of this thesis is that the results from estimating a model will depend not only on the data, but also on the prior specification of the model.

It also leads to the difficulty of deciding when a disproof becomes conclusive? In Popperian terms this is a matter of setting methodological limits on stratagems which might be adopted to safeguard theories against refutation.

How individual participants, and particularly Keynes, reacted to

the apparent falsification is considered in the following section. First it can be indicated what 'immunising strategy' was, historically, adopted in defence of the neoclassical diminishing marginal product of labour hypothesis (against the challenge that its prediction of countercyclical real wages had been refuted empirically).

First, paraphrasing the passage from Popper cited above: it has been argued that the reported results are not necessarily reliable.

Second has been a 'Lakatosian' tendency to treat the neoclassical diminishing marginal product of labour hypothesis as an increasingly 'hard core' belief surrounded by a protective belt of auxiliary assumptions. The most extreme example, discussed in chapter 3, is that of Tatom.

It might be objected by modern economists that the interconnection of labour and product markets, the possibility of supply or demand shocks, and so on do not imply a countercyclical real wage hypothesis, regardless of whether the diminishing marginal product of labour hypothesis is valid or not. There would therefore be no need for a protective belt of auxiliary assumptions around such a belief protecting it from actual cyclical patterns of real wage movements. In other words there are enough indispensible assumptions, without which the model would be mis-specified, to produce an agnostic prediction for real wages.

The point, however, is that such a view of the economy, with its

agnostic view as to the cyclical pattern of real wages, was not the view held in the 1930s: hence Keynes' assertion (or unthinking acceptance) of the requirement for real wages to move countercyclically (and hence for real wages to decline in the boom). It was this (diminishing marginal product of labour) model of the economy, and this empirical prediction (of countercyclical real wages) that was confronted in the 1930s by apparent falsification. Today's theory, and cyclical wage predictions, have developed out of that, 1930s version and the resulting 'immunising strategy' adopted by that version of neoclassical theory in the face of apparent falsification.

2.2 Falsification and the individual responses

The response of Keynes (1939) to the apparent falsification of the theory held by Keynes (1936) was particularly striking in terms of the methods used to immunise theories against such falsification. He responded with three defences.

First, he makes clear that he had not intended his assertion (regarding the countercyclical behaviour of real wages) as a scientific prediction to be tested:

> 'I complain a little that I in particular should be criticised...as if I was the first to have entertained the fifty-year-old generalisation that, trend eliminated, increasing output is usually associated with a falling real wage'.
> (Keynes, 1939, pp.50-51)

It is ironic in this context, though, that his original General Theory statement regarding the countercyclical behaviour of real wages was worded in terms of an empirical task to be undertaken.

Second, Keynes suggests that possibly 'the experimental results

are not reliable' (to quote from the above passage from Popper).

Third, Keynes argues that even if his hypothesis had been falsified it would not affect his general theory of employment, other than to strengthen it.

These responses from Keynes are considered in greater detail in the survey of the literature (chapter 3), as are the other contributions. Keynes ended his 1939 article with an appeal for more empirical work (which would be the Popperian approach to overcoming Duhem's irrefutability theorem - despite Keynes' other, anti-Popperian, responses). It is striking, however, that the subsequent two contributors, Ruggles (1940) and Tobin (1947) far from attempting any such work instead raised further doubts as to the reliability of the work which had been undertaken, by Dunlop (1938) and Tarshis (1939).

3. Inference

A third level of the debate, then, which was rarely explicitly discussed, is the issue of inference: the question of how observations related to theories.

Keynes tended to treat theory as prior, attacking 'pseudo natural science' procedures which did otherwise. His response to theory being confronted with empirical results was, far from viewing theory as being inferred from such empirical observations, close to the extreme apriorism of von Mises cited above.

Stewart (1979, p.122) distinguishes between apriorism of the von

Mises school on the one hand, and, on the other hand Keynes' methodology which he labels 'analytical', as follows:

> 'Quite often in methodological literature, writers fail to make any distinction between the analytical and apriorist schools, using either one of the labels to describe both approaches. But there is a clear and significant difference between the two. The analytical account does not assert that the propositions of economic theory are materially true a priori. What is being argued, instead, is that these are propositions about empirical reality - that they are capable of being set against factual observation - but that they are so obvious to commonsense that they do not need to be 'tested' by inductive-statistical means'. (emphasis in original)

Similarly in his classic Essay on the Nature and Significance of Economic Science Robbins (1948, pp.115-6) refers to the 'analytical' school to mean the standard, orthodox tradition of economics; and describes the analytical school's use of prior beliefs as follows:

> 'These are not postulates the existence of whose counterpart in reality admits of extensive dispute once their nature is fully realised. We do not need controlled experiments to establish their validity: they are so much the stuff of our everyday experience that they have only to be stated to be recognised as obvious.' (p.79)

The 'Law of Diminishing Returns' is stated by Robbins (pp.76-77) to be one of these prior beliefs that 'have only to be stated to be recognised as obvious': a prior belief of some importance in establishing the belief that cyclical returns to labour in an expansion must diminish.

The distinction is an important one: between those (like von Mises) who hold prior beliefs independent of experience, and those (like Robbins and Keynes) who hold prior beliefs which, while being so obviously true that they do not need to be tested, nevertheless could be so tested, and, more importantly, are

considered to derive from experience. Rather than use Stewart's terminology of aprioriśm and the analytical school, the fact that the latter do, in practice, hold prior beliefs, can be indicated by using the distinction in Klant (1984) between 'rationalistic aprioriśm' (corresponding to the philosophical school of aprioriśm) and 'empirical aprioriśm'.

Keynes' criticism of the idea that economists should, empirically, discover the 'real values' for the variable functions in economic models is best known from his writings on Tinbergen's work. Similar sentiments are voiced in the following letter to Roy Harrod:

> 'It seems to me that economics is a branch of logic, a way of thinking; and that you do not repel sufficiently firmly attempts a la Schultz to turn it into a pseudo-natural science. One can make some quite worthwhile progress merely by using your axioms and maxims. But one cannot get very far except by devising new and improved models. This requires, as you say, a "vigilant observation of the actual working of our system". Progress in economics consists almost entirely in a progressive improvement in the choice of models...
>
> 'But it is of the essence of a model that one does not fill in real values for the variable functions. To do so would make it useless as a model. For as soon as this is done, the model loses its generality and its value as a mode of thought. That is why Clapham with his empty boxes was barking up the wrong tree and why Schultz's results, if he ever gets any, are not very interesting (for we know beforehand that they will not be applicable to future cases). The object of statistical study is not so much to fill in missing variables with a view to prediction, as to test the relevance and validity of the model.
>
> 'Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. It is compelled to be this, because, unlike the typical natural science, the material to which it is applied is, in too many respects, not homogeneous through time. The object of a model is to segregate the semi-permanent or relatively constant factors from those which are transitory or fluctuating so as to develop a logical way of thinking about the latter, and of understanding

> the time sequence to which they give rise in particular cases.
>
> 'Good economists are scarce because the gift for using "vigilant observation" to choose good models, although it does not require a highly specialised intellectual technique, appears to be a very rare one.
>
> 'In the second place, as against Robbins, economics is essentially a moral science and not a natural science. That is to say, it employs introspection and judgements of value.'
> (Keynes, 1973, pp.296-7; cited by Blaug, 1980, pp.90-91)

It is not clear why Keynes cites Robbins as believing economics to be a natural science. Following from the passage cited above Robbins (1933, pp.99-100) goes on to conclude that:

> 'In the light of all that has been said the nature of economic analysis should now be plain. It consists of deductions from a series of postulates, the chief of which are almost universal facts of experience present whenever human activity has an economic aspect, the rest being assumptions of a more limited nature based upon the general features of particular situations or types of situations which the theory is to be used to explain.'

Robbins also argues (pp.108-110) that while the coefficients derived from observation are useful, they cannot be compared to 'statistical laws' of natural science. And he criticizes Mitchell's attempts to generalise from statistical data.

Thus Robbins would accept Keynes' objection to infering theory from observation: that economic relations are not stable over time, (an objection with which Popper would also agree). Hence, Keynes argued, it was not methodologically acceptable to infer economic 'laws' as applying to data other than those from which the inference was made, (in which case they would lack generality and would not be laws).

In so far as this criticism is made against any attempt to infer a theory of cyclical wages from observations, it would receive support from the empirical results reported in this thesis. These show that where such theories have been inferred, they fail to account for data other than those on which the inference was based. To this methodological point modern economics would object that to attempt such an inference would be the result of mis-specification but that it is possible to specify underlying stable relations (albeit with structural breaks) which would not be falsified by observed cyclical wage behaviour. Nevertheless, not only have inferences of cyclical wage behaviour been attempted, the fifty year old generalisation accepted by Keynes originally came not from a prior belief but from, precisely, such an invalid inference from observations taken from one, single, atypical, cycle (as described in chapter 8).

Modern economists would emphasise the need for identifying assumptions before estimates could be used to test hypotheses in the context of a simultaneous equations system. In this framework, there is no reason to expect any systematic reduced form regularity to emerge; and even were it to emerge, its implications for the theory would be ambiguous in the absence of non-data based identifying assumptions. Of course there are considerable differences in methodological approach within modern economics. A currently standard econometric textbook (Koutsoyiannis, 1977, pp.22-25) distinguishes between the 'orthodox approach' and the 'experimental approach', the latter being described as less rigid in sticking to a priori assumptions than the former. Hendry & Wallis (1984) state that their book 'reflects the change of emphasis from estimation to modelling'

(Preface); and contrast the role of theory in such modelling as follows:

> 'Theories are designed to highlight the features of importance in an analysis, and are necessarily highly idealized abstractions. Often the variables of the theory are not directly observable, or even have no clear measurable counterparts... The "correct" formulation of the econometric model is not just highly uncertain, it may not even be a sensible concept.
>
> 'In empirical econometrics, however, the emphasis is placed squarely on the operational - is the model adequate for the purposes to which it will be put? One does not ask an engineer if the "correct" bridge was built, but rather if it will fulfil its functions satisfactorily; when the functions alter (carrying tanks rather than pedestrians) so will the adequacy.' (pp.3-4)

Marshall (1885, p.159) used a similar analogy to make the same point:

> 'The theory of mechanics contains no statement of fact as to the greatest strain which bridges will bear. Every bridge has its peculiarities of construction of material: and mechanics supplies a universal engine, which will help in determining what strain any bridge will bear. But it has no universal dogmas by which this strain can be determined without observation of the particular facts of the case.'

It is not an original point that while a bee would put many a human architect to shame by the construction of its honeycomb cells, what distinguishes the worst of architects from the best of bees is that the architect raises his or her structure in their imagination before they erect it in reality. So not only is theory necessary for empirical work, but the results of that work will depend in part on the prior assumptions. Thus, for example, Hendry & Wallis state that:

> '...theories are themselves part of an iterative strategy, formalising and abstracting the salient features of existing evidence in a coherent framework, summarising current understanding and seeking to predict or explain new phenomena, and this emerges clearly from Nickell's account.' (p.8)

where 'Nickell's account' is 'The modelling of wages and employment' (chapter 2 of Hendry & Wallis). This study assumes that firms face no quantity constraints, one of the results being that cyclical fluctuations in employment are only possible through the influence of the real interest term in labour supply:

> 'Thus a rise in government expenditure can, if it raises the real interest rate, both raise employment (and hence output) and lower the real wage.' (p.17)

While some such modern studies claim direct relevance to the cyclical wage literature (particularly the various studies by Symons), that literature (including recent contributions) tends to adopt a different methodological approach. Instead of specifying and estimating structural equations, the reduced form correlation of the two (wage and cyclical variable) series is tested for. Bernanke & Powell (1984, p.1) explicitly state that:

> 'The methodology of this study follows that of the traditional Burns & Mitchell (1946) business cycle analysis... we have not formulated or tested a specific structural model of labour markets during the cycle but instead concentrate on measuring qualitative features of the data. As did Burns & Mitchell, we see descriptive analysis of the data as a useful prelude to theorising about business cycles. Thus, although the research reported in this paper permits no direct structural inferences, it should be useful in restricting the class of structural models or hypotheses which may subsequently be considered.' (emphasis in original)

It is also the reduced form correlation (rather than structural model) which is tested for in the empirical chapters of this thesis; and a more explicit explanation than occurs in any of the cyclical wage studies should be given of why such an approach is followed. First is the point (discussed in chapter 3 section 3.1: 'wage equations and labour demand schedules') that the effect on the correlation coefficient (for wages regressed on cyclical output) of omitting regressor variables uncorrelated

with the cycle would be expected to cancel each other out. Hence nothing is lost by omitting them. As for the other omitted regressor variables - those which are correlated with the cycle - it is only by omitting them that the cyclical output variable can be forced to proxy for all cyclical influences, hence the only way the coefficient on that regressor can be made to reflect the actual cyclical pattern of wages. Second, fully specified and estimated models at present allow contradictory cyclical wage patterns. Hence, for example, Layard & Nickell (1983), replying to a criticism from Whitley & Wilson (1983) of their (1980) assertion that the current state of the art in economics renders it impossible to analyse policy effects in the context of a fully dynamic model, stated that:

> 'What we meant by this was not that we consider the existing UK macro models to be unsuitable but that there exists no theoretical dynamic macro model which commands wide enough support among economists to enable us to generate dynamic responses which would convince more than a small proportion of the profession...
>
> 'This absence of consensus does, in fact, spill over into the empirical models as well in the sense that with the key wage-equation, for example, the difference in specification across the various large models is very large indeed and generates very different responses to certain types of policy, particularly in the short run.'

The reason for this is that, first, as E.H.Carr (1962) put it in his criticism of empiricism (and of Popper in particular), 'a fact is like a sack - it won't stand up till you've put something in it'(p.11); and, second, that the results infered from such facts will then depend in part on what 'you've put...in'.

Hence the interest in looking at simple direct relationships not embedded in a more specific model, as a way of abstracting from the assumptions of a model, assumptions which in each case would

not necessarily be generally accepted.

To conclude on the question of inference, then, few would go along with von Mises' view that:

> 'The economist need not displace himself; he can, in spite of all sneers, like the logician and the mathematician accomplish his job in an armchair.' (1962, p.78; cited in Klant, 1984, p.73)

The reaction of Keynes to the cyclical wage question showed that he was not opposed to statistical work in principle. The reference made above to Robbins' criticism of Mitchell was not for compiling descriptive statistics, but for attempting to generalise from them. However, while naming no names, the criticism from Burns & Mitchell (1946, p.8) of the theorist who 'often stops before his work is finished, leaving "inductive verification" to others, who may or may not take on the job' is a reasonable description of Keynes' approach to the cyclical behaviour of wages (leaving aside the now outdated reference to 'inductive verification'). Thus the differences in the methodological approaches of participants in the cyclical wage debate to the question of inference are displayed not just by what they say but by what they do.

4. Structure of thesis

This thesis will use the history of the cyclical wage debate and the empirical analysis to illustrate these themes of observation, theory and inference.

The theoretical assumptions underlying the cyclical wage literature are surveyed in chapter 2 not to identify various

possible mutually incompatible theories for each possible empirical outcome but, on the contrary, to develop a more general framework within which to consider the real wage - cyclical output relation.

Of course, whether any correlation would be expected at all depends on how each (cyclical output and cyclical wage) series is thought to be generated: in which markets and what the relation is thought to be between the relevant markets. The models considered in chapter 2 (and the generalised model there developed to consider the possible relation between competing assumptions over the course of the cycle in capacity utilisation) merely set some constraints (or not) on the limits within which the outcome of the labour-market and product-market price fixing processes must operate to be compatible with cyclical output (and productivity). It is these latter constraints, as opposed to the former mechanisms, with which the cyclical wage literature has been concerned. Indeed, Keynes' 1936 pronouncement on the necessity of countercyclical wages was based on the acceptance that the neoclassical diminishing marginal product of labour constraint operated and hence the assumption that the price fixing processes in the labour and product markets must conform to those constraints.

The resulting literature, on the actual empirical behaviour of cyclical wages, is surveyed in chapter 3.

The remaining chapters then report the results of testing for the wage:output (and wage:employment) correlation across countries, time, cycle phases, and industries.

One problem underlying the theory, and investigation, of the cyclical behaviour of earnings, is whether output or employment is the appropriate cyclical indicator. The business cycle refers to the output cycle, and so a consideration of the cyclical behaviour of earnings must establish whether there exists any systematic relation between earnings and this, output, cycle. It is this task which this thesis attempts. Chapter 4 reports the results of such an investigation on post-world war two (WW2) international data.

At the same time, however, the neoclassical theory of countercyclical (product) earnings derives from hypothesised variations in the marginal product of labour as employment varies over the cycle. Thus it is this cyclical behaviour of employment which is directly associated with cyclical earnings. This question, then, of whether there exists any systematic relation between earnings and cyclical employment is considered in chapter 5.

A more detailed look at the cycle, testing for the possibility of different behaviour in different phases of the cycle is carried out for quarterly UK data as reported in chapter 6.

Industry-level UK disaggregated data are tested for in chapter 7, both as a comparison with the aggregate results and to allow further tests of the neoclassical marginal product of labour theory of cyclical wages.

Chapter 8 reports comparisons with pre-WW2 UK data; and these

data are used to trace the empirical basis from which earlier writers (Marshall and Keynes) drew their conclusions.

At the level of observation and the search for the 'stylised fact' of cyclical wage behaviour the empirical work reported in chapters 4 to 8 find no such stylised fact. Real wages are found to be non-cyclical. The results there reported are believed to be comprehensive enough to finally close the door on this empirical literature. While it is always possible to extend the data-base and improve the statistical techniques, neither would alter the failure of the data tested for in this thesis to indicate any such cyclical wage pattern.

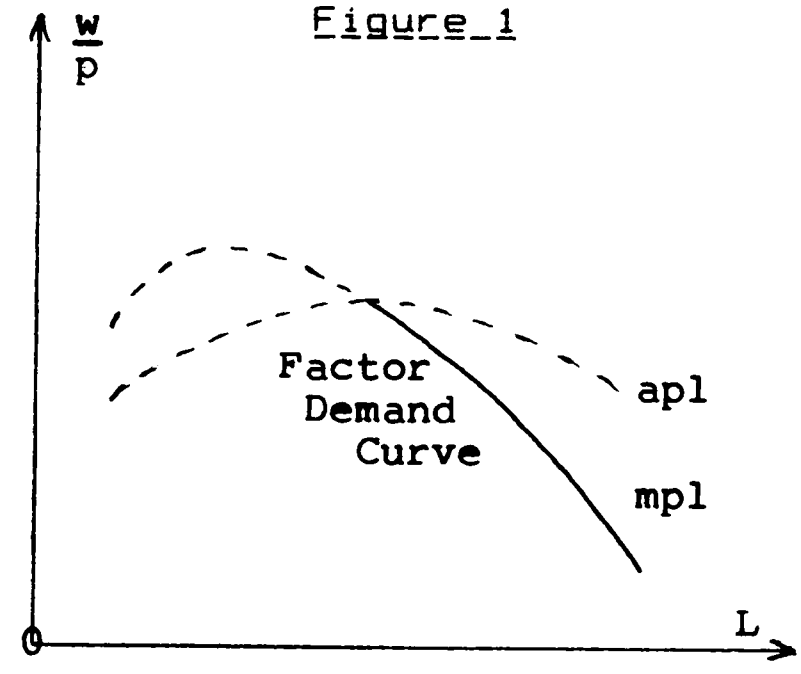
The methodological implications of this work, taken in this sense as a 'case study' in economic methodology, are drawn together in the concluding chapter.

Chapter 2. THEORETICAL BACKGROUND

1. Neoclassical assumptions

The elements of the neoclassical model relevant to the cyclical behaviour of product wages[1] are, first, that in order to have positive profits the feasible range of output corresponds to the marginal product of labour (mpl) being less than the average product of labour (apl); and, second, competitive assumptions assure that the product wage will be equal to the mpl.

Figure 1



The addition of standard neoclassical full market clearing would not, however, be compatible with fully fledged cycles. Neoclassical assumptions do not involve cyclical output

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1. The term 'real wage' is used in this thesis in the general sense of the nominal wage deflated by a price index, without specifying what price index. When the term 'product wage' is used it is in the generally accepted sense of the nominal wage having been deflated by an index of the price received by the employer for the products produced by the worker whose money wage is being referred to. When the term 'real wage' is used specifically as an alternative to the product wage then it refers to the nominal wage deflated by an index of prices of consumer goods. However, the term 'real wage' is also used in the broader sense when the context is clear.

   The real wage is what is of interest to the worker. The product wage is what is of interest to the employer. It is this product wage with which this thesis is concerned.

   Similarly the terms 'earnings' and 'wages' are used interchangably to mean the amount actually received on average per hour. Further distinctions, between wage rates and earnings, for example, are discussed with reference to data sources in the empirical chapters.

behaviour. The starting point in this chapter for discussing the economic theory behind hypothesised wage-output correlations is the debate in the 1930s to which the arguments of the Treasury and Keynes (1936) referred. These were based on the application of neoclassical assumptions to a situation already without full market clearing. That is, real wages are too high because of a failure of labour markets to clear (Treasury), or because of insufficient aggregate demand (Keynes, 1936). This is historically and intellectually the framework within which the debate developed.

These economic assumptions, which imply countercyclical real wages (or, at least, an inverse wage-output correlation as the economy adjusts back to equilibrium from a disequilibrium position) in both their (Treasury and Keynesian) forms, are also compatible with imperfect competition. In this case the labour demand curve would not be the marginal product of labour curve (mpl) but would be a function of it reflecting the degree of monopoly. If the degree of monopoly was invariant to the cycle the wage would be equal to some constant proportion of the (countercyclical) mpl and hence would itself be countercyclical.

Such assumptions implying countercyclical wages are not, however, the only logically coherent ones by which a study of cyclical wage behaviour can be informed. Different assumptions involve different (pro-, or non-) cyclical wage behaviour. Thus an empirical investigation into cyclical wage behaviour need not have a priori beliefs to which the data must either conform or else be regarded as 'perverse'.

2. Alternative assumptions

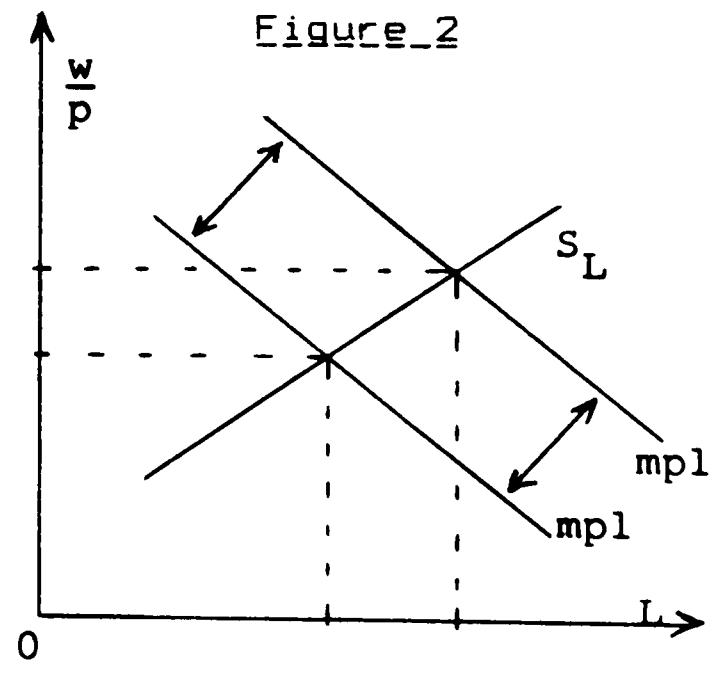
This section sets out some alternative assumptions which, in contrast to the 'standard' neoclassical ones, would allow the possibility of procyclical wages. Such alternative assumptions are set out in three categories, each successively more 'radical', representing successively more fundamental breaks with the 'standard' neoclassical assumptions.

The first category maintains both the neoclassical assumptions that, first, the marginal product of labour (mpl) diminishes as employment expands, and, second, the product wage will be equal to the mpl. The second category, quantity rationing, introduces a distinction between the notional and effective demand for labour and hence the notional and actual mpl. The third, Kaleckian, category drops the assumption of a diminishing marginal product of labour altogether.

2.1 Technology shocks

Of the three categories of theoretical assumptions which break the neoclassical requirement of countercyclical real wages (and of, therefore, real wages to decline in order to return to full employment equilibrium), the first, least radical, category consists of those involving the marginal product of labour curve itself shifting up to the right in the boom.

Figure 2



Such a mechanism might be referred to as a supply shock or technology shock. Several possible causes have been put forward in the literature, and others come to mind, although none appear particularly convincing.

First, changes in non-labour material input prices might shift the net marginal product of labour. The role of such non-labour inputs is considered extensively in this thesis, although the sort of cyclical variation in relative labour and non-labour components as would result from this suggested mechanism does not appear to hold.

Second, fluctuations in the rate of capital accumulation over the cycle would introduce such a pattern cyclically. However, Bowers, Deaton & Turk (1982, p.15) argue that in so far as one can meaningfully measure capital stock its cyclical variation is negligible. They cite Panic (1978) for a capital stock series in manufacturing the coefficient of variation of the deviation cycle of which is 0.28 per cent, which is negligible compared with those for output and employment.

Two possibilities put forward in the literature have been changes in capacity utilisation, as discussed by Tatom (1980); and the price-theoretic approach of Lucas and Barro.

In the latter, general (procyclical) price increases are mistaken for being relative increases in the prices of the products of the immediate producer (or wage earner if it is the price of labour). Thus the economic agents concerned work harder and output

increases, until they learn that their relative prices have not risen, and hence the boom ends.

Ackley (1983) argues that such a price theoretic version of the business cycle cannot apply to a world with firms and hired employees because the inflation would have to fool people in opposite directions: employers believing that product price had risen relative to wages, workers believing that wages had risen relative to product prices. While logically it could be argued that this could occur, despite Ackley's objections, because of the possibility of workers and employers within each firm/industry (mistakenly) thinking that their firm/industry prices and wages had risen more than in other firms/industries, nevertheless it remains rather far fetched as a theory of the business cycle. Barro, at least, appears to have abandoned such a causal hypothesis; rejecting it as being inconsistent with time-separable preferences. Instead business cycles are generated by 'disturbances to technology' (Barro & King, 1984, p.818). However, such technology shocks, allowing procyclical real wages within what is still a neoclassical framework, would ordinarily imply countercyclical prices (as more output is produced from given inputs). This latter implication might itself, however, be thought to throw doubt on such a category of explanations.

Tatom (1980) states that real wages and productivity are procyclical, but that the diminishing returns to labour theory still holds true. The diminishing returns to labour theory has only been thought contradicted by the above facts because of a misspecification: because the cyclical pattern of factor

employment has been ignored.

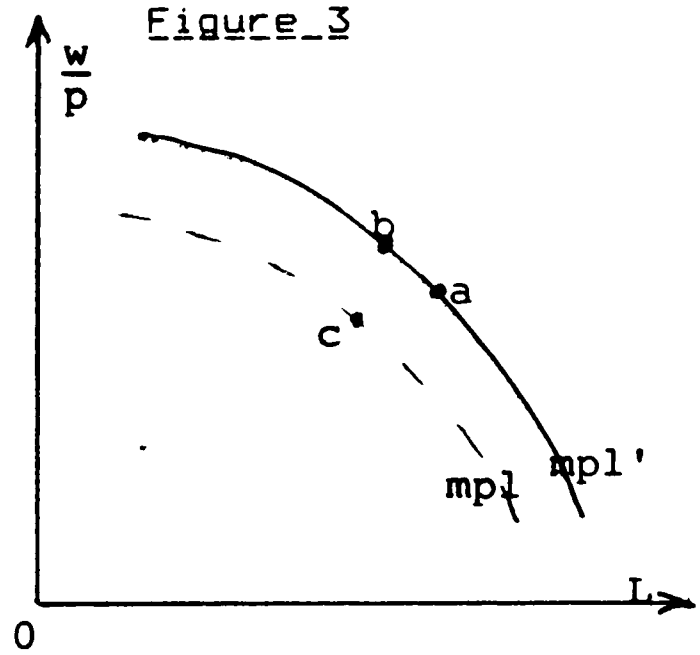
Looking at capital utilisation, k = c.K, where K is capital stock and c is the capacity-utilisation rate. Tatom finds that during recessions, the ratio of capital to labour employed declined. Any mpl curve shows what the marginal product of any level of employment services would be with that, given, level of capital services. In recessions, the level of capital services declines so that instead of moving back up the mpl curve, we shift down onto a lower mpl curve corresponding to the new, lower, level of capital services. Thus, in Figure 3, instead of moving from a to b, we move from a to c.

The converse applies to an expansion: instead of moving down the mpl curve from a, resulting in a lower mpl and hence a lower product wage (implying countercyclical productivity and real wages), we will move up on to a new, higher mpl curve representing a higher flow of capital services. Hence productivity and the product wage are procyclical.

It seems that Tatom has only saved the idea of the neoclassical mpl curve by redefining it. The neoclassical mpl curve is normally drawn for a given capital stock (K), so that increased L with constant K results in moving to the right down the mpl curve, while increased L with increased K results in the mpl curve shifting up to the right. This allows the distinction to be drawn between short-term fluctuations along a curve, and the longer-term necessary for altering the capital stock. Tatom's definitions do not allow this distinction: no period is too short for a change in capitalservices. Indeed, any change in labour

services would very likely be accompanied by a change in capital services so that any movement requires a move onto a new mpl curve. The mpl curve which Tatom wished to defend no longer exists to either side of the point we happen to be on.

Figure 3



The standard textbook idea of moving along the mpl curve is of varying L while not affecting the level of utilisation of capital services:

> 'Implicitly we assume here a constant rate of utilisation of capital stock so that there is a one-to-one relationship between capital stock and machine-hour input'.
> (Branson, 1972, p.209)

A vintage model, on the other hand, does not have a given capital stock. Rather, capital in use is explicitly allowed to vary, with different vintages being brought into, or dropped out of, use. A vintage model would then explain the declining marginal product of labour in an expansion as being caused by the older, less efficient, vintages being bought into use. This increased capacity utilisation, however, far from increasing the marginal product of labour will mean - assuming efficient rationing so that employment expands on successively less productive plants - reduced marginal product of labour in the boom and hence reduced real wages.

To conclude, neoclassical assumptions involve the necessity of real wages falling towards equilibrium. If the marginal product

of labour curve itself shifts up to the right, this can allow a return to (a different) market clearing equilibrium without the necessity of any reduction in real wages. This category of explanations involving such a mechanism therefore avoids the neoclassical requirement of countercyclical real wages while remaining closely within the neoclassical model.

Some of the implicit contract literature assumes such a modified model of the cycle with 'bad times' (slumps) involving lower marginal product of labour than 'good times' (booms); (see, for example, Hart, 1983).

The implicit contract idea can thus be used to explain <u>why</u>, when the economy is knocked off equilibrium by a negative technology shock, market clearing fails to establish a new equilibrium. The reason is that stable wages have been 'guaranteed' in the implicit contracts, hence preventing market clearing and leaving involuntary unemployment, until such time as 'good times' return, returning the economy to (the previous) equilibrium.

<u>Without</u> such implicit contracts markets would clear and there would be no involuntary unemployment, but wages would then be <u>procyclical</u>, not countercyclical as in the 'pure' neoclassical model. It is this procyclical pattern, not the neoclassical countercyclical pattern, of wages which implicit contracts distort (flatten). Put another way: the point is that implicit contracts cause involuntary unemployment by raising wages above what they would otherwise be in the slump, and (as the other half of the contract, to compensate the employer) reduce wages, relatively, in the boom. This is the precise opposite effect

from the one with which we are interested, namely, modifications (or alternatives) to neoclassical assumptions which allow for higher wages in the boom (and lower in the slump) than would be generated by 'pure' neoclassical assumptions.

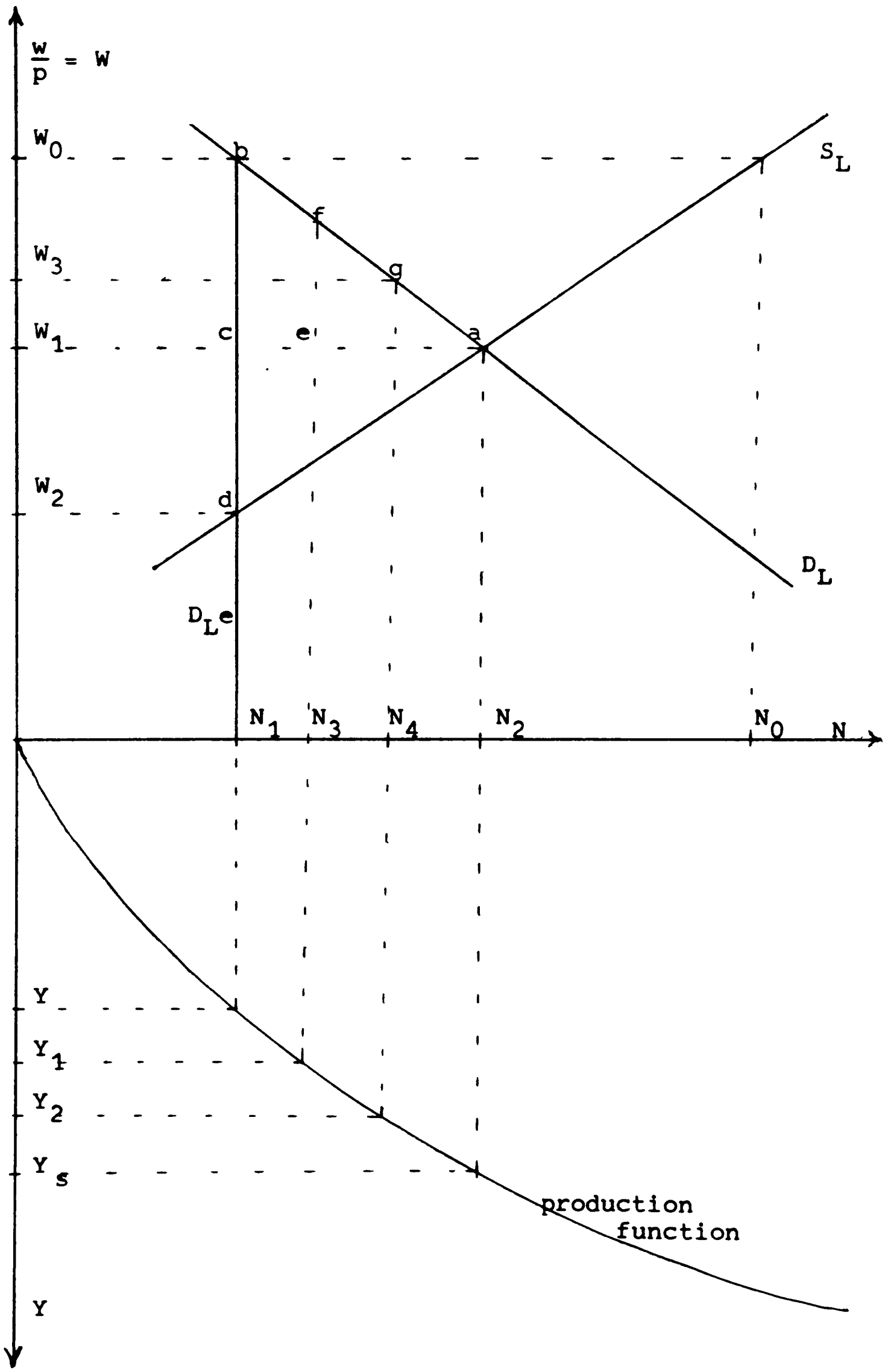
2.2 Quantity rationing

The neoclassical prediction of reduced real wages with increased output (indeed, the theory that the reduced real wage is a necessary concomitant of the increased output) follows from the belief that, first the marginal product of labour curve slopes down to the right and, second, the wage is equal to the marginal product of the marginal worker.

A quantity rationing model avoids the conclusion by denying that the firm/industry/economy is necessarily constrained by a diminishing marginal product of labour (or, more generally, by relative prices). Instead there may be quantity (demand) constraints. Hence in a recession the wage may be below the marginal product of the marginal worker so that in an expansion, the real wage can increase towards the (decreasing) marginal product of labour.

Barro & Grossman (1971) suggest that with quantity rationing, the effective demand for labour, $D_{L}e$, becomes a vertical line at N_1 determined by y, where $y < y_w$; (fig.4).

Figure 4


w/p = W
W0
W3
W1
W2
b
f
g
c
e
a
d
SL
DL
DLe
N1
N3
N4
N2
N0
N
Y
Y1
Y2
Ys
production function
Y

Unemployment in the neoclassical model is caused by the real wage, W_2, being too high, thus causing unemployment = (N_2-N_1). If the real wage is reduced to W_1, we move down the marginal product of/demand for labour curve to point a, where full employment, N_2, is achieved. With quantity-rationing, however, cutting the real wage from W_2 to W_1 would move us, not down the demand for labour curve (D_L), but down the effective demand for labour curve (D_Le), ie down bc not ba. Thus there is no effect on employment. But we are no longer on the marginal product of labour curve and hence there is no necessity for the real wage to fall. Instead, we can move from 'c' to 'a' with no reduction in the real wage. Alternatively, if the wage had been reduced to W_2 (thus eliminating unemployment while maintaining employment unchanged), then 'W' moves up the S_L curve from 'd' to 'a', thus rising from W_2 to W_1. Thus increased output is accompanied by increased real wages. The analysis can be taken further to show that (it is at least logically possible for) an increase in real wages to cause an increase in output. This depends on the cause of the initial rationing (ie the reason for y being less that y_2). If this is due to an insufficient level of effective demand, then increasing real wages from W_2 to W_1 may increase y to y_2, hence increasing N from N_1 to N_2 and moving from 'd' to 'a'.

Even if the effect is less dramatic, we may have a period of increasing real wages causing increased employment, before hitting the demand for labour curve (D_L), at which point increased employment will only occur with reduced real wages. The wage increase from W_2 to W_1 in Figure 4 may increase the level of (demand-constrained) income from y to y_1. This will

increase employment from N_1 to N_3. Since the corresponding point 'e' is still below point 'f' (the point on the demand for labour curve corresponding to employment level N_3), this process can continue. In this case, increasing the real wage even beyond W_1 will, if it continues to increase the level of (demand-constrained/Quantity rationed) income, also continue to increase employment, beyond N_3. This process, then, can continue until we are back on our (non-quantity constrained) demand for labour curve (D_L), for example at point 'g', where the increase in the real wage from W_1 to W_3 increased income from y_1 to y_3, hence increasing employment from N_3 to N_4.

Since the economy is now on the D_L curve, further increases in the real wage will move us back up the D_L curve to the left, hence reducing employment. But if y_3 is still our quantity-ration, then the remaining unemployment is of the quantity-rationing type whereby reduced real wages will not increase employment and may, if it sets off the above process in reverse, reduce employment.

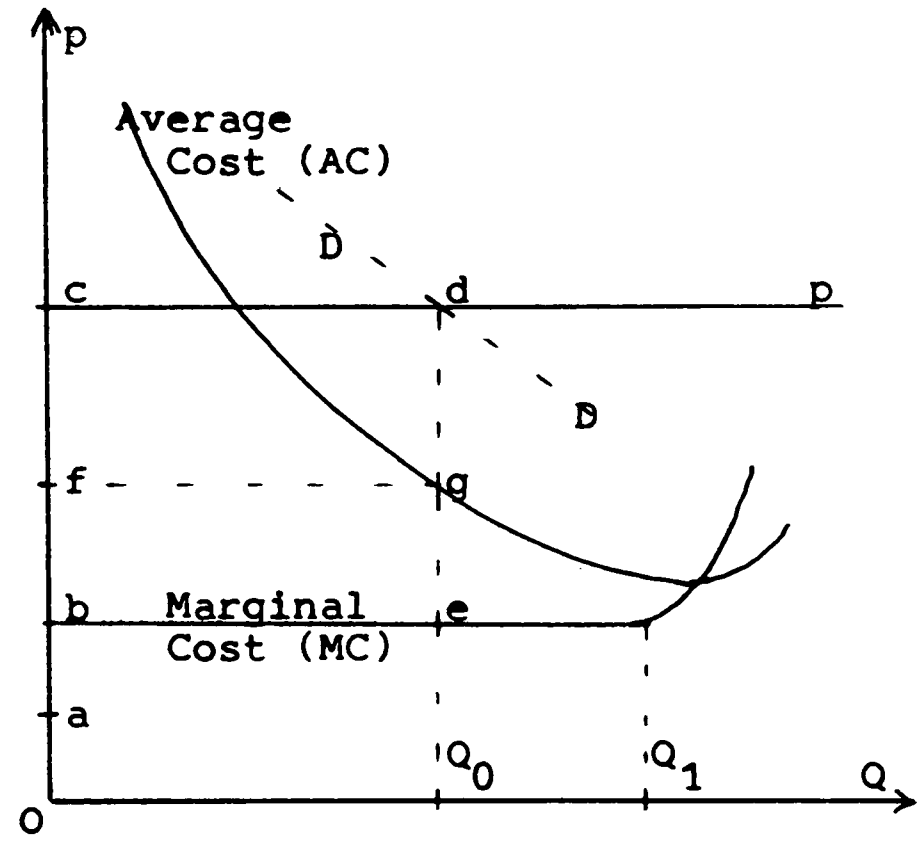
To summarise: section 1 above set out the standard neoclassical assumptions requiring countercyclical wages. Alternative assumptions (section 2) allow other cyclical wage patterns. Technology shocks (section 2.1) allow neoclassical assumptions to predict procyclical wages (by shifting, rather than moving along, the mpl curve). Quantity rationing (section 2.2) preserves the countercyclical pattern of productivity, but allows any pattern of wage movements. The more fundamental break of assuming horizontal productivity and cost curves (section 2.3) was suggested by Sraffa (1926) but used most extensively as an

operating framework by Kalecki.

2.3 Kalecki

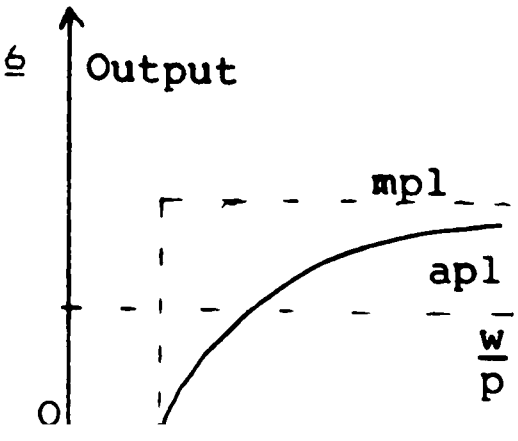
Kalecki's model can be drawn in output:price space (Figure 5). Oa is the wage, ab is other prime costs, so that total prime costs = Ob; price Oc, is a (here constant) mark up over prime costs. The average cost curve (AC), incorporating overhead costs (including overhead labour) therefore slopes down to the right. After Q_1 (=full capacity utilisation) marginal cost rises steeply to the right so that it is unprofitable to produce much past Q_1. The firm will then sell, at price c, as much as it can, which will be determined by the demand curve DD: in this case Q_0, so that surplus = bcde of which bfge goes to pay overheads, leaving fcdg as net profits.

Figure 5



Such a diagram can be inverted and drawn in employment:output space (Figure 6); thus corresponding to the previous diagrams. Marginal product is considered constant, and is also, therefore, the average product for direct workers. Assuming that non-wage prime costs are a constant fraction of total

Figure 6



prime costs, then the real wage is some proportion of the (constant) marginal product.

Such Kaleckian assumptions are considered further, below. For present purposes it is clear enough that the neoclassical requirement of countercyclical wages is completely broken.

There is no requirement, within such a framework, for real wages to, of necessity, rise or fall. Firms simply produce as much as they can sell. The greater the resulting capacity utilisation the more are overhead costs spread. The resulting pattern of prices, profits and real wages then depend on only two other factors: the behaviour of (non-labour, materials) input prices; and the degree of monopoly (or mark up). Kalecki expected these two factors to influence wages in opposite directions over the cycle. First, he expected the ratio of the price of raw materials to wages to be procyclical, so that a constant mark-up over total direct costs would result in a countercyclical tendency for real wages. Second, however, he expected the mark up itself (the 'degree of monopoly') to be countercyclical, resulting in a procyclical tendency for real wages.

> 'Thus the rise or decline in real wages depends on the relative weight of the two opposite tendencies. It is very likely that the resulting changes in real wages are generally rather small'.
> (Kalecki, 1969, p.54)

and 'the direction of the changes in real wages cannot be foreseen' (p.61).

Theoretically, the possibility of different cyclical patterns for input and output prices is introduced by the differential price

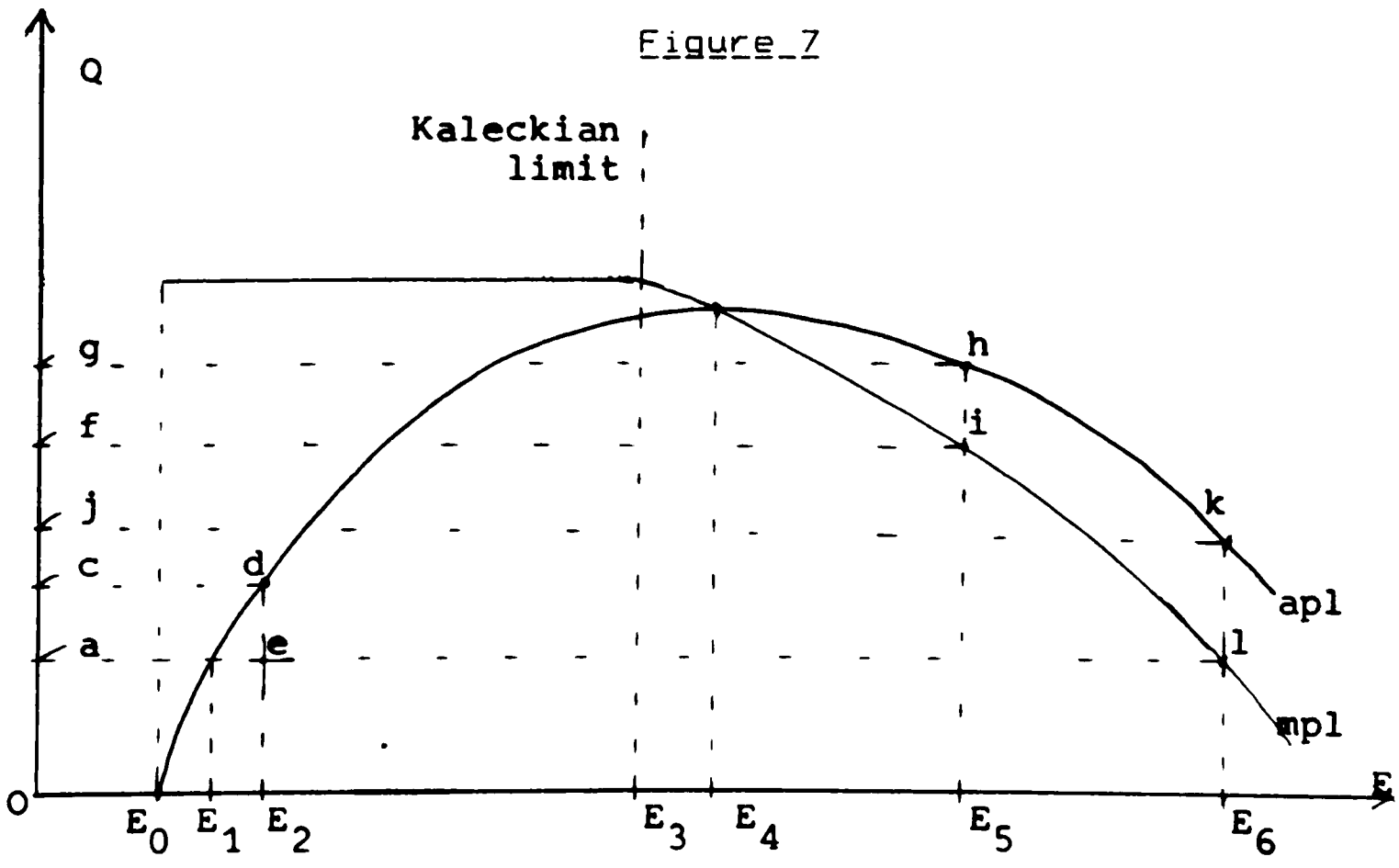
formation mechanisms for 'cost-determined' and 'demand determined' groups of commodities (Kalecki, 1943). Empirically, the cyclical pattern of non-labour input prices is investigated in the later, empirical, chapters of this thesis.

As for the mark up, Kalecki had no theoretical requirement for this to conform to any particular cyclical pattern despite his expectation for it to be countercyclical. Layard & Nickell (1985) similarly echo Kalecki in analysing different possibilities for the cyclical behaviour of the mark-up (but within a framework of diminishing marginal productivity).

3. Generalised model

The generalised model is one which incorporates the area of the economy that the neoclassicals consider to be relevant (declining marginal and average productivity) with the area that Kalecki considered to be relevant (constant marginal productivity).

Figure 7



OE_0 is overhead Labour. Thus to the left of E_0 there is no

output.

OE_1 is the lowest level of employment at which total product meets the wage bill (of both production and overhead workers). The loss is, then, precisely equal to non-Labour overhead payments.

OE_2 At some output, say that corresponding to OE_2, the surplus precisely meets the non-labour overhead costs, both of which are, then, equal to acde. Net profits are then zero (or, if normal profits are included with overhead costs, then normal profits precisely are earned).

OE_3 is considered by Kalecki the practical limit beyond which marginal productivity falls so rapidly (ie marginal costs rise so rapidly) that production to the right of E3 would be unprofitable. In other words, OE_3 would be followed immediately by OE_4 (which is the point where mpl first falls below the Kaleckian real wage).

OE_4 For neoclassical economics the wage is determined by the marginal product of the marginal worker. To the left of OE_4 this is above the apl and hence total product would not even meet the wage bill. At OE_4, apl = mpl = (w/p). Thus total product is precisely equal to total wage bill. The losses (negative profits) are then equal to total non-labour overhead costs.

OE_5 There is then some point, say OE_5, where (apl - mpl)E is equal to total overheads (including 'normal' profits), in this case equal to fghi. To the right of E_5 profits will be greater than normal, and to the left, less than normal.

It can now be seen how the alternative models envisage the business cycle. For the neoclassical, normal profits are earned at E_5. In an expansion, E increases beyond E_5, but this is only profitable if the real wage falls. The economy faces a diminishing marginal product of labour, and the wage is equal to the marginal product of the marginal worker. Thus in an expansion the real wage must fall. This can occur via reduced money wages, or via increased prices; the latter being advocated by Keynes (1936). Profits will increase. Thus if the expansion involved employment increasing from E_5 to E_4, profits will increase from (fghi - non-labour overheads) to (ajkl - non-labour overheads). Thus if overhead costs are, indeed, constant, profits increase by (ajkl - fghi).

In a recession employment will contract from E_5 . Real wages

rise and profits fall below normal. If employment falls below E_4, the marginal product of labour continues to rise, but now the average product of labour is falling rather than rising.

For Kalecki, fluctuations occur between E_6 and E_5, with the real wage given.

The purpose of developing this generalised model has been to show that, logically at least, the seemingly opposed models of, on the one hand, the Kaleckian type, and, on the other hand, the neoclassical type may be (accurately) describing different possible states of the economy corresponding to different levels of economic activity. The result is that if, for example, we want to describe an economic expansion, it may be that no simple conclusion can be reached applicable to all phases of the expansion. On the contrary, an expansion (if it involves wide enough fluctuations in capacity utilisation) may pass through various phases: both Kaleckian (with no particular cyclical requirement for product wages) and neoclassical.

Initially the expansion may proceed with no fall in the marginal product of labour (although this assumes that the product wage is not, therefore, equal to the mpl; and in the following description is assumed constant at the 'Kaleckian' level 'a' in figure 7). In this case not only profits, but total surplus (out of which overhead costs are met) may be negative. As output expands, surplus will approach zero and then grow as (negative) profits approach zero and, in turn, become positive and grow. At some point the marginal product of labour will begin to fall, thus falling below the average product which will, therefore, itself

begin to fall. Profits will, however, continue to increase although after the point at which the mpl and apl curves intersect (ignoring overhead costs and overhead labour) less than proportionately with N, until mpl falls to equal the real wage (still assuming this to have been at the 'Kaleckian' level marked 'a' in figure 7). Beyond this point, profits will fall back towards normal as the expansion continues, and, if the expansion continues further with no cut in the real wage, profits will fall below normal towards zero.

Such a model allows different wage:output relations over different phases of the cycle.

4. Procyclical wage movements

Having indicated various non-neoclassical assumptions which would allow the avoidance of the neoclassical result of countercyclical wages, this section considers both the logical possibility, and possible casual mechanisms, for procyclical wage movements.

4.1 Logical possibility

In a Kaleckian model profits increase in an expansion at a constant product wage, so that it is quite possible for a part of this increase to go on higher wages. This result is also allowed in a neoclassical model if, for whatever reason, we are off our mpl and apl curves, so that, in an expansion, we move up to the right towards them. In either case - Kaleckian or modified neoclassical - it is therefore logically possible for increased real wages to cause an expansion (and hence increased employment).

Of course, for a wage increase to also lead, via an expansion of the economy, to increased profits, requires increased non-wage spending (investment and/or consumption of non 'wage-goods') in order for the increased profits to be realised. Indeed, it was Kalecki who made the point that 'workers spend what they get, and capitalists get what they spend'. Simple models can be constructed which while satisfying Kalecki's behavioural description of workers and capitalists, also allows increased wages to increase profits, the increased realisation of profits coming from capitalist consumption being dependent in part at least on potential profits, or investment being dependent, in part at least, on output (or the rate of increase of output).

4.2 Causal Mechanism

A possible causal mechanism for procyclical real wages, considered by Lucas (1970), follows from Marris' (1964) study of shift working. The procyclical occurence of overtime working, along with the existence of overtime rates, allows procyclical wage movements. An ironic aspect of Lucas' paper, as well as that of Solow & Stiglitz (1968), is that in the face of empirical evidence it abandons the neoclassical insistence on countercyclical real wage movements, while still assuming countercyclical productivity movements. In fact, though, the empirical evidence pointing to procyclical productivity movements is much stronger than the evidence pointing to procyclical real wage movements.

The causal mechanism which our model would suggest is that the increased profits in an expansion reduce the necessity to match

increased money wages with increased prices, ie that the mark-up falls.

Coutts et.al (1978), however, find a constant mark-up in so far as wage rates are concerned. Even accepting their findings, though, there are three possible mechanisms which would still cause procyclical wage movements.

First, increased money wages could lead to wages becoming an increased share of normal cost. Thus normal cost, and hence prices, would not increase in the same proportion as had money wages. Cowling (1982) considers this, however, and finds no evidence of it happening.

Second, 'normal' costs may be a lagged function of actual costs, so that the firm's idea of what is normal is affected by past experience. Thus as actual unit costs fall, this may have a dampening effect on 'normal' costs, and hence on prices.

Third, Coutts et.al's 'normal earnings series - has been purged of its reversible cyclical component' (p.26), and that component is procyclical.

It is not clear, however, how any of these would be able to explain a 'profit-squeeze'; nor, given a profit squeeze, how they would operate.

Cowling (1981) suggests three reasons for price increases being less than money-wage increases, all of which could operate under a profit squeeze. The first is balance of payments constraints,

which devaluation would be unable to overcome. The second is political pressure leading to price controls, subsidies of wage-goods and so on (pp.213-214). The third (p.197) is if the level of concentration, and thereby the mark-up, falls in the boom.

The first factor, namely balance of payments constraints, would seem unlikely to be a general explanation, and certainly Cowling does not provide any hypothesis for why it should operate as such. The second factor appears unlikely to have operated in many, if any, cases. The third factor, of the changed mark-up forced on firms by reduced concentration, is a more fundamental point.

Indeed, the basic theoretical point of such a discussion goes wider than simply allowing a possible causal mechanism for procyclical real wages.

The idea of a direct, necessary, causal link between productivity and product wages and any resulting cyclical wage requirement, ceases to hold when the possibility is introduced of variations in the mark-up of prices over wages (or direct costs). However, simply pointing out the existence of this pricing process, mediating between productivity and product wages, is not in itself sufficient cause to reject the neoclassical claim that if the marginal product of labour is countercyclical then so must be the product wage.

Unless there is some reason to suppose that the mark-up will vary, then the neoclassical hypothesis holds.

If, however, there are reasons to suppose that noncyclical factors do, in practice, alter the mark-up, the pattern of product wage movements becomes that much less cyclical.

To the extent that the mark-up is assumed to move countercyclically, acceptance of no observable cyclical pattern in product wage movements can be accompanied by the retention of neoclassical assumptions which would otherwise require the empirical observation of countercyclical product wages. If such an assumption of a countercyclical mark-up is introduced simply to overcome inconsistencies between other assumptions in the model then it is clearly a fairly weak procedure unless some convincing explanation is made as to, first, why the mark-up is assumed countercyclical and, second, why the other assumptions (those which require the mark-up assumption to introduce consistency with what is believed to be the actual movement of product wages) are retained.

Kalecki himself did not introduce the mark-up for such purposes. He assumed horizontal marginal product curves and hence no requirement for product wages to move cyclically in response to cyclical productivity. He did, as reported above, believe there to be a countercyclical pattern to the mark-up; but he also believed there to be a procyclical movement of non-labour direct costs, and hence did not believe that the mediating role of the mark-up process between cyclical productivity and cyclical product wages would determine the behaviour of the latter.

5. Conclusion

This chapter began by setting out the theoretical background to the neoclassical proposition of countercyclical wages. Alternative assumptions, consistent with wages not being countercyclical, were then considered. These were categorised in terms of how fundamentally they differed from the neoclassical assumptions. First is the movement of, rather than movement along, the marginal product of labour curve. Second are those who maintain the idea of the marginal productivity of labour diminishing with increased employment, but argue that quantity rationing prevents this from necessarily being a constraint on output, hence removing the necessity of countercyclical wage movements. Such ideas are common to all quantity rationing models, and to authors such as Malinvaud, and Solow & Stiglitz. To limit the chapter's length the discussion of such models was limited to the example of Barro & Grossman. Finally and most 'radically', are the ideas of Kalecki which do not involve a diminishing marginal productivity for labour and hence imply no presumption at all for wages to move countercyclically.

Having set the scene for the empirical investigation, with rival assumptions allowing different expectations as to the evidence on cyclical wage behaviour, the argument in the chapter then posed the possibility of a wage increase, in addition to being compatible with a cyclical expansion of output, actually causing such an increase, and such (demand-stimulating) real wage increases actually leading to increased profits.

Having set out different assumptions allowing of different

empirical patterns for cyclical wage behaviour, the remainder of the thesis attempts to establish what that pattern is.

How theory confronts data, and therefore how the models outlined in this chapter would confront the results reported in the following chapter, and developed in the empirical chapters, is a methodological question the answer to which would differ between different methodological schools. These schools of thought differ over how interesting such descriptive empirical work is; and also over how such work relates to theory. These methodological issues are left to the concluding chapter.

Chapter 3. SURVEY OF LITERATURE

> 'The cyclical behaviour of real wages, productivity, and labour's share has been explored in a vast number of econometric studies in the past 40 years. It is fair to summarise the consensus as finding no detectable significant pattern in real wages. Meanwhile, the procyclical pattern of productivity movements has been solidly established in dozens of empirical studies.'
> (Okun, 1981, p.16)

While the procyclical pattern of productivity movements is, indeed, generally accepted, the number of econometric studies on the cyclical behaviour of real and product wages is far from vast (although several have been published since Okun's statement). There is not, as yet, the consensus Okun suggests. Recent econometric studies, surveyed in this chapter, have come to contradictory conclusions.

1. The Literature

Keynes (1936) and Keynes (1939) are turning points in this field. Keynes (1936) presented the accepted belief of countercyclical real wages, and presented the accepted theoretical marginal-productivity arguments behind the accepted belief. Because, perhaps, of the manner in which this accepted theory and its corresponding predictions were made, in the form of suggested research, it provoked statistical investigations by Dunlop (1938) and Tarshis (1939) which seemed to contradict the accepted prediction, instead finding procyclical real wages.

This contradiction between accepted theory and the new statistical findings provoked Keynes (1939) to suggest possible

modifications to the theory. At the same time, he suggested that the new findings were inconclusive and that further statistical work was necessary to determine the actual cyclical behaviour of the real (product) wage.

Far from carrying out this work, Ruggles (1940) and Tobin (1947) threw further doubt on the little statistical work in existence. It was not until 1969 that an attempt was made, by Bodkin, to directly tackle this question. His (weakly procyclical) results were questioned by the countercyclical results of Neftci (1978) and Sargent (1978), the generality of which has, in turn, been questioned by Geary & Kennan (1982a) who report no cyclical correlation.

This latter conflicts with the countercyclical results of Otani (1978) and Sachs (1979), and is directly challenged (for not including the cost of materials as an explanatory variable) by Symons & Layard (1984) and Symons (1985); as well as (for the choice of deflator) by Layard & Nickell (1984). The robustness of the alternative results reported in these latter two studies is questioned by Wadhwani (1985) after respecifying the demand for labour equation. Bernanke & Powell (1984) find rather more procyclical results than Geary & Kennan, although their explanation of the different results is not entirely satisfactory.

The issue appears, then, to be further from a consensus than ever.

2. From Keynes (1936) to Keynes (1939)

Keynes (1936) assumes real wages to be countercyclical. He postulates an inverse relationship between the real wage and the money wage, thus taking the money wage to be a proxy for output movements. He also assumed employment to be a proxy for output movements. His argument goes as follows:

> 'It would be interesting to see the results of a statistical enquiry into the actual relationship between changes in money wages and changes in real wages. In the case of a change peculiar to a particular industry one would expect the change in real wages to be in the same direction as the changes in money wages. But in the case of changes in the general level of wages, it will be found, I think, that the change in money wages, so far from being usually in the same direction, is almost always in the opposite direction... This is because, in the short period, falling money wages and rising real wages are eacch, for independent reasons, likely to accompany decreasing employment; Labour being readier to accept wage cuts when employment is falling off, yet real wages inevitably rising in the same circumstances on account of the increasing marginal returns to a given capital equipment when output is diminished'.
> (Keynes, 1939, p.34, citing Keynes, 1936, pp 9-10)

Dunlop (1938) and Tarshis (1939) attempted the statistical enquiry which Keynes had expressed an interest in. But they did not find what Keynes had thought they would.

Dunlop found, for Britain, that when money wages are rising, real wages have usually risen also; whilst, when money wages are falling, real wages are no more likely to rise than to fall. Tarshis obtained similar results for the US.

Keynes (1939) begins by stating that the studies by Dunlop and Tarshis:

> 'clearly indicate that a common belief to which I acceeded in my General Theory of Employment needs to be

> reconsidered... I was accepting, without taking care to check the facts for myself, a belief which has been widely held by British economists up to the last year or two.'
> (Keynes, 1939, p.394)

He then traces this view to Marshall (1926) and the evidence he gave before the Gold and Silver Commission in 1887 and the Indian Currency Committee in 1899. This historiographical aspect of Keynes' article is considered further in chapter 8. The relevance of Keynes' article to this chapter is its comprehensive review of the literature up until that date, which there is little point in repeating here. He also discusses the neoclassical theory underlying predictions about real wages being countercyclical.

The important pointer for any future research is where Keynes suggests five areas for further statistical investigation:

> 'with a view to discovering at what points the weaknesses of the former argument emerge',

where 'former' refers to the neoclassical argument.

These five areas are as follows:

1. Accuracy and uniformity:

> 'First of all, are the statistics on which Mr Dunlop and Mr Tarshis are relying sufficiently accurate and sufficiently uniform in their indications to form the basis of a reliable induction?' (p.41)

2. Real and product wages:

> 'It is important, therefore, if we are to understand the situation, that the statisticians should endeavour to calculate wages in terms of the actual product of the labour in question.' (p.44)

3. Marginal user cost:

> 'Has the identification of marginal cost with marginal wage cost introduced a relevant error?' (p.44)

4. Shape of cost curves:

> 'Is it the assumption of increasing marginal real cost in the short period which we ought to suspect? Mr Tarshis finds part of the explanation here; and Dr Kalecki is inclined to infer approximately constant marginal real cost.' (p.44)

5. Mark-up:

> 'There remains the question whether the mistake lies in the approximate identification of marginal cost with price, or rather in the assumption that for output as a whole they bear a more or less proportionate relationship to one another irrespective of the intensity of output.' (p.46)

These five issues are now dealt with in turn.

2.1 Accuracy and Uniformity

Keynes (1939) questions whether the statistics on which Dunlop and Tarshis rely are:

> 'sufficiently accurate and sufficiently uniform in their indications to form the basis of a reliable induction.'

He gives, as an example, the findings of Meade (1938) of countercyclical real wages in both the depression starting in 1929, and the following recovery. Such conflicting results can emerge from inaccurate statistics, and we will see that there are debates in the literature up to and including current articles, which question which statistics are the appropriate ones. The other point, however, on uniformity, is rather different. It has been argued in chapter two that, depending on the economic assumptions thought appropriate, it is quite possible for the actual behaviour (as opposed to the imperfectly measured behaviour) of real wages in the cycle to differ from one period to another and/or from one country to another. In this case, the lack of uniformity of the statistics is not necessarily a basis

for doubting the reliability of any induction, but, rather, a basis for defining the induction as only necessarily being applicable to the country and time period to which the statistics referred.

The Meade study which Keynes quotes as contradicting the Dunlop/Tarshis prediction, by finding falling real wages in the 1930s recovery, itself finds that no such fall took place in the US or France.

2.2 Real and product wages

Keynes recognises that different conclusions may result using real wages rather than product wages.

That said, Keynes recognises the importance of testing any results for product wages:

> 'It is important, therefore, if we are to understand the situation, that the statisticians should endeavour to calculate wages in terms of the actual product of the labour in question.'

It is ironic, therefore, that the only previous (albeit crude) attempt to do this, where Rueff (1925) divided money wages by the WPI instead of by the CPI is criticised by Pigou (1933) for having done so, and further, Keynes seems to accept that Rueff has somehow made a mistake by writing that:

> 'Pigou points out that these statistics are vitiated by the fact that M Rueff divided money wages by the wholesale index instead of by the cost-of-living index.'
> (p.39, emphasis added)

The issue of what is the relevant wage series is considered further in section 3.4 ('Wage series and the role of materials').

2.3 Marginal_user_cost

Keynes defines user cost as:

> 'A+(G'-B')-G, where A is the amount of our entrepreneur's purchases from other entrepreneurs, G the actual value of his capital equipment at the end of the period, and G' the value it might have had at the end of the period if he had refrained from using it and had spent the optimum sum B' on its maintenance and improvement.' (1936, p.66).

He concludes that this factor could not explain a divergence of marginal wage costs away from a countercyclical movement of the marginal product of labour (procyclical marginal costs). On the contrary:

> 'marginal user cost is likely to increase when output is increasing, so that this factor would work in the opposite direction from that required to explain our present problem, and would be an additional reason for expecting prices to rise more than wages. Indeed, one would, on general grounds, expect marginal total cost to increase more, and not less, than marginal wage cost.' (1939, p.44)

The role of that component of user cost constituted by non-labour direct costs ('materials') - as distinct from the role of depreciation - is considered in section 3.4 below, and is investigated in the empirical chapters.

2.4 Shape_of_Cost_Curves

The first two of Keynes' comments - on the accuracy and uniformity of the data, and on the importance of measuring product wages - are points to be borne in mind when trying to establish the actual behaviour of wages in the cycle. Keynes' third comment, on the shape of cost curves, relates to possible explanations for empirical findings suggesting that the real wage/product wage is not countercyclical.

This third comment concerns the range of capacity utilisation to be discussed. Keynes suggests that Kaleckian assumptions may hold over some phases of the business cycle, but that they may be superceded over other phases. It is this importance of considering the whole range of capacity utilisation fluctuations, and the behaviour of cost/productivity curves over different levels of capacity utilisation, and hence over different phases of the business cycle, which I tried to present diagramatically in chapter 2, (figure 7, page 36).

2.5 Mark-up

Again, this section is simply suggesting a logically possible reason why the real/product wage might be procyclical: that is, because the mark-up is countercyclical. Keynes does not necessarily accept, however, that the real/product wage will be procyclical. At the time of his writing, this had still to be satisfactorily statistically tested. He concludes, therefore, by appealing for further such statistical enquiry, and, in particular, that such enquiry seek to determine:

> '(i) How the real hourly wage changes in the short period, not merely in relation to the money wage, but in relation to the percentage which actual output bears to capacity output;'
>
> [In other words, to determine the relation between changes in the real wage and changes in capacity utilisation]
>
> '(ii) How the purchasing power of the industrial money wage in terms of its own product changes when output changes;'
>
> [In other words, how the product wage changes when output changes], and
>
> '(iii) how gross profit per unit of output changes
> (a) when money costs change
> (b) when output changes.' (p.51)

Up until 1936, then, economists were generally agreed that a statistical study would reveal countercyclical real wage movements, and were agreed that this was due to countercyclical productivity movements. Keynes (1936) restated both beliefs.

The studies of Dunlop and Tarshis claimed to find the opposite of this. Their studies seemed to show procyclical real wage movements. But neither study attempted to also overturn accepted theory. This left the economics profession with a contradiction between accepted theory (countercyclical real wages) and evidence (procyclical real wages).

Keynes (1939) did not claim to solve this contradiction, but tried to suggest the logically possible ways of re-uniting accepted theory with accepted fact. On the one hand, the studies of Dunlop and Tarshis could be questioned on technical grounds, so that there was not, as yet, any definite statistical conclusions. On the other hand, the theoretical underpinnings of the previously-agreed conclusions could also be questioned. His only definite conclusion was that further work was required.

3. Methods

Keynes' call for further work was first taken up by Richardson (1939) who supported the traditional countercyclical position. Reviewing the debate, however, Ruggles (1940) found that all three studies, those of Dunlop, Tarshis and Richardson, were 'of doubtful significance' (p.137). Nevertheless, his article does not attempt any such study itself, simply concluding that

'statisticians and theorists should unite in studying the cyclical relationships of the above variables' (p.149).

Again, Tobin (1947) simply cites Ruggles to the effect that the above investigations were statistically inconclusive (p.577). And again, he simply concluded that further theoretical and statistical work was necessary (p.587); and simply repeated Keynes' call for someone to do the necessary statistical investigation.

The call was not taken up until 1960, and even then not explicitly, when Hultgren published Changes in Labour Cost during Cycles in Production and Business, followed in 1965 by Cost, Prices and Profits: Their Cyclical Relations. In tracing the source of the well-known tendency for profits of manufacturing concerns to rise and fall with the volume of sales, Hultgren finds that:-

1. margins (profits per dollar of sales) also rise and fall with sales
2. prices do not regularly rise and fall with sales (at least postwar)
3. unit costs tend to move inversely with sales.

The two major drawbacks of Hultgren (1965) are, first, that he does not try to isolate the cyclical from the secular movements, and second, that he only considers money wages. This results in Hultgren finding that his earnings measure was higher at the peak of the output cycle than at the trough in every quantity-expansion; and that they were also higher at the trough than at the peak in all but two contractions.

The only post-Ruggles (1940) work which Okun cites, with

reference to the quote from Okun on page 46, are Kuh (1966) and Bodkin (1969).

Kuh's article does not, in fact, report any statistical tests. An appendix records real wage data in manufacturing which indicates that over long stretches of time the real wage increases rather steadily with acceleration or retardation. Kuh therefore concludes that there appears to be slight systematic relation between real wages and short term fluctuations in output and employment (p.240).

Remarkably, then, the 30 years following Keynes' call for further research saw little work on the subject: reflecting, perhaps, the general acceptance by the profession of 'Keynesian' assumptions which implied that the cyclical behaviour of product wages was of little importance. Bodkin (1969) begins his article by pointing out that there was more than a quarter of a century of data available to him since the last published statistical examination of whether real wages tend to increase or decrease with increased utilisation of labour over the course of the business cycle.

As we shall see, Bodkin's article remained the only published study until 1978, since when this topic has become an area of active economic investigation.

The resulting literature is not yet developed enough to have reached any generally-accepted conclusions. More than this, however, the investigation techniques to be used are still subject to dispute. The various published results have been challenged on the grounds of incorrect techniques. In surveying

this literature, then, it is necessary to go into some detail about the techniques used by each study, including the form of the equation, the dependent variable, the independent variable(s), the price deflators, countries covered, whether lags are used, the statisitical tests employed and so on. We will raise each of these issues concentrating attention on the only paper acknowledged in all other studies: that of Bodkin. This will give us the list of issues in the light of which all subsequent papers can be viewed. Finally, we summarise the techniques used by each study in a table.

These points concerning methods are grouped, in the remainder of this chapter, in the following categories:

1. Wage equations and labour demand schedules
2. The existence of cycles
3. The cyclical variable
4. Alternative wage series; and the role of non-labour costs
5. Lags
6. Detrending
7. Data coverage (across countries, time and industries).

3.1 Wage equations and labour demand schedules

The cyclical wage literature is concerned not with a full causal explanation of wages and product prices via a simultaneous system, but simply with the net result of the various forces which are at work on the direction of movement of these variables, and with the resulting cyclical behaviour of product wages.

All the tests, and regressions, within this literature could have been conducted instead with a properly specified wage equation, the construction of which could be based on any number of such reported equations. The reason why such an approach has not been

adopted by these studies is that the issue in question is how the wage moves in relation to cyclical output. A wage equation attempts to pick up not simply the effect of output on wages but also the effects of other explanatory variables on the wage, part of which might produce cyclical fluctuations in the wage series additional to that picked up directly by the output term. Thus say a wage equation were estimated with as explanatory variables the terms of trade (TT), level of unionisation and rate of change of unionisation (TU, TU*), the level of unemployment and rate of change of unemployment (U, U*), as well as the cyclical behaviour of output (Q), thus:

$$W = a.Q + b.TT + c.TU + d.TU^* + e.U + f.U^* \qquad [1]$$

then the coefficient on cyclical output Q - 'a' - is no longer measuring what is wanted, because other explanatory variables may have a cyclical pattern so that the effect of those coefficients on W will be to move W in a cyclical way. The direct effect which a given increase in output in a boom will have on cyclical wages other things being equal is what the coefficient 'a' shows in the above formulation. But other things are not equal in a cyclical upturn. The literature is concerned to establish how will the cyclical wage series behave given that the cyclical expansion of output may have effects on the wage (or at least be associated with changes in the cyclical wage series) which are captured only partly in the coefficient 'a', and are also captured in part by the coefficients on the other explanatory variables.

Thus, equation [1] can be rewritten as:

$$W = a.Q + b.Z + d.X \qquad [2]$$

where Z comprises all those explanatory variables uncorrelated with the output cycle and X comprises those which are so correlated, so that in:

$$Z = c.Q \qquad [3]$$

$$X = e.Q \qquad [4]$$

$E(c) = 0$. The procedure of simply running regression tests on:

$$W = a'.Q \qquad [5]$$

will involve a reparameterisation such that $a' = (a+c.b+e.d)$. Now $E(c.b) = 0$, so if a large number of regressions are run as in this thesis then there will be no reason to suppose that dropping the 'Z' regressors will bias the results. On the other hand, the cyclical correlation coefficient describing the actual cyclical pattern of wages will not be 'a', but the reparameterised 'a+e.d', the estimation of which is therefore the desirable consequence of dropping the 'X' regressors.

By eliminating all explanatory variables other than the cyclical output variable clearly the resulting regression may have a low explanatory power. But that remaining cyclical variable will be forced to act as a proxy for the cyclical components of the eliminated variables. This may constitute only a small proportion of non-trend movements of wages. That proportion may even be zero. Nevertheless, it is that portion which the literature has set out to establish: how, if at all, are non-trend fluctuations in wages associated with the output cycle?

This has indeed been the approach adopted in most of the literature (eg Bodkin; Geary & Kennan; Bernanke & Powell). There is, however, a rather different literature which attempts to

estimate a labour demand schedule (eg Symons & Layard). The relevance of the latter to this survey of the cyclical wage literature arises because (if for no other reason) authors such as Symons have themselves implied such relevance: implied, that is, not only that the sign of the coefficient on the price of labour in a labour demand schedule represents the actual historical pattern of wages over the output cycle; but also that studies in the cyclical wage literature which suggest a pattern other than this are therefore at fault.

The question of whether the appropriate cyclical variable is output or employment is a separate one from the basic differences in method between the two branches of the literature, and is considering in section 3.3 below.

The point on method is that a coefficient in a wage equation, or labour demand schedule, does not represent (i.e. is not 'picking up') the same information as the ultimately reduced form correlation between historical movements in the two, output and wage, series. That the labour demand schedule is indeed estimating something other than the historical, empirical pattern of wages over the output cycle is indicated by the use such studies have been put to in the Treasury (1985) survey to indicate that a cut in wages would increase employment over several subsequent years. To say that for a <u>given</u> output there is an inverse real wage - employment relation does <u>not</u> necessarily imply that an actual reduction in the real wage would increase employment, because it may be that the reduction in the real wage would, via reduced product demand, reduce output. Whether or not there is such a negative wage - employment

relation for a given output is a (logically) separate question from whether such wage cuts have occured in cyclical expansions in the past. Indeed, the Treasury paper indicates that such wage cuts have not occured in the past due to trend influences in the various series. No attempt is made, however, to detrend such series. There may be reasons in economic theory to expect a cyclical decline in wages to lead to a cyclical expansion in employment (although as indicated in chapter 2, such assumptions are certainly not as universally accepted as might be implied by the Treasury discussion). Even were this so, however, there may be other, logically consistent assumptions which allow for increases in cyclical output (and employment) for reasons other than reductions in cyclical wages, and (perhaps) for such cyclical expansions in output to lead to a cyclical expansion in wages. Thus the former hypothesised relation between wages and employment, while logically coherent, may not be the determining one when it comes to the actual behaviour of real wages over the cycle. Whether this is so or not is what the cyclical wage literature aims to establish.

3.2 The existence of cycles

The very idea of the existence of cycles is, of course, 'conditional' on the view of the world from which the empirical investigation is being conducted. This whole literature on cycles, and the cyclical behaviour of wages is of course set within a view of the world which sees the description 'cyclical' as valid, and hence can look at series in terms of their trend movements, their cyclical fluctuations, and other fluctuations. Thus Zarnowitz's (1985) review of Recent Work on Business Cycles argues that:

> 'The term "business cycle" is a misnomer insofar as no unique periodicities are involved, but its wide acceptance reflects the recognition of important regularities of long standing.' (p.525)

Certainly different views of the world can be compared, and empirical evidence can have some bearing on such comparisons. Such competing views of the world could perhaps be divided between two categories. On the one hand are different assumptions which can be compared and tested within the framework adopted for the research. Thus the discussion in subsequent chapters is, where possible, put in terms theoretically capable of encompassing such different assumptions (for example 'associated with' rather than 'caused by' or 'causes').

The broad framework of the work reported in this literature - cyclical relations - within which it is possible to discuss and compare certain alternative theoretical models, itself is conditional on the theory that the deviations from trend in time do represent cyclical movements. The results, including those of comparing different models, are therefore conditional on that general view of the world. The latter can only then be compared with the alternative, that there is no such cyclical behaviour, in much more general terms of the apparent usefulness of looking at events in that way - from that 'window'.

So while on the one hand objections could be made to looking at everything in cyclical terms, the tide is rather in the other direction, of increasing attention being focussed on cyclical behaviour, and neoclassical/new classical theory being criticised for being inconsistent with empirically observable cyclical behaviour. As a corollary of this, neoclassical/new classical

theory itself is increasingly discussing cyclical fluctuations; although of course such economists look at the cyclical data with very different prior beliefs. Hence Keynes' criticism of orthodox theory's attempts to account for cyclical behaviour, in a letter to Beveridge dated 28/7/36:

> 'I am indeed arguing that the orthodox theory is in effect based on the assumption that there is no such thing as cyclical fluctuation. That is to say, although orthodox economists purport to be discussing it, they are discussing it on the basis of assumptions which, if valid, mean that it is non-existent.' (Keynes, in Moggridge, 1973, p.56)

To conclude: the starting point of the cyclical wage literature is, of course, that output cycles do, empirically, occur. The literature is not only looking at detrended series for output and wages: it is looking at how the wage series does or does not move with the output cycle. Investigating the empirical regularities, or lack of them, over cycles is to investigate the effect on an economic variable (product wages) of all the entangled relations involved. Those economic relations (and the corresponding correlation coefficients) may themselves vary over the cycle: it may be, for example, that the constraint on employment varies, in some circumstances being relative input prices (the resulting employment level hence determining output levels), and at other times being product demand. If firms were constrained in this way - output being determined by 'the short end of the market' - then both the labour demand equation and the production function may play distinct roles. Whether or not they do is not here the point at issue; rather it is to test the ultimately reduced form correlation of cyclical movements in the product wage series with movements in the cyclical output series.

3.3 Cyclical Variable

Bodkin describes the purpose of his paper as:

> 'primarily to have a fresh look at the issue of whether real wages tend to fall or rise with an increased utilisation of the labour force, over the course of the business cycle.' (p.356)

The cyclical variable is unemployment (although he uses an employment variable in two cases, with similar results). Thus in terms of Bodkin's results 'procyclical' or 'countercyclical' movements of earnings do not technically refer to the movement of earnings over the business (output) cycle, but over the employment cycle. Clearly the employment cycle is closely related to the output cycle, although the cyclical relation itself may change over time. In addition, the Employment/Unemployment relation may change over time.

The implications of his introduction on the possible cyclical behaviour of earnings is that employment and earnings are related in two separate ways. First, there is a causal link whereby unemployment inversely affects the real wage. Hence with procyclical employment one obtains procyclical earnings. Second, there is the contemporaneous effect of a change in output on both unemployment and the real wage. This output-effect on real wages operates both countercyclically, via procyclical price movements (and a money wage adjustment coefficient <1); and procyclically via a profit-level effect whereby increased profits in the upswing allow increased wages.

Bodkin then tests for the resulting behaviour of earnings over the cycle using unemployment as the cyclical variable. When

interpreting the results of such tests it should be borne in mind that 'unemployment' has entered the story in two separate ways. First, as having a direct effect on wage-levels. Second, as a proxy for the output cycle: a cycle which affects wages through three channels, one of which is unemployment itself (the other two being pricing and profitability).

When a variable is described as procyclical this is normally interpreted to mean it rises in the (output) boom and falls in the (output) slump. That is, it is positively correlated to the output cycle. Yet the important variable for the cyclical behaviour of earnings (dictated, for example, by a downward sloping mpl/D_L curve) might be thought to be employment (rather than output). Hence the lack of clarity within and between studies about whether we are measuring wage-changes against output-changes or employment-changes.

Otani, Geary & Kennan, and Bernanke & Powell use output directly, while the other studies (including, again, Geary & Kennan) use employment and/or unemployment.

There are two points with regard to the choice of output and/or employment. First, we should include whichever our model suggests should be correlated, and if there are independent reasons for both output and employment to cause changes in earnings, as suggested by Bodkin, then both variables should be included (although Bodkin, as we have seen, does not include output). Second, if we are interpreting the coefficient on employment, we should make clear that any 'procyclical' relations are with respect to employment, and the behaviour of earnings

over the (output) cycle will be mitigated by the output-employment relation.

The former point generalises to which variables are to be included and which are not. Some studies have earnings as the dependent variable, dependent on one or more cyclical variables, while a rather separate body of work is related, rather, to labour-demand schedules and hence specify employment as their dependent variables.

Such labour-demand schedules are then interpreted as equivalent to the tests on the cyclical behaviour of earnings. Thus Symons (and Symons & Layard) interpret labour-demand schedule tests as contradicting Geary & Kennan's findings of no significant reflection of the real wage on the level of employment. If the results of the labour-demand schedule studies (such as Symons') are to be compared with the results of the cyclical behaviour of earnings studies (such as Geary & Kennan), as Symons does, then the distinction should be made explicit.

That Symons' negative coefficient on the real wage (implying an elasticity of around one) may contain information other than simply the effect of the output cycle on earnings is also suggested by Symons' negative coefficients on input prices (in real terms) and strikes. These latter two are not (in that study) interpreted to mean that input prices and strike behaviour are countercyclical.

To conclude on the question of using output and/or employment as the cyclical variable, the two are dealt with separately in this

thesis in chapters 4 and 5 respectively, chapter 5 then considering further the separate and joint correlations these two series might have with cyclical earnings.

3.4 Wage Series and the role of materials

Bodkin's wage series are average hourly earnings of production workers (payment to non-production workers is included in one case), deflated alternatively by the consumer price index and wholesale price index, for both manufacturing and the total private economy, for operatives (and in one case all workers), including overtime, but straight-time for the historical Canadian data. Thus he tests a number of series for both the U.S. and Canada.

Given the dependent variable, the question remains of which independent variables should be included. An earlier version of Geary & Kennan is criticised by Symons (1981) for not including non-labour input costs. Symons estimates a simple demand for labour schedule for the British manufacturing sector: EM = EM(RW, FL, KS, NH, ST, RE) where EM is employment in manufacturing; RW is the product wage (= nominal wage divided by PR, wholesale prices of domestic sales); FL ('Fuel') is real input costs (=nominal input costs, FN, divided by PR); KS is capital stock; NH is normal hours; ST is strikes; and RE is the relative price of exports, (= export unit values divided by PR). He finds an elasticity of employment with respect to the real wage of around -1; and with respect to the real price of inputs at around -0.5. If input costs are excluded from the model he finds only the weak relationship found by Geary & Kennan.

The difference between the two (cyclical wage, and labour demand) approaches has been discussed above. That non-labour costs should be included in such studies does, nevertheless, seem correct for both, although for different reasons. In Symons' case of estimating a labour demand schedule then clearly if non-labour material input prices is a genuine explanatory variable then it must be included as such. In the case of the cyclical wage literature, on the other hand, the interest in non-labour material input prices would be different. The theoretical underpinnings for expectations as to the cyclical behaviour of wages, discussed in chapter 2, implicitly assumed no cyclical pattern of non-labour direct costs so that, for example, Kalecki's horizontal marginal cost curve was taken to be equivalent, over the cyclical fluctuations in capacity utilisation, to a horizontal marginal labour cost curve. If, however, there were some cyclical pattern to non-labour inputs then the assumption as to the cyclical constraints on total direct costs would impose some reciprocal constraints from the non-labour input price fluctuations onto the possible behaviour of the cost of labour. Thus investigations of cyclical wage costs must investigate the behaviour of total direct costs, and of labour costs within that.

This point, of the importance of considering non-labour inputs, and of total direct costs, is developed further in the empirical chapters.

To conclude on the question of materials costs, it should be pointed out that Symons' criticism applies equally to all studies in the cyclical wage literature, not just to that of Geary &

Kennan.

Since we are concerned with labour costs we should start with average hourly earnings, rather than wage rates; should include all payments including overtime payments; and should adjust for other costs to the employer of paying wages (NI contributions in Britain). Whether actual average hourly earnings (including overtime) or only 'straight time' should be used appears to be in dispute: Symons & Layard (1984), for example, use 'straight time', while Bodkin uses actual (except for his Canadian historical series). It is the actual earnings, including overtime differentials, which the employers pay, and so it is this series which is used in this thesis. Note however that by averaging these costs of employing a marginal hour of labour in the upswing out over all hours worked, the cost of the marginal hour is still made to appear less procyclical (more countercyclical) than is in fact the case.

The other crucial factor in constructing our earnings series is what price index is used to deflate the money wage series. Sachs argues that the

> 'most important problem with the Geary-Kennan analysis is that the wage is measured relative to the wholesale price index (WPI), rather than to Pv. [The price of value added]. This procedure is treacherous in a period of supply shocks, which raise WPI relative to Pv. It appears that the real wage has decreased when measured as W/WPI, when in fact it has <u>increased</u> when measured as W/Pv.'
> (Sachs, 1983, p.265 note 8, emphasis added)

We have already agreed with Symons that non-labour direct costs should be included in any analysis of the cyclical behaviour of labour costs. In this case the WPI, rather than the VAP (or Pv

in Sachs terminology) is the appropriate price deflator. It is only if non-labour direct costs have not been included that the VAP becomes a more useful price deflator for reasons explained below. All the major empirical investigations are subject to this two point criticism. Only Sachs so far has used VAP and only Symons has included material costs [where references to Symons includes the extention to international data with Layard].

In the absence of a non-labour material cost index being included in such tests, however, the use of VAP remains treacherous, albeit not to the same extent as is the use of the WPI.

The implications of using one or other of the two possible price deflators for constructing a product wage is discussed in Appendix 1.

3.5 Lags

The insistence on the necessity of testing for lagged relations has not been challenged, and hence casts doubts on the pre-1978 results. But none of the studies to date have adequately discussed the interpretation of coefficients on lagged variables, particularly when the lagged effect is over a time scale which makes a nonsense of the picture of a 'procyclical' series. When the wage series is not claimed to move, say, counter to the output series but, instead, to be negatively related to lagged output then it raises the question of what the meaning is of 'procyclical' or 'countercyclical' descriptions in the presence of lags. For example, Symons reports that it:

> 'it is about seven quarters before half the effect is felt... Sargent estimates a similarly slow response of employment to the real wage in his 1978 JPE paper.'

and that:

> 'The real wage has a powerful but slow-acting negative effect on the demand for labour: long-run elasticity is about 2 and the mean lag is over 18 months.'
> (Symons 1981, p.47; and Symons 1985, p.37, respectively)

Neftci cites the lack of lags as causing Bodkin to miss the countercyclical (dynamic) relation, although Otani finds just that relation without the use of lags, and with the use of lags Geary & Kennan find no such relation.

Certainly, if we have reason to believe some relation is lagged then such lags should be tested for. For example, if we hypothesise that an increase in output caused by an increase in demand reduces the marginal productivity of labour, necessitating eventually a reduction in the product wage, and that this will be brought about by price changes which may take up to a year to be implemented, then we would test with four quarterly lags to pick up such lagged behaviour. We would expect to have some idea about such lag lengths.

A specific example of this lack of discussion about the meaning of lagged coefficients is the citing by Neftci of a negative sum of lagged coefficients as proof of a countercyclical relation. In their criticism of Neftci's results, Geary & Kennan do not question this approach, but, rather, repeat the exercise of adding the 24 (monthly) lagged coefficients of alternative regressions (with different price deflators and samples).

The point is that a 24 month lag is fairly long in relation to a (say) four year cycle, at least if we are trying to reach conclusions as to pro- or counter-cyclical movements. If a study

reported finding countercyclical wage movements, this would normally be interpreted as implying that wages will rise during the recession. Since, however, the recession often lasts twelve months, if this 'countercyclical' movement only operated significantly over a distributed lag of more than twelve months, the description of wage movements as 'countercyclical' might not be very informative.

3.6 Detrending

Bodkin reports sometimes using an arithmetic trend and other times using a semilog trend. In most cases, the period was broken into sub-periods so that the fitted trend would fit the real wage better. As this is all the detail reported it is impossible to comment on the technique used. However, it seems that the actual percentage unemployment figure was taken as the final form of this variable, rather than deviation from trend. The assumption, presumably, is that there is no trend component in unemployment. While this may be true of Bodkin's data, it would not necessarily be an acceptable procedure to apply to more recent data, where there is a possibility of a trend movement in unemployment, nor to European data, where likewise there have been trend movements in unemployment even over Bodkin's sample:

> 'In Britain and to a slightly lesser extent in other European countries the fundamental unemployment problem is the inexorably rising trend upon which the business cycles are superimposed. This trend is barely apparent in the United States...'
> (Nickell, 1982, p.51)

To test for the cyclical behaviour of variables we must use cyclical data. Bodkin's deviation-from-trend measure has not been criticised, and yet it has not been repeated. Otani simply uses percentage changes. But this is not really a satisfactory

cyclical measure. Does a 2% increase in output correspond to a cyclical expansion or a cyclical contraction? The answer, of course, is that we cannot say: in the 1950s or 1960s it may have corresponded to a cyclical contraction, being below trend, while today it might be above-trend, and hence correspond to a cyclical expansion. Put another way, it may be that, historically, percentage changes in output of 4%, 5% and 6% are accompanied by percentage changes in real wages of 9%, 8% and 7%; while at another period percentage changes in output of 0%, 1% or 2% are accompanied by percentage changes in real wages of around 5%, 4% or 3%. We may, therefore, pick up a (positive) trend correlation rather than the negative cyclical one. Similarly Symons' use of logarithms of the original series may not totally isolate the cyclical behaviour of the series from trend behaviour.

The detrending method used by Geary & Kennan, and by Alogoskoufis (1982) is to take 'innovations' of the series.

The definition of an innovation (from Alogoskoufis p.4) is a deviation from a variables 'rational forecast' conditional on information available up to the end of the previous period.

But a variable's rational forecast conditional on information available up to the end of the previous period might itself contain a cyclical factor which would not, then, be included in the innovation. Certainly the standard deviations of Geary & Kennan's univariate innovations are all less than the corresponding standard deviations in their 'trend and seasonal components removed' data. Indeed the average 'innovation' is less than half the fluctuation in the 'trend and seasonal removed'

series.

Alogoskoufis actually makes the following qualification concerning the use of innovations:

> 'Our results are opposite to the Dunlop-Tarshis-Bodkin results, although it has to be said that they were concerned with actual wages and employment, not innovations.'
> (p.4)

It seems that since we want to test for deviations from trend, then that is the series we should use. For testing between cycle-phases (ch.6) clearly the turning points in such a series are crucial. We will, therefore, use deviations from trend as calculated by the 'Phase Average Trend' technique, originally developed at the National Bureau of Economic Research. The results reported in other chapters use a simple moving average trend.

3.7 Data coverage

Only Otani, Geary & Kennan, and Symons & Layard have attempted comprehensive international studies. Otani uses no lagged relations and has not generally been referred to in subsequent studies. Some of the criticisms of Geary & Kennan's methods would, however, apply to Otani's study. The discussion of this issue is easy to summarise: that research cannot be generalised from one country. It is desirable to test any proposition using data from a range of countries.

Bodkin hints at the importance of testing against disaggregated data, and Geary & Kennan mention other work in passing. Bernanke & Powell (and Burda, 1985) report results of such work on US

data. In general we should be wary of accepting conclusions based solely on studying aggregated data because of the dangers involved in aggregation. What we would actually expect from such disaggregated work would depend on our assumed model. Specifically, what we think the causal mechanism is behind any earnings results. Alternative mechanisms might be best captured by different price-deflators. Thus a labour demand curve idea would hinge on the product wage and movements in this. A wage bargaining model, on the other hand, might predict the real wage to be the one with cyclical tendencies (in which case it is particularly ironic that Neftci and Sargent use the CPI). If such a real wage relation were found, then whether or not it would survive at a disaggregated level would depend, presumably, on whether it was the result of factors such as cyclical bargaining strength, in which case it might not survive (given the difference between the output cycles for industry as a whole on the one hand and for individual industries and firms on the other), or whether it was the spin-off from some product wage relation, in which case we would expect it to survive.

These questions are considered further in chapter 7 where UK disaggregated (and aggregate) data are tested.

4. Results

Bodkin's weakly procyclical results were challenged in 1978 by Otani, by Neftci and by Sargent, all of whom reported countercyclical results for real wages. These results (and the methods used in the latter two studies) were challenged by Geary & Kennan. Their paper has, in turn, been criticised by Sachs and

by Symons. Both have made specific criticisms which they report as allowing the Geary & Kennan result and which, when corrected for, show countercyclical earnings. Both criticisms (not having included material prices and, alternatively, not having used the $P_{\smile}$ rather than the WPI as the price deflator) apply equally to all other studies.

Bernanke & Powell consider their results from frequency and time domain tests respectively (and the differences from each) as explaining why Geary & Kennan find independence of wages over the cycle rather than procyclical wages (as do Bernanke & Powell). They make this statement with respect to real wages, however, rather than the product wage series considered by Geary & Kennan (and by Bernanke & Powell elsewhere in their paper). Also Bernanke and Powell use only US data which, according to the results reported in chapter 4, tend to be more procyclical than data taken from other countries. Burda, on the other hand, reports a negative wage-employment correlation for US data; but does not report (or discuss) whether the correlation is statistically significant, and does not attempt to account for the contrast with other studies.

Starting, then, with Bodkin's regression results, these suggest that since world war two, real wages have moved procyclically in the USA, and noncyclically in Canada. The results for different tests are summarised in table 1.

Table 1: Bodkin's results summarised

Price deflator	Country		Coefficient on U sign	significant
CPI	Canada	historical	-ve	no
		postwar	+ve	no
	USA	historical	-ve	yes
		postwar	-ve	no
WPI	Canada		+ve	no
	USA	economy	-ve	yes
		manufacturing	+ve	yes*

* but insignificant after correcting for autocorrelation of the residuals, indicated by the dw statistic for this original regression.

It does seem strange for Bodkin to report regression results with such poor Durbin-Watson statistics, varying from 0.24 to 1.42. In the one case where the regression gave different conclusions to the X^2 tests (USA, Wholesale Price Index, manufacturing) when autocorrelation is corrected for, the significant result disappears. However, of the eight post-war US regressions, all show procyclical earnings, and all show autocorrelation of the error term. He only corrected for two of the regressions, and simply reports that the coefficients remain significant. He does not report any regression results with satisfactory Durbin-Watson statistics, that is, after autoregressive transformation.

Otani (1978) confirms that there is no statistically significant relation between changes in product wages and changes in output for either Canada or the USA. (Otani refers to 'real wages', but had divided by the wholesale price index [WPI] to achieve his wages variable, in order, explicitly, to approximate product wages. It was when Bodkin divided the money wage by the WPI that he, too, found no relation). His data is only annual, over about 25 years. His method of detrending is simply to use percentage changes.

However, Otani goes on to test for a total of fourteen countries. Three of them showed positive coefficients between the product wage and output, but none of these were significant. The other eleven showed negative correlations, of which six were significant.

Only six out of fourteen countries showed a statistically significant coefficient at the 5% level.

Countercyclical earnings are found by Neftci (1978), Sargent (1978) and Sachs (1979). Sachs simply cites Otani's results, and reports briefly on similar findings. Neftci, on the other hand, introduces his paper as finding the relationship between real wages and employment to be significantly different from the one reported in Bodkin. When the appropriate distributed lags are estimated, argues Neftci, employment and real wages are negatively correlated. This response is non-contemporaneous and statistically significant. The sum of coefficients in the distributed lag is negative for employment and positive for unemployment. The only significant coefficient which has the 'wrong' sign is the contemporaneous one.

Similar results are reported in Sargent's estimation and testing of a dynamic linear demand-schedule for labour. He argues that the simple contemporaneous correlation that formed the evidence in the Dunlop-Tarshis-Keynes and after exchange are not sufficient to rule on the question of whether we are on the demand-schedule for labour. His results, on the other hand, support the view that earnings-real wages observations lie on a

labour demand schedule sloping down to the right.

The major difference in method between Sargent and Neftci (both finding countercyclical real wages) and Bodkin is their use of lags. They also distinguish between overtime payments and straight-time rates. Their use of straight-time rates will bias their results in favour of neoclassical results, since straight-time rates underestimate the average hourly cost of labour in a boom.

Geary & Kennan (1982) contrast these recent studies, finding countercyclical real wages, with the older empirical work which suggest that real wages and employment are statistically independent over the cycle. They conclude that it is difficult to reject this hypothesis using data for twelve countries. They explain the difference between their findings and those of Neftci and Sargent as due to different price deflators and sample periods.

Symons & Layard (1984) report a negative 'real wage effect' on employment; ask 'Why have other researchers (and especially Geary & Kennan) not found results like ours for the real wage effect?'; and answer that 'The basic reason is that they have not simultaneously included real input prices' (p.796).

Thus Symons & Layard pose their results as contradicting the non-cyclical conclusions of Geary & Kennan, and as proving instead that wages are countercyclical. As already indicated, however, Symons & Layard's 'real wage effect', found in their demand for labour schedule, does not in itself prove that wages

are countercyclical. The demand schedule for any commodity would be expected to show a negative coefficient on its own price, but that does not mean that simply because the demand is procyclical the price must be countercyclical.

On the reported results themselves, Symons & Layard appear in any case to overstate their (countercyclical) conclusions. Of the 25 wage terms (current and four lagged, on each of five countries) almost half have positive coefficients, and in either case the majority of wage terms prove insignificant. The large elasticities quoted are due to large coefficients on the lagged dependent variable (1.23 to 1.45 on l_{t-1} and -0.57 to -0.32 on l_{t-2}). This of course results in very large long run effects for the other regressors.

Symons' work, as already mentioned, is cited by the Treasury (1985) as indicating an inverse wage-employment relation. However, the Treasury is not concerned with unemployment in general, but only that part 'due to' wages being 'too high'. The remainder may well, therefore, be due to 'other' (cyclical) factors which, if eliminated in a cyclical expansion of output, might well have a quite different relation to wages than that claimed for the wage-employment relation discussed in the Treasury paper.

Wadhwani (1985) demonstrates that such econometric results are in any case notoriously unreliable. He finds the result, that increased real wages reduce the aggregate demand for labour, to be not robust when the equation is re-specified by the addition of variables:

> '...we suggest that the higher (in absolute terms) real wage elasticities obtained by previous researchers (eg Symons 1984, Layard & Nickell 1984) might simply result from omitting other relevant variables'.

He also recalls that Symons' result depends on stopping at the second quarter of 1977, and re-estimating to the fourth quarter of 1980 gives a positive (although statistically not significant) estimate of the wage elasticity. This breakdown is discussed by Symons (1985, p.44: Note that Symons, 1985 is the publication date of the paper referred to by Wadhwani as Symons, 1984). Another worry with Symons' work in terms of the cyclical wage literature has already been discussed, namely the fact that 'the mean lag is over 18 months' (p.37).

Bernanke & Powell (1984) use frequency domain and time domain techniques to consider US (disaggregate and aggregate, pre- and post-war) data. On the question of lags they state that

> '...there is some dispute over whether the contemporaneous correlation of the real wage and output (or employment) is an interesting measure of the real wage's cyclical pattern.' (p.7)

They define procyclical as contemporaneous, and countercyclical as a lagged relation with the lag being half the cycle length (p.18). Using their frequency domain technique they find that real wages lagged output pre-war, and were procyclical postwar. They do not report the results for product wages. Using their time domain technique they find real wages to be independent of other variables, although (pp.29-30) the pre-war data suggest a wage shock would lead to a decline in output and employment, whereas post-war data suggest the opposite effect.

They then cite the differences between the frequency and time

domain results to explain why Geary & Kennan find independence (as they do with their time domain technique). However, this is in relation to the real wage in their tests while Geary & Kennan use a product wage.

To conclude on Bernanke & Powell's results, these differ as between their two techniques, as between their two (pre- and post-war) data samples, and as between their two (real and product) wage measures. Taken as a whole, however, their results suggest that if there is any cyclical wage relation, then it is a procyclical one.

One study not yet refered to is Schor (1982). This reports procyclical wages for 1955-70, followed by countercyclical, for 9 OECD countries. These results are not, however, directly comparable with the cyclical wage literature since, first, Schor's units of observation are business cycle turning points, rather than chronological units; and, second, changes in acceleration and deceleration of wages are investigated, rather than rates of change themselves. However, the reporting of these results in Schor (1985) is presented as a hypothesis for explaining the different findings reported in the different contributions to the cyclical wage literature (p.454). While different data samples can account for some of the differences between reported results (as shown, for example, in Geary & Kennan's discussion of Neftci's results), they do not account for the whole of such differences, and other factors (such as different price deflators, accounting or not for non-labour inputs, lags, and so on) can be shown to account for some discrepencies between reported results. Further, using the

methods of the cyclical wage literature (as in chapters 4 to 8 below) does not produce the same results as do Schor's; hence the results of the latter can not account for discrepencies within the former.

Finally, in a short note Burda asserts the following:

> 'That the covariation of real wages and employment is positive over the business cycle remains a central, relatively undisputed "stylized fact" since its identification in the 1930s by Dunlop (1938), Tarshis (1939) and Keynes (1939), and continues to influence theoretical and econometric research in aggregative economics.' (1985, p.283)

Burda's short note finds negative 'wage-employment relationships for aggregate and disaggregated US manufacturing data for the period 1949-1978' (p.283). The statistical significance, or otherwise, of the correlations is not reported or discussed.

The appearance of this article is of more interest, then, as an illustration of the methodological point being argued in this thesis: that to understand the cyclical wage debate as an episode in the history of economic thought requires some analysis of the meaning and significance of the debate. Thus Burda's article is presented as a contribution to the debate (involving Dunlop, Tarshis and Keynes) over the stylised fact of cyclical wages, but with no explanation for, or discussion of, the 46 year gap between Keynes (1939) and the paper's response to Keynes' call, and no mention of Bodkin, and hence no attempt to compare the reported results with the post-1930s literature.

Thus Burda's paper illustrates one of the conclusions of this thesis: that the comeback being made by the neoclassical labour

demand equation is not due to a change in the 'facts', nor even to a more accurate observation of the facts being achieved, but rather to an attempt to overthrow the Keynesian theoretical assumptions implicit in the bulk of applied macro econometric work up to the late 1970s; (see Chapter 9 section 2.2).

Table 2: Summary of Studies' Methods and Results

	Bodkin	Otani	Sargent	Geary & 1982a	Kennan 1982b	Symons & Layard	Bernanke & Powell
Tests	R, X^2	R	R(FIML)	R, S&F tests	innov-ations	R	t & freq
Lags	no	no	yes	yes	yes	yes	yes
De-trending	dev. from trend	% change		innovations		none (t trend)	log-diff
Overtime	yes	yes	no	nc	nc	no	not
NI costs	no	no	no	no	no	yes	known
Deflator	CP&WP	WPI	CPI	WPI	WPI	WPI	CP&WP
Materials	no	no	no	no	no	yes	no
Cyclical Variable	U &E	Q	E	E	Q,E	D_L	Q
Countries	2	14	1	12	5	6	US
Dis-aggregated	no (calls for)	no	no	no	no	no	yes
Results	weakly pro	coun-ter	counter	non	non	coun-ter	non,pro

Notes: R stands for Regression
nc not consistent
materials = non-labour input costs
(only included by Symons)
(inclusion allows WPI to act as product-wages price deflator)
earnings series (4) may be straight-time or actual (including overtime payments, averaged over all hours)
Should be adjusted for National Insurance contributions (or their equivalent).

5. Conclusion

As seen in the chapter on the theoretical background to cyclical movements in earnings, when it appeared that the data did not fit the simple neoclassical model, modifications to that model, and alternative models, were developed to fit with the data. Strangely, then, there is no agreement on what the data show. Strangest of all are those articles which explicitly set out to modify the simple diminishing marginal product of labour model to fit with the evidence of procyclical earnings (such as Tatom) when the most recent studies have tended to come down, out of the three possible options, on the side of one or other of the other two options - non-cyclical or countercyclical. Tatom refers to other publications, but to no empirical investigations.

Three points have been made[1] about what has to be incorporated in any such study. These are:

1. Incorporation of lagged relations
2. Incorporation of non-labour costs
3. Application to international data.

Symons & Layard is the only published study to date attempting to cover all these points, although as argued above, their study is not directly comparable, being an attempt to estimate a demand for labour schedule. Their article is therefore unlikely to be accepted as answering the question with which the literature is concerned, namely what is the cyclical pattern of earnings. The literature is likely therefore to continue its current growth until such an answer is considered to have been established, Meanwhile, to the three above requirements for work aimed to

establish the empirical facts a fourth could be added: that the data series be clearly measuring cyclical behaviour.

The results of such an empirical investigation incorporating the above points, are reported in the remaining chapters of this thesis.

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1. proponents of point (i) include Neftci and Sargent;
of point (ii) Symons;
and of point (iii) Otani, and Geary & Kennan.

Chapter 4. INTERNATIONAL RESULTS

This chapter reports the results of performing the tests which the previous chapter suggested as appropriate for testing the cyclical behaviour of wages.

Annual post world war two data are taken for six countries: the US, Canada, Japan, France, West Germany and the UK. The data are all set out in the Appendix 5, and the sources and data construction methods discussed, as are the statistical methods used.

As a general rule data on which regression and other statistical tests were performed in this thesis were first plotted. The international post world war two data on output, employment, nominal and real wages, are all, of course, dominated by the strong upward trends of the post war boom.

1. Product Wages

To investigate possible cyclical, as opposed to trend, correlations between output and wages, the percentage deviation from trend was taken of all data series, where trend was taken as a five year moving average of the series in question. The wage series was hourly compensation in manufacturing industry, in product terms, ie deflated by producer prices. The compensation data were on a national currency basis, and were adjusted to include changes in employment taxes that are not compensation to employees, but are labour costs to employers. All data series were for 1950-1982, with two years being lost at either end in

constructing the trend.

These series of the percentage deviation from trend of product earnings were plotted against time, along with the percentage deviation from trend for output, as reported in Appendix 2.

To investigate further, the percentage deviation from trend of product earnings were regressed on the output-deviation. The original regressions, using ordinary least squares, indicated serial correlation of the error terms, so all reported regression results are from the Hildreth-Lu (HILU) method. This loses a further observation. Observations were also lost when lags and leads were introduced, as discussed below.

The results are reported in table 1. The same basic statistical methods, and presentation format, are used in all the tables of results, so the following comments will not be repeated for each table of results. Each set of six figures corresponding to each country, for each regression, refer to, first: the value of the coefficient on the regressor, in this case the deviation of output from trend; second: the absolute value of the corresponding t-statistic; third: the value of the $\bar{R}^2$ statistic adjusted for degrees of freedom; fourth: the Durbin Watson test statistic; fifth: the Standard Error of the Regression; and sixth: the F-statistic; thus:

value of coefficient	$\bar{R}^2$	SER
(absolute t-statistic)	DW	F-statistic

A constant term was included and was in all cases not significant (except where indicated). Where a t-statistic indicates a coefficient being statistically significant at the 5% level the

Table 1. Product Wage Deviation regressed on Output Deviation

	Coefficient on Q (absolute t-stat)	$\bar{R}^2$ DW	SER F-stat.
US	0.16	0.135	1.54
	(2.29)*	1.75	5.22′
Canada	-1.10	-ve	1.97
	(0.81)	1.52	0.66
Japan	-0.32	0.265	2.50
	(3.28)**	1.62	10.8′′
France	-0.82	0.055	4.18
	(1.61)	1.89	2.58
Germany	-0.10	0.007	1.40
	(1.09)	1.67	1.18
UK	-0.28	0.100	2.22
	(2.00)	2.34	4.01

Notes:
1. HILU
2. Constant term insignificant in all cases
3. 1952-1980
4. N=28 (one observation being 'lost' to allow construction of rho, for HILU)
5. F-statistic (1,26): ′ statistically sig. at $F_{0.05}$
   ′′ statistically sig. at $F_{0.01}$
6. t-statistic: * statistically significant at 5% level
   ** statistically significant at 1% level
   (2-tailed test: see text)
7. DW statistics compared with significance points of d_1 and d_u at 5%.
   All show non-autocorrelation.

t-statistic is marked with an asterisk, *; and when statistically significant at the 1% level, with a double asterisk, **. These refer to the two-tailed test since any a priori expectations regarding the sign of the coefficients of the economic relationships being tested in this chapter are not sufficiently established to allow the use of the one tailed test.

The cyclical wage behaviour in each country, set out in table 1, vary considerably. Of the six countries the coefficients are negative in five cases, positive in one. The only two countries with significant coefficients are the US and Japan, although

these are significantly procyclical and significantly countercyclical relations, respectively.

This contrast in results across economies suggests that there is no necessary cyclical behaviour of wages in 'free market' economies.

2. Lags and leads

The different wage behaviour between countries was considered further by repeating all regressions adding the deviation of output from trend lagged one year as a second explanatory variable. The results are reported in table 2. As can be seen, the results confirm the different wage patterns, with no convergence towards a norm being produced by the addition of the lagged variable.

In the case of the US, the relation between the current wage and lagged output is different from the contemporaneous one, the coefficients on the output variables being equal and opposite (negatively and positively related respectively). This suggests that two quite different correlations are being picked up with, for example, increased (cyclical) output being associated (causing?), with a lag, cyclically lower wages; while a cyclical increase in wages is associated (perhaps via increased demand effects) with an increase in cyclical output.

Table 2. Product Wage regressed on Current and Lagged Output

	Coefficient on Q (t-st)	Coefficient on Q(-1) (t-st)	$\bar{R}^2$ DW	SER F-stat.
US	0.14	-0.15	0.221	1.46
	(2.07)*	(2.13)*	1.90	4.70′
Canada	-0.15	-0.45	0.456	1.47
	(1.59)	(4.75)***	1.70	11.9′′
Japan	-0.35	-0.09	0.297	2.55
	(3.58)**	(0.93)	1.62	6.50′′
France	-0.89	-0.93	0.168	4.05
	(1.74)	(1.84)	1.84	3.62′
Germany	-0.10	0.06	-ve	1.40
	(1.10)	(0.60)	1.95	0.78
UK	-0.27	-0.08	0.068	2.29
	(1.77)	(0.57)	2.28	1.95

Notes:
1. HILU
2. C insignificant
3. 1953-1980
4. N=27
5. F-statistic (2,24): $F_{0.05}$=3.40; ′sig.
   $F_{0.01}$=5.61; ′′sig.
6. t-stat: * 5%; ** 1%; *** 0.1%
7. DW's all above upper limit, d_u

In the case of Japan the two coefficients have the same sign and the contemporaneous (negative) relation appears strengthened. For Canada a relation now appears (being a lagged one), while for France, although the regression explains a little more, the coefficients on contemporaneous and lagged output are, as with the US, opposite in sign. The addition of the lagged variable does nothing for the regression equation on German or UK data other than lose it degrees of freedom.

To conclude: the introduction of lagged output to the regression tends to confirm the separate patterns suggested by the original regression results rather than explain the differences as being due to similar economic mechanisms working with different time

lags in the different countries.

One possible such theory of cyclical wage behaviour which might imply a lagged relationship would be a bargaining model whereby changes in the deviation of output from trend changed the relative bargaining position of agents in production, with information lags and/or structural delays in the bargaining and/or price setting processes tending to create a lag in the mechanism working through to wage levels. A neoclassical model might suggest a lag working in the opposite direction, with a reduction in the wage being a necessary pre-condition for expanding output, or an increase in the wage necessarily leading to a reduction in output, so that there might be a relation between current wage levels and future output. This sort of hypothesised correlation lies behind much current policy debate, with wage cuts being advocated in order to allow increased output. To test for this possibility the deviation of product wages from trend was now regressed on the deviation from trend of both current and future output.

The results of these regressions are summarised in table 3.

With the notable exception of France, the addition of future output as a second regressor does not significantly alter the statistical significance of the contemporaneous relation. However, two results of this exercise are worth noting: first, in the case of both countries where a statistically significant relation had been found previously (the US and Japan), and in the case of France and Canada, there is a statistically significant

Table 3. Product Wage regressed on Current and Future Output

	Coefficient on Q (t-st)	Coefficient on Q(+1) (t-st)	$\bar{R}^2$ DW	SER F-stat.
US	0.17	0.17	0.283	1.38
	(2.57)*	(2.53)*	1.66	6.13''
Canada	-0.07	0.30	0.183	1.72
	(0.61)	(2.65)*	1.64	3.90'
Japan	-0.26	0.17	0.365	2.17
	(3.18)**	(2.11)*	1.77	8.46''
France	-1.24	2.24	0.714	2.37
	(4.15)***	(7.47)***	2.02	33.5''
Germany	-0.11	0.05	-ve	1.44
	(1.09)	(0.51)	1.65	0.71
UK	-0.29	0.08	0.073	2.29
	(2.00)	(0.52)	2.30	2.02

Notes:
1. HILU
2. C insig.
3. 1952-1979
4. N=27
5. $F_{0.05}(2,24)=3.40$: sig.'; $F_{0.01}=5.61$: sig.''
6. t-stat: * 5%; ** 1%; *** 0.1%
7. DW all show non-autocorrelation.

(positive) correlation between the deviation from trend of product wages in time 't' and the deviation from trend of output in time 't+1'; and, second, in all six cases this coefficient is positive. This result is the precise opposite of what would be expected according to the theory which prompted the test to be made.

The latter test has, again, confirmed the different contemporaneous wage-output relations existing across countries but has, at the same time, revealed a positive relation, statistically significant in four of the six countries, between current wage and future output levels (in cyclical terms).

These results appear to lend weight to the argument that wage

cuts would be associated with reduced future output, and that increases in future output would be correlated with increased current real wage levels (working, presumably, through demand effects).

The striking results from the French data suggest two separate effects being picked up, one contemporaneous, the other lagged. Thus, for example, increased output might, via increased prices (of the six countries the French data produced the largest positive coefficient when prices are regressed on output, although as with the positive coefficients in each case, not statistically significant) be contemporaneously correlated with reduced wages; while at the same time 'exogenous' wage increases might, via increased demand and with a lag, lead to increased future output (again, of the six countries tested for by Symons & Layard - the same six as in this thesis - France was the only one for which employment appeared to respond positively to increased demand from either government spending or world trade).

3. Materials costs

The case for including non-labour costs in any such investigation has already been made (as reported and discussed in chapter 3), particularly for any post-oil price shock study. This conclusion was actually reached independently when the first set of data were analysed: the UK quarterly series discussed in Chapter 6 and in particular, the behaviour of the real wage series over the first cycle. This was one of only two cycles for which earnings were below trend at the output-peak. This quarter actually witnessed a lower level of product earnings than any of the other

127 quarters covered by the data. This was the result of a fall in product earnings of more than 20% over less than two years leading up to 1951 II, caused by a surge in the WPI (of more than 38% over the corresponding seven quarters). These initial results first suggested the necessity of constructing a non-labour direct cost series ('materials'), which could then, in addition, allow the cyclical behaviour of total costs to be considered.

The marginal decision of whether or not to hire another worker will depend not only on what is happening, over the cycle, to the cost in product terms of employing that worker but also on what is happening to the price of the materials (to the employer: i.e in product terms) which that worker will use. Any cyclical investigation of earnings should, therefore, test also for the cyclical behaviour of the price of materials.

Price indices were therefore constructed for non-labour direct costs ('materials'), and were weighted through time by a moving average of output per hour to construct a 'cost of materials used per hour' index. This was deflated by producer prices to give material costs in product terms (MC). Further details are given in the Appendix 3.

This series for the cost of materials used per hour in product terms was plotted against time, along with the output series, both detrended. The data suggested a procyclical relation, particularly in the cases of Canada, France and Germany. Other countries suggest some cyclical influences at work, but not consistent ones over the whole sample period. The US, for

example, displayed an initially negative correlation followed by a positive correlation. The positive correlation suggested by the UK data, on the other hand, did not survive the violent fluctuations in materials costs of the 1970s.

The deviation from trend of these material costs were then regressed on the deviation of output from trend.

This component of direct costs might be expected to behave more consistently across countries than the labour component, given the relatively fewer institutional, non free-market, forces at work in their supply; and to the extent that such factors are at work, the less country-specific form they take (in contrast to, say, the trade union, bargaining, structure). This is confirmed by the results, reported in table 4. Only in Japan does there appear to be no contemporaneous correlation. For the other 5 countries there is a positive coefficient on output, statistically significant in 4 cases.

The results reported in table 5 show that lagged output, when added as a regressor, while not having a statistically significant coefficient itself (with the exception of the US where lagged output was significant at the 5% level, though not the 1% level as is contemporaneous output in both regressions) does tend to confirm the previous pattern. Positive coefficients are found for 5 countries, raising the explanatory power of the regression equation for the US, Canada and the UK. The regression continues to be totally independent of the regressors in the equation for Japanese data.

Table 4. Material Cost (in product terms) regressed on Output

	Coefficient on Q (t-statistic)	$\bar{R}^2$ DW	SER F-stat
US	0.59	0.239	4.09
	(3.08)**	1.86	9.46''
Canada	0.70	0.242	3.41
	(3.10)**	1.74	9.62''
Japan	-0.04	-ve	5.18
	(0.17)	1.78	0.03
France	1.27	0.221	3.55
	(2.94)**	2.00	8.64''
Germany	0.20	0.196	1.10
	(2.75)*	1.82	7.57'
UK	0.46	0.041	4.63
	(1.46)	1.42	2.14

Notes: 1. HILU
2. C insig.
3. 1952-1980
4. N=28
5. $F_{0.05}(1,26)$ sig.'; $F_{0.01}(1,26)$ sig.''
6. t-stat: * 5%; ** 1%
7. DW show non-autocorrelation except UK which is indeterminate

Table 5. MC regressed on Current and lagged Output

	Coefficient on Q	Q(-1)	$\bar{R}^2$ DW	SER F-stat
US	0.64	0.43	0.392	3.71
	(3.60)**	(2.48)*	1.92	9.39''
Canada	0.76	0.22	0.288	3.34
	(3.40)**	(1.00)	1.77	6.25''
Japan	-0.08	0.07	-ve	5.33
	(0.35)	(0.30)	1.66	0.11
France	1.31	-0.37	0.194	3.64
	(2.86)**	(0.80)	2.06	4.12'
Germany	0.20	0.01	0.154	1.14
	(2.59)*	(0.17)	1.72	3.37
UK	0.45	0.38	0.060	4.49
	(1.46)	(1.23)	1.60	1.83

Notes: 1. HILU
2. C insig.
3. 1953-1980

4. N=27
5. $F_{0.05}(2,24)=3.40$: sig.'; $F_{0.01}(2,24)=5.61$: sig.''
6. t-stat: * 5%; ** 1%
7. DW all show non-autocorrelation

Adding the deviation from trend of output with a one year lead shows no relation, except in the case of the UK. The statistical significance of these regression equations on future output are not improved by the savings in degrees of freedom involved in dropping current output.

4. Wages and materials costs

There are two conflicting pressures on the relation between product wages and product materials cost, which each lead to different apriori expectations as to the sign of the coefficient we would expect when the deviation from trend of product wages is regressed on the deviation from trend of material costs.

On the one hand, given a constant mark-up over total direct costs to form prices, the labour and non-labour (materials) components of direct costs would tend to be negatively related.

On the other hand, any change in the mark up over total direct costs would affect both components of that total direct costs in the same direction, thus leading to the opposite apriori expectation, of a positive coefficient. This latter effect refers to an exogenous change in the mark up, not an endogenous one caused by a modification of the former effect in which the mark up does not remain constant but is reduced to absorb some proportion of the rise in nominal terms of the element of direct costs which increased. In this case, the reduction in the mark

up would not simply imply a positive coefficient relating the two direct cost components in product terms, but, rather, would reduce the former negative effect (with the increased cost of the one direct cost component representing a larger increase in product terms, while the direct cost component which is unchanged in nominal terms translates into a smaller reduction in product terms).

Plotting the deviations from trend of the two components of direct costs - labour and materials - only the plots for Japan and Germany indicated a consistent correlation, in both cases negative (plots not reproduced).

Regressing the deviation from trend of product wages on the deviation from trend of materials costs (in product terms) confirmed these patterns, with significant coefficients in 2 of the 6 countries - Japan and Germany - both being negative, as reported in table 6.

Table 6. Product Wage Deviation Regressed on MC Deviation

	Coefficient on MC	$\bar{R}^2$ DW	SER F-stat
US	0.04	-ve	1.67
	(0.54)	1.66	0.30
Canada	-0.11	0.016	1.94
	(1.20)	1.57	1.43
Japan	-0.29	0.234	2.49
	(3.04)**	1.77	9.26''
France	-0.19	-ve	4.30
	(0.91)	2.00	0.82
Germany	-0.75	0.431	1.06
	(4.66)***	2.09	21.7''
UK	-0.11	0.030	2.31
	(1.35)	2.23	1.83

Notes: 1. HILU

2. C insig.
3. 1952-1980
4. N=28
5. $F_{0.01}(1,26)$ sig.''
6. t-stat: ** 1%; *** 0.1%
7. DW all show non-autocorrelation

In contrast to the positive coefficient which would be expected from an 'exogenous' change in the mark up, which would affect both components of direct costs simultaneously thereby generating a contemporaneous positive coefficient, the effect of a change in one component on the other may operate through lags (and leads). The negative relation caused by the constant mark up may be reflected in the coefficient on contemporaneous or one-year lagged variable, depending on the lags involved in marking up to final prices.

The results of adding lagged material costs in product terms (MC) are reported in table 7.

Table 7. Product Wage regressed on Current & Lagged MC

	Coefficient on MC	MC(-1)	$\bar{R}^2$ DW	SER F-stat
US	0.05	-0.30	0.716	0.88
	(1.50)	(8.16)***	1.75	33.7''
Canada	-0.09	-0.32	0.432	1.50
	(1.18)	(4.44)***	1.43	10.9''
Japan	-0.29	0.04	0.207	2.58
	(2.95)**	(0.42)	1.80	4.40'
France	-0.22	-0.16	-ve	4.42
	(1.02)	(0.75)	2.04	0.78
Germany	-0.72	-0.01	0.392	1.08
	(4.32)***	(0.07)	1.92	9.37''
UK	-0.12	0.02	-ve	2.40
	(1.19)	(0.16)	2.23	0.75

Notes: 1. HILU
2. C insig.
3. 1953-1980
4. N=27
5. $F_{0.05}(2,24)=3.40$: sig.'; $F_{0.01}(2,24)=5.61$: sig.''

6. t-stat: ** 1%; *** 0.1%
7. DW show non-autocorrelation except Canada, indeterminate

The coefficients on the US and Canadian lagged series are both significant and negative. In no cases are the coefficients on contemporaneous MC significantly affected, those for the US and Canada remaining statistically insignificant.

The strong negative relation in Japan and Germany implies that workers do not/cannot offset increased material costs in increased earnings. The lag in the US and Canadian negative correlations suggests a lagged mark up effect of one of the components of direct costs, via the output price, on the other component (in product terms).

It should also be noted that even complete absorption of changes in real material costs by wages would produce a coefficient less than one, since earnings represent a greater proportion of total direct costs than does material costs. Thus the results for Germany, for example, suggest that the extremely procyclical pattern of non-labour direct costs represents something other than (or at least additional to) any compensating mechanism operating between the two components of total direct costs. Otherwise, for the other five countries, the largest absolute value attained by any of the coefficients on (lagged and contemporaneous) material costs was 0.32, suggesting that cyclical fluctuations in the two cost series were absorbed partly by each other and partly by the price mark up over total direct costs.

Having constructed an index for non-labour direct costs, and considered its relation to labour direct costs, the next section considers the role which this 'material costs' index plays in the correlation (or lack of it) between the output cycle and the deviation of product wages from trend.

5. Wages, materials costs and output

Adding this index of the deviation from trend of non-labour direct costs ('materials costs') in product terms to the regression equations of wages on output confirms the different behaviour patterns across countries. Comparing the results of these regressions, given in table 8, with the results of regressing on output alone (table 1), it can be seen that there is very little change at all in the value or the significance of the coefficient on output.

Table 8. Product Wage Regressed on MC & Output

	Coefficient on MC	Coefficient on Q	$\bar{R}^2$ DW	SER F-stat
US	-0.06	0.20	0.122	1.55
	(0.85)	(2.36)*	1.82	2.76
Canada	-0.10	-0.04	-ve	1.98
	(0.88)	(0.25)	1.58	0.69
Japan	-0.30	-0.33	0.581	1.93
	(4.34)***	(4.58)***	1.80	18.9''
France	-0.06	-0.74	0.20	4.26
	(0.24)	(1.25)	1.89	1.22
Germany	-0.83	0.06	0.426	1.07
	(4.39)***	(0.79)	2.14	10.6''
UK	-0.07	-0.25	0.096	2.22
	(0.93)	(1.79)	2.30	2.33

Notes: 1. HILU
2. C insig
3. 1952 - 1980
4. N = 28
5. $F_{0.01}$ (2,25) sig.''

6. t-stat: *5%; ***0.1%
7. DW all show non-autocorrelation

For the Japanese data, and to some extent the UK data, the combination of both MC and output, as regressors, does improve the significance of the correlations. Taken as a whole these results suggest that the cyclical output - product wage relation is not dominated by cyclical fluctuations in non-labour direct costs. The two elements of direct costs should, however, be combined to test if the cyclical output - product wage relation is repeated for total direct costs.

It is this latter index, rather than labour costs alone, which neoclassical theory should consider to be constrained by, and to constrain, cyclical output.

The index of the cost of materials used per hour was, therefore, combined with the index of the cost of labour per hour to produce an index of total direct costs used per hour. The same weights were used as had been derived from the quarterly UK data, as reported and discussed in Appendix 3; and were here applied to the average of all 33 observations per country.

6. Total direct costs

This index of total direct costs used per hour, in product terms, was plotted over time, along with output, both detrended, as reported in Appendix 2.

The percentage deviation from trend of this total direct cost index (DC) in product terms was then regressed on output, (table

9); current and lagged output, (table 10); and current and future output (table 11).

Comparing the behaviour of this total direct cost index with, first, the behaviour of wages alone, the insignificant correlation of wages with the output cycle found for France, Germany and the UK remains, with no cyclical behaviour at all for total direct costs. The two countries which did show significantly cyclical wage costs now show even more marked cyclical behaviour for the composite index: for the U.S., more procyclical, for Japan more countercyclical (although with a smaller coefficient, albeit more statistically significant). These relations between the wage index and total direct cost index are also borne out when lagged output is included, as well as when future output is included.

Table 9. Direct Costs Regressed on Output

	Coefficient on Q	$\bar{R}^2$ DW	SER F-stat
US	0.30	0.422	1.46
	(4.55)***	2.02	20.7''
Canada	0.12	0.015	1.53
	(1.19)	1.70	1.42
Japan	-0.23	0.398	1.44
	(4.34)***	1.79	18.8''
France	-0.13	-ve	2.98
	(0.35)	1.91	0.12
Germany	-0.02	-ve	0.83
	(0.31)	2.02	0.10
UK	-0.09	-ve	1.88
	(0.70)	1.85	0.49

Notes:
1. HILU
2. C insignificant
3. 1952-1980
4. N=28
5. $F_{0.01}$ (1,26) sig.''
6. t-stat: *** 0.1%
7. DW all show non-autocorrelation

Table 10. Direct Costs Regressed on current and lagged Output

	Coefficient on Q	Coefficient on Q(-1)	$\bar{R}^2$ DW	SER F-stat
US	0.31	0.02	0.408	1.50
	(4.42)***	(0.33)	1.84	9.95''
Canada	0.14	-0.26	0.229	1.37
	(1.49)	(2.80)**	1.85	4.87'
Japan	-0.25	-0.04	0.441	1.45
	(4.74)***	(0.82)	1.94	11.3''
France	-0.04	-0.74	0.090	2.83
	(0.10)	(2.08)*	1.90	2.28
Germany	-0.01	0.04	-ve	0.84
	(0.18)	(0.77)	2.06	0.31
UK	-0.10	0.02	-ve	1.94
	(0.75)	(0.16)	1.90	0.29

Notes: 1. HILU
2. C insignificant
3. 1953-1980
4. N=27
5. $F_{0.05}$ (2,24)=3.40: sig.'; $F_{0.01}$ (2,24)=5.61: sig.''
6. t-stat: * 5%; ** 1%; *** 0.1%
7. DW all show non-autocorrelation

Table 11. Direct Costs Regressed on Current and Future Output

	Coefficient on Q	Coefficient on Q(+1)	$\bar{R}^2$ DW	SER F-stat
US	0.30	0.04	0.386	1.50
	(4.23)***	(0.54)	2.15	9.16''
Canada	0.13	0.21	0.207	1.28
	(1.56)	(2.46)*	1.99	4.40'
Japan	-0.23	0.07	0.413	1.45
	(4.08)***	(1.28)	1.77	10.2''
France	-0.39	1.49	0.579	1.94
	(1.60)	(6.08)***	1.95	18.9''
Germany	-0.02	0.01	-ve	0.87
	(0.31)	(0.07)	2.01	0.05
UK	-0.07	-0.13	-ve	1.90
	(0.52)	(1.02)	1.96	0.68

Notes: 1. HILU
2. C insignificant
3. 1952-1979

4. N=27
5. $F_{0.05}$ (2,24)=3.40: sig.'; $F_{0.01}$ (2,24)=5.61: sig.''
6. t-stat: * 5%; *** 0.1%
7. DW all show non-autocorrelation

For the UK and Germany, then, direct costs show no cyclical pattern. For France there is no contemporaneous relation, although there is a weak (negative) correlation between direct costs and lagged output, and a strong (positive) correlation with future output. In Japan direct costs and output show a significant negative correlation while in the US there is the opposite, significantly positive correlation. The Canadian data on total direct costs are negatively correlated with lagged output and positively correlated with future output.

Despite the generally positive correlation of total direct costs with future output, there appears a lack of any persistent relation between the two series.

Total direct costs, in product terms, appear to bear no necessary relation to the business cycle.

7. Comparison with other studies

The results from regressing wages on output are similar to those reported by Otani, who also finds a positive contemporaneous relation for the US, and negative coefficients for Canada, the UK and Japan, in order of increasing significance. The order is not the same for the remaining 2 countries, with Otani's coefficient on output for the German data being (the most) positive, rather than negative; and for the French data the most negative, rather than the third most. Thus ranking the country results from this

chapter's test, Otani's, and Symons & Layard's, starting with the most procyclical and ending with the most countercyclical (the relation being negative after the '*******', and positive before), and with countries for which the correlation is statistically significant being asterisked, gives:-

Otani	Above_tests	Symons_&_Layard
Germany		
US	US*	US
*****	*****	*****
Canada	Canada	
	Germany	Germany
	France	France
UK*	UK	Japan
Japan*	Japan*	UK*
France*		Canada*

It is not clear why Otani should have got a different ranking for France (although having used different sample periods it is perhaps not surprising). The Durbin-Watson statistic for Otani's regression on German data indicates autocorrelation of the errors, which would prevent too much weight being put on the different ranking Germany's coefficient has in the international results table.

The results of testing for total direct costs give the same international ranking, although the coefficient on cyclical output for the Canadian data, while remaining statistically not significant, becomes positive.

As indicated in the previous chapter, none of the other studies provide similar comparable descriptive statistics indicating the cyclical pattern of product wages, and the statistical significance of any apparent pattern. Geary & Kennan test the null hypothesis of no relation, but do not investigate whether the alternative hypothesis, of a cyclical movement, would be pro-

or counter-cyclical. The studies within the demand for labour schedule approach (Symons; Symons & Layard; Layard & Nickell) tend to test for correlations between employment and a number of other variables, rather than testing for an ultimately reduced form correlation of product wages with the output cycle; and while material prices are included in such 'demand for labour schedules', no comparable index for total direct costs is tested. While not, therefore, directly comparable, Symons & Layard's results are nevertheless reported above. The two differences with the results reported in this chapter are the reversal of the UK-Japan ordering; and the more negative correlation for Canada. In both cases Otani's results correspond to those found for the data tested in this chapter.

It should be stressed that the different ranking (and statistical significance) reported by Symons & Layard is not necessarily surprising. They are conducting a quite different test. Indeed, a more negative correlation for Canada is reported in the following chapter (table 3) when product wages were regressed on employment as well as a separate cyclical output variable the role of which may have been played to an extent by Symons & Layard's demand variables.

The above comparisons have been considered on the basis of the R^2 statistic (adjusted for degrees of freedom), t-statistics, deviation of the Durbin Watson statistic from two, and F-tests of the significance of the regressor variables, other than the constant term, taken together. The following section, and Appendix 4, consider more elaborate tests (not directly reported by TSP version 3.5, the package on which the regressions were

run).

Section 8 discusses the question of parameter stability, and reports the results of running Chow tests on selected equations.

The results of testing for heteroscedasticity (using the Goldfeld-Quandt test), and for higher order serial correlation, are reported in Appendix 4.

8. Parameter stability

We would not necessarily expect the coefficients in any of the above tests to be stable over the entire data sample, specifically not post and prior to 1973.

The data series were, therefore, divided into two samples: the first including all data up to 1970 (the final deviation from trend figure being from a trend taking account of data only up to 1972), and the second including only post 1971 data. The regression equations were then re-estimated, this time separately against each of the two samples respectively, and an F ratio was constructed in order to perform the test suggested by Chow (1960)[1]:

$$F^* = \frac{(RRSS-URSS)/(k+1)}{URSS/(n_1+n_2-2k-2)}$$

where RRSS stands for the restricted sum of squares, that is the sum of squared residuals from the regression equation being estimated with the restriction that the parameters are stable over the entire data sample;
URSS stands for the unrestricted sum of squares, that is the addition of both sums of squared residuals from the two regression equations being estimated without the restriction;
K is the number of regressors, excluding the constant term;

n_1 is the number of observations in the first of the two sub-samples;
n_2 the number of observations in the other (so that F* has an F distribution with degrees of freedom (k+1), (n_1+n_2-2k-2)).

Table 12 reports the calculated value of this F* for each of the 6 countries on 9 regression equations (all previously reported above), along with the F-distribution degrees of freedom, and the theoretical value of $F_{0.05}$ and $F_{0.01}$ corresponding to each of these degrees of freedom.

In order to calculate the statistics reported in Table 12, the regression equations were all estimated over both sub-samples as well as over the entire sample. Rather than report the sub-sample results for each equation, tables 13 and 14 report these results for a selected two equations: W on Q, which the Chow test had shown to be stable across sub-samples; and DC on Q and lagged Q, which the Chow test had shown not to be stable on data from the US, Canada and the UK.

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1. Maddala (1979) points out that the test was derived by others before Chow, and argues, therefore, that in view of this, it is better not to attach any name to the test (p.198n). The test is only referred to above as the 'Chow' test to fit with common usage, rather than to imply authorship.

Table 12. Chow Test for Parameter Stability

Regression Equation $(k+1),(n_1+n_2-2k-2);F_{0.05},F_{0.01}$	US	CAN.	JAP.	FRAN.	GERM.	UK
W on Q 2,23; 3.42, 5.66	3.26	0.66	3.25	0.43	1.47	2.65
W on Q, MC 3,21; 3.07, 4.87	5.85**	1.14	4.52*	4.26*	2.52	2.47
W on MC 2,23; 3.42, 5.66	1.22	1.25	2.89	4.06*	4.24*	0.24
W on MC, MC (-1) 3,20; 3.10, 4.94	10.1**	3.50*	3.56*	3.00	3.24*	0.26
W on Q,Q(-1),MC, MC(-1) 5,16; 2.85, 4.44	8.06**	4.39*	2.10	1.96	2.65	4.28*
MC on Q 2,23; 3.42, 5.66	7.46**	4.59*	0.03	2.25	1.63	1.15
MC on Q,Q(-1) 3,20; 3.10, 4.94	4.02*	5.20**	0.82	4.75*	1.78	1.05
DC on Q 2,23; 3.42, 5.66	19.9**	1.34	3.13	0.26	2.27	4.45*
DC on Q,Q(-1) 3,20; 3.20, 4.94	12.1**	7.70**	1.99	1.20	2.25	3.70*

Notes: 1. * signifies rejection of the null hypothesis at the 95% level of significance
** signifies rejection at the 99% level
2. Rejecting the null hypothesis is to accept that the two samples give different relationships.

Table 13. W on Q: Pre-1971; N = 18, F (1,16)

	Coefficient on Q	$\bar{R}^2$ DW	SER F-stat
US	0.05	0.010	0.74
	(1.07)	1.24	1.15
C	-0.07	-ve	1.01
	(0.73)	2.08	0.54
J	-0.27	0.381	1.77
	(3.39)**	1.50	11.5''
F	-0.93	0.035	3.82
	(1.27)	1.82	1.62
G	-0.08	-ve	1.14
	(0.91)	1.52	0.83
UK	0. 05	-ve	1.04
	(0.44)	1.48	0.19
Post-1971; N = 9, F (1,7)			
US	0.37	0.302	2.36
	(2.11)	2.14	4.47
C	-0.07	-ve	3.36
	(0.19)	1.33	0.04
J	-0.32	0.090	3.30
	(1.34)	1.73	1.79
F	-1.17	0.046	5.41
	(1.18)	1.75	1.39
G	-0.17	-ve	1.85
	(0.74)	1.75	0.55
UK	-0.58	0.236	3.51
	(1.86)	2.60	3.48

Notes: Pre-1971: 1. DW show non-autocorrelation except for US which is indeterminate
2. $F_{0.05} = 4.49$; $F_{0.01} = 8.53$
3. $t_{0.005} = 2.92$

Post-1971: 1. DW statistic not appropriate to sample size. The sign patterns of the residuals from each regression equation estimated over post 1971 data, from both tables, were therefore examined through contingency tables. The appropriate X^2 test could not reject the hypothesis of non autocorrelation.
2. $F_{0.05} = 5.59$; $F_{0.01} = 12.2$
3. $t_{0.025} = 2.36$

Table 14. DC on Q, Q(-1)

	Coefficient on Q	Coefficient on Q(-1)	$\bar{R}^2$ DW	SER F-stat
	Pre-1971: N=17, F(2,14)			
US	0.02	0.01	-ve	0.57
	(0.55)	(0.22)	1.91	0.15
C	0.01	-0.19	0.104	1.04
	(0.06)	(1.92)	1.91	1.93
J	-0.22	-0.04	0.345	1.45
	(3.22)**	(0.66)	1.80	5.21'
F	-0.12	-1.48	0.281	2.81
	(0.23)	(2.78)*	2.04	4.12'
G	0.01	0.09	0.050	0.64
	(0.13)	(1.62)	2.00	1.39
UK	0.15	0.25	0.730	0.46
	(3.03)**	(5.43)***	2.12	22.7''
	Post 1971: N =9, F(2,6)			
US	0.59	-0.05	0.798	1.56
	(5.73)**	(0.55)	1.58	16.8''
C	0.31	-0.41	0.329	1.91
	(1.44)	(2.06)	1.77	2.96
J	-0.33	-0.01	0.562	1.26
	(3.50)*	(0.01)	1.86	6.12'
F	-0.23	-0.53	-ve	2.96
	(0.44)	(1.02)	1.92	0.57
G	-0.12	-0.06	-ve	1.07
	(0.91)	(0.46)	1.84	0.45
UK	-0.40	-0.20	0.043	3.03
	(1.38)	(0.71)	2.07	1.18

Notes: Pre-1971 1. DW show non-autocorrelation
2. $F_{0.05} = 3.74$; $F_{0.01} = 6.51$
3. $t_{0.025} = 2.11$; $t_{0.005} = 2.9$; $t_{0.0005} = 3.96$

Post-1971 1. DW stat. inappropriate: see note to table 13
2. $F_{0.05} = 5.14$; F0.01 = 10.9
3. $t_{0.025}=2.45$; $t_{0.005}=3.71$; $t_{0.0005}=5.96$

As expected, the economic relationships being studied change over time, specifically pre- and post- the early 1970s.

The extent to which the two samples give different relationships varies between the correlations being considered. Specifically,

the correlations between materials costs and either output or wages differ significantly between samples, while the wage-output correlation does not, indeed is the only one of the 9 regressions to display parameter stability against data from every country. The lag structures, in particular, appear to have changed over time. Thus while the parameter of W on MC shifts significantly for 3 of the 6 countries, 5 of the 6 show a significant shift in the correlation between W and current and lagged MC.

The main conclusions from these tests of parameter stability are, then, that the oil shock (for want of any other generally acceptable phrase to describe the breakdown of the post war boom) affected different economies in different ways - the correlations reported in tables 13 and 14 becoming more procyclical in the US but more countercyclical in the UK - and that the lack of uniformity between countries seems even more pronounced after 1971.

9. Conclusion

The past few years have seen increasingly sophisticated econometric approaches to investigate the cyclical pattern of wages. This increased sophistication has not, as yet, established a consensus view of the facts. This is due, in part at least, to the different studies, from the 1930s to the present, not only using different degrees of econometric sophistication, but also using different data samples, series and sources, as discussed in chapter 3. To attempt to establish the facts of cyclical wage behaviour requires a study which, at least, tests for data drawn from several countries; and

constructs and tests the appropriate data series, taking into account the relevant discussions in, and criticisms of, previous studies. It is the results from such an attempt which have been reported in this chapter.

The results show clearly that there is no necessary cyclical wage behaviour common to advanced capitalist economies, as would be predicted by the neoclassical assumptions outlined in chapter 2. Those cyclical patterns which are found (for example the conflicting patterns which emerge from the US and Japanese data) do not, therefore, suggest that some necessary relation exists but, rather, that such specific patterns are the product of those institutional and market factors specific to the economy which generated the earnings data in question.

Breaking the data series between the post war boom and the subsequent years does not help to establish a common pattern.

Testing for possible lags, and leads, simply confirmed the different contemporaneous wage-output relations existing across countries. However, a statistically significant positive correlation was found in four of the six countries between (the cyclical series for) the current wage and future output levels. Depending on whether terms such as 'procyclical' and 'countercyclical' are thought appropriate to describe correlations with the output cycle other than contemporaneous ones, this result might be taken as evidence against a traditional countercyclical wage view. That view was associated with the assumption that a (cyclical) expansion in output would be associated with a (cyclical) decline in the real wage.

However, these results would be more consistent with a rather conflicting view: namely that wage cuts would be associated with reduced future output.

While the behaviour of non-labour ('materials') costs may help explain specific fluctuations in real wages, taken as a whole the results from testing jointly for the two component parts of total direct costs suggested that the cyclical output - real wage relation is not dominated by cyclical fluctuations in non-labour direct costs (section 5); and total direct costs, in product terms, appear to bear no necessary relation to the business cycle (section 6).

Chapter 5. EMPLOYMENT

One difference in method between the various empirical investigations into the cyclical behaviour of wages not accounted for in chapter 4 is the difference in the cyclical variable against which the real wage is tested for possible correlation. This chapter therefore compares the results reported in chapter 4 with the results of using employment, rather than output, as the cyclical variable.

1. Methods

The methods of enquiry pursued in this chapter are similar to those used in the last chapter, where deviations from trend of product wage series were tested for possible correlation with the output cycle. These points concerning method are not, therefore, repeated here, and under the following headings only points new to the method used in this chapter are mentioned.

1.1 The specification of the correlation to be tested

Without implying by the word 'dependent' any causal relations, the dependent variable was the same as used in the last chapter, namely the percentage deviation from trend of product wages. Similarly, the same functional forms and lag structures were used. The only major difference was, therefore, in testing for possible correlations of wages with employment rather than output.

The explanatory variables

The employment series was for total hours in manufacturing, relating to all employed persons (wage and salary earners, the

self-employed, and unpaid family workers) in the US and Canada, and all employees (wage and salary earners) in the other countries, the source being the US Department of Labor, Bureau of Labor Statistics. As with the other series this was transformed into a series for the percentage deviation from trend.

Two points to be mentioned regarding the explanatory variables are, first, that the tests were repeated substituting the above employment series (E) with a series for the total number employed (N); and that, with both data series, output was also introduced as a second explanatory variable. Also, series for non-labour, and for total direct, costs were introduced.

The reason for testing separately for possible correlations with the number employed rather than total employed hours is because of the possible differences in the cyclical behaviour of the two series, and, further, the possible role wage costs play in this.

The reason the correlations are tested for with the introduction of the output series in addition to the employment series is to be able to indicate the sort of negative correlation which would exist between employment and earnings conditional on output. The converse, of the correlation with output conditional on employment is not really relevant. While a change in employment unrelated to any output change is not what would be referred to as a cyclical change in employment (but, rather, a substitution between inputs presumably caused by relative input price shifts), a change in output not accompanied by a change in employment would still be part of the output cycle, and would suggest some additional cyclical factor being at play such as labour hoarding

(this discussion being only in terms of cyclical output, not trend changes which clearly could be unaccompanied by employment changes).

All data series original to this chapter are reproduced in Appendix 5.

1.2 The estimation of the correlations

The possible correlations between the various cyclical series discussed above were tested for by means of the Hildreth-Lu regression technique (OLSQ indicating serial correlation) using annual data between 1950 and 1982 for the US, Canada, Japan, France, West Germany and the UK. The various possible correlations to be tested are reported in the following order. First the employment series is considered in relation to wages. Second non-labour direct costs, and a composite total direct costs index, are introduced. Third the correlations are considered with employment conditional on output. Fourth the different behaviour of number employed and total hours employed over the cycle is considered.

All the theorised correlations discussed above and below were plotted out, both over time and against each other; and lags and leads were tested for in regression equations. In order to restrict the sheer volume of reported results, these are only reported in selected cases.

2. Results

2.1 Wages and employment

The deviations from trend of both the employment and earnings

series were plotted together over time, as reported in Appendix 2.

The possibility of correlations between these two series (in each of the 6 countries) was tested for by regressing the series for the deviation of wages from trend onto (a constant and) the series for the deviation of employment from trend. The results are given in table 1.

Unless reported otherwise the coefficient on the constant term was not significant. For some regressions a time trend was tested for but as expected with such percentage deviation from trend series this was not significant and is not reported. Further econometric tests, for parameter stability, heteroscedasticity, and higher order serial correlation, are reported for some chosen regressions in Appendix 4.

Table 1. W regressed on E

	Coefficient on E	$\bar{R}^2$ DW	SER F-stat
US	0.12	0.022	1.63
	(1.27)	1.76	1.62
Canada	-0.30	0.077	1.88
	(1.80)	1.65	3.25
Japan	-0.83	0.430	2.16
	(4.62)***	1.53	21.4''
France	-1.95	0.441	3.26
	(4.73)***	1.46	22.3''
Germany	-0.13	0.025	1.38
	(1.30)	1.66	1.69
UK	-0.48	0.142	2.16
	(2.34)*	2.37	5.49'

Notes: 1. HILU
2. C insignificant
3. 1952-1980
4. N=28
5. F(1,26): 5% '; 1% ''

6. t-stat: * 5%; *** 0.1%
7. DW show non-autocorrelation except France, indeterminate.

The regression results reported in table 1 are in line with those suggested by the scatters. Only France and Japan show very definite correlations between the wage and employment series, in both cases a negative one. The negative correlation seen for the UK 1970s data is only just significant (the t-statistic at the 5% level, as is the F-statistic) because of the lack of such correlation in the earlier part of the sample.

These results are broadly similar to the findings for the behaviour of wages over the (output) cycle (reported in table 1 of the previous chapter). In the case of each country, however, the relation with employment is, as expected, more countercyclical/less procyclical. This is because given output, employment and wages would be expected to be inversely correlated. But such correlations between wages and employment which occur with a given output are not 'cyclical' correlations.

Allowing for different speeds of adjustment between countries by adding lagged employment to the regressions did not explain the international differences. While the US displayed a significant negative correlation between the earnings series and lagged employment, this relation did not appear in the other countries, except for Canada. In the case of both Germany and the UK, not only was the coefficient on lagged employment (insignificant and) positive, but the addition of this variable reduced the overall explanatory value of the regressions.

2.2 Materials costs and total direct costs

The cost-of-materials-used-per-hour index described previously was now compared with the behaviour of employment. The two series were significantly (positively) related in the US and Germany. Ordering the six countries from the most procyclical to the most countercyclical, the order is almost identical when this materials index is compared with employment as when wages are. Only France and Germany swap the last two positions. Thus the (generally not significant) inverse relation between labour and non-labour direct costs reflects itself here in the former being generally negatively correlated with employment while the latter is generally positively correlated, but this does not appear to be part of a process of maintaining fluctuations in total direct costs within limits in relation to employment fluctuations.

Given these results, the addition of non-labour direct costs in the former regressions (which tested for possible correlations between labour costs and employment) would not be expected to explain the different results found across countries. So it turns out.

Similarly, total direct costs were compared with the employment series (table 2).

This relation, too, differed over countries, and along the same lines as with the wage-employment patterns. The order of countries listed in the type of sequence described above does not alter significantly. The following three further results emerge from comparing the relation of employment to wages with the relation of employment to total direct costs. First, in all six

countries the total direct cost index is more positively/less negatively related to employment (in terms of the sign of the coefficient on employment). Second, the difference between countries is, if anything, greater when the behaviour of total direct costs is considered, as the two 'extreme' countries, the US and Japan, have stronger correlations. Third (and connected with the first) of the five countries showing a negative correlation the coefficients have reduced significance in four cases, and in all cases the absolute value of the coefficients are reduced.

Table 2. DC regressed on E

	Coefficient on E	$\bar{R}^2$ DW	SER F-stat
US	0.31	0.292	1.59
	(3.48)**	2.10	12.1''
Canada	-0.04	-ve	1.57
	(0.31)	1.80	0.09
Japan	-0.60	0.628	1.13
	(6.83)***	2.08	46.6''
France	-1.10	0.294	2.48
	(3.50)**	1.39	12.3''
Germany	-0.04	-ve	0.83
	(0.59)	2.00	0.35
UK	-0.14	-ve	1.88
	(0.72)	1.84	0.52

Notes: 1. HILU
2. C not significant
3. 1952-1980
4. N=28
5. F(1,26): 5% '; 1% ''
6. t-stat: 1% **; 0.1% ***
7. DW show non-autocorrelation except France, indeterminate

2.3 Employment conditional on output

It was argued above that to compare series of (deviations from trend for) earnings and employment would pick up two relations. First the correlation (or lack of it) due to the output cycle,

and the fluctuations in employment related to the output cycle. It would also reflect the relation between deviation from trend of employment not connected with the output cycle, and wages. The earnings series was therefore regressed on both the output and the employment series. This aims to measure the correlation between earnings, on the one hand, and fluctuations in employment given output, on the other; as well as the equivalent earnings-output relation.

The results of these regressions are reported in table 3.

Table 3. W regressed on E and Q

	Coefficient on E	Coefficient on Q	$\bar{R}^2$ DW	SER F-stat
US	-0.60	0.63	0.295	1.39
	(2.63)*	(3.33)**	1.61	6.39''
Canada	-0.80	0.41	0.133	1.82
	(2.32)*	(1.64)	1.71	2.95
Japan	-0.93	0.06	0.411	2.20
	(2.98)**	(0.37)	1.57	9.99''
France	-2.41	0.73	0.435	3.23
	(4.30)***	(1.37)	1.64	10.9''
Germany	-0.21	0.08	-ve	1.41
	(0.75)	(0.30)	1.68	0.82
UK	-0.42	-0.05	0.110	2.21
	(1.13)	(0.21)	2.37	2.56

Notes:
1. HILU
2. C insignificant
3. 1952-1980
4. N=28
5. $F(2,25)_{0.95} = 3.39$ '; $_{0.99} = 5.57$ ''
6. t-stat: * 5%; ** 1%; *** 0.1%
7. DW all show non-autocorrelation

The results are in line with what had been predicted. The earnings-employment coefficient, given the level of output, is more negative than when it also reflected (by ommitting output) employment associated with fluctuations in output. The sign of

the employment (conditional on output) series is in all cases negative, significantly so in four of the six cases.

Similarly the results on output conditional on employment are more positively correlated than when all output fluctuations, including those associated with similar movements in employment, are tested for possible correlation with earnings.

An obvious problem is that to the extent that the output-cycle variable picks up some of the cyclical employment behaviour, this introduces the problem of multicollinearity. The problem is increased by the instability of the output-employment relation. This latter prevents the possibility of accurately decomposing the employment series into the two behavioural series which combine to generate non-trend fluctuations.

These points support the conclusion that the attempt to establish what the 'cyclical behaviour of earnings' is should aim to establish the correlation (or lack of it) between non-trend earnings and cyclical output. Such findings would, then, have implications for employment about which the results reported in this chapter would have some bearing.

To test the hypothesis formulated above concerning the different results to be expected when output was, and was not, included in the regression equations, the index for non-labour direct costs was considered. As predicted, the coefficients on employment tended to be more countercyclical when the output variable was included. This might have been expected regardless of whether labour or non-labour costs were the instigator of change, given

the positive correlation to be expected in the cyclical behaviour of employment and cost of materials used per hour; (while this does not follow from neoclassical theory, it was found, although only weakly, in regression tests). When wages were regressed on the employment and materials indices, both with and without output included, the wage and materials indices were then more negatively correlated when output was included. This would tend to favour the second of the two alternative hypotheses discussed above as to the cause of non-cyclical fluctuations, namely that these are driven by changes in the cost of non-labour direct costs, rather than by changes in wages.

Finally, the results of regressing the total direct cost series on both output and employment are reported in table 4.

As predicted, the coefficients on the employment terms tend to be more negative than when the direct cost series is regressed on employment alone; and the coefficients on the output term tend to be more positive. Indeed, these latter coefficients are now positive in five of the six countries, and significantly so in three. The corresponding results reported in chapter 4 (table 9, p.104), prior to the separate influence of employment being taken out by including such a series in the regression test, had suggested a positive coefficient for the correlation of total direct costs with output in only two of the six countries.

Table 4. DC regressed on E and Q

	Coefficient on E	Coefficient on Q	$\bar{R}^2$ DW	SER F-stat
US	-0.23	0.48	0.402	1.46
	(0.96)	(2.41)*	2.13	9.68''
Canada	-0.86	0.67	0.313	1.28
	(3.53)**	(3.76)**	1.80	6.87''
Japan	-0.66	0.03	0.601	1.15
	(4.10)**	(0.38)	1.95	20.5''
France	-1.83	1.09	0.428	2.22
	(4.71)***	(3.02)**	1.60	10.7''
Germany	-0.13	0.09	-ve	0.84
	(0.79)	(0.62)	2.02	0.35
UK	-0.09	-0.04	-ve	1.92
	(0.25)	(0.16)	1.85	0.26

Notes:
1. HILU
2. C insignificant
3. 1952-1980
4. N = 28
5. $F(2,25)_{0.95} = 3.39'$; $_{0.99} = 5.57''$
6. t-stat: 5% *; 1% **; 0.1% ***
7. DW all show non-autocorrelation

2.4 Number employed

Within the movement of total employed hours there are the two composite movements of number employed and hours per person. Similarly with cyclical earnings, there are earnings per person and earnings per hour. Analysis of cyclical earnings refers to earnings per hour, and that is what has been tested for in this thesis. Compared to the results of this, earnings per person would be more procyclical/less countercyclical due to the procyclical movement in hours per person. If such earnings series (per hour) are to be compared with cyclical employment (rather than with output directly) then similarly it is total employed hours which is the comparable employment series, and that is what was tested for in the preceding sections. Studies which have used unemployment as the cyclical variable (eg Bodkin)

are closer to (the inverse of) number employed. There are also implications within theories of cyclical earnings for hourly earnings to be related differently to number employed than to hours employed and, indeed, for the former to be more closely correlated, for example if wage costs have to be reduced in order to take on more employees but do not have to (or cannot) when hours per existing employees are increased.

For these reasons all the above tests were repeated using a series for non-trend employment (N).

In all cases the results were similar to those reported with the total employed hours series, and so are not discussed further. Again, for example, the total direct cost series was less negatively related to the employment series alone, and again this meant no relation whatsoever for Canada, Germany and the UK; a negative correlation for Japan and France; and a positive correlation for the US.

3. Discussion

The results reported in this chapter suggest a negative answer to Keynes' assertion/question:

> '...I should have thought that employment never did fall materially without a rise in the real hourly wage. Is not this one of the best established of statistical conclusions?'
> (Keynes, 1937a: letter to Ohlin dated 29/4/1937, in Moggridge, 1973, p.190)

Keynes was not here meaning to refer specifically to employment as opposed to output: his statement is made in the context of the cyclical behaviour of wages - not differentiating between the

output cycle and the corresponding employment changes. The results of the previous chapter would have the same relevance, then, to this question.

The differences between using output and using employment as the cyclical variable turns out to be small. As expected the employment-wage correlation is in every case more countercyclical/less procyclical than the output-wage correlation. The significantly procyclical wages of the US correspond to an insignificant (although positive) wage-employment correlation. Similarly, the non-significant countercyclical wages in France and the UK correspond to significant negative wage-employment correlations.

Reporting this chapter's results, using employment as the cyclical variable, allows comparisons with the other studies which do so, and which are not, therefore, directly comparable with the tests in the previous chapter. Referring to the sample of such studies reported in chapter 3 (table 9): Bodkin only tested for the US and Canada, finding weakly procyclical wages. This is not radically different (given different techniques, data samples and so on) from the results reported here of a positive, although not statistically significant, relation for the US, and a negative, although not statistically significant, relation for Canada.

Sargent's countercyclical results are at odds with those reported here for the US, but are explained away by Geary & Kennan. Their results of no significant cyclical relations are consistent with the results reported here but largely by default, in that of the

six countries from which data are tested in this chapter, the only two with strong wage-employment (negative) correlations are Japan and France, and neither of these countries is included in Geary & Kennan's international sample of 12 OECD countries. Of the other four countries for which results are reported in this chapter (and which are all included in Geary & Kennan's sample) only the UK shows any relation, and that is not at a high level of statistical significance. The other three countries all demonstrate independence between the non-trend wage and non-trend employment series which is what is also reported in Geary & Kennan.

It has already been argued, above, that Symons & Layard's demand for labour approach, which yields negative real wage effects, is not comparable with the direct testing of the actual pattern of cyclical wages over the business cycle. With that proviso the remainder of this section compares the numbers reported by Symons & Layard with those reported in this chapter.

Without the introduction of material costs, Symons & Layard actually find a more positive correlation between wages and employment than that reported in this chapter. In addition to their wage-employment correlations being generally more positive, the order of the six countries (ranked from the most positive correlation to the most negative) is slightly different: a relatively minor difference is the case of Germany (which in the tests reported in this chapter showed no significant correlation) which in the order switches places with the US; the major difference in country order, which survives comparisons of the two sets of results with the addition of materials, is Canada

which in the tests reported above showed no significant correlation, while in the results reported by Symons & Layard Canada shows a more negative correlation than any of the other countries.

This extreme result for Canada from Symons & Layard's tests is surprising, particularly as it puts the US and Canadian economies at polar opposites of the international comparisons. The pattern of coefficients reported for Canada which go to make up their result do appear strange. On contemporaneous and four lagged values of wages they have the following pattern of coefficients using either of their regression techniques: -ve, +ve, -ve, +ve, -ve; the latter two being precisely opposite and equal in both cases. The only other possible clue given in their paper for the Canadian results is that a different price series is used from the other five countries.

The major difference between the numbers reported by Symons & Layard and those reported in this thesis results from the different effects of the introduction of materials. Symons & Layard's materials measure is negatively related to employment, and its introduction also makes the wage-employment correlation more negative than previously. The materials index constructed in this thesis has no effect on the wage-employment correlation, although the materials index itself is positively correlated to employment (although not as positively correlated as it is with output). Thus the total direct cost index is less negatively related to employment than is the wage index alone.

Two more general points can be made concerning the relation which

the Symons & Layard type labour demand schedule literature bears to the cyclical wage literature. The first has been referred to in chapter 3: namely that the negative coefficient on wages in a labour demand schedule cannot necessarily be interpreted to mean that wages are countercyclical. Just as a negative coefficient on real material prices or strike behaviour cannot necessarily be interpreted to mean that material prices and strike behaviour are countercyclical. A related point concerns the different materials index constructed in this thesis (the cost of materials used per hour's labour) from that used by Symons & Layard. The relevant statistic for deciding whether to employ the marginal worker in the boom would be the total direct costs of employing the marginal (hour of) labour. That turns out to be procyclical due to the procyclical movement of materials used per hour of labour. This directly procyclical influence was actually purged from the series' used in this thesis by simply using the trend of inputs per hour; (see Appendix 3). That such a purging of the procyclical influence was necessary is in itself a contradiction of the countercyclical marginal productivity assumptions which underlie the neoclassical requirement for countercyclical wages.

4. Conclusion

In chapter 3 it was argued that the appropriate correlation to test for an inquiry into the cyclical behaviour of wages is the output-wage correlation. The results of such tests were reported in chapter 4. To test instead for possible wage-employment correlations would be likely to produce generally more negative coefficients because of the presumed negative correlation between non-trend fluctuations in employment not associated with the

output cycle and non-trend wages. Such a negative (countercyclical) 'bias' was indeed found in the tests, the results of which are reported in this chapter.

The actual pattern of results is similar in chapters 4 and 5. Relative changes in that pattern between countries does not appear directly related to the closeness or otherwise of the output-employment correlation.

Taken together the results do give a more comprehensive picture with which to compare the empirical literature on the cyclical behaviour of wages, as summarised in chapter 3. The basic conclusion of chapter 4 - that no common pattern emerges - is fully vindicated by the results of this chapter.

Chapter 6. CYCLE PHASES

Geary & Kennan (1982b) state that

> 'a serious concern is the stability of the results over alternative sample periods (in particular, preliminary tests show instability of the UK results).'[no page numbering]

Such stability, and lack of it, has been tested for in the preceding two chapters (as reported in chapter 4.8 and, for the chapter 5 data, Appendix 4) finding, like Geary & Kennan, the UK results to be particularly unstable; and is considered further in this chapter with reference to UK quarterly data.

Chapter 2 outlined the theory behind the neoclassical belief that wages are (counter-) cyclical. It is this belief which has been tested, empirically, in the studies surveyed in chapter 3. The results reported above suggest that the idea that there are economic forces necessitating a fixed cyclical pattern of product wages, is not supported by the evidence.

In addition to outlining the neoclassical model, chapter 2 also incorporated those neoclassical assumptions within a wider framework incorporating Kaleckian assumptions. This wider model implied that while there may be no necessary cyclical pattern to wages, the influence which the output cycle has on wages (and vice versa) may in any case vary over the cycle, between different cycle phases. These implications of the theory as outlined in chapter 2 are investigated in this chapter. The output cycles are divided into their different phases, with reference to the cycle turning points. It is thus possible to test for the existence of any hypothesised correlation within any

given cycle phase alone taking data from across all cycles.

1. Methods

1.1 Phase Average Trend

The Phase-Average-Trend (PAT) method was used for picking the cyclical turning points, required in order to separate the series out according to different cycle phases. This is a sophisticated method of both taking the trend of a series (and thus calculating the ratio to trend) and picking the turning points in that trend. See Appendix 6 for a discussion of the technique.

1.2 Dependent and independent variables

Changes in the ratio of actual output to trend output are taken as indicators of the cycle. The cyclical variable with which earnings are compared is, then, output rather than employment.

The cycle is then divided into peaks, 'slumps', troughs and 'booms', where the 'slump' quarter is midway between the preceding peak and subsequent trough, and the 'boom' quarter is midway between the trough and the following peak.

The cyclical turning points are summarised in table 1. These are as selected by the PAT programme, with the exception of the final trough and peak, as explained in Appendix 6.

Table 1. Final turning points of the ratio to final trend

Troughs	Peaks
1948 II	
	1951 II
1952 III	
	1955 I
1958 IV	
	1960 I
1963 I	
	1965 I
1967 III	
	1969 IV
1972 I	
	1973 III
1975 II	
	1979 II

Table 2 shows the corresponding ratios to trend for output (Q), earnings (W), cost of non-labour direct costs ('materials') used per hour (M), and the composite index of total (labour and non-labour) direct costs (DC).

Notes to Table 2:

1. +/- beside each ratio indicates whether it is greater or less than the previous value. A strictly procyclical movement would begin, with these series, with '++', followed by '--', '++' and so on.
2. Where there are an even number of quarters between peaks and troughs the boom or slump is taken as the average of the middle two quarters.
3. Figures are given to one decimal place except where two are necessary to indicate above or below trend (simply for convenience of tables 4 and 5).

Tables 3 to 5 summarise the cyclical earnings information given in table 2.

Table 2. Ratios to trend of Q, W, M and DC.

Cycle Phase	Quarter(s)	Q	W	M	DC
Trough	1948. II	91.4	108.8	94.7	98.6
Boom	1949. IV	98.0	106.8-	91.0-	99.6+
Peak	1951. II	106.2	87.0-	123.0+	104.2+
Slump	1951. IV - 1952. I	101.3	88.5+	105.5-	98.6-
Trough	1952. III	92.0	94.7+	99.2-	98.5-
Boom	1953. IV	100.6	97.0+	94.6-	97.4-
Peak	1955. I	106.7	101.6+	101.0+	101.6+
Slump	1956. IV	100.7	101.1-	105.4+	102.4+
Trough	1958. III	94.4	99.99-	98.7-	99.2-
Boom	1959. II	99.6	99.5-	99.6+	99.5+
Peak	1960. I	104.8	100.03+	101.5+	100.3+
Slump	1961. III	100.6	101.6+	99.3-	101.0+
Trough	1963. I	94.5	99.6-	98.4-	99.4-
Boom	1964. I	100.2	100.8+	101.4+	101.0+
Peak	1965. I	103.3	101.0+	100.8-	101.0
Slump	1966. II	101.1	102.6+	102.4+	102.3+
Trough	1967. III	97.0	100.6-	97.0-	99.5-
Boom	1968. III - 1968. IV	101.9	98.7-	101.6+	99.9+
Peak	1969. IV	102.6	98.3-	106.8+	101.6+
Slump	1970. IV - 1971. I	99.2	99.4+	100.2-	99.5-
Trough	1972. I	93.3	103.5+	90.3-	99.4-
Boom	1972. IV	101.2	101.7-	89.1-	97.3-
Peak	1973. III	105.2	101.2-	100.7+	101.2+
Slump	1974. II - 1974. III	102.8	95.5-	106.7+	99.6-
Trough	1975. II	94.1	99.0+	94.5-	97.4-
Boom	1977. II	96.3	92.9-	103.4+	97.5+
Peak	1979. II	103.7	107.8+	101.0-	104.0+

Table 3. Direction of movement.

	Product Earnings: W					
	--	++	-+	+-	+	-
Trough to Peak	3	2	2	0	4	3
Trough to Boom					2	5
Boom to Peak					4	3
Peak to Trough	1	2	1	2	2	4
Peak to Slump					4	2
Slump to Trough					3	3

Table 4. Total Sample

	Relation to trend			
	above	below	average value	N
Troughs	3	4	100.9	101.4
Booms	3	4	99.6	100.1
Peaks	5	2	99.6	100.1
Slumps	3	3	98.1	98.5

Note: N series is 'normalised' to average 100.0

Table 5. Sample minus first cycle

	Relation to trend		
	above	below	average value
Troughs	2	4	99.6
Booms	2	4	98.4
Peaks	5	1	101.7
Slumps	3	2	100.0

Earnings tend to be above trend earnings at the cycle peak, particularly if the first cycle, during which earnings fluctuate wildly, is ignored. Over the rest of the cycle, however, earnings seem to show no clear patterns.

Regression tests were performed not simply as in chapter 4, but also against data falling only within each cycle phase. The results are reported in the following section.

2. Results

The regression tests on these data series produced similar results to those reported for the UK in chapter 4: over the whole sample period taken together neither earnings nor material costs

(nor the composite direct cost index) were significantly correlated with output.

The negative correlation between wage costs and material costs (both in product terms) reported in chapter 4, which there proved not to be statistically significant, now is so at the 5% level of both the t-statistic and F-tests, as reported in equation (1):

$$W = \underset{(2.53)*}{0.11.M}$$

$\bar{R}^{2} = 0.041$; DW = 1.84; SER = 1.76; F-stat = 6.39'

Notes: 1. Method: Cochrane-Orcutt iterative technique (CORC)
2. Constant term not statistically significant
3. $F(1,125)_{0.95} = 3.92$ '; $F(1,125)_{0.99} = 6.85$ ''
4. t distribution: 5% = 1.98 *; 1% = 2.62 **
5. DW statistic indicates no autocorrelation
6. 1948 I - 1979 IV
In order to include the cyclical behaviour of series in 1948, and 1979, all series constructed in this chapter were extended backwards and forwards by extrapolating the trend movements to allow deviations from trend to be calculated. Unlike previous chapters, therefore, no observations are lost through detrending.
7. N = 127
8. The series were seasonally adjusted by either seasonal dummies or, in the case reported in equation (1), by a common seasonal adjustment procedure; the results being not significantly altered. When raw data were used the seasonal variations were clearly affecting the coefficients on lagged variables.

It was, in fact, this quarterly data (which were taken back to the first quarter of 1948, including the deviation from trend series, by extrapolating the trend series) which first suggested that non-labour costs might help explain the behaviour of labour costs over the cycle; that the behaviour of labour costs over the cycle might depend, first, on the relation of total direct costs over the cycle, and, second, on the relative movements of the two component parts of the direct cost series - labour costs and non-labour (materials) costs. This hypothesis was suggested by the fact that the huge fall in earnings between the 1948 II

trough and 1951 II peak was not due to the fact that it was a cyclical expansion but, rather, to the behaviour of world material prices over this period. The implication is that the boom in material prices forced a corresponding fall in labour costs (wages).

2.1 Cycle phases

Having determined the cyclical turning points the data series were divided into cycle phases so that all data from, say, a peak to a trough phase, could be pooled.

The data series were divided up in two different ways, and each time all regression tests were repeated on the resulting data series. First the series were divided into two composite series corresponding to, first, all trough to peak years and, second, all peak to trough years. Next the series were divided between four more specific cycle phases: trough to boom, boom to peak, peak to slump, and slump to trough.

The above results held across all cycles within each of the six cycle phase divisions: pooling the data from all cycles but corresponding to only one cycle-phase in turn, neither earnings nor material costs nor the composite direct cost index were significantly correlated with output.

As discussed in the previous chapter, however, the UK results are heavily influenced by the negative wage-output (and wage-employment) correlation in later years. All regression tests were therefore repeated for data from the trough of 1952 III to the trough of 1967 III.

2.2 1952 III to 1967 III

The results from regressing wages on output for the data from 1952 III to 1967 III are reported in table 6.

Table 6. Wages regressed on output over different cycle Phases

Phase N; F(_,_)	Coeff. (t-stat)	$\bar{R}^2$ DW	SER F-stat
All 60; (1,58)	0.11 (1.86)	0.040 1.83	0.91 3.46
Trough to Peak 22; (1,20)	0.02 (0.14)	-ve 1.96	0.88 0.02
Peak to Trough 38; (1,36)	0.17 (2.29)*	0.103 1.49	0.93 5.26
Trough to Boom 11; (1,9)	0.35 (2.38)*	0.386 1.55	0.80 5.65
Boom to Peak 11; (1,9)	-0.09 (0.45)	-ve 0.92	0.98 0.20
Peak to slump 19; (1,17)	-0.08 (0.40)	-ve 0.93	1.17 0.16
Slump to Trough 19; (1,17)	0.12 (1.40)	0.051 1.88	0.55 1.97

Notes:
1. CORC
   When there are gaps in the sample, as for all but the first of the regression equations reported in the table, the CORC procedure drops the first observation in each group since it would otherwise use the wrong lagged variables for that observation in estimating 'rho'. This accounts for the low values for the number of observations (N) and the corresponding degree of freedom for the F statistic.
2. C not significant
3. F 0.95
4. t-stat: 5% *
5. DW is indeterminate for 'peak to trough' but indicates autocorrelation for 'boom to peak' and for 'peak to slump'.

The overall correlation remains not statistically significant. Splitting the cycle into two phases - from trough to peak, and peak to trough - this lack of statistical significance applies to the upswing but not to the downswing. The latter demonstrates a statistically significant procyclical relation. Thus, depending

on the hypothesised direction of causation, reduced output tends to reduce wages, or reduced wages tend to reduce output, while increased wages appears to have no statistically significant relation to output (and vice versa). Splitting each of such phases into two, of the resulting four cycle phases, three demonstrate similarly non-significant correlations, while the fourth phase, of trough to boom (that is, the first half of the upswing) demonstrates a statistically significant positive correlation.

This tendency for product wages to accompany/be accompanied by increased output in the beginning of the upturn, but not during the second half (leading up to the downturn) does not seem consistent with assumptions of profits squeezed by wages choking off the boom; although such a profit squeeze might result from slower productivity growth as the boom continues. The increased wages, whether or not they cause the increased output, at least do not appear to choke off such output growth. And whatever leads to the cyclical upturn being choked off, it does not appear to be increased wages.

3. Conclusion

While the tests reported in this chapter required a large number of regression equation estimations (over different sample periods), the different patterns which emerged did so within the statistically noncyclical wage:output (and direct-cost:output) correlation indicated by the data series as a whole. These statistically non-significant results have not, therefore, been reproduced in tables of results. Instead the following patterns

are described.

With respect to the post world war two UK data the earnings series is clearly subject to very different influences over time. The period for which we might predict the influence of the output cycle to be significant is for the trough of 1952 III to the trough of 1967 III. Prior to this the overriding influence appears to be the explosion in world commodity prices. Since 1967 III there has been a succession of 'non-cyclical' influences on earnings including devaluation, deflation, incomes policies and material price shocks (particularly oil).

Thus if there are reasons for us to expect the output cycle to have an effect on the behaviour of earnings we would expect this effect to be more significant in periods when other influences are less significant. Regression results did not, however, indicate a clear increase in significance of the cyclical wage output correlation.

Within this 1952 III to 1967 III sample, though, different correlations were found between different phases of the cycle. The only such statistically significant correlations proved to be positive.

Chapter 7. DISAGGREGATED

Geary & Kennan (1982) refer to unpublished work on disaggregated data as follows:

> 'In related work (Kennan, 1979), the Haugh technique has been applied to monthly data, using the WPI deflator, for the US (1947-77) and Canada (1961-77). For both countries, strong contemporaneous correlations were found between the innovations in real wages and employment, and independence was therefore rejected. Only three of nine two-digit Canadian industries studied showed this positive contemporaneous relationship, however, and independence was accepted in five of the nine industries. These disaggregated results provide strong evidence against Sargent's hypothesis of a stable dynamic labour demand curve, since Sargent's model of profit maximisation by an individual firm should work better with disaggregated data' (p.865).

While Geary & Kennan find no neoclassical countercyclical relation at the disaggregated level, nevertheless, given the procyclical relation they report at the aggregate level the noncyclical results at the disaggregated level are in the right empirical direction for neoclassical theory, albeit not strong enough.

The neoclassical prediction of countercyclical wages would be expected to apply with greater certainty to individual industries than to the aggregate of manufacturing industry, being derived from a diminishing marginal product of labour at the individual (firm & industry) level. The aim of this chapter is to test whether wages are more countercyclical (less procyclical) at the industry level as compared with the aggregate level of manufacturing industry.

Quite aside from testing this hypothesis there is another reason why aggregate studies should test their results against industry

data and that is to investigate the possibility of aggregation effects. For example a cyclical behaviour of wages established at an aggregate level may obscure quite different wage patterns between industries. Further, if there were such different wage patterns across industries, the aggregate result may be affected by changing percentages of total output being accounted for by each industry over the cycle. Again, shifts in aggregate cyclical behaviour over time may be due to shifts at industry level or, instead, to relative changes in total output (and employment) shares between industries over time.

Two further hypotheses are developed and tested later in the chapter. The first concerns the relative correlation of, on the one hand, industry output with industry wages; and, on the other, aggregate output with industry wages. The second concerns the industry output-wage correlation in aggregate booms versus aggregate slumps.

1. Methods

Annual data from 1948 to 1974 inclusive were taken on output, money wages per hour, and a price index for the price of value added, for seven UK manufacturing industries: Chemicals (including petrol); Textiles, leather and clothing; Stone, etc.; Paper, print and publishing; Engineering and shipbuilding; Vehicles; and Metal manufacture.

The data series are discussed further in the Appendix 5, but the following points should be made before discussing the methods used. No attempt was made to construct series for the price of

non-labour inputs used per hour for any of the industries, as had been done for the manufacturing sector as a whole. This had two implications for the data series used. First, the appropriate index for prices was the price of value added rather than the price of total output. Second, the series were not tested for after the oil shock of the early 1970s: without being able to take account (as had been done above when testing for the aggregate manufacturing sector) of changes in non-labour input prices, it would not be sensible to have included the later values - particularly for industries such as 'Chemicals including petrol'.

The statistical and econometric methods used were as described in previous chapters.

All tests in this chapter were re-run against employment in place of output, but the pattern of results was similar; and the sign and significance of the coefficients were in line with the relation between the chapter 4 and chapter 5 results. In this case the correlation of wages with output was significantly positive, while the correlation with employment was not statistically significant.

2. Results

For each of the seven industries in turn, and for aggregate manufacturing, the percentage deviation of both output and product wages were plotted together over time. The two series were also graphed against each other, again for each of the seven industries in turn. These plots and graphs tended to suggest a

positive correlation between the two series.

The percentage deviation from trend of product wages were then regressed on the percentage deviation of output from trend, for each of the seven industries in turn, as well as for the corresponding series for aggregate manufacturing. The results are reported in table 1.

Table 1. Wages regressed on (industry) output

Industry	Coeff. (t-stat)	$\bar{R}^2$ DW	SER F-stat
C	0.78	0.213	3.87
	(2.59)*	2.15	6.69'
T	0.40	0.161	3.42
	(2.25)*	2.41	5.04'
S	0.45	0.170	3.08
	(2.30)*	1.72	5.30'
P	0.21	0.206	1.96
	(2.54)*	1.01	6.46'
E	0.90	0.426	3.23
	(4.07)***	2.28	16.6''
V	0.63	0.331	3.67
	(3.78)**	1.81	11.4''
M	0.25	0.093	3.47
	(1.78)	2.08	3.16
A	0.31	0.330	1.12
	(3.37)**	2.08	11.3''

Notes: 1. Industries - C: Chemicals (including petrol)
T: Textiles, leather & clothing
S: Stone, etc
P: Paper, print & publishing
E: Engineering & shipbuilding
V: Vehicles
M: Metal manufacture
A: Aggregate

2. Constant term included but not statistically sig.
3. HILU
4. 1950-1972
5. N = 22
6. $F(1,20)_{0.05} = 4.35$ '; $_{0.01} = 8.10$ ''
7. $d_L = 1.24$, $d_U = 1.43$, so all DW statistics indicate absence of autocorrelation except P (Print).
Re-estimating with OLSQ: 0.26 0.231 2.28
(2.76)* 2.18 7.62'

(DW tests failed with OLSQ for V and T)

8. $t_{0.025}$ = 2.09*; $t_{0.005}$ = 2.84**; $t_{0.0005}$ = 3.85***

The results indicate that product wages at the industry level are positively correlated with that industry's output.

The above regression equations were re-estimated with the inclusion of leads and lags on output (both with and without contemporaneous output) but the general pattern of results was not significantly altered.

This procyclical behaviour of product wages contrasts with the previously reported lack of a statistically significant correlation at the aggregate level of UK manufacturing. The regression tests were therefore re-estimated on the chapter 4, 6 and 7 data over the same years. The seemingly different results turn out to to be due to the previously discussed question of the role of non-labour direct ('materials') costs. Since in this chapter only labour costs are being considered, the appropriate price deflator is an index of the price of value added, rather than total output. Starting with similar nominal wage behaviour in each case, it is the different cyclical patterns of the two price series (although themselves very positively correlated) which result in the more procyclical pattern of product wages in value added terms.

It is not the sign of the estimated correlation coefficient with which the tests in this chapter is concerned however: that having already been established in chapter 4 (the non-cyclical results for the UK from chapter 4 being compatible with the procyclical results reported in this chapter with different time periods and

price deflators). Rather, what has been shown is that the failure of the UK data in chapter 4 to have shown a statistically significant countercyclical pattern was not due to some fallacy of composition: the correlations at industry level were similar to those at the aggregate level.

3. Aggregate output & industry wage

The industry-level wage series were now regressed on both the respective industry-level output series and total manufacturing output.

While the neoclassical prediction of countercyclical product wages should apply more directly at the industry level, there is no necessary reason why this should not be directly reflected in the aggregate behaviour. Thus the idea, cited above from Geary & Kennan, that the neoclassical negative correlation 'should work better with disaggregated data' should, to be totally fair to the neoclassical case, read 'at least as well, if not better...'.

What should be true for the neoclassical view that a diminishing marginal product of labour necessitates (/causes/is caused by) reduced product wages, is that the negative correlation between industry-level wages and aggregate output should be merely the result of such a relation at the industry level.

Alternative models of cyclical wage behaviour (including in this term models of noncyclical wage behaviour) such as discussed in chapter 2 may imply this pattern of causation (with the causal mechanism being the spreading of overhead costs at the disaggregate level), but do not necessarily. Aggregate output fluctuations could, according to such assumptions, have a direct

effect on industry-level wages, and, consequently, a part at least of any correlation between industry wages and industry output could be simply capturing this other correlation.

The general (Kaleckian type) model posed in chapter 2 as a broad alternative to the neoclassical one would predict positive correlations to be generated independently by, on the one hand, aggregate output and industry wages, and, on the other hand, industry output and industry wages.

Aggregate output would enter the industry wage picture from both the supply and demand sides. The higher is aggregate output (in the cycle) the lower is unemployment (and the threat of unemployment). Hence the higher will be union wage demands. On the supply side, the greater will be labour shortage and hence companies (and industries) willingness to agree to the wage demands in order to keep their workforce from being attracted elsewhere.

Both these effects will be reflected at the industry level with an expansion of that industry's output. The former effect operating via unemployment will apply specifically to the industry to the extent that employment is industry specific (for skill, regional, or other reasons). The latter effect, of labour shortages, will apply to industries in relation to how full their order books are. In general terms this will influence the extent to which they are prepared to 'bid up' wages to maintain, or expand, their workforce. It may also influence their willingness to meet any wage claims rather than risk industrial action.

None of these (aggregate or industry) influences on money wages necessarily affect product wages, but various mechanisms will influence this. At the aggregate level this would tend to include factors such as international competition. At the disaggregate level the ability to pay increased (labour or non labour) costs without passing them on in the form of increased prices may vary with output. If over the expansion the industry faces constant marginal costs and is able to spread overheads over an increased output, then the ability to absorb increased money wages in the form of increased product wages would tend to produce a positive industry product wage - industry output correlation.

To consider the (possibility of this) joint influence of industry output and aggregate output on industry product wages, both output terms were included as regressors. The results are reported in table 2.

Table 2. Wages regressed on industry & aggregate output

	Coefficient & t-stat		$\bar{R}^2$	SER
	Ind. Q	Aggreg. Q	DW	F-stat
C	1.02	-0.27	0.177	3.96
	(1.36)	(0.35)	2.12	3.09
T	0.53	-0.22	0.125	3.50
	(1.45)	(0.42)	2.43	2.37
S	0.78	-0.61	0.247	2.94
	(2.94)**	(1.74)	1.72	4.20'
P	0.09	0.23	0.144	1.99
	(0.54)	(0.72)	0.95	2.61
E	0.83	0.19	0.408	3.28
	(3.30)**	(0.63)	2.22	7.79''
V	0.26	0.83	0.404	3.46
	(0.97)	(1.85)	1.53	7.68''
M	0.20	0.14	0.049	3.55
	(0.80)	(0.27)	2.06	1.46

Notes: 1. HILU
2. 1950-1972
3. N = 22
4. d_1 = 1.19; d_u = 1.54; DW indeterminate for V and indicates serial correlation for P
5. $t_{0.025}$ = 2.09; $t_{0.005}$ = 2.86**; $t_{0.0005}$ = 3.88
6. $F(2,19)_{0.05}$ = 3.52'; $F(2,19)_{0.01}$ = 5.93''

The pattern of results reported in table 2 were similar to those from regression equations including leading and lagged terms. The latter results are not, therefore, reported.

The obvious problem in attempting to estimate the above regression equations is the high correlation to be expected between the two regressors - the deviation of an industry's output from trend and the deviation of total manufacturing output from trend. This expectation was confirmed by plots of the two series. Thus the results reported in table 2 would be expected to suffer from multicollinearity. That this is the case can be seen both from the regression statistics reported in table 2 and by comparing the results reported in table 2 with those reported in table 1 when wages were regressed on industry output alone. 'Vehicles' is the most glaring example of an equation with a high explanatory power (according to the equation's F-statistic, and R^2) and yet no statistically significant coefficients. Thus the explanatory variables do jointly determine the behaviour of the dependent variable (or at least are correlated with the latter). The problem is in isolating the individual effects (correlations).

In addition, with the two explanatory variables having a high positive correlation, the estimators would be subject to opposing biases. That this effect is operating can be seen by comparing

the results from table 2 with not only results from table 1, of wages regressed on industry output alone, but also with the results of regressing wages on total manufacturing industry output alone which are reported in table 3.

Table 3. Wages regressed on aggregate output

	Coeffic. (t-stat)	$\bar{R}^2$ DW	SER F-stat
C	0.69	0.142	4.04
	(2.11)*	2.23	4.46'
T	0.44	0.077	3.59
	(1.66)	2.33	2.74
S	0.12	-ve	3.45
	(0.41)	1.82	0.16
P	0.38	0.174	1.95
	(2.33)*	0.91	5.43'
E	0.64	0.115	4.01
	(1.93)	2.15	3.73
V	1.15	0.406	3.46
	(3.92)***	1.46	15.3''
M	0.46	0.066	3.52
	(1.58)	2.03	2.49
A	0.31	0.330	1.12
	(3.37)**	2.08	11.3''

Notes: 1. HILU
2. 1950-1972
3. N = 22
4. $F(1,20)_{0.05} = 4.35'$; $F(1,20)_{0.01} = 8.10''$
5. DW indicate no serial correlation other than for P
6. $t_{0.025} = 2.09$*; $t_{0.005} = 2.84$**; $t_{0.0005} = 3.85$***

The coefficients on manufacturing output now all become positive, and statistically significant (as are the regression equations) in three of the seven cases.

However, since we know that the explanatory variables are not orthogonal it is not satisfactory to rely on such simple regressions of the dependent variable on each of the explanatory variables in turn. It could be that the seeming relation of

industry wages with aggregate output in such a simple regression is nothing other than a reflection of the industry level effect, given the correlation between industry output and aggregate output. In other words the apparent correlation of aggregate output with industry wages may be simply picking up the correlation of the wage series with that element of aggregate output which is correlated with ('though not necessarily totally accounted for by) output fluctuations of the industry concerned.

This problem is a special case of collinearity between two explanatory variables: a collinearity due to composition effects, one series being a composite of a number of others one of which is the other explanatory variable. Assuming the collinear output movement is correlated with earnings, adjusting one or other of the output series to remove the multicollinearity will simply remove that part of the explanatory power of the series being adjusted. Such an adjustment was made to the aggregate output series. This is simply to tackle the multicollinearity. The resulting loss of explanatory power of the aggregate output series is not being presented as representing a more 'genuine' relation but, rather, is the price paid for having no entirely satisfactory method of removing the statistical effects of what is a real (multicollinear) economic correlation.

For each industry, the series for aggregate manufacturing was regressed on the series for that industry's output in order to establish the correlation between the industry output and aggregate output, thus:

$$Q = b.q_i + v_i \qquad [1]$$

where Q is aggregate manufacturing output;

q_i is industry output; and
v_i is that component of Q orthogonal to q_i.

The resulting coefficients indicated the proportion of the industry level output series correlated with the aggregate series: 0.86, 0.55, 0.57, 0.46, 0.34, 0.48, and 0.40 for the 7 industries respectively. By subtracting the estimated aggregate output from the actual a series was derived (v_i in [1] above) for that portion of aggregate output fluctuations uncorrelated with output fluctuations at the industry level.

For each industry, then, the industry-level wage series was regressed on both the corresponding industry-level output and the series for the component of output fluctuations uncorrelated with the fluctuations in industry output:

$$w_i = f.q_i + g.v_i \qquad [2]$$

The latter two regressands are, of course, now totally uncorrelated so that the problem of multicollinearity has been eliminated in the sense that individual simple regressions will now give the same information as will the multiple regression. The problem now re-appears in the form of the reduced significance of the series from which the information has been lost in the adjustment process. The results are given in table 4.

Table 4. W regressed on industry, & adjusted aggregate, output

	Coefficient on industry (t-stat)	Coefficient on adj. man. (t-stat)	$\bar{R}^2$ DW	SER F-stat
C	0.78	-0.27	0.177	3.96
	(2.51)*	(0.35)	2.12	3.09
T	0.41	-0.22	0.125	3.50
	(2.23)*	(0.42)	2.43	2.37
S	0.45	-0.61	0.247	2.94
	(2.42)*	(1.74)	1.72	4.20'
P	0.19	0.23	0.144	1.99
	(2.23)*	(0.72)	0.95	2.61
E	0.89	0.19	0.408	3.28
	(3.98)***	(0.63)	2.22	7.79''
V	0.63	0.83	0.404	3.46
	(3.57)**	(1.85)	1.53	7.68''
M	0.25	0.14	0.049	3.55
	(1.73)	(0.27)	2.06	1.46

Notes: 1. HILU
2. 1950-1972
3. N = 22
4. $F(2,19)_{0.05} = 3.52'$; $F(2,19)_{0.01} = 5.93''$
5. $d_L = 1.15$; $d_U = 1.54$
DW statistics indicate no serial correlation other than V (indeterminate) and P (definite serial correlation)
6. $t_{0.025} = 2.09$*; $t_{0.005} = 2.86$**; $t_{0.0005} = 3.88$ ***

Comparing the results reported in table 4 with those in tables 1-3, it can be seen that orthogonalising the explanatory variables simply results in a reparameterisation, whereby the coefficient on industry output reflects not only the effect of industry output itself (as in table 2), but also the effect of industry output proxying for that part of aggregate manufacturing output with which the industry output is correlated (as in table 1); while the coefficient on manufacturing output reflects (as in table 2) only that part of the manufacturing output series which is orthogonal to the individual industry series (v_i in equation [1], above). Thus:

$$w_i = h.q_i + g.Q \qquad [3]$$

$$= h(c.Q+u_i) + g(b.q_i+v_i) \qquad [4]$$

where $q_i = c.Q + u_i$ [5]

and the parameters 'h' and 'g' are those reported in table 2, while the reparameterisation involved in table 4 is as follows:

$$w_i = h.q_i + g(b.q_i+v_i) \qquad [6]$$

$$= (h+g.b)q_i + g.v_i \qquad [7]$$

where the coefficient 'f' in equation [2] above consists of '(h+g.b)'. Similarly, then, were the orthogonalisation achieved by adjusting the individual industry output series (by running the regression of equation [5]), the reparameterisation would result in the coefficients on q_i (now u_i) and Q being 'h' and '(g+f.c)' respectively.

To conclude on the results reported this far (and in tables 1-4, specifically): the significant positive correlation between industry level wages and aggregate output fluctuations appears to be (statistically rather than causally) a correlation between the industry level wage series and the collinear movement of the respective industry level output series and the aggregate output series. This makes regression analysis limited to that which has so far been stated: any adjustments for multicollinearity tends to remove that from which any additional information would be, in theory, forthcoming. The problem which regression tests have in allocating the variation in the regressand among the (collinear) regressors is replaced with the problem of arbitrarily adjusting one or other of the regressors in order to orthogonalise them. In order to consider further the effect of aggregate output fluctuations on disaggregate wage series (and on the correlations, over the cycle, between industry level output and industry level wages) a different approach was adopted, as

reported in the following section.

4. Wage-output correlation, and the aggregate cycle

As discussed above, different theoretical assumptions lead to different expectations of whether or not cyclical output fluctuations will be associated with cyclical wage fluctuations, and, if so, the nature of any such association. Different such assumptions also imply different foundations of a wage output correlation: whether micro or macro.

The neoclassical marginal product of labour foundation of cyclical wage behaviour operates at a micro level. As the firm (industry) cyclically expands output the marginal product of labour, and therefore the product wage, will be cyclically reduced. This relation should hold regardless of aggregate, macro, behaviour. The macro is simply the aggregate of the micro foundations.

The general alternative view of the economy outlined previously would expect not only different micro foundations of macro relations but would also expect the micro relations to be affected by the macro. Thus the behaviour of an industry's product wages during a cyclical expansion of the industry's output could not be predicted without knowing the corresponding behaviour of the cycle in aggregate output. The latter may, for example, effect the relative bargaining power of the employers and employees in the industry concerned (as would the industry's cyclical prediciment).

This alternative formulation of the hypothesis of whether the cyclical wage-output correlation at the industry level will be independent of the aggregate cycle allows an additional comparison to be made of the two models of the economy. Thus while previous studies have tested the neoclassical (non neoclassical) hypothesis according to whether aggregate cyclical wage behaviour is countercyclical (non countercyclical), whatever the results of the literature to date are taken to be, they have been rationalised by neoclassicals within a neoclassical model. Thus Tatom 'accepts' that 'One of the more settled facts about the cyclical behaviour of the US economy is that real wages are procyclical, rising during expansions and falling during recessions' (1980, p.385). But he goes on to reconcile procyclical wages with the neoclassical diminishing returns to labour hypothesis. Tatom's cyclical wage theory would, as with the standard neoclassical theory, apply whether aggregate output was in a cyclical boom or a cyclical slump. Therefore aggregate output should add nothing to the cyclical wage-output relation at the industry level. But also the same disaggregate relation should be found whether tested against all data, or only data from one or other of the upswing/downswing.

Thus this section tests for the independence of the cyclical wage-output correlation from the aggregate output cycle.

Setting out whether the time series for output and earnings are above or below their own trend for each of the seven industries as well as for aggregate manufacturing indicates, as would be expected, that the industry output series are broadly in line with each other and with aggregate manufacturing output. This

restricts the ability to compare contrasting industry and total manufacturing output behaviour. For each industry in turn, the output expansions were divided between those occurring during aggregate expansions and those occurring during aggregate contractions, and similarly for all industry downturns. Pooling the results over the seven industries over the 22 years gives 154 observations. The correspondence between industry booms and slumps, and aggregate booms and slumps, is given in table 5

Table 5. Booms/slumps in aggregate/disaggregate output

Aggregate level	Industry level: Booms	Slumps	
Booms	59	11	: 70
Slumps	13	71	: 84
	72	82	: 154

The four central numbers in the table indicate, starting with the top left hand corner and moving clockwise, the number of industry expansions occurring during aggregate booms, the number of industry contractions occurring during aggregate booms, the number of industry contractions occurring during industry contractions, and the number of industry expansions occurring during aggregate contractions.

The proportion of these observations for which product wages were above trend are given in table 6.

Table 6. Conditional probabilities

	Industry level	
Aggregate level	Booms	Slumps
Booms	71%	64%
Slumps	62%	34%

These conditional probabilities give the percentage probability of wages being above trend in each of the four possible states. It can be seen, for example, that the likelihood of wages being

above trend in an industry contraction depends heavily on the state of the aggregate economy.

5. Conclusion

One possible explanation for the failure of the international data to indicate statistically significant negative correlations between cyclical output and cyclical earnings for all countries (for example the UK) would be the presence of aggregation effects blurring what might be a statistically significant negative correlation at the industry level. The results reported in section 2 above do not support such a hypothesis. The failure of the UK data in chapter 4 to have shown a statistically significant countercyclical pattern was not due to some fallacy of composition: the correlations at industry level were similar to those at the aggregate level.

Section 3 attempts to identify whether any correlation of industry-level earnings with cyclical output is with aggregate or industry-level output fluctuations, and finds both to be the case, the two series (disaggregate and aggregate output) being correlated and it being this collinear component (at least of the aggregate series) with which wages move (in a procyclical direction - at least for UK 1948-1974 data of nominal wages deflated by the value added price).

Finally, the industry output cycle's correlation with cyclical earnings is tested for consistency over the aggregate cycle and appears not to be totally independent of the latter.

Chapter 8. HISTORICAL

It has been demonstrated in previous chapters that, to the extent that product wages are correlated with the output cycle (and it has been shown that there is no such consistent correlation across countries), there is no reason to expect that correlation to be stable over time. Either such correlations are simply contingent rather than necessary, or else the economic assumptions underlying any particular necessary correlation are time specific (as well as country specific) and therefore such assumptions cannot be taken as necessarily of any relevance to the future behaviour of economic variables.

Thus the UK data, for example, indicated a countercyclical correlation of the output and product wage series during the period surrounding the Korean War, a correlation clearly caused by sharp fluctuations in the price of non-labour manufacturing inputs (in a procyclical direction, causing a sharp procyclical movement in the price of manufacturing output, causing a countercyclical movement in the product wage). This pattern (clearly the result of factors other than the output and product wage series themselves) was superceded by several business cycles relatively free from such exogenous influences, during which product wages moved procyclically. Finally this correlation, in turn, broke down.

Comparing such post-WW2 results on UK data with pre-WW2, the well known countercyclical pattern of product wages over the 1929-1937 cycle was clearly not the result of any requirement of the UK economy such as would operate over the twentieth century taken as

a whole. This 1929-1937 pattern has clearly not held consistently since.

Bernanke & Powell (1984) find a similar failure of the output and product wage series to display a historically consistent pattern with US data, finding (lagged and weak) countercyclical product wage behaviour pre-war and (in line with the US results reported in chapter 4) procyclical product wages post-war.

The studies which have tested historical data fall largely into two categories. First are those which are interested in how wages actually behaved in some particular cycle: most notably the 1929-37 cycle in the UK - see Worswick (1984c) and the papers by him and others in the Bank of England (1984a) and the National Institute Economic Review (1984). Second are those such as Bernanke & Powell which are interested in how the cyclical pattern of wages has altered over time - see Sachs (1980), Taylor (1984), Gordon, Weisskopf & Bowles (1983), and Schor (1985).

The results from testing the UK data compiled for this chapter showed little correlation for the interwar period, although the countercyclical pattern between 1929 and 1937 was evident. The hypothesis of Gordon et al of procyclical wages in 'normal' cycles (during prosperous long-swings), and countercyclical wages in long-swing recessions, was tested and, while the results certainly did not contradict the hypothesis, the results were not considered sufficient to establish a long-swing mechanism to be at work; and hence are not reported here.

The bulk of studies reporting results from testing historical

data are heavily criticised by Solow:

> 'As I inspect current work in economic history, I have the sinking feeling that a lot of it looks exactly like the kind of economic analysis I have just finished caricaturing: the same integrals, the same regressions, the same substitution of t-ratios for thought. Apart from anything else, it is no fun reading the stuff any more. Far from offering the economic theorist a widened range of perceptions, this sort of economic history gives back to the theorist the same routine gruel that the economic theorist gives to the historian. Why should I believe, when it is applied to thin eighteenth-century data, something that carries no conviction when it is done with more ample twentieth-century data?'
> (Solow, 1985, p330)

He argues that because of the path down which economics has gone, economic theory learns nothing from economic history.

Rather than report the results of repeating the previous tests on this chapter's data, then, the issue of inference, and how theory relates to empirical observations, is considered by looking, historically, at the role played by inference, and how observations did relate to theory.

The following section, then, uses historical UK data to re-trace, following Keynes (1939), the historiography of the neoclassical assumptions.

1. Historiography

Commenting on criticisms from Dunlop (1938) and Tarshis (1939), Keynes (1939) stated that his 1936 view - 'this common belief' - needed to be reconsidered, and that he had, in the General Theory, accepted, without taking care to check the facts for himself, a belief which had been widely held by British

economists. He traced this belief to a generalisation made by Marshall from the 1880 to 1886 data. Extending the data to 1914, Keynes reported the following procyclical pattern, save for the initial 1880-1886 cycle.

Table 1. Keynes' description of cyclical wage behaviour

	Cycle Phase	Real Wages
1880-1884	Recovery	Falling
1884-1886	Depression	Rising
1886-1890	Recovery	Rising
1890-1896	Depression	Falling
1896-1899	Recovery	Rising
1899-1905	Depression	Falling
1905-1907	Recovery	Rising
1907-1910	Depression	Falling
1910-1914	Recovery	Rising

Note: Keynes (1939) refers to Marshall's data as being from the 1880 to 1886 cycle. The output data used in this chapter suggest, however, that this cycle began in 1879, and this also agrees with other standard references, from Rostow (1947) to Matthews, Feinstein and Odling-Smee (1982).

From this, Keynes concludes (1939, p.38) that

> 'we have been living all these years on a generalisation which held good, by exception, in the years 1880-86, which was the formative period in Marshall's thought in this matter, but has never once held good in the fifty years since he crystallised it!'

This chapter tests for the pre-1914 changes in the cyclical pattern of real wages, setting out the 1855-1913 data, and the 1880-86 cycle within that.

The money wage series was deflated by an index for the price of the principal industrial products. Table 2 shows the percentage deviation of this product wage series from trend at each cyclical peak and trough. The direction of movement of the wage-deviation is also recorded.

Table 2. Deviation of Product Wages from Trend

Cycle Phase	Year	Q	PWR : Change	
Peak	1860	2.7	-0.1	Decrease
Trough	1863	-3.8	-6.3	Increase
Peak	1866	5.3	1.7	Increase
Trough	1869	-6.9	7.0	Decrease
Peak	1871	3.8	1.2	Decrease
Trough	1873	-0.1	-5.7	Increase
Peak	1877	1.1	-2.8	Increase
Trough	1879	-6.6	5.1	Decrease
Peak	1883	3.8	-2.7	Increase
Trough	1886	-5.9	4.4	Decrease
Peak	1891	3.1	3.0	Decrease
Trough	1893	-4.8	-4.2	Increase
Peak	1896	1.5	-1.8	Increase
Trough	1897	-0.4	5.0	Decrease
Peak	1899	2.5	-5.4	Increase
Trough	1904	-3.0	4.1	Decrease
Peak	1907	4.8	-8.1	Increase
Trough	1908	-3.5	11.4	Decrease
Peak	1913	0.9	0.4	

The product wage (PWR) can be seen to move in a strong countercyclical fashion from the peak of 1877 through to the trough of 1886 (roughly the years looked at by Marshall). This is confirmed by the appropriate regression equation:

$$PWR = \underset{(0.36)}{-0.25} - \underset{(3.16)}{0.68}.Q \qquad (1)$$

$$1876\text{-}1886\ (N=11);\ \bar{R}^2 = 0.474;\ DW = 2.63$$

In contrast, the pre 1877 data shows no cyclical relation (the value of the R^2 statistic for the appropriate regression showing that the output deviation fails to explain any of the movement in the PWR deviation).

While Keynes, and Dunlop, contrast the countercyclical behaviour of the Marshall data with the subsequent procyclical relation, it can be seen from table 2 that the PWR series does not appear to conform to this, and is in marked contrast to table 1 from

Keynes. The appropriate regression confirms the post 1886 countercyclical relation suggested by the pattern of the wage series in table 2.

$$PWR = \underset{(0.25)}{0.19} - \underset{(2.91)}{0.95}.Q \qquad (2)$$

1887-1914 (N=28); $\bar{R}^2 = 0.157$; DW = 1.79

Thus, in contrast to the argument of Keynes and Dunlop, the countercyclical behaviour of wages in the cycle considered by Marshall appears not to have been the freak result suggested. Instead, the countercyclical relation, while strongest for the 1879-1886 cycle, nevertheless holds for the entire pre 1914 sample:

$$PWR = \underset{(0.05)}{0.02} - \underset{(2.84)}{0.53}.Q \qquad (3)$$

1859-1914 (N=56); $\bar{R}^2 = 0.114$; DW = 1.93

These tests illustrate a point which Keynes drew attention to in 1939: namely that the data which Marshall had available to him when formulating his ideas on the cyclical behaviour of wages were not typical of the pre 1914 data as a whole. However, the post 1886 procyclical pattern reported by Keynes (table 1) is contradicted by the series here tested. The opposite relation from that suggested by Keynes, and Dunlop, is found for the post 1886 sample. This countercyclical relation is only absent in the pre 1880 data (not referred to by Keynes); and when these are poolled with the post-1880 data, the countercyclical relation is shown to be robust.

1.1 Comparison with Dunlop and Keynes

How can Keynes' results be explained in the light of the evidence reported above? The series so far tested were constructed to correspond as closely as possible to the economic variable

appropriate to marginal productivity theory. Alternative series are now constructed in order to see to what extent the different results can thereby be explained.

First, though, a bit more can be said about the results which are to be explained.

In his evidence for the Indian Currency Committee Marshall (1899) states that he has accumulated a great number of facts, but that nearly everything he has accumulated is implied in a table taken from Bowley (1898) which does not, however, report annual data which would allow the cyclical behaviour of wages to be subjected to the above tests; and the same is true of the other four tables contained in Bowley (1898). Marshall did submit a number of diagrams and statistical tables to the Committee on Indian Currency which are not reproduced in Marshall (1899), but are deposited in the Marshall Library in the University of Cambridge. However, these largely relate to India and include no annual wage series. It is not, therefore, possible to submit Marshall's own results to regression analysis.

Keynes does not report his annual data, nor his data sources, but implies that they correspond to Dunlop's. Dunlop gives annual figures for the change in money wages and for the deviation from trend of real wages, between 1860-61 and 1912-13; (no trend adjustment was, in fact, performed for the period 1900-01 to 1912-13). He also corrected for changes in the terms of trade, although this did not materially alter his results. From this data he reported the following table:

Table 3. Dunlop's description of cyclical wage behaviour

Years	Phase	Money Wage Rates	Real Wage Rates	Real Wage Rates: Trend Eliminated
1860-62	Downswing	+ 1.8	+ 1.9	-2.6
1862-66	Upswing	+13.8	+10.5	+6.2
1866-68	Downswing	- 1.6	- 5.2	-9.2
1868-73	Upswing	+19.2	+16.4	+7.2
1873-79	Downswing	- 5.8	+ 7.0	-0.6
1879-83	Upswing	+ 2.1	+ 1.5	-3.0
1883-86	Downswing	- 0.8	+ 8.6	+2.7
1886-90	Upswing	+10.0	+ 9.9	+5.1
1890-93	Downswing	- 0.6	+ 0.6	-5.0
1893-1900	Upswing	+10.5	+ 9.6	+7.8
1900-04	Downswing	- 3.3	- 7.0	
1904-07	Upswing	+ 5.2	+ 3.7	
1907-09	Downswing	- 1.5	- 3.4	
1909-13	Upswing	+ 5.2	+ 1.2	

Real wages (trend eliminated up to the 1893-1900 upswing) are shown to move procyclically in every cycle save for the one from which Marshall took his data. Thus Dunlop's results appear to show strongly procyclical real wages.

However, regressing Dunlop's annual series against the previously-used output series (Dunlop does not give any output figures) shows that this procyclical relation for real wages is not statistically significant.

The only sub-period in which cyclical output explains any of the change in the real wage variable is post-1887, and even in this case the coefficient on output is not significant:

$$\text{DUNLOP'S REAL WAGE} = \underset{(0.57)}{-0.20} + \underset{(1.25)}{0.19}.Q \qquad (4)$$

1887-1913 (N=27); $\bar{R}^2 = 0.021$; DW = 1.50

To conclude the description of Dunlop's (and Keynes') results: the findings reported here - of countercyclical wages - appear to be diammetrically opposed to the results of both Keynes (table 1) and Dunlop (table 3); but, when the real wage data being

described by Dunlop is analysed more closely it turns out not, after all, to follow any statistically significant procyclical pattern.

There remains, however, a difference between the statistically significant countercyclical results, and the statistically insignificant, but seemingly procyclical, pattern of real wages described by Keynes and Dunlop. It turns out that this can largely be accounted for by the fact that, while recognising the relevant variable to be the product wage, both Keynes and Dunlop considered, instead, the real wage.

Wage series

The wage series used above was measuring wage rates, which will tend to be less procyclical than actual hourly earnings. The problem is that there are no accurate statistics available for actual hourly earnings. The alternative measure, of weekly earnings, will be biassed in the opposite direction, being more procyclical than hourly earnings because of the procyclical pattern of hours worked. Denoting the previous series - wage rates in product terms - by PWR, a series of weekly earnings in product terms, denoted by PWE, was then constructed. The effect on the cyclical behaviour of the series is reported below along with the effect on both these series of altering the price deflator.

Price series

The above two wage series were deflated by a consumer price index in order to test whether this explains any of the difference between Keynes' and Dunlop's results, and those reported above.

There are now, therefore, four alternative wage indices:

Table 4. Alternative wage measures

	Price Index	
Wage Series	Price of Principal Industrial Products	CPI
Wage Rates	: Product Wage Rates (PWR)	Real Wage Rates (RWR)
Weekly Earnings	: Product Wage Earnings (PWE)	Real Wage Earnings (RWE)

Table 5 now reproduces table 2, only replacing the PWR series with the RWR series.

Table 5. Deviation of Real Wages from Trend

Cycle Phase	Year	Q	W : Change
Peak	1860	2.7	-2.1 Decrease
Trough	1863	-3.8	-2.6 Increase
Peak	1866	5.3	2.2 Decrease
Trough	1869	-6.9	-1.0 Increase
Peak	1871	3.8	0.6 Decrease
Trough	1873	-0.1	-2.1 Increase
Peak	1877	1.1	-2.0 Increase
Trough	1879	-6.6	2.1 Decrease
Peak	1883	3.8	-2.5 Increase
Trough	1886	-5.9	1.5 Increase
Peak	1891	3.1	1.8 Decrease
Trough	1893	-4.8	-2.6 Increase
Peak	1896	1.5	1.5 Decrease
Trough	1897	-0.4	-0.7 Increase
Peak	1899	2.5	2.4 Decrease
Trough	1904	-3.0	-0.7 Decrease
Peak	1907	4.8	-1.3 Increase
Trough	1908	-3.5	1.3 Increase
Peak	1913	0.9	2.2

Table 5 demonstrates the irony of Marshall's data sample for a consideration of the cyclical behaviour of real wages. Looking at the movement of real wages between the cyclical peak of 1877 and the trough of 1886, the countercyclical pattern is clear. Altering the price deflator has also accounted for the remaining puzzle over Keynes' and Dunlop's results. The direction of movement of the real wage is now procyclical in every cycle outside the 'Marshall sample' other than the 1904 to 1907 boom

and subsequent slump, to 1908. Dunlop and Keynes report procyclical movements for this cycle also (although both date it slightly differently from here, and from each other).

The RWE series actually reproduces such procyclical results for this cycle also, although in general the choice of wage series does not significantly alter the cyclical results.

Having generated results at odds with those implied in Keynes (1939) and Dunlop (1938), it was first demonstrated that their results are not statistically significant, and, second, it was shown how the countercyclical wage series tested in section one could, with a different price deflator, exhibit the type of procyclical pattern contained in the tables from Keynes' and Dunlop's articles. It now remains to test the statistical significance of the procyclical relation so generated.

As would be expected the RWR and RWE series which reproduce the Keynes/Dunlop cyclical pattern are, like Dunlop's data, not significantly procyclical. The regressions over the whole sample cannot account for any of the movement in RWR nor RWE and the following regression is the closest the RWE series got to being significantly procyclical over the whole sample:

$$\underset{\quad(0.20)\ (1.06)}{RWE = 0.04 + 0.08.Q} \qquad (5)$$

$$1959\text{-}1914\ (N=56);\ \bar{R}^{2} = 0.003;\ DW = 1.66$$

1.2 Materials and total direct costs

The importance of the cost of material inputs in explaining real wage behaviour has been discussed and tested in previous chapters. Such a total direct cost series can be constructed using either of the two product wage series (combined with the

appropriately deflated materials series), as indicated in table 6. Of course, the two corresponding real wage series could be used, but the resulting real direct costs (as opposed to product direct costs) is not an economically meaningful variable.

Table 6. Alternative direct cost measures

Wage Series	PRICE INDEX Price of Principal Industrial Products
Wage Rates	PDC_r
Wage Earnings	PDC_w

Table 5 repeats the analysis of tables 2 and 5, showing the relation to trend of both the materials and the direct cost indices over cyclical peaks and troughs, where the two alternative direct cost measures are indicated in the table.

Table 7. Deviation of Materials and Direct Costs from Trend

Cycle Phase	Year	Q	PM	WAGE INDEX Rates PDC_r	Earn. PDC_w
Peak	1860	2.7	0.4	0.1	0.5
Trough	1863	-3.8	0.0	-3.7	-2.3
Peak	1866	5.3	-0.2	0.9	1.6
Trough	1869	-6.9	9.7	8.1	7.8
Peak	1871	3.8	-2.1	-0.2	-1.3
Trough	1873	-0.1	0.3	-3.3	-1.1
Peak	1877	1.1	0.4	-1.6	-1.1
Trough	1879	-6.6	1.2	3.7	3.3
Peak	1883	3.8	-1.9	-2.4	-2.0
Trough	1886	-5.9	1.8	3.5	2.2
Peak	1891	3.1	1.4	2.4	1.8
Trough	1893	-4.8	-1.5	-3.3	-3.0
Peak	1896	1.5	-0.9	-1.5	-1.8
Trough	1897	-0.4	1.4	3.8	3.3
Peak	1899	2.5	-2.4	-4.4	-4.5
Trough	1904	-3.0	1.2	3.0	2.3
Peak	1907	4.8	0.7	-4.7	-3.0
Trough	1908	-3.5	3.9	8.5	8.7
Peak	1913	0.9	0.4	0.4	-0.7

The results reported in table 7 suggest a countercyclical pattern for material costs in product terms (PM). The basic pattern of cyclical fluctuations of total direct costs appears similar

whether the labour component was calculated using the 'rates' or 'earnings' series: in product terms both DC indices appear to move countercyclically between 1877 and 1886, and post-1897. These observations are confirmed by regression analysis.

A summary of regression results are shown in table 8.

Table 8. DC regressed on Q

Sample Years (number of years in sample)	Wage Index: Rates PDC_r		Wage Index: Earnings PDC_w	
1859-1875 (17)	...no relation...			
1876-1886 (11)	-0.52 3.40	.513 2.42	-0.39 2.88	.422 2.19
1887-1914 (28)	-0.60 2.61	.177 2.01	-0.53 2.35	.144 1.96
1859-1914 (56)	-0.42 3.15	.140 2.05	no relation	

Note: The only explanatory variable other than Q in the regression equations was a constant term. This was insignificant in all cases.

The following pattern emerges. There is no cyclical relation during the early part of the time series being considered. For the middle portion direct costs behaved countercyclically. The final (post-1887) years see direct costs moving countercyclically in product terms. Taking the sample as a whole then, the total direct cost series moved countercyclically, with statistical significance for the series compiled from wage rate data, but not for the series compiled from earnings data.

On the basis of previous discussion, the most relevant indices for wages and direct costs from the point of view of the theory being considered, would be constituted from the producer price index and an earnings index somewhere between the two indices

available, for rates and earnings. That is, for direct costs, somewhere between the PDC_w and PDC_r series.

Table 9. Cyclical behaviour of DC indices

Level of Significance	Cyclical pattern: Countercyclical
Insignificant:	PDC_w
Significant:	PDC_r

To conclude: the data for the two components of total direct costs in product terms (labour and materials costs) tended to move in a similar cyclical pattern. This is also true for Marshall's data sample, and hence the countercyclical pattern of wages over that cycle was not due to the product wage being 'squeezed' by movements in non-labour direct costs.

2. 1920-1939

Broadberry (1983) argues that 'wages and prices in interwar Britain have received surprisingly little attention', and attempts to describe the wage-price process. His paper does not, however, attempt to look at the cyclical real wage process. First, it is not explicitly testing for real wages, and, second, it does not attempt to isolate trend and cycle processes. The paper concludes that in the long run the real wage was a function of the terms of trade and labour productivity, and that unemployment had little, if any, impact on wage settlements. He does not test for the effect of an output variable, although presumably such a variable would have been positively related to productivity or negatively to unemployment. His paper concludes that aggregate demand could have been raised without leading directly to pressure on nominal wages and prices. It could be

argued, however, that the productivity variable in his wage equation was (at least partly) proxying for demand fluctuations within cyclical output (deviation from trend) and the positive coefficient thus indicates that an increase in demand would have led to higher wages and/or prices.

With reference to the lack of any significant coefficient on the unemployment term, Phillips (1958) did not test for the inter war period. His paper used pre WW1 data to construct the curve which was then superimposed on the inter war data which fitted, although in a clustered fashion with the data for the 1920s generally above the curve and the data for the 1930s generally below. Lipsey (1960) did test for inter war data, but without significant results for unemployment.

Regression tests on this chapter's UK interwar data indicated no statistically significant correlation between cyclical wages and output, although a statistically significant negative correlation was found over the 1929-37 cycle.

Beenstock, Capie & Griffiths (1984) argue that such countercyclical wage movements were responsible for the cyclical fluctuations in output: a view disputed by Worswick (1984a, 1984b, 1984c) and Dimsdale (1984) who argue first that the causes of the output fluctuations lay elsewhere, and, second, that the timing of the wage fluctuations do not fit the Beenstock et al (neoclassical) story.

This debate (in the Bank of England Panel Papers, 1984a; and the National Institute Economic Review, 1984) relates more to the

interpretation of an established countercyclical pattern rather than to determining whether such a countercyclical pattern was present. Worswick's point is that countercyclical wage behaviour does not necessarily imply the operation of neoclassical causation nor the applicability of neoclassical policy prescriptions.

The point made in this thesis is that such countercyclical wage behaviour (as occurred over 1929-37) is not, in any case, a general economic 'law' (or valid assumption). It was shown, in chapter 2, that there are valid theoretical reasons for predicting that such neoclassical assumptions are not necessarily universally valid (if at all). The contradictory results of the literature to date were shown to be partly due to different studies using data taken from different countries and time periods which, were the textbook assumptions valid, would not upset the results; and partly also due to different studies employing different methods and therefore picking up to different degrees the 'ultimately' reduced form of the cyclical wage : cyclical output correlation.

The regression results reported in chapters 4 and 5 confirmed that no such universal 'cyclical pattern of wages' operates internationally, so that either there are different 'data generating processes' or else the data generating process common to advanced capitalist countries refers to economic variables other than the product wage, the behaviour of the latter being contingent to the common data generating process. Even within the data series of one country (the UK) the cyclical wage pattern appeared, from the results reported in chapter 6, to conform to

no necessary pattern across the entire output cycle; and appeared at industry level, according to the tests reported in chapter 7, to vary according to aggregate output effects.

This argument, that assumptions involving necessarily countercyclical product wages prove empirically not universally valid, is confirmed by the UK data from 1859.

3. Conclusion

While not claiming that results from pre WW2 data would be the appropriate ones to inform current economic policy, nevertheless the historical data exhibit the same lack of consistent patterns as do post WW2 data. Any correlation between cyclical output and wage fluctuations is of limited statistical significance, if any. And the sign of any such correlation itself alters: both between cycles and, possibly, within a pattern of long swings.

Whether product wages do decline (in cyclical terms) in the upswing depends on relative nominal wage and price movements. The data show that the outcome of the cyclical behaviour of these two series varies, resulting in different patterns of output - product wage correlations between cycles over time: sometimes procyclical, sometimes countercyclical and sometimes noncyclical. The fact that the pattern is in some cases not countercyclical thereby suggests that any such countercyclical pattern is not a necessary condition for the upswing. And the fact that there are cyclical reductions in product wages during some cyclical output downturns in turn suggests that such cyclical reductions in product wages are not a sufficient condition for an output

expansion.

Thus the historical data suggest that reductions in product wages are neither a sufficient nor a necessary condition for an output expansion.

This is in contradiction to what has been referred to in this thesis as the 'standard' ('1930s', 'Treasury') neoclassical theory of countercyclical product wages. That theory, Keynes showed, derived from an inference by Marshall from historical observations. A closer look at that inference reveals the following:

(i) Marshall's conclusion that wages move countercyclically is seen to be supported by the data for the years from which Marshall took his evidence.

(ii) The seemingly procyclical pattern of wages in the years not considered by Marshall, drawn attention to by Keynes and Dunlop, turns out not to be statistically significant, even when Dunlop's data are used.

(iii) The years following those considered by Marshall actually suggest the opposite, of countercyclical wages, when the money wage is deflated by the product price.

(iv) Total (wage and material) direct costs are more procyclical/less countercyclical than wage costs alone. The shifts in the cyclical behaviour of this direct cost index are broadly in line with the corresponding shifts in the cyclical behaviour of wages.

It was shown in chapter 3 that the 'cyclical wage' literature originated in the 1930s with Keynes' statement of an a_priori belief as to the implications of economic theory for the empirical behaviour of wages. While Keynes (1939) admitted to not having taken care to check his theoretical statement with the facts, that same theoretical belief had originated from Marshall allowing the 'facts to speak for themselves', and inferring from them a more general theory than was, methodologically,

appropriate.

The contrast between the way these two authors reported the cyclical wage behaviour is perhaps symptomatic of their methodological differences. Pheby (1985, p.100) reports that Marshall's view of himself as representing a 'dull mean' between the two methods of induction and deduction is not shared by Coase (1975), who argues that Marshall was more inclined towards induction, nor by Keynes who made a similar observation (Keynes, 1973, p.296).

Chapter 9. CONCLUSION

In times of prolonged recessions - when the 'normal' cyclical expansion of output (and employment) fails to materialise - the topic of the 'cyclical behaviour of wages' tends to emerge as an area of debate. This was the case in the 1930s, and is the case again today.

The situation of prolonged recession and accompanying unemployment raises the theoretical question of why the economy is not returning to full employment equilibrium: why the 'normal' cyclical upturn in output (and employment) has not worked itself through. Similarly the cyclical recovery in the US up to 1985 raised the question of what lies behind the different output behaviour there. The corresponding debate over what did cause the 1931 to 1937 expansion of the UK economy, and the role played (if any) by the behaviour of wages, has been referred to above (chapter 8).

These questions of economic theory and empirical evidence should then inform the political debate over economic policy proposals for overcoming the obstacles to cyclical output expansion. It might, of course, be suspected that it is, rather, the debates over policy proposals which determine the corresponding debates in economic theory: but certainly the two areas of debate - over economic theory and government policy - are inextricably linked.

The 1930s slump sparked such a debate: both at the level of government policy prescriptions and in the economic literature. The former lasted only as long as the slump. The latter had got

no further than establishing that further empirical work was required when the attention of the economics profession was diverted to other matters, such as How to Pay for the War?

Following the second world war and the post war reconstruction, sustained economic growth developed and the attention of economists turned to growth theory. Worswick recalls the prevailing belief amongst economists that they had solved the economic problems of slumps and the cycle, and the task before them was simply to publicise their solutions beyond the economics profession (Worswick, 1985, p.1).

From the 1950s, theories of economic fluctuations were gradually replaced in economic publications by growth theory, the neoclassical model, at least, stressing the equilibrating tendencies of the system. Conditions for convergence to steady state growth were investigated in detail, with the rate of growth of output equalling the rate of growth of the capital stock, the rate of growth of the profit rate being zero, and the rate of growth of real wages being equal to the rate of growth of productivity, with a constancy of income distribution between capital and labour. Thus the behaviour of wages was investigated, but in terms of equilibrium growth rates rather than cyclical fluctuations.

The failure to have settled the cyclical wage debate allowed the question to slip back into its textbook context where the neoclassical synthesis allowed the neoclassical belief in countercyclical real wages to reappear within the micro marginal product of labour context. At the same time the emphasis of the

Keynesian macro part of the synthesis on macro procyclical aggregate demand, far from challenging the micro side of the neoclassical synthesis, allowed that micro assertion of countercyclical real wages to appear relatively unimportant.

It was with the breakdown of that apparently equilibrium growth, and the intensification of cyclical behaviour, that attention returned to cycles, and to the cyclical behaviour of wages.

1. The cyclical wage debate

The debate on the cyclical movement of wages centres on whether or not wages have a necessary correlation with the output cycle; and if so, whether they are procyclical or countercyclical. This might appear a strange object of economic controversy. Whether or not the output cycle would have any necessary implications for wages would depend on the causes of the output cycle. Different 'shocks' to output would have different implications for wages. Hence different cyclical wage implications. Further, the concept of decomposing time series into 'cyclical' and trend components is itself theoretically - and practically - problematic; and whether or not the cyclical wage series was thought correlated to the cyclical output series would clearly be influenced by what was understood by 'cyclical'; and whether the predicted correlation was detected would depend on the statistical method of detrending.

Nevertheless, the publication of Keynes' General Theory did lead to just such a debate on the cyclical behaviour of wages. Not only was that debate of some importance in the 1930s, but the

cyclical wage debate has re-emerged in the literature with Bodkin (1969), and a number of studies since the mid-1970s.

From a methodological standpoint the literature can be divided into two: first, the debate in the 1930s; and second, the current studies. The doubts expressed above - as to the point of searching for a 'stylized fact' of cyclical wage behaviour - relate differently to these two categories of work.

Considering first the debate in the 1930s: it was sparked by Keynes' (1936) assertion of just such a necessary relation. And as Keynes (1939) was at pains to point out, his 1936 statement had not been intended as a bold prediction but, on the contrary, as a passing reference to what all knew to be true (that wages moved countercyclically).

It is true that the 1930s debate did not satisfactorily resolve the empirical question; and that the 1970s cyclical wage literature has continued the search for the 'stylised fact'. It was argued in Chapter 1, however, that to understand the cyclical wage debate - in the sense of an economic controversy which deserves serious study as an episode in the history of economic thought - requires some analysis of the meaning and significance of the debate; and that this could be examined at a number of levels.

The explanation for the re-emergence of the cyclical wage debate in face of the above objections to such an object of inquiry goes deeper, then, than simply a desire to fill in a 'descriptive statistic' gap in the literature. That re-emergence is described

in the following terms in one of the recent additions to the literature:

> 'The approach stands or falls by the establishment of a negative correlation between employment and the wage. That such a correlation did not exist was, until a few years ago, thought to be an established fact in macroeconomics, but since Sargent's paper, the negative correlation and thus the labour demand equation have made something of a comeback.'
> (Newell & Symons, 1985, p.1)

It is argued in the following section that this comeback was not due to a change in the 'facts', nor even because a more accurate observation of the facts was achieved, but rather because fashions in inference changed.

2. The three levels of the debate

2.1 The search for a stylised fact

At one level, the aim of this thesis has been to contribute to the understanding of the cyclical behaviour of product wages, the 'stylized fact' of cyclical wage behaviour. The importance of this question is due to its implications for the debate as to whether a cyclical reduction in product wages is a necessary condition for a cyclical expansion of output.

Whether or not a cyclical decline in product wages is viewed as being a necessary condition depends on the theoretical assumptions made about the economy; and specifically the assumptions about the marginal product of labour. The competing views of the economy were discussed in Chapter 2. The declining marginal product view is that of the 1920's Treasury, of neoclassical textbooks, and of modern new-classicals.

Firms facing a declining marginal product of labour, and being price takers, make a reduced product wage necessary for increased output. Whether or not such a reduction in product wages would be sufficient for increased output depends on additional assumptions as to how the economy operates. It was on this last point that Keynes departed from the Treasury view in 1936 (as well as over whether or not money wage cuts would in any case reduce real wages).

The alternative view that firms are not necessarily price takers, and can be demand constrained, was put well by Sraffa (1926, p.543):

> 'The chief obstacle against which they have to contend when they want gradually to increase their production does not lie in the cost of production - which, indeed, generally favours them in that direction - but in the difficulty of selling the larger output of goods without reducing the price, or without having to face increased marketing expenses. This necessity of reducing prices in order to sell a larger quantity of one's own product is only an aspect of the usual descending demand curve, with the difference that instead of concerning the whole of a commodity, whatever its origin, it relates only to the goods produced by a particular firm...
>
> 'This method of regarding the matter appears the most natural and that which adheres to the reality of things.'

Reduced product wages are, from this view, not necessary, and may even worsen a cyclical decline in output by reducing aggregate demand. A typical example of this demand generating role of wages being cited is from a commentary on the UK economy:

> '... economic growth should be maintained through 1985. A key factor will be a resumption in consumer spending growth: earnings growth should comfortably outstrip inflation...' (Barclays, 1984; emphasis added)

Modern empirical studies, following from those sparked off by these policy debates in the 1930s, were reviewed in Chapter 3.

It was seen that no consistent results have, to date, emerged. The results of the empirical work reported in this thesis aim to fill that gap, and are as follows:

1. The cyclical output wage correlation varies significantly

   (i) across countries;
   (ii) within the cycle; and
   (iii) over time.

2. The variation is from significantly procyclical (US) to significantly countercyclical (Japan).

3. Cyclical wages tend to be negatively related to lagged cyclical output and positively related to future cyclical output.

4. Cyclical labour costs tend to be negatively related to cyclical non labour costs.

5. This negative correlation between the two series - labour costs and non-labour ('materials') costs - is, however, accompanied by no consistent cyclical pattern for total direct costs.

The relation between employment and wages will depend partly on output, and hence will reflect the above patterns; and partly on non-cyclical factors, which, given output, imply a negative correlation. This description of the two sources of possible wage output correlations turned out to be consistent with the results of the Chapter 4 tests, thus demonstrating that there is, similarly, no 'stylized fact' of a correlation between wages and cyclical employment to be found.

What, then, of the recent comeback made by the labour demand equation and related negative correlation between employment and wages?

2.2 Theory, facts and falsification

It was argued in chapter 1's section on 'Theory, facts and falsification' that the response of Keynes (1939) to the apparent

falsification of the theory held by Keynes (1936) was particularly striking in terms of the methods used to immunise theories against such falsification. Thus Ward (1972, pp.174-5) argues that:

> '...the notable thing about both the General Theory and the massive discussion in the leading economic journals that followed its publication, is the dearth of empirical studies...
>
> 'Given the importance which nearly all economists attached to ending depressions, one would expect that at least in the area of policy solid empirical work would play a central role in the development of Keynesianism. But this does not seem to be the case. To take just one example, consider the magnitude of the impact multipliers... The standard textbook version (and early discussion) of Keynes did not attempt to isolate this change by estimating impact multipliers empirically...and the first public presentation of estimates of impact multipliers of policy relevance does not occur until 1958, twenty two years from the publication date of the General Theory.'

The irony was noted in chapter 3 of the empirical debate in the 1930s having been provoked by a statement from Keynes presented very much as a prior belief. The more general irony of Keynes, who was opposed to attempts to fill in real values for the variable functions in a model, nevertheless giving rise to the mass of Keynesian empirical work post war, has been noted by others (notwithstanding Ward's rather different assessment). The point, however, is that that empirical work has been largely devoted to policy implementation rather than the attempted falsification, or verification, of theories. Indeed, the 1970s macro models (including the Treasury's), assumed the Kaleckian rather than neoclassical version of cyclical behaviour outlined in chapter 2; (see Wren-Lewis, 1985, p.68). The recent comeback by the labour demand function has not been the result of a shift in favour of empirical work, but rather is an attempt to

overthrow the Keynesian theoretical assumptions implicit in the bulk of applied macro econometric work up to the late 1970s.

Just as the economic crisis in the 1930s provoked a crisis in economics when the policy prescriptions (of wage cutting) were found not to work, so the economic crisis in the 1970s provoked a crisis in economics when the policy prescriptions (of fiscal reflation) were found not to work. Keynes (1936) was the clearest exponent of the futility of attempting to escape a recession via wage cutting; and Keynes (1939) argued that no cyclical reduction in the real wage was, in any case, required. Perhaps the 1970s counterpart to Keynes - the most famous conversion to the futility of attempting to escape a recession via fiscal reflation - was the Labour Prime Minister in Britain:

> 'We used to think that you could spend your way out of a recession, and increase employment by cutting taxes and boosting Government spending. I tell you in all candour that that option no longer exists, and that in so far as it ever did exist, it only worked on each occasion since the war by injecting a bigger dose of inflation into the economy, followed by a higher level of unemployment as the next step.'
> (Callaghan, 1976)

In the 1930s, then, the neoclassical marginal product of labour assumption, and corresponding wage cutting policy proposals, were replaced by Keynesian (Kaleckian) theories of demand determined output levels with mark up pricing, implying no necessary requirement for any particular cyclical pattern to real wages. The cyclical wage debate, and literature, played some part in this process.

Now, in the 1970s and 1980s, the neoclassical marginal product of labour theory, and corresponding policy implication that an

increase in employment requires a reduction in real wages (below the alternative, unemployment causing, level), is making a comeback. And it is therefore considered important to verify (eg Sargent, 1978; Neftci, 1978) or falsify (eg Geary & Kennan, 1982) the neoclassical diminishing marginal product of labour theory, by subjecting its supposed corollary - of countercyclical real wages - to empirical testing.

That is the methodological background to the re-appearance of the cyclical wage debate.

This takes us to the third of the three levels of the debate identified in chapter 1: the question of how observations relate to theories.

2.3 Inference

The argument from Ward cited in the previous section continues as follows:

> '...statistical tests are of very little help in resolving controversies until there is general agreement on the properties of the surrounding theory. Without that general agreement, even tests that are accepted as decisive, as was the case with Tarshis, do not change anyone's mind.'
> (Ward, 1972, p.176)

The controversies in economics in the 1930s, and again in the 1970s and 1980s, had more to do, then, with the economic climate, the lack of success of Government policies in dealing with them, and a subsequent battle of ideas, than they had to do with the statistical tests reported in the respective cyclical wage literatures. (As shown in chapter 3, Ward's description of Tarshis [1939] as being 'accepted as decisive' is not actually

accurate; but the point remains, and would no doubt have had validity even had Tarshis' tests been accepted as technically beyond criticism).

The results reported in the empirical chapters of this thesis would claim to show decisively that there is no cyclical pattern to wages (as have Geary & Kennan), but such a demonstration, even were it to be accepted as decisive, would not stop the attempted comeback of the diminishing marginal product of labour theory. Thus Tatom (and Canzoneri, 1978) claim to show empirical support for the diminishing marginal product of labour theory while accepting that the resulting countercyclical pattern of product wages does not in fact occur, due to the procyclical pattern of capital utilisation. While Tatom clearly sees his results as aiding the neoclassical comeback, the theoretical, as well as empirical, results are perfectly compatible with the Kaleckian model outlined in chapter 2, and underlying the macro econometric models of the 1970s; namely, that in the cycle capacity utilisation increases with constant marginal costs (and product) and no requirement for any particular pattern of cyclical wage movements (although with spreading overheads profits will be procyclical allowing the possibility of procyclical wages), until full capacity utilisation is reached when marginal costs not only rise, but, for Kalecki, rise so steeply as to prevent further expansion.

Thus Tatom infers a neoclassical marginal product of labour theory from the same (noncyclical, or even procyclical) wage data as is compatible with, indeed predicted by, the Keynesian (Kaleckian) theory he wishes to challenge.

Tatom is not typical of supporters of the comeback. Others, as has been shown, hang the theoretical challenge on an empirical one; infering a marginal product of labour theory from a negative wage employment correlation. But being an exception, Tatom proves the rule: that theories infered from observations change not only with changes in empirical observations, but also with changes in fashions of inference.

3. Policy

The different methodological motives behind the different contributions to the current cyclical wage literature also underlie the different theoretical and empirical methods adopted between studies. Thus Bernanke & Powell acknowledge that while a descriptive analysis of the cyclical data may be useful in restricting the class of structural models or hypotheses which may subsequently be considered, it allows no direct structural inferences (1984, p.1). This is the (unstated) view underlying Keynes' response to Dunlop and to Tarshis. On the other hand, the rather different literature - which does formulate and test a specific structural model of labour markets during the cycle - necessarily requires implicit identifying assumptions. Any resulting statistical correlation necessarily reflects those assumptions. The data alone can tell us nothing about the underlying theoretical structure.

Returning to the irony that the mass of empirical work post war was undertaken by Keynesians - despite Keynes' view that 'it is of the essence of a model that one does not fill in real values

for the variable functions' - even were Keynes right in being dubious as to the value of empirical work for testing theory, nevertheless descriptive statistical work could still be of use in informing policy analysis. Thus if Dunlop and Tarshis were correct in concluding that there is no countercyclical pattern to real wages, then the argument that to overcome a cyclical recession (and the accompanying unemployment) government expansionary policy should be accompanied by wage cuts is shown not to be valid, and the corresponding policy prescriptions should be rejected:

> 'If we can advance farther on the road towards full employment than I had previously supposed without seriously affecting real hourly wages or the rate of profits per unit of output, the warnings of the anti-expansionists need cause us less anxiety.' (Keynes, 1939, p.41)

Keynes continues the above passage with a call for further statistical work before discarding 'our former conclusions' - that a cyclical expansion in employment requires a cyclical reduction in real wages - which 'have a_priori support and have survived for many years the scrutiny of experience and common sense.' As reported in chapter 3, Keynes' call was ignored for 30 years. The subsequent study (by Bodkin, 1969) has been criticised and challenged in the post 1978 literature. It was argued above, however, that that literature was initiated not so much as an answer to Keynes' call, but rather as an attempt at verification of the 'former conclusions' refered to by Keynes. The statistical work reported in this thesis suggests, however, that there is indeed no requirement for real wages to move countercyclically.

Thus, to repeat Keynes' conclusion: we can advance farther on the

road towards full employment than would otherwise be the case - the warnings of the anti-expansionists need cause us less anxiety.

Appendix 1. WPI AND VAP AS WAGE DEFLATORS

This appendix considers the implications of using one or other of the two possible price deflators for constructing a product wage series. Sachs, for example, criticises Geary & Kennan's study for using the WPI rather than the price of value added (PVA). These two 'product' wages are denoted by W_{wpi} and W_{va} respectively.

This is only a serious issue when we have (relatively) large movements in material costs, thus allowing the different series to indicate precisely opposite movements for the product-wage series. The example Sachs gives (taken from recent experience) is an increase in material costs leading to a fall in the W_{wpi} while the W_{va} is actually rising. For Sachs, this behaviour suggests that the W_{va} index is the more appropriate.

If the real price of non-labour inputs increases, then this will tend to increase the real price of total direct costs. It is this which will hit profits, and may lead to reduced employment and output. These results do not stem from an increase in product wages, although even if workers are unsuccessful in protecting themselves against a fall in the wage deflated by the WPI, their (unsuccessful) attempts at doing so may well result in the wage deflated by the VAP rising. Table 1 gives such an example, where the doubling of the money value of materials results in the real cost of materials (deflated by either price index) rising.

Table 1. Pre- and Post-price of raw materials shock

	State	
	Pre-shock	Post-shock
mat	1	2
W	1	1.5
dc	2	3.5
m	0.25	0.2
PR	0.5	0.7
VA	1.5	2.2
p	2.5	4.2
PR_{vm}	1/3 = 0.3̇	0.32
PR_{wpi}	1/5 = 0.2	0.16̇
W_{vm}	2/3 = 0.6̇	0.68
W_{wpi}	2/5 = 0.4	0.36
mat_{vm}	2/3 = 0.6̇	0.91
mat_{wpi}	2/5 = 0.4	0.48
dc_{vm}	4/3 = 1.3̇	1.59
dc_{wpi}	4/5 = 0.8	0.83̇

where mat is non-labour direct costs ('materials')
W is labour costs ('wages')
dc is total direct costs (=mat+W)
m is the mark-up over direct costs
PR is profits (=dc.m)
VA is value added (=W+PR): the $_{vm}$ price deflator
p is price (=dc+PR): the $_{wpi}$ price deflator; and
non-subscripted variables are in money terms.

Deflating by the WPI, both profits and wages suffer. The fall in the profits mark-up over direct costs combined with the unsuccessful attempt at preventing the fall in W_{wpi} via the money wage being increased by 50%, does, however, result in the W_{vm} rising. It can be seen that the W_{wpi} and W_{vm} move in opposite directions and hence focussing on one or other may lead to different conclusions. It is not, however, a case of one misleading while the other leads to a correct understanding. Both (opposite) movements are caused by changes in non-labour costs, and the fall in profits is not due to the increased W_{vm} but, rather, to the increased direct costs. Hence the importance of considering movements in the cost of non-labour inputs. If this is done, however, the more appropriate deflator is certainly the price index for total output (WPI) rather than the price index for value added alone (PVA).

Appendix 2. PLOTS

Chapter 4.

Figures 1 to 6 show the series of the percentage deviation from trend of product earnings plotted against time, along with the percentage deviation from trend for output; as discussed in chapter 4.1. While there are no immediately striking correlations, the diagrams do suggest different patterns between countries, and variations between countries over whether or not any pattern exists. The time series plot for Japan, for example, does suggest that the two series move, if anything, inversely, and this was also borne out when the two series were graphed against each other, with almost all the cases of output being above trend being correlated with wages below trend.

Figure 1. US: % deviations of Q & W from trend

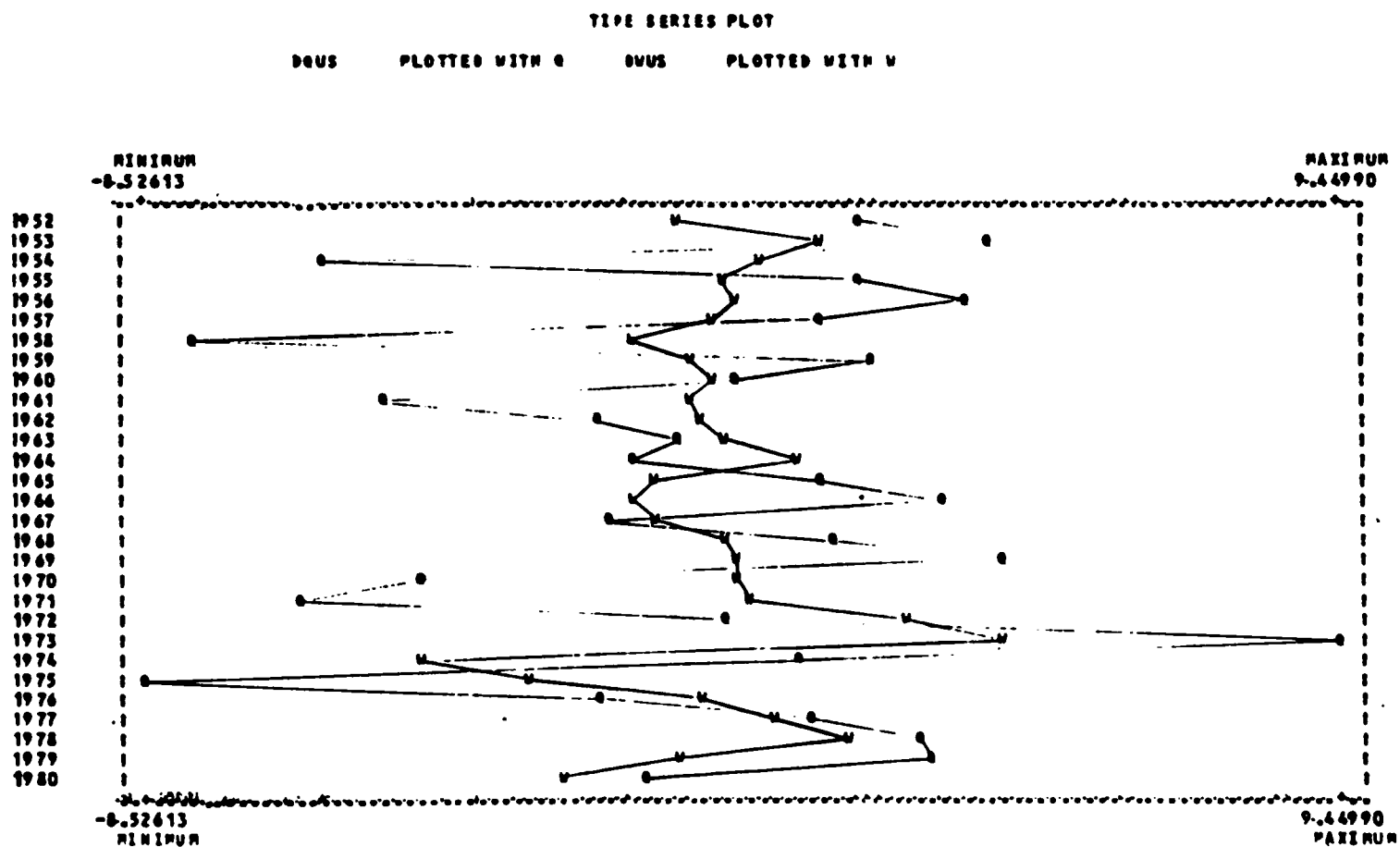


Figure 2. Canada: % deviation of Q & W

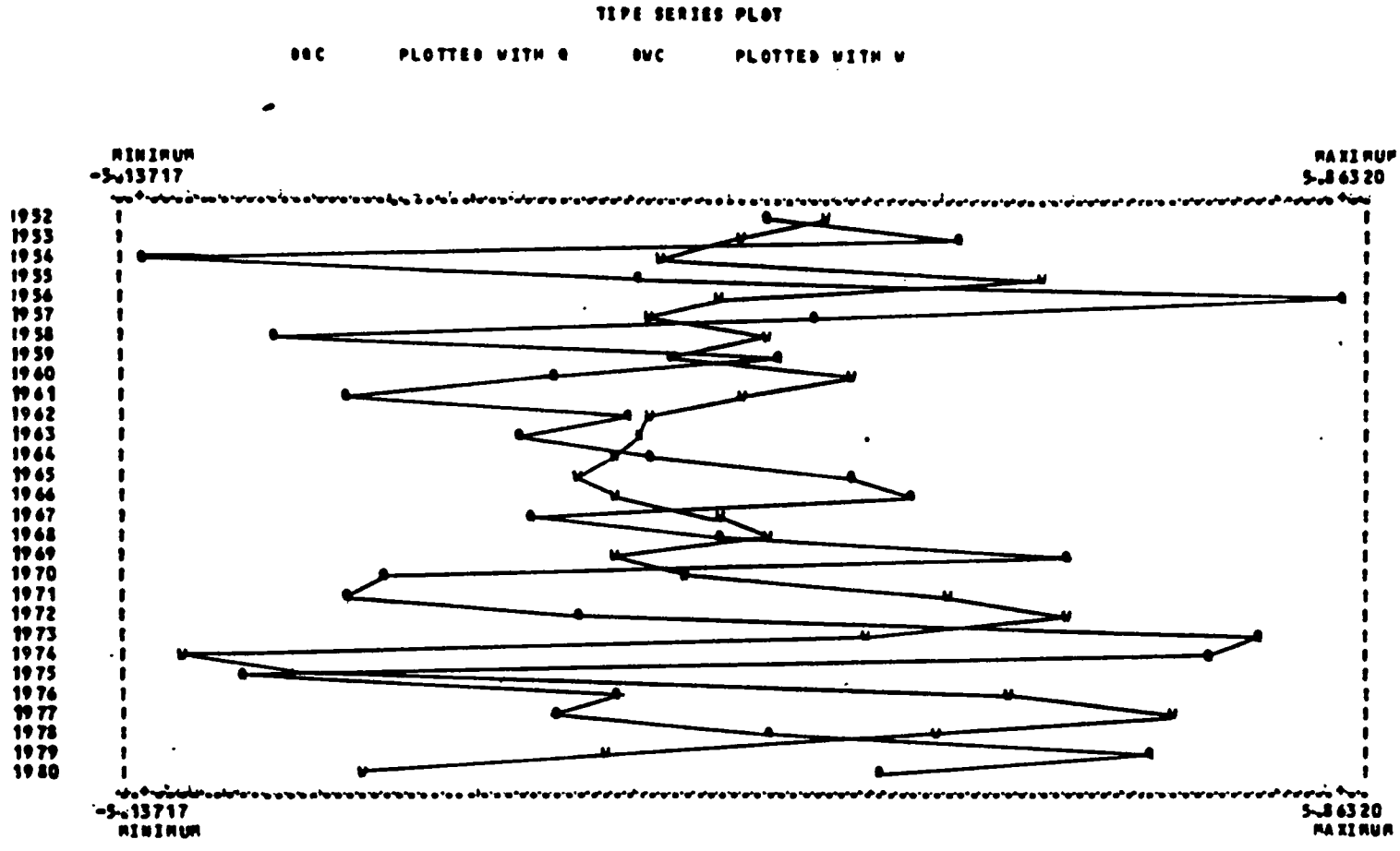


Figure 3. Japan: % deviation of Q & W

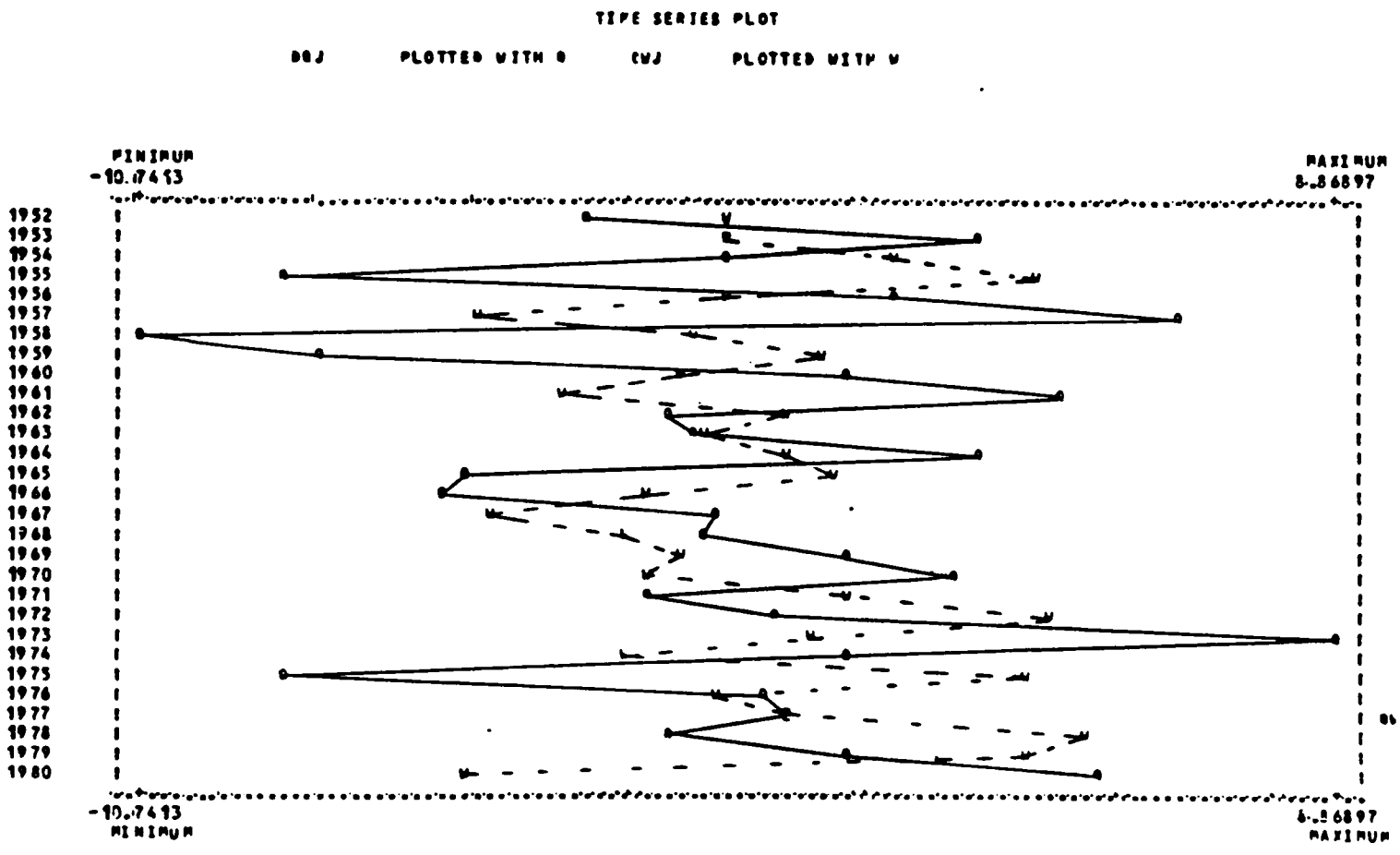


Figure 4. France: % deviation of Q & W

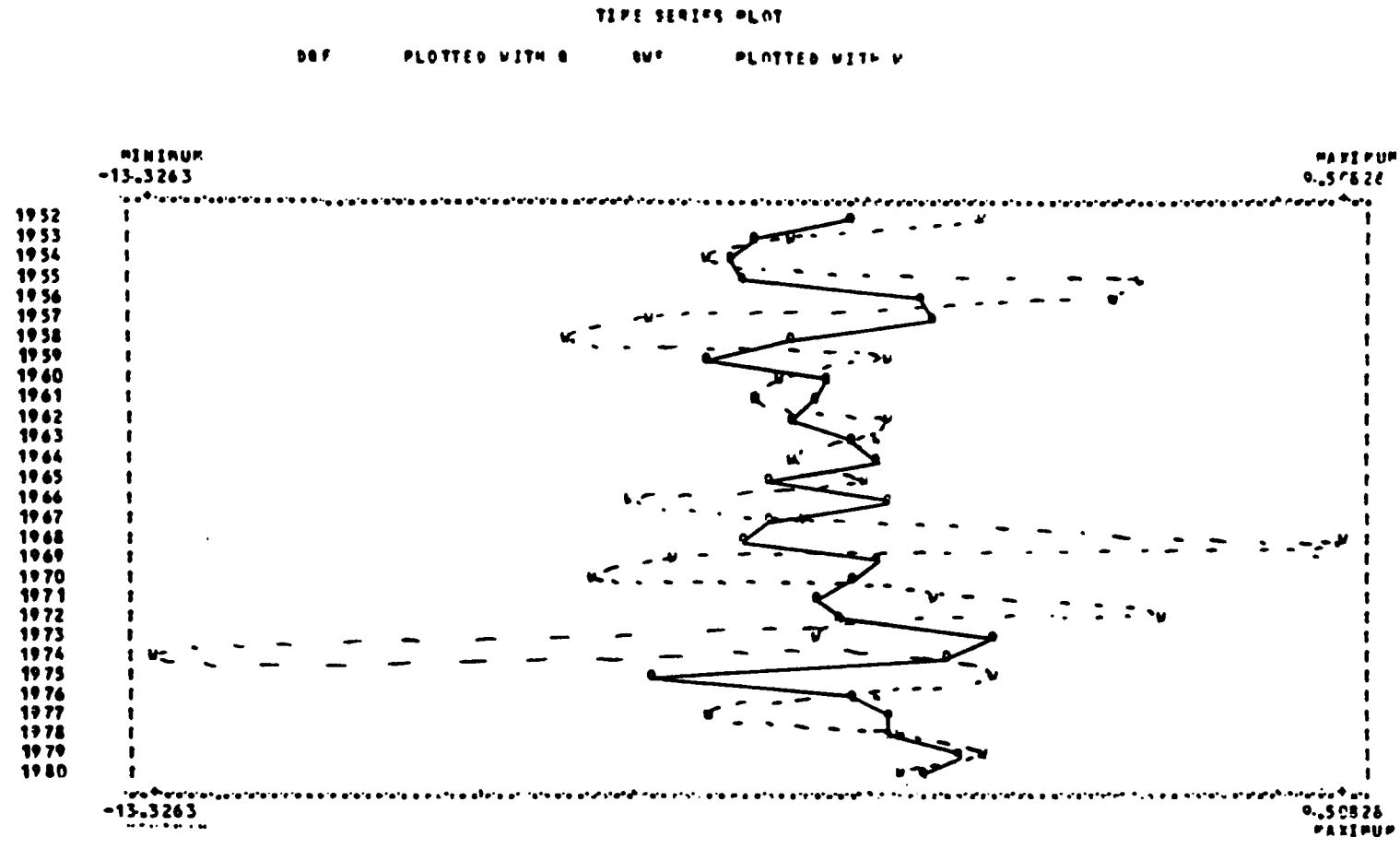


Figure 5. Germany: % deviation from trend of Q & W

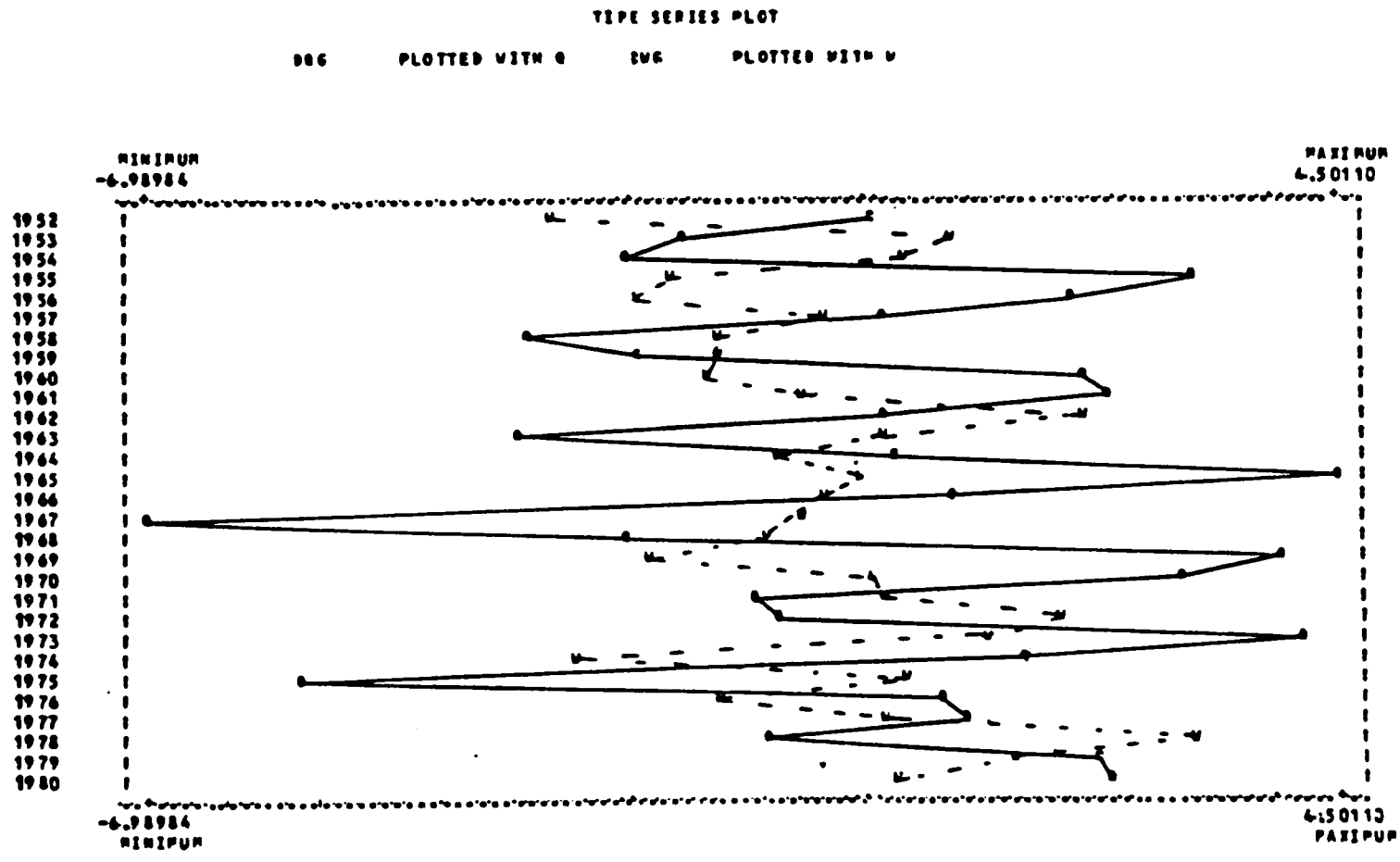
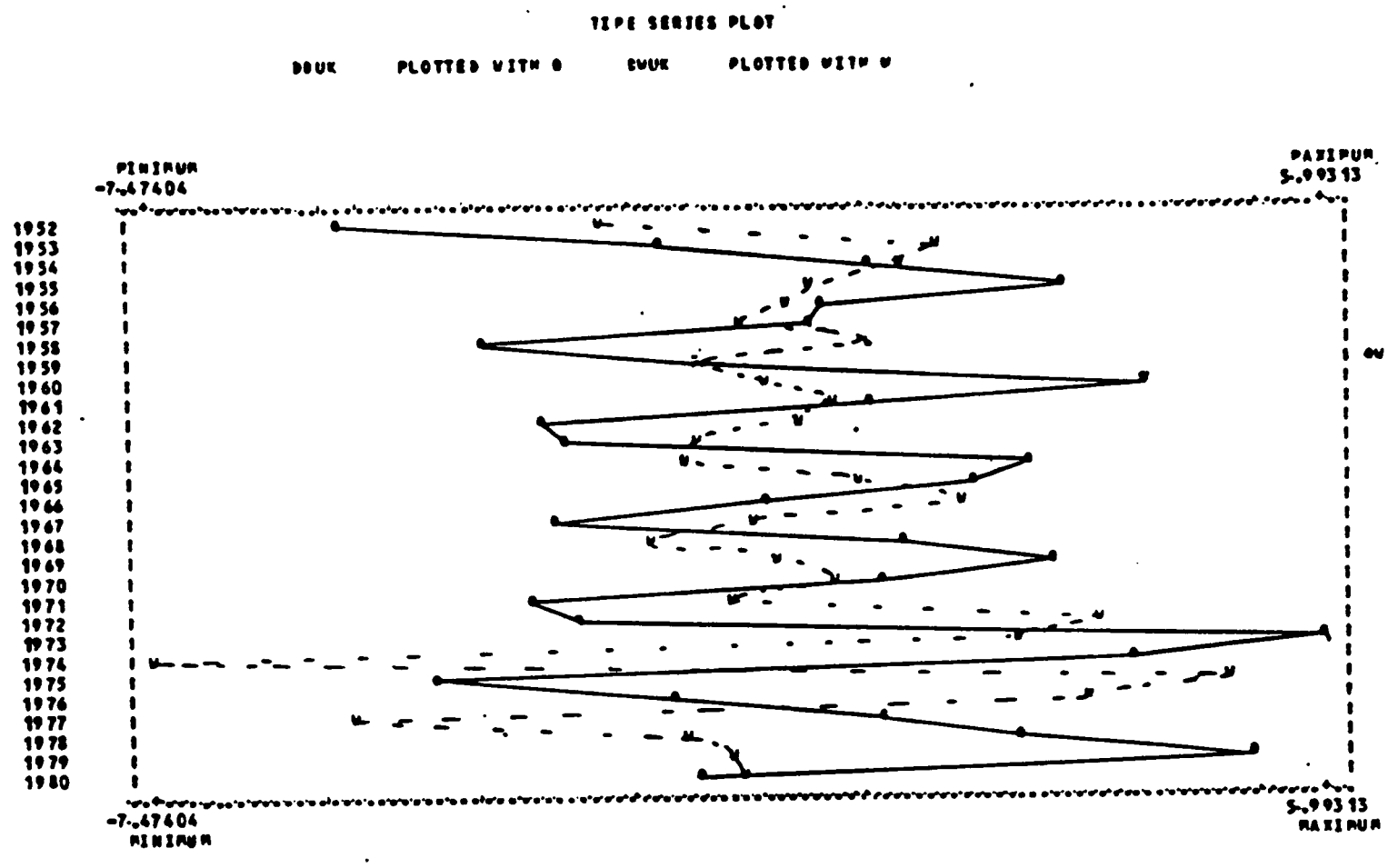


Figure 6. UK: % deviation from trend of Q & W



Notes to figures 1-6

1 The character 'Q' is used to plot the series for the percentage deviation of output from its own five-year moving average, against time.

2 The character 'W' is used to plot the series for the deviation of hourly compensation from trend against time, both when this is in nominal terms and when in product terms.

3 When the observations for both series correspond to the same point, a '2' appears in place of both 'Q' and 'W'.

Total direct costs

The index of total direct costs used per hour in product terms - as discussed in chapter 4.6 - is plotted over time, along with output, both detrended, in figures 7 to 12. The US data suggest a procyclical movement, although the positive regression coefficient that this predicts would presumably be largely produced by the latter large fluctuations over which direct costs were extremely procyclical. The cyclical behaviour of the index from Canadian data appears unstable, as does the index for France. The German index shows no particular cyclical activity for direct costs, while for the UK a generally procyclical pattern appears to be replaced over time by a countercyclical pattern. Finally, the Japanese data move countercyclically.

Figure 7. US: % deviation of Q & Direct Costs (DC)

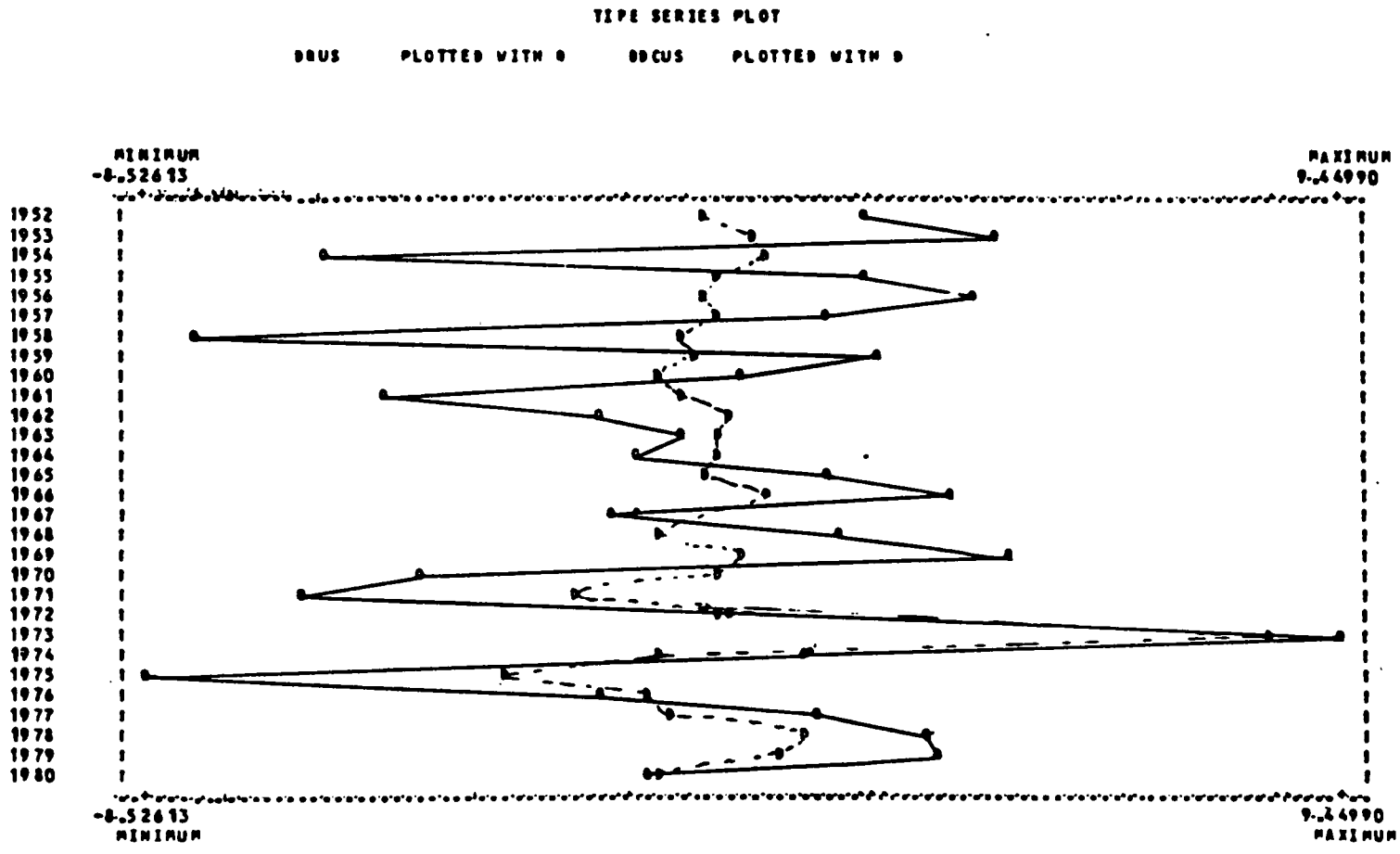


Figure 8. Canada: % deviation of Q & DC

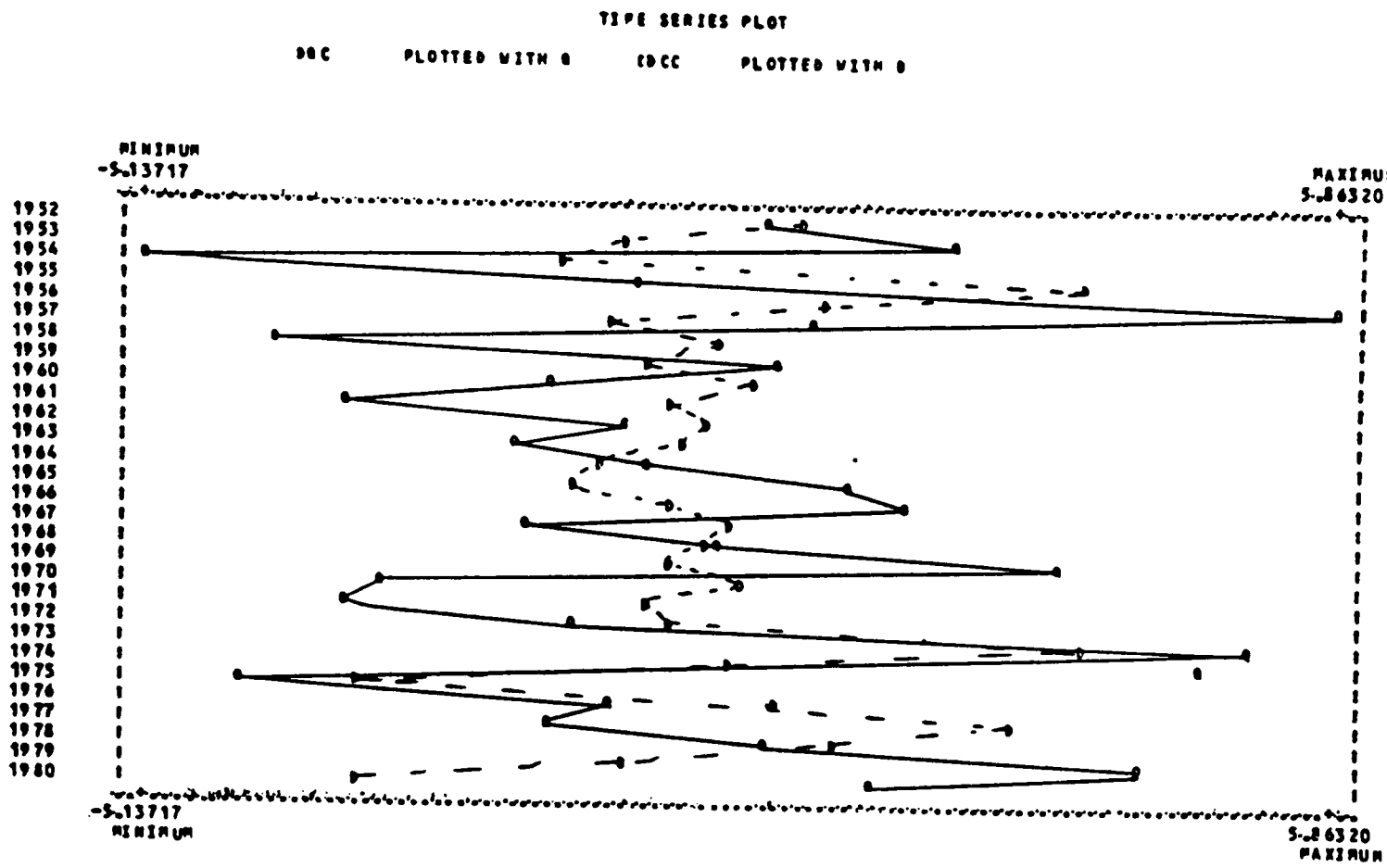


Figure 9. Japan: % deviation of Q & DC

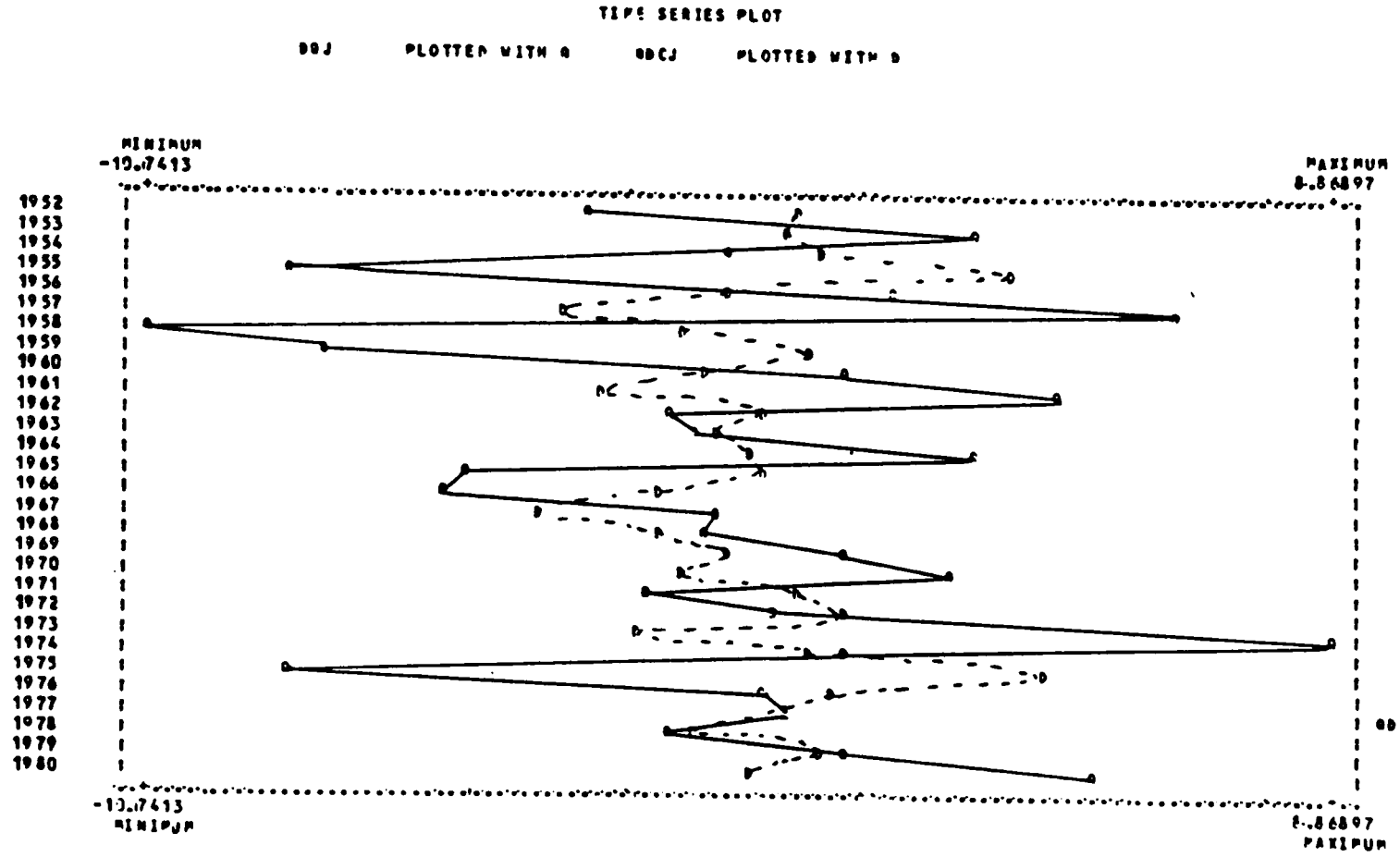


Figure 10. France: % deviation of Q & DC

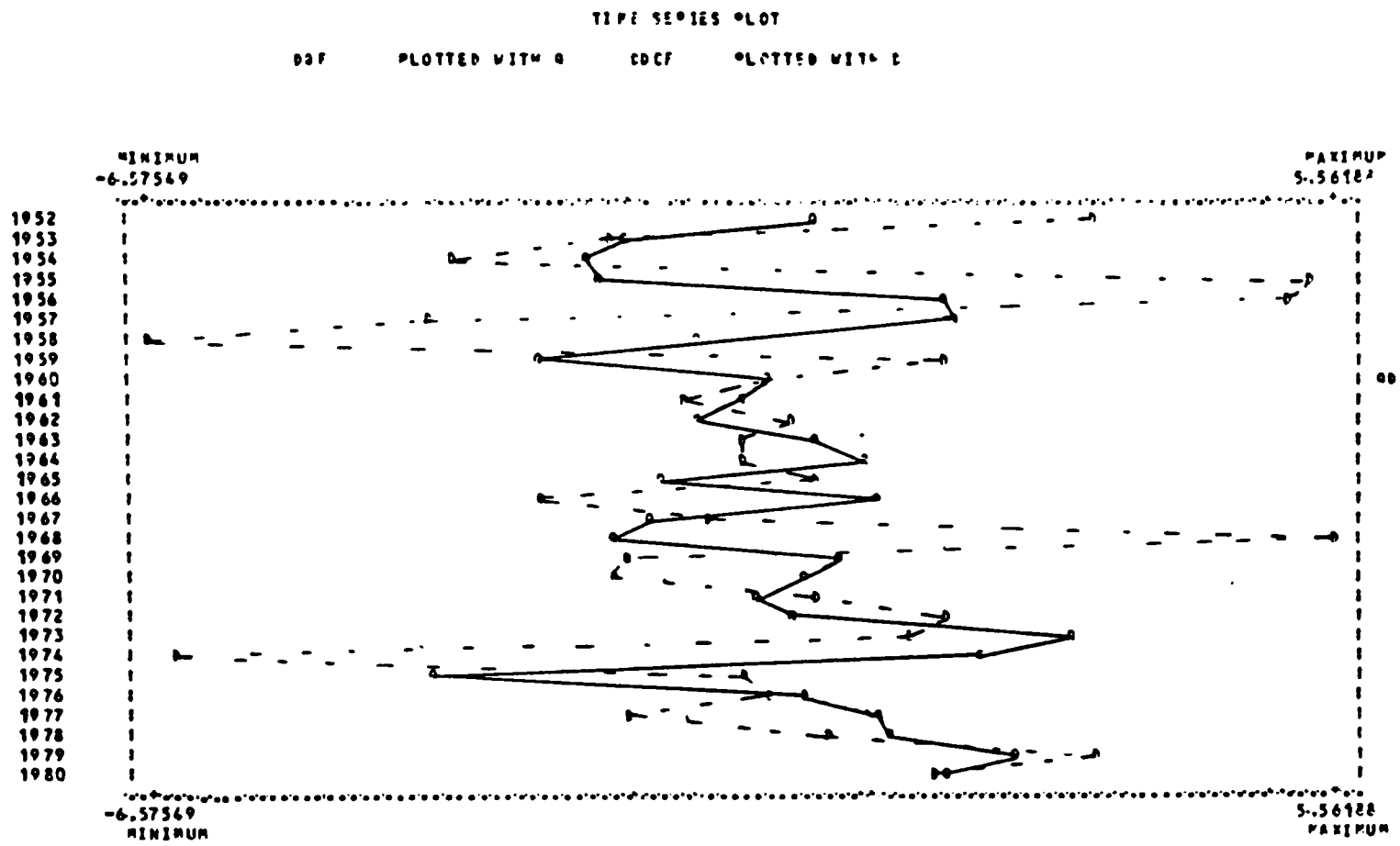


Figure 11. Germany: % deviation of Q & DC

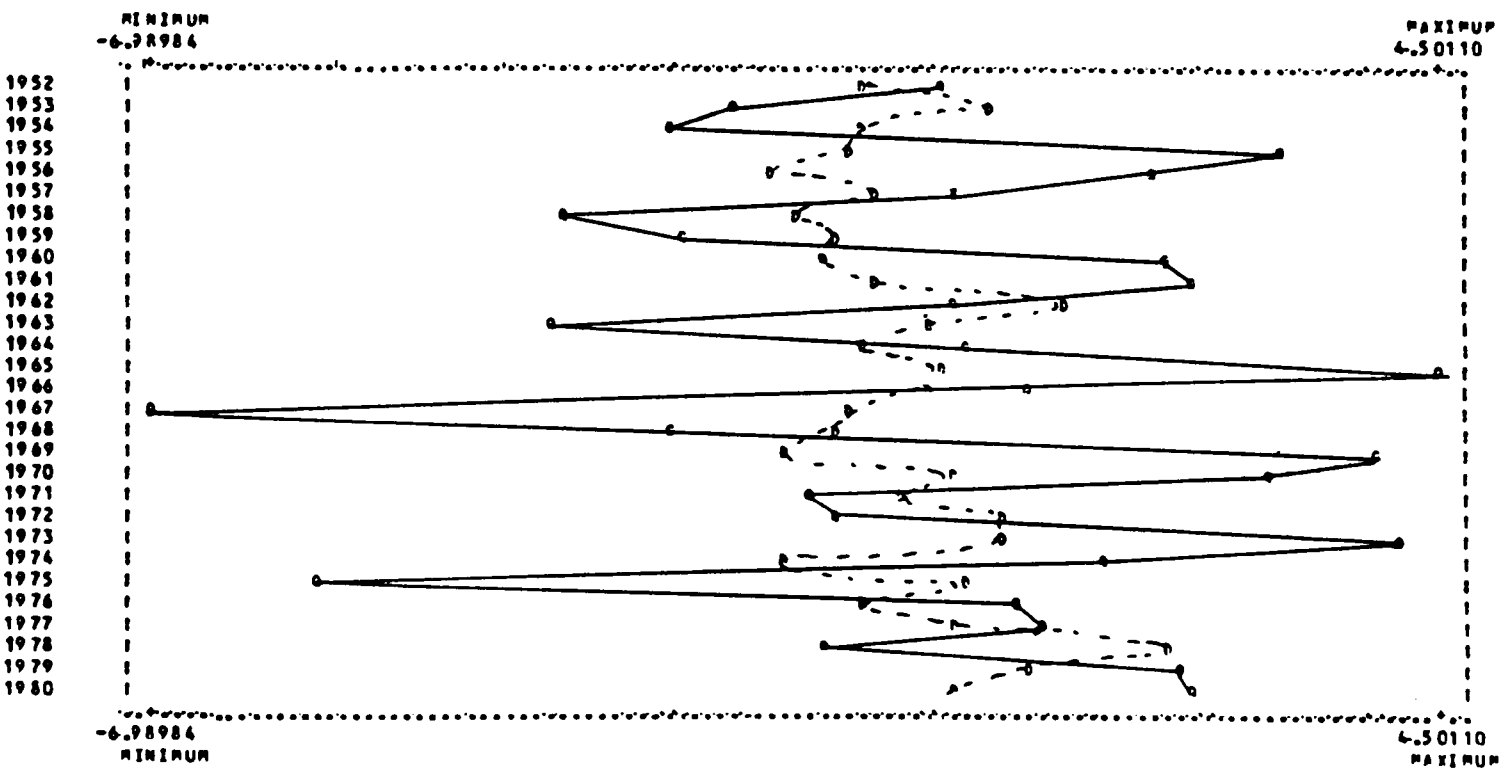
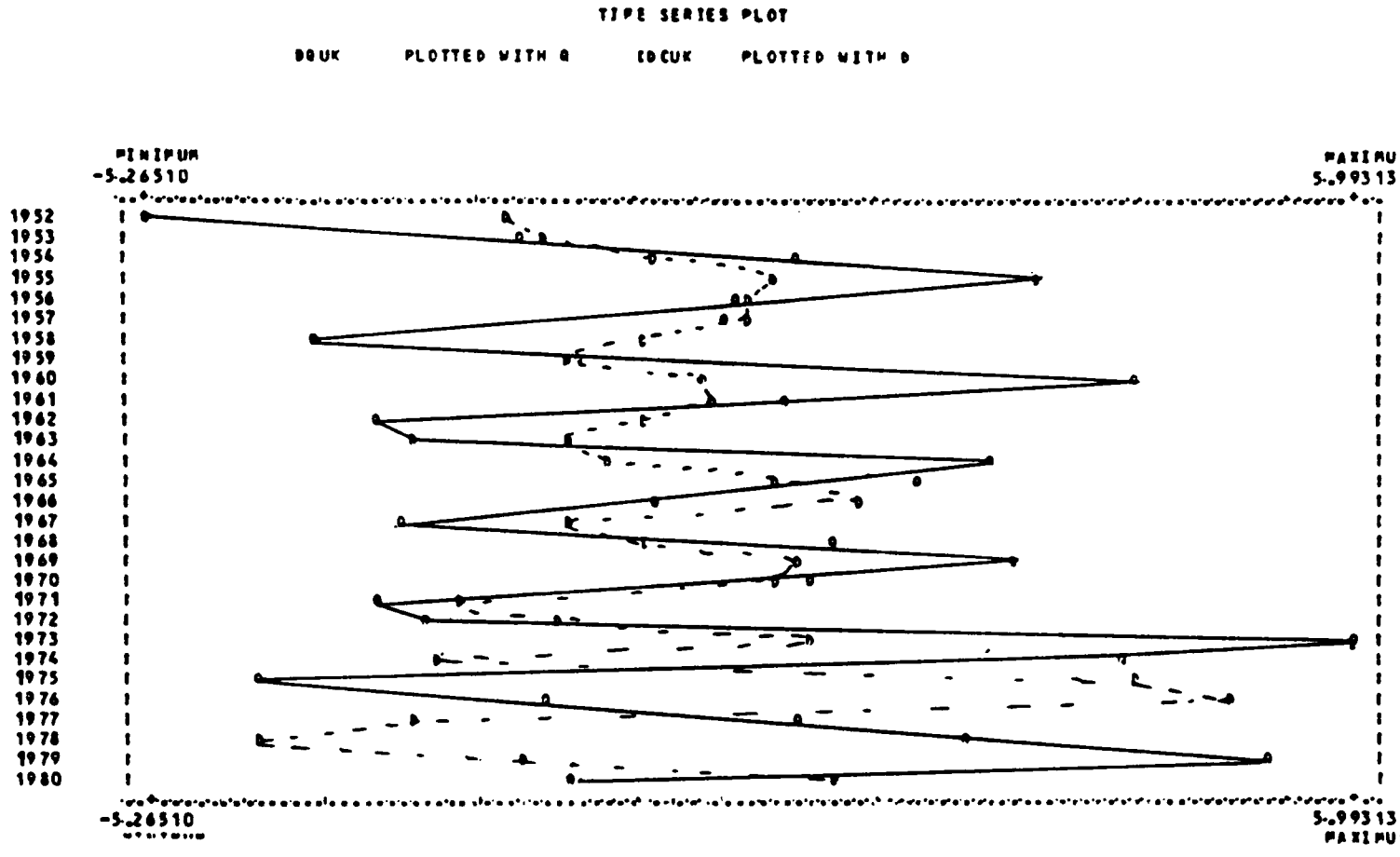


Figure 12. UK: % deviation of Q & DC



Chapter 5.

The deviations from trend of both the employment and earnings series are plotted together over time in figures 13-18, for each of the 6 countries; as discussed in chapter 5.2.1.

It can be seen that the pattern is different across countries, and, in some cases, changes over time. In the UK for example, a procyclical pattern appears to hold up until the early 1970s, following which major out of phase fluctuations would be expected to dominate any regression equation estimated over the whole sample. It turns out that the regression result is as hypothesised, as reported in chapter 5 table 1, with a significantly negative coefficient on employment. Graphing the percentage deviation from trend of employment against the percentage deviation from trend of wages in a scatter diagram suggests, however, that this statistically significant inverse

correlation is indeed the result of a few outliers.

Comparing countries, the time plots suggest a possible negative correlation between the two series in Japan and France, while the US suggests, if anything, a (weakly) positive correlation, while the plots for Canada and Germany suggest no correlation at all. While scatter plots (not produced here, for reasons of space) broadly confirm this picture, the US weak possibility of a correlation appears to depend on one outlier (corresponding to 1973), and, similarly, the scatter for France does not suggest much were it not for the help of a few outliers.

Figure 13. US: % deviation of wages (W) & employment (E)

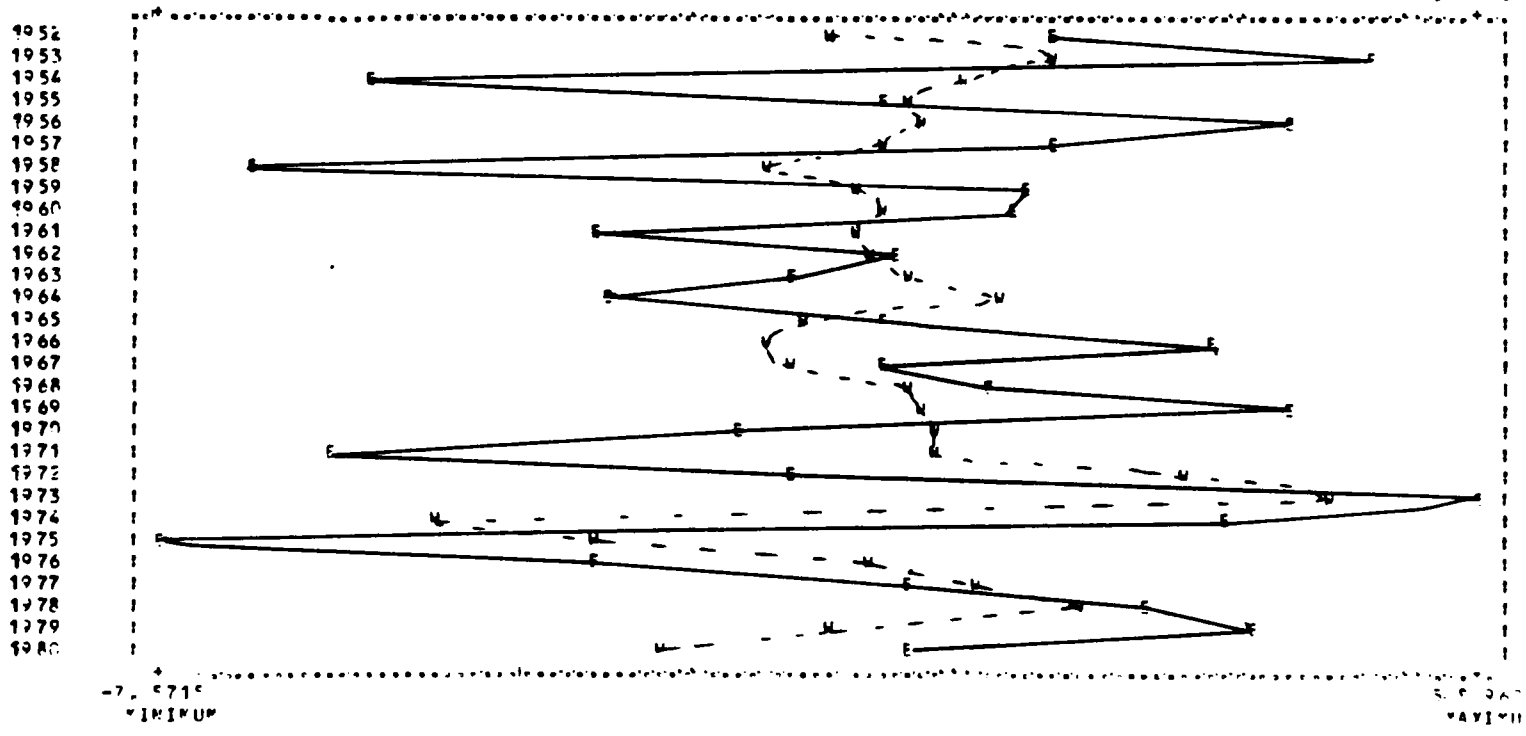


Figure 14. Canada: % deviation of W & E

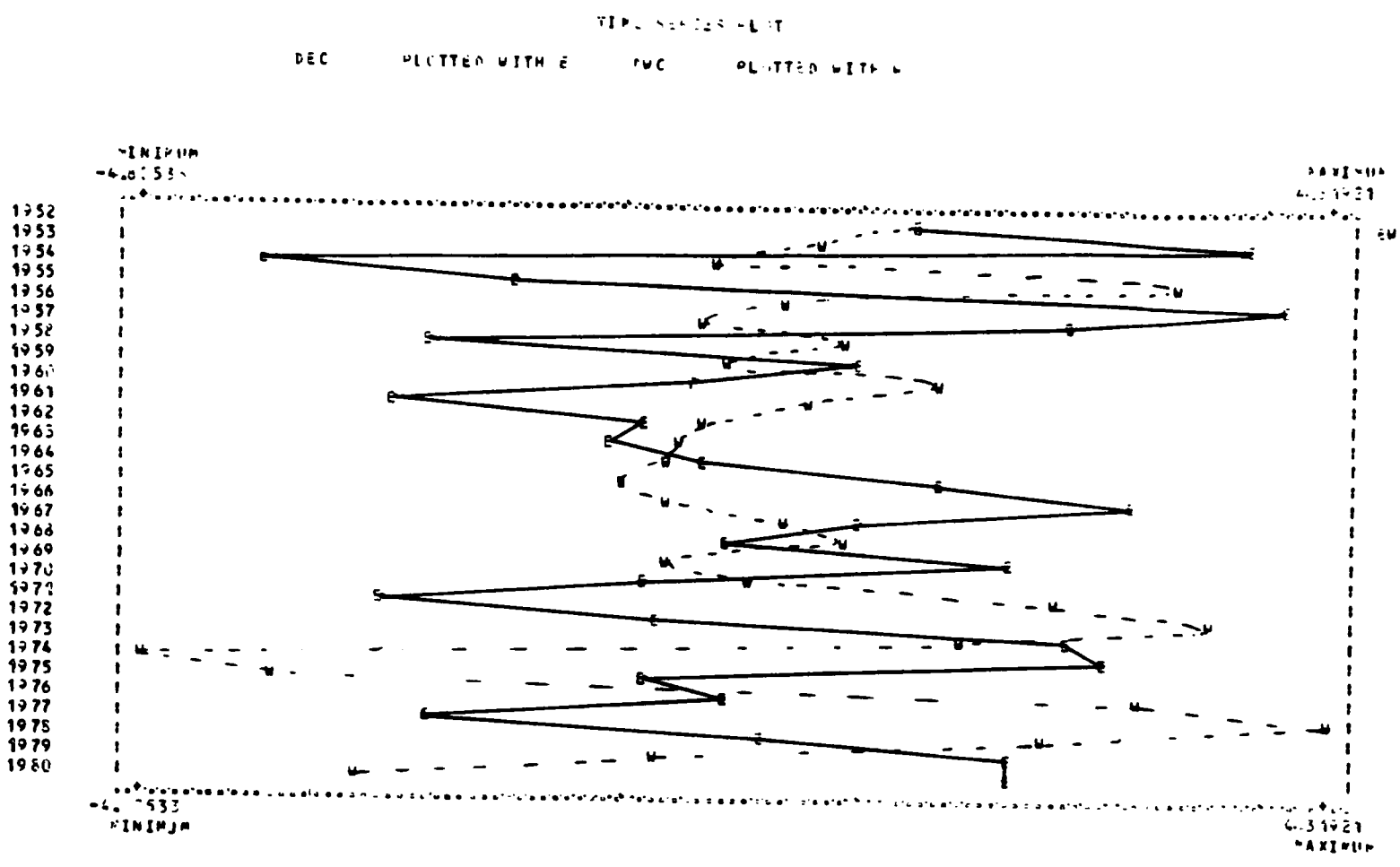


Figure 15. Japan: % deviation of W & E

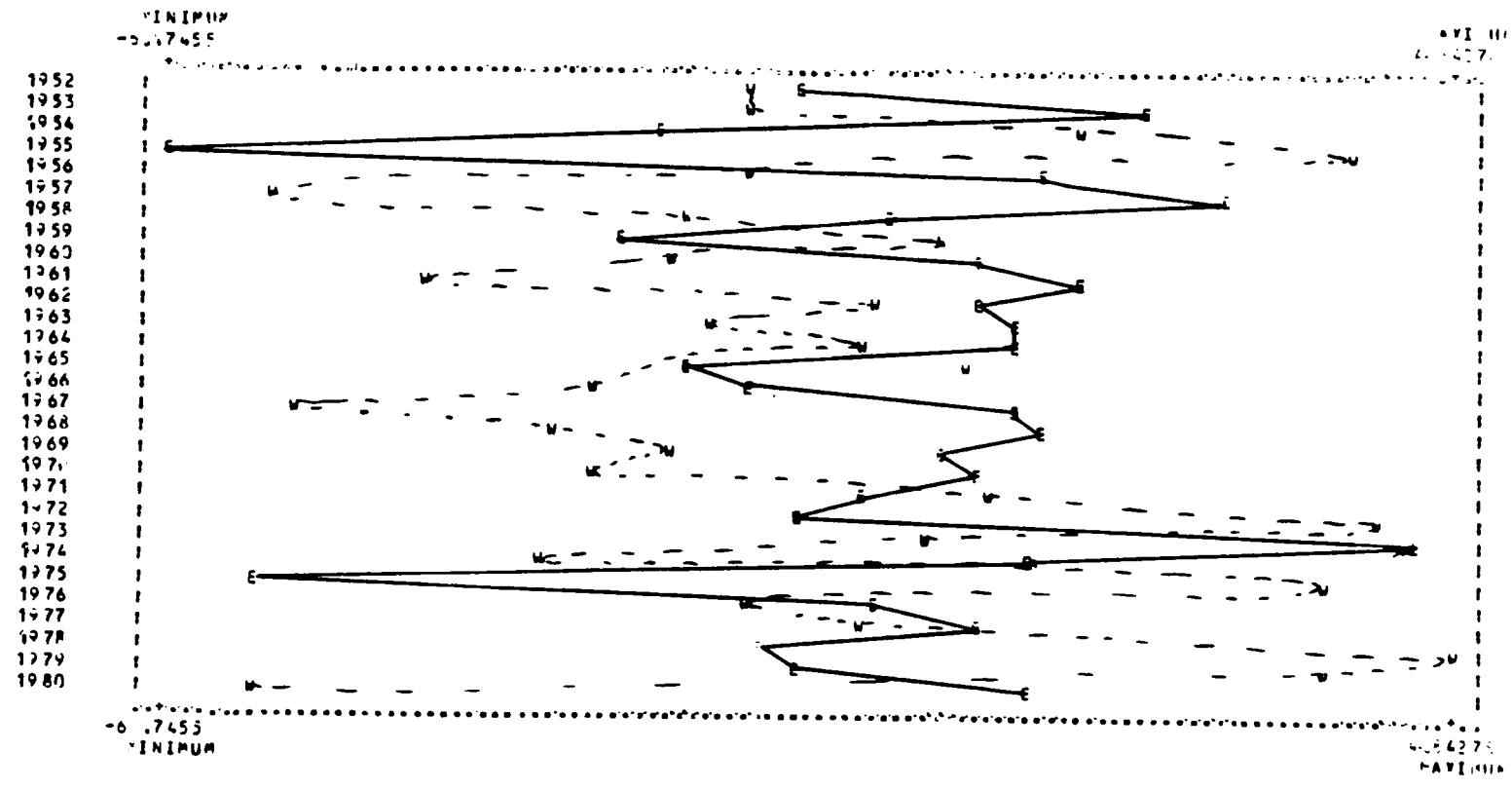


Figure 16. France: % deviation of W & E

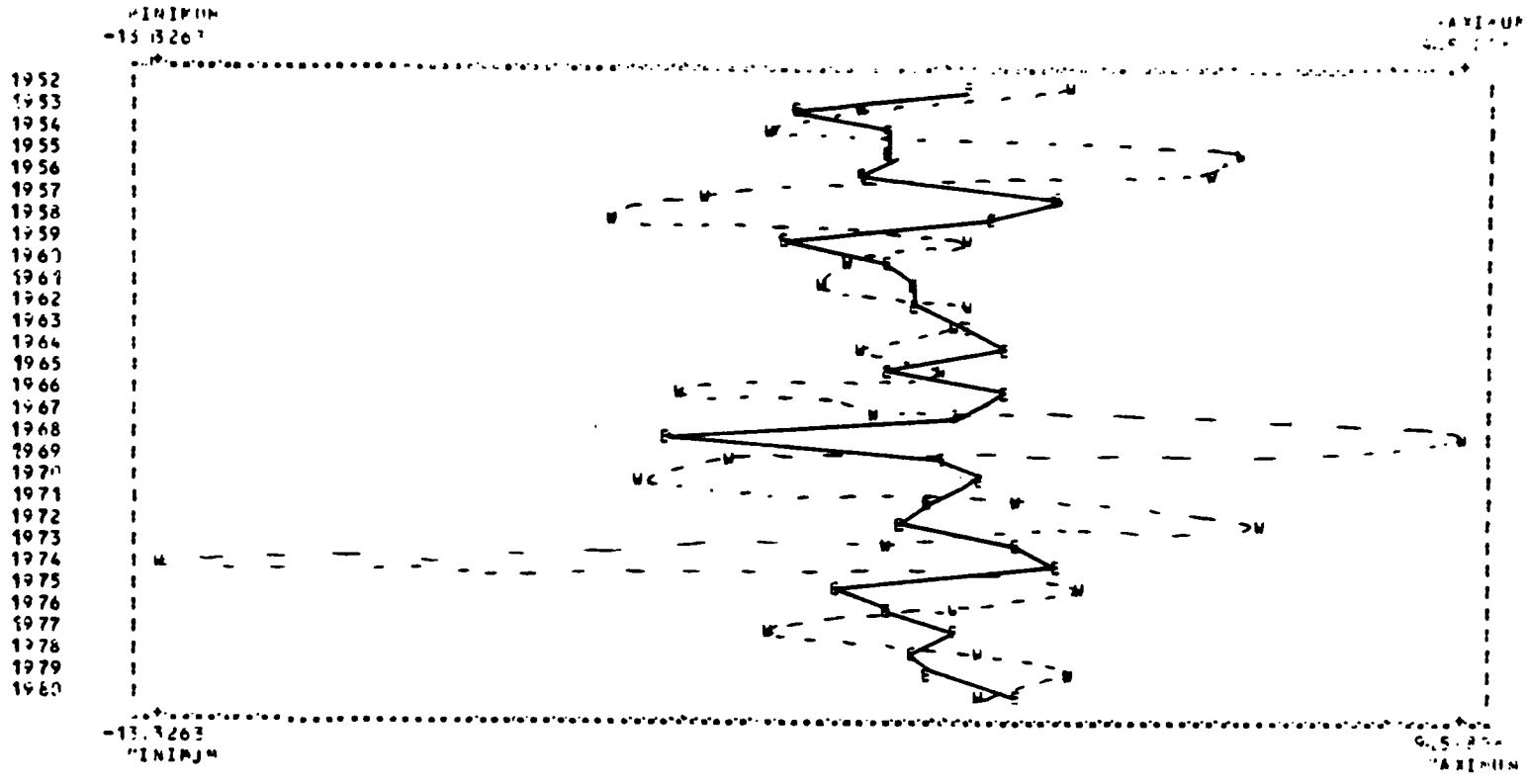


Figure 17. Germany: % deviation of W & E

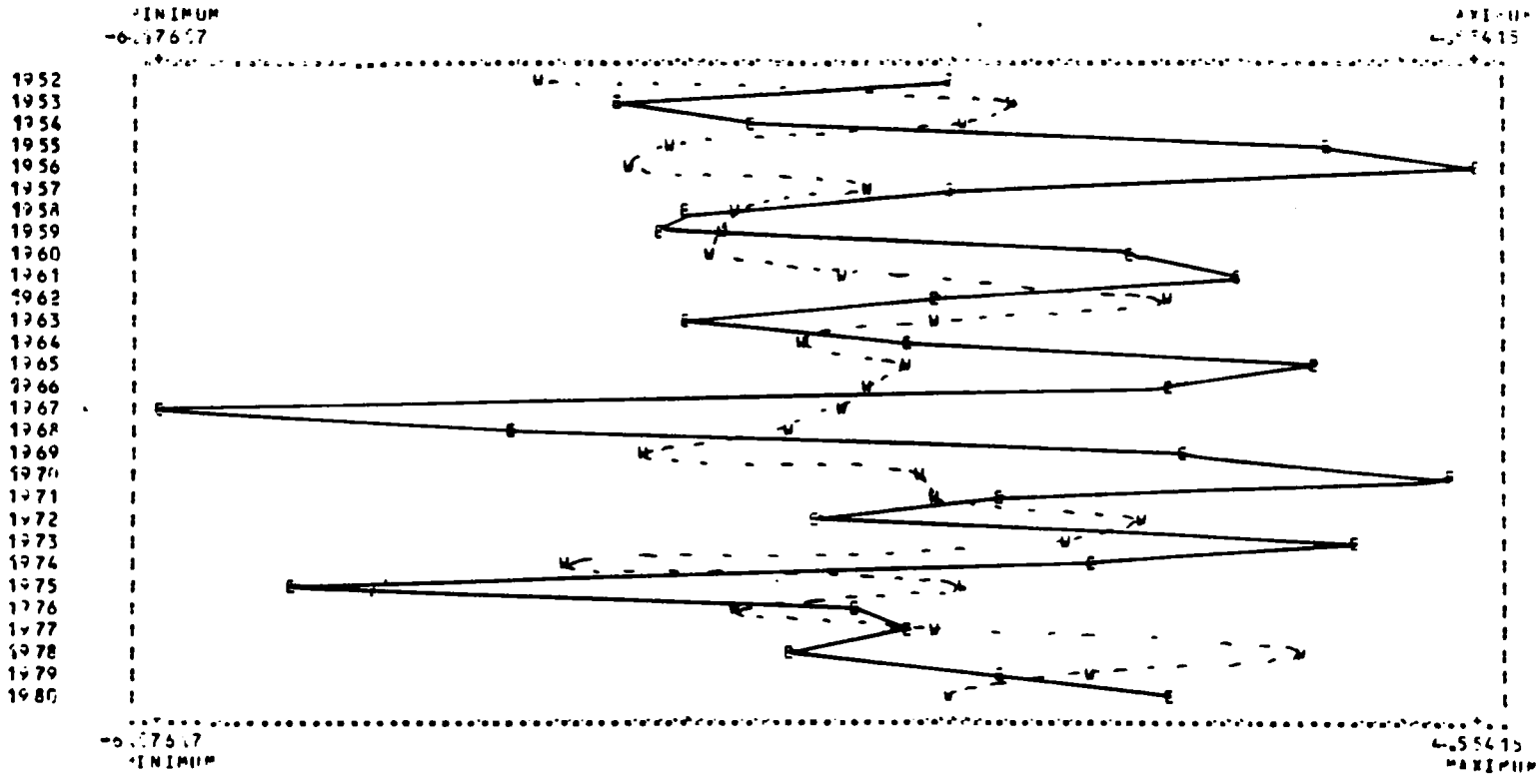
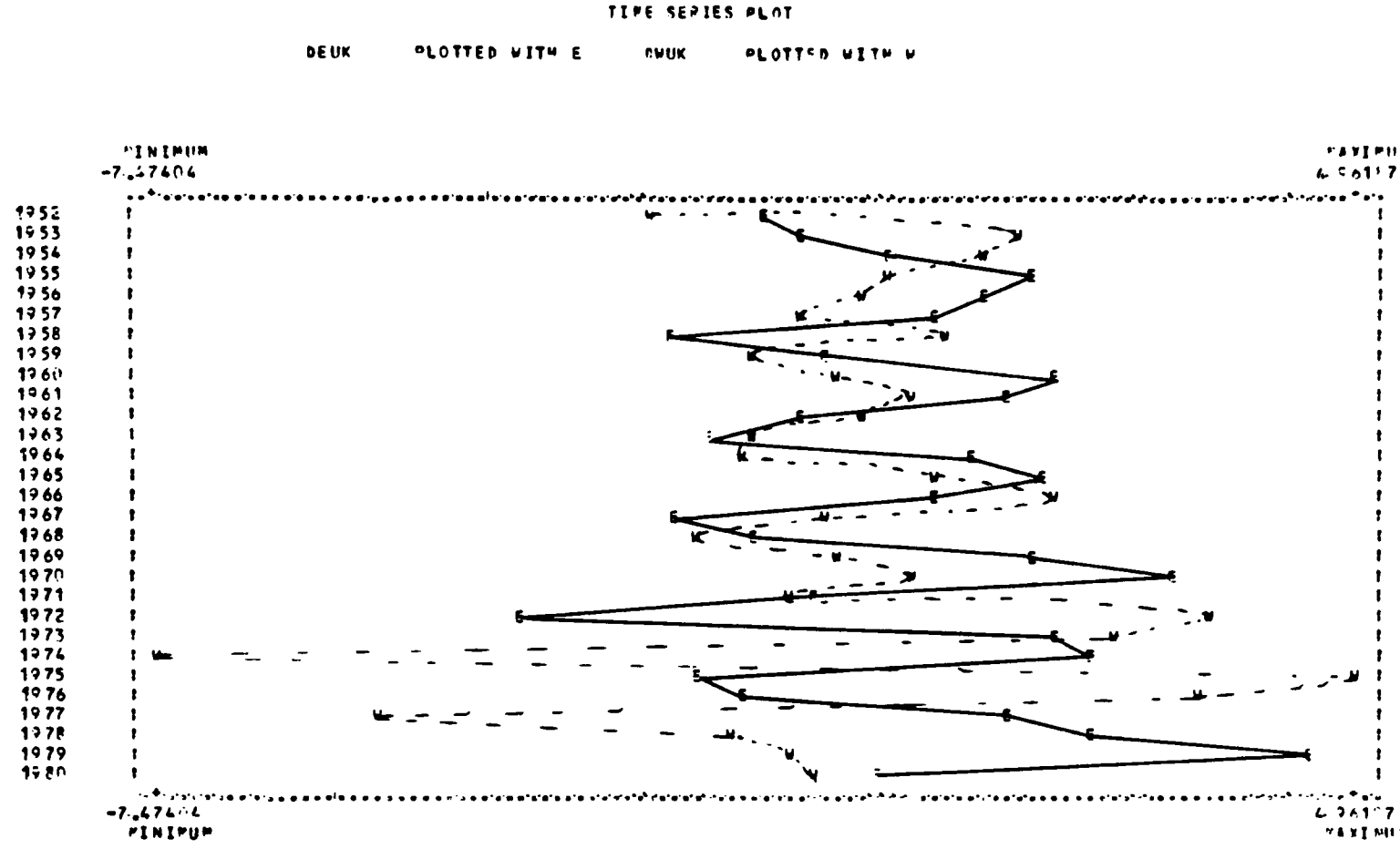


Figure 18. UK: % deviation of W & E



Appendix 3. CONSTRUCTION OF TOTAL DIRECT COST INDEX (DC)

Coutts, Godley & Nordhaus (CGN), 1978 p.40, report the share of materials in sales for total manufacturing less food, drink and tobacco as being 17.8%. For the same year (1963) Cowling (1982, p.170) reports the ratios of the materials bill to the wages bill as being 4.25. Since he also reports the ratio of salaries to wages as 0.431, this gives a ratio of materials to earnings of 2.97. Combining this figure with the above percentage share of materials in output would give a share of earnings in sales of 6%, which is clearly incorrect. Turvey (1980, pp.106-106) reports that the gross output of manufacturing industry in 1977 consisted of 57% cost of goods and work done purchased from other firms, and 43% payment for certain services and value added to materials by the process of production, about half of this being wages and salaries, which thus constitute 22% of total output. Maynard (1978) takes the gross profits component of final product price as 20%, the remaining 80% representing direct costs. Within this, he derives a 60:40 weighting for labour costs to raw material and fuel costs.

Cowling calculates ratios over time, while the other three studies analyse the picture for a single year. CGN take 1963, Maynard takes 1971 and Turvey takes 1977. The different dates could not possibly explain the different figures which they arrive at for share of material costs. These are, again, 17.8%, 32% and 57% respectively.

This Appendix attempts to reconstruct the data presented in these three studies in order to compare the measures, and hence decide

on appropriate weightings for constructing a total direct cost index.

The CGN data are shown in Table 1. This shows the value of total stocks and work in progress, of total sales, and of purchases of materials. The fourth column then shows the share of materials in sales. These values are shown for various industry groupings as well as for total manufacturing less food, drink and tobacco.

A striking feature of the table is that the share of materials in sales for the various industry groupings are all between 32.3% and 49.8%. An average of the seven industries would be 37.9%. This is well above the figure for manufacturing industry as a whole, of 17.8%. It is much closer to Maynard's figure of 32%. This divergence gives a hint at the source of the divergence between the studies.

Unfortunately, CGN's only reference to how their data were constructed is to cite one source: 'derived from Department of Industry'. The Department of Industry does not appear in their Bibliography.

The 1963 Input Output tables were therefore used to reconstruct the CGN data.

Table 1. Production period by industry 1963

Industry	Total stocks and work in progress £m (end year)	Total sales £m (per year)	Purchases of materials £m (per year)	Share of materials in sales, α %	Production period θ (in months)		
					Only progressively-added inputs $\beta = 0$	$\beta = \frac{1}{2}$	Only initial-entry inputs $\alpha = \beta = 1$
Chemicals and allied industries	362.7	1699.7	548.7	32.3	5.1	4.2	2.6
Mechanical engineering	967.5	2186.3	727.0	33.3	10.6	8.7	5.3
Electrical engineering	760.1	1629.3	607.4	37.3	11.2	9.0	5.6
Textiles	506.2	1405.3	485.5	34.6	8.6	7.0	4.3
Clothing and footwear	152.7	807.9	402.0	49.8	4.5	3.4	2.3
Timber and furniture	112.7	596.6	245.7	41.2	4.5	3.6	2.3
Paper industries	173.9	656.3	242.5	37.0	6.4	5.1	3.2
Total manufacturing less food, drink and tobacco	5426.7	13 446.1	2390.1	17.8	9.7	8.7	4.8

Source: derived from Department of Industry.
α is the share of materials in total sales.
β is the share of materials entering at the beginning of the production period.

For each of the industry groups within total manufacturing industry (minus food, drink and tobacco), their purchases from all other manufacturing industrial groups was then calculated. By subtracting all purchases from other manufacturers, as well as subtracting value added, we get a figure for total non-labour inputs for the manufacturing sector. Note that by including all possible inputs this is a broader category than what would normally be thought of as 'materials'.

For the manufacturing sector, then, this broad input figure is £5781.1 million, which is 42.0% of 'Total Sales' defined in the CGN way as total gross output less purchases from other manufacturing industries. This is, however, to include categories such as taxes and imports of services under the aggregate of 'materials'. Defining materials as simply imports of goods plus purchases from non-manufacturing industries 1-11, plus gas, electricity and water, a figure of 19.1% was derived as the share of materials in final sales.

It is this figure of 19.1% which was taken, then, to calculate the weighting for the price index of materials in order to construct an index of total direct costs. The corresponding figure for earnings is 41.2%. This gives direct costs a 60.3% share of total sales - the remaining 39.7% being made up of gross profits (16.7%) and non-direct costs (23%).

The materials:earnings weighting is, then, 19.1:41.2; (= 31.7:68.3).

The following should be noted with regard to the series being constructed. First, the weighting is taken as constant (at the 1963 value) throughout the time period, in the sense of the coefficient by which each of the two component series (of total direct costs) is multiplied; (as in the formula for deriving the combined series, given below). Differential movements in the two component series themselves will still result, then, in a corresponding change in the share of total direct costs attributable to either labour or non-labour costs. Second, the price index is not yet directly comparable with the earnings index, as it is the price of a given bundle of materials, not of materials used per hour.

What is of interest here is the cost of an hour's labour, including the materials used by that labourer. The starting point is the price indexes for materials and labour. The cost of the extra hour's labour in terms of the labour is simply the hourly earnings index. The cost of the extra hour's labour in terms of the extra materials which will be consumed in that hour is more complex. It is measured by the price index of materials,

multiplied by the quantity of materials used per hour. Following CGN (p.9) it can be assumed 'that the "productivity" of materials, fuel and services does not vary either cyclically or secularly'. This allows output to proxy for total materials used. Thus materials consumed per hour is proxied by output per hour.

This index of the cost of materials per hour was then combined with the previous data on the cost of labour per hour using the previously calculated weightings for materials and labour:

$$DC = L[(WE/h)/WPI] + m[(Q/h.E).(P/WPI)]$$

Where DC is total hourly direct costs, in product terms

L is the weighting for labour costs to correspond with their share in the 1963 Input/Output tables
m is the equivalent weighting for material and fuel costs bought from the non-manufacturing industry sector
WE is weekly earnings
h is average hours worked per week
WPI is the wholesale price index
Q is output
P is price index of materials
E is employment: EH = F(FE.fh) + M(ME.mh)
where FE is female employment
ME is male employment
fh is average hours worked per week by females
mh is average hours worked per week by males
F is the share of female employment in total
M is the share of male employment in total.

Appendix 4. STATISTICAL TESTS

Chapter 4.

Heteroscedasticity

The three basic regression equations from chapter 4 which test for the three possible correlations, of output with wages, materials costs, and total direct costs respectively, were tested for the null hypothesis of the error terms being homoscedastic, against the alternative hypothesis of their being heteroscedastic. The percentage deviations of output from trend were ordered according to absolute size for each of the six countries. The seven central observations in each case were omited from the analysis, and the remaining 22 observations were divided into two sub-samples of eleven observations each, one including the eleven smallest deviations from trend, the other the eleven largest. Separate regressions were then fitted to each sub-sample (the three regression equations being W on Q, MC on Q and DC on Q) and the sum of squared residuals were obtained from each of them. The two sub-samples were similar for all 6 countries, but none were identical, so each of the regression equations were run against data from 12 separate time periods - 2 per country. The regressions were fitted by OLS.

Obtaining the sum of squared residuals from each of the 2 regressions (for each of the 6 countries), the ratio of the two variances was calculated, F*, which has an F distribution with [(n-c-2k)/2] degrees of freedom, where n is the total number of observations, c stands for the central observations omitted, and k represents the total number of parameters estimated from each

regression.

This test is due to Goldfeld & Quandt (1965). If the calculated value of F* is greater than the theoretical value of F (at whatever level of significance has been chosen) with (n-c-2k)/2,(n-c-2k)/2 degrees of freedom then we accept that there is heteroscedasticity.

The calculated values of F* for each of the 3 regression equations, for each of the 6 countries, are shown in table 1. The four values in brackets are calculated by dividing the sum of squared residuals from the regression run with the smaller values of the percentage deviation of output from trend by the sum of squared residuals from the other regression, rather than the other way round as was the case for all other values.

Table 1. Test for Heteroscedasticity

	Regressand (on Q)		
	W	MC	DC
US	(1.94)	1.88	13.06*
Canada	2.12	1.16	1.11
Japan	(1.19)	1.03	1.84
France	3.08	1.48	5.85*
Germany	(1.73)	(2.45)	1.04
UK	2.18	1.80	1.42

Notes:
1. $F_{0.05}$ (9,9) = 3.18
   $F_{0.01}$ (9,9) = 5.35; significance denoted by *
2. Those calculations represented by results in parentheses gave values less than one when the sum of squared residuals from the regression on larger Q were divided by the sum of squared residuals from the regression on smaller Q. The inverse was, therefore, taken.

Of the 18 calculated values of F*, only 2 indicated heteroscedasticity: the regressions of total direct costs on output for the US and France. In both cases, heteroscedasticity is demonstrated at the 99% level. The other 16 regression equations all demonstrate homoscedasticity.

Higher_order_serial_correlation

The second test is a Lagrange Multiplier test (Breusch & Pagan, 1980) for up to 5th order residual serial correlation. It is distributed as X^2 with 5 degrees of freedom, and is calculated as $N.R^2$ from the regression of the estimated residuals on 5 lagged values and the regressors which were in the original equation. The test regression was estimated over 1958-1980, so N=23.

Table 2 gives the calculated test statistics for each of the equations estimated against the data from each country. The original form of the 7 regression equations were:

1. MC on Q
2. W on MC
3. W on MC and Q
4. W on Q
5. DC on Q
6. MC on W and Q
7. MC on W

Table_2.__Test_for_Higher_Order_Serial_Correlation

Equ	US	Canada	Japan	France	Germany	UK
1.	8.85	11.34*	14.57*	11.11*	9.01	13.93*
2.	7.27	16.59**	6.50	9.01	2.08	10.40
3.	4.74	16.56**	1.69	8.67	3.16	10.18
4.	6.06	15.23**	2.91	7.92	6.86	9.91
5.	4.61	7.71	1.46	7.10	4.67	10.82
6.	6.43	9.93	7.01	11.60*	8.60	15.69**
7.	10.99	13.09*	2.75	14.40*	7.33	12.90*

Note: For 5 degrees of freedom,
$P(X^2 \geq 11.07) = 0.05$ - denoted by *
$P(X^2 \geq 15.09) = 0.01$ - denoted by **
$P(X^2 \geq 16.75) = 0.005$ - not achieved

Of the various statistical tests reported in chapter 4 and in this Appendix, this last comes closest to suggesting that the original equations should be re-specified. However, the degree of higher order serial correlation indicated may be preferable to any such re-specification: first, not all the equations are

affected. Equation 5 shows no higher order serial correlation in the data of any of the six countries. Second, not all countries' data are affected. The data from the US and Germany show no higher order serial correlation for any of the equations. Third, none of the 42 values of the test statistic indicate higher order serial correlation at the 0.005 significance level.

Chapter 5.

The same econometric tests were performed on various regression equations from chapter 5 as were used, and discussed, in chapter 4 and in this appendix, above. That is:

(i) parameter stability: Chow test

(ii) heteroscedasticity: Goldfeld-Quandt

(iii) higher order serial correlation.

In view of the previous discussion, further comments are kept to a minimum. The regression results reported in table 1 of chapter 5 (p.120), for the basic regression equation of W on E, are discussed.

Parameter stability

Rather surprisingly, the cyclical wage-output relation investigated in the chapter 4 turned out to be stable in terms of the parameter on the cyclical output variable when the wage series was regressed on it. Looking again at figures 13-18 (Appendix 2), the UK is the only country for which the relative behaviour of the wage and employment series clearly alters, despite the relatively large fluctuations in both series in all countries over the 1970s as compared with the 1950s and 1960s.

To test for such parameter stability (or lack of it in the case of the UK) the sample was broken at the same point as with the chapter 4 tests: 1952 to 1970, and 1971 to 1980. The regression equations were then re-estimated and an F ratio was constructed in order to perform the Chow test, as before:

$$F^* = \frac{(RRSS-URSS)/(k+1)}{URSS/(n_1+n_2-2k-2)}$$

Table 3 reports the calculated value of this F* for the regression of W on E, as previously reported in ch. 5, table 1.

Table 3. Chow test for Parameter Stability

	Calculated F*
US	0.77
Canada	2.23
Japan	1.79
France	2.25
Germany	1.26
UK	5.79**

Notes: 1. Regression Equation: W on E
2. HILU
3. Restricted sample: 1952-1980
Unrestricted samples: 1952-1970; 1971-1980
4. The F-distribution degrees of freedom are $F_{(2,23)}$, one observation having been lost in estimating each sub-sample by the HILU regression technique. The theoretical values of the F-distribution corresponding to these degrees of freedom are $F_{(0.95)} = 3.42$ and $F_{(0.99)} = 5.66$.
* signifies rejection of the null hypothesis at the 95% level of significance
** signifies rejection at 99% level
Rejecting the null hypothesis is to accept that the two samples give different relationships.

As expected all countries except for the UK show parameter stability and in the UK the evidence for separate wage-employment correlations pre- and post-1970 is strong.

To give a more detailed picture the separate regression results, for 1952-1970 and for 1971-1980 are reported for each country in table 4. These separate results should be considered in relation

to the restricted/whole sample results reported in chapter 5, table 1.

Table 4. Post & Pre Break regression results

	Sample 1: 1952-1970			Sample 2: 1971-1980		
	E (t-stat.)	$\bar{R}^2$ DW	SER F-stat	E (t-stat)	$\bar{R}^2$ DW	SER F-stat
US	0.06 (1.10)	0.012 1.25	0.74 1.21	0.26 (0.99)	-ve 1.82	2.84 0.98
C	-0.13 (1.23)	0.029 2.12	0.99 1.50	-1.11 (1.91)	0.249 1.77	2.96 3.65
J	-0.80 (5.10)***	0.596 1.81	1.40 26.0	-0.72 (1.66)	0.180 1.53	3.25 2.76
F	-1.76 (4.49)***	0.530 1.21	2.74 20.2	-3.57 (3.63)**	0.604 1.55	3.98 3.19
G	-0.09 (0.99)	-ve 1.50	1.14 0.98	-0.19 (0.72)	-ve 1.79	1.86 0.52
UK	0.13 (0.85)	-ve 1.49	1.03 0.72	-0.98 (2.76)*	0.452 2.81	3.03 7.61

Notes on 1952-1970 regression results:

1. N=18
2. F(1,16): 5% = 4.49'
   1% = 8.53''
3. t-stat: *** 0.1%
4. DW show non-autocorrelation except US and France which are both indeterminate.

Notes on 1971-1980 regression results:

1. N=9
2. F(1,7): 5% = 5.59'
   1% = 12.2''
3. t-stat: *5% (2.26)
   ** 1% (3.25)
   *** 0.1% (4.78)
4. DW statistic not appropriate to sample size. The sign patterns of the residuals from each regression were therefore examined through contingency tables. The appropriate X^2 test could not reject the hypothesis of zero correlation even at the 10% level. While autocorrelation is clearly rejected in all cases, this rejection is least emphatic in the case of the UK, which is what the DW statistics would have indicated.

The US, Canada and Germany have non-significant coefficients in both sub-samples and the whole sample. The size of the coefficient does increase quite considerably in absolute terms in

the case of France, although in both sub-periods the coefficient remains statistically (very) significant. In the case of Japan a very stable coefficient has a very different standard error (hence t-statistic) between the two samples. Only in the case of the UK does the sign of the coefficient vary pre- and post 1970/1: from being non-significant (and positive) to being significantly negative.

That the relative changes in the size of the coefficient between countries is not reflected exactly in the relative size of the calculated F* values is due to the additional factor of changed standard errors between the two samples.

To conclude on the question of parameter stability, the change in the correlation for UK data is in line with that suggested by the original graphing and plotting of the data series. That suggested that the resulting negative coefficient on the whole sample was due to the presence of a few outliers within the latter part of the wage data series. If so, this would suggest heteroscedasticity, as tested for in the following section.

Heteroscedasticity

Several of the regression equations were tested for the null hypothesis of the error terms being homoscedastic, against the alternative hypothesis of their being heteroscedastic. This section reports the results for the regression of the non-trend wage series on the non-trend employment series, reported in chapter 5, table 1, and tested for parameter stability in the previous section.

Again, the procedure is as described above for tests on the chapter 4 data.

The results are reported in table 5.

Table 5. Test for Heteroscedasticity

	F*
US	3.49*
Canada	1.04
Japan	1.03
France	2.45
Germany	(2.08)
UK	5.08**

Notes: 1. $F_{(10,10)}$ 5% = 2.98 *
1% = 4.85 **

2. The calculated value of F* for Germany, in brackets, was calculated by dividing the sum of squared residuals from the regression run with the smaller values of the percentage deviation of employment from trend by the sum of squared residuals from the other regression, rather than the other way round as was the case for all other values.

Of the six countries' equations, only the US and the UK indicate heteroscedasticity at the 95% level, and only the UK at the 99% level. The heteroscedasticity indicated by the UK results appears to be a result of the same parameter instability pre- and post-1970/1 which was demonstrated in the previous section. Of the 11 years with the largest absolute size of employment deviation from trend the majority (7) are 1970 and after.

Higher order serial correlation

The final test is the Lagrange Multiplier test (Breusch & Pagan, 1980) for up to 5th order residual serial correlation. The procedure is as set out above. The results for the calculated test statistics for the basic regression, of non-trend earnings on non-trend employment, are reported for each country in table 6.

Table 6. Higher Order Serial Correlation

	$N.\bar{R}^2$
US	11.75*
Canada	16.43*
Japan	4.62
France	8.24
Germany	8.68
UK	12.09*

Note: For 5 degrees of freedom,
$P(X^2\ 11.07) = 0.05$ *
$P(X^2\ 15.09) = 0.01$ **
$P(X^2\ 16.75) = 0.005$ ***

There appears slightly more evidence of higher order serial correlation in these results than in the previously reported results for the regression equation of non-trend wages on cyclical output reported in table 2 above, for the chapter 4 data (equation 4). Again, Canada is the only case exhibiting such correlation with 99% or greater probability, and again in no cases are the results significant at the 0.005 level. In the results reported here, however, the US and UK now demonstrate such correlation at the 95% probability level. Again, then, of the three statistical tests, this last comes closest to suggesting that testing for possible correlation between the two series in the fashion reported here is invalid. On the other hand, the alternatives (taken to overcome this problem of higher order serial correlation) may get no closer to measuring the possibility of such a correlation.

First, if the correlation test were treated as an equation-estimation exercise which was susceptible to equation re-specification, then any additional variable introduced alongside cyclical output would immediately obscure the actual behaviour of wages in relation to cyclical output. The relation

between non-trend wages and the additional explanatory variable might itself be responsible for changes in wages. When this is combined with the apparent behaviour of wages over the output cycle as indicated by the coefficient on the cyclical-output variable, the resulting pattern of wage fluctuations over time ('pattern' not being meant to necessarily imply a non-random walk pattern) might differ in relation to the output cycle from that implied by the coefficient on the output cycle term alone. Thus, for example, the coefficient on output might imply a definate cyclical behaviour of wages, but when the additional behaviour of wages related to the additional variable is added, the composite behaviour of non-trend wages might no longer bear any significant relation to the output cycle.

Second, it may be the cyclical form the series are in which needs correcting: but then that is the data form with which a test for cyclical patterns is interested.

This is not to say that if serial correlation is present it should not be tackled. Only that the cure might be as bad as the original problem in terms of the correlation being described.

Lastly, however, three of the six countries show no such higher order serial correlation. These include the two with the most 'definite' (non random walk) correlation coefficients. For this latter reason, at least, the results are left as reported above.

Appendix 5. DATA

Chapter 4.

The major problem in choosing data series for individual countries for use in an international study is to use series which are as comparable as is possible. In all cases, therefore, data were taken from sources which were reporting data for all the countries here covered. The source appearing to make the greatest effort at such comparability is the unpublished US Department of Labor (1983a) and (1983b) which were, therefore, the sources used in all appropriate cases. Where these were not suitable, or not adequate, data were taken from OECD and UN sources.

Abbreviations used in the notes to data tables for data sources are as follows:

US_BLS (1983a): 'Output per hour, hourly compensation and unit labor costs in manufacturing. Eleven countries, 1950-1982. Index tables'
unpublished
Prepared by: US Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, May 1983. Including revised data released July 29, 1983.

US_BLS (1983b): 'Underlying data for indexes of output per hour, hourly compensation, and unit labor costs in manufacturing, eleven countries, 1950-82'
unpublished
Prepared by: US Department of Labor, (as above).

MEI: OECD Main Economic Indicators (1984) (April)
(1984a) (March)
(1982) (March)
(1982a) (April)
(1981) (March)
(1981a) (December)
(1979) (March)
(1962) (February)

MEI HS: OECD Main Economic Indicators Historical Statistics 1960-1979
HSa: 1955-1964
HSb: 1955-1971

OEEC: Organisation for European Economic Co-operation Statistical Bulletin, November 1960

Japan-SY: Japan Statistical Yearbook, various issues
UN-SY: United Nations Statistical Yearbook, various issues
MBS: United Nations Monthly Bulletin of Statistics, various issues

Tables 1 to 4 give the original series for output, nominal wages, output prices and material prices.

A five year moving average of output per hour [source: US BLS (1983a) Table 2, 'Output per hour in manufacturing'; for the US and Canada the data related to all employed persons (wage & salary earners, the self-employed, and unpaid family workers); and for all other countries to all employees (wage & salary earners)] was used to proxy trend inputs per hour for use as a weight for cost of materials used per hour so that the price of materials becomes comparable with the price of labour used per hour (which even in real terms has a strong upward trend). This then allows the two indices (cost of labour used per hour, and cost of non-labour direct costs used per hour) to be combined in a total direct costs index. The resulting series for the cost of materials used per hour is given in table 5. The combined index for the cost of labour and non-labour direct costs used per hour, in product terms, is given in table 6.

Table 1. Output (Q)

	QUS	QC	QJ	QF	QG	QUK
1950	38.6	27.5	3.7	22.5	18.0	52.3
1951	43.0	29.9	5.2	24.6	20.7	53.8
1952	44.5	31.0	5.6	25.0	23.5	51.1
1953	47.5	33.2	6.9	25.7	26.2	54.8
1954	44.1	32.5	7.6	26.9	29.1	57.7
1955	48.9	35.6	8.2	28.5	33.9	61.4
1956	49.2	39.0	10.1	31.2	36.4	61.2
1957	49.5	38.9	12.0	33.0	38.7	62.7
1958	45.2	38.2	11.8	34.1	40.3	62.2
1959	50.5	40.9	14.3	35.5	43.9	65.7
1960	50.7	41.7	17.9	38.5	49.2	71.0
1961	50.7	43.3	21.5	41.0	52.6	71.1
1962	55.1	47.3	23.3	43.8	55.0	71.3
1963	59.6	50.5	26.0	47.2	56.4	73.8
1964	63.9	55.4	30.2	50.7	61.5	80.6
1965	69.8	60.4	31.4	52.8	66.4	82.9
1966	75.1	64.9	35.6	57.3	67.4	84.3
1967	75.0	66.8	42.7	59.7	66.0	84.9
1968	79.1	71.0	49.3	63.6	73.1	90.9
1969	81.7	76.3	57.3	69.4	81.9	94.3
1970	77.0	75.3	65.3	73.9	86.0	94.7
1971	78.7	79.7	69.4	78.6	86.9	93.6
1972	86.2	85.8	76.7	83.5	89.7	95.9
1973	95.9	94.9	87.4	89.3	95.2	104.7
1974	91.9	98.3	85.7	92.1	95.0	103.5
1975	85.4	92.6	82.2	90.2	90.4	96.2
1976	93.6	98.0	93.2	96.5	97.6	98.2
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	105.3	105.2	107.3	103.2	101.3	100.6
1979	108.2	111.4	118.0	105.9	106.1	100.7
1980	103.5	108.1	129.1	105.8	106.7	91.5
1981	106.5	110.4	130.4	103.0	105.1	85.7
1982	99.1	96.8	130.8	102.9	102.3	85.0

Notes: 1. Series' labels take the same form in each of the following tables, the first letter or letters denoting the economic variable (in this case output, denoted by 'Q'), the remaining letters denoting the country, namely:
   - US: USA
   - C: Canada
   - J: Japan
   - F: France
   - G: Germany
   - UK: United Kingdom

2. Source: US_BLS (1983a)
3. Output in manufacturing, indexes, 1977 = 100.

Table 2. Nominal Wages (W)

	WUS	WC	WJ	WF	WG	WUK
1950	21.5	14.9	3.7	6.2	8.4	8.0
1951	23.6	16.8	4.7	8.0	9.6	8.7
1952	25.2	18.5	5.4	9.2	10.3	9.6
1953	26.5	19.4	5.7	9.5	10.8	10.1
1954	27.7	20.5	6.2	10.1	11.1	10.6
1955	28.8	21.1	6.5	10.8	11.9	11.4
1956	30.6	22.3	6.8	11.8	12.9	12.4
1957	32.5	23.8	7.1	12.7	14.4	13.2
1958	33.9	25.0	7.3	14.1	15.6	14.1
1959	35.2	26.0	8.1	14.9	16.9	14.5
1960	36.7	27.3	8.9	16.1	18.9	15.5
1961	37.7	28.0	10.4	17.8	21.2	16.7
1962	39.1	28.8	11.8	19.6	24.0	17.6
1963	40.3	29.9	13.2	21.5	25.6	18.4
1964	42.0	31.0	14.9	23.2	27.5	19.7
1965	42.8	32.6	16.7	25.0	30.3	21.6
1966	44.8	35.1	18.5	26.7	32.8	23.5
1967	47.0	37.8	20.7	28.9	34.6	24.2
1968	50.4	40.6	24.1	32.8	36.7	26.0
1969	53.9	43.6	28.5	34.0	39.9	28.4
1970	57.6	46.9	33.9	38.0	46.3	32.3
1971	61.1	50.5	39.3	42.5	52.0	37.0
1972	64.4	54.1	45.4	47.5	57.6	41.9
1973	69.0	59.6	55.7	54.1	65.0	46.7
1974	76.3	69.1	73.0	64.7	74.7	58.3
1975	85.4	78.9	85.4	77.0	84.0	75.8
1976	92.3	90.1	91.1	87.9	90.5	88.8
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	108.3	106.7	105.9	112.8	108.5	116.5
1979	118.8	117.5	112.8	128.1	116.4	138.7
1980	132.7	129.3	120.2	146.6	126.7	172.5
1981	145.8	143.7	128.5	168.6	136.1	200.2
1982	158.2	159.5	132.9	199.7	143.4	218.3

Notes: 1. Source: US BLS (1983a)

2. 'Hourly compensation in manufacturing, national currency basis'Compensation adjusted to include changes in employment taxes that are not compensation to employees, but are labor costs to employers. The data relate to all employed persons (wage and salary earners, the self-employed, and unpaid family workers) in the US and Canada, and all employees (wage and salary earners) in other countries.

Table 3 Output Prices (P)

	PUS	PC	PJ	PF	PG	PUK
1950	41.5	44.2	36.1	27.5	49.0	21.2
1951	46.2	50.2	50.1	36.9	57.6	24.9
1952	45.0	47.3	51.1	36.2	59.3	25.4
1953	44.3	46.2	51.3	36.2	57.6	24.9
1954	44.4	45.4	50.9	36.2	56.4	24.9
1955	44.6	42.6	50.0	34.1	58.1	25.9
1956	45.9	43.9	52.2	36.6	59.3	27.1
1957	47.5	45.1	53.8	41.3	60.4	28.0
1958	48.6	45.2	50.3	45.3	61.0	28.4
1959	48.5	45.8	50.7	43.4	60.4	28.6
1960	48.9	45.9	51.8	44.9	61.6	29.1
1961	48.6	46.4	56.0	46.4	62.5	29.9
1962	48.6	46.9	55.1	46.8	63.3	30.2
1963	48.5	47.5	56.1	48.2	63.6	30.4
1964	48.8	47.9	56.2	49.7	64.3	31.0
1965	49.4	48.6	56.7	49.7	65.9	31.8
1966	50.4	49.9	57.9	51.2	67.0	32.7
1967	51.2	50.9	59.1	50.6	66.4	32.9
1968	52.5	52.0	59.1	49.7	65.7	34.2
1969	54.3	53.9	60.1	55.0	67.1	35.3
1970	56.3	55.2	62.2	59.1	70.5	37.9
1971	58.4	56.4	61.5	60.3	73.5	41.8
1972	60.5	58.9	62.1	63.3	75.2	44.3
1973	64.5	65.5	71.4	72.2	80.4	47.8
1974	78.8	79.6	89.9	93.4	91.1	63.9
1975	87.9	88.4	92.4	88.1	94.0	72.5
1976	93.5	92.9	97.3	94.7	97.3	84.7
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	107.3	108.4	99.2	100.8	100.9	109.3
1979	120.9	124.1	104.2	105.9	106.3	124.3
1980	137.1	140.7	119.5	115.1	114.3	146.6
1981	149.9	155.1	120.9	130.5	121.4	157.6
1982	156.0	164.4	121.4	142.0	127.3	168.4

Source: US 1982 MEI (1984, p22)
- 1980-81 MEI (1982, p20)
- 1960-79 MEI HS p72
- 1955-59 MEI HSa p77
- 1950-54 OEEC (1960, p50)

C 1982 MEI (1984, p22)
- 1980-81 MEI (1982, p20)
- 1979 MEI (1981, p166)
- 1976-78 MEI (1979, p64)
- 1960-75 MEI HS p32
- 1955-60 MEI HSa p32
- 1950-54 OECC (1960)

J 1982 MEI (1984, p22)
- 1980-81 MEI (1982, p20)
- 1967-79 MEI HS p118
- 1960-67 Japan-SY (1968, p369)
- 1954-59 Japan-SY (1962, p333)
- 1952-53 Japan-SY (1955/6, p321)
- 1950-51 Japan-SY (1953, p307)

F 1981-82 MEI (1984, p22)
- 1979-80 MEI (1982)
- 1977-78 MEI (1981, p110)

1968-76 UN-SY (1979/80, p714)
1959-67 UN-SY (1969, p518)
1950-58 UN-SY (1959, p435)
G 1982 MEI (1984, p22)
1980-81 MEI (1982a, p112)
1960-79 MEI HS p338
1956-59 MEI (1962, p11)
1950-55 OEEC (1960, p50)
UK 1981-82 MEI (1984a, p166)
1980 MEI (1981a)
1960-79 MEI HS p604
1955-59 MEI HSb p460
1950-54 UN-SY (1959, p472)

Table 4. Input Prices for Materials (M)

	MUS	MC	MJ	MF	MG	MUK
1950	48.9	40.8	21.2	26.0	45.8	19.1
1951	56.0	45.5	25.4	39.2	57.8	26.7
1952	51.3	42.0	32.1	36.8	62.9	22.3
1953	47.5	39.6	31.9	34.6	59.9	20.1
1954	47.0	39.2	30.8	33.3	57.6	19.7
1955	45.1	40.0	32.3	34.0	61.7	21.1
1956	45.3	41.2	33.7	35.5	62.4	21.6
1957	46.4	39.9	36.2	37.1	62.9	22.3
1958	47.4	39.9	32.7	37.8	62.9	20.4
1959	46.2	40.2	33.2	41.0	62.4	20.5
1960	45.1	40.0	33.8	42.1	62.9	20.7
1961	44.9	40.5	35.7	43.3	62.9	20.7
1962	45.3	42.7	34.6	43.2	62.9	20.5
1963	44.3	43.3	36.1	44.6	62.9	20.7
1964	43.9	43.1	36.6	48.0	64.1	21.6
1965	65.6	44.1	36.8	48.4	65.5	22.1
1966	49.1	46.3	39.1	50.1	66.3	22.8
1967	46.5	46.9	40.3	48.8	64.0	22.5
1968	47.2	47.5	40.8	47.7	63.7	25.0
1969	50.4	49.6	42.1	54.6	65.6	26.0
1970	52.2	50.5	43.3	59.9	68.7	26.7
1971	53.4	48.7	41.9	58.0	70.3	27.6
1972	59.7	52.3	43.3	59.3	72.1	28.7
1973	81.2	70.5	53.7	74.8	79.0	37.7
1974	91.6	89.8	89.6	98.7	93.7	61.2
1975	92.2	89.8	94.4	81.9	94.5	70.5
1976	95.8	91.3	102.2	92.5	99.6	89.4
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	112.1	107.1	86.6	101.6	100.2	98.0
1979	131.2	126.1	106.6	114.7	106.5	118.2
1980	145.6	144.4	149.7	122.2	116.9	151.6
1981	157.3	172.0	155.4	136.4	126.7	164.9
1982	152.7	186.3	165.4	143.8	133.8	176.2

Source: US 1979-82 MBS (1984, p180)
1972-78 UN-SY (1979/80, p718)
1955-71 MEI HSb p77
1950-54 UN-SY (1957, p472)
C 1979-1982 MBS (1984, p170)
1972-1978 UN-SY (1979/80, p713)
1955-71 MEI HSb p30
1950-54 UN-SY (1957, p463)

J 1979-82 MBS (1984, p176)
1972-78 UN-SY (1979/80, p176)
1955-71 MEI HSb p169
1950-54 Japan-SY (1957, p317)
F 1981-82 MEI (1984a, p118)
1980 MEI (1981, p116)
1960-79 MEI HS p296
1955-59 MEI HSb p234
1950-54 UN-SY (1957, p469)
G 1981-82 MEI (1984a, p124)
1980 MEI (1981a, p122)
1960-79 MEI HS p340
1952-59 UN-SY (1961, p476)
1950-51 UN-SY (1953, p406)
UK 1981-82 MEI (1984a, p166)
1980 MEI (1981a, p164)
1960-79 MEI HS p605
1955-59 MEI HSb p461
1950-54 UN-SY (1957, p472)

Table 5. Cost of Materials used per hour, Nominal

	MUS	MC	MJ	MF	MG	MUK
1950	24.6	14.0	2.2	6.5	10.2	8.2
1951	28.8	16.4	2.8	10.3	13.6	11.7
1952	27.0	15.8	3.8	10.2	15.7	10.0
1953	25.7	15.6	4.2	10.0	15.8	9.1
1954	25.8	16.1	4.3	10.1	16.1	9.0
1955	25.3	17.0	4.9	10.7	18.3	10.0
1956	25.8	18.1	5.3	11.6	19.4	10.4
1957	26.9	18.3	6.0	12.8	20.9	11.0
1958	27.8	18.9	5.9	13.7	22.2	10.4
1959	27.6	19.8	6.6	15.5	23.5	10.8
1960	27.6	20.6	7.3	16.7	25.3	11.2
1961	28.6	21.9	8.5	18.1	26.8	11.6
1962	30.1	24.0	9.1	18.9	28.5	12.0
1963	30.7	25.5	10.3	20.6	30.2	12.6
1964	31.6	26.4	11.3	23.4	32.5	13.7
1965	34.3	28.0	12.5	25.0	35.2	14.7
1966	37.4	30.7	14.8	27.8	37.8	16.0
1967	36.0	32.6	17.0	28.9	38.6	16.4
1968	37.0	34.4	19.6	29.9	40.3	18.9
1969	40.4	37.6	22.6	36.4	43.6	20.4
1970	43.2	40.3	25.9	42.3	47.9	21.9
1971	45.9	40.8	27.8	43.1	51.4	23.6
1972	52.7	45.6	31.1	46.2	55.2	25.5
1973	73.9	63.6	41.1	61.0	63.8	34.5
1974	86.0	83.5	73.5	85.4	80.3	57.8
1975	88.7	86.0	82.6	73.9	85.6	68.0
1976	93.8	89.3	95.0	87.8	94.9	87.6
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	114.0	109.5	93.5	106.6	104.4	100.6
1979	135.5	130.7	122.1	124.8	114.8	125.1
1980	152.3	149.8	179.6	138.4	129.5	165.8
1981	166.7	180.5	194.1	159.7	144.5	182.8
1982	163.8	197.5	214.7	173.9	157.1	197.9

Table 6. Total Direct Costs used per hour, in product terms (DC)

	DCUS	DCC	DCJ	DCF	DCG	DCUK
1950	54.3	33.1	9.0	22.9	18.1	38.1
1951	54.7	33.2	8.2	23.7	18.5	39.2
1952	57.3	37.4	9.6	26.2	19.7	38.3
1953	59.2	39.4	10.2	26.7	21.0	39.2
1954	61.1	42.1	11.1	27.9	22.0	40.5
1955	62.0	46.5	12.0	31.3	23.3	42.2
1956	63.3	47.9	12.2	32.1	24.7	43.2
1957	64.7	48.9	12.5	30.8	26.6	44.4
1958	65.7	51.2	13.7	30.8	28.4	45.1
1959	67.5	52.5	15.1	34.8	30.8	46.1
1960	69.1	54.8	16.3	36.3	33.4	48.2
1961	71.5	56.2	17.5	38.6	36.2	50.1
1962	74.4	58.3	19.9	41.8	39.7	51.8
1963	76.7	59.9	22.0	44.0	42.1	53.8
1964	79.3	61.8	24.6	46.8	44.8	56.8
1965	81.1	64.2	27.3	50.3	47.9	60.4
1966	84.1	67.5	27.3	52.8	50.9	63.9
1967	84.7	71.0	33.2	57.0	53.7	65.3
1968	87.7	74.4	38.4	64.1	57.3	68.9
1969	91.2	77.4	44.5	63.2	60.9	72.6
1970	94.0	81.2	50.6	66.6	66.3	75.7
1971	96.1	84.2	58.3	70.8	70.5	77.4
1972	100.2	87.0	66.2	74.4	75.8	81.7
1973	109.5	93.0	71.8	78.0	80.5	88.8
1974	100.8	92.5	81.4	76.3	83.6	91.0
1975	98.4	91.8	91.5	86.2	89.9	100.9
1976	99.3	96.7	94.8	92.8	94.2	104.3
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	102.6	99.2	103.0	109.9	106.4	101.5
1979	102.7	98.1	111.0	120.0	109.1	107.7
1980	101.5	96.5	115.6	125.1	111.5	116.1
1981	101.8	100.2	122.7	127.0	113.9	123.2
1982	102.6	104.3	129.7	134.8	115.5	125.4

Chapter 5.

The data sources are as reported for chapter 4, with the exception of total hours worked in manufacturing, and total employment in manufacturing, both of which were introduced in chapter 5 and which are reported in tables 7 and 8 respectively.

Table 7. Total hours in manufacturing (E)

	EUS	EC	EJ	EF	FG	EUK
1950	78.2	79.3	40.8	89.0	81.9	116.0
1951	84.2	82.8	46.1	92.3	91.2	119.8
1952	85.4	83.7	47.3	90.9	94.5	118.6
1953	89.8	86.7	51.5	88.7	98.5	121.2
1954	82.1	81.3	52.7	90.1	105.3	123.6
1955	86.6	83.6	54.4	91.3	115.1	127.1
1956	87.9	87.8	62.9	92.4	120.3	126.8
1957	86.5	87.0	68.4	96.4	117.8	126.6
1958	79.4	82.6	71.9	96.4	116.8	123.2
1959	84.7	84.1	74.8	94.2	117.5	125.2
1960	84.4	82.6	81.5	96.9	123.1	127.7
1961	82.3	81.5	86.4	98.7	124.9	126.8
1962	85.6	84.6	89.8	100.7	122.8	124.0
1963	86.5	87.0	92.7	102.9	120.3	121.9
1964	88.4	91.3	95.0	104.7	121.7	124.2
1965	93.6	96.0	94.7	103.2	123.4	123.7
1966	99.8	99.8	97.5	104.5	120.9	121.3
1967	99.6	99.6	101.9	103.5	111.2	116.7
1968	101.4	99.0	104.5	98.7	115.2	116.6
1969	103.1	100.5	105.3	104.0	121.9	118.1
1970	97.3	97.7	106.4	105.4	126.0	117.6
1971	93.7	96.6	106.3	106.4	122.3	111.9
1972	97.8	99.6	105.5	106.7	118.6	106.3
1973	103.2	103.6	109.0	108.3	118.8	109.3
1974	101.2	105.0	104.3	108.1	112.4	107.2
1975	91.4	101.4	96.4	102.6	101.6	101.7
1976	95.9	102.0	99.9	101.5	102.4	99.8
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	104.5	103.4	99.5	97.7	98.1	97.4
1979	106.6	106.4	100.5	95.7	98.0	94.3
1980	101.8	105.7	103.0	94.0	97.1	84.7
1981	101.2	107.0	103.2	90.0	93.2	75.0
1982	93.0	96.6	102.5	84.2	89.2	71.9

Source: US BLS (1983a, table 4)

Table 8. Employment in manufacturing (N)

	NUS	NC	NJ	NF	NG	NUK
1950	78.0	73.1	37.8	79.5	62.7	101.2
1951	83.7	77.6	41.9	81.9	70.3	103.7
1952	84.9	79.4	42.6	81.8	72.7	103.4
1953	89.5	81.8	45.9	80.0	75.8	104.8
1954	83.3	78.2	47.1	80.3	80.4	106.2
1955	86.1	80.1	48.1	81.2	88.0	108.8
1956	87.8	83.4	53.9	82.7	94.0	109.5
1957	87.5	83.8	59.0	85.6	97.2	109.5
1958	81.3	79.5	62.5	86.7	98.2	107.7
1959	85.0	80.4	64.0	85.2	99.2	108.6
1960	85.6	79.6	69.0	86.5	104.4	111.8
1961	83.2	79.0	74.4	87.7	108.2	112.6
1962	85.8	81.1	79.3	89.3	109.0	111.3
1963	86.4	83.1	82.5	91.7	108.4	109.5
1964	87.7	86.9	85.2	93.9	109.2	110.7
1965	91.8	91.4	86.5	93.4	111.7	112.0
1966	97.4	95.7	88.6	94.3	111.2	111.9
1967	98.6	96.1	92.4	94.1	104.4	108.6
1968	100.3	95.4	95.1	92.8	105.8	107.6
1969	102.2	97.3	97.3	95.2	111.8	109.0
1970	98.2	95.0	99.5	97.6	116.0	110.3
1971	94.4	94.5	101.1	99.2	115.2	107.6
1972	97.1	97.5	100.9	100.6	112.9	103.3
1973	102.2	101.9	104.9	103.0	113.7	104.7
1974	101.8	103.9	105.2	104.4	110.7	106.7
1975	93.0	101.6	99.8	101.5	103.3	102.6
1976	96.5	102.0	100.2	100.5	100.8	100.4
1977	100.0	100.0	100.0	100.0	100.0	100.0
1978	104.2	103.2	98.9	98.4	99.4	97.6
1979	107.0	106.9	98.8	96.6	99.8	95.1
1980	103.3	106.6	101.3	95.3	100.4	89.5
1981	102.7	108.6	102.2	91.8	97.9	80.6
1982	96.1	98.6	101.7	90.0	94.3	75.9

Source: US BLS (1983a, table 5)

Chapter 6.

Pre-1963 earnings data were taken from the British Labour Statistics Historical Abstract, 1886-1968 (Department of Employment and Productivity, London HMSO 1971) which gives an index of average hourly earnings for full time manual workers in UK manufacturing industry (p.161, table 85). These data are reproduced in table 9.

Table 9. Average hourly earnings

Date	Male	Females
1948	59.1	60.1
	61.0	61.2
1949	61.6	63.2
	62.8	64.6
1950	63.9	66.0
	65.2	67.4
1951	68.5	71.4
	71.5	74.2
1952	75.3	77.3
	76.8	78.8
1953	79.7	81.9
	81.1	83.6
1954	84.2	85.8
	86.5	88.4
1955	91.4	92.1
	93.7	94.6
1956	99.3	98.6
	100.7	101.4
1957	102.3	103.7
	107.6	107.6
1958	108.6	109.1
	110.9	111.3
1959	112.9	113.0
	115.3	115.9
1960	122.2	121.2
	125.1	124.3
1961	130.3	130.0
	132.7	132.0
1962	135.8	135.1
	138.3	138.5
1963	140.9	140.7
	144.5	144.1
1964	151.2	150.3
	155.6	154.3
1965	162.7	160.5
	171.0	168.7
1966	178.2	176.6
	180.5	179.7
1967	182.8	182.3
	188.9	188.2
1968	195.6	194.1
	201.6	200.9

Notes to table 9:

1. The index is given twice yearly, for April and for October.
2. The 1948 Standard Industrial Classification (SIC) was introduced in October 1948 and the 1958 SIC in October 1959. In each case the coverage of this table was affected, but only marginally, and the indices have been linked to take account of this factor.
3. Postmen and dockworkers previously on daily or half daily engagements were included in earnings surveys from October 1967 but for purposes of comparability they have been excluded from the calculations for this table.

Apart from not being quarterly, the immediate drawback is that the data are given separately for males and for females. The two indices reported in table 9 had, therefore, to be weighted to construct a single index for employees earnings. The Historical Abstract gives figures for number of employees in employment by industrial order, 1948-1968 (Table 133 for Males, Table 134 for Females), as shown in table 10.

An index was then constructed for average hourly earnings (E), for all employees (male plus female), as [(ME*MN)+(FE*FN)]/N, as shown in table 11.

Table 10. UK Manufacturing Industry: number of employees (N)

Year	UNLINKED Males (MN)	UNLINKED Females (FN)	MN	FN	N
1948	5433.1	2694.9	5092.1	2592.4	7684.5
1949	5543.3	2751.3	5195.4	2646.7	7842.1
1950	5657.1	2862.6	5302.1	2753.8	8055.9
1951	5761.5	2984.4	5399.9	2870.9	8270.8
1952	5794.6	2874.7	5430.9	2765.4	8196.3
1953	5829.8	2917.3	5463.9	2806.4	8270.3
1954	5956.5	3017.0	5582.7	2902.3	8485.0
1955	6119.1	3103.2	5735.1	2985.2	8720.3
1956	6199.0	3093.6	5810.0	2976.0	8786.0
1957	6224.0	3061.1	5833.4	2944.7	8778.1
1958	6218.5	2964.9	5828.2	2852.2	8680.4
1959	6196.8	2924.9			
59	5717.9	2776.0	5807.9	2813.7	8621.6
1960	5949.1	2901.4	6042.7	2940.8	8983.5
1961	6046.2	2926.0	6141.4	2965.7	9107.1
1962	6015.8	2877.5	6110.5	2916.6	9027.1
1963	5936.5	2816.7	6029.9	2854.9	8884.8
1964	6016.0	2864.9			
64	6025.2	2882.9	6110.7	2903.8	9014.5
1965	6133.1	2895.2	6220.1	2916.2	9136.3
1966	6139.9	2915.0			
66	6227.0	2936.1	6227.0	2936.1	9163.1
1967	6082.0	2796.4	6082.0	2796.4	8878.4
1968	6018.1	2772.1	6018.1	2772.1	8790.2

Notes: 1. These data refer to 'number of employees' while the earnings data referred to 'full time manual workers'. Also, these data were only available annually, so the annual data were used to proxy for both the April and October earnings data for that year. The data had to be taken from numerous editions of the Monthly Digest of Statistics, as there is no long-run historical table.

2. The original data (unlinked) are shown, as well as the linked data, calculated by multiplying the 1965 and 1964 Males figures by 6227/6139.9; the 1963, 1962, 1961, 1960 and 1959 figures by 6110.7/6016 [where 6110.7 = 6025.2*(6227/6139.9)]; and the pre-1959 figures by 5807.9/6196.8; and similarly for Female workers. The two linked series were then summed.

Table 11. UK Index for average hourly earnings (E)

Year		E
1948	April	59.4
	October	61.1
1949		62.1
		63.4
1950		64.6
		66.0
1951		69.5
		72.4
1952		76.0
		77.5
1953		80.4
		81.9
1954		84.7
		87.1
1955		91.6
		94.0
1956		99.1
		100.9
1957		102.8
		107.6
1958		108.8
		111.0
1959		113.9
		115.5
1960		121.9
		124.8
1961		130.2
		132.5
1962		135.6
		138.4
1963		140.8
		144.4
1964		150.9
		155.2
1965		162.0
		170.3
1966		177.7
		180.2
1967		182.6
		188.7
1968		195.1
		201.4

From 1963, weekly earnings figures for all employees in manufacturing, were taken from OECD p.603. These are for Great Britain rather than the UK, so when linking with the above statistics these data were linked to the previous, rather than linking backwards as is normal. Also, there is no reading for 1972 I, which is, therefore, taken to be (1971 IV + 1972 II)/2.

These data refer to weekly earnings. As has been seen, however, weekly earnings may have a cyclical movement caused by fluctuations in hours worked, and so the weekly earnings data were divided by the weekly hours of work figure (from OECD p.602) to obtain earnings per hour. Note that 1971 I is calculated as above. E/H is, then, E divided by H, all multiplied by 100.

The pre-1963 quarterly earnings data had to be derived by interpolating the half-yearly.

The earnings data were adjusted to include employers national insurance contributions.

Prices

The above data are, of course, still in money terms. This series was then deflated by the price index of the output of all manufactured products. From April 1948 to October 1961 these data were collected from various issues of the Central Statistical Office's Monthly Digest of Statistics, the various series then being linked. This series was then linked to the OECD's (p.604) data from 1960. The OECD series is excluding food, beverages and tobacco, although this is unlikely to affect the cyclical findings aggregated over manufacturing industry as a whole.

Output

All data were collected in seasonally unadjusted form, for reasons discussed below (Appendix 7). Unfortunately, however, the CSO's Economic Trends does not give seasonally unadjusted data. The OECD, which does give these data, does not give them to sufficient significant places to allow cyclical analysis. An index was therefore compiled from various issues of the CSO's Monthly Digest of Statistics, calculated from monthly data (quarterly not being given). In fact even this has now ceased to show unadjusted data, although they remain available by writing directly to the CSO.

The resulting data series used (prior to detrending) are reproduced in the following tables:

12 Output
13 Nominal earnings
14 Wholesale price index
15 Price index for materials inputs
16 Output per hour

Table 12. Output

	I	II	III	IV
1948	45.8	44.4	43.5	47.1
1949	48.3	49.1	46.4	51.0
1950	53.0	53.5	51.1	56.6
1951	56.0	57.8	53.3	56.6
1952	57.1	53.3	48.7	55.3
1953	56.7	56.7	53.8	60.9
1954	61.4	61.8	58.1	65.4
1955	67.1	66.5	60.9	69.0
1956	67.1	65.9	60.1	67.1
1957	67.9	66.7	62.8	68.3
1958	67.9	65.7	60.8	67.9
1959	66.9	70.9	65.6	75.5
1960	76.6	76.4	70.9	77.7
1961	76.8	77.7	71.3	76.6
1962	76.4	77.5	72.4	77.7
1963	76.6	79.2	75.9	83.8
1964	84.3	87.3	80.1	88.9
1965	89.8	89.1	82.5	91.3
1966	92.4	90.6	84.3	89.5
1967	88.4	90.9	82.5	92.0
1968	93.3	93.9	88.0	98.0
1969	96.2	97.5	90.9	100.1
1970	97.2	98.6	91.4	101.7
1971	98.2	98.3	91.7	100.0
1972	96.7	101.1	95.2	107.8
1973	111.1	110.8	103.8	113.0
1974	106.5	108.7	103.2	108.4
1975	105.3	100.7	93.9	102.6
1976	102.8	102.2	97.1	106.2
1977	106.7	101.7	97.0	104.8
1978	104.3	105.5	99.6	105.4
1979	104.5	107.3	98.0	106.3

Table 13. Nominal earnings

	I	II	III	IV
1948	58.4	59.4	60.2	61.1
1949	61.6	62.1	62.8	63.4
1950	64.0	64.6	65.3	66.0
1951	67.8	69.5	71.0	72.4
1952	74.2	76.0	76.8	77.5
1953	79.0	80.4	81.2	81.9
1954	83.3	84.7	85.9	87.1
1955	89.4	91.6	92.8	94.0
1956	96.6	99.1	100.0	100.9
1957	101.8	102.8	105.2	107.6
1958	108.2	108.8	109.9	111.0
1959	112.4	113.9	114.7	115.5
1960	118.7	121.9	123.4	124.8
1961	127.5	130.2	131.4	132.5
1962	134.0	135.6	137.0	138.4
1963	139.6	141.2	141.7	143.3
1964	149.2	150.2	150.7	153.9
1965	161.4	162.4	163.5	166.7
1966	174.1	177.8	175.7	177.8
1967	179.4	182.6	184.7	187.9
1968	196.4	197.5	197.5	201.2
1969	208.6	211.3	212.9	220.8
1970	231.4	238.9	245.2	255.8
1971	265.4	275.5	276.5	284.5
1972	305.2	304.7	311.6	323.8
1973	330.7	339.7	346.6	363.6
1974	388.5	391.2	422.5	460.2
1975	491.5	512.8	546.2	572.2
1976	596.1	614.1	620.0	639.1
1977	653.9	668.8	667.2	707.6
1978	730.4	772.3	780.8	813.7
1979	846.6	891.7	889.1	961.3

Table 14. Wholesale Price Index

	I	II	III	IV
1948	22.7	23.2	23.3	23.2
1949	23.3	24.2	24.2	25.2
1950	25.8	26.8	28.0	30.2
1951	32.2	33.7	34.0	34.7
1952	35.0	34.6	34.2	34.3
1953	34.4	34.9	34.5	34.4
1954	34.3	34.5	34.7	34.8
1955	35.1	35.5	35.9	36.3
1956	36.9	37.3	37.5	37.7
1957	38.8	38.8	38.8	39.0
1958	39.0	39.1	39.1	39.2
1959	39.3	39.2	39.2	39.3
1960	39.4	39.7	39.9	40.0
1961	40.4	40.6	41.1	41.3
1962	41.6	41.7	41.8	41.9
1963	42.0	42.2	42.2	42.5
1964	42.8	43.4	43.7	43.9
1965	44.4	45.1	45.3	45.5
1966	45.9	46.2	46.5	46.5
1967	46.6	46.6	46.9	47.1
1968	48.0	48.6	48.9	49.2
1969	49.9	50.3	50.7	51.2
1970	52.3	53.5	54.6	56.0
1971	57.5	58.8	59.7	60.0
1972	60.6	61.4	62.5	63.9
1973	64.7	65.0	67.2	69.9
1974	75.2	80.5	83.7	88.0
1975	93.7	98.5	101.2	105.7
1976	110.3	114.5	119.2	125.2
1977	133.0	139.6	143.8	145.8
1978	149.2	151.8	154.8	157.3
1979	161.6	168.0	176.4	181.8

Table 15. Price index for materials inputs

	I	II	III	IV
1948	20.9	22.1	22.3	22.6
1949	22.8	22.6	21.4	23.9
1950	25.3	26.7	30.7	36.8
1951	45.0	43.4	39.0	39.1
1952	37.9	35.0	33.8	32.9
1953	32.5	31.7	30.8	30.6
1954	30.4	31.1	30.9	31.8
1955	32.5	32.2	33.5	33.1
1956	33.4	33.4	33.5	34.2
1957	34.5	33.8	32.8	31.5
1958	30.9	31.2	31.2	31.2
1959	31.3	31.2	31.4	31.7
1960	31.8	31.7	31.2	31.2
1961	31.1	31.2	31.0	30.8
1962	31.4	31.1	30.7	31.0
1963	31.5	31.6	31.4	32.8
1964	32.9	32.8	33.1	33.7
1965	33.6	33.6	33.3	33.6
1966	34.3	34.9	34.3	34.1
1967	33.8	33.6	33.7	35.8
1968	37.6	36.9	37.0	37.3
1969	37.9	38.4	38.7	39.7
1970	40.4	40.6	40.6	41.3
1971	41.9	42.7	43.0	42.6
1972	43.0	43.2	44.5	47.0
1973	51.3	54.2	61.3	68.2
1974	85.5	85.3	85.6	90.6
1975	92.2	95.5	101.8	110.5
1976	115.4	124.6	128.9	138.9
1977	144.8	148.8	146.5	142.2
1978	140.2	146.3	144.9	147.1
1979	153.4	163.3	169.9	183.9

Table 16. Output per hour

	I	II	III	IV
1948	65.3	63.4	67.0	66.5
1949	67.5	68.9	70.4	70.6
1950	70.8	71.8	74.0	74.9
1951	73.3	75.7	75.4	73.3
1952	75.2	70.4	69.2	72.0
1953	73.7	74.0	75.7	78.6
1954	76.9	77.6	78.6	81.2
1955	81.9	81.4	80.5	83.4
1956	81.9	80.7	79.3	81.2
1957	83.4	81.9	83.4	83.1
1958	85.1	82.4	82.4	84.3
1959	82.9	88.0	88.0	92.8
1960	93.0	93.0	93.0	93.5
1961	93.7	94.9	94.2	92.5
1962	94.7	96.1	97.1	95.4
1963	95.4	99.0	102.2	103.4
1964	103.9	108.0	106.7	108.7
1965	110.6	110.1	110.1	111.6
1966	116.1	114.2	114.9	115.6
1967	114.2	117.8	115.4	117.8
1968	120.7	121.7	123.1	125.5
1969	123.1	125.1	125.8	126.7
1970	127.2	129.2	129.2	131.6
1971	136.6	137.1	138.1	137.8
1972	137.8	144.6	147.0	152.3
1973	155.7	155.7	157.3	156.6
1974	150.1	153.7	157.3	151.3
1975	160.7	154.2	155.2	155.2
1976	158.8	158.6	162.7	162.7
1977	164.1	156.9	161.2	159.5
1978	161.2	163.6	166.7	161.4
1979	164.8	169.9	167.2	166.0

Chapter 7.

The annual UK data series from 1948 to 1974 inclusive for the seven industries and for aggregate manufacturing on output, earnings, employment and price of value added were supplied to me in their present form, already prepared (linked and so on), and are reproduced in tables 17-20 below.

The earnings data were, however, for earnings per head rather than per hour, so indices of hours actually worked had to be constructed (table 21).

Table 17. Output

	CHEM.	TEXT.	STO.	PR.	ENG.	VEH.	M.M.	MAN.
1948	297.3	1085.5	321.4	529.0	1649.8	608.5	682.9	6721.1
1949	307.5	1170.4	351.0	577.4	1771.6	653.5	686.1	7144.7
1950	348.3	1253.8	389.5	640.6	1775.3	698.6	721.5	7780.1
1951	371.0	1237.7	411.9	664.8	1863.9	714.1	749.4	8020.2
1952	350.6	1063.6	399.7	545.1	1860.2	716.9	767.6	7624.8
1953	396.0	1218.7	405.5	610.7	1886.0	814.1	761.2	8161.4
1954	433.4	1255.3	411.9	715.4	2000.5	924.0	820.2	8613.2
1955	455.0	1240.6	427.3	771.7	2151.8	1062.0	888.8	9149.8
1956	484.5	1228.9	421.5	761.4	2181.3	995.8	902.7	9135.6
1957	508.3	1220.1	408.1	777.5	2236.7	1069.1	914.5	9347.4
1958	525.3	1117.7	402.3	802.8	2221.9	1108.5	829.8	9248.6
1959	579.8	1192.3	427.3	840.7	2299.4	1200.0	866.3	9785.2
1960	639.9	1247.9	475.4	921.2	2421.2	1297.2	1004.6	10575.9
1961	651.3	1224.5	495.3	906.3	2816.2	1204.3	945.6	10590.0
1962	671.7	1188.0	504.3	905.1	2609.5	1226.8	893.1	10618.2
1963	719.3	1224.5	520.3	932.7	2631.6	1286.0	934.9	10999.5
1964	792.0	1296.2	600.5	1017.8	2853.1	1393.0	1061.4	12016.1
1965	846.4	1337.2	608.2	1039.7	2956.4	1370.5	1109.6	12369.1
1966	895.2	1335.7	603.7	1067.3	3148.3	1356.4	1047.4	12595.0
1967	938.3	1299.1	628.8	1063.8	3236.9	1331.0	986.3	12679.8
1968	1013.2	1446.9	665.3	1106.4	3377.2	1445.1	1050.7	13555.2
1969	1074.5	1468.9	667.9	1142.0	3576.5	1501.5	1075.3	14063.5
1970	1134.6	1463.0	641.6	1150.1	3690.9	1408.5	1072.1	14120.0
1971	1159.6	1495.2	693.6	1119.0	3709.4	1400.0	978.8	14063.5
1972	1219.7	1528.8	739.1	1180.0	3676.1	1460.6	979.9	14458.9
1973	1361.5	1612.2	815.5	1289.3	4056.3	1480.3	1072.1	15645.0
1974	1423.9	1508.4	748.1	1251.3	4019.4	1426.8	983.1	15263.7

Note: The eight columns represent the following:

CHEM. - Chemicals
TEXT. - Textiles
STO. - Stone etc.
PR. - Print
ENG. - Engineering
VEH. - Vehicles
M.M. - Metal Manufacturing
MAN. - Aggregate Manufacturing

Table 18. Nominal earnings per head

	CHEM.	TEXT.	STO.	PR.	ENG.	VEH.	M.M.	MAN.
1948	3.19	2.34	2.93	3.40	3.07	3.51	3.78	2.95
1949	3.41	2.46	3.28	3.57	3.02	3.77	3.99	3.08
1950	3.58	2.65	3.43	3.72	3.18	3.86	4.18	3.25
1951	4.02	2.86	3.77	4.15	3.55	4.16	4.49	3.54
1952	4.34	3.02	4.02	4.41	3.96	4.46	4.96	3.87
1953	4.58	3.29	4.45	4.83	4.19	4.89	5.16	4.13
1954	4.93	3.40	4.60	5.11	4.41	5.26	5.35	4.34
1955	5.30	3.59	4.86	5.51	4.69	5.76	5.84	4.66
1956	5.78	3.76	5.11	5.93	5.12	6.10	6.35	5.02
1957	6.12	3.97	5.50	6.35	5.42	6.49	6.81	5.34
1958	6.43	4.17	5.72	6.37	5.62	6.84	6.98	5.59
1959	6.80	4.34	5.86	6.66	5.96	7.37	7.44	5.94
1960	7.12	4.51	6.11	6.91	6.19	7.63	7.78	6.21
1961	7.52	4.74	6.45	7.25	6.58	8.11	8.01	6.56
1962	7.91	4.92	6.80	7.62	6.77	8.35	8.32	6.81
1963	8.29	5.17	7.19	7.95	6.98	8.82	8.63	7.12
1964	8.83	5.51	7.63	8.56	7.48	9.59	9.33	7.63
1965	9.64	6.50	8.16	9.11	8.07	10.41	10.01	8.23
1966	10.26	6.39	8.24	9.80	8.51	11.02	10.36	8.64
1967	10.57	6.72	8.75	10.19	8.73	11.40	10.59	9.01
1968	11.64	7.66	9.25	11.04	9.43	12.66	11.33	9.77
1969	12.72	7.89	9.63	11.92	11.13	13.63	12.59	10.61
1970	14.09	8.91	11.61	13.57	12.58	15.22	14.78	12.11
1971	14.06	10.06	13.29	15.44	13.83	17.03	16.17	13.58
1972	18.91	11.92	16.56	18.25	16.58	20.00	18.20	16.12
1973	21.66	14.08	18.38	21.65	19.38	23.42	21.20	18.80
1974	25.44	28.46	21.96	25.46	23.04	27.44	25.39	22.39

Table 19. Employment

	CHEM.	TEXT.	STONE	PRINT	ENGIN.	VEH.	M.MAN	MAN.
1948	421.2	1644.0	314.5	459.4	1822.2	670.7	549.4	7568.5
1949	433.7	1717.3	319.5	479.3	1877.4	683.4	554.1	7723.7
1950	450.0	1787.5	330.7	504.7	1899.6	704.3	561.6	7933.2
1951	462.6	1818.8	337.8	514.6	1952.4	727.8	569.3	8144.0
1952	469.2	1639.2	340.6	510.0	2021.8	766.9	579.6	8072.5
1953	467.1	1725.9	336.2	500.2	2010.3	782.8	570.3	8145.1
1954	478.9	1752.2	340.8	524.5	2064.5	820.7	571.6	8356.8
1955	495.7	1704.1	347.2	545.8	2177.8	858.9	591.7	8587.6
1956	505.2	1679.3	346.9	557.6	2217.1	874.7	601.9	8652.9
1957	511.3	1677.9	337.4	568.6	2235.6	854.6	601.7	8646.1
1958	514.7	1575.4	326.5	599.8	2244.9	865.9	587.4	8551.4
1959	517.3	1535.2	327.2	574.5	2217.5	869.7	573.9	8493.9
1960	530.3	1557.0	339.3	603.0	2327.7	919.8	617.1	8850.5
1961	531.3	1550.8	347.5	618.7	2404.8	898.0	633.1	8972.3
1962	518.0	1499.7	351.7	627.2	2428.5	883.5	596.0	8893.3
1963	513.8	1458.7	341.0	626.6	2371.7	874.3	592.0	8753.2
1964	510.5	1462.5	355.3	629.6	2428.6	879.7	622.3	8908.1
1965	517.5	1319.9	358.3	639.7	2505.1	870.1	632.4	9028.3
1966	527.3	1425.0	364.9	650.9	2590.5	853.2	623.0	9163.1
1967	518.1	1331.7	352.5	640.3	2556.0	823.0	591.8	8878.5
1968	500.3	1311.2	355.1	641.7	2507.0	811.0	580.1	8790.2
1969	519.6	1331.1	353.8	649.0	2347.7	830.2	585.1	8910.6
1970	526.0	1273.3	344.9	654.9	2402.0	837.0	591.7	8898.4
1971	570.5	1211.6	333.7	624.3	2355.0	814.6	555.2	8599.9
1972	457.4	1094.1	304.3	579.2	2013.0	779.0	516.1	7767.1
1973	456.6	1081.0	308.6	574.2	2025.0	792.0	518.0	7817.4
1974	463.2	1056.0	304.4	588.7	2065.0	786.9	507.0	7860.5

Table 20. Index for price of value added

	CHEM.	TEXT.	STONE	PRINT	ENGIN.	VEHIC.	M.MAN.	MANUF.
1948	74.28	58.95	42.22	46.29	44.56	49.14	45.04	51.29
1949	76.69	59.75	42.51	44.01	42.84	48.15	48.36	50.50
1950	72.66	62.46	40.24	44.54	41.93	45.23	48.45	49.29
1951	86.55	66.98	46.54	54.55	51.17	53.96	47.50	56.13
1952	100.54	68.20	50.44	59.56	64.87	60.66	51.13	63.73
1953	99.50	68.78	54.01	58.10	64.91	65.74	49.63	63.03
1954	104.70	68.62	57.10	57.33	65.29	64.34	49.92	64.53
1955	105.46	67.79	58.44	58.61	66.03	60.98	60.00	66.18
1956	108.74	68.47	60.23	62.20	72.19	67.83	63.58	70.77
1957	113.38	75.22	64.06	64.71	74.44	66.08	68.78	72.39
1958	132.68	81.28	66.79	66.40	77.89	70.55	82.78	75.93
1959	111.51	73.90	67.09	64.90	78.77	70.97	80.78	76.11
1960	110.67	79.06	66.59	65.54	80.31	70.26	81.07	77.31
1961	109.14	82.65	68.04	68.96	74.08	73.18	83.06	79.48
1962	108.12	83.99	68.87	73.07	83.03	73.89	81.32	80.41
1963	107.07	85.29	69.09	74.13	84.12	77.90	83.04	81.59
1964	109.24	86.14	70.40	75.06	85.86	76.88	76.32	82.01
1965	116.92	88.41	72.85	78.06	88.95	81.42	83.42	85.89
1966	109.63	94.59	74.00	80.47	122.85	82.57	82.23	87.36
1967	106.69	96.05	73.11	83.53	90.05	84.06	79.45	88.28
1968	108.70	90.96	73.90	87.48	92.15	84.77	79.40	88.55
1969	101.16	96.78	75.64	89.72	93.02	87.63	85.84	91.11
1970	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1971	104.79	106.48	104.14	110.87	110.19	111.15	114.69	109.70
1972	116.71	108.93	115.58	121.03	116.95	124.62	119.87	117.39
1973	128.48	127.36	113.31	128.55	120.50	150.65	113.60	126.21
1974	107.89	242.18	131.08	149.24	130.05	166.41	159.59	142.58

Table 21. Hours worked per head per week

	CHEM	TEXT	STO.	PR.	ENG.	VEH.	M.M.	MAN.
1948	47.0	46.4	46.0	45.1	46.5	45.7	47.3	46.5
1949	47.3	46.6	45.8	46.3	46.4	45.5	47.3	46.6
1950	48.2	47.1	47.4	46.4	47.7	46.4	48.1	47.5
1951	48.0	46.4	48.1	46.7	48.2	46.9	48.2	47.6
1952	47.2	46.8	48.1	45.6	48.3	46.8	47.9	47.6
1953	48.3	47.4	47.9	47.4	48.1	47.2	47.9	47.9
1954	48.7	47.6	48.6	48.0	48.9	47.7	48.6	48.5
1955	49.1	47.6	49.7	48.1	49.2	47.8	48.9	48.7
1956	48.6	47.3	49.4	47.2	48.9	46.5	48.5	48.2
1957	48.6	47.0	48.5	47.0	48.4	47.1	48.0	48.0
1958	48.1	46.5	48.7	46.8	47.5	46.1	46.4	47.3
1959	48.5	47.6	50.5	47.7	48.2	47.5	47.9	48.2
1960	47.4	47.1	50.9	47.5	47.5	44.8	47.4	47.4
1961	46.9	45.9	49.6	46.7	47.2	44.9	46.1	46.8
1962	46.4	45.5	50.8	45.9	46.2	44.4	45.4	46.2
1963	46.8	46.2	51.1	46.4	46.7	45.4	46.6	46.8
1964	47.0	46.0	51.5	46.8	47.1	45.0	46.7	46.9
1965	46.1	45.7	50.3	46.5	46.0	43.6	46.1	46.1
1966	45.2	44.7	51.0	45.5	45.3	41.3	45.0	45.0
1967	45.5	44.5	50.5	45.8	45.0	43.4	45.0	45.3
1968	46.0	45.2	50.7	46.2	45.6	43.9	46.0	45.8
1969	45.9	44.8	51.5	46.1	45.5	43.6	45.8	45.7
1970	44.8	43.9	51.8	45.3	44.7	42.4	45.1	44.9
1971	44.0	43.4	49.3	44.4	43.2	41.2	43.3	43.6
1972	44.1	43.9	49.0	44.7	43.5	42.3	44.6	44.1
1973	44.4	44.2	48.8	45.1	44.3	43.0	45.1	44.7
1974	44.2	43.0	48.0	43.9	43.8	42.3	44.8	44.0

Notes: 1. Source : Department of Employment, British Labour Statistics: Yearbook, 1975 (p56, table 22); 1972 (p54, table 22); and Historical Abstract (p108, table 45)

2. Different series relate to different editions of the Standard Industrial Classification and are not therefore fully comparable

3. All series linked backwards.

For example, 'Chemicals & allied industries' (Order IV; MLH's 261-277) in the 1958 edition was replaced by two Orders in the 1968 edition: 'Coal and petroleum products' (Order IV; MLH's 261-263) and 'Chemicals & allied industries' (Order V; MLH's 271-279). To construct a single series after the split the two series were weighted according to relative employment (June 1971 = 39.3:311.8).

Chapter 8.

A widely accepted (and easily accessible) source of UK data from 1855 is Feinstein (1972). To allow the results reported here to be easily repeated, wherever possible data were taken from Feinstein. An attempt was made to reproduce, and hence expand along the above lines, Marshall's results from his own data.

However, the Marshall library, where the statistical tables compiled by Marshall for this aspect of his work were deposited, have no annual series on wages, prices or output. The data used by Keynes and Dunlop come largely from the many publications of Bowley (1937), although strangely Bowley (1898)[1] is not referred to. The major such references are Bowley (1895a, 1895b, 1898, 1899) and Wood (1909).

(i) Wages

The money wage variable being considered is the amount actually paid per hour. Keynes stressed this in private correspondence with Dunlop (Keynes, 1979, pp.284-7), both then attempting to measure the value of one hour's wages to the worker. As discussed under 'Prices', the money wage series was also used to approximate the cost of one hour's wages to the employer. The two wage series in Feinstein (Table 65, pp.T140-1) measure average weekly wage rates (column 1) and average weekly earnings (column 2); (reproduced in table 22 below). The wage rate series measures the average movement in the level of full time weekly rates of wages. It covers the main categories of manual workers. The Weekly Earnings series is for actual average weekly earnings for manual workers in the main industries and services.

(ii) Prices

The wage, materials, and direct cost series were deflated by both a consumer price index to reconstruct and test the 'real wage' series being discussed by Keynes and Dunlop, and by a producer price index. The 'consumer price' series is from Feinstein, Table 65, pp.T140-1; (column 3 of table 22). The series for the price of the principal industrial products up to 1913 was taken from Mitchell & Deane (1971, pp.472-3); (reproduced in table 23 below). A Wholesale Price Index from 1871 to 1938 is reported on

pages 476-7 of Mitchell & Deane; (reproduced in table 24 below).

The original index of the price of materials used were taken from Mitchell & Deane (1971, pp.474-5, column 8); (reproduced in table 25 below).

Table 22. Earnings & Prices: Feinstein's Table 65, pp.T140-1

	Average weekly wage rates (1)	Average weekly wage earnings (2)	Retail prices (3)
1855	72	59	112
1856	72	59	112
1857	69	57	115
1858	68	56	104
1859	68	57	106
1860	69	58	111
1861	69	58	110
1862	70	58	111
1863	71	60	113
1864	74	60	113
1865	76	62	111
1866	78	66	112
1867	77	66	112
1868	76	64	111
1869	76	64	109
1870	78	66	108
1871	81	69	111
1872	86	76	118
1873	90	83	120
1874	91	81	113
1875	89	80	109
1876	88	79	108
1877	87	78	108
1878	85	75	102
1879	83	73	99
1880	83	73	103
1881	83	73	101
1882	83	76	100
1883	84	76	100
1884	84	76	95
1885	83	74	89
1886	83	73	87
1887	83	74	86
1888	83	76	86
1889	86	81	87
1890	90	84	87
1891	90	84	87
1892	89	84	88
1893	88	84	87
1894	88	84	83
1895	87	84	81
1896	88	84	81
1897	89	85	83
1898	91	88	86
1899	93	90	84
1900	97	95	89
1901	95	94	88
1902	94	92	88
1903	93	92	89
1904	93	90	90
1956	507	771	389
1957	533	813	404
1958	552	841	416
1959	567	864	418
1960	581	914	422

	Average weekly wage rates (1)	Average weekly wage earnings (2)	Retail prices (3)
1905	92	90	90
1906	94	92	91
1907	94	97	93
1908	94	95	91
1909	94	95	92
1910	94	95	94
1911	95	96	95
1912	98	99	98
1913	100	100	100
1914	101	101	101
1915	108	117	121
1916	118	133	143
1917	139	170	173
1918	179	211	199
1919	215	241	211
1920	257	278	244
1921	256	260	222
1922	198	209	179
1923	176	193	171
1924	178	196	172
1925	181	198	173
1926	181	193	169
1927	179	197	164
1928	177	194	163
1929	176	195	161
1930	175	193	155
1931	173	189	145
1932	170	185	141
1933	168	184	137
1934	168	186	138
1935	170	189	140
1936	173	194	144
1937	180	199	152
1938	185	207	153
1939	187	..	158
1940	207	269	179
1941	226	294	197
1942	242	331	210
1943	254	364	217
1944	267	370	222
1945	280	368	226
1946	302	383	236
1947	313	412	249
1948	329	449	268
1949	337	468	275
1950	344	490	283
1951	373	538	311
1952	403	582	338
1953	422	617	349
1954	441	657	355
1955	470	713	371
1961	606	978	437
1962	628	1,012	455
1963	651	1,055	465
1964	681	1,147	480
1965	711	1,240	503

Table 23. Producer Prices: Mitchell & Deane pp.472-3

	Principal Industrial Products(c)
1845	99
1846	99
1847	104
1848	92
1849	87
1850	93
1851	89
1852	93
1853	112
1854	126
1855	122
1856	120
1857	124
1858	112
1859	116
1860	117
1861	114
1862	124
1863	128
1864	125
1865	118
1866	118
1867	114
1868	112
1869	100
1870	109
1871	112
1872	127
1873	129
1874	115
1875	110
1876	107
1877	103
1878	92
1879	88
1880	95
1881	92
1882	95
1883	94
1884	89
1885	85
1886	79
1887	79
1888	82
1889	84
1890	83
1891	79
1892	77
1893	78
1894	71
1895	71
1896	73
1897	71
1898	75
1899	87
1900	95
1901	87
1902	85
1903	86
1904	86
1905	91
1906	103
1907	104
1908	87
1909	93
1910	100
1911	103
1912	108
1913	114

(c) Viz. up to 1850—coal, pig iron, mercury, tin, lead, copper, hemp, cotton, wool, flax, tar, tobacco, hides, skins, tallow, hair, silk, and building wood; after 1850—coal, pig iron, tin, lead, copper, wool (two quotations), hemp, cotton, linseed oil, palm oil, flax, tar, jute, hides, skins, tobacco, silk, foreign tallow, native tallow, and building wood.

Table 24. WPI: Mitchell & Deane pp.476-477

	Total Index
1871	135·6
1872	145·2
1873	151·9
1874	146·9
1875	140·4
1876	137·1
1877	140·4
1878	131·1
1879	125·0
1880	129·0
1881	126·6
1882	127·7
1883	125·9
1884	114·1
1885	107·0
1886	101·0
1887	98·8
1888	101·8
1889	103·4
1890	103·3
1891	106·9
1892	101·1
1893	99·4
1894	93·5
1895	90·7
1896	88·2
1897	90·1
1898	93·2
1899	92·2
1900	100·0
1901	96·7
1902	96·4
1903	96·9
1904	98·2
1905	97·6
1906	100·8
1907	106·0
1908	103·0
1909	104·1
1910	108·8
1911	109·4
1912	114·9
1913	116·5
1914	117·2
1915	143·9
1916	186·5
1917	243·0
1918	268·1
1919	296·5
1920	368·8

	Total Index (*g*)
1920	307·3
1921	197·2
1922	158·8
1923	158·9
1924	166·2
1925	159·1
1926	148·1
1927	141·6
1928	140·3
1929	136·5
1930	119·5
1931	104·2
1932	101·6
1933	100·9
1934	104·1

1930	100·0
1931	87·8
1932	85·6
1933	85·7
1934	88·1
1935	89·0
1936	94·4
1937	108·7
1938	101·4

(*g*) The weights are as follows: Total Food—52; Coal—10; Iron and Steel—24; Other Metals and Minerals—10; Cotton —16; Wool—9; Other Textile Materials—6; Other Articles—15.

Table 25. Materials' Price: Mitchell & Deane pp.474-5

Prices 4. The Sauerbeck-*Statist* Price Indices—1846–1938

NOTES

[1] SOURCE: A. Sauerbeck, 'Prices of Commodities and the Precious Metals', in the *J.S.S.* (1886), continued annually thereafter in the same source by Sauerbeck and subsequently by the editor of *The Statist*.

[2] These indices are based on wholesale prices and unit values of imports.

(Average of 1867–77 = 100)

	Raw Materials		Raw Materials
	Total		Total
1846	85	1896	60
1847	86	1897	59
1848	73	1898	61
1849	73	1899	70
1850	78	1900	80
1851	76	1901	72
1852	81	1902	71
1853	97	1903	72
1854	104	1904	72
1855	101	1905	75
1856	102	1906	83
1857	107	1907	86
1858	94	1908	74
1859	98	1909	75
1860	100	1910	81
1861	99	1911	83
1862	107	1912	88
1863	115	1913	91
1864	119	1914	88
1865	108	1915	108
1866	107	1916	140
1867	100	1917	179
1868	99	1918	206
1869	100	1919	222
1870	99	1920	264
1871	101	1921	153
1872	115	1922	132
1873	114	1923	134
1874	100	1924	146
1875	93	1925	143
1876	91	1926	131
1877	89	1927	129
1878	81	1928	124
1879	78	1929	119
1880	84	1930	97
1881	80	1931	82
1882	80	1932	81
1883	77	1933	83
1884	73	1934	85
1885	70	1935	90
1886	67	1936	94
1887	67	1937	110
1888	69	1938	96
1889	70		
1890	71		
1891	68		
1892	65		
1893	65		
1894	60		
1895	60		

(iii) Output

The index for industrial production was taken from Feinstein, Table 8, pp.T24-5, column 2; (reproduced in table 26 below). An attempt has been made to choose series to be consistent, with as similar as possible industrial coverage. This has turned out to be, in general terms, 'industrial production'.

(iv) Direct_Cost_Index

Deciding the appropriate weight for the two series (labour costs and materials costs) to be used to create the total direct cost series poses problems for such early data. The weighting was, therefore, initially calculated from the 1963 input output tables. The resulting relative weights (wages 68%, materials 32%) were compared with the results of the same exercise performed on input output tables referring to 1948 (Stewart, 1958) and 1935 (Barna, 1952). These suggested a 67:33 ratio and a 64:36 ratio respectively. In view of the lack of comparability between the tables and the need to assume that Stewart's wages profits ratio held for 1935, this seems reasonably consistent, and certainly does not imply that this ratio shifts so as to affect any of the results.

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1. Bowley's (1898) article is actually listed in the Economic Journal Index under 'Dowley'.

Table 26. Output: Feinstein's Table 8, pp. 124-5

TABLE 8 INDEX NUMBERS OF OUTPUT AT CONSTANT FACTOR COST, 1855–1965 (1913 = 100)

	Industrial production[b] (2)
1855	26.3
1856	28.1
1857	29.1
1858	28.5
1859	30.0
1860	31.7
1861	31.7
1862	32.4
1863	32.5
1864	35.0
1865	37.3
1866	38.7
1867	36.4
1868	36.4
1869	35.8
1870	40.2
1871	43.5
1872	44.8
1873	45.3
1874	46.4
1875	46.7
1876	47.5
1877	47.4
1878	47.3
1879	45.6
1880	50.3
1881	53.5
1882	55.7
1883	56.5
1884	54.4
1885	52.1
1886	51.0
1887	55.1
1888	58.3
1889	62.4
1890	63.3
1891	64.1
1892	61.0
1893	60.0
1894	63.5
1895	66.5
1896	71.4
1897	73.4
1898	77.0
1899	80.1
1900	80.1
1901	80.3
1902	81.7
1903	80.0
1904	81.0
1905	85.7
1906	89.3
1907	91.0
1908	83.7
1909	84.3
1910	85.5
1911	91.5
1912	93.9
1913	100.0
1920[d]	99.3
	97.9
1921	79.7
1922	92.2
1923	97.6
1924	108.4
1925	112.7
1926	106.6
1927	122.8
1928	119.5
1929	125.5
1930	120.1
1931	112.3
1932	111.9
1933	119.3
1934	131.2
1935	141.2
1936	153.9
1937	163.1
1938	158.7
1946	162.6
1947	171.3
1948	186.0
1949	196.8
1950	208.0
1951	214.8
1952	210.0
1953	222.0
1954	235.6
1955	247.6
1956	248.6
1957	253.1
1958	250.3
1959	263.1
1960	281.6
1961	285.1
1962	288.1
1963	297.9
1964	320.9
1965	330.2

Appendix 6. THE PHASE AVERAGE TREND TECHNIQUE

The essentials of the method are described by Charlotte Boschan and Walter Ebanks (1978), and its application fully discussed in Friedman and Schwartz (1982); (and in Mintz, 1969; and Bry & Boschan, 1971).

Since cycle duration varies, constructing trends using moving averages may leave some residual cyclical movement in the moving average trend, an effect especially noticeable in the rate of growth in the trend line. The phase average trend method was specifically designed to remove this bias without sacrificing fit or flexibility.

The programme is designed:

1. to select turning points (peaks and troughs) in data;
2. to measure the long-term trend and its rate of change; &
3. to produce trend-adjusted data.

The trend is estimated in such a way as to cut through, and contain no significant elements of, the short-term cyclical movements in the series.

Specific turning points (determined by the programme) in the deviation (ratio or differences) from a centred 25-quarter (or 75-month) moving average trend (first trend) are used to break up the original series into segments (phases). The final trend is then interpolated (logarithmically or not) between the centred values of the averages of the data within these phases, and the programme selects turning points in the deviations of the raw data from the final trend.

The PAT programme was used for the quarterly data of chapter 6. There were a few minor differences in turning points chosen as compared with my previous calculations prior to compiling and using the PAT programme. Most were very minor and the new choices were accepted (the PAT programme putting a greater weight on centering turning points in between the two opposite turns). The only major difference was at the series end when, running on data only to 1979 IV the programme could not specify 1979 II as a turning point (peak). In this case, then, the PAT turning points are not accepted.

The PAT programme requires data in seasonally adjusted form. The problems with using seasonally adjusted data are discussed in the next Appendix.

Appendix 7. SEASONAL ADJUSTMENT

The question of seasonal adjustment only arose in relation to the chapter 6 results, which were from quarterly data. The tests reported in that chapter were for the possible existence of cyclical relations between output and labour costs (as well as non-labour costs). Seasonally adjusted data might, therefore, seem more appropriate than unadjusted for these tests. Given that the series were already de-trended, such seasonally adjusted series would reflect only the cycle (and irregular movements) rather than cycle plus seasonal. Certainly there may be a seasonal relation, but if so, this would, were we to use seasonally unadjusted data, prevent us from interpreting any results as giving any information on the cyclical relations.

Wallis (1974) and Sims (1974) however, question the use of seasonally adjusted data, at least of 'officially adjusted' data. Sims proposes a complex procedure which he suggests should only be attempted as a check in the final stages of research. Wallis concludes that applying the same filter to all series prevents distortions of the lagged relationships.

The chapter 6 data were, therefore, all collected in unadjusted form, and then all adjusted by the same method. As a check, however, all tests were repeated using a simple moving average trend representation rather than the PAT programme. This allowed a comparison between the results using, on the one hand, the seasonally adjusted data and, on the other, the original, unadjusted data. The major difference between the results with adjusted, and those with unadjusted, data was the choosing of

cyclical tuning points. For this the adjusted data-series is clearly the relevant one for cyclical testing. The peak or trough quarter must be selected because it is at the cycle peak or trough. Some other quarter close to these may, in the unadjusted data, be higher (or lower) for seasonal reasons, but such seasonal information is precisely what a cyclical analysis must abstract from.

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